

CROSSBAR SYSTEMS
NO. 5
COMPLETING MARKER CIRCUIT

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SECTION I - GENERAL DESCRIPTION1. PURPOSE OF CIRCUIT

1.01 The completing marker is arranged to recognize requests for service and to establish any of the following connections:

- (a) From calling line to outgoing trunk.
The trunk may be associated with the office of the called number, an operator, an announcement machine, various tones, or a ringing selection switch.
- (b) From calling line to called line within the same office.
- (c) From incoming trunk to called line.
- (d) From incoming trunk to outgoing trunk.
- (e) From sender to trunk for pulse conversion or billing.

2. MARKER EQUIPMENT ARRANGEMENT

2.01 The completing marker circuit consists of several equipment frames. These are:

- (a) Common Equipment Frame (two bays):
This frame contains the relay units associated with control of the trunk link frames, line link frames, senders, number group, ringing switch, AMA charging, master test frame, trouble recorder, and class of service.
- (b) Translator and Code Treatment Frame (two bays): This frame contains relay units associated with translation and routing of called office codes, screening, route series and preroute relays, and associated cross-connection fields.
- (c) Route Relay Frame (two bays): This frame contains the route relays for four non-ETS completing markers.

2.02 The 4-wire frame is provided optionally for both non-ETS and ETS markers while the following frames are provided optionally for non-ETS markers only:

- (a) Code conversion frame, PBX allotter frame, supplementary or auxiliary service treatment frame, FC relay frame, line link pulsing frame, route program frame, and miscellaneous relay rack mounted units.

3. PRINCIPAL CIRCUIT FUNCTIONS

- 3.01 To recognize seizure by marker connectors or test circuits and to make marker busy to all other circuits.
- 3.02* To determine routing and charging from translation of information received for call.
- 3.03**To signal the ETS processor when the marker has been seized and the information from the connector is available.
- 3.04* To select an idle trunk associated with the selected route.
- 3.05 To seize trunk selected for call.
- 3.06* To identify the outsender group associated with selected trunk.
- 3.07 To select and seize an idle sender within the identified sender group.
- 3.08* To transmit to the sender information to control outpulsing and/or billing and the information to be outpulsed.
- 3.09* To select and seize a number group or direct access pretranslator for translation of the called line number.
- 3.10* To recognize line intercept conditions and to determine intercept routing.
- 3.11* When more than one line is associated with the called number to hunt for an idle line within the group.
- 3.12 To register the line location associated with the called number and to connect to the line location.
- 3.13 To recognize line busy and to initiate alternate actions.
- 3.14 To control the ringing selection switch associated with the incoming, intra-office, revertive, or ringer test trunk.
- 3.15 To select an idle channel between line and trunk circuits.
- 3.16 To establish and check linkage between the line and trunk circuit over the selected channel.
- 3.17 To cause the sender to outpulse after linkage is established.

* Non-ETS markers only.

** ETS markers only.

- 3.18 To cause the connecting circuits to disconnect when the call is completed.
- 3.19 To recognize trouble conditions and to initiate alternate actions.
- 3.20 Wideband Switching: The wideband switching feature requires that completing markers 0 and 1 perform the additional functions listed below:

- (a) The marker recognizes a dialed wideband prefix from the originating register.
- (b) The marker operates a wideband line link connector on wideband calls involving a line link arranged for wideband service.
- (c) The marker operates a trunk link connector for calls requiring wideband trunks.
- (d) The marker verifies that wideband calls will be set only between customers having like wideband service.
- (e) The marker requires additional linkage tests be satisfied when setting wideband connections.
- (f) The marker operates in the "light traffic" mode on wideband calls so that all standard linkage checks will be made.
- (g) The marker provides additional plant register peg count indications for wideband calls.
- (h) The marker prevents use of all centrex transfer features on wideband calls.
- (i) The marker has provisions to set, release, or interrogate the state of a wideband maintenance busy condition associated with the customer line. This function is performed under the control of the master test control or the trunk test register.
- (j) The marker is arranged to connect wideband customers to a "wideband maintenance busy" announcement when they encounter a wideband maintenance-busy condition or to a "denied wideband" announcement when they attempt to place a wideband call to a nonwideband line.
- (k) The marker will route nonwideband customer dialing wideband requests directly to overflow.

- (l) The marker provides additional release delay for any condition requiring the marker to release a wideband linkage.
- (m) The marker cancels the setting of any wideband linkage on tone or announcement routes and on intercept.

4. TYPES OF CALLS

4.01 The marker is arranged to process service requests for seven basic types of calls. The service requests are received through an Originating Register Marker Connector (ORMC), an Incoming Register Marker Connector (IRMC), a Transfer Register Connector (TRMC), or a Line Link Marker Connector (LLMC), via the originating line identifier.

SERVICE REQUEST VIA THE ORMC

4.02 After a customer has dialed into an originating register, the register is connected to a marker via an ORMC. Using the information received from the register the marker or the ETS processor determines whether the request for service should be processed as an outgoing call or as an intra-office call.

A. Subscriber Outgoing Call

4.03 When the service request is processed as a subscriber outgoing calls (SOG) the marker connects the calling line to one of several types of outgoing trunks, such as:

- (a) A trunk to another office, another marker group within the same building, an operator, or an announcement machine.
- (b) A junctor circuit for CAMA junctor or coin junctor operation.
- (c) Tone trunks for line busy or overflow conditions.
- (d) Reverting call trunks that are used to ring another party on the originating line.
- (e) Station ringer test trunks.

An outgoing sender may be required to outpulse the called number and for billing purposes in non-ETS markers. For reverting and ringer test trunks, ringing switch control is required.

B. Intraoffice Call

4.04 When the service request is processed as an intraoffice call (ITR), an intra-office trunk, which has two trunk link appearances, is used. The calling customer is connected to one appearance and the other appearance is connected to the called customer or to one of several types of line circuits such as lines to various types of PBXs, or lines for various types of intercept treatment if the called number is a nonworking number. Ringing switch control is required and an outgoing sender may be required for outpulsing or for billing purposes in non-ETS markers.

SERVICE REQUEST VIA THE IRMC

4.05 When the called number has been pulsed into the incoming register, the register is connected to a marker via an IRMC. Using the information received from the register the marker or the ETS processor determines whether the request for service should be processed as a terminating, tandem outgoing, pulse conversion, CAMA first, or phase I or II centrex transfer call.

A. Terminating Call

4.06 When the service request is processed as a terminating call (TER), the marker connects the incoming trunk to the called customer or to one of several types of line circuits such as lines to various PBXs, or lines for various types of intercept treatment if the called number is a nonworking number. Ringing switch control is required and an outgoing sender may be required for outpulsing.

B. Tandem Outgoing

4.07 When the service request is processed as a tandem outgoing call (TOG), the marker connects the tandem or toll incoming trunk to a tandem or toll outgoing trunk. An outgoing sender may be required for outpulsing, or to operate the TM relay in the outgoing trunk.

C. Pulse Conversion Call

4.08 When the service request is processed as a pulse conversion call (PCCL), the marker connects the proper type of outgoing sender to the pulse conversion trunk for outpulsing to the distant office. A linkage through the line link and trunk link crossbar switches is not required.

D. CAMA First

4.09 When the service request is processed as a CAMA first call (CMF), the marker connects a CAMA sender to the incoming CAMA trunk for billing purposes. As for the pulse conversion call, a linkage through the line link and trunk link crossbar switches is not required. A subsequent marker usage (CAMA second usage) will complete the call either as a TER call or a TOG call.

E. Phase I or II Centrex Transfer Call

4.10 When the service request is processed as a phase I or II centrex transfer call (TRF), the marker connects the line link appearance of the incoming or intra-office trunk to the trunk link appearance of an attendant trunk in a manner similar to a TOG call. An outsender is not required for a TRF call.

SERVICE REQUEST VIA THE TRMC

4.11 The marker handles two types of service requests via the TRMC in phase III centrex offices: dial transfer identification usage, and dial transfer usage. In phase I or II centrex offices arranged for dial transfer only the dial transfer usage is handled.

A. Dial Transfer Identification Usage

4.12 When the service request is dial transfer identification usage (DTI), the marker connects the customer requesting transfer to the transfer trunk after releasing the linkage between the customer requesting transfer and the incoming or intraoffice trunk. If the call is a result of the don't answer transfer (DAT) feature and not a transfer request the linkage to the called line which did not answer and the incoming or intraoffice trunk is released, but the linkage to the transfer trunk is not set. On a subsequent marker usage, a linkage is set from the incoming trunk or intraoffice trunk to the attendant as a DTF call.

B. Dial Transfer Usage

4.13 A dial transfer usage call (DTF) is processed by the marker as a TER call. The incoming or intraoffice trunk is connected to the "transferred to line" which may be a station, an attendant line circuit, an LLP line circuit, or an intercept line circuit. Ringing switch control is required and an outsender may be required for outpulsing.

SERVICE REQUEST VIA THE LLMC

4.14 When the originating line identifier, OLI, is provided the marker handles requests for dial tone via the LLMC. These requests are processed as an SOG call without a sender. A connection is made from the line requesting dial tone to the proper type of originating register.

5. TYPES OF LINKAGES

5.01 The marker has two methods of operation to establish the connections through the line link and trunk link crossbar switches: call back and call forward.

CALL-BACK LINKAGE

5.02 Call-back linkage (CB) is used when the line location to be used on the call is obtained from the register, and before the CB linkage is set, the linkage from the line to the register is released. The CB linkage is used for SOG, ITR, and DTI calls. When the originating line identifier is provided the CB linkage is also used for dial tone calls, the line location is obtained from the originating line identifier.

CALL-FORWARD LINKAGE

5.03 Call-forward linkage (FLG) is used when the line location to be used on the call is obtained from translation of the station or trunk number. The translation is done by the number group for non-ETS markers and by the processor for ETS markers. The FLG linkage is used for terminating, intra-office, tandem outgoing, and phase I or II centrex transfer calls.

6. GENERAL SEQUENCE OF OPERATION ON A CALL BASIS WHEN ETS IS NOT PROVIDED

SUBSCRIBER OUTGOING CALL

6.01 This type of call requires a connection between the customers line appearance on the line link frame LL and a trunk appearance on the trunk link frame TL. The trunk would generally be one of the following:

- (a) An outgoing trunk to another office.
- (b) A trunk to a switchboard.
- (c) A tone trunk for busy or overflow tone.

6.02 An outgoing sender may be required to send pulses over the trunk to the connecting office or to transmit information to the automatic message accounting AMA equipment. The general sequence of operation on an SOG call is as follows:

(a) The marker determines from the translation of the called number and signals received from the OR, the required route, and operates the route relay.

(b) A TL is selected containing the desired idle trunks by testing the FTC- leads of the TL, and an idle trunk is selected according to required trunk block TB- and trunk group TG- information.

(c) Following possession of the TL (TFK1,2 relays operated), the LL is seized which contains the calling line, giving the marker control of the calling line select and hold magnets.

(d) The channel test leads are closed through to select an idle channel between the calling customer and trunk, and the select and hold magnets are operated to close the linkage through the crossbar switches of the LL and TL frames.

(e) If a sender is required for AMA, or for pulsing information to a connecting office, an outsender group OSG- is selected, and the required information is transmitted to the sender.

(f) Following hold magnet operation, the channel is checked for crosses, continuity, and double connections, and the sender and trunk information is checked to ensure its proper transmission.

(g) With all checks satisfied, the marker disconnects and restores itself to normal, leaving the established connection between line and trunk under supervisory control of the trunk.

INTRAOFFICE CALL

6.03 An intraoffice call is one between two customers in the same marker group. This type of connection requires a double ended trunk. One connection is established between the called customers line appearance and the trunk link appearance of one end of the trunk; another connection is established between the calling customers line appearance and the trunk link appearance of the other end of the trunk.

6.04 After translation and operation of a route relay, the call is recognized as an ITR call. This type of call requires a FLG linkage to be established to the called line first, followed by a CB linkage to the calling line. Marker work time is minimized by attempting to select the path from trunk to called customer first, in case the connection can not be made because of line-busy, or channel busy conditions.

6.05 The general sequence of operation is as follows:

- (a) The marker determines the required route, and operates a route relay, as a result of translation of the called number, and the signals received from the OR.
- (b) A TL is selected containing an idle intraoffice trunk by testing the FTC-leads, and the trunk is selected according to TB- and TG- information contained in the operated route relay.
- (c) Since the called number does not directly indicate the called line equipment location, a number group is called in to translate the called number into its equipment location on the LL. This location is by frame tens FTT-, frame units FUT-, vertical group VGT-, horizontal group HGT-, and vertical file VFT-. A ringing combination code is also received to control proper ringing for the particular called line.
- (d) The marker seizes the LL containing the called line in order to control selection of the line.
- (e) The channel test leads are closed through to select an idle channel between the called customer and one end of the ITR trunks, and the select and hold magnets are operated to connect the linkage through the LL and TL frames.
- (f) The established channel is checked for a satisfactory connection, and that the ringing switch operation is completed. The marker LK1,2 relays operated indicate that the FLG operation is completed and that advance must be made to set up the CB linkage.
- (g) Certain apparatus associated with channel selection, hold magnet control, and line equipment control is released for use with the CB linkage. The equipment location of the calling line is recorded from information contained in the OR. The LL is seized to provide marker control of the calling line.
- (h) The channel test leads are closed through for the CB linkage to select an idle channel between the calling customer and the other end of the ITR trunk, and the select and hold magnets are operated to connect the linkage.

- (i) If a sender is required for an AMA record of the call, an outsender group OSG- is selected. Sender pulsing is not required. The sender is selected at the time of the completion of the check on the FLG linkage.
- (j) The CB linkage is checked for a satisfactory connection and the sender memory checks are completed.
- (k) The marker disconnects and restores to normal leaving the established ITR connection under supervisory control of the ITR trunk.

TERMINATING CALL

- 6.06 A terminating call (TER) is one placed to a customer served within the marker group which requires a connection to be established between the trunk link appearance of the incoming trunk and the called customers line appearance on the LL.
- 6.07 A route relay is not required on a TER call. Direct signals or translation determines that the call is to be completed locally and that an FLG linkage is required.
- 6.08 The general sequence of operation is as follows:
 - (a) The marker must first seize the trunk link frame on which the incoming trunk terminates. The TL number is received from the IR and the trunk is controlled over its F lead through the IRMC and the incoming register link IRL.
 - (b) A number group is selected to translate the called number into an equipment location. This selection is made by the operated local completion relay and the thousands digit of the called line number.
 - (c) The LL containing the called number is seized to enable marker control of the desired select and hold magnets.
 - (d) The channel test leads are closed through to select an idle channel between the incoming trunk and the called customer, and the select and hold magnets are operated to connect the linkage through the LL and TL frames.
 - (e) The established channel is checked, the number group is released, and the ringing switch is operated. The LK1

relay operates if all tests are satisfactory and the marker proceeds to disconnect and restore to normal.

TOLL OR TANDEM THROUGH SWITCHED CALL

A. Tandem Call

6.09 A tandem call (TAN) is a type of incoming call whose destination requires it to be switched through to a subsequent office. In this case this office becomes an intermediate switching point. The trunks used for handling tandem traffic may also be used for handling terminating calls for local completion in this office.

6.10 The tandem trunk has appearances on both the LL and the TL. The TL appearance is used for local completion TER. The LL appearance is used for the tandem connection which is established between this LL appearance of the incoming trunk, and the TL appearance of an outgoing trunk to a connecting office.

6.11 The information received from the incoming register will enable the marker to establish the proper connection.

6.12 A feature known as tandem screening may be used to restrict tandem calls on an office code and trunk class basis.

B. Toll Calls

6.13 A No. 5 crossbar office can be arranged to handle toll traffic which may be processed as outgoing toll calls, incoming toll calls, or through switched toll calls. The main distinction between toll traffic and normal outgoing, incoming, or tandem traffic is in the use of a different type of supervision on the call which requires provision of separate toll trunks.

6.14 Incoming and two-way intertoll trunks are also arranged with two line link appearances to increase channel access for through switched calls, and with one trunk link appearance for locally completed toll calls (TOL).

6.15 The marker establishes the same type of connection for toll calls as it does for outgoing, incoming, or tandem types of calls. The information received from the connected register and the desired routing information will enable the marker to establish the proper connection.

C. General Sequence of Operation - TOG

6.16 The incoming register passes the called number and other signals to the marker from which the marker recognizes a request for a through switched call, and operates a route relay.

6.17 The sequence of operation for establishing the through switched call is as follows:

(a) The operation of the route relay controls the selection of a TL and an outgoing trunk. The route relay also operates as OSG- relay to select a sender.

(b) The sender indication with the TAN or TOL class indication causes operation of the FLG and TOG which indicates that a number group translation of a trunk number is required.

(c) After the TL has been seized to select an outgoing trunk, a number group for translating trunk numbers is seized. The 3-digit trunk number received from the IR is passed to the number group and is translated into the LL equipment location of the incoming trunk.

(d) The marker seizes the LL containing the incoming trunk to control the select and hold magnets.

(e) The channel test leads are closed through to select an idle channel between the incoming trunk and the outgoing trunk, and the select and hold magnets are operated to connect the linkage through the LL and TL frames.

(f) A linkage check is made to ensure that all marker functions have been satisfactorily completed, and the marker disconnects.

PULSE CONVERSION CALL

6.18 Pulse conversion is the action of converting MF pulsing received from a switchboard keyset to either dial or reverte pulsing and is required on a call from an operator to a type of connecting office using dial or reverte pulsing.

6.19 A trunk arranged for pulse conversion is seized by the operator. An MF incoming register is seized, connects to the marker, through an IRMC, and passes the

necessary information to it. The marker selects an outgoing sender of the type required (dial or revertive pulse) which transmits the pulses back into the trunk and to the connecting office. Connections through the LL and TL switches are not required.

6.17 The general sequence of operation is as follows:

- (a) The operator initiates the pulse conversion request over the trunk to the TL. The marker recognizes the service request as an incoming call and from the signals received determines that the call requires pulse conversion to either revertive or dial pulse.
- (b) The trunk number, called number, and other signals are received by the marker and a route relay is operated directly. This route relay indicates the outsender group OSG- required, the delete information to be transmitted and the arbitrary or compensating resistance signals for revertive senders.
- (c) The outgoing sender is selected, and the information from the register is transmitted via the marker to the sender. Since the call is non-AMA, the message billing index, line location, etc, are not transmitted.
 - (1) Conversion from MF pulsing to revertive pulsing requires shifting the digits when transferring the information to the revertive sender.
 - (2) The MF register records the digits consecutively on the A, B, C, and D register relays. With dial pulse senders, the information is registered on similarly designated relays. On PCR, pulse conversion revertive calls, the digits are shifted to the D, E, F, and G register units in revertive senders arranged for 3 digit office codes and the C, D, E, and F register units on 2 digit office codes. The shift is accomplished by the operation of the KGS1, 2 relay.
- (d) With the sender available, the marker seizes the TL and the pulse conversion trunk. The trunk then enables the selected sender to be attached to the trunk through the outsender link OSL.
- (e) The marker transmits the called number, trunk class, and other necessary information to the sender.

(f) A check is made to ensure that the various functions are completed, and that the sender has recorded the information satisfactorily. Following this the marker disconnects and restores to normal, leaving the outgoing call from the operator under control of the pulse conversion trunk.

REVERTING CALL

6.18 A reverting call is a call to a customer on the same line as the calling customer.

6.19 When a reverting call is required, a connection is established from the customers line through the LL and TL switches to:

- (a) A reverting trunk if charging is not required.
- (b) An operator trunk if charging is required or reverting trunks are not furnished.

6.20 Customers instructions for making a reverting call vary, as described in the circuit descriptions for the reverting call trunks. However, all instructions require dialing the directory number of the called party, which in turn is transmitted to the marker through the ORMC.

6.21 Since all customers on the same line have the same line location, the marker makes the reverting test by matching the calling line location against the called line location, and if a match is made the call is handled as a reverting call.

6.22 The general sequence of operation is as follows:

- (a) The calling line location is received from the OR and is stored in the marker. The called number is also received and translation of its office code causes the call to proceed as an ITR call with FLG linkage.
- (b) When translation from the number group is received and recorded, an operate circuit for the RV1,2 relays is closed in the calling and called line location match circuit. The RV relay operates from RV1,2 indicating a reverting call.
- (c) The marker route advances, dropping the ITR trunk and selects a reverting trunk RV route.

(d) The call is now handled as an SOG call between the calling customer and the reverting trunk.

(e) Since it is a reverting call, the ringing selection switch is operated. The ringing combination required was obtained from the number group translation and held in the marker by the operation of RV relay. The number group line location relays release on route advance.

(f) The marker passes the ringing information to the trunk and checks the ringing switch before releasing. The connection is left under supervisory control of the reverting trunk.

INTERMARKER GROUP CALLS

6.20 Intermarker group calls (IMG) are requests for service between two No. 5 offices (marker groups) in the same building. An intermarker group call requires the service of a completing marker in each of the marker groups to complete the connection.

6.21 These calls do not require pulsing between marker groups, but do require an intermarker group sender. The sender operates as an outgoing sender in the calling marker group and as an incoming register in the called marker group. The number of the TL on which the IMG trunk appears in the called marker group is transmitted to the sender by the outsender link.

6.22 Three types of intermarker group trunks are required. The types of trunks and the type of marker operation involved are as follows:

<u>Type of Trunk</u>	<u>Type of Call</u>	
	<u>Calling Marker Group</u>	<u>Called Marker Group</u>
Sub to Sub	SOG	TER
Sub to Trk	SOG	TOG
Trk to Sub	TOG	TER

CAMA CALLS

6.23 The No. 5 crossbar arrangements are designed to serve extra charge customer originated traffic formerly handled by DSA or toll operators by a centralized system of automatic message accounting. The CAMA concentrates the charging equipment at a central point for common use by a number of offices.

6.24 There are three types of CAMA calls, each having similarities with types of calls already discussed. Details are covered in a separate section of this CD. These three types of calls each require dual usage of the marker. On the first marker usage (CAMA function) they are referred to as:

(a) Incoming Cama (INC CAMA) - This is a recording function to pass called and calling party information to a CAMA sender via a sender link, from the CAMA incoming trunk. No linkage is required.

(b) CAMA Junctor (CMJ) - A CAMA junctor is used on 4-party and rural lines. A call-back linkage is established to connect the TL appearance of the junctor to the calling customer, and a connection is made from the junctor to the CAMA sender in the same manner and for the same purpose as in the INC CAMA call.

(c) CAMA Intermarker Group (CAMA IMG) - On calls originating from lines in another marker group, the call is advanced to the CAMA marker group. This is done by establishing a call-back linkage in the originating marker group to the TL appearance of an intermarker group trunk, and as before, the intermarker group trunk connects to the CAMA sender for recording the information necessary for call completion. No linkage is set by the CAMA marker.

6.25 The second marker usage is known as the completing function. The CAMA incoming trunk, junctor, or intermarker group trunk seizes the marker to complete the call as a tandem switch TOG or TER call for outgoing or local completion, respectively.

AUTOMATIC NUMBER IDENTIFICATION

6.26 The ANI arrangements permit charging and routing information to be forwarded to a CAMA equipped office. The information may contain the calling line directory number, or if the call is from a 4-party station, may not contain the calling directory number. If the information is complete, the CAMA office will process the call on an automatic basis. If it is incomplete an operator is summoned to determine the calling line number. The marker circuit operation is similar to that used for interoffice AMA calls.

CENTREX

6.27 Centrex provides a service similar to that of an automatic PBX plus direct indialing identified outdialing, and transfer of direct indialed calls. Centrex customers are identified by class-of-service and up to 100 centrex customers can be handled by a marker group.

6.28 Calls to centrex stations are handled as ITR or TER calls with some variations. Calls made within a centrex customer group, and transfer calls, require a class-of-service match to ensure that they are kept within the same customer group.

6.29 Transfer calls may be made from a station to an attendant, from an attendant to a station, or from a station to a station. Specific arrangements and circuit operation are dependent upon the type of centrex operation provided.

WIDEBAND SWITCHING

A. Locally Switched Wideband

6.30 When referring to marker operations, "locally switched wideband" implies any wideband linkage that must be set in the wideband link circuit and is denoted by operation of marker relay LSW. If the wideband line is remote (having its wideband appearance on a remote switch) and a linkage is to be set in the wideband link circuit, the LSWR relay is also operated to indicate a locally switched wideband-remote line. The LSW relay is always operated for wideband SOG, TER, TOG, and DTI calls since at least part of the wideband linkage will be set in the wideband link circuit.

B. Remotely Switched Wideband

6.31 When referring to marker operations, "remotely switched wideband" implies an intraoffice wideband linkage that exists entirely in the remote switch. This type of linkage is denoted by operation of marker relay RSW and is used only for wideband intercom calls between centrex lines on the same remote switch. The associated audio linkage for the call is set through the standard crossbar network in the central office.

7. GENERAL SEQUENCE OF OPERATION ON A CALL BASIS WHEN ETS IS PROVIDED

7.01 When the marker is arranged for ETS operation the marker can function in any one of three modes:

- (a) NON-ETS
- (b) ETS-AMA ONLY
- (c) FULL-ETS

7.02 Operation in the NON-ETS mode is as described in 6.

7.03 In the ETS-AMA ONLY mode, all AMA functions are provided by the ETS processor. The marker is scanned by the processor when seized and when the outgoing trunk is selected. If all the information required for billing is received and checked a signal CHA is distributed by the processor which allows the marker to establish the connection.

7.04 When operating in the FULL-ETS mode, all translation, routing, call recording, trunk selection, loading of the sender, and hunting line selection functions are provided by the ETS processor. A data ready (DR) scan point is grounded by the marker when seized, which causes the processor to scan all data scan points. The information is processed and the information required for completion of the call is distributed to the distributor and scanner (DAS-ETS) circuit which passes the information to the marker distributor control (MDC) circuit for translation and for gating of information to the marker. On some calls from the incoming register marker connector when information to complete the translation and routing must be obtained through the trunk link connector, the type of call (TER) is distributed which causes the marker to seize the trunk link frame and the incoming trunk. Grounding of the LCK scan point when the trunk is seized is the signal to the processor that the information is available. The processor again scans all data scan points and the information is processed and distributes are made for completion of the call.

SUBSCRIBER OUTGOING CALL

7.05 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.06 The marker is scanned, the information is processed, and a distribution is made of the following information: selected trunk, route series, type of call, and if a sender is used, the digits to be outpulsed, the sender class information, and arbitrary digits if required. The outsender group is identified by the type of call information.

7.07 When a sender is required for out-pulsing the marker determines that a sender is available before seizure of the TL and the outgoing trunk selected by the processor.

7.08 Following possession of the TL, the LL which contains the calling line is seized.

7.09 The marker tests for and selects a channel between the calling line and the outgoing trunk and operates the hold magnets associated with the channel.

7.10 Upon seizure of an idle sender the information stored in the MDC is passed to the sender via the outsender connector.

7.11 Following hold magnet operation, the channel is checked for crosses, continuity, and double connection, and the sender and trunk information is checked.

7.12 With all checks satisfied the sender, if provided, is advanced and the marker disconnects and restores to normal, leaving the established connection between line and trunk under supervisory control of the trunk.

INTRAOFFICE CALL

7.13 The DR scan point is grounded as a signal to the processor that the marker has been seized and translation and routing is required.

7.14 The marker is scanned, information is processed, and a distribution is made of the following information: selected intra-office trunk, route series, type of call, line equipment numbers to be used for the FLG linkage, ringing combination, and type of line indication. If a LLP sender is required, the outpulser group, digits to be outpulsed, and sender class information is also to be distributed.

7.15 The marker seizes the TL and the intra-office trunk selected by the processor.

7.16 Following possession of the TL, the LL which contains the called line is seized. If a sender is to be used for out-pulsing to a distant PBX (LLP), the LL is not seized until the marker has determined that an idle sender is available.

7.17 The marker tests for and selects a channel between the called line and the intraoffice trunk and operates the hold magnets to establish the FLG linkage.

7.18 The ringing selection switch associated with the intraoffice trunk is set.

7.19 Upon seizure of an idle LLP sender (if required) the information stored in the MDC is passed to the sender via the outsender connector.

7.20 Following hold magnet operation the channel is checked for satisfactory connection and the ringing switch operation is completed.

7.21 The marker then advances to set the CB linkage. The LL containing the called line is released and apparatus associated with channel selection, hold magnet control, and line equipment control is released for use with the CB linkage.

7.22 The LL containing the calling line is seized.

7.23 The marker tests for and selects a channel between the calling line and the intraoffice trunk and operates the hold magnets to establish the CB linkage.

7.24 Following hold magnet operations the channel is checked for crosses, continuity, and double connections, and the sender (if used) and trunk information is checked to ensure proper transmission.

7.25 With all checks satisfied the sender (if used) is advanced and the marker disconnects and restores to normal, leaving the established connection under supervisory control of the intraoffice trunk.

TERMINATING CALL

7.26 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.27 The marker is scanned and if enough information is received to route the call a distribution is made of all the information required to complete the call. If information must be obtained through the trunk link connector to complete routing the type of call (TER) is distributed, which causes the marker to seize the TL and the incoming trunk. Grounding of the LCK scan point when the trunk is seized signals the processor that the information is available. The processor again scans the marker and the information is processed.

7.28 A distribution is made of the following information: type of call (if not distributed in 7.27), line equipment number to be used, ringing combination, and type of line. If a LLP sender is required, the out-sender group, digits to be outpulsed, and sender class information is also distributed.

7.29 The TL and incoming trunk are seized if they have not previously been seized.

7.30 After gaining possession of the TL, the LL containing the line location to be used is seized. If a sender is required LL seizure is delayed until a idle sender is found.

7.31 The channel test leads are closed through to select an idle channel between the incoming trunk and the called line, and the select and hold magnets are operated to connect the linkage through the LL and TL frames.

7.32 The ringing selection switch is set.

7.33 If a sender is used, upon seizure of the sender, the information stored in the MDC is passed to the sender via the out-sender connector.

7.34 The established channel, ringing selection switch and outsender, if used, are checked and if all checks are satisfactory the marker advances the sender and proceeds to disconnect and restore to normal.

TANDEM OUTGOING CALL

7.35 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.36 The marker is scanned, the information processed, and a distribution is made of the following information: selected outgoing tandem trunk, route series, line location of the incoming tandem trunk, type of call information (which identifies the out-sender group), the digits to be outpulsed, the sender class and arbitrary digits if required.

7.37 After determining that there is an idle sender, the TL is seized and the outgoing tandem trunk on the TL is seized.

7.38 Following possession of the TL, the LL containing the line location of the incoming tandem trunk is seized.

7.39 An idle sender is selected and the outsender link is set between the selected sender and the outgoing tandem trunk.

7.40 Upon seizure of the sender the out-pulsing information stored in the MDC is passed to the sender via the outsender connector.

7.41 The channel test leads are closed through to select an idle channel between the LL appearance of the incoming tandem trunk and the outgoing tandem trunk. The select and hold magnets are operated to establish the selected channel.

7.42 After checks of the channel, outsender, and trunk class information, the marker advances the sender, checks the advance and proceeds to disconnect and restore to normal.

PULSE CONVERSION

7.43 The DR scan point is grounded as a signal to the processor that the marker has been seized and translation and routing is required.

7.44 The marker is scanned, the information processed, and the following information is distributed: type of call (which identifies the outsender group), the digits to be outpulsed, class information, and arbitrary digits if required.

7.45 After the marker determines that a sender is available, it seizes the TL and the pulse conversion trunk associated with the call.

7.46 The sender is selected and the out-sender link is set between the trunk and the sender.

7.47 The sender information is passed from the MDC to the sender via the outsender connector.

7.48 A check is made to ensure that the various functions are completed, and that the sender has recorded the information satisfactorily.

7.49 The marker advances the sender then disconnects and restores to normal, leaving the outgoing call from the operator under control of the pulse conversion trunk.

REVERTING CALL

7.50 The DR scan point is grounded as a signal to the processor that the marker has been seized and translation and routing is required.

7.51 The marker is scanned, the information is processed, and a distribution is made which is the same as is made on an intraoffice call.

7.52 The marker route advances when the line location received from the processor (the called line) matches the line location received from the originating register (the calling line). When the marker route advances the RA and RV scan points are grounded to inform the processor that the call is to be set to a reverting trunk. All the information previously distributed is released and on the route advance all the relays operated from the distribution except the ringing control RCT- relays are released.

7.53 When the relays are checked down, ground is removed from the RA and RV scan points and the processor distributes the following information: the selected reverting trunk, route series, and type of call.

7.54 The marker proceeds to set the call as a SOG call by seizing the TL and the reverting trunk selected by the processor.

7.55 Following possession of the TL, the LL which contains the calling line is seized.

7.56 The channel test leads are closed through to select an idle channel between the reverting trunk and the calling line. The select and hold magnets are operated to establish the selected channel.

7.57 The ringing selection switch associated with the reverting trunk is operated and checked.

7.58 With the ringing selection switch and the linkage checks made the marker disconnects, leaving the call under supervisory control of the reverting trunk.

RINGER TEST CALL

7.59 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.60 The marker is scanned, the information is processed, and a distribution is made of the following information: selected ringer test trunk, route series, ringing combination, and type of call.

7.61 The marker seizes the TL and the ringer test trunk selected by the processor.

7.62 Following possession of the TL the LL which contains the calling line is seized.

7.63 The marker selects an idle channel and operates the select and hold magnets to establish the linkage.

7.64 The ringing selection switch associated with the ringer test trunk is set and checked.

7.65 After checks of the linkage and ringing selection switch the marker disconnects leaving the call under supervisory control of the trunk.

CAMA FIRST

7.66 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.67 The marker is scanned, the information is processed, and a distribution is made of the following information: type of call, which identifies the outsender group, the digits to be passed to the sender, and the sender class information.

7.68 After the marker determines that a sender is available, it seizes the TL and the CAMA trunk associated with the call.

7.69 The sender is selected and the outsender link is set between the CAMA trunk and sender.

7.70 The sender information is passed from the MDC to the sender via the outsender connector.

7.71 A check is made to ensure that the various functions are completed and that the sender has recorded the information satisfactorily.

7.72 The marker advances the sender and restores to normal, leaving the call under control of the CAMA trunk.

TRANSFER CALL (CENTREX PHASE I OR II)

7.73 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.74 The marker is scanned and since the TRF scan point is grounded the processor takes no action at this time.

7.75 The marker seizes the TL containing the incoming or intraoffice trunk requesting transfer and the class of service of the transferring customer is read out by the marker.

7.76 When the class is read in and checked the TL is released and the RE scan point is grounded to signal the processor that the information to complete the routing is available.

7.77 The marker is scanned again the information is processed, and a distribution is made of the following information: the selected attendant trunk, route series, type of call, and the line location of the incoming or intraoffice trunk arranged for transfer.

7.78 The TL and the attendant trunk are seized.

7.79 Following possession of the TL, the LL containing the LL appearance of the incoming or intraoffice trunk is seized.

7.80 The marker selects an idle channel and operates the select and hold magnets to establish the linkage.

7.81 The linkage is checked and the marker disconnects leaving the call under control of the attendant trunk.

DIAL TRANSFER IDENTIFICATION (CENTREX PHASE III)

7.82 The DR scan point is grounded as a signal to the processor that the marker has been seized and a translation and routing is required.

7.83 The marker is scanned, the information is processed and the following information is distributed: the customer group identity of the line requesting transfer, and the type of line information.

7.84 The marker seizes the TL and the transfer trunk associated with this call.

7.85 Following possession of the TL, the LL containing the line requesting transfer is seized.

7.86 The marker selects an idle channel and operates the select and hold magnets to establish the linkage.

7.87 The customer identity and the type of line information passed to the transfer register and the transfer trunk.

7.88 After checking the linkage and the storage of the information in the trunk and register, the marker disconnects, leaving the call under supervisory control of the transfer trunk.

DIAL TRANSFER CALL (CENTREX PHASE III OR PHASE I OR II WITH DIAL TRANSFER)

7.89 The DTF call is processed the same as a TER call. The processor however, for a DTF call, matches the customer group identity before the call is routed to the called line. If a mismatch occurs the call is routed, still as a TER call, to a recorded announcement.

SECTION II - DETAILED DESCRIPTION1. MARKER SEIZURE

SEIZURE OF MARKER BY REGISTER MARKER CONNECTORS, SC101, B39

1.01 When pulsing is completed in any of the registers, a start relay operates and causes the register to be connected to a marker through the ORMC or IRMC. The start relay is the TC2 in incoming registers and the MST in originating registers.

1.02 When the start relay operates, it causes its associated register start (RS-) relay to operate in the ORMC or IRMC. In turn, a group of multicontact relays operate and extend a large group of leads from the register through the register part of the connector. The multicontact relays also close battery to the marker start (MS) relay in the preference control circuit for the ORMC or IRMC. The MS- relay in operating closes battery to operate a group of multicontact relays in the marker part of the connector to extend the large group of register leads into the marker.

1.03 Ground on the MB lead from the connector relays operates the marker connector busy (MCB-) relays in the marker. This in turn connects ground over the CB- leads to operate CB- relays in all connectors associated with the selected marker. The MCB- relays also lock over the TM lead to a connector ground. The operation of the CB- relays in the connector indicates that the marker is busy and causes start leads in other connectors to be transferred to select another idle marker.

1.04 The MS- relay in the preference control circuit causes the marker MAK, MCK, and MSK relays to release and operates the TM and TMS relays to start the work timer within the marker. The standing cross test (STX) relay, is also operated at this time to remove the standing cross tests while the marker is handling a call. The MAK, MCK, and MSK relays are normally operated. These relays release when the marker is selected or a trouble causes an open in the MAK-, MCK-, or MSK- leads, which control the operation and work contacts of the connector preference relays.

1.05 The connector relays which were operated by the MS relay close ground to start the overall timer (OAT) as a secondary check of the work timer. Operation of either the work timer or overall timer causes the marker to call in the trouble recorder.

1.06 The connector multicontact relays connect ground to the connector check ground (CKG) lead causing the operation of the marker CKG1-7 relays. These relays set the marker off-normal and operate the trunk link control (TLCl-2) and line link control (LLCl-3) relays. In addition the CKG- relays prepare the marker for use.

1.07 When ETS operation is provided, operation of the CKG6 relay, the last CKG- relay to operate, activates the DR status scan point after all connector relays are operated. Activation of the DR scan point causes the processor to scan all data scan points. The information is processed and distribute points are activated by the processor to cause the marker to complete the call.

REGISTER INFORMATION TO THE MARKER

1.08 After the connector relays and the marker off-normal relays operate, the marker starts its action in accordance with information received over the large group of leads from the register. The information passed by these leads is summarized below:

Information Transmitted Through
Register Marker Connectors

<u>Leads</u>		
<u>ORMC</u>	<u>IRMC</u>	<u>Information</u>
A2/5-L2/5,M7	A2/5-L2/5,M7	Called number.
LT,LT1,LT2 LT3,11,X11 2DT,FVD	TT,LT,X11 11,FVD,2DT	Translator to be used for translating area or office codes.
	OA,OB, PHC,THC	Local completion codes. Office codes not received with called number. No translation.
CTA2/5,CU2/5 CRU2/5,CGA CGB,TP,RP	TAN1-4 TCA,TCB	Subdivisions of customer or trunk class-of-service and treatment.
MF,D		Type of customer signaling, TOUCH-TONE® or dial.
FAC,OR	INC,TAN,TOL PCR,PCD,PCD1	Type of call for originating customer or incoming trunk calls.

Leads (Cont)

<u>ORMC</u>	<u>IRMC</u>	<u>Information</u>
FT2/4, FU2/5 VG2/6, HG2/5 VF1/5, LL2/5	HT2/5 TT2/5 UT2/5	Line or trunk equipment location on line link frame.
	TF2/5 FG0-2 F	Trunk link frame, and trunk indications.
MRL, RL, BT, TRL, BRL	MRL, BT, TRL	Release signals to register for normal, busy, and trouble releases.
TRK, TR2, TRS	TRK, TR2, TRS	First and second trial, and start lead transfer signals.
PS, PD, SCN, PK, SCK, CR, CNR	RO, LR, DCK	Trouble, and check signals from register.
CKG, TM, MB	CKG, TM, MB	Marker seizure from register.
OBS, NOB		Service observing or no service observing.
MON	TST, SRT, MON	Automatic monitor, sender, register tests.
ECN, OCN	ECN, OCN	Even or odd register marker connector.
	ACD, LCD0-2 DNC, FC, VTC, WKC	CAMA calling - called area, vacant, free, denied or working code classes.
	SPL	Special calls, no test, no-hunt, etc.
CDP2/5, CD2/7, CPNT, CDA2/5, 2W, 4W CE, SCK, CR, CNR	CDP2/7, CPNT, CD2/7, CPNT, CDA2/5, 2W, 4W SCK, CR, CNR	Four-wire priority and routing, pre-emption test, and preempt or polite cycle indications. Stuck coin, coin return.

FIRST OR SECOND TRIAL AND TRANSFER START

1.09 Ground on the TRK lead causes the marker TRK relay to operate; this indicates to the marker a first attempt to complete the call. If the marker fails to complete the call and a second attempt is possible, the marker grounds the TRL lead to the connector; this causes the connector to shift start leads and make a second attempt to complete the call.

1.10 On the second attempt the TR2 lead is grounded and the TR2 relay of the marker operates. The TR2 relay in operating causes the marker to shift preference circuits, cancel line tests, and cause a BT or trouble release signal to be sent to the register in case trouble prevents completion of the call.

1.11 The connector starts a timing circuit when it makes a bid for a marker. If the timer operates before a marker is selected, the connector transfers to another start lead. When the marker is selected, a ground on the connector TRS lead operates the marker TRS relay causing the marker to take a trouble record before disconnecting.

1.12 Option ZKZ adds a GT1 contact to the TRS circuit to provide an operate path for the TRS relay on all calls. Previously, the circuit was closed through by a contact of the CON1 relay which only operates when the light traffic relay (LTR) is operated. Consequently, transfer start troubles occurring during periods of heavy traffic were not able to operate the TRS relay and produce a trouble record to report the trouble.

2. TRANSLATION

2.01 The marker action for any call depends on directing information received from the register. The information required may come from a direct signal or from a translation of the office or area code. Translation is a function of the marker when ETS operation is not provided. When ETS operation is provided the marker translators are disabled.

2.02 Marker translation consists of changing the code digit information into a single indication, which is called a code point. Thus, the result of translation is to mark a code point.

2.03 The information received from the register and used for translation is the type of translation and the code digits.

2.04 The called number may contain from 1 to 11 digits, designated A through L (I omitted). Each digit is received on a 2-out-of-5 code basis. The called number information can be in any of the various numbering plans, but in general the number consists of the following:

- (a) Four numerical digits.
- (b) One-, two-, or three-digit office code, plus four numerical digits.
- (c) A three-digit area code, three-digit office code, and four numerical digits; and a stations digit, if required.

The code digits plus the type of translation selects a code point that determines the marker routing.

TYPES OF TRANSLATORS, SC102

2.05 The marker provides several types of translators to handle the various office and area codes. The type of translator to be used is always indicated to the marker by the register.

2.06 The various translator indications from the register and their purpose are as follows:

- (a) Local Translator, LT - Requests the marker to use the translator provided for 3-digit local office codes, or for 3-digit area codes where digit 0 or 1 prefixes are not used. The LT translator can also be used with 1- or 2-digit office codes as long as there is no conflict with its use for 3-digit codes.
- (b) Toll Translator, TT - Normally, toll codes are 3-digit codes, and are handled by the LT translator. However, 2-digit toll codes may be translated by using the TT lead, and the ET extra translator. It is also possible to use the TT lead and/or ET translator for other purposes.
- (c) 11 Translator - The 11 translator may be used for a directing signal to reach one foreign dialing area; when the 11 directing signal is not required, the translator may be used for 11X service codes. The 11 is recorded in the register on the 11 registers and the X is passed to the marker as the A digit, which is translated.

(d) 11XX Translator - The 11XX translator is provided for translation of the fourth digit in addition to the first three. This is required when 2-digit TX operator codes are used or when an office code represents a number of PBX customers and the D-digit (the thousands digit of the called number) identifies the customer. The output of the 3-digit translator (see 2.10), which would be the C110-9 outputs for the 2-digit TX operator codes or any office code print for the D-digit identification of the PBX customer, is connected to the 11XX translator to provide ten outputs per code point input. The 11XX translator is arranged to serve ten code points for a maximum of 100 outputs.

(e) X11 Translator - The X11 translator is used for service or straightforward codes. Only the A digit is passed to the marker and translated.

(f) FVD Translator - The FVD, 5-digit, translator is used for an incoming type trunk when translation of only the A digit is required to indicate the office code.

(g) 2DT Translator - On incoming calls the 2DT translator is required to translate 2-digit BX codes received over trunks from step-by-step offices where the A digit was absorbed in the step-by-step office. The extra translator (ET), is required for 2DT translation because the LT handles the 3-digit local and toll translation. On originating calls, the 2DT translation marker indicates that a tie line code has been dialed by a PBX customer.

(h) ELT Translator (Option WO) - The ELT translator is used when the digit 1 access prefix is dialed. Ground on lead LTL indicates that this translator should be used. Digit 1 indicates an extra charge call and is normally used as a prefix to positively identify called office codes that are outside a local 7-digit area but within the home area. Digit 1 prefix is also used to positively identify called area codes outside the home area. The digit 1 access code must be prefixed to the called number on calls for which an extra charge is applicable. This will prevent charging customers who erroneously dial such an extra charge call.

(j) LT2 Translator (Option VZ) - The LT2 translator (lead LT2 grounded) is used when the digit 0 access prefix is dialed. The digit 0 prefix indicates a person-to-person or other special type of call. The

digit 0 access is prefixed to the called number when the calling customer wishes a special service such as person-to-person, collect, charge to a third number, etc. On calls to extra charge locations a screen is made to ensure that the access code was dialed.

(k) LT3 Translator (Option SM) - The LT3 translator (lead LT3 grounded) is used when the digit 8 prefix is dialed. The digit 8 prefix indicates a call within a CCSA network.

(l) No Translation (OA, OB, PHC, and THC) - A marker group may serve several office divisions, with number groups associated with each office division. Incoming trunk calls may reach the marker group with only the numerical digits of the called number. To reach the proper number groups, the incoming trunk indicates to the register, and in turn to the marker the office division to which the call should be completed. The trunk itself from the originating office may be representative of a particular office code and is thus translated in the incoming register to a certain office division. This arrangement is of value for high traffic between nearby offices as it allows the use of 4-digit called numbers. The indications are:

- (1) OA, office A number groups.
- (2) OB, office B number groups.
- (3) PHC, physical office division of office A.
- (4) THC, theoretical office division of office A.

TRANSLATION OF DECIMAL CODES

A. A-Digit Translation - FS34

2.07 The A-digit information is received over the A0, 1, 2, 4, and 7 leads from the registers and operates the AC0, 1, 2, 4, and 7 relays, respectively. The AC-relays translate the information from the 2-out-of-5 code to a 1-out-of-10 decimal code. The output of the AC-relays is then connected to contacts of the translator relays, LT, LT2, ELT, ET, FVD, 4LT, 11X, or X11. The output of these relays terminate on code points that can be used to operate route relays, or the AT0-9 relays or ET0-9 relays in case 2-digit translation is required.

B. Two-Digit Code Translation - FS34,35

2.08 If AB (2-digit translation) is required, the output of the LT relay is cross-connected to the AT0-9 relays, and, if provided, the output of the ET relay is cross-connected to the ET0-9 relays.

2.09 The B-digit information is connected to the BC0, 1, 2, 4, and 7 relays, which translate the information from the 2-out-of-5 to the decimal 1-out-of-10 code. The output of the BC-relays is then connected through the AT0-9 or ET0-9 to provide the AB, 2-digit, AT-, and ET- code points. These codes points may be used for operation of route relays or they may be cross-connected to the BT-punchings to operate the BT-relays, if 3-digit translation is required.

C. Three-Digit Code Translation - FS34, 35, 36

2.10 To obtain the C-digit translation the CO, 1, 2, 4, and 7 leads operate the CC0, 1, 2, 4, and 7 relays, respectively, which translate the information from the 2-out-of-5 to the 1-out-of-10 code. The output of the CC-relays is then connected through the B147, B258, and B369 relays. The numerics of these B-relays correspond to the B digit of the code. These relays connect the output of the CC-relays to the proper group of 10 contacts of the 30 make multicontact BT-relays. The outputs of the BT-relays are treated as 3-digit code points or they may be used with the 11XX translator.

D. F-G Digit Translation - FS164

2.11 The F-G digit translator makes use of the ET0-9 relays to perform translation of the F and G digits. The translator is activated by cross-connecting C- or TX-terminals to the FGT terminal. This operates relay FGT which connects the F0,1,2,4,7 and G0,1,2,4,7 leads to the FX0,1,2,4,7 and GX0,1,2,4,7 relays, respectively. The FX-relays translate the F-digit information from 2-out-of-5 to 1-out-of-10 to operate one of the ET0-9 relays. The GX-relays translate the G digit information from 2-out-of-5 to 1-out-of-10 and combine with contacts of the ET-relays to provide the F-G digit code points (ET00-00 terminals).

Note: When the F-G digit translator is provided, the ET0-9 relays cannot be used to perform AB-digit translation.

E. Misdialed Double Area Codes

2.12 The marker is arranged to intercept double area codes misdialed by customers.

2.13 The FACD dialing of an area code followed by a second area or operator code may permit completion of the call by the operator. Double area codes introduce accounting center problems. On FACD calls, a second area, or operator code is indicated by a 0 or 1 in either the D or E digits.

2.14 With FACI relay operated, a 0 or 1 in the D or E digits operates the corresponding TH- and HN- relay whose contacts cause the FD0, FD1, FE0, or FE1 relay to operate. An FD- or FE- relay operated operates the INT relay.

2.15 When the SON relay and TK relay operate, a route advance is made towards the paths busy tone trunk route. At this point the operated INT relay switches the route advance from the PB terminal to a route relay for a special intercept trunk.

2.16 Intercept routes should have the NSO relay operated. Normal route advance from the special intercept trunk should be to the common overflow route or to register busy tone.

F. Interception of PBX Calls With Mutilated Digits

2.17 Option ZSU provides for interception of PBX originated calls containing a mutilated A, B, or C digit(s). Option ZSN provides a means of enabling and disabling this feature from the jack, lamp, and key circuit.

2.18 With this arrangement, a mutilated A, B, or C digit causes ground to be switched from that digits translator circuitry through a TR2E relay contact and a screening contact to a route relay. The route relay is associated with a route to a special attendant. Because of the TR2E (second trial) contact, the feature is only activated on second trial. Thus, the first trial fails and provides a trouble record and the second trial is intercepted. The screening contact assures that the feature is only activated on PBX originated calls.

DIRECT SIGNALS USED IN CONJUNCTION WITH TRANSLATIONA. Customer Line Information - FS30

2.19 Trouble and traffic indications from the originating register are as follows:

PS - Permanent Signal.

PD - Partial Dial.

SCN - Stuck Coin.

The above indications are handled as direct signals. A called number and translation are not required.

2.20 The marker is arranged to provide a ground on the RL lead to the originating register on partial dial calls if all trunks for the partial dial route are busy and the marker route advances to RBT. Previously, only the BT lead was grounded, causing the register to hold the connection and return reorder tone to the customer. If the customer remained off-hook the register would time out and release the connection. However, if for some reason the partial dial is caused by a continuous TOUCH-TONE signal or a stream of dial pulses, the registers timing circuit is disabled and the register is held out of service as long as the condition persists. By grounding the RL lead along with the BT lead, the register will be released and returned to service. Option ZKP (rated Standard) provides this improved arrangement.

2.21 The following signals are sent on good calls to indicate that the register did not detect any trouble:

PK - No permanent signal or partial dial.

SCK - No stuck coin.

CR - Coin returned.

2.22 The marker checks for one and only one indication in the PS, PD, and PK group. It also checks for one and only one indication in the SCN, SCK, and CR group.

2.23 Trouble and traffic indications from the incoming register are as follows:

RO - Reorder. Condition caused by a register time-out or register detection of a dialing error.

LR - Link Release. Trouble due to failure of the register to receive information from the incoming register link.

DCK - Indicates that the LR indication was not caused by a double connection at the incoming register link.

B. Type of Call Indication - FS31

2.24 Originating customer calls are indicated to the marker by the originating registers. Incoming trunk calls are indicated to the marker by the incoming registers. These indications are used to operate control relays, which in turn permit the marker to vary its operation in accordance with the type of call involved.

(a) Originating Customer Calls - The OR or FAC indicates that the call is from a local customer.

(1) The OR indicates that a foreign area code was not dialed.

(2) The FAC indicates that a foreign area code was dialed.

(b) Incoming Trunk Calls - The INC, TAN, TOL, PCR, PCD0-1 indicates that the call arrived over an incoming trunk.

(1) The INC indicates that the call is TER class and is to a customer served by the marker group.

(2) The TAN indicates that a tandem trunk is involved and the call may be switched through the office as a TOG call to a tandem outgoing trunk or completed to a customer within the marker group as a TER call.

(3) The TOL indicates that a toll trunk is involved and the call may be switched through the office to a toll outgoing trunk as a TOG call or terminated to a customer within the marker group as a TER call.

(4) The PCR, PCD0, or PCD1 indicates a PCCL call. The PCR indicates that revertive pulsing senders should be used while PCD0-1 indicates which of two groups of dial pulse senders should be used.

2.25 The following table lists the relationship between the incoming class leads and the marker trunk class relays. When more than one TAN or TOL class or CAMA is provided, cross-connection terminals may be provided to permit certain incoming class leads to be associated with the marker trunk class relays as desired.

Marker Trunk Class Relays

<u>Trunk Class</u>		<u>TCA Group</u>	<u>TCB Group</u>
TAN	TSC0	TAN	TRF
TAN1	1	TAN Note 400	TOL Note 400
TAN2	2	TAN Note 400	TOL Note 400
TAN3	3	TAN Note 400	TOL Note 400
TAN4	4	TAN Note 400	TOL Note 400
TOL	5	TOL	TOL Note 400
INC	6	INC	CMF0
PCR	7	PCR	CMF1
PCD	8	PCD0	CMS0
PCD1	9	PCD1	CMS1

3. CUSTOMER AND TRUNK CLASS SCREENING

3.01 Customer and trunk class screening is a function of the marker when ETS operation is not provided. As described in 2., the translation of a code grounds a code point. A route is not necessarily identified by the grounded code point alone, but usually requires a combination of code point and class. Customers and trunks are assigned classes for this purpose. The process of combining code point and class to identify a route is called service treatment. This service treatment is accomplished by using S-, screening, relays and their associated cross-connections. The S- relay contacts are wired to SC- and S- terminals. Cross-connections between code points and SC- terminals and between S- terminals and route relays control the selection of a route when service treatment is required.

3.02 As shown in Note 405, the S- relays are operated by the customers class of service CGA, CTA-, CUA- or CGB, CTB-, CUB- relays, or by the trunk class OR, INC, TAN, TOL, or TSC0-9 and TCA or TCB relays. A specific code point is grounded by the A-, B-, and C- code (or other code) received from the register.

ASSIGNMENT OF S- RELAYS

3.03 All classes, customer and trunk, are served by a common group of service

treatment relays. The marker has capacity for a maximum of 240 relays; 60 of them are located on the translator and code treatment frame, 60 are located on the supplementary service treatment frame, 60 are located on the auxiliary service treatment frame, and 60 are located on the supplementary auxiliary service treatment frame. These relays are furnished in single mounting plate units. Each unit has 12 relays each having 12 make contacts, and two D- type terminal strips. The control winding terminal of each relay is wired to an SW- punching on terminal strip TA. The 12 make springs of each relay are wired to 12 service treatment punchings S0-11 on terminal strip TM. The 12 fixed springs on each relay are wired in multiple to three other relays on the same unit and the common multiple is connected to 12 punchings designated USC0-11 on the D- type terminal strips. Thus the wiring pattern on each unit gives three sets of four relays and each set of relays has 12 USC- punchings on the unit terminal strips.

3.04 The marker is arranged for 140 service common SC- punchings, which appear on cross-connection terminal strips on the translator and code treatment frame. Sets of 12 SC- points, that is, SC0-11, SC12-23, etc, are connected by means of loose wire on the rear of the frame to USC- points on the service treatment relay unit terminal strips. The loose wire is assigned on a job basis to multiple the required number of S- relays, in groups of four relays, to each set of 12 SC- points.

3.05 The number of customer and trunk classes, the number of S relays, and the multiplying arrangement of SC points must be selected to suit the requirements of the particular installation. The cross-connections for the SC and S points are determined from a careful study of the service requirements for the office. In offices with relatively few classes and SC- points, it is probably desirable to order one S- relay per class per 12 SC- points. In offices with more complex service treatment patterns, substantial reductions in the number of relays and S- point cross-connections are often possible by use of group sort treatments. The SC- points for which the treatments are variable from class to class, with no particular pattern, must be handled on an individual treatment basis; one S- relay must be furnished per class per 12 SC- points. The SC- points for which two or more classes are always treated alike may be served on a group sort basis; one relay may represent several classes for this group of SC- points, for example, the group sort method is particularly applicable to screen coin and non-coin customer classes. A large number of different classes from one sort may enable one S- relay (or a multiple of S- relays)

representing noncoin service treatment. The contacts of this S- relay(s) may then apply this treatment to a large number of code points. Screening relays operated from the same class of a different sort (individual or group) may be used in conjunction to determine the particular route, or route series required.

3.06 As shown on Table 1, B7, groups of four S- relays are wired to a common multiple of make contacts and connected to USC- punchings. Groups of USC- punchings are then multiplied to provide an S- relay for class or classes requiring the same service treatment.

3.07 The USC- punchings are then cross-connected to SC- punchings; one SC- punching provided for each code point code group, or equivalent, which requires variations in treatment according to the classes of service. See Notes 407 and 408.

3.08 In the marker cross-connection field, SC- points may be considered as inputs; they cross-connect to code points or R- points. The S- points are outputs which are cross-connected to RC- points or punchings associated with route series relays. See Notes 408, 409 and 410.

CUSTOMER CLASS SCREENING - FS10, FS11 (NOTE 405)

3.09 When the dial tone connection was made, the originating register stored the LL location and the class of service assigned to the line. When the register is connected to the completing marker, the class of service is transmitted to the class tens, CTO,1,2,4, and 7 relays and class units CUA0,1,2,4, and 7 relays. A class of service cross-connection terminal on the LL may be connected to one or more vertical files on the LL to provide a distinctive mark for each vertical file.

3.10 The "sort" arrangement in the marker basically provides either two or four separate output points (SWC- punchings) for each class of service.

3.11 These punchings are used to control the operation of service treatment, S- relays, by means of cross-connections to SW- punchings associated with S- relays. The purpose of two SWC- punchings is to permit both individual and group sort treatments for each class of service. When the office requires 30 or less classes of service, four SWC- punchings may be grounded for each class and this will permit one individual and three group sort treatments. This group sort arrangement may be considered as a presort arrangement.

3.12 The customers lines are generally divided into types such as individual, coin, 2-party, multiparty, and manual lines. The type of lines may be further subdivided for extended and restricted dialing area. Each division may be assigned S- relays for screening purposes. See Note 405.

3.13 General treatment of all customer classes can also be controlled with the ORS- punching, which is grounded on OR or FAC calls by the operation of the SCCK relay. When 30 or less customer classes of service are required, the CGA and CGB relay contacts in the SCCK relay operate path are made ineffective.

3.14 Option ZLG moves the 2-out-of-5 check of the CT- relays from the operate path of the SCCK relay to the operate path of the CTA- relays. This prevents the operation of the CTA- relays when more than two CT- relays are operated, thereby preventing overloading of the F2 fuse.

CLASS OF SERVICE ON A 1-OUT-OF-30 BASIS (A&M ONLY)

A. Thirty Classes of Service - Two Sorts

3.15 If 30 or less customer classes of service are required, the CT- relay operates a CTA- relay. The CUA- and CTA- relays translate the class of service number to ground one of 30 A terminals in Group A, sort 1, and Group A, sort 2.

B. Sixty Classes of Service - Two Sorts (Prior to Issue 17D)

3.16 If more than 30 customer classes of service are required, the CT- relay operates a CTA- and CTB- relay and the register also operates a CGA or CGB relay in the marker to indicate the A or B group of 30 customer classes. The operated CTA, CUA-, and CGA relays; or CTB-, CUB-, and CGB relays ground one of 30 terminals in both A groups or both B groups of sort SWC- terminals.

C. Sixty Classes of Service - Two Sorts (Subsequent to Issue 17D)

3.17 If more than 30 customer classes of service are required, the CTO relay operates relay CTA0 or CTA3, the CT1 relay operates relay CTA1 or CTA4, the CT2 relay operates relay CTA2 or CTA5, and the register also operates a CGA or CGB relay in the marker. The operated CGA or CGB determines which CTA- relay will be operated by the CT- relay. The operated CTA- and CUA- relays ground one of 60 terminals in both sorts of SWC- terminals.

D. Thirty Classes of Service - Four Sorts (Prior to Issue 17D)

3.18 If more than two sorts are required, the CT- relay operates a CTA- and CTB- relay. In this case the operated CTA- and CUA- and CTB- and CUB- relays ground one of 30 terminals in both the group A sorts and both of the group B sorts.

E. Thirty Classes of Service - Four Sorts (Subsequent to Issue 17D)

3.19 If more than two sorts are required, the CT- relay operates two CTA- relays. Two SSU- relays are operated in parallel with relays CUA- over leads CU- from the originating register. In this case, one of the operated CTA- and the CUA- relays ground one of 30 terminals in each of sorts one and two. The second CTA- and the SSU- relays ground one of 30 terminals in each of sorts three and four.

F. Fifty Classes of Service - Four Sorts (Subsequent to Issue 17D)

3.20 This operation is similar to 60 classes with two sorts except that additional CTA6-9 relays are provided, and the control of CTA5 relay is removed from control of the CT2 and CGB relays. Relays CTA5-9 are used to provide the additional contacts required to expand from two sorts to four sorts and 1-out-of-50 terminals is grounded in each sort.

CLASS OF SERVICE ON A TENS AND UNITS BASIS (STANDARD)

A. Thirty Classes of Service - Two Sorts

3.21 If 30 or less classes of service are required, the CT- relays operated on a 2/5 basis from the register operate a CTA- relay. The operated CTA- and CUA- relays ground a terminal in both sorts of SWC- terminals.

B. Sixty Classes of Service - Two Sorts

3.22 If more than 30 classes but less than 60 classes are required, WU option adds relays CTA3, 4, and 5. The operated CTA- and CUA- relays operated ground the proper terminals as described above.

C. One Hundred Classes of Service - Two Sorts

3.23 If more than 60 classes of service are required, the use of option WW enables the marker to handle a maximum of 100 classes of service by adding relays CTA6,7,8, and 9. The CTA- and CUA- relays ground the proper terminals as described above.

D. Fifty Classes of Service - Four Sorts

3.24 If fewer than 50 classes and more than two sorts are required, the use of option TR and Fig. 87 enables the marker to handle a maximum of 50 classes with four sorts. In this case two CTA- relays are operated causing two of 100 terminals to be grounded in each sort.

RATE TREATMENT

3.25 When Fig. 79 is provided, the register also transmits to the marker one of 20 rate treatments associated with the customers line. Relays CRU0,1,2,4, and 7 record the units digit and relay CGRA or CGRB record the tens digit. The operated CRU-relay and the operated CGRA or CGRB relays ground one of 20 TWC- terminals.

3.26 Rate treatment is provided essentially for use with centrex operation. Basically the feature provides a further division of customer service treatment within each class of service.

TRUNK CLASS SCREENING - FS31

3.27 Operation of S- relays for trunk screening is very similar to customer class screening. The S- relays may be operated directly by the operation of the INC, TAN, or TOL relays on a sort one and sort two basis.

3.28 If more than one tandem or toll class is required, then additional screening can be obtained with the TCA, TCB, and TSC0-9 relays.

3.29 The ORS, INS, TAS, TOS, TSA0-9 and TSB0-9 punchings for sort one and sort two may be cross-connected to SW- punchings to operate desired S- relays, which provide the individual and group sorts for trunk screening. The USC- punchings are connected to SC- punchings as explained for customer screening.

3.30 Notes 405, 407, and 408 should be used for engineering the most economical and efficient screening field.

FLEXIBLE INCOMING TRUNK CLASS SCREENING

3.31 Leads previously dedicated to pulse conversion (PCR, PCD, and PCD1 with TCA) or CAMA (INC, PCR, PCD, and PCD1 with TCB) are now brought into a cross-connection field where they may either be used for their originally intended purpose or they may be used to increase the number of TOL or TAN classes beyond those made available in option LJ. This makes available an absolute maximum of 17 trunk classes that may be assigned for TOL, TAN, pulse conversion. CAMA or INC classes.

3.32 Option DT (rated Standard) provides the additional cross-connection fields (TCA7-9, TCB6-9, TPC, TPC0, TPC1, CMF0, CMF1, CMS0, CMS1, TCA-4, and TCB1-4).

3.33 Option LJ which previously provided cross-connection terminals TCAL-4, TCB1-4 is rerated A&M Only. Option DW (rated Standard) provides cross-connection terminal TCB0. Option DU (rated Mfr Disc.) was a part of App Fig. 53 and option DV (rated Mfr Disc.) was a part of option ZF.

3.34 When option DT is provided option CN (rated after-date Standard) is required as a part of the check circuit that enables the A digit translator. Options ZG and GT are rerated Mfr Disc. Option CL (rated Mfr Disc.) was a part of App Fig. 53 and option CM (rated Mfr Disc.) was a part of option ZF.

4. ROUTE AND ROUTE SERIES OPERATION - NOTES 401, 402, 403, 404, 407, 408, 417, AND SC102

4.01 Route relay operation is required when ETS operation is not provided. As shown in Note 408, a route, preroute, and route series relay operate from a grounded code point.

4.02 Ground on a particular code point is controlled by translation, S- relay screening preroute operation, direct signals from the register, route advance, etc. Requirements for cross-connecting between the code points and the RC- points of the R- relays are explained in the D section of the SD. Also, the D section of the SD lists the cross-connection information for the route R- punchings and route series punchings.

PREROUTE RELAY - FS40, FS41

4.03 A preroute relay is considered an auxiliary to the route relay and provides extra contacts, not available on the route relay, for other functions. Preroute relays and their functions are as follows:

(a) Local Completion Relays LPA, LPB, LTA, LTB, LEA, and LEB - The local completion relays operate on calls terminated within the marker group. They operate the desired route relay on ITR calls and determine the number groups required on ITR and TER calls.

(b) Individual Peg Count - If 60 or more trunks are provided for a route, ground on the code point that corresponds to this route, operates an IPC0-9 relay, which in turn operates the route relay. The IPC- relay provides a peg count lead on a per marker basis; by multiplying like numbered IPC- leads from all odd markers

and multiplying like numbered IPC- leads from all even markers the IPC- relay provides one peg count lead for odd markers on one peg count lead for even markers for that route.

(c) Peg Count - The PC00-27 relays are connected ahead of a route relay that is common to several code points. This relay provides a peg count on a code point basis instead of a route basis.

(d) Option ZN and Fig. 72 - With the addition of relays PC28-39 and wiring associated with make contact 4 of the PC00-27 relays, a method is provided to reduce the number of route relays for those routes having the same trunk information, but different charge patterns, by operating a route series relay from the PC- relay.

(e) Code Conversion - The CV00-95 relays provide 2- or 3-digit code conversion where 2 or 3 digits are to be prefixed to the outpulsed number. (See FS62.)

(f) Operator Routes - The OPS0-3 relays are provided on operator routes when the marker is required to pass a class signal to the trunks over the TC lead. The signal usually results in a tone signal to the operator which indicates the class of the calling customer.

(g) Diverted or Denied Routes, DR0-7 - Some routes, or codes, may be arranged to deny service to certain classes of customers. This is accomplished by S- relay screening between the route relay, R- punching, and route series relays. On diverted service the S- points connect to a DR0-7 diverted route relay, which prevents the R- route relay from operating. The operation of the DR- relay acts as a preroute to operate the desired R- relay for the route assigned to the customer who is being denied access to the route he requested.

(h) Digit 0 and 1 Access Code Operation - Options RC, UQ, VZ, and WO are provided in the marker as an after-date Standard. The digit 0 is used for person-to-person operation. Digit 1 is used as a prefix when extra charge calls are made.

(1) Person-to-Person - The originating registers are arranged to time for an interval after a digit 0 is registered. If no further digits are received the register furnishes a ground on the LT translator lead to the marker. If further digits are registered the register grounds the LT2 translator lead to the marker instead of LT. A digit 0 call with an LT mark will ordinarily be routed to a local assistance operator

trunk by the marker. A digit 0 call with an LT2 mark may be screened in the marker and routed to a trunk arranged for person-to-person operation.

(2) Access Code 1 - The digit 1 access code is used as a barrier to mis-dialing of extra charge calls. The originating registers are arranged to register a digit 1 and to furnish a ground on the LT1 translator lead to the marker. If the digit 1 is not dialed the register furnishes ground on the LT translator lead. The marker uses the marks to screen those code points that are extra charge. If an extra charge code is dialed without a digit 1 the marker will route the call to intercept or announcement trunks. If a digit 1 is dialed in error for non-extra charge calls the marker may be arranged to route the call to intercept or announcement.

(3) PPCS-LAMA Operation - Fig. 83, 84, SJ - This feature used to furnish person-to-person operation is rated A&M on Issue 25D.

ROUTE RELAY

4.04 The route relay (R-) controls the marker functions required for selecting trunks and senders. Service cross-connections in the marker and TL permit the information controlled by a route relay to vary, depending on the office requirements.

4.05 The relay provides 30 contacts used as follows:

- (a) The route relay provides 20 contacts, one per TL which permit the marker to make a simultaneous test of all frames for idle trunks in a particular route.
- (b) The route relay provides one contact for the TB- and one for the TG- for controlling and selecting an idle trunk of the desired trunk block and trunk group after TL selection.
- (c) The route relay provides one contact to select the proper sender or indicate no sender operation.
- (d) The route relay provides four contacts for controlling desired sender action:
 - (1) CR- arbitrary code or compensating resistance.
 - (2) CL- class information to sender.
 - (3) DL- deletion of digits not to be pulsed.
 - (4) CP- code pattern.

- (5) Traffic register peg count, PC- and OF.

4.06 A contact is provided for the RA-route advance, which controls the operation of the new route relay that should be selected on route advance.

4.07 One contact of the PC- operates a peg count register on all R- relay operations. This is to count the calls offered to the route.

4.08 A contact of the OF relay operates a traffic register on route advance. This register is used to count the calls that overflow the route.

FRAME TEST LEAD CUT-IN RELAY

4.09 The FC relay is an additional route relay required in offices having more than 20 trunk link frames. When it is provided, it operates in parallel with the route relay. The FC relay consists of 12 make contacts used as follows:

- (a) Test for trunk link frames with idle trunks over FTC leads 20-29; these require one contact per TL or ten contacts.
- (b) Check for the operation of at least one FC relay.
- (c) Check by use of an associated XFC cross detection circuit, that only one FC relay operates.

Functionally, the FC relay may be considered as part of the route relay.

5. SEIZURE AND CONTROL OF THE TL

5.01 The trunk link frame can be seized either through the frame select FS-relays operated when a trunk is selected (SOG, TOG, ITR, and TRF calls) or through the FG- and TF- relays when a trunk is not selected (TER, CMF, or DTI calls). Trunk selection is provided by the marker when ETS is not provided or when ETS is provided and the marker is operating in the non-ETS or ETS-AMA only modes. When the marker is operating in the full-ETS mode, trunk selection is provided by the No. 5 ETS processor.

TRUNK LINK FRAME SEIZURE - TRUNK SELECTED

A. ETS Operation Not Provided - SC104A

5.02 The marker determines which trunk link frames have at least one usable trunk when it operates a R- relay. The R-relay in operating closes through individual FTC- lead to each TL. The FTC- leads are used in common by the markers and one or all markers can connect to the same FTC- leads at the same time. There may be none, one, or more than one trunk assigned to each TL

for use with the R- relay. Each trunk if it is idle, grounds the FTC- lead causing the operation of one FTC- relay for each TL that has idle trunks. During the test for idle trunks the marker connects the frame busy (FB-) relays to the individual TL frames to determine which TL frames are in use. The marker is provided with a frame memory circuit (FS21) that keeps a record of the number of the last used TL. Using the above information the marker operates a frame select (FS-) relay. The FS- relay corresponding to the last used TL may operate if no other FS- relay operates.

5.03 The operation of the FS- relay extends battery over the ST- lead to the preference control and make-busy circuit for the TL to operate the associated marker preference (MP-) relay. The operation of the MP- relay extends ground back into the marker over the CK lead to operate the TFK1,2 trunk frame check, relays. The operation of these relays indicates that the marker has seized the TL.

B. ETS Operation Provided - SC104B

5.04 The trunk link frame to be seized is identified by the TLG1/3 and the TLF2/5 distributes. This information is translated by the MDC circuit and is passed to the marker over the FS0-29 leads to operate the frame select relay, FS-. The trunk block TB2/6 distribute operates the associated TB- relays in the MDC and a two-up check of the TB- relays operate the FCK relay in the MDC. Operation of the FCK operates the markers FTCK and FTCK1 relays. The FTCK relay operated returns ground to the MDC circuit over the TBG lead to operate the markers TB- relays through the operated TB- relays in the MDC. A one-up check of the markers TB- relays operates the TBC relay. With the TBC and FTCK relays operated the seize frame SF timer is started and battery is applied to the trunk link frame start (ST0-29) lead through the following relay contacts: FS-, FTCK and TBC operated; a one-up check of the TLG0-2 relays in the MDC; NSI or NSO, when a sender is not required, or SKA or SKB (idle sender available) when a sender is required; SP nonoperated, TLC1 operated and a one-up check of the 2S, 4W relays if provided. When the marker gains preference to the trunk link frame (MP- relay operated), the TFK1,2 relays are operated which stop the seize frame timer and cuts through the BSO battery to operate the trunk link connector relays. As the connectors relay operate the connector check relays MDK and MAK1 are operated.

TL CONNECTOR OPERATION

5.05 The MC relay in the TL connector is operated when the MP- relay operates. Battery supply leads BS0-5 are extended

from the marker through the operated connector MC relay to operate the TL (MCA, MCB, MCC, and MCD) connector cut-through relays. Operation of the MC- multicontact relays is checked in the marker by the operation of relay MAK1 and MDK connector check relays. Operation of the other connector cut-through relays is checked by subsequent marker operation described later.

5.06 A summary of the information transmitted over the leads through the trunk link connector is contained in the following table:

<u>Leads</u>	<u>Information</u>
FT0-3, FU2/5, VG2/6 HG2/5, VF1/4	Transfer of line equipment location to OR when used with originating line identifier.
PR, SF, TTF SZA, SZB, SZC	Office size indication from TLC.
P0-9, L0-8, RK, LK R, L, RF, EF, SEF, JC0-9, GO, GOA, G1-4	Junction pattern and group control to TLF.
FTC-, XFT, FB0-29	Frame test and busy indications.
ST-, CK, BS0-4 MAK, MDK	Trunk link frame seizure.
TB0-9, BT00-19, XTG1, TG00-19, TGA1-4, TBK	Trunk block and trunk group control for selecting trunks on TL.
RC, TP, TC	Class information to trunk or ringing switch control.
LVK, FAK, FBK, TSX, ASM, BSM, JS0-9	Select magnet control operation.
LH0-9, J0-9, LCK, ALC, BLC, S1	Channel test, level control, and trunk hold supervision.
ATT, ART, BTT, BRT, ATTB, ARTB, BTB, BRTB, AST, BST	Tip and ring lead tests for continuity and ground, and sleeve lead control.
SS0-9, SLK	Outsender select control.
RS0-9, RSK	Ringing switch control.
WBS	Wide Band Link Start.
L0LP	Long Loop ringing signal to trunk.

<u>Leads (Cont)</u>	<u>Information</u>
NN, NG, NT, CNT	Control for special hunt, no hunt, no test, busy verification.
TCB, OF, INC, ESK, ES	Peg counts on a TL basis. Universal pad control in trunks.
PRO, PRI, PRE	Precedence indication to trunks.
CTT2/5, CUT2/5	Centrex read-in and read-out.
TT, TTM, TTA, TLF	Test leads.
DAT, DTR, CDN, OV	Centrex dial-transfer and directory number, and overflow signals to trunk.
HF	Hunt field indication to special trunk for test purposes.
1SE, 1TB, 2SA, 2MB, 3NA, 3FB, 4NE, 4TT, 5ST, 5MT, 6NT, 6FT, 7RN, 7TP, 8SP, 8MP, 9NP, 9FP, ONN, RN10-19	Trunk class information to marker.
TRUNK SEIZURE - TRUNK SELECTED (ETS NOT PROVIDED)	
A. <u>Trunk Block and Trunk Group Control - FS25, 27</u>	

5.07 The 2-wire TL has 200 outlets maximum that are used for trunks and originating registers. These outlets are divided into ten groups of twenty with each group being identified by a TB- trunk block relay. Any of the twenty outlets associated with a TB- relay may be grouped for a route and indicated by the TG00-19 leads as a trunk group. The trunks of a given route on the TL are located in terms of TB- and TG-, these group indications being the same for that route on all frames that have trunks assigned to the route.

5.08 The 4W TL frames differ from the 2W in that a regular TL frame and a supplementary TL frame may be provided. The regular 4W TL is arranged for 100 trunk or register terminations and uses TB0-4 with TG00-19 to indicate usable trunk groups. The supplementary 4W TL provides 100 trunk terminations and uses TB5-9 with TG00-19 to indicate usable trunk groups.

5.09 All trunks selected by the marker route relay operation are assigned to TL locations having a busy test BT lead

available to the marker for selecting an idle trunk in the group desired. These leads are connected to the marker by the TB0-9 relays.

B. Test For an Idle Trunk

5.10 With one of the TB0-9 relays operated, the BT00-19 leads are extended to the marker to permit testing for an idle trunk. Ground is extended from the marker TG00-19 leads through the TG0-9, and TGP or TGS relays to the TG00-19 punchings in the TL. These punchings are cross-connected to the F punchings of all trunks in the route. An idle trunk connects a TB- lead to a TG- lead to operate one of the marker TT0-9, trunk test, relays.

5.11 When the TLC1,2 relays operated, they permitted the marker to determine that none of the trunk select (TS-) relays were operated by the operation of the TSEL, 2-trunk select end, relays. This check ensures that the marker first tests for and then selects an idle trunk.

5.12 The operated TSE2 relay provides the battery for operating, the TT0-9 relays. The TT0-9 relays are double wound with each of the windings being connected to one of the BT- leads. An idle trunk is indicated by the operation of a TT- relay. The operation of any TT- relay does not along indicate the particular trunk that is idle. The marker must determine which one of the two BT- leads is grounded with an odd and even preference lockout circuit.

C. Trunk Selection - FS27, 28

5.13 After the TLC1, TSEL, TBK, and MAK1 relays operate, ground is extended through the operated or unoperated SQ0, sequence, relay through an operated JSQ0-5, junctor sequence relay to the TT0-9 relay preference chain to operate a TS- relay. The operated TS- relay locks under control of the TLC1 relay and releases the TSEL-2 relays, which in turn release the TT0-9 relays.

5.14 The JSQ0-5 relays distribute the traffic handled by the marker among the trunks.

5.15 With the operation of the TS- relay, marker selection of a trunk is directed to one of the two trunks that appear on a particular TS- relay. These leads, which indicate idle trunks when grounded, are extended to an OTS, odd trunk selection or an ETS, even trunk selection, relay to permit selection of one of the two trunks.

If at this time only one of the two leads is grounded, the operated or unoperated condition of the trunk sequence (TZ) relay has no significance. Therefore, if the odd BT- lead is grounded the OTS relay operates, and if the even BT- lead is grounded the ETS relay operates. If however, the BT- leads are both grounded, then the operated or unoperated condition of the TZ causes the operation of either the OTS or the ETS relay in series with some one trunk relay.

D. Preference Lockout Circuit

5.16 The ETS and OTS are double wound relays; the current through the primary, 10 ohm, winding is in a direction to operate the relay, and the current through the secondary, 200-ohm, winding is in the direction to hold the relay nonoperated. When both windings are energized the current through the 200-ohm biasing winding is of sufficient magnitude to hold the relay nonoperated. If the TZ relay is nonoperated, the biasing winding of the ETS is opened. Therefore, with ground on both the odd and even BT- leads the ETS relay operates and the OTS relay is biased nonoperated.

5.17 However, if the TZ relay is operated, the OTS biasing winding is open and the OTS relay operates.

5.18 Operation of either an OTS or ETS relay opens the operating circuit of the other relay.

5.19 For trouble recording purposes, an OT, odd trunk, relay operates on odd trunk selection. The operated or unoperated condition of the OT relay and the trunk TS- relay gives an indication of the trunk selected.

5.20 The busy tests are made with high-resistance TT- relays. The 16-ohm F, frame cut-through, relay of the trunk does not operate in series with the TT- relay.

5.21 The operation of the OTS or ETS relay changes the high resistance to a low resistance, which locks the OTS or ETS operated and operates the F relay of the trunk.

E. Check of Continuity of TG- and BT- Leads Using Relay TA - Option JC

5.22 When TBK operates following seizure of the trunk link frame, relay TA is operated through front contacts of the operated FS- and the associated FTC-. Relay TA starts the trunk busy timer to time for trunk selection. If ground is maintained on the FTC lead for the selected trunk link indicating a trunk is available, a trunk should

be selected before TBT operates. If a trunk is not selected, indicating an open FTC- or TG- lead, TBT will operate to cause a trouble record or route advance. However, if ground is not maintained on the FTC- lead, indicating that the available trunk or trunks have been lost (seized at the distant office), the FTC- relay will release to release TA. With TA released, relay TSEL maintains trunk busy timing to allow route advance.

5.23 Option ZTW is provided to cancel trunk busy timing if the F relay operates in the trunk. Previously, with option JC, timing was not canceled unless the OT or TE relay operated in the marker. However, option ZTW does not cancel timing due to operation of the F relay on test calls selecting a particular trunk.

TRUNK SEIZURE - TRUNK SELECTED (ETS PROVIDED)

5.24 When the trunk link connector relays operate, the TB- relay on the trunk link associated with the selected trunk is operated which operates the markers TBK relay. Operation to the TBK starts the trunk busy timer by operating relay TBTB. If the marker cannot seize the trunk, either because of an open BT- lead or because the trunk is 2-way trunk and it has been seized from the distant end; the TBT timer operates and the marker will route advance. The operate path for the TBTB relay (FS54) is from the TBTB winding through TBT nonoperated; through FTCK, FTCK1, SLRK relays operated; LCK non-operated; to the MDC circuit over lead TMS; through the transition relay nonoperated to the marker over lead TMG; through MAK1, TBK, and TBC relays operated.

5.25 The operate path for the F relay in the trunk (FS27) is as follows: either ODT or EVT relay operated in the MDC circuit removes the XTG1 cross-detection relay and applies ground to the multiple of TG- contacts over lead TSG. Since the TG- relays are not operated for full ETS operation, the ground is applied to all TG(0-19) leads to the trunk link connector, which grounds all idle F relays on the trunk link frame. Twenty (maximum) F relays of the trunks associated with the operated TB- relay are connected to the marker over the busy test BT0-19 leads. Two of the twenty busy test leads are cut through the operated TS- relay to the MDC circuit over the OT and ET leads. The OT or ET lead is returned to the marker over the FC2 lead

through the operated ODT or EVT relay in the MDC. The FC2 lead is connected through an operated CKG4 contact through unoperated linkage check relays DCT1 and DCTA in parallel, back to the MDC circuit over lead FC1 then back to the marker over the OB lead if ODT is operated or the EB lead if EVT is operated. The OB lead is connected to a 90-ohm battery through the windings of the OT and OTS relays through the 2500-ohm resistor OTA.

5.26 The OA lead is connected to a 90-ohm battery through the windings of the TE and ETS relays, through the 2500-ohm resistor ETA.

5.27 When the trunk link connector relays and the TB- relays on the trunk link frame are operated, all contacts in the F relay operate path are closed. If the ODT relay in the MDC is operated, the OT and OTS relays in the marker operate. The OTS relay operated removes the 2500-ohm OTA resistor and the F relay in odd trunk associated with the operated TS- relay is operated by the 90-ohm resistance battery. If the EVT relay in the MDC is operated the TE and ETS relays in the marker operate. The ETS relay operated removes the 2500-ohm ETS resistor and the F relay in the even trunk associated with the operated TS- relay is operated by the 90-ohm resistance battery.

5.28 The F relay operated in the trunk operates the LC- and LV- relays on the trunk link frame. The LV- relay cuts through the FAK and FBK leads to the marker and the markers FAK or FBK relay operates. The LC- relay operates the markers LCK relay and activates the LCK status scan point.

5.29 The LCK relay operated releases the TBTB relay which stops the trunk busy timer. The LCK status scan point being activated causes the processor to scan the marker for a trunk identification check.

TRUNK LINK FRAME SEIZURE - TRUNK NOT SELECTED

A. TL Seizure

5.30 On terminating, pulse conversion, CAMA first, or dial transfer identification calls (calls on which a trunk is not selected) the marker is directed to the trunk link frame containing the incoming or transfer trunk. The trunk link frame number is passed to the marker from the incoming

or transfer register via the register marker connector and is registered on the FG0-2 and TF2/5 relays. When the type of call relay TER1, DT11, or TRF2 operates the seize frame (SF) timer is started and battery is applied to the trunk link frame start leads ST0-29 through the FG0-2, TF2/5 relays operated. If the type of call relay PCL1 operates, indicating a pulse conversion or CAMA first call requiring a sender, the battery is not cut through until the SKA or SKB relay operates, indicating an idle available sender has been found. When the marker gains preference to the trunk link frame (MP- relay operated) the TFK3 relay is operated which stops the seize frame timer and cuts through the BSO battery to operate the trunk link connector relays. As the connector relays operate the connector check relays MDK and MAK1 are operated.

B. Trunk Seizure

5.31 As shown on FS33, when preference to the trunk link frame is obtained, relay TFK3 operated, a 90-ohm -48 volt battery is applied to the F lead to the register marker connector, through the connector and through the register link to operate the F relay in the trunk.

5.32 The F relay operated in the trunk operates the LC- and LV- relays on the trunk link frame. The LV- relay cuts through the FAK and FBK leads to the marker and the markers FAK or FBK relay operates. The LC-relay operates the markers LCK relay and if ETS is provided activates the LCK status scan point which causes the processor to scan the marker for information which the marker received through the trunk link connector.

CONTROL OF TRUNK CLASS INFORMATION TO TRUNKS - FS42, 43

5.33 As shown in Note 408, a route relay may be associated with various route series relays to control the transmission of trunk class information to the trunks.

5.34 The various types of trunk class information are as follows:

- (a) Charge or noncharge - The presence or absence of a signal on the TC lead indicates charge or noncharge respectively. This signal is generally used by the trunk to indicate a charge call.

- (b) Tip or ring party - The presence or absence of a signal on the TP lead indicates a tip or ring calling party respectively, and is used with a charge call when a distinction must be made to charge the right party. The TP signal may be used on terminating calls to operate a ringing selection switch hold magnet.

- (c) Coin or noncoin - The presence or absence of a signal on the CN lead indicates a coin or noncoin calling customer. This signal is used by the trunk to control the selection of coin control equipment when required.

5.35 Where the above signals are not required for the conditions stated for a particular trunk, the same signal may be used for some other purpose. For example, a signal on the TC lead may be used to identify calls to an operator that would normally be charged for, and thus notify the operator by a tone that a ticket should be made on the call.

5.36 The marker ensures that the trunk class signals are locked in the trunk when making the linkage check, SC110, by checking the operation of either the NOC, no class transmitted, or the CLK, class information transmitted and checked relay.

5.37 The route series relay is selected on the initial route and does not change on route advance to alternative routes. However, a route advance to a tone route causes another route series relay to operate. This relay takes preference over the initial route series relay and may change the trunk class information.

5.38 Note 400 explains which route series relay should be used for transmitting on the various class leads. The class leads required for the various trunks must be obtained from the trunk circuits.

NON-AMA CALLS - FS42, 43

A. Options XA, ZR (Mfr Disc.)

5.39 The route series relay used on the initial route depends on which of leads TC, TP, or CN is to be grounded to operate relays in the trunk. The information is as shown in Notes 404 and 408.

5.40 If trunk class information is not required, ground through the route series contact networks operates the NOC relay, which satisfies the linkage check and prevents the CLG and CLK from operating.

5.41 If trunk class information is required, the NOC will not operate when the route series relay operates. As the call progresses, the operation of the FAK or FBK on SOG calls or the RCK3 on ITR calls provides ground to operate the CLG with the NOC released. Since ground for operating the NOC is provided early, the marker assumes the NOC will not operate if it has failed to operate by the time the FAK, FBK, or RCK3 operates.

5.42 The operation of the CLG, transmits ground over the TC, TP, or CN leads to the trunk as controlled by the operated route series relay. This starts the operation of the CLT, capacitor timed relay, to provide sufficient time to operate the trunk relays. The CLT operates the CLT1, which releases the CLG to remove ground from the class leads. The release of CLG starts timing the release of the CLT timer to permit the trunk and marker relays to release if the trunk relay fails to lock. When the CLT releases, it causes the operation of the CLT2 relay. The CLT2 relay causes the operation of the CLK relay if the TC, TPK, or CNC marker relay is held to the corresponding locked relay in the trunk.

5.43 If more than one of the route series relays operate, or if the coin zone dialing feature is provided and the CZ and CZT relays are operated simultaneously, provision is made to prevent the CLK relay from operating and to cause the marker to block when the linkage test is made.

B. Options XB, ^{ZS}XS (Standard)

5.44 In order to same marker machine time in setting up trunk information on customer originated outgoing calls in a non-AMA office or on coin zone trunk calls, the previous method of trunk class information timing and checking is replaced by option XB.

5.45 The operation of the route series relay prepares the marker to operate the trunk class relays and when the marker has been connected to the required trunk, ground is closed through a low resistance voltage divider network to one of the primary windings of polar CNK, TCC, or TPK

relays to operate the various trunk class relays over the CN, TC, or TP leads via the trunk link connector to the trunk. A class relay may also be operated via the line link connector using the polar PDK relay and the LF lead. The direction of current flow is such as to prevent operation of the polar relays until the trunk class relays have operated and locked. Ground is then returned over the same leads and is in a direction to operate the polar checking relays. Operation of the required check relays aid in operating the CLK relay for marker advance.

5.46 Wiring option ZS provides separate transmission of TP signals to the trunk and to the sender. The RPK relay operating ground is supplies by relay TGS2 and the RPK trouble punch indicates a 1 up check of the TPS and RPK relays. The operation of GTL and GTL2 relays checks that the TP or RP information has been registered in the sender.

AMA CALLS - FS42, 43

5.47 On AMA calls the charge information is controlled by one of the route series relays, MBS0-9; or MBT9 on spillover calls from 4-wire or from CCSA customers. The MBT9 cancels other treatment and substitutes a detailed billing treatment. Class information is not transmitted to the trunk, but the CLK is operated as a check that the TP or RP information was transmitted to and registered in the sender.

5.48 An improved check circuit is provided for AMA relay operation in the marker. The check circuit has been extended to include the AMA5 relay. Option ZPC provides the wiring.

TRANSMIT ON RC LEAD TO TRUNK

5.49 If a trunk can be used on either SOG or TOG class calls the SOG class calls may use route series relays other than the TOS. The TOS route series is used on TOG class calls and serves to ground the RC lead to the trunk. This ground conditions the trunk for use on a through switch connection.

COIN ZONE DIALING, WIDE AREA TELEPHONE SERVICE - SC135

5.50 The marker is arranged to provide a coin zone dialing feature which permits direct dialing by coin customers to areas where the charge is greater than the initial deposit.

5.51 When the originating register passes the information to the marker, translation and screening permits the marker to select a coin zone trunk, attach a sender with the proper pulsing ability and prime the trunk with one of eight charge conditions via the TP, TC, and CN leads. The CZ and CZT relays in conjunction with the TCCN, TCNC, NCCN, and NCNC relays provide a method of originating the light charge conditions.

5.52 The selected trunk may be direct, to a tandem office, or may be a junctor type trunk and tandem through the No. 5 office to gain access to outgoing trunks serving noncoin traffic.

5.53 The selected trunk will call in an operator and display on lamps at her position the proper charge for the call. The operator informs the customer of the charge involved and when deposited, signals the sender to start pulsing for subsequent call completion.

5.54 The coin zone dialing feature requires a DR- relay for each combination of coin zone trunk group and charge. The number of DR- relays in the marker is increased to provide for the feature.

5.55 An AMA record may be required on some coin zone calls. The coin zone feature may also be used where an AMA record and a signal to the trunk are both required. This feature is usable for WATS service.

TL CONTROL AND SELECT MAGNET OPERATION - FS45, 46, 47

5.56 Each trunk is connected to an A or B trunk appearance on the TL. The operation of the F relay in the trunk places ground on the FA lead associated with the trunk. The ground on the FA lead is extended to the TL to operate the FA-- or FB-- relay, which in turn operates relays to indicate circuit switch and level, and the FAK or FBK relay closes battery to the ASM or BSM leads to the TL to operate the select magnets of the trunk switch. The FA-- or FB-- relay also extends the T, R, and S leads of the trunk appearance on the trunk switch into the marker for later tests. Intraoffice trunks use a FA- and a FB- appearance.

5.57 When the marker picks an outgoing trunk, the operation of the F relay closes ground from the marker over the S1 lead to operate the S1 relay in the trunk.

5.58 The junctor switch select magnets are connected to the marker over the JS0-9 leads by the JC- relays and, in the case of 12-level switches, the SA or SB relays of the TL according to the line link circuit being used. Following channel selection, the CH- relay closes battery or ground to one of the JS- leads to operate the junctor switch select magnets. Battery through relay XJS is used for 10-level switches. Ground is used for 12-level switches with battery through the XJS and XJS1 relays supplied to the TL over leads SBA1 and SBA2. Relays 10LV and 12LV are operated by the TL connector to provide proper operation when both 10- and 12-level switches are provided.

6. SEIZURE AND CONTROL OF LL

6.01 A LL seizure is necessary whenever a connection to a calling or called line or a tandem type trunk is required. There are two types of connections for which an LL can be seized. The connections are:

- (a) Call forward linkage, which is that portion of a call that connects the trunk to the called line.
- (b) Call back linkage, which is that portion of the call that connects the trunk to the calling line.

6.02 The purpose of seizing the LL for these linkages is to execute the following:

- (a) Close the LB- and LL- test leads for testing the line links.
- (b) Close the select magnet SM- test leads to the LL.
- (c) Close the path to the line hold magnet for line busy test and hold magnet operation.
- (d) Close the path to operate the CN, coin; MR, message register; 2WC, 2-wire; or AOC, all other classes, relay when distinction is needed for different classes of service (option WX). Close the path to operate the class of service tens CST- and class of service units CSU- relays for recording the class of service of the vertical file in the marker. The operation of the CST-, CSU- relays will close a path to operate the CNA, coin auxiliary; MRA, message register auxiliary; 2WD, 2-wire; AOA, all other class auxiliary; or

CGS, customer group relay when distinction is needed for different classes of service (option WY or UG).

(e) Close the path to seize a line link pulsing line circuit (option TU).

(f) Close the sender select SS- leads to the outsender link (option TU).

6.03 A summary of the information transmitted over the leads through the line link connector is contained in the following table:

<u>Leads</u>	<u>Information</u>
ST00-59, LFK, LFK1 BS, BS0, 1, 2	Select and checks that LL is attached to the marker through connector.
TMB	LLF plugged busy.
DTK, LOK, G, LO, LOB	Controls frame lockout of dial tone starts.
LOL	Controls long-loop cut-in relays in LL.
LOLP	Indicates a long-loop line.
NLL	Indicates a non-long-loop line.
LLF	LL busy indication at jack, lamp, and key circuit.
PL, LCB, OF, TER	Operation of traffic registers.
LF, FK, BY	Control line seizure on line link pulsing.
MPP, MFK	LL seizure and control on paired LL operation.
CS00-29, CGA, CGB V0-4, VGB0-11, HG0-9, HGK	Class of service and line location.
SM0-9	LL select magnet control.
LH0-4, LL0-9, LB0-9	Channel test and hold magnet control.
SS0-9, SLK	Sender select magnet control with LLP.
NT	No test connector hold magnet control.

Leads (Cont)

ES, ESK

Information

Echo suppressor or pad control.

PRO, PRE, PRI

Precedence indication to lines.

VFT0-4, RL, BYP

Auxiliary circuit pre-emption control.

CALL FORWARD LINKAGE

A. ETS Not Provided - SC107A, FS3-8

6.04 On an FLG linkage, a translation is necessary from the number group to translate the called customers number into the line location on the LL. This location is registered on the FTT- or FTS- in the case of 4-wire frames, FUT-, VGT-, HGT-, and VFT- relays in the marker. Besides furnishing the marker with the line location, the number group also provides the marker with the ringing combination when the RCT-relay is operated in the marker.

6.05 With the seizure of the TL and the information received from the NG the marker can now close battery to the ST- lead to seize the LL connector. The FTT- or FTS-, and FUT- relays determine the LL and the VGT-, HGT-, and VFT- relays determine the customer's line location on the particular switch. The VGB- relay in the LL and the VFT- relay in the marker close through the necessary leads to indicate the class of service of the calling customer. The HG-relay in the LL closes the LB- and LL- test leads used for channel testing and closes the SM- test leads to the LL for select magnet operation. The operation of the LG-relay in the LL cuts through the LH- leads to the marker for use in the line idle and line busy test and to operate the line hold magnet in the LL if the line is found idle.

B. ETS Provided - SC107B

6.06 The call forward linkage relays FLG and FLG1 are operated by the TER1, TOG1, or TRF3 type of call relays. Relay FLG1 operated operates the lock line identity relays LLI and LLIA. Relay FLG operated operates the FLGA relay and grounds the NGS lead to the MDC circuit which operates the LLI relay in the MDC to cause the line equipment number and other information concerning the called number or tandem trunk number to be passed to the marker.

6.07 The LLI relay operated in the MDC causes the following information to be passed to the marker:

(a) Line equipment number which is registered on the FTT-, FUT-, HGT-, VGT- and VFT- relays in the marker. These relays lock to the LLI relay operated in the marker.

(b) Ringing combination and charge condition. The RCT- relays are operated through the operated gate number group GNG- relay in the MDC, through the activated ringing combination distribute point in the DAS-ETS, through the operated LLI relay in the MDC, to ground through either the activated TC distribute point and the nonoperated FNA relay in the marker or the activated FNK distribute point and the operated FNA relay in the marker. On a TOG or TRF call TOG is distributed rather than a ringing combination. The RCL relay in the marker is operated directly from the TOG relay in the MDC.

(c) Terminating treatments relays POTS, LDN, TST, DAT are operated through the operated GNG- relay in the MDC, through the activated terminating treatment distribute point to ground through the operated LLI relay in the MDC. On a TOG or TRF call TOG is distributed rather than a terminating treatment. The POTS relay in the marker is operated by the operation of the TOG relay in the MDC.

(d) When the called number is associated with a hunting group, relays CKR, SLCK are operated, and if a loop test is to be made, the LGT and PBXA relays are also operated.

6.08 The LLI relay operated in the MDC also recycles the marker work timer by operating RYT relay and if the immediate ring feature is provided the LLI operates the brush gate BRG relay to determine which brush is in use on the ringing switch. When the line equipment location, ringing combination, and terminating treatment relays are operated and locked in the marker the release number group RNG relay is operated and the LLI relay in the MDC is released.

6.09 The seize frame timer SF is started and battery is applied to the line link frame start leads (ST0-59) through the operated FTT- and FUT- relays after the marker has gained preference to the trunk link frame (TFK3 operated) and after an idle sender is found SKA or SKB relay operated) on a call to a LLP circuit. When the

marker gains preference to the line link frame, the line link connector relays are operated and the link frame check relay LFK in the marker and MDC and operated. Operation of the LFK in the MDC circuit applies ground to the type of line distributed points to operate the marker type of line relay (AO, CN, CGS, etc) associated with the activated distribute point. On a TOG or TRF call the AO relay is operated by the operation of TOG in the MDC. If the called line is associated with a centrex customer, the customer identification (CST-, CSU-) is distributed and the corresponding relays in the marker are also operated when ground is applied by the LFK relay.

6.10 As the line link connector relays operate the HG- relay in the line link cuts through the LB- and LL- test leads used for channel testing and closes the SM- test leads to the line link for select magnet operation. The operation of the LG- relay in the line link cuts through the LH- leads to the marker for use in the line idle and line busy test and to operate the line hold magnet if the line is found idle.

C. Line Circuit Seizure and Control - FS137 (Line Link Pulsing)

6.11 Ground on a V- lead operates a VF- relay to extend the LF lead to a line circuit. The marker operates the line circuit F relay over the LF lead and checks its operation with the FK and XLF relays over the FK lead.

CALL BACK LINKAGE, CB - SC106, SC103, FS1

6.12 A call back linkage connects the trunk on the TL to the calling line.

6.13 Any call that is handled by a marker is distinguished by signals indicating the type of call and the kind of linkage. A CB linkage occurs on only two types of calls; the ITR and the SOG.

6.14 ON ITR calls, the marker must first release all of the registered number group information that was used on the FLG linkage in order to start the CB linkage. On an SOG call, the marker does not use an FLG linkage and, therefore, can start on the CB linkage as soon as the SOG- relays operate.

6.15 The marker receives from the register the calling line identification, which is registered on the FT-, FU-, VG-, HG-, and VF- relays. The operation of the CB relays cuts through this information and gives a translation as to the line location of the calling line. The calling line location is registered on the FTT- or FTS-, FUT-, VGT-, HGT-, and VFT- relays.

6.16 The FTT- or FTS- and the FUT- relays in operating select the LL. The VGT- and the HGT- relays then operate the associated VGB- and HG- relays in the LL. The HG- relay in operating closes through the LB- and LL- test leads for testing the line links, and also closes through the SM- leads to operate the LL select magnet. The VBG- and the HG- relays operate the associated LG- relay in the LL. The operation of the LG- relay closes through the LG- leads to the VFT- relay for controlling the operation of the proper LL hold magnet.

ITR CALL, ADVANCE TO CB - SC105

6.17 The ITR calls require two linkages through the LL and TL. The first linkage is the FLG, from the called line to the ITR trunk. The second linkage is the CB, from the calling line to the ITR trunk.

6.18 The marker performs some similar functions on both linkages but some functions are used only on CB, and some are used only on FLG. Accordingly, when the marker advances from the FLG to the CB linkage, the marker must:

- (a) Release all apparatus associated with FLG functions that will be reused on the CB linkage.
- (b) Release relays that are only required on FLG.
- (c) Reoperate relays required for CB linkages.

A. Line Link Frame Control

6.19 On FLG linkage, the LL information was obtained from the NG and registered on the FTT-, FUT-, VGT-, HGT-, and VFT- relays. When the LK2 relay operates, the above relays are released and then reoperated through the CB- relay contacts from the calling line information as recorded in the originating register.

B. Channel Selection

6.20 Since another channel is required the marker releases the relays used to set up the first channel and then reoperates relays required for selecting a second channel.

C. Linkage Check Relays

6.21 Channel test relays and linkage check relays are released and then reoperated on the CB linkage.

D. Trunk FA and FB Appearance

6.22 On FLG linkages, the FB trunk appearance is used, however, on the CB linkage the FA appearance is used.

LOCKOUT OF LL DIAL TONE STARTS - FS5

6.23 On CB linkages, the marker operates the RL relay in the originating register, which causes the channel from the calling line to the register to release. The release of the line hold magnet permits the line relay to reoperate. This would ordinarily cause a dial tone start. However, the lockout feature prevents this line from starting a call and also prevents this line from being falsely identified, if some other line on the frame has already started a call.

6.24 When the CB2 relay operates on call back operation, the LOT relay operates to prepare for the lockout test. When the TCHK relay operates, ground is applied to the G lead to the LL. If the DT relay in the LL is released indicating no dial tone starts, ground is returned over the LO lead to operate the marker LOT1 relay.

6.25 The operation of the LOT1 relay returns battery to the LL over the LOB lead, which operates the LO relay in the LL and prevents any dial tone starts. The LO relay also returns ground over the LOK lead to operate the marker DTK relay as a check that the LO relay operated.

6.26 If the DT relay in the LL is operated indicating a dial tone start, then ground on the G lead operates the DTK relay in the completing marker and the DTK relay in the dial tone marker through the LLMC.

6.27 The operation of the DTK in the dial tone marker blocks the HGG and GK relays and prevents identification of the calling line. With identification blocked in the DT marker, the operation of the L relay when the call back linkage is established will not cause false line identification.

6.28 Lockout in the DT marker only occurs when the completing marker has control of the frame through the frame connector.

LL PLUGGED BUSY

6.29 If the LL is plugged busy, battery on the start lead to operate the LL MP- relay operates the LLB relay over the TMB lead. The operation of the LLB causes alternative action as shown on SC125, which may be to return busy tone, route advance, or a similar action depending on the type of call.

LINE-BUSY OR IDLE TESTS - FS47

6.30 On an ITR or TER call, after receiving the location of the called line, the marker seizes the LL by operating the marker preference control relay (MP-). The MP-relay operates the LL connector relays, thereby establishing a connection from the marker to the LL. The LL seizure is checked in the marker by the line frame check (LFK) relay. The marker checks that only one VGT-, HGT-, and VFT- relay has operated by the operation of the VTK1, HTK1, and FTK1, respectively. Closure of the connector relays operates the vertical group B (VGB-) and the horizontal group (HG-) relays in the LL from the VGT- and HGT- relays in the marker.

A. Test of Line Hold Leads LH0-4

6.31 When the marker goes off-normal, the LHT relay is operated. Battery is then extended through the LHT relay and the back contacts of the VFT- relay over the LH- leads. If a cross appears on the VFT- contacts, or if the LH- leads to the LL are crossed or falsely grounded, battery or ground is returned through the selected VFT- relay and operates either the LIT relay or LBT relay.

6.32 If this occurs, the LIT or LBT relay holds the LHT relay operated. The LHT blocks the HGK relay from operating, resulting in a marker time out and a trouble record.

6.33 If there are no crosses on the VFT- contacts or if the LH- lead to the LL are not crossed or falsely grounded, then the LHT relay releases. The HG- relay in the LL then operates the HGK, horizontal group check, relay in the marker. The HGK relay and the VGB- relay operates the associated LG- relay in the LL.

B. Line Idle Test

6.34 With the LG- relay in the LL operated, the marker tests for line idle or line-busy over an LH- lead to the line hold magnet as determined by the operated VFT-relay. If the line is idle, the line hold magnet battery operates the LIT relay in the marker.

C. Line-Busy Test

6.35 When the marker is testing for an idle or busy line, a ground appearing on the sleeve of the hold magnet indicates a line-busy condition. This ground operates the LBT relay in the marker, the LBT relay operates the LBTA relay which prevents the operation of the HMS1 relay. The LBTA relay then operates the LB relay.

6.36 On an ITR call, a line busy condition indicated by the operation of the LB relay causes a route advance from the ITR route to a tone trunk. The route advance is started by the operation of the RAV1,2, route advance, relays.

6.37 On a TER call, a line busy condition operates a BY relay. This releases the LL by releasing the LLC1 relay in the marker. The BY relay also releases the RS-relay, which releases the previously selected ringing switch select magnets and in turn, releases the RSK relay. The RSK and SRK, in releasing, operate the overflow hold magnet (OFH) relay and cause the operation of the ringing switch select magnets 9 and 1, which is the combination for signaling the trunk to return busy tone. The RSK and SRK relays then reoperate. The OFH relay operated, operates the LI relay. The ringing switch hold magnet operates in a similar manner as for an idle line. The ringing selection switch check relays operate the overflow hold magnet auxiliary (OFH1) - which releases the F relay in the trunk. The RCK1-3 relays then release and with the BY relay operated, operate the DIS1,2, disconnect, relays B37.

7. NUMBER GROUP OPERATION - SC116

7.01 When ETS is not provided number group (NG) operation is required to translate the called station number or the incoming tandem or toll trunk number into a line equipment number, ringing combination, and if provided a terminating treatment. When ETS is provided this function is provided by the No. 5 ETS processor.

7.02 A number group is equipped to assist in the translation of 1000 directory numbers. Therefore, one NG is assigned to each series of 1000 numbers. By examining the thousands digit of the called number, the marker determines the particular NG required.

7.03 The marker selects and seizes a NG, and transmits the called hundreds, tens, and units digits to it. The NG translates the called numerical digits into called line location in terms of the LL number and location on the frame in terms of vertical group, horizontal group, and vertical file. The NG also provides the marker with the ringing code that the trunk should use in ringing the called line. If tens block screening is provided, a terminating treatment mark is also obtained in each translation to indicate any special treatment to which a line may be entitled.

7.04 A summary of the leads between the NG and marker that are cut through by the NG connector are shown in 7.08.

7.05 On TER calls, before seizing the NG, the marker must seize a TL. On ITR calls, the marker attempts to seize an NG at the time a TL seizure is attempted. If the marker fails to obtain a TL before completing its NG seizure, the NG is released for use by other markers and the marker awaits a TL seizure before attempting another NG seizure. This permits a saving of marker holding time by permitting the marker to attempt NG and TL seizure at the same time.

CALLED NUMBER - FS71, 75, 81

7.06 The marker receives the office code and numericals of the called line directory number from the register. The marker must determine which digits of the called number are the office code digits and which are the numerical digits, in order to operate the correct thousands, hundreds, tens, and units digit relays. Since the number dialed may have 0, 1, 2, or 3 office code digits ahead of the line number the marker provides a group of N1, 2, 3, and 4 relays which connect the numerical registration to the TH-, HN-, T-, and U- relays.

7.07 If a 10-digit call is to be completed locally (non-CAMA), the N1, 2, 3, and 4 relays are not operated, and instead a foreign area translator must be used to provide this function. In this case the TH-, HN-, T-, and U- relays will be connected to the G-, H-, J-, and K- leads from the register. An FAT-(A) terminal must be used to seize the FAT, which operates its DEF3 and GHJ1, 2 relays, and causes the TH-, HN-, T-, and U- relays to record the numericals of the called number.

7.08 A summary of the information transmitted over the leads through the number group connector is contained in the following table:

<u>Leads</u>	<u>Information</u>
ST00-39, UK BS1-4, NGK, W	Start, battery supply and check leads for selecting NG.
PN, PN1, TN, TN1, PTN PTN1, EN, EN1, BNK	Physical, theoretical, extratheoretical check and blank number check from NG.
TMB	NG plugged busy - operate NGB.
AK, SCK, LA, OA, OTB, EG	Number group control with PBX hunting.

Leads (Cont)

Information

OHB, LHB, SPT, HB0-9 TB0-9, U0-9	Hundreds, tens, and units information to NG.
WL, WG, WF, FN, L	Battery supply for NG translation.
FT0-5, FU0-9, HG0-9, VG0-11, VF0-4, RC1-15	Line location and ringing combination from NG.
TNK, OFK, FNA, FNB, PBN, PMO	Trunk number check, overflow check, free number, and permanent busy or overflow.
S0-9	Sleeve busy test for lines in PBX hunting group.
ANK, AN0-4	PBX allotter control and busy test.
NGF	NG busy indication at jack, lamp, and key circuit.
OOF	Traffic register for overflow.
TBS0-3	Tens block screening control.
LOLC	Indicates long-loop operation with PBX lines.
LOLN	Battery supply for long-loop operation.
NGBS	Block-select tests.
LGC	Status connector circuit control.
XSC	NG cross indication to MTFC.

7.09 The numericals of the called directory number are identified in the marker by the operation of the TH2/5, HN2/5, T2/5, and U2/5 relays. These relays translate the digits from a 2-out-of-5 code to a 1-out-of-10 code that is used for the NG control.

7.10 As an indication of which digits are office digits and which are numerical digits, one of the number translator N1-4 relays is operated. The operation of the N1 relay is controlled from the OA, OB, PHC,

and THC register signals, if the number does not have any office code digits. The N1-4 relays are controlled from the local completion relays. Relays LPA, LPB, LTA, LTB, LEA, and LEB plus the type of translator used on the call.

<u>Number of Office Code Digits</u>	<u>N Relay</u>
0	N1
1	N2
2	N3
3	N4

(a) Number Series: 10,000 or less non-conflicting numbers between 0000 and 9999. They may be associated with one, two, or three office codes.

(b) Number Series Group: 30,000 or less numbers that are associated with three or less office codes. There is a maximum of two number series groups, which are designated group A and group B, each consisting of a maximum of three number series with a maximum of three office codes.

(c) Number Group Frame: A frame containing 1,000 numbers that can be used with one, two, or three office codes. A maximum of 40 number groups may be provided for one marker group.

(d) Rate Discrimination: A means of differentiating, where necessary, between numbers in different office codes, but within the same number series group. Numbers in two different number series groups are differentiated by a number series group A or group B indication. Where required, rate discrimination is provided to give separate rate treatment to the three or less office codes within a number series group.

NG SELECTION - FS83

7.11 The marker selects the proper number group as described in the following paragraphs.

A. Call to Station Number

7.12 The marker selects the proper NG by operating the thousands digit TH2/5 relays plus a number series NSS0-5 relay which closes battery to one of the 60 ST0-9 cross-connection terminals. There is one set of ST0-9 terminals for each NSS- relay. The ST0-9 terminal is cross-connected to one of the NG connector start ST00-39 terminals, which causes the NG to be connected through the NG connector to the marker.

7.13 A marker group is arranged to handle a maximum of six office codes spread over six number series with a maximum of 40,000 numbers. An office code may use the full 10,000 numbers of a number series or it may use only part of the 10,000 numbers. If the full 10,000 numbers of a number series is not used, then two or three office codes can use the same number series. When a number series is used with two or three office codes all of the numbers within a hundred block are restricted to one of the office codes.

7.14 As shown in Note 406 and FS81 the office code group terminals are cross-connected to the NSS0-5 terminals to operate the number series relays.

7.15 A maximum of three discriminating treatments by office codes is permissible within a number series group. The local completion discriminating marks for a 5-, 6-, or 7-digit terminating connection are LPA, LTA, and LEA for number series group A and LPB, LTB, and LEB for number series group B. For a 4-digit incoming connection the incoming trunk group discriminating marks are 8SP or 9NP, 5ST or 6NT and 1SE or 4NE, with a nondiscriminating mark 2SA or 3NA. For a 4-digit incoming connection the number series group mark is OA or OB. Discriminating marks are also obtained from the NG and are designated PN or PNL, TN or TN1 and EN or EN1, with a nondiscriminating mark PTN or PTN1. The information received from the NG is matched against the local completion relay information that the marker used in selecting the NG. If a match is made, the PTK relay operates. See sheet B63.

B. Through-Switched Call

7.16 A translation to give the line link frame appearance of an incoming toll or tandem trunk is used on a TOG call when the linkage is established between this appearance and an outgoing trunk. The trunk number is received from the incoming register on the HT-, TT-, and UT- leads. The TRN relay operates instead of the N1-4 relays to cut these leads through to the HN-, T-, and U- relays, and to control the seizure of a trunk number NG. The marker may be arranged for a maximum of 4000 trunk numbers. Any of these 4000 numbers can be assigned to AMA or non-AMA trunks. However, due to AMA equipment limitations, the maximum number of 1000 CAMA trunks and 2000 tandem AMA trunks still applies in these marker groups.

7.17 Marker relays, THT0-3, are used to identify the thousands group in which the incoming trunk appears. The marker uses this information to select the trunk number group to determine the location of the incoming trunk on the line link

frame. Relays THK0-3 provide a check that the thousands digit is locked in the outgoing sender.

7.18 Option ZZT provides the 4000 trunk numbers. CAMA offices must also provide option ZTZ where 4000 trunk numbers are provided.

7.19 Two number groups are provided for translating each group of 1000 trunk numbers in order to prevent troubles from blocking tandem or toll calls.

7.20 For toll trunks a different equipment location is received from each of the number groups, because the toll trunk has an appearance on two LLs. For tandem trunks, the translation is the same from both number groups because only one LL appearance is provided. In order to equalize traffic in the number groups, the marker is arranged to prefer the A number group on ECN, even numbered IRMC and the B number group on OCN, odd numbered IRMC.

C. Intercept Trunk Translation

7.21 When a call is to be routed to intercept off the line link frame, a different number group may be required than the one used for the called station. Therefore, a number group start punching is provided for each type of intercept.

D. Test Desk Access to Originating Only Lines

7.22 The options ZLY and ZLX provide test desk access to originating only lines without using SC- relays. The TNK mark from the number group is used for outgoing only lines and the lines are no longer associated with a hunt group. Service calls to these lines will be routed to BN intercept when the TNK relays operate. On a SPL call the TNK operate path is opened and if option UY is provided the RCT1 is operated by the TNK ground (option ZLY). If option UY is not provided the RCT10 is operated and the RCT1 operate path is not required. The option ZLW is provided for nonspecial markers or special markers when the feature is not provided.

NG SEIZURE - SC116, FS83

7.23 The NG is seized for TER, ITR, TOG, and TRF calls.

7.24 On TER calls, the TFK3 and SNG2 relays operate the marker preference MP- relay in the NG preference control and make-busy circuit. This seizes the NG connector, which connects the marker to the NG by operating the connector multicontact relays. The marker knows when it is attached to the NG by the operation of the number group check NGK and NGK1 relays.

7.25 On ITR calls, marker holding time may be reduced by allowing the marker to attempt an NG seizure while attempting a TL seizure. The FS- and ITR1 relays operate the marker preference MP- relay for NG seizure. When the NGK1 relay operates, it causes the release of relay FSA, which opens the operating circuit for the MP- relay in the preference control and make-busy circuit. However, if the TFK2 is operated, indicating trunk frame seizure, the circuit to the MP- relay remains closed. If the TFK2 relay is operated, prior to the release of the FSA relay, the MP- relay is held operated. If, however, the marker is delayed in its TL seizure and the TFK2 relay is not operated, the MP- relay releases, releasing the NG. Reseizure of the NG on this call then awaits TL seizure and the operation of the TFK2 relay.

7.26 On TOG calls, the TFK2 and SNG2 relays operate the marker preference MP- relay to start NG seizure.

7.27 In those offices where unused hundred series of numbers exist in a NG, a second thousand series of numbers in the same office code group may be put into the NG to employ the unused hundred series of numbers. In such offices, the ST- terminal associated with the added thousands series is cross-connected to the AS terminal and causes the operation of the AST, additional start, relay. Battery is then extended through the AST relay and an NSS- relay to an AST0-5 terminal, which is cross-connected to the ST- terminal of the NG, containing the partially used series. The MP- relay associated with this marker then operates.

A. Operation of the Hundreds Block Relay in the NG - FS90, 86

7.28 An HB0-9 relay in the NG is associated with the hundreds digit of the called number. Battery is extended to the NG over the HB0-9 lead associated with the operated HN2/5 relays to operate an HB0-9 relay in the NG.

7.29 The operation of the NG HB0-9 relay places ground on the PT cross-connection terminal associated with that HB-relay. The cross-connections for the PT terminals are made in accordance with the cross-connection information shown in the NG. These cross-connections provide discriminating marks which are designated PN, TN, EN, and PTN or are designated PN1, TN1, EN1, and PTN1 if the number is part of an added thousand series. If a PN1, TN1, EN1, or PTN1 relay is operated the marker compares this fact with the operated AST relay. If they do not agree the blank thousand indication is given. The information received from the number group is matched against the local completion relay information that the marker used in selecting the number group. If a match is made, the PTK relay operates.

B. Operation of the Tens Block Relay in the NG - FS92

7.30 A TB00-99 relay in the NG, associated with the tens digit and the hundreds digit of the called number, is operated to indicate the group of ten directory numbers in which the called number is located. The PN, TN, EN, or PTN relay closes battery to the NG over the one TB0-9 lead associated with the operated T2/5 relays. The TB-lead is extended in the NG through the HB-relay contacts to operate the one TB00-99 relay associated with the tens digit and hundreds digit of the called number. The marker TBW relay operates in series with the NG TB-- relay and checks that the operate path has been completed.

C. Operation of the Units Relay in the NG - FS94

7.31 A U0-9 relay in the NG is operated when the NG connector relays close the U0-9 leads from the marker to the NG. Battery is closed through the operated U2/5 relays in the marker to one U0-9 lead to the NG. The operation of the NG U- relay extends ground over the UK lead to the marker, operating the UK relay, which checks that the NG units relay has operated.

NG TRANSLATION - FS96

7.32 Each of the 1000 numbers in a NG has three terminals designated L, G, and F. Each also has three separate fields of cross-connection terminals. These three fields consist of the LL, VH, and RF terminals. The translator gives information

about the called number over two sets of leads from each cross-connection.

7.33 The hundreds, tens, and units digits transmitted to the NG by the marker determine which set of L, G, and F terminals are connected to battery from the marker over the WL, WG, and WF leads.

7.34 The L terminal is cross-connected to an LL- terminal, which extends battery over the FT0-5 leads and FU0-9 leads to cause operation of the proper frame tens number FTN0-5 relay and frame units number FUN0-9 relay in the marker.

7.35 The G terminal is cross-connected to a VH- terminal, which extends battery over the HG0-9 leads and VG0-11 leads to cause operation of the proper horizontal group number HGN0-9 relay and vertical group number VGN0-11 relay in the marker.

7.36 The F terminal is cross-connected to an RF- terminal, which extends battery over the RCL-15 or the TNK lead and VF0-4 leads to cause operation of the proper ringing combination RCN1-15 or TRC relay and vertical file VFN0-4 relay in the marker.

7.37 The information on leads FT-, FU-, VG-, HG-, and VF- causes the operation of the associated FTN-, FUN-, VGN-, HGN-, and VFN- relays. This information is then stored on the corresponding FTT- or FTS-, FUT-, VGT-, HGT-, and VFT- relays which lock through their associated FTL, FUL, VGL, HGL, and VFL relays. See FS3, 4, 6, 7, and 8.

7.38 The vertical file and ringing combination cross-connection in the NG for a station number is from an F to an RF terminal. The ground received on the RC-lead causes operation of an RCN- relay. If tens block screening is not provided, the corresponding RCT- relays operate and lock to RCL relay operated. In a NG for trunk numbers, the standard cross-connection is from an F to an RFTN terminal in which case a signal is transmitted on the TNK lead instead of the RC- leads. Relay TRC operates in turn operating TNK relay which locks the RCL relay operated. RCN information is not required with trunk numbers.

7.39 An improved cross check on the FTN- relays (option ZPD) detects shorted FTN- contacts on calls which use a different FTN- from the shorted one. When the marker does detect trouble with FTN- contacts, the XFTN relay operated will operate the FTTB relay which releases all the

FTT- relays. This opens the start leads to the preference control and make-busy circuit (SD-26039-01) and prevents a backup of traffic.

7.40 An operated TNK relay normally indicates that the marker is processing a through-switched call. If TNK operates on a terminating or intraoffice call, it is an indication that the customer dialed a trunk number and the call is routed to blank number intercept. A permanently operated TNK (most likely caused by sticking contacts of the TRC relay, option UZ) will cause all terminating and intraoffice calls to be routed to blank number intercept with no indication that a trouble exists.

7.41 A check circuit provides a trouble record if TNK is operated when it should not be. Contacts of the TNK and OAT relays are added to the XRC circuit to provide the check. If TNK is operated while the marker is idle, the OAT break-contact provides a path to operate the XRC and produce an XRS1 trouble record. If TNK operates falsely during a call, one of the RCT relays will be operated and again a path is provided to operate the XRC relay. Option ZKI (rated Standard) provides this check circuit.

A. Tens Block Screening Provided - FS104, 139

7.42 When tens block screening is provided, cross-connections are made in the number group so that 1-out-of-4 TBS- relays in the number group operates in series with the TB-- relay. This indication is passed to the marker to operate the corresponding TBS-relay in the marker. The particular TBS-relay that is operated can screen certain ringing combination indications to give four different meanings to each ringing combination depending on the group of tens blocks in which the line is located. If all lines in a number group are assigned to the same group of tens blocks the TBS- relays need not be furnished in the number group and the required TBS- lead to the marker is permanently grounded.

7.43 After being screened each of the ten altered ringing combination indications terminate in two independent punchings. One of the punchings is cross-connected to operate the desired RCT- relay which operates and locks to the RCL relay. The other punching is cross-connected to operate the desired terminating treatment relay which operates and locks to the TTL relay. If no special terminating treatment

is required or the numbers are associated with a trunk number, the cross-connection is made to the POTS relay to satisfy the TTL check. Since the ten altered ringing combination indications from the number group are no longer associated with a ringing switch level, they are grouping points with the cross-connection in the marker determining the actual meaning of the F to RF cross-connection in the number group.

7.44 Option ZSZ provides tens block screening of the RCN8 mark from the number group. This provides some degree of flexibility in assigning tens block screening terminating treatments.

7.45 In addition option ZSW arranges the LLPX mark from the number group to indicate individual customer group intercept announcement in centrex offices with tens block screening. This makes the customer group announcement independent of tens block screening marks in these offices.

7.46 Option DO permits association of a PBX hunting group with more than one TBS-relay.

B. Number Group Release

7.47 The operated LA relay indicates that the line location information is registered and locked. The operated RCL relay indicates that the ringing combination information is registered and locked. The operated TTL relay indicates that the terminating treatment information is registered and locked.

7.48 On calls to nonhunting numbers requiring no overflow registration, the NG is released by the RNG relay as soon as the translation is registered in the marker. If overflow registration is required the NG is held until the LL is seized and the line tested for busy condition.

7.49 On calls to hunting groups, the NG is held until all lines are found busy or an idle line is selected, and the line hold magnet location and ringing information are obtained.

7.50 The marker releases the NG by releasing the MP- relay of the preference circuit.

C. Overflow Registration

7.51 In order to obtain overflow registration from nonhunting numbers, it is

necessary to furnish one OF relay in the NG for each number. When the marker connects battery to the G number terminal, relay OF operates, ground lead OFK to inform the marker that overflow registration is required, if it is a regular call. The OF relay also connects the battery that is on the L lead to the VH terminal. After receiving the line hold magnet location information, the marker holds the NG while it connects to the LL and tests the line. If the line is busy and the call is a regular one and not a no-hunt or no-test call, the marker operates the overflow register over the OFF lead.

7.52 For overflow registration on a hunting group, the POF relay in the NG is connected to the A terminal of the last SC-relay of the group. When the marker connects battery to the OA lead, POF operates and connects ground to lead OFK to operate relay OFK in the marker. The operation of OFK indicates the end of the hunting group. It also indicates that overflow registration is required if the marker finds all the trunks busy.

INTERCEPT TREATMENT - SC122

7.53 The marker connects the calling line to intercept under the following conditions:

- (a) A blank number is called.
- (b) A changed or disconnected number is called.
- (c) A temporarily disconnected number is called.
- (d) A number associated with the line link appearance of a trunk is called by a customer.
- (e) A number associated with a line link pulsing line circuit is called by a customer.
- (f) The physical and theoretical match is not made.
- (g) The class of service match is not made when the multiple class of service match feature is provided for centrex.

7.54 The conditions listed above cause the operation of one of the intercept relays listed below.

- (a) BN - This causes the calling line to be connected to a no-such-number tone trunk or a machine intercept announcement.
- (b) RI - This causes the calling line to be connected to a regular intercept trunk.
- (c) OVC - This causes the overflow tone ringing condition to be set up on the ringing selection switch (option TY).
- (d) PMO - Same as above (option TX).
- (e) RIP - This causes the calling line to be connected to a PBX recorded announcement.

7.55 Some of the intercept conditions listed above are enabled by removing one or more number group cross-connections. In order to determine if intercept is required, the marker starts the TYM timing circuit when relay HTUK operates. If the called number is not to be intercepted, it is translated, the number group released, and the TYM timer recycled before the end of the timing period. Under this condition the call proceeds in the usual manner. However, if the called number is to be intercepted, the TYM timer times out and operates the TYM and TYMA relays.

7.56 The operation of relay HTUK removes ground from the secondary winding of the TYM relay and the short circuit from the TYM1 capacitor. This permits the TYM1 capacitor to charge through the 2600-ohm winding of the TYM relay and TYM0 resistor. After an interval of time, the capacitor will be fully charged and the current flow through the 2600-ohm winding will cease. The TYM relay then operates on its 200-ohm winding in series with the TYM1 resistor.

7.57 The operation of relay TYM operates the TYMA relay, which extends ground through the nonoperated line identification relays to the intercept cross-connection terminals (option Y).

7.58 When discrimination between local and toll incoming calls is provided (option X), the ground is extended to either the local or toll intercept cross-connection punching.

A. Called Number Associated With Unequipped NG

7.59 When the called number thousands digit represents an unequipped NG, the

marker proceeds with its functions up to the selection and seizure of a NG. Then, when the marker extends battery to an ST-lead, a NG is not seized. The battery on this ST- lead is extended to the associated ST- cross-connection terminal. This ST-cross-connection terminal is cross-connected to the BNTH cross-connection terminal, thereby extending battery to operate the blank number thousands or hundreds BNTH relay.

B. Called Number Associated With Blank Hundreds Group

7.60 When the called number is one of a blank hundreds group, the marker proceeds until NG translation is required. Then, the operation of the number group HB-relay extends ground to the PT cross-connection terminal in the NG. When the hundreds group has only blank numbers, the PT cross-connection terminal is cross-connected to the BNK terminal in the NG thereby, extending ground over the BNK lead to operate the BNTH relay in the marker.

7.61 The operation of the BNTH relay extends ground to the BTI cross-connection terminal. These terminals are cross-connected to the BN, RI, or RO cross-connection terminals.

C. Called Number is a Changed or Disconnected Number or is an Individual Blank Number that is Treated as a Disconnected Number

7.62 When the called number is a changed or disconnected number, or is an individual blank number that is treated the same as a disconnected number, the marker proceeds with its functions until NG translation is required. However, in the NG, the cross-connections to the L-, G-, and F-cross-connection terminals for this called number are omitted. Therefore, the called line identification relays in the marker do not operate. The operation of the timer extends ground to the NI cross-connection terminal which is cross-connected to the appropriate intercept relay.

D. Called Number is an Individual Blank Number that is Treated Differently from a Disconnected Number

7.63 When the called number is an individual blank number or an unassigned number, and it is treated differently from a disconnected number, the marker proceeds with the connection until NG translation is required. In the NG, the cross-connections to the L- and F- terminals are omitted, but the G- terminal associated with the called number is cross-connected to the VHG-terminal. Battery is extended through the

NG and operates the VGN- and HGN- relays in the marker. The VTN- and HGN- relays cause the VGL and HGL relays in the marker to operate as described in 7.32 through 7.52.

7.64 The TYM timing circuit functions as described. Upon timing out the TYMA relay extends ground to the GI cross-connection terminal through the operated VGL and HGL relay contacts and the nonoperated VFL, RCL, FTL, and FUL relay contacts. This terminal is cross-connected to the RI or BN terminals depending on the type of intercept treatment desired.

E. Called Number is an Individual Number That is Temporarily Disconnected

7.65 When the called number is an individual number that has been temporarily disconnected, the marker proceeds with the connection until NG translation is required. In the NG the G- and F- cross-connection terminals are cross-connected to the VHG- and RF- terminals. The cross-connection to the L- terminal in the NG is omitted. Marker relays VGL, HGL, VFL, and RCL are operated as a result of these cross-connections in the NG and the FTL and FUL relays in the marker are nonoperated.

7.66 Since a complete NG translation cannot be made the TYM timer times out and operates the TYMA relay. The TYMA relay causes ground to be extended through the operated VGL, HGL, VFL, and RCL relay contacts, and the nonoperated FTL and FUL relay contacts to the TI cross-connection to the RI or BN terminals for the desired intercept treatment.

7.67 When a line with centrex service is temporarily disconnected it may, if desired, be routed to the attendant for that customer. The line is cross-connected in the number group to look like the listed directory number with the exception that the translation gives any convenient non-hunting ringing combination instead of RC10. The call is then handled as a LDN call.

F. Called Number is a Trunk Number or LLP Line Circuit Number

7.68 If a customer calls a trunk number or a LLP line circuit number, ground is placed on the TNI punching. This terminal is cross-connected for the desired intercept treatment.

G. Physical and Theoretical Match

7.69 If the physical and theoretical check between the trunk class or local completion relays and the output of the number group does not match, ground is placed on the NMI punching. This terminal is cross-connected for the desired intercept treatment.

H. Multiple Class of Service Match Feature for Centrex

7.70 If a mismatch occurs when the multiple class of service match feature is provided, the MM relay operates. This causes a marker recycle in the same manner as a plugged-up line condition except that with the MM relay operated the RIP relay is operated to give a PBX announcement.

TROUBLE INTERCEPT CONNECTION

7.71 When the marker determines that a connection to the called number cannot be completed because the customer's line is out-of-service, the marker connects the calling customer to a trouble intercept trunk. The trouble intercept trunk connects the calling customer to an operator.

7.72 The trouble intercept trunks terminate on the LL. Therefore, in setting up a trouble intercept trunk connection, a connection is established from the LL associated with the trouble intercept trunk to the TL associated with the ITR or TER trunk.

A. Call to a Non-PBX Number

7.73 If the call is for a non-PBX number, the line out-of-service is plugged-up on the MDF. When the line is plugged-up, battery on the ring conductor and ground on the tip conductor indicate to the marker that the call should be routed to a trouble intercept trunk. The marker functions for a called number associated with a plugged-up line are described in 13.

B. Call to a PBX Number

7.74 On calls to nonhunting numbers, which are plugged-up, the marker distinguishes the plugged-up condition by finding the proper potential on the tip and ring conductors. This method cannot be used on calls to hunting numbers, because improper operation of the PBX may present a condition on the tip and ring conductors that looks to the marker like the plugged-up line signal.

7.75 If it is desired to take out of service one or more lines, but not all lines of a PBX line group, those lines that are to be removed from service are made busy. The marker in performing the terminal hunting functions selects only those lines in the PBX line group that are idle or not made busy. The marker operation for this condition is similar to that described for terminal hunting.

7.76 If it is desired to take out of service all of the lines in a PBX line group, they are all made busy, except the first PBX line, which is the director number. The G- and F- cross-connection terminals in the NG which are associated with the first PBX line, are disconnected. Therefore, the marker, in performing the NG translation, recognizes that only the L- terminal is cross-connected in the NG and a connection to a trouble intercept trunk is established.

7.77 The marker proceeds in the usual manner until NG translation is received. In the NG, the cross-connections to the G- and F- cross-connection terminals are omitted and only the L- terminal is cross-connected to the LL- terminal. Battery is extended through the NG to operate the FTN- and FUN-relays in the marker, and the FUL and FTL relays, in the marker are operated.

7.78 The marker starts the TYM timing circuit when the HTUK relay operates, and a time-out results. The TYMA relay, in operating, extends ground through the operated FUL and FTL relay contacts and nonoperated VGL, HGL, VFL, and RCL relay contacts to the winding of the PUL relay, which operates. The PUL relay operates the trouble intercept TBI relay to start a connection to a trouble intercept trunk.

VACANT AND DENIED CODE INTERCEPT

7.79 The marker is arranged to intercept unused or vacant codes usually contained in the area numbering plan and certain codes denied (hereafter referred to as denied codes) to some originating customers and to specific types of incoming trunks because of rate discrimination. Incoming trunks with only trunk link frame appearances may be set to return reorder on vacant or denied codes (A&M Only arrangement) or these trunks may be connected to intercept trunks on the line link frame for vacant or denied codes.

7.80 Denied or nonworking code points (in some cases screened through the S relays) that enter the marker group over incoming trunks are either cross-connected to operate the DCI (denied code intercept) relay, or the VCI (vacant code intercept) relay. The operation of the DCI or VCI relay will operate the BN and RI relays respectively, as well as the TER1-2 relays which marks this call as a terminating call, the BN relay with the CDI relay operated will operate the DCIA (denied code intercept auxiliary) relay. The RI relay with the VCI relay operated will operate the VCIA (vacant

code intercept auxiliary) relay. The call then progresses as a terminating call that has encountered a blank number or regular intercept condition. The marker transmits the DCIA or the VCIA line number information to the number group and obtains from it the line link frame location of the intercept trunk. This intercept trunk line number is placed on the HB-, TB-, and U- leads to the NG by associated cross-connections. See FS90, 92, 94.

SEPARATE TRUNK GROUPS FOR LINE LINK FRAME INTERCEPT - OPTIONS SM, QE, YG - APP 82

7.81 This feature adds relays and wiring to permit additional intercept trunk group numbers to be generated. Seven different trunk groups may be provided. Cross-connection terminals are provided to allow either common or individual use of the intercept trunk groups as determined by marker screening relays.

8. RINGING SELECTION SWITCH CONTROL

8.01 Trunks that can be connected to called customer lines are provided with verticals on the ringing selection switch.

8.02 The marker controls the selection of the ringing selection switch for ringing the called station or for returning line busy or overflow signals to the trunk. The ringing combination is obtained from the NG at the same time the marker obtains the line location of the called line.

8.03 Each ringing selection switch serves ten trunks that are wired directly to the verticals on the switch. The horizontal are all wired to the ringing supplies and to the interrupter. The ringing to be applied to the called line is transmitted to the selected trunk, which extends the ringing to the line at the proper time. The marker provides a maximum of fifteen different ringing combination translations that control the selection of a required ringing code on the ringing selection switch. The ringing voltage may be applied in coded form to the tip or ring conductor. This voltage is an alternating voltage superimposed on a dc voltage of either polarity.

8.04 One of two ringing selection switch select magnets (levels 0 to 1) is operated to select the tip and ring conductor to which the ringing should be applied. One of seven other select magnets (level 2 to 8) is operated to select the proper ringing supply. The remaining select magnet (level 9) is used to control

the line busy or overflow signals returned to the trunk. For this condition the 0 and 1 magnets distinguish between busy and overflow. By operating a hold magnet associated with the selected trunk, the proper ringing supply is connected through the crossbar switch crosspoints.

SETTING THE RINGING SELECTION SWITCH - FS96, 105

8.05 After the NG supplies the ringing combination for the called line to the marker, the marker establishes the ringing condition on the ringing selection switch and then transfers control of the ringing to the selected trunk.

8.06 The marker identification of the ringing combination translation is made by the one operated RCT1-15 relay, which operates two of the associated ringing selection RS0-9 relays. The RS0 or RS1 relay operates and determines if the ringing is to be on the tip or ring conductor; the RS2-9 relay operates to determine the ringing switch level and ringing code.

A. Ringing Selection Switch Check

8.07 With the operation of the RCT- relay and the two associated RS- relays, the marker is ready to set the select magnets of the switch for the desired ringing code. To ensure the operation of select magnets 0 or 1 and one of the select magnets 2 through 9 the RS2-9 relays operate select magnets 2-9 first. The marker RSK relay checks the operation of select magnets 2-9 and then closes the path to operate select magnets 0 or 1 to close through the proper ringing code. The RCK1 is used to make an overall check of the trunk and ringing switch.

B. Ringing Switch Hold Magnet Operation - FS43, SC110

8.08 The marker start ringing check (SRK) relay checks that the ringing switch select magnets are operated, and the CHA1 relay checks that an idle channel is available before operating the line idle (LI) relay. The LI relay grounds the RC lead to operate the ringing control (RC) relay in the trunk. Ground from the marker over the TP lead is closed by the trunk RC relay to operate the ringing switch hold magnet.

8.09 When the hold magnet operates, the locking ground is returned to operate the RCK1, which in turn operates the RCK2. The RCK2 operates the RCK3 to indicate proper operation of the RS switch. With the RCK3 relay operated and other linkage

checks performed, the double connection test (DCT1) relay operates and the call proceeds to completion.

<u>Ringing Selection Switch Control</u>		
<u>Ringing Control Information</u>	<u>*Ringing Selection Control Leads</u>	<u>Notes</u>
RCT1	RS0,RS6	
RCT2	RS0,RS2	
RCT3	RS0,RS3	
RCT4	RS0,RS4	
RCT5	RS0,RS5	
RCT6	RS0,RS7	
RCT7	RS1,RS7	
RCT8 - LCH	RS0,RS8	6-wire switches
RCT8 - TCH	RS0,RS6	See Note (a)
RCT8	RS0,RS8	4-wire switches only (A&M Only)
RCT9 - LCH	RS1,RS8	6-wire switches
RCT9 - TCH	RS1,RS6	See Note (a)
RCT9	RS0,RS6	See Note (b)
RCT9	RS1,RS8	4-wire switches only (A&M Only)
RCT10	RS0,RS6	
RCT11	RS1,RS6	
RCT12	RS1,RS2	
RCT13	RS1,RS3	
RCT14	RS1,RS4	
RCT15	RS1,RS5	
FNA(Free No.)	-	4-wire switches only, See Note 3
FNB(Free No.) - LCH	RS0,RS8	6-wire switches
FNB(Hunting) - TCH	RS0,RS6	See Note (d)

<u>Ringing Control Information</u>	<u>*Ringing Selection Control Leads</u>	<u>Notes (Cont)</u>
BNB	RS0,RS2	See Note (d)
RIB	RS0,RS2	See Note (d)
TBIB	RS0/1,RS2	See Note (d)
BY	RS1,RS9	See Note (d)
OV	RS0,RS9	See Note (d)
DCI	RS0/1,RS2	See Note (d)
VCI	RS0/1,RS2	See Note (d)

Notes:

* RS0 is associated with the ring party

RS1 is associated with the tip party

(a) FNA relay operates locally from RCT8 or 9.

(b) In offices arranged for RS control of LDN calls (A&M Only centrex). Used when a maximum of one incoming restricted treatment is sufficient.

(c) Free number operation does not affect switch levels determined by RCT-action.

(d) This action cancels any previous RCT-action.

For detailed information on the association of ringing supply and party line types with ringing selection switch level, see CD-26080-01.

ARRANGEMENT OF RINGING SELECTION SWITCHES (4- AND 6-WIRE)

8.10 The ringing selection switch formerly used was a 4-wire crossbar switch. In a cost reduction study of the No. 5 crossbar system, it was found that control of line busy, overflow, charge, and free call indications could be incorporated into a 6-wire switch thereby saving trunk relay equipment. The design of the wire spring relay type trunks on the basis of working with 6-wire switches introduced problems of circuit compatibility when these trunks are added to an office having 4-wire switches. In order to permit the use of the wire spring relay type trunks with the existing 4-wire switches, it is necessary to modify the existing 4-wire switches.

8.11 The marker is provided with options permitting it to operate with 4-wire, 6-wire or both 4- and 6-wire switches.

A. Six-Wire Switches

8.12 The charge supervision is controlled by the 6-wire ringing switch rather than the trunk. The operation of RCT8 or RCT9 indicate free service to nonterminal hunting lines. The free number FNA or FNB indication is not required from the number group as either RCT8 or 9 operates the FNA relay locally. For free service to terminal hunting lines (other than blank numbers or intercept which do not return charge supervision) RCT10 is used together with a free number FNB indication from the number group. The operation of RCT8, RCT9, FNA, or FNB causes the ringing switch to be set to one level on a local charge (LCH) or to another level on a toll charge (TCH).

8.13 This ringing selection switch level for local charge is wired to give free service.

8.14 When the ringing selection switch is used for centrex LDN calls (A&M Only) level 5 is also wired to give free service on LDN calls.

8.15 Charging supervision on toll calls to free numbers is obtained by the operation of the talking charge check (TCK) relay under control of the LI relay. The LCH relay or the TCH relay is operated by a trunk class relay on a TER call. The LCH relay is also operated on an ITR call. When the LCH relay is operated, the TCK relay is prevented from operating by the previously operated FNA or free number (FNB) relay.

B. Four-Wire Switches Only

8.16 The charge supervision is controlled directly by the trunk so, therefore, the setting of the ringing selection switch is not influenced by a free call. A FNA free number indication is received from the number group for both hunting and nonhunting lines. The regular RCT information is obtained from the number group as desired.

C. Intercept

8.17 With either 4- or 6-wire switches, the ringing switch is always set to level 2 on intercept trunks. Whether the ringing is applied to tip or ring can be controlled by cross-connections in the marker. On the ringing selection switches

serving trunks with no PU relay, level 2 gives continuous alternating and direct current or superimposed negative audible ringing.

CANCEL RINGING SELECTION SWITCH

8.18 The operation of the ringing selection switch is canceled on certain types of calls where no ringing is required and charge control is in the trunk.

8.19 The operation of CSW relay satisfies the marker check on ringing switch operation. Ringing is canceled and CSW relay operates on:

(a) Phase II centrex LDN calls - LDN relay operated.

(b) Free calls served by LLP - LSC1 relay operated.

(c) With the 4-wire switching feature, for certain preemptible and nonpreemptible lines - relays PML or LNP operated.

(d) Option ZOP provides a cross-connect field for ringing selection on 4-wire line intercept. A separate terminal is provided for 4-wire regular, blank number, and trouble intercept. Each may be cross connected to the no ringing (NRG) terminal to cancel the operation of the ringing switch or to the intercept ringing (IRG) terminal to provide ringing from the ringing switch. With this feature, the 4-Wire Intercept Line Circuit, SD-27647-01, can be arranged to not return a short off-hook to trip ringing in the incoming trunk. This off-hook, if returned, could be reflected back to the calling office. If the call originated from a 757, No. 1A ESS, or No. 101 ESS PBX the customer could be left high-and-dry or is connected to dial tone depending on the PBX.

9. TERMINAL HUNTING - SC118

9.01 When ETS is not provided terminal hunting is the function performed by the marker and NG in searching for an idle line or trunk in a group of lines or trunks. If the called line or trunk is busy, another line or trunk within the group may be selected.

9.02 When ETS is provided selection of an idle line in a hunt group is a function of the processor. The line is selected and the information concerning the line is

passed to the marker via the MDC circuit together with a PBX or NPBX indication. Operation of either the PBX or NPBX relay in the MDC will operate the CKR relay in the marker to cause a PBX recycle if the selected line is found busy at the line link frame.

9.03 Terminal hunting is used when more than one line or trunk is grouped with one number such as:

- (a) A number used to identify a PBX line group.
- (b) A number used to identify a group of trunks appearing on line positions and used for calls requiring regular or trouble intercept.
- (c) A number used to identify a group of trunks appearing on line positions and used as a routing for calls where the dialed number is a blank number.
- (d) A number of a line or trunk requiring exchange of busy with No. 5 equipment (emergency line, etc).

9.04 On PBX lines, the marker and NG proceed to translate the called directory number into equipment location and ringing combination in the same manner as for a non-PBX line. However, after the equipment location and ringing combination of the called line have been received, the marker recognizes from the ringing combination that terminal hunting is required. Ringing combination RC10 is used to indicate that a line is in a terminal hunting group.

9.05 When the marker recognizes RC10, it releases the called line location identification relays. The marker and NG then proceed with the selection of an idle line. To allow the marker and NG to hunt for an idle line within the terminal hunting group, the sleeve conductors within a tens block are extended to the marker. The marker tests these conductors for an idle condition (battery through the line hold magnet is recognized as an idle indication) and selects an idle line. The NG then transmits to the marker the line location information of the selected line.

9.06 Lines in a terminal hunting group require different treatment in the NG than nonterminal hunting lines, as follows:

- (a) All the lines in a terminal hunting group must use the same office code.
- (b) A nonallotted terminal hunting group may be distributed among several tens and hundreds blocks, but must remain within one NG.

(c) The cross-connection for the G, L, and F terminals in the NG are the same for both terminal hunting and non-hunting lines. However, for terminal hunting the F terminal is always cross-connected to an RF terminal associated with ringing combination RC10.

HUNTING WITHIN ONE TENS BLOCK - FS87

9.07 The circuit operation for a call to a terminal hunting line is the same as that for a nonhunting line up to the ringing combination indication. The marker operates the RCN10 and RCT10 relays indicating ringing combination ten is to be used. The PBX1-2 relays operate, indicating that the directory number is in a PBX terminal hunting group.

9.08 To extend the sleeve conductors of lines in a PBX group to the marker, a number group SC- relay is provided for each tens block. In addition, a TBA relay is provided for those tens blocks that have more than one PBX group, B65, SC116.

9.09 In tens blocks where lines of a single PBX appear, the SC- relay operates in parallel with the NG TB00-99 relay.

9.10 In tens blocks where more than one PBX appears, the NG TBA relay operates with the tens block relay. The selection of the proper SC- relay is determined by the TBA and U0-9 relays.

9.11 The sleeve check SLCK relay is closed through to the NG over the SCK lead and operates to check the operation of the NG SC- relay. SLCK relay operating:

- (a) Operates SAC relay allowing registration of idle line information.
- (b) Locks under control of the GB group busy relay normal.
- (c) Operates the CK0 relay which releases the LLI lock line identification relay, and the SNG1,2 relays.

9.12 The line identification and NG MC-relays release. After the line identification relays are released, the check release (CKR) relay operates to prepare for the new line identification and provision is made, via the CK0 relay make contact, to operate relay RYT for recycling the WT timer.

A. Sleeve Test - FS97

9.13 The NG SC- relay extended the sleeves of the lines over the S0-9 leads to the marker sleeve test SL0-9 relays. Cross-connections are provided to connect the

sleeves of lines within a terminal hunting group. If the line is busy, ground is applied to the sleeve lead, or if the line is idle, battery is applied through the LL hold magnets. Therefore, an SL0-9 relay in the marker operates for each idle line within the selected tens block. A set of SA0-9 relays records those PBX hunting lines that are idle at this time. To prevent any interference from other PBX lines that may become idle after the sleeve test, the SA-relays operated, operate the SAE relay which releases the SAC relay, opening the SA-relay operate path. The lowest numbered operated SA-relay, equal to or greater than the called number units digit closes its U-lead to the NG (FS94), the SAE relay operated also reoperates the SNG1,2 relays which reoperate the NG, MC-relays. The NG now proceeds to provide a translation for the idle PBX line.

BLOCK HUNT/SELECT OPERATION - FS88, 94

9.14 Where lines of a terminal hunting group are distributed over one or more tens blocks, the marker and NG first test for an idle line within the first tens block. Where the hunting group is confined to a single tens block, and all lines or trunks of the hunting group are busy an end of group (EG) relay operates to inform the marker that no further hunting should be attempted. The group busy (GB) relay also operates and causes the call to be connected to a tone trunk.

9.15 Where more than one tens block is involved in the hunting group and no lines are idle in the first tens block, the marker and NG advance to another tens block. In this manner all the terminal hunting lines within all tens blocks of the hunting group can be tested until an idle line is found.

9.16 Advancing from one tens block to another can be accomplished by the block hunt or block select method, depending upon which of these features is used.

9.17 In the block hunt method, after the marker has determined that no idle lines of the terminal hunting group exist in the tens block being tested, it advances to another tens block. It then hunts through this tens block. The order of advance is predetermined by cross-connections in the NG.

9.18 In the block select method, after the marker has determined that no idle lines of the terminal hunting group exist in the tens block being tested, it tests for a tens block having idle lines of the terminal hunting group and selects the block. The order of advance is predetermined, but it is contingent upon the existence of idle lines in a tens block.

9.19 Marker relay advance (A) operates from SLCK relay and locks under control of SCR relay normal. A relay operated prepares for block hunt or select to allow selection of a second tens block. The operation of the marker A relay extends battery over the OA lead to the A cross-connection terminal in the NG. By means of NG cross-connections, A to AD or A to AS, the A relay or SA relay operates for either block hunt or block select, respectively, B65. To check the operation of either of these relays, ground is extended over the AK lead to the marker which operates the AK relay B64.

9.20 The A or SA relay in the NG operated so that if there are no idle PBX lines within the first tens block, the marker is able to select a second tens block in the hunting group.

9.21 To provide sufficient time for any SA-relays to operate from the first tens block, the AK relay operates relay TYMA. When TYMA operates, and if none of the SA-relays are operated, the GB relay operates to indicate that all lines within the first tens block are busy, B69. The GB relay causes the release of the NG hundreds and tens block relays by removing the battery from the LHB lead, B67, and SCK lead, B65, to the NG SLCK relay also releases.

9.22 When the marker advances to test the lines associated with the hunting group in the second tens block, it must be able to select any one of the lines regardless of the number dialed. The units transfer (UT) relay operates to start the hunting beginning with the first line in the tens block, B64. This is done by transferring the operating path of the number group U0-9 relay from the control of the marker U2/5 relays to the UT relay, B69.

9.23 The marker relay SCR has been shunted by the NG, SC relay operated. The release of the SC relay is thus checked by

the operation of SCR relay. The SCR relay operates in series with the winding of the number group A or SA relay, which was previously operated, B65, and releases the marker A relay, B64.

9.24 If the NG is arranged for block hunt operation, battery on the OTB lead is extended from the marker to operate a predetermined tens block TB- relay and an SC-relay associated with the second tens block of the hunting group. For block select operation, the number group TB- and SC-relays operate in tens block in which idle lines of this terminal hunting group appear.

9.25 The marker GB relay releases and causes the SLCK relay to reoperate over the SCK lead. This checks the operation of the number group SC- relay for the second tens block. The marker and NG then test for an idle line in this tens block of the hunting group in the same manner as previously described.

9.26 Whether the NG is arranged for block hunt or block select operation, it is possible that all lines of the terminal hunting group in the second tens block are busy. In block hunt operation, since selection of a second tens block is predetermined by cross-connections, it is possible that all lines in the second tens block are busy prior to its selection. In block select operation, where a second tens block is chosen on the basis that idle lines appear therein, it is still possible for another marker to make a connection to the last idle line in the tens block during the interval of selecting the second tens block and the start of hunting by this marker.

9.27 If all the lines of a terminal hunting group are found busy, the NG and marker advance from tens block to tens block until informed by the marker end of group (EG) relay operation that the last tens block of the hunting group has been reached. When arranged for block select operation and all lines are found busy, the EG relay operates immediately and no further hunting is attempted.

9.28 Where lines are found idle during the hunting operation, the marker SA0-9 relays operate to identify these lines, B71. The SAE relay operates to signal the NG connector relays to reoperate and close through the U0-9 leads to the marker, B69. The NGK1 operates over the W lead to check the additional operation of the MC- relays. During

first trial calls with the TR1A relay operated, the selection of the number group U0-9 relay is made through the lowest numbered SA0-9 relay operated. For second trial, the selection is reversed through the highest numbered SA0-9 relay operated. With the units recorded in the NG the marker is now able to proceed with a translation of the number of the selected line into its associated equipment location.

10. OUTGOING SENDER SELECTION AND CONTROL - SC112 OR SC145

10.01 A No. 5 crossbar office is required to supply information to a connecting office when a call is to be routed through or completed in the connecting office.

10.02 Senders are used to store the call information received from the markers. Usually the senders convert the information to a pulse train form that can be used by the connecting offices. The connecting offices may be of various types and each office type may require a different sender type to work with the office.

10.03 The senders are arranged into sender groups, with a maximum of ten senders in a group. All the senders in a sender group have the same type of pulsing. In any one office there can be a maximum of twelve sender groups. Each sender group is subdivided into sender subgroup A and sender subgroup B, with a maximum of five senders in a subgroup. Senders may be associated with trunks having trunk link frame appearances, and line circuits having line link frame appearances (line link pulsing). The marker is directed to a sender group of the proper type to determine if either subgroup contains idle senders by:

- (a) The operation of the R- route relay when working with trunks.
- (b) The number group translation when working with line circuits.
- (c) The No. 5 ETS processor when ETS operation is provided.

10.04 After the marker has determined that an idle outgoing sender is available, it selects the associated sender subgroup. If more than one sender is idle in the selected subgroup, the marker selects the most preferred sender for service.

10.05 The marker gains access to the selected sender through the OSC. The connection between the marker and the sender consists of two channels: a channel that is common to all markers, and a channel that is individual to each marker and each sender.

10.06 The common channel is established by the operation of the OSC cut-through MA1,2, MB1,2, MC1,2, SA1,2 SB1,2, and SC1,2 relays. This channel extends the registration and route information leads to the sender, and is released after this information is received by the sender and checked by the marker. After the common channel of the OSC is released it may be used by other markers, to reach other senders within the same subgroup.

10.07 The individual channel, is established by the operation of the OSC control S relay; it extends control leads from the marker to the sender. For this description the S relay in the OSC will be referred to as the individual channel. Using the individual channel, the marker can retain control of the sender after releasing the common channel. This arrangement is used so that the marker will not exclude an entire sender subgroup from other markers for a long period of time.

10.08 The connection between the sender and the outgoing trunk or line circuit is established through the outgoing sender link (OSL). All outgoing senders of one type, up to a maximum of ten, have access to the outgoing trunks and line circuits that require senders of that type. However, when more than ten senders of the same type are required, two or more sender groups are provided. These sender groups each with the same type of senders, each has access to a different group of trunks and line circuits. When two or more sender groups of the same type are provided, the marker route relay selects the sender group used with the outgoing trunks required for that route, and the number group translation picks the sender group required for the selected line circuit.

10.09 The outgoing senders appear on the horizontals of the OSL crossbar switch, and the outgoing trunks and line circuits appear on the verticals of the switch. Therefore, the selection of an outgoing sender determines the select magnet to be operated, and the selection of a trunk or line circuit determines the hold magnet to be operated. Outgoing trunks and line circuits may not be intermixed on the same outsender link switch.

10.10 A summary of the leads used to select and control a sender through the OSC is shown below:

Information Transmitted Through Outgoing Sender Connector

<u>Leads</u>	<u>Information</u>
FT0-3, FU2/5, VG2/6, HG2/5, VF1/4	Calling line equipment location.
TM, TP, RP	TOG call, tip party, ring party.
AV	Advance signal to sender.
TG	Sender trunk guard signal to marker.
RO	Reorder signal to release sender.
OSGA0-11, OSGB0-11 SKA, SKB, ST(A), ST(B)	Outsender group selection in connector.
MA, MB, MC SAM, SBM, SCM	Battery supply for OSC, MC- relays, and cross test.
OSC-4	Test for idle sender in sender group.
S0-4, S, XS, XSA	Control of S- relay operation in OSC.
GBO(A), GBE(A), GBO(B), GBE(B)	Outsender group busy indication.
ON1	Sender off-normal relay control.
ORC0,1,2	Originating classes to CAMA sender.
AD, OD	Automatic or operator ID or CAMA sender.
AR2/5, BR2/5	Arbitrary digit information to OS.
CR2/5	Compensating resistance information to OS arbitrary digit information.
CL 1-8	Class information to OS.
MB2/5	Message billing information to OS.
DL1-6, AMA	Delete digit, AMA.

Leads (Cont)Information

TVT, SC, NOB, OBS

Test, service call, and service observing information to OS.

CP2/5, 4DG, 5DG, LST, L5D

Code pattern and 4-digit, 5-digit, lettered stations, and lettered 5-digit number structure information to OS.

A2/5 - L2/5, M7

Transmit called number to OS.

TSR, TSRL

Check of OSC, MC- relays.

RN2/5

Recorder number to OS.

MON, M, C, SLP
CD2/5, CDP2/5,
CDA2/5

Test leads and lamp indications control digit, priority, and routing information to OS.

SPC, NSP

Traffic sampling: sample or no sample.

ND

No digit pulsed class indication.

IDENTIFICATION OF OUTGOING SENDER GROUP - PS57-60A. ETS Not Provided

10.11 The operation of a R- route relay directs the marker to the proper trunks, and by operating an OSG0-11 relay, identifies the required sender group. The marker may then proceed to select one trunk and one sender to service the call.

10.12 A group of line circuits assigned to a PBX customer may be served by all of the sender groups used for line link pulsing. Each line circuit however, has access to only one sender group. The number group translation of FT-, FU-, VG-, HG-, and VF- directs the marker to a specific line circuit, and the RC- operates an OSG0-11 relay to inform the marker which sender group serves that line circuit.

10.13 Crossed wiring in the marker cross-connection fields may result in the operation of several OSG- relays. Previously when this occurred, the marker could seize a sender which was busy with another call. The information already stored in the sender would be mutilated by the marker as it attempted to store new information.

Then when the sender seized a transverter, the mutilated information may have caused an overload of the K fuse in the transverter, causing the fuse to blow. The OSG- circuit is arranged to provide detection of multiple OSG- relays and prevent the marker from seizing a busy sender.

10.14 The battery connection is removed from the OSG- relays and the relays are connected to the XT relay. The OSG- operating current must now flow through the marginal XT relay and, if more than one OSG- is energized, XT operates. A break-contact of XT added to the OSC operate path prevents OSC from operating, thereby preventing the marker from seizing any sender.

10.15 Another opportunity for falsely operating on OSG- relay occurs at the end of a call while the marker is waiting for the sender to complete a trunk guard test. If the marker had route advanced and the OSG- for the alternate route is different than the OSG- for the primary route, the primary route OSG- may reoperate when the GS- relay releases prior to completion of the test. With both the alternate route and the primary route OSG- relays operated, their associated sender connector start leads are connected together. This may cause the preference circuit to transfer to the emergency chain and bring in a minor alarm. A break-contact of the DIS2 relay is added to the OSG- relays from operating during the trunk guard test. Option ZJB provides these improvements.

B. ETS Provided

10.16 The outsender group number is distributed on a 2-out-of-6 basis. The MDC circuit translates this to a 1-out-of-12 and operates the corresponding outsender group OSG0-11 relay in the marker.

10.17 Operation of a sender group relay operates marker off-normal relays OGC, OSC, and SON. These relays prime the marker to function with an outgoing sender.

10.18 The outgoing class OGC relay operates relays that are used to transmit grounds to operate relays in the sender. The OGC relay also starts functions that transmit the called number to the sender.

10.19 The sender off-normal SON relay closes through leads for marker functions used on calls with senders. The SON relay is also used to identify the type of call.

C. Sender Idle Test

10.20 Operation of a sender group, OSG0-11, relay operates marker off-normal relays OGC, OSC, and SON. These relays prime the marker to function with an outgoing sender.

10.21 The outgoing class (OGC) relay operates relays that are used to transmit ground to operate relays in the sender. The OGC relay also starts functions that identify the called customers number.

10.22 The outgoing sender control (OSC) relay extends battery to the OSC to seize it, and to operate the OSC cut-through relays.

10.23 The sender off-normal SON relay closes through leads for marker functions used on calls with senders. On outgoing calls, it also operates the outgoing class relays. The subscriber outgoing class SOG1,2 relays, or the tandem or toll outgoing class TOG1,2 relays are operated, depending on the class of the call.

10.24 The operation of the OSG- relay extends test leads from the marker to the selected group of outgoing senders to determine which subgroup within the selected group has idle senders. Ground extended to the marker over the SIE or SIO leads indicates that there are idle senders within the subgroup. The operation of the sender idle in A subgroup (SIA) relay and the operation of the sender idle in B subgroup (SIB) relay indicates the subgroup with idle senders. The even-numbered markers test a subgroup over the SIE lead, and the odd-numbered markers test a subgroup over the SIO lead. This arrangement is a safety feature, so that an open ISE or SIO lead makes the associated subgroup unavailable to approximately half the markers.

10.25 It is also necessary to determine if the OSC associated with the A subgroup and the OSC associated with the B subgroup are busy. The operation of the OSG0-11 relay extends the GBE and GBO leads from the associated OSC to the marker. The presence of ground on either of these leads indicates that the associated OSC is busy. It also operates the sender subgroup A busy (GBA) relay or the sender subgroup B busy (GBB) relay.

10.26 The marker then seizes the OSC associated with the sender subgroup that has idle senders.

SEIZURE OF THE OUTGOING SENDER CONNECTOR AND SENDER - FS59, 60

10.27 The operation of the SIA or SIB relay and the GBA or GBB relay directs the marker to seize one of the two OSC. If there are idle senders in both subgroups and if both subgroups are idle, the marker junctor sequence circuit determines the OSC that is to be seized. The OSC is seized when the marker extends battery over the ST- lead to the OSC to operate the marker preference (MP-) relay.

10.28 The MP- relay is operated when the SIA or SIB relay operates with the OSC, FTCK, or LSC1 and OSG0-11 relays operated.

A. Outgoing Sender Selection - FS57-61

10.29 After the marker has selected the sender subgroup and has seized the OSC it determines which senders within the subgroup are idle. If more than one sender is idle, one of these will be preferred, as determined by the setting of the junctor sequence circuit.

10.30 The operation of the SKA or SKB relay operates the OSC subgroup control OSGA or OSGB relay associated with the selected subgroup. The operation of the OSGA or OSGB relay extends the OS0-4 leads from the marker to the selected sender. Ground on any of the OS0-4 leads indicates an idle sender and operates the associated OS0-4, outgoing sender selection, relay in the marker.

10.31 The operation of one or more OS- relays operates the OSE and OSE1, outgoing sender end, relays. The operation of the OSE indicates that the sender has been seized and that the line link selections (LLS) or trunk link selections (TLS) relays are properly set for this call.

10.32 After the sender is selected and the OSE relay has operated, the OSE1 relay tests the OS- lead to the OSC to check that the ground that operated the preferred OS- relay was not a false ground. When the sender SB relay operates, the ground on the

OS- lead from the OSC is removed, and the OSE1 relay releases. If the OSE1 does not release, it indicates that the operating ground was a false ground; the marker then requests that a trouble record be taken.

10.33 If two or more OS- relays operate, indicating that more than one sender is idle and available for service, the preferred OS- relay is locked operated and all others are released.

10.34 The operation of the OSE relay opens the operating path for the OS0-4 relays. However, the junctor sequence circuit provides a locking path that determines which one of the operated OS- relays will remain operated. The selection preference for the OS- relays is under control of the junctor sequence circuit so that the preference of senders is rotated on every call. Of course, if only one OS- relay operates, it is locked operated.

10.35 The operation of the OSE and OSE1 relays operates the outgoing sender check OSK relay, which in turn operates its auxiliary OSKA relay. The operating time of the OSK and OSKA relays provides sufficient time for any nonpreferred OS- relay to release. This ensures that only the desired S relay in the OSC can be operated.

10.36 The operation of the OSKA relay releases the SIA, SIB, and the GBA or GBB relays since they are no longer needed.

B. Operation of OSC Connector Relays - FS60

10.37 The operation of the OSKA relay, with the preferred OS- relay operated, operates the S relay in the OSC. The marker also operates the OSC relays associated with the common channel between the selected sender and the marker. The operated S relay establishes the individual channel between the marker and the sender. This individual channel is used for recorder number information, some of the class information, and advance and reorder information from the marker to the sender. It is necessary to pass this information through the S relay as the common channel is released early. Thus the marker is still able to control the sender after the common channel has released.

10.38 The connector cut-through MA1,2 MB1,2, MC1,2, and SA1,2, SB1,2, SC1,2 or DSA1,2 relays in the OSC are operated to establish the common channel between the marker and the sender. The MC1,2 and SC1,2 relays are operated only on automatic message accounting, AMA, calls. These relays cut-through information pertaining to the calling customer. The MA1,2, MB1,2, and SA1,2, SB1,2, or DSA1,2 relays cut-through information pertaining to the dialed digits and information derived from the route relay.

10.39 The operation of the OSGA or OSGB relay in the OSC operates the OSC MA1,2 relays. The MA1,2 relays in turn operate the MB1,2 relays, and, if required, the MC1,2 relays.

10.40 The operation of the S relay in the OSC operates the DSA1,2 relays or the SA1,2 relays, and if required, the SB1,2 and, if required, the SC1,2 relays.

TRANSMISSION OF INFORMATION TO SENDER - ETS NOT PROVIDED

10.41 The marker must record the called number so that it can be transferred to the sender. It must also record the information derived from the route or line route relay such as: class and digits deleted etc, in order to transfer it to the sender.

A. Operation of Called Number Registration and Check Relays - FS71-76

10.42 When operating with trunk circuits, the marker off-normal OGC relay operates the called number digit cut-in relay KG. The KG operates the digit cut-in relays KA, KBC, KDE, KFG, KHJ, and KKL.

10.43 When operating with line circuits the OGC relay operates the called number digit cut-in relays KGS3 and 4.

10.44 These cut-in relays are used to extend ground to operate the called number registration relays A2/5 through L2/5, in the marker and in the sender.

10.45 The operation of any of the digit cut-in relays operates the check cut-in KK relay.

10.46 When operating with line circuits, only four digits of the called number are transmitted to the sender, they are the thousands, hundreds, tens, and units digits. These four digits must be transferred to the sender in the A2/5, B2/5, C2/5, and D2/5 positions. As an example, if the marker receives a 7-digit called number the digits received by the marker in the D2/5, E2/5, F2/5, and G2/5 positions must be shifted to the A2/5, B2/5, C2/5, and D2/5 positions before they can be stored in the sender. This digit shift is accomplished by using one of the N1-4 number cut-in relays and the KGS3 and 4-digit cut-in relays. The operated N- relay selects the TH2/5, HN2/5, T2/5, and U2/5 from the called number, and extends ground to operate the TH2/5, HN2/5, T2/5, and U2/5 relays. With the operation of the KGS3 and 4, these same grounds operate the A2/5, B2/5, C2/5, and D2/5 digit check relays in the marker and the memory relays in the sender.

10.47 The register places ground on a B7-M7 lead to the marker causing the operation of a B7-ST7 relay. The marker uses the relay contacts in a check circuit to determine whether it has received a valid number on a 2/5 basis.

10.48 The operation of the outgoing registration check ORK1,2 relays indicate that the proper number of A2/5 through M2/5 relays have operated. If the ORK1,2 relays remain operated after the digit cut-in relays have released, it indicates that the registration relays in the sender have locked operated.

10.49 Option ZLQ is provided to block 7-digit calls with a 0 or 1 in the B-digit position. When either B0 and/or B1 or B4 and B7 are received with a single H7, the ORK1 and ORK2 relay operate path is held open which causes a marker timeout to identify the faulty originating register. Cross connections are provided to disable the feature when NOX or N1X type codes are added to the home numbering plan area.

10.50 On some outgoing calls, the sender is not required to transmit the A, AB, or ABC digits and hence, is not required to receive them, even though they are registered in the marker. Since the ORK1,2 must remain operated to indicate a successful transfer of all digits, the ORK1,2 operating path is arranged to bypass the digit check relay contacts of the deleted A, AB, or ABC digits. Therefore, when the sender relays with the deleted digits fail to return a locking ground to the associated marker digit check

relays, the release of these relays does not open the operate path of the ORK1,2. The bypass arrangement is determined by the operated OSG0-11 relay and the cross-connection between the SA, SAB, SABC, and SK0-11, SKD0,1, and PRV terminal.

B. Determining Number of Digits to be Outpulsed by the Sender - FS64, 65

10.51 For outgoing calls, the sender may outpulse all the digits received from the marker, or it may omit from the first, through the tenth digit. The marker informs the sender how many digits to omit. The digits omitted from the outpulsing are said to be deleted. The operation of the route relay or the translation received from the number group determines the digits to be deleted.

10.52 The DL0-6 and DLP or DLS relays control the number of digits to be deleted. These relays may be operated by:

(a) Cross-connection of the route relay DL-- terminal to the DLOP-6P or DLOS-6S terminal.

(b) Cross-connection of the line route relay LDL-- terminal to the DLOS-4S terminal.

(c) Operation of a VFT- relay as a result of a number group translation. The VFT- will operate an OPO-4 (outpulse) relay which in turn operates a DLOS-4S relay.

10.53 The relays that operate determine the delete information, and transfer this information to the sender. The cross-connections necessary are described in Note 400. The operation of these relays determines which DL1-6 lead to the sender is grounded. If the DLP relay operates, the CL1 lead to the OSC is grounded.

C. Arbitrary Digits to be Prefixed or Compensating Resistances Required - FS62, 63

10.54 When a dial pulsing or multifrequency pulsing sender is required to outpulse arbitrary digits, the marker ARN-, BRN-, and CR- relays are operated. The CR0-4 and CRP or CRS relays are operated when it is desired to outpulse one arbitrary digit. The CR0-4 and CRP or CRS, and BRN0-4 and BRP or BRS relays are operated when it is desired to outpulse two arbitrary digits. The CR0-4 and CRP or CRS, BRN0-4 and BRP or BRS, and ARN0-4 and ARP or ARS relays are operated when it is desired to outpulse three arbitrary digits. The BRN0-4 and BRP or BRS

relays and ARNO-4 and ARP or ARS relays are provided when code conversion is necessary.

10.55 If a route using either a PCI or an RP sender requires compensating resistances, the CR0-4 and CRP or CRS relays are operated.

10.56 If compensating resistances are required, or if it is desired to outpulse one arbitrary digit, the operation of the route or line route relay operates the CR0-4 and CRP or CRS relays. The cross-connections necessary are described in Note 400.

10.57 In offices where certain routes require the outpulsing of two or more arbitrary digits, the CV00-95, code conversion, relays are operated. Ground appearing on the code point associated with the route operates the CV00-95 relay. The CV- relay operates the CR0-4 and CRP or CRS, BRN0-4 and BRP or BRS, and BRN0-4 and ARP or ARS relays, as required to represent the arbitrary digits. The cross-connections necessary are described in Note 400.

10.58 The operation of these relays determines which CR- leads and, if required, which AR- and BR- leads to the OSC are grounded, FS63, FS66.

10.59 If the code conversion relays are operated and the selected route (an alternative route) does not require code conversion, the cancel code conversion KVC relay is operated. The operation of the KVC relay opens the operating circuits for the ARN0-4, BRN0-4, and CR0-4 relays. The CR5 relay is operated in series with the CRS relay to indicate that no arbitrary digits are required. The KCV relay is operated when the KCV terminal is cross-connected to the CR- terminal and the associated route relay is operated.

D. Determining the Class Information - FS64, 67

10.60 The operation of the CL0-8 relays determines the class information which is used to indicate a variety of control signals to the senders: for type of trunk and type of call identification for CAMA, with MF senders; number of digits in office code with revertive senders; type of trunk, type of pulsing and pulse speed, with dial pulse senders (see Note 400).

10.61 With the CL- or LCL terminal cross-connected to the CLOP-8P or CLOS-8S terminals, the class CL0-8 and CLP or CLS relays are operated when the route relay or line route relay operates. The cross-connections necessary are described in Note 400. The operation of the marker relays determines which CL1-8 leads to the OSC are grounded.

E. Determining the Code Pattern and Number Structure Information - FS64, 78

10.62 The code pattern information is used on AMA calls to indicate the structure of the called number. It tells the sender how many digits are in the office code and whether the numerals consist of 4 or 5 digits (party letters). The marker determines the code pattern and number structure information by operating one of the CP0-9 and CPP or CPS relays.

10.63 With the CP- terminal cross-connected to the CPOP-9P or CPOS-9S terminals the code pattern CP0-9 and CPP or CPS relays are operated when the route relay operates. The cross-connections necessary are described in Note 400. The operation of the CP- and CPP or CPS relays determines the code pattern and number structure information transferred to the sender over the CP2/5, 4DG, 5DG, L5D, and LST leads.

F. Determining the Message Billing Information - FS41, FS68, FS130

10.64 The message billing information is required only on AMA calls for charging purposes. One message billing series MBS0-9 or MBT9 relay is operated in series with the route relay when the code point is grounded. The operation of one of the MBS0-9 relays determines which of the MB2/5 leads to the OSC are grounded.

G. Transfer and Check of Information to the Sender - FS66-69, 77

10.65 The transmitting ground supply, TGS1, 2, and 3 relays are operated to extend ground to operate check relays in the marker and also to operate registration relays in the sender. These relays are operated when the OGC relay operates. The TGS2 relay operates on AMA calls only, therefore, it extends ground for functions that are concerned with AMA operations.

10.66 The operation of the TGS1 relay operates the class check CLK1-3 relays and extends ground to one of the CL2-6 leads to the OSC with the proper CL- relay operated.

10.67 The TGS1 relay, in operating, operates the delete digit check DLK1,2 relays. It extends ground to one of the DL1-6 leads to the OSC with the proper DL1-6 relay operated. Also, if the DLP relay is operated, ground is extended to the OSC over the CL1 lead as described in Note 400.

10.68 The compensating resistance or arbitrary digit check, CRK1,2 relays are grounded when the TGS1 relay operates. The ARK1,2 and BRK1,2 relays are operated, if required, and the associated AR- and BR- leads to the OSC are grounded. This identifies the compensating resistance or arbitrary digits required for this call, FS63.

10.69 The TGS2 relay operates only on calls that are associated with AMA. The TGS2 relay operates the message billing check MBK1-4 relays. Ground is extended to the proper MB- leads, AMA leads, and the SC or TVT lead to the OSC, FS68, FS69.

10.70 The operation of the TGS2 relay operates the code pattern check CPK1,2 relays and grounds the CP- leads to the OSC. Its operation also operates the number structure check NSK1 relay, grounds the 4DG, 5DG, L5D, or LST lead, and the other leads associated with miscellaneous functions.

H. Outgoing Sender Registration and Release Timing - FS77

10.71 The outgoing sender registration timing is started when the OSC cut-through relays are operated and ground is extended to the marker over the TSR lead to the OST1 relay.

10.72 The operation of OST1 removes the bias from the secondary winding of the OST relay and allows current to flow through the primary winding in the operate direction. The time interval is determined by the time it takes the OST capacitor to charge. Current flows through the secondary winding to charge the OST capacitor and holds the OST relay nonoperated, while the primary current is in the operate direction. As the OST capacitor charges, the charging current decreases. When the OST capacitor is fully

charged, no current flows through the secondary winding of the OST relay. When the operate flux produced by the primary winding exceeds the nonoperate flux produced by the secondary winding, the OST relay operates. The OST, in operating, operates the OST2.

10.73 To ensure release of the OST1 relay if recycle or route advance occurs before the OST2 relay operates to remove the OST1 locking ground, the OST1 locking circuit is placed under control of an RYC relay break contact.

10.74 The purpose of the OST timing interval is to allow sufficient time for the sender registration relays to operate.

I. Release of Marker Registration Relays

10.75 The operation of the OST2 releases the TGS1,2,3 relays thereby removing the operating grounds from the AR2/5, BR2/5, CR2/5, CL1-8, MB2/5, DL1-6, AMA, TVT, and SC, and CP2/5, 4DG, 5DG, L5D, and LST leads to the OSC.

10.76 The OST2 relay in operating, releases the GTL and GTL2 relays. The release of the GTL and GTL2 removes the operating grounds from the calling line location FT0-3, FU2/5, HG2/5, VF0-4, and VG2/6 relays in the marker and the associated leads to the OSC, FS1.

10.77 The called number digit cut-in KG relay, and in turn the KA, KBC, KDE, KFG, KHJ, and KKL relays, or the cut-in KGS3-4 relays are released when the OST2 operates. These relays remove the transmitting grounds from the called number leads, to the sender. When the cut-in relays have released, the digit cut-in check KK relay releases.

J. Outgoing Sender Registration Release Timing

10.78 The outgoing sender registration release timing is provided to allow sufficient time to detect the release of any of the operated marker check relays. When the operating grounds from the registration leads to the OSC are removed, the marker registration and check relays on these leads release if ground is not returned from the sender. Ground returned from the sender indicates that the associated relay locked operated to ground in the sender and this ground also holds the marker relays operated.

10.79 The release of the KK, TGS1, and (on AMA calls) the GTL relays releases the OST1 relay. The release of the OST1 relay starts the timed release of the OST relay. When the OST1 relay releases, current flows in the primary winding of the OST relay in the nonoperate direction. Also, current flows through the OST relay secondary winding in the operate direction; the discharge of the OST capacitor causes the current flow through the secondary winding. When the OST capacitor has sufficiently discharged, the nonoperate flux exceeds the operate flux and the OST relay releases.

10.80 If the required digits of the called number have been locked in the sender, the marker digit check relays remain operated and, therefore the ORK1,2 relays do not release.

10.81 If all the information derived from the route or line route relay has been transferred satisfactorily to the sender, the marker class, delete, and arbitrary digits or compensating resistance check relays remain operated. On AMA calls, the code pattern, number structure, and message billing information is checked in the same manner. If the calling line location information has been transferred satisfactorily the RK1,2 relays remain operated, FS2.

K. Recorder Number and Pulse Conversion Sender Class Information - FS78, 79, SC115

10.82 On AMA and pulse conversion calls, the FA-- or FB-- relay in the TL associated with the trunk provides the recorder number that should be used for the AMA record and also the sender class information on pulse conversion calls. Since this information is not available with the other sender information, it is transmitted through the sender connector S- relay, which is provided on a per marker per sender basis. This method of operation reduces the marker holding time and increases the efficiency of the large sender connector.

10.83 When the TL is seized the operation of the FA-- relay associated with the trunk operates one of the ONN to 9NP class relays. The class relay operates the RN2/5 relays. The numerical of the designation of the class relay determines which RN2/5 relays operate. On AMA calls the operation of the OGC, outgoing class relay causes the operation of the RN relay, which closes the windings of the RN2/5 relays to the ONN to 9NP relay contacts.

Marker Arranged for More Than 10 AMA Recorders

10.84 When the marker is provided with App Fig. 71 and option YY, and if the senders are equipped to operate with 10 or less AMA recorders, an operated contact of the AMAL relay and cross-connection terminals NTR1 and NTR2 become part of the RNT1 relay operate circuit to parallel the non-operated AD or OD relay contacts.

10.85 If the senders are arranged for more than 10 AMA recorder operation, the AD and OD relays are operated in parallel to the RTN and RUN relays, respectively. When the AD or OD lead circuit is completed through the sender connector, the recorder number tens registration relay is operated in the sender.

10.86 When the marker is arranged for 20 AMA recorder operation, the recorder units number (RUN) relay or the recorder tens number (RTN) relay will be operated via one of the ONN-9NP or RN10-RN19 leads, respectively. The RUNA recorder units number auxiliary relay or RTNA, recorder tens number auxiliary relay will be operated to complete the operating circuit for one of the ONN-9NP relays which in turn operate the RN2/5 relays.

More Than 20 AMA Recorders

10.87 The marker is arranged to work with more than 20 AMA recorders. The maximum is 30 AMA recorders which will allow up to 3000 LAMA trunks to be provided in a marker group.

10.88 The marker is arranged for ten new leads (RN20-29) from the trunk link via the trunk link connector to identify the AMA recorder to which a trunk has been assigned. However, the trunk link connector is arranged for only six new leads since only six connector relay contacts are available at this time. The four remaining leads will be made available as the need arises.

10.89 A new recorder number tens digit indication is provided through the outgoing sender connector to the LAMA outgoing sender to indicate recorders numbered 20 to 29. The existing ORCO lead is used to pass the information through the outgoing sender connector. This lead was formerly used only for CAMA functions. The sender in turn provides a new tens digit lead (RNT2) through the transverter connector to the transverter for use in selecting the proper AMA recorder.

10.90 Option ZRL provides the apparatus and wiring required for AMA recorders (20 to 25) and option ZRJ provides the additional wiring required for recorders (26 to 29).

Pulse Conversion

10.91 On pulse conversion calls, the PCL1 operates instead of the RN, and the SCL- relay operates from the ONN, 2SA, 3NA, or 5ST on a 1-out-of-4 code basis.

10.92 The PCL1 also operates the SCL-, which connect the CL2, 3, and 5 leads from the sender to the windings of the SCL- relays (FS67).

Recorder Number Timer and Check Circuit

10.93 The RNT, recorder number timer, is energized whenever the PCL1 or AMA5 relay operates.

10.94 With ground on the TSR lead, which indicates operation of the sender connector relays, a path is provided to operate the RNT1 relay if the RN- and MBK5 relays are operated, or one SCL- relay is operated. The MBK5 is used to check that the OBS, observe, or NOB, nonobserve information has been sent to the sender. On TOG calls requiring an AMA record, a contact of relay TOG3 causes MBK5 to operate and complete the check. The operation of the RNT1 indicates that ground is being transmitted to the sender over the RN-, OBS and NOB, or CL- leads. Operation of the RNT1 also causes the RNT to start operating as determined by the charge time of the RNT capacitor.

10.95 When the RNT operates, it operates the RNT2, which causes the RN or PCCL relays to release and open the ground path to the RN-, OBS, and NOB, or SCL- windings. These relays release if corresponding relays in the sender have not operated and locked to ground.

10.96 The release of the RN or PCCL also releases the RNT1, which causes the RNT to release as timed by the discharge of the RNT capacitor. This time is provided to permit the RN- or SCL- relays to release, if the sender relays did not lock to ground.

10.97 When the RNT releases, the RNK1,2 relays should operate through the RN2/5 and MBK5, or the SCL- contacts as an indication that the information has been transmitted and locked in the sender. The marker checks for the operation of the RNK1,2 during linkage check.

TRANSMISSION OF INFORMATION TO SENDER - ETS PROVIDED

10.98 The following information is passed to the sender either from the marker or from the MDC via the marker.

- (a) Called Number.
- (b) Arbitrary digits (if required).
- (c) Class.
- (d) Service Observed Mark (SOB/NOB).
- (e) Service or Test Call (SC/TVT).
- (f) Calling Line Equipment Number (ANI Calls).
- (g) Recorder Number (CAMA Junctor or CAMA first Calls).
- (h) Originating Rate Class (CAMA Junctor or CAMA first Calls).

A. Operation of the Called Number Registration and Check Relays

10.99 Operation of the outgoing class OGC relay operates the sender gate control KN1-4 relays in the MDC through the OST2 and RSC relays nonoperated. The KN- relays operate the marker KK relay and applies ground to the called number distribute points and cuts through the called number leads to the marker to operate the called number registration (A2/5 - M2/5, N7) relays in the marker and the sender.

10.100 The operation of the outgoing registration check ORK1,2 relays indicate that the proper number of A2/5 through M2/5, N7 relays have operated. If the ORK1,2 relays remain operated after the gate control KN- relays have released, it indicates that the registration relays in the sender are locked operated.

B. Operation of the Sender Class and Arbitrary Digit Relays

10.101 The KN- relays also cuts through the class and arbitrary digit distribute points. The activated class and arbitrary distribute points operate the class CL- relays in the sender, the class check CLK- relays in the MDC, the arbitrary digit AR-, BR-, CR- relays in the sender and the arbitrary digit check relays in the MDC. If the class check and arbitrary check relays remain operated after the gate control KN- relays have released, it indicates that the information is stored correctly in the sender.

C. Outgoing Sender Registration and Release and Release Timing

10.102 The outgoing sender registration timing is started when the OSC cut-through relays are operated (TSR lead from the OSC grounded) and the digit check ORK1,2 relays are operated to operate the OST1 relay.

10.103 The operation of the OST1 starts the OST timer. When the timing interval is reached, the OST relay operates and operates the OST2 relay. The purpose of the OST timing interval is to allow sufficient time for the sender registration relays to operate.

D. Release of the Transmitting Ground Relays

10.104 The operation of the OST2 relay releases the KN- relays in the MDC which removes the operating grounds for the called number, arbitrary digits, and class leads to the senders. The OST2 also releases the GTL, GTL2 relays which removes the operating grounds from the calling line location FT0-3, FU2/5, HG2/5, VF0-4, and VG2/6 relays in the marker and the associated leads to the OSC. The release of the KK, TGS1, and (on ANI calls) the GTL relays releases the OST1 relay. The release of the OST1 relay starts the timed release of the OST relay. The release of the OST1 and OST relays will operate the release sender connector RSC relay or an ANI calls will re-operate the GTL, GTL2 relays which operate the RSC relay provided all required checks are made. The operate path for the RSC relay is from ground through contact 3 make of the OST2 relay, through OSE1, OST1, and OST relays released, OST2, ORK1,2 (called number check) relays operated, MEK4 (service or test call mark check) on ANI or CAMA calls, MEK5 (service observed mark check) on ANI calls, to the MDC circuit over the SK1 lead through a two-up check on the CK2/5, BK2/5, and AK2/5 relays (arbitrary digit checks) through a match of the number of CLK- relays operated with the CLO- relays (indicating the number of CL- leads which should be grounded) back to the marker over the SK2 lead, through NDK, NDI (no digit check) to the RSC relay. Or if the AMA relay is operated (ANI Call) from the NDI through the RPK, TPS relays (party check) through the RK1,2 relays operated (line equipment number check) to the GTL, GTL2 relays. When the GTL operates, the RSC is operated through OGC, GTL operated,

OST1 nonoperated, AMA3 (ANI Call) operated, CAMA nonoperated and OST2, OGC operated to ground. Operation of the RSC relays starts the release of the sender connector which is described in 10.105 through 10.113. Outgoing Sender link control is described in 10.114 through 10.129.

RELEASE OF THE OUTGOING SENDER CONNECTOR - FS77

10.105 The marker, after checking that all registration relays in the sender have locked operated, releases the OSC common channel associated with this call. The OSC individual channel is not released at this time so that the marker can still control the sender.

10.106 After the OST relay is released and if all the marker checks are satisfactory the release sender connector (RSC) relay is operated. On AMA calls, the GTL and GTL2 relays are reoperated, and they operate the RSC relay. Although the GTL and GTL2 relays are reoperated on AMA calls, their functions are only used on test calls where it is desired to check the calling line location.

10.107 The operating circuit for the RSC relay on the non-AMA calls or the GTL and GTL2 relays on AMA calls is as follows:

- (a) With NDI and NDK, no digit, relays both operated or both released.
- (b) If the code conversion feature is equipped.
 - (1) With CVS relay nonoperated, code conversion not required on the call.
 - (2) With KCV relay operated, code conversion was required on initial route, but is not required on new sender route on a route advance.
 - (3) With CVS relay operated, the BRK1,2 relays operated; and the ARN5 relay operated for 2-digit code conversion; or the ARK1,2 relays operated for 3-digit code conversion.
- (c) With CRK1,2 relays operated either for arbitrary digits or compensating resistances, or the CR5 relay operated indicating no arbitrary digits or compensating resistance to the sender.

(d) With the class check circuit having CLS or CLK3 relay operated, along with the various combinations of the CL- and CLK- relays operated (see Note 400).

(e) With the 4-wire switching feature, the CDT1,2,3,4 relays operated for network and priority control digits, and RDK1,2 relays operated for routing control digits.

(f) With the delete check circuit having combinations of DLK1,2, DLO,DLS relays operated (see Note 400).

(g) On an AMA call, with CPK1-2, NSK1, and MBK1-4 relays operated.

(h) With the ORK1,2 relays operated.

(i) With OST2 operated with OST, OST1, and OSEL relays released.

A. Release of the OSC Relay - FS57

10.108 The operation of the RSC opens the operate path of the OSC, which releases the OSC common channel between the marker and the sender.

10.109 The release of the OSC relay releases the common channel connector relays in the OSC. This in turn releases the operated digit check A2/5 to J2/5 relays, the DLK1,2 relays, the CLK1-3, and the CRK1,2 relays. On AMA calls, release of the MC1,2 and SC1,2 relays releases the CPK1,2 NSK1 and MBK1-5 relays.

10.110 The release of the digit check relays releases the ORK1,2 relays.

10.111 The release of the OSC relay releases the OSC marker preference MP- relay. The common channel between the marker and sender is released when the cut-through relays release, and the OSC appears idle to other markers when the MP- relay releases.

10.112 The release of the MP- relay releases the SKA or SKB relay. The SKA or SKB relay in turn release the OSGA or OSGB relay in the OSC.

10.113 The individual channel has not been released at this time and allows the marker to control the sender. The individual channel is held until the marker disconnects.

OUTGOING SENDER CONNECTION TO OUTGOING TRUNK OR LINE CIRCUIT

10.114 The marker connects the sender to the outgoing trunk or line circuit through the crossbar switches in the OSL. This connection is made after outgoing sender and trunk or line circuit selection is completed.

10.115 The outgoing senders are connected to the horizontals of the crossbar switch and the outgoing trunks or line circuits are connected to the verticals. The OSL select magnet is operated when the sender is selected and the trunk link or line link seized. However, the operation of the OSL hold magnet must wait until the outgoing trunk or line circuit selection is completed.

A. Operation of the OSL Select Magnet - FS61

10.116 The operation of the SKA or SKB relay operates the SSA or SSB relay. Contacts of these relays close the ten select magnet leads either to the XSS cross detector relay or to the OS0-4 relays.

10.117 The operated SSA or SSB will operate the LLS or TLS or extends the SS0-9 leads to the line link connector to select a sender to serve a line circuit. The TLS extends the SS0-9 leads to the trunk link connector to select a sender to serve a trunk circuit.

10.118 With the nonpreferred OS- relays released and the SSA or SSB and LLS or TLS relays operated, the OSL select magnet SS- associated with the selected sender operates.

B. Operation of OSL SH- Hold Magnet - FS61

10.119 After the SS- select magnet operates, battery potential is extended from the winding of the hold magnet through the operated trunk or line circuit F relay to the marker over the SLK lead to operate the sender link hold check SHK relay. The SHK operates the sender link hold check auxiliary SHKA.

10.120 After the SHKA relay operates, ground is extended through the SH lamp, through the primary winding of the SLK relay, and over the SLK lead to operate the OSL SH- hold magnets.

10.121 If the dual voltage method is used to operate the hold magnets, the SH1-2 capacitors are precharged to +130 volts.

10.122 When the SON relay operates, the charging circuit for the SH1-2 capacitors is from +130 volts source to the capacitors, through primary winding of the SLK relay, and through the SH lamp. The operation of the SHKA relay removes the +130 volt supply from the circuit leaving the SH1-2 capacitors to +130 volts. The charged capacitors in series with the hold magnet produce an effect similar to a momentarily applied 180 volt battery. Therefore, the hold magnet operates rapidly. When the voltage at the 10 contact of relay SKHA drops to about -1/2 volt, the SH diode conducts. The SH diode then passes the steady current necessary for holding the magnet operated.

C. Operation of the Sender Link Check SLK and SLK1 Relays - FS61

10.123 Since the OSL hold magnet and the SLK relay are in series, the operate current for the hold magnet also flows through the primary winding of the SLK relay. When the SHKA relay operates, with the trunk or line circuit F relay operated, the OSL hold magnet and the SLK relay operate.

10.124 Normally, the SLK relay is biased in the nonoperate direction by the current which flows through the secondary and primary windings. This bias current passes through the secondary winding in the nonoperate direction, and through the primary winding in the operate direction.

10.125 However, the nonoperating flux is greater than the operating flux and the relay is biased to the nonoperate position. When the operate current for the OSL hold magnet passes through the primary winding the operate flux becomes greater than the nonoperate flux and the SLK relay operates.

10.126 The operation of the SLK relay indicates that the hold magnet was not operated by a false ground. The operation of SLK operates the sender link check auxiliary SLK1 relay.

D. Connection of Sender to Trunk

10.127 The operation of the OSL hold magnet operates the sender off-normal ON relay to provide off-normal grounds for sender functions. The sender cut-through CT relay is operated when the ON relay operates and cuts through the tip and ring leads to the trunk or line circuit.

10.128 The ON relay also operates the trunk or line circuit disconnect D relay, which removes the tip and ring leads of the outgoing trunk or line circuit from the trunk pair. This permits the sender to signal the distant office or PBX, as required, to set up the connection in that office. After the D and CT are operated, the sender line release LR relay is operated to provide holding ground for the OSL hold magnets. In outgoing trunks, the D operates the trunk circuit supervisory S1 relay to provide a holding ground for the LL and TL hold magnets.

E. Sender Attached - FS61

10.129 The operation of the sender LR relay provides a holding ground for the OSL hold magnets and also shunts the primary winding of the SLK relay. The release of the SLK relay indicates that the holding ground for the OSL hold magnets has been transferred to the sender. The release of the SLK relay also causes the operation of the sender link check auxiliary SLK2 relay.

SENDER ADVANCE - FS49, 61, SC110

10.130 After the marker has checked that the connection has been established, as indicated by the operation of the DCT and GT1 relays, and that the information has been transferred satisfactorily, as indicated by the operation of the RSC relay, an advance signal is given to the sender. The marker operates the advance AV relay in the sender. If the call is AMA or pulse conversion call, it is necessary to also check that the recorder number information has been checked by the RNK1,2 relays.

10.131 The sender AV relay operates in series with the primary winding of the AVK relay and the AVK1 resistor. The operate current for the AV relay flows in the direction to hold for AVK relay nonoperated. The AV relay is operated just before the marker disconnects from the connection, after determining that all checks are satisfactory.

10.132 After the AV relay has operated, it locks to ground in the sender. This locking ground is extended to the marker over the AV lead from the OSC. The AV lead is through the individual channel or S relay part of the OSC as the common channel has been released. This locking ground is extended to the primary winding of the AVK relay and causes current to flow in a direction to operate the relay. The operation of the AVK relay indicates that the sender AV relay is locked operated.

10.133 After operating, the AVK relay operates the advance check auxiliary AVK1 relay. The operation of the AVK1 relay causes the marker to perform linkage checks and then to disconnect.

TRUNK TEST PERFORMED BY THE OUTGOING SENDER - FS51, SC113

10.134 As a maintenance aid, the markers are arranged on light traffic, HTR released, to delay disconnect from the sender until the sender makes trunk guard (TG) test. This test is canceled on all intra-office calls.

10.135 Trunk guard test is made by the sender to test for battery and ground on the tip and ring conductors. When light traffic conditions exist, the marker retains control of the sender by holding the individual channel, although the LL and TL frames are released.

10.131 If the sender finds an open trunk towards the distant office or PBX, the marker times out, takes a trouble record, and sets the sender to return a re-order signal to the trunk. The trouble record produced shows the sender and trunk or line circuit involved on TG failure.

10.137 The TG relay is operated when the off-normal ON relay in the sender operates and grounds the TG lead to the OSC. The sender grounds the TG lead until battery and ground have been detected on the tip and ring conductors.

10.138 During the light traffic periods, if the sender has completed trunk test and the TG relay has released before the LK1 relay has operated, the disconnect DIS1,2 relays operate when LK1 operates. However, if the sender has not completed trunk test (TG relay is still operated) the operation of the LK1 relay operates the trunk guard test TGT relay, FS50.

10.139 The TGT relay in operating:

- (a) Holds the OSC S- relay, which keeps the TG lead closed to the sender.
- (b) Operates the DIS1,2 relays, which permit the rest of the marker to release.
- (c) Operates the SFT relay which starts the SDT timer and stops the WT timer.
- (d) Holds marker relays MCB0,1 operated.

(e) When operating with trunk circuits, hold the TS-, FS-, and TB relays operated to indicate the trunk involved if a trouble record is made, or if operating with line circuits LLP, the LTI relay operates and is locked to the off-normal SON. The LTI holds operated the FTT-, FUT-, VGT-, HGT-, and VFT- relays to identify the line circuit involved if a trouble record is taken.

(f) Holds the OSG- and OS- relays operated to indicate the sender involved if a trouble record is made.

A. TG Test Satisfactory

10.140 The sender starts TG test when the marker operates the sender AV relay. If the sender TG relay operates before the marker SDT timer functions, the marker TG and TGT relays release and the marker disconnects.

B. TG Test Failure

10.141 If the trunk is open, the sender TG relay does not operate and the marker SDT timer functions and causes a trouble record to be taken. When the trouble record is taken, the TRB1 operates. Operation of the TRB1 grounds the RO lead to the sender, which sets the trunk or line circuit to reorder. The TRB1 in operating also releases the TG and TGT, which release the marker.

11. CHANNEL SELECTION

11.01 Connections between a line and a trunk are made by closing the line switch and junctor switch crosspoints on the LL, and the trunk switch and junctor switch crosspoints on the TL.

11.02 The select magnets and hold magnets involved in closing the specific cross points depend on the location of the line on the line switch and the trunk on the trunk switch, and on the channel selected.

CHANNEL ARRANGEMENTS

11.03 A channel is made up of a line link, a junctor, and a trunk link, which are tested, selected, and treated as a unit when establishing a connection between a line and a trunk or between two trunks.

11.04 The line links consist of the line switch banjo wiring, the line junctor switch banjo wiring, and the wiring between these switches.

11.05 The trunk links consist of the trunk switch vertical unit, the trunk junctor switch vertical unit, and the wiring between the two switches.

11.06 The juncctors consist of the line junctor switch vertical unit, the trunk junctor switch banjo wiring, and the wiring between the line junctor and trunk junctor switches.

11.07 The marker in selecting a channel, tests a maximum of ten channels at a time. The CHT-, channel test, relay tests a line link, a junctor, and a trunk link with numbers corresponding to the CHT- relay numbers. These tests are made simultaneously. Ground on any of the test leads operates a CHT- relay to indicate a busy channel.

11.08 The channel number corresponds to the junctor switch number 0-9 on both the LL and the TL, and also to the horizontal level 0-9 on the LL line switch.

LINK AND JUNCCTOR PATTERNS

A. Line Link Pattern - FS46

11.09 The line links follow the same pattern for all line link frames. The links start on the horizontal multiples of the line switches and terminate on the horizontal multiples of the junctor switch. The links are subdivided into 10 groups, 10 links per horizontal group. Within a group the channel number of each link is the same as the horizontal level of the line switch to which it is connected.

11.10 The links are terminated on the junctor switches in the standard primary-secondary distribution. The switch and level numbers reverse on their respective terminations. For example, the link from line switch 9, level 0, would terminate on junctor switch 0, level 9.

11.11 Marker access for test and control is through the LL connector and through the HG- relay on the LL.

B. Trunk Link Pattern - FS46

11.12 The trunk link pattern, which is the same for all frames, uses two primary-secondary distributions, which are called the left half and right half.

11.13 The trunk links for the left half interconnect the 0-9 left junctor switch hold magnets and the 0-9 left trunk switch hold magnets. The trunk links for the right half interconnect in a similar manner except hold magnets 10-19 are used, but are designated 0-9 right.

11.14 The trunk links for each half are divided into 10 groups, 10 links per group. Marker access for test and control of the link groups is through the LC0-9, link connector, relays on the TL. The link connector relay number corresponds to the trunk switch number. Relays R or L are operated by the marker to select the right or left trunk link groups.

11.15 When paired TL frames are used, the trunk link frame junctor switches are associated with an extension junctor switch by a multiple between the vertical of the regular and the verticals of the extension junctor switch. When tripled TL are used, the multiple is extended to the verticals of the second extension junctor switch. The above arrangement permits a trunk link to terminate on the regular, extension, and second extension junctor switches. Juncctors from the various LL terminate on the regular, the extension, or the second extension switches. When paired or tripled frames are provided, the juncctors from a particular LL connect to corresponding locations on the junctor switches or extension junctor switches of all the TLs, which make up the pair or triple. This multiple connection permits a junctor to handle a call to a trunk on any of the TLs, which make up the pair or triple. The pair or triple is known as a TL group.

C. Junctor Patterns

11.16 The manner in which the juncctors are connected from the LL junctor switches to the TL junctor switches varies for every size of office. There is no simple scheme for determining the detailed pattern of connections of the juncctors for an office of any size. This detailed pattern of connections can be obtained by consulting BSP AA241.209. However, there are certain general features as follows:

(a) Each LL has at least one group of 10 juncctors that connect to each TL or group of TLs. These are called first subgroup juncctors. Of the 100 juncctors connecting to a LL, those not required for the first subgroup are proportionally divided over the TL in subgroups of 10 or less juncctors to each TL or group of TLs. A TL arranged for nonpaired operation has appearances for 200 juncctors, 100 for the left half and 100 for the right half; for paired frame operation 400 junctor appearances are available; for tripled frame operation 600 junctor appearances are available.

(b) The total number of juncctors connecting the junctor switches on a particular LL and the junctor switches on a particular TL varies from 50 juncctors in

an office equipped with 2 TLs to 10 junctors in an office equipped with 10, 20, or 30 TLs. All of the junctors connecting the junctor switches of one LL and one TL are called a junctor group. Each junctor group is divided into junctor subgroups of ten or less junctors.

(c) A minimum of 10 junctors is always provided between each LL and TL or TL group. Thus, when the number of LL exceed 20 frames or whenever the office is equipped to expand to a number of LL greater than 20 frames, the extension junctor switches are required as junctor terminations so that the TL can accommodate junctors from the additional LL in excess of 20. The second extension junctor switches are required as junctor terminations so that the TL can accommodate junctors from the additional LL in excess of 40.

(d) All junctors in the same subgroup are connected either to the left half or to the right half of the regular, extension, or second extension junctor switches on the TL.

(e) All junctors in the same subgroup are connected to the same horizontal level on the regular, extension, or second extension junctor switches.

(f) Where extension junctor switches are equipped, the TLs are grouped into pairs. The two TLs that are thus grouped together are called paired frames. Similarly, where second extension junctor switches are equipped, the TLs are grouped into triples. The three frames which are thus grouped together are called tripled frames. Where extension and second extension junctor switches are equipped, each junctor is terminated on a horizontal level on the regular, extension, or second extension junctor switch; and is then multiplied to the horizontal termination on its complementary junctor switch on the other TL of the pair or other two TLs of the triple. The multiple between the paired or tripled TLs terminates on the same horizontal level, on the same junctor switch level, and on the same half of the junctor switch of each of the paired or tripled TLs.

(g) To determine if a particular channel is available for use, it is necessary to test the particular line link, junctor,

and trunk link associated with this channel for a busy condition. If the line link, the junctor, and the trunk link associated with a channel are not busy, the channel is available for use. However, if the line link, the junctor, or the trunk link is busy, the entire channel is unavailable for use. The test for busy channels is made by the CHT- relays.

(h) The marker is equipped to simultaneously test ten channels between a particular line and a trunk circuit. To do this, the marker tests the line link, junctor, and trunk link associated with each of the ten channels. However, before testing the channels, the marker determines which ten channels in the office should be selected for channel testing; it then determines the ten line links, the ten junctors, and the ten trunk links associated with these ten selected channels. After the line link, the junctor, and the trunk link associated with each channel have been identified, the marker proceeds to test them for busy conditions.

11.17 In many cases more than one junctor subgroup is available. Subgroups other than the first may contain less than 10 junctors. When this condition exists, the marker must decide which junctor subgroup to use, and also, when a partially filled subgroup is selected, which channels are available for use on this call.

LINK AND JUNCTOR SELECTION

A. Selection of the Group of Line Links

11.18 When a connection between a line and a trunk is required, the marker records the line location. The FTT- and FUT- relays are used to direct the marker to connect to the proper LL through the frame connector. The horizontal group information causes the marker to operate the HG- relay on the LL, which controls the group of ten line links, or horizontal multiples on the line switch that have access to the switch vertical of the line.

11.19 Associated with, and connecting to, each sleeve conductor of the line links there is a line link test lead designated LL0-9 and a link busy test lead designated LB0-9.

11.20 The leads are extended through the LL HG-, horizontal group, relay to

the marker. The LL0-9 leads connect to the CHT0-9 relay; the LB0-9 leads connect to the CH0-9 relays to permit a secondary busy test after the channel has been selected.

11.21 The selected group of ten line links are assigned to the channels in a manner such that the numerical designation corresponds to:

- (a) The CHT0-9, channel number.
- (b) The horizontal level on the line switch.
- (c) The LL junctor switch number.

B. Selection of Trunk Link Group on the Trunk Link Frame - FS46, FS17

11.22 Trunks are terminated on the horizontals of the trunk switches. Each horizontal has access to the 20 switch verticals on which the trunk links terminate. The trunk links are divided into two groups; those that terminate on the left half trunk switch verticals 0-9, and those that terminate on the right half, verticals 10-19. The termination for the other end of the left and right trunk links is on the left and right verticals, respectively, of the junctor switch.

11.23 In order to test for idle trunk links, the marker extends ten LH009 test leads, from the CHT0-9 relays through the trunk link frame connector and the R or L and LC0-9 relays on the TL.

11.24 The LC0-9 relays are associated with the trunk switch number and are operated from the FA-- to FB-- relay associated with the trunk.

11.25 The R or L relays operate under control of the marker FUT0-9, frame units test, and JG0-4, junctor subgroup relays.

11.26 The numerical designation of the channel, of which the trunk link is a part, is identical with the numerical designation of the trunk link test lead JH0-9 and with the numerical designation of the TL junctor switch to which the trunk link connects.

C. Selection of the Subgroup of Junctors

11.27 The number of junctors in a junctor group may vary from a maximum of fifty junctors to a minimum of ten junctors. Since the marker is equipped to simultaneously test a maximum of ten channels, and therefore to test a maximum of ten junctors each junctor group is subdivided into junctor subgroups consisting of ten or less junctors. The marker selects those junctors within one junctor subgroup when testing for an idle channel. The selection of the subgroup of ten or less junctors is, in general, determined by the following factors:

- (a) The number of TLFs in the marker group as indicated by the 2-10 TLF relays.
- (b) The LL number.
- (c) The junctor sequence position JSQ0-5 which is used to equalize and rotate the traffic among the subgroups.
- (d) The junctor step, STP1,2, position.

11.28 The number of junctors within a junctor group and within a junctor subgroup for various office sizes is shown in the following junctor distribution tables.

11.29 The selected subgroup of junctors is assigned to the ten channels so that the numerical designation of the junctor switch on both the LL and the TL to which the junctor connects is also the numerical designation of the channel of which the junctor is a part.

JUNCTOR DISTRIBUTION
FOR OFFICES WITH NONPAIRED TL

Number of LL In Office	Number of TL In Office	Number of Junctor Groups From Each LL	Number of Junctors Within Subgroup of Junctors Con- necting to One TL From Each LL Junctor Subgroup Numerical Designation				
			0	1	2	3	4
4	2	2 groups of 50	10	10	10	10	10
4	2-3	See 11.43 through 11.45	10	10	10		
6	3	2 groups of 33 and 1 group of 34	10 10	10 10	10 10	3 4	
8	4	4 groups of 25	10	10	5		
10	5	5 groups of 20	10	10			
12	6	4 groups of 17 and 2 groups of 16	10 10	7 3		3	
14	7	2 groups of 15 4 groups of 14 and 1 group of 14	10 10 10	5 4 2			2
16	8	4 groups of 13 and 4 groups of 12	10 10	3 2			
18	9	1 group of 12 and 8 groups of 11	10 10	2 1			
20	10	10 groups of 10	10				

JUNCTOR DISTRIBUTION
FOR OFFICES WITH PAIRED TL

Number of LL In Office	Number of TL In Office	Number of Junctor Groups From Each LL	Number of Junctors Within Subgroup of Junctors Con- necting to One TL From Each LL Junctor Subgroup Numerical Designation				
			0	1	2	3	4
8	4 (2 Pair)	2 groups of 50	10	10	10	10	10
8	4-6 (2-3 Pair)	See 11.43 through 11.45	10	10	10		
12	6 (3 Pair)	2 groups of 33 and 1 group of 34	10 10	10 10	10 10	3 4	
16	8 (4 Pair)	4 groups of 25	10	10	5		
20	10 (5 Pair)	5 groups of 20	10	10			
24	12 (6 Pair)	1 group of 18, 2 groups of 17 and 3 groups of 16	10 10 10	4 7 3	4 3		

Number of LL In Office (Cont)	Number of TL In Office	Number of Juncator Groups From Each LL	Number of Juncators Within Subgroup of Juncators Con- necting to One TL From Each LL Juncator Subgroup Numerical Designation				
			0	1	2	3	4
28	14 (7 Pair)	2 groups of 15, 4 groups of 14 and 1 group of 14	10 10 10	5 4 2		2	
32	16 (8 Pair)	4 groups of 13 and 4 groups of 12	10 10	3 2			
36	18 (9 Pair)	1 group of 12 8 groups of 11	10 10	2 1			
40	20 (10 Pair)	10 groups of 10	10				

JUNCTOR DISTRIBUTION
FOR OFFICE WITH TRIPLED TL

Number of LL In Office	Number of TL In Office	Number of Juncator Groups From Each LL	Number of Juncators Within Subgroup of Juncators Con- necting To One TL From Each LL Juncator Subgroup Numerical Designation				
			0	1	2	3	4
12	6 (2 Triple)	2 groups of 50	10	10	10	10	10
12	6-9 (2-3 Triple)	See 11.43 through 11.45	10	10	10		
18	9 (3 Triple)	2 groups of 33 and 1 group of 34	10 10	10 10	10 10	3 4	
24	12 (4 Triple)	4 groups of 25	10	10	5		
30	15 (5 Triple)	5 groups of 20	10	10			
36	18 (6 Triple)	4 groups of 17 and 2 groups of 16	10 10	7 3		3	
42	21 (7 Triple)	2 groups of 15 4 groups of 14 and 1 group of 14	10 10 10	5 4 2		2	
48	24 (8 Triple)	4 groups of 13 and 4 groups of 12	10 10	3 2			
54	27 (9 Triple)	1 group of 12 and 8 groups of 11	10 10	2 1			
60	30 (10 Triple)	10 groups of 10	10				

OFFICE SIZE AND JUNCTOR PATTERN - SC108

11.30 Office size determines junctor distribution. When the TL is connected to the marker, the identification of office size is initiated. The office size is identified by determining the number of TLs in the office and whether they are single, paired, or tripled.

A. Operation of the STF, PR, or TTF Relay - FS13

11.31 To determine if the selected TL is a nonpaired, paired, or tripled TL, the single frame relay (STF) the paired relay (PR) or the tripled relay (TTF) in the marker is operated.

11.32 The operation of the TLCl relay extends ground to the SPF cross-connection terminal. If the TL associated with the office are all nonpaired, the grounded SPF terminal is cross-connected to the SF terminal, thereby operating the STF relay. If the TLs are paired, the grounded SPF terminal is cross-connected to the PR terminal, thereby operating the PR relay. If the TLs are tripled, the grounded SPF terminal is cross-connected to the TTF terminal, thereby operating the TTF relay.

11.33 However, when the office is in the process of being expanded, the STF, PR, or TTF relay is not operated when the TLCl relay is operated, but is operated from the TL connector. Ground is extended from the TL connector to the marker over the STF, PR, or TTF lead to operate the associated STF, PR, or TTF relay. The TL grounds the SF lead, if the frame is nonpaired; the PR lead, if the frame is paired; or the TTF lead, if the frame is tripled.

B. Operation of the 2TLF-10TLF, 6TFA, and 7TFA Relays - FS13

11.34 To determine the junctor distribution associated with the selected TL one of the 2TLF-10TLF relays is operated, in addition to the operation of the STF, PR, or TTF. The 6TFA and 7TFA relays are auxiliaries to the 6TLF and 7TLF, respectively, and are used only for tripled frame offices.

11.35 The operating path of each 2TLF-10TLF, 6TFA and 7TFA relay is extended to an associated SZ 2-10 cross-connection terminal. The SZ 2-10 terminals are cross-connected to the SZA, SZB, SZC, or SZD cross-connections terminal in the marker circuit according to the following table:

DETERMINING OFFICE SIZE FOR SELECTED TL

<u>Number of Trunk Link Frames</u>			<u>SZ2-SZ10 Terminal Connected</u>	<u>2TLF-10TLF Relay Operated</u>
<u>Nonpaired Frames</u>	<u>Paired Frames</u>	<u>Tripled Frames</u>		
2	4	6	SZ-2	2TLF
2-3	4-6	6-9	SZ-2-3	2-3TLF
3	6	9	SZ-3	3TLF
4	8	12	SZ-4	4TLF
5	10	15	SZ-5	5TLF
6	12	18	SZ-6	6TLF-6TFA*
7	14	21	SZ-7	7TLF, 7TFA*
8	16	24	SZ-8	8TLF
9	18	27	SZ-9	9TLF
10	20	30	SZ-10	10TLF

*If provided

11.36 The 2TLF-10TLF, and 6TFA, 7TFA relays denote the number of single frames in a nonpaired office, the number of pairs in a paired office, and the number of triples in a tripled office.

11.37 Normally, the one SZ2-10 terminal associated with the office size is cross-connected to the SZD terminal. The operation of the TLC 1 relay grounds the SZD terminal to operate one of the 2TLF-10TLF, and the 6TFA, or 7TFA relay, if required.

11.38 When an office is being expanded, it is necessary to remove junctors from some of the subgroups to form new junctor groups to the added TL. During this work, the subgroups are unusable. To prevent the selection of the affected subgroups, the associated TL is temporarily cross-connected to indicate that it has a junctor distribution not containing these subgroups. Therefore, as the work progresses, some TLs will have a junctor distribution corresponding to the original size, some to an intermediate size, and some to the new size. To provide for this, the 2-10 TLF and 6, 7 TFA relays can be operated from the TL via cross-connections on a temporary basis during the expansion period as described in the following paragraph.

11.39 A TL of the original size junctor distribution would have a cross-connection from the G to the SZA, SZB, or SZC terminals (customarily, the SZA is used for original size). In the marker, the SZA would then be cross-connected to the 2-10TLF representing the original size junctor distribution. A TL that is, in itself, in the process of expansion, would have its G terminal cross-connected to the SZB; again SZA, SZB, or SZC could be used. Assuming SZB were used, the SZB in the marker would be cross-connected to the 2-10TLF terminal, representing the junctor grouping needed for the intermediate size;

on most conversions the 10TLF is used for the intermediate size since it indicates that only one subgroup of ten junctors exists from any LL to that TL. A TL that has been converted to the new office size junctor distribution has its G terminal cross-connected to the SZC cross-connection terminal (arbitrarily). The marker SZC is cross-connected to the 2-10TLF representing the new size. These cross-connections facilitate additions to the office and reduce the number of junctors that are out of service simultaneously. The 2-3TLF size is provided for use as an intermediate arrangement during conversion from 2TLF to 3TLF (single, paired, or tripled) arrangements. For details on these cross-connections, refer to BSP Section 819-220-150.

C. Operation of the 20F, 40F, and 60F Relays, FS13

11.40 To provide an auxiliary indication of an office size that consists of 20 or less LLs, the 20F relay is provided. It operates if the 2TLF, 2-3TLF, or 3TLF relay operates, or if the 4, 5, 6, 7, 8, 9 or 10 TLF relay and the STF relay are operated, or if 4TLF or 5TLF and PR are operated.

11.41 To provide an auxiliary indication of 21 to 40 LLs, the 40F relay is provided. It operates if the 6, 7, 8, 9, or 10TLF and the PR relays operate or with 4-5 or 6TLF and the TTF relays operated.

11.42 To provide an auxiliary indication of 41 to 60 LLs, the 60F relay is provided. It operates if the 7, 8, 9, or 10TLF and the TTF relays operate.

D. Pattern Control and Identification of the Junctor Subgroup Pattern

11.43 After the identification of the office size has been completed, the marker identifies the selected junctor subgroup junctor distribution pattern as shown in the following table:

JUNCTOR SUBGROUP PATTERNS

<u>Pattern Number</u>	<u>Pattern Tens Digit Relay Operated</u>	<u>Pattern Units Digit Relay Operated</u>	<u>Junctor Channels Available Within The Junctor Subgroup</u>
Pattern Normal	PNR	-	0,1,2,3,4,5,6,7,8 and 9
P0	PA	P0, P0A	0,7
P1	PA	P1, P1A	1,8
P2	PA	P2, P2A	2,4,6
P3	PA	P3	3,5,9
P4	PA	P4	0,1,7,8
P5	PA	P5, P5A	1,3,5,9
P6	PA	P6, P6A	2,4,6,8
P7	PA	P7, P7A	1,3,5,7,9
P8	PA	P8, P8A	0,2,4,6,8
P9	PA	P9, P9A	0,1,3,5,7,8,9
P11	PB	P1, P1A	1
P12	PB	P2, P2A	2
P13	PB	P3	3
P14	PB	P4	4
P15	PB	P5, P5A	5
P16	PB	P6, P6A	6
P17	PB	P7, P7A	0,7
P18	PB	P8, P8A	8
P19	PB	P9, P9A	9
P20	PC	P0, P0A	0,2,4,6,8
P21	PC	P1, P1A	1,3,5,7,9
P30	PE	P0, P0A	2,4,6
P31	PE	P1, P1A	3,5,9
P35	PE	P5, P5A	0,1,7,8
P36	PE	P6, P6A	2,4,6
P37	PE	P7, P7A	3,5,9
P38	PE	P8, P8A	0,1,3,5,7,8,9
P39	PE	P9, P9A	0,1,7,8

11.44 The number of junctors within a junctor subgroup varies from a maximum of ten junctors to a minimum of one junctor, depending upon the office size and the selected subgroup. The marker is equipped to simultaneously test 10 separate channels, but for subgroups with less than 10 channels, the marker tests only the available channels within the subgroup.

11.45 As an indication that the selected junctor subgroup consists of a full group of ten junctors, the pattern normal PNR relay is operated in the marker. However, when the selected junctor subgroup consists of less than a full group of ten junctors, one of the junctor pattern tens digit number, PA, PB, PC, or PE relays and one of the junctor pattern units digit number P0-9 and, if provided, a pattern auxiliary PA relay operates to identify the junctors subgroup pattern and to identify the junctors that are available in the junctor subgroup. When the pattern normal PNR relay operates, the junctor subgroup pattern is identified, therefore, although a P0-9 relay may also operate, it is not required for pattern identification. The operating path of the PNR, PA, PB, PC, and PE relays varies with each office size and is controlled by the LL number, TL number, STP1

or STP2 relay, the junctor sequence JSQ0-5 relay, and the PR, STF, or TTF relay.

E. Pattern Number and Operation of the Pattern Relays - FS14

11.46 The operating path of each pattern units digit P0-9 relay and, if provided, P0A-P9A relay is extended by means of the P0-9 lead to an associated pattern P0-9 cross-connection terminal in the TL when the TL cut-through relay is operated. These pattern P0-9 cross-connection terminals are cross-connected to the L0-8 cross-connection terminals in the TL in accordance with the requirements of BSP Section AA241.209. The cross-connection of the P0-9 and L0-8 cross-connection terminals are made to operate the required pattern relay in the marker, and vary for each office size. For certain office sizes where all junctor subgroup patterns are normal pattern (PNR relay operated), no cross-connections are required. The operation of the 20F, 40F, or 60F relay, the operation of one FTB0-5, and if provided, one FTA0-4 relay and one FUT0-9 relay in the marker extends ground over one L0-8 lead to ground the associated L0-8 cross-connection terminal in the TL in accordance with the following table:

GROUNDING THE L0-8 PUNCHING IN TL

L0-8 Lead or Cross-Connection Terminal Grounded	LL Number		
	20 or Less LL Office	20 to 40 LL Office	40 to 60 LL Office
L0	0,1	0,1,2,3	0,1,2,3,24,25
L1	2,3	4,5,6,7	4,5,6,7,28,29
L2	4,5	8,9,10,11	8,9,10,11,30,31
L3	6,7	12,13,14,15	12,13,14,15,26,27
L4	8,9	16,17,18,19	16,17,18,19,32,33
L5	10,11	20,21,22,23	20,21,22,23,34,35
L6	12,13	24,25,26,27	36,37,38,39,40,41
L7	14,15	28,29,30,31	42,43,44,45,46,47
L8	16,17	32,33,34,35	48,49,50,51,52,53
None (See 11.43 through 11.45)	18,19	36,37,38,39	54,55,56,57,58,59

E. Operation of the 2G or 3G Relay - FS16

11.47 In offices with six or seven single, paired, or tripled TLs, the junctor groups consists of either two or three subgroups, depending upon the particular P0-9 operated. The two group 2G relay is operated for patterns requiring two subgroups, and the three group 3G relay is operated for patterns requiring three subgroups. With six or seven single, paired, or tripled frames, the number of junctor subgroups from each frame is not equal; there are either two or three subgroups from these frames. Thus, the 2G and 3G relays are provided to differentiate between two or three subgroups.

11.48 The operation of the 6TLF or 7TLF relay, with one of the P5, P6, P7, P8, P9 relays operated, operates the 2G relay.

11.49 The operation of the 6TLF or 7TLF relay with one of the P0, P2, P3, or P4 relays operated, operates the 3G relay.

G. Operation of the TCH0-9, TCHK, and MT7 Relays - FS16

11.49 The test channel TCH0-9 relays are operated to prepare the marker for

channel test. The nonoperation of a TCH-relay indicates that the channel is non-existent.

11.50 When the pattern normal PNR relay operates, all the TCH0-9 relays are operated, which indicates that there are ten junctors, and, therefore, ten channels available for test. The operation of the pattern tens digit PA, PB, PC, or PE relays and one of the P0-9 or P-A relays operates the TCH0-9 relays to indicate usable junctors. As an indication that one or more of the TCH0-9 relays have operated, the test channel check TCHK relay operates.

11.51 In order to reduce current drain, the MT7 relay is operated to release the TCH0-9 relays after the channel has been selected and the CHA relay operated. The MT7 relay is also operated on marker test calls when it is desired to operate a particular TCH0-9 relay in order to select a particular channel.

11.52 See the following three tables which indicate the patterns available in each of the junctor subgroups for each office size, and the fourth table which shows the junctor subgroup selection.

JUNCTOR SUBGROUP PATTERNS
FOR NONPAIRED TRUNK LINK FRAMES

<u>Number of TL Singles</u>	<u>Junctor Subgroups</u>				
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
2	PNR	PNR	PNR	PNR	PNR
2-3	PNR	PNR	PNR		
3	PNR	PNR	PNR	P2,P3 or P4	
4	PNR	PNR	P7 or P8		
5	PNR	PNR			
6	PNR	P2 or P9	P2		
7	PNR	P0,P5,P6, P7, or P8	P0		
8	PNR	P0,P1 P2 or P3			
9	PNR	P11,P12 P13,P14, P15,P16 P17,P18 or P19			
10	PNR				

JUNCTOR SUBGROUP PATTERNS
FOR PAIRED TRUNK LINK FRAMES

<u>Number of TL Pairs</u>	<u>Junctor Subgroup Selected</u>				
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
2	PNR	PNR	PNR	*PNR	*PNR
2-3	PNR	PNR	PNR		
3	PNR	PNR	PNR	P2,P3 or P4	
4	PNR	PNR	P7 or P8 P20, or P21		
5	PNR	PNR			
6	PNR	P2, P3 P4, or P9	P2,P3 or P4		
7	PNR	P0,P5,P6 P7 or P8	P0		
8	PNR	P0, P1 P2 or P3			
9	PNR	P11,P12, P13,P14, P15,P16, P17,P18 or P19			
10	PNR				

*Relays P2 and P3 operate with 2 TL pairs to determine whether the regular frame or extension frame should be used on subgroup 3 and 4.

JUNCTOR SUBGROUP PATTERNS
FOR TRIPLED TRUNK LINK FRAMES

<u>Number of TL Triples</u>	<u>Junctor Subgroup Selected</u>				
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
2	PNR	PNR	PNR	*PNR	*PNR
2-3	PNR	PNR	PNR		
3	PNR	PNR	PNR	P2,P3,P4 P30,P31,P35 P36,P37,or P39	
4	PNR	PNR	P7 or P8		
5	PNR	PNR			
6	PNR	P2,P9, P36, or P38	P2 or P30		

Number of TL Triples (Cont)	Juncture Subgroup Selected				
	<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
7	PNR P0,P5,P6 P7, or P8		P0		
8	PNR P0,P1,P2,or P3				
9	PNR P11,P12,P13 P14,P15,P16 P17,P18, or P19				
10	PNR				

*Relay P6 and P7 operate on 2 TL triples to determine whether the extension frame or second extension frame should be used on subgroups 3 and 4.

JUNCTURE SUBGROUP SELECTION

Number of Trunk Link Frames			Juncture Step Position (STP1 or STP2)	Juncture Sequence Position					
<u>Single</u>	<u>Paired</u>	<u>Tripled</u>		<u>0</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
2	4	6	1	JG0	JG1	JG2	JG0	JG1	JG2
			2	JG3	JG4	JG3	JG4	JG3	JG4
2-3	4-6	6-9	1	JG0	JG1	JG2	JG0	JG1	JG2
			2	JG1	JG2	JG0	JG1	JG2	JG0
3	6	9	1	JG0	JG1	JG2	JG0	JG1	JG2
			2	JG3	JG3	JG3	JG3	JG3	JG3
4	8	12	1	JG0	JG1	JG0	JG1	JG0	JG1
			2	JG2	JG2	JG2	JG2	JG2	JG2
5	10	15	1	JG0	JG1	JG0	JG1	JG0	JG1
			2	JG1	JG0	JG1	JG0	JG1	JG0
6	12	18	1	JG0	JG0	JG0/1*	JG0	JG0	JG0/1*
			2	JG1	JG1/2∅	JG0/2∅	JG1/2∅	JG1	JG0/2∅
7	14	21	1	JG0	JG0	JG0	JG0	JG0	JG0/1*
			2	JG1	JG1/2∅	JG1	JG1/2∅	JG1	JG0/2∅
8	16	24	1	JG0	JG0	JG0	JG0	JG0	JG0
			2	JG1	JG1	JG1	JG1	JG1	JG1
9	18	27	1	JG0	JG0	JG0	JG0	JG0	JG0
			2	JG1	JG1	JG1	JG1	JG1	JG1
10	20	30	1	JG0	JG0	JG0	JG0	JG0	JG0

*JG0 operates if 3 junctor subgroups exist between the LL and the TL.

JG1 operates if 2 junctor subgroups exist between the LL and the TL.

∅ The higher numbered JG- relay operates if 3 junctor subgroups exist between the LL and the TL.

The lower numbered JG- relay operates if 2 junctor subgroups exist between the LL and the TL.

JUNCTOR SUBGROUP IDENTIFICATION - FS17, FS19

11.53 While the marker is in the process of identifying the junctor pattern, it proceeds to identify the junctor subgroup selected for service.

11.54 The operated JG0-4, junctor subgroup, relay indicates the numerical designation of the selected junctor subgroup within the junctor group.

11.55 With the group control GC relay operated, the JG0-4 operates a correspondingly numbered G0-4 group, relay in the TL. However, with the group control auxiliary GCA operated, the JG0-2 operates the G- relays as follows.

<u>JG- Relay</u>	<u>Group Relay in TL</u>
JG0	0
JG1	3
JG2	4

A. Operation of the GC and GCA Relays

11.56 The GC and GCA relays along with the JG- relays are used to control the operation of the G- relays in the TL.

11.57 The GC operates in single and paired frame offices having any number of TLs. It operates in tripled frame offices of any size having frame tens FTA0, FTA1 relays operated; or an FTA2 operated on all sizes except six tripled TLs.

11.58 The GC relay control in the trunk link G- relay operate path prevents two G- relays from being operated at the same time when the line link information is reset on a PBX call.

11.59 The GCA operates only in 6 tripled TL offices having a frame tens FTA2 relay operated, or in any tripled size office having an FTA3 or FTA4 operated.

B. Operation of the Regular Frame, Extension Frame, or Second Extension Frame Relays in the TL - FS18

11.60 Battery is extended to the TL over the R or L lead to operate the right R and, if provided, the extension right ER and second extension right SER relay; or the left L and, if provided, the extension left EL and second extension left SEL relays. The operated FUT- and JG- relays extend the battery from the marker to operate these relays.

11.61 To check the operation of the R, ER, and SER relays, or L, EL, or SEL relays in the TL, the associated marker right check RK or left check LK is operated.

11.62 By consulting BSP Section AA241.209, it is possible to determine whether the RF, EF, or SEF relay should be operated. The BSP AA241.209 identifies the junctor connector (JC-) relay associated with the selected junctor subgroup. If a JC0-9 relay is associated with the selected junctor subgroup the regular frame (RF) relay is operated. If a JC10-19 relay is associated with the selected junctor subgroup, the extension frame (EF) relay is operated. If a JC20-29 relay is associated with the selected junctor subgroup, the second extension frame (SEF) relay is operated.

C. Operation of the 7Q and RQ Relays - FS19

11.63 The 7Q and RQ relays are used to differentiate between the junctor distribution required on seven paired or tripled TLs and six, eight, or nine paired or tripled TLs.

11.64 The seven quad 7Q and regular quad RQ relay designations originally derived their functional meanings from paired junctor configuration, in which four LLs (quads) would always require the same JC lead. However, with the advent of triple frame offices, this functional meaning is not descriptive, because the 7Q and RQ relays are used in tripled frame offices where four, six, or more LLs require the same JC lead.

11.65 The 7Q relay operates when the 7TLF and PR or TTF operate. The RQ relay operates when the 6TLF, 8TLF, or 9TLF and the PR or TTF relays operate.

D. Operation of the Junctor Connector Relay in the TL - FS19

11.66 One JC- junctor connector relay in the TL is operated to extend the ten junctor test leads J0-9 from the selected TL to the marker.

11.67 The operation of the JG, FUT-, FTB- the 20F, 40F or 60F relay and, where required, the 7Q or RQ relay places battery on one of the JC0-9 leads to the TL. This battery is extended in the TL, through contacts on the G relays to the cross-connection terminals G10-19, G20-29, G30-39, or G40-49. These terminals are cross-connected to the JC0-9 terminals in the TL per BSP Section AA241.209, and hence operate the JC0-29 relays as determined by the RF, EF, or SEF relays.

11.68 The GC and GCA relays, along with the JG0-4 relays control the selection of a group relay G0-4 in the TL. In offices of six triple frames or larger, it is necessary for a particular JC0-9 lead to operate either of two JC- relays in the TL depending on the LL being served. The operation of the proper G- relay in the TL as determined by the operated GC or GCA makes this possible.

11.69 As a check that the TL JC- relay has operated, the JCK relay is operated over the JS0 lead to the TL. The JCK relay is operated in series with the winding of the junctor switch select magnets on the TL when the JC- relay operates. However, the junctor switch select magnets are not operated because of the high resistance of the JCK relay and the JCK resistor.

LINK SELECTION IN TL AND LL

A. Selection of the Group of Trunk Links - FS46

11.70 The group of ten trunk links, associated with the ten channels to be tested, terminate on either the left half or the right half of the trunk switch. If the selected junctors terminate on the left half of the TL junctor switch, the ten trunk links associated with the selected ten channels are terminated on the left

half of the TL trunk switch. If the selected junctors terminate on the right half of the TL junctor switch, the ten trunk links are terminated on the right half of the TL trunk switch.

11.71 Associated with and connecting to each sleeve conductor of the trunk links there is a trunk link test lead designated RLH0-9, if the trunk link is associated with the right half of the trunk switch; or designated LLH0-9, if the trunk is associated with the left half of the trunk switch.

11.72 The selected trunk F relay controls the operation of the FA-- or FB-- relay in the TL.

11.73 Operation of the FA-- or FB-- operates the proper LV2-9, level connector, and LC0-9, link connector, relays in the TL for marker control of the select magnet operation, channel tests, and hold magnet operation. The A or B appearance and the horizontal level on the trunk switch is checked by the operation of the FAK or FBK relay in the marker. To check that the LC- relay operated the LCK relay in the marker operates.

11.74 When the FAK or FBK relay in the marker operates, battery is extended to the TL on the ASM or BSM lead. This battery is directed by the operated LV- and FA-- or FB-- relays in the TL to operate a select magnet on the A or B trunk switch steering level and on the level of the selected trunk. Ground for the trunk link select magnets is provided by the marker on the TSX lead. This ground is present upon the release of TSEL relay immediately following the selection of an idle trunk, B19.

11.75 The operated LC- and LV- relays locate the trunk on the trunk switch. After the junctor subgroup has been selected, the marker determines if the selected junctors are associated with the right half or with the left half of the junctor switch and operates the R relay or the L relay in the TL. The operation of the LC- relay, with the R relay operated, extends the ten RLH 0-9 trunk link test leads connecting to the trunk links associated with the selected ten channels to the ten LH0-9 trunk link test leads in the marker. The operation of the LC- relay with the L relay operated extends the ten LLH0-9 trunk link test leads to the ten LH0-0 trunk test leads in the marker.

11.76 The selected group of ten trunk links are assigned to the channels so that the numerical designation of the channel of which the trunk link is a part is identical with the numerical designation of the trunk link test lead LH0-9, and with the numerical designation of the TL junctor switch to which the trunk link connects.

B. Selection of the Group of Line Links - FS9, FS46

11.77 After the horizontal group of the line (calling customer line for a call back linkage or called customer line for a call forward linkage) has been determined, the LL horizontal group HG- relay operates. As a check that the HG- is operated, the horizontal group check (HGK) relay in the marker operates. Associated with and connecting to each sleeve conductor of the line links there is a line link test lead LL0-9. The operation of the HG- relay extends the LL0-9 leads to the marker for testing.

11.78 The selected group of ten line links are assigned to the channels so that the numerical designation of the channel is identical with the numerical designation of the line link test lead LL0-9. The designation also agrees with the numerical designation of the junctor switch and the horizontal level of the line switch that are connected by the line link.

C. Operation of the TK Relay - FS44

11.79 To indicate that the marker has performed the preliminary functions necessary for the selection of a channel, the test relay (TK) is operated. The TK relay operated indicates the satisfactory completion of the following test checks:

- (a) Relay LCK operated, indicating that the desired trunk has been located by the LC- and LV- TL relays.
- (b) Relay HGK operated, indicating that the group of line links associated with the line has been determined.
- (c) Relay TCHK operated, indicating that there is at least one channel available for test.

(d) Relay LK or RK operated, indicating selection of either the right or left group of trunk links on the TL.

(e) Relay FAK or FBK operated, indicating that the trunk is associated with the proper TL level and appearance.

(f) Relay SCCK or TCKK operated, indicating check of originating class of service, or terminating class of service information.

(g) If SON relay is operated, indicating a sender required, ORK1 and 2 relays must be operated, indicating that the digit information to be transmitted has been received from the originating register.

CHANNEL TEST - SC109

11.80 The marker simultaneously tests the line link test leads, the junctor test leads, and the trunk link test leads of each channel to determine which channels are busy. A ground on the line link test lead, the junctor test lead, or the trunk link test lead associated with a channel indicates a busy and, hence, unavailable channel.

11.81 On call-back linkages the originating register grounds the LL2 leads corresponding to the line link used on the dial tone connection. Ground on the LL2 leads

operates corresponding marker relays, which in turn cause that line link to test idle when channel test is made.

11.82 After the marker determines which channels are idle, it selects the preferred channel to connect the line to the selected trunk. The preference of channel selection is permanent and nonrotating. A higher grade of service, with less delay due to no channels available, is given at peak traffic by arranging the preference of channels in a definite order.

A. Operation of the CHT0-9 Relays - FS46

11.83 The CHT0-9, channel test, relays are provided to test the sleeve leads, associated with the channels, for a busy indication. The CHT0-9 relays test the line links, the junctors, and the trunk links

for ground. Ground on the sleeve test leads indicates that the associated channel is busy. Therefore, the operation of a CHT-relay indicates that at least one of the three linkages that make up the channel is busy. The operation of the CHT-relay prevents the marker from selecting that channel for the call.

11.84 The windings of the CHT0-9 relays are connected to the sleeve circuit through the associated L0-9, J0-9, and T0-9 diodes, L0-9, J0-9, and T0-9 resistors; and through the unoperated contacts of the CH0-9 relays to the respective LLO-9, J0-9, and LHO-9 leads.

11.85 The diodes are used to prevent the high negative surges, produced by the release of hold magnets that had been associated with busy linkages, which may be releasing at the instant of channel test, from reaching the windings of the CHT0-9 relays. A voltage divider is provided by the L0-9, J0-9, and T0-9 resistors. The L0-9, J0-9, and T0-9 capacitors reduce the transient voltages.

11.86 When the marker is idle, a standing cross test is made on these leads by the XCH relay. During this period, the negative side of the windings of the CHT0-9 relay is connected through the XCH winding to battery. However, when the marker is off-normal, the STX relay connects the negative side of the CHT0-9 windings directly to battery.

B. Operation of the CHT Relay - FS44

11.87 It is necessary to delay the operation of the channel selection CH0-9 relay until all CHT0-9 relays have had sufficient time in which to operate. This delay is provided by the (CHT) channel timer relay.

11.88 The operation of the CKG5 relay, with the TK relay released, permits current to flow through the secondary winding of the CHT relay in the nonoperate direction, and through the primary winding of the CHT relay in the operate direction. The magnetic flux of the secondary winding predominates and the CHT relay remains in the nonoperated position. When relay TK operates, the CHT relay operation is delayed because of the momentary current flow through the secondary winding caused by charging the CHT capacitor.

C. Operation of the CH0-9 Relay and the CHA, CHA1 Relays - FS44

11.89 Following the operation of the CHT relay, one preferred channel selection CH0-9 relay is operated to select the channel comprised of an idle link link, an idle trunk link, and an idle junctor.

11.90 The operating path of the CH0-9 relay is as follows:

- (a) Through a transfer chain of CHT- and TCH- relay contacts.
- (b) Via the channel selector preference cross-connections (S to INO, M to OT4, M1 to IN5, and ET0 to OT9).
- (c) The DTK, SLRK, and CHT operated.
- (d) Through a chain of break contacts on the CH- relays.
- (e) Through the operated LLC1 to ground.

If all TCH0-9 relays are operated, the ground operates the first CH0-9 relay that has an associated CHT0-9 relay in a released position. If a TCH- relay is not operated, the ground is extended to the next CH- relay having an operated TCH- and nonoperated CHT-.

11.91 When one CH- relay operates, the CHA and CHA1 relays operate as an indication that a channel has been selected.

D. Operation of Select Magnets Associated With Channel - FS45

11.92 The operation of the CH- relay closes battery over the JS0-9 lead through the JC- relay on the TL to operate the junctor switch select magnet. The CH- in operating also operates the select magnets on the LL associated with the selected channel. The select magnets on the trunk switch operate as previously described.

JUNCTOR STEP AND FAILURE TO MATCH - FS44, 55, SC126

11.93 All office sizes except 10 TLs non-paired, 20 TLs paired, or 30 TLs tripled have more than one subgroup of junctors. Since the marker can test only one subgroup of junctors at a time, facilities are provided to shift junctor subgroups if the marker finds all channels busy when testing the first choice subgroup.

11.04 When the CHT operates to select an idle channel, the STP operates if all channels are busy. The STP releases the GC, and causes the marker to select another junctor subgroup.

11.95 If testing the second subgroup of junctors also results in an all channel busy indication, the operation of the CHT causes the FMP relay to operate.

11.96 The FMP causes the FM, failure to match, to operate and control the operation of two sets of counting relays. One set of counters, 1F, 1FA, 2F, and 2FA counts the total failures to match, and the RF, RFA counts the matching failures within a route.

11.97 Failures to match causes the following marker action:

- (a) First failure causes recycle or allotter advance.
- (b) Second failure within route causes route advance.
- (c) Third failure causes route advance; register returns busy-tone.

CHANNEL PREFERENCE - FS44

11.98 To provide the CH0-9 arrangement with CHO the most preferred, the following cross-connections must be made:

- (a) S terminal cross-connected to IN0.
- (b) M terminal cross-connected to OT4.
- (c) M1 terminal cross-connected to IN5.
- (d) E terminal cross-connected to OT9.

11.99 To provide the CH5-9,0-4 arrangement with CH5 the most preferred, the following cross-corrections must be made:

- (a) S terminal cross-connected to IN5.
- (b) M terminal cross-connected to OT9.
- (c) M1 terminal cross-connected to IN0.
- (d) E terminal cross-connected to OT4.

11.100 There are two channel selection preference arrangements. One is from the most preferred CH0 relay through the CH1 through CH8, to the least preferred CH9 relay. The other is from the most preferred CH5 relay through the CH6 through CH9, through the CH0 through CH3, to the least preferred CH4 relay. One arrangement is used on first trials (TR2B relay released) and the other is used on second trials (TR2B relay operated). Cross-connections are provided to determine which of the two arrangements is used on first trials.

11.101 It is important to periodically alternate the preference arrangement to equalize the use of equipment. It is very important to have all marker preferences the same.

12. HOLD MAGNET OPERATION - FS46, 47

12.01 When there is no ground on the sleeve conductor of all the three links that comprise a channel, the marker recognizes this as an idle indication and, therefore, it may select that channel. The marker does not know how long this channel has been idle and, therefore, this channel may be selected just after it becomes idle from a previous connection, but before the hold magnets and select fingers have had time to release. To ensure against trying to reoperate a hold magnet before the hold magnet and select finger have released from a previous connection, the marker is equipped with a hold magnet timing circuit.

12.02 After the completion of the hold magnet timing interval, the hold magnets required for this call are operated. During light traffic conditions, the line link frame junctor switch hold magnet, the trunk link frame junctor switch, and trunk switch hold magnets are operated immediately after the completion of the hold magnet timing interval. After these hold magnets have operated, a false cross and ground test on the tip and ring conductors is made, followed by operation of the LL frame hold magnet.

12.03 During heavy traffic conditions, the false cross and ground test is eliminated. Therefore, in this case, all of the hold magnets, including the LL line switch hold magnet, are operated after completion of the hold magnet timing interval.

12.04 To decrease the time required for hold magnet operation and marker machine time, the hold magnets may be operated by the use of a momentarily applied dual voltage of 178 volts (130 + 48) instead of 48 volts. Thus when a hold magnet is operated, the marker momentarily applies a voltage of +130 volts to the hold magnet winding. Since the other end of the hold magnet winding connects to -48 volts, this gives a total operating voltage of 178 volts, which operates the hold magnet in about one-third the time required for 48-volt operation.

12.05 Certain trouble conditions, such as an open sleeve test lead, could cause the marker to select a channel, all or part of which is actually busy. To prevent falsely connecting into busy links a second linkage test is made during the hold magnet timing interval and before the hold magnets are operated.

12.06 The LLT relay tests over the LB- leads for a ground on the line link sleeve. The JGCK relay checks for battery on the junctor sleeve through the LL junctor hold magnet. The TGCK relay checks for battery on the trunk link sleeve through the TL junctor and trunk switches.

12.07 After the crossbar switches are operated, tests are made to check the closure of the sleeve crosspoints and then an overall check is made to ensure that the connection holds when control is shifted from the marker to the trunk.

HOLD MAGNET TIMING AND CONTROL - FS47

12.08 After the selection of a channel the marker delays the operation of the hold magnets. Sufficient time is allowed for the select magnets to fully operate and for the full release of any previously operated hold magnet.

12.09 The HMT relay provides a time delay in the progress of the marker to allow time for hold magnets and select fingers to release from a previous connection. The release time of a hold magnet is determined by the time required to release the armature and crosspoints; while the release time of the select finger is determined by the time required for the select finger vibration to stop after it is released from the trap. False operation of cross points would occur if the hold magnet were reoperated before the select finger vibration had stopped.

DUAL VOLTAGE OR MESSAGE REGISTER OPERATION - FS9, 47

12.10 Dual voltage operation of line hold magnets equipped for message register service may cause false operation of the register. Accordingly, the marker must operate all line hold magnets used with lines that are equipped with message registers, using only 48 volts.

12.11 Lines equipped with message registers are indicated to the marker over the class of service leads from the LL. The class of service indication is received over the CS00-29 leads, which in turn are cross-connected to operate relay CNA, coin line auxiliary, MRA message register auxiliary, AOA, all other auxiliary, or CGS, centrex station. The operation of the CNA, AOA, or CGS relays operates the DVO relay, which in turn operates the DVA relay indicating that the marker should use dual voltage to operate the line hold magnet. The operation of the MRA indicates 48-volts operation for the line hold magnet.

12.12 With DVA or MRA operated and the HMT operated, ground is closed to operate the HMT1 relay.

HOLD MAGNET START - FS47

12.13 The operation of the HMS1 relay closes circuits for operating the LL and TL hold magnets and the line hold magnet of the channel. The operation of HMS1 depends upon the operation of several relays as follows:

(a) Operation of HMT1 relay, which indicates the completion of the hold magnet timing interval (HMT operated), and determination of dual voltage (DVA operated) or message register (MRA operated) operation.

(b) A secondary check is made for a busy line link in the selected channel. Relay LLT operates under this condition, and causes operation of LLTA relay. The LLTA must be normal for HMS1 relay operation.

(c) A secondary check is made for a busy junctor. The high-resistance JGCK relay operates from the junctor hold magnet battery indicating continuity and the absence of ground on the junctor. Relay JGCK operated is required for operation of HMS1 relay.

(d) A secondary check is made for a busy trunk link by operation of TGCK relay similar to JGCK operation as above.

(e) Relay SLRK operated, which performs a standing check that certain relays remain normal until after TK relay has operated, and checks that TK has operated.

12.14 With the HMT1, JGCK, TGCK, and SLRK relays operated, and other check relays released, the HMS1 relay operates to start hold magnet operation.

CHARGING OF CAPACITORS ON DUAL VOLTAGE OPERATION - FS47

12.15 One side of the LH, JH, and TH- capacitors are connected to ground through the LXP relay, JXP relay, and TXP lamp, respectively. When relay CHA1 operates, the +130 volts battery charges the capacitor to +130 volts. The operation of the HMT1 relay opens these charging circuits. While the capacitors are charging, the LH, JH, and TH diodes do not conduct current.

HOLD MAGNET OPERATION - FS46, 47

12.16 The operation of the HMS1 closes the operate circuit over the LH, LLJ, and TLH leads to the LL and TL hold magnets of the selected channel. Relay HMS1 operated extends the +130 volts on the capacitor to the winding of the hold magnet. The capacitor discharges through the hold magnet, causing it to operate. When the voltage across the capacitor drops to about -0.5 volts the diode becomes conducting and passes a steady current to hold the hold magnet operated.

12.17 The TL trunk and junctor hold magnets and the LL junctor hold magnet are always operated on a dual voltage basis.

LIGHT TRAFFIC AND HEAVY TRAFFIC OPERATION - FS47, FS147

12.18 The sequence for operating the hold magnets and the number of tests made by the marker depends on whether the HTR relay is operated or released.

12.19 On heavy traffic, all hold magnets start operating at the same time. The false cross and ground (FCG) and continuity tests (CON) are canceled.

12.20 On light traffic, the TL junctor and trunk hold magnets, and the LL junctor hold magnets are operated first. The FCG test is made and then the line hold magnet is operated, followed by the CON.

12.21 At the end of each call, the HTR relay operates and, with the marker idle, holds operated for approximately one second as controlled by the operation of the HTT timer.

12.22 If the HTR is still operated on re-seizure of the marker, the call is handled on an HTR, heavy traffic basis.

12.23 If the HTR is released on re-seizure of the marker, the call is handled on an LTR, light traffic basis.

13. LINE TESTS

SLEEVE CROSSPOINT CHECK - FS47

13.01 To check that all sleeve crosspoints have closed, the SLA, LLTA, JXP1, and LXP1 relays are operated as follows:

(a) When the trunk switch hold magnet operates, ground through the TXP, TXP1 lamps is extended through the operated TL switch sleeve lead crosspoints, and back to the marker over the AST or BST lead, thereby operating the SL relay. Relay SL operates SLA relay, thus indicating that the TL trunk switch crosspoints have closed.

(b) The current for holding the LL junctor switch hold magnet flows through the primary winding of the JXP relay, thereby operating this relay. The operation of the JXP operates the JXPA relay. When the TL junctor switch hold magnet operates, ground through the TXP- lamps is extended through the closed sleeve crosspoint over the J0-9 lead to the marker JXP relay. This ground applied to the windings of the JXP results in the release of this relay. The release of the JXP, with the JXPA operated, operates the JXP1 relay, thus indicating that the TL junctor switch crosspoints have closed.

(c) When the LL junctor switch hold magnet operates, this same ground from the TXP- lamps is extended over the junctor, through the operated LL junctor switch crosspoint and over the LB0-9 lead

to the marker, thereby operating the LLT relay. The operation of LLT relay checks that the line junctor switch crosspoints have closed, and operates the LLTA relay.

(d) The current for operating the LL line switch line hold magnet flows through the primary winding of the LXP relay thereby operating this relay. The operation of relay LXP operates the LXPA relay. When both the TL and LL junctor switch hold magnets operate, ground through the TXP lamp is extended to the line link sleeve. When the line switch line hold magnet operates, this ground is further extended through the operated crosspoint over the LH0-4 lead to the marker LXP relay. This potential applied to the LPX relay results in the release of this relay. The release of the LXP, with the LXPA operated, operates the LXPl relay, thus indicating that the LL switch crosspoints have operated.

13.02 The SLA, JXP1, and LXPl relays operated transfer the holding ground for all the hold magnets from the TXP- lamps, to the DCT relay winding ground. Relay DCT operates if no double connection condition exists (see 13.40 through 13.56).

13.03 These relays also open the operating path for the JXP and LXP relays, leaving the connection held only through the DCT relay winding.

13.04 On heavy traffic, HTR operated, the operation of the LXPl, LLTA, JXP1, and SLA relays cause operation of the GT1 relay. On light traffic, LTR operated, the FCG and then the CON, are made before the GT1 relay is operated.

FALSE CROSS-GROUND TEST - FS48

13.05 During light traffic conditions, at the completion of hold magnet timing, the marker operates all hold magnets except the line hold magnet, and momentarily applies the FCG relay to the tip and ring leads before completing the connection. The line hold magnet is operated following the successful completion of the FCG test.

13.06 The FCG is a sensitive double wound relay, with ground on one winding and battery on the other winding. The operation of the FCG indicates a false cross between the tip and ring conductors, a false ground on the ring conductor, or a false battery on the tip conductor.

13.07 The primary winding of the FCG relay is extended via the ART or BRT lead from the marker through the operated TL trunk switch and junctor switch hold magnet crosspoints; over the ring conductor of the junctor to the LL; through the operated LL junctor switch hold magnet crosspoints to the nonoperated LL line hold magnet crosspoints.

13.08 The secondary winding of the FCG relay is extended via the ATT or BTT lead from the marker through the TL and over the tip conductor of the LL to the nonoperated LL line hold magnet crosspoints in a similar manner as described above.

13.09 If there is a false ground on the ring conductor at any point from the nonoperated LL line hold magnet crosspoints to the primary winding of the FCG relay, the FCG is operated by current through the primary winding. If there is a false battery on the tip conductor at any point, the FCG is operated by current through the secondary winding. If there is a false cross between the tip and ring conductors at any point, the FCG relay is operated by current through the primary and secondary windings.

13.10 The FCG relay locks operated when the light traffic (LTR) relay operates. This prevents the ground line hold magnet (GLH) relay from operating, thus blocking the call and forcing a time out and a trouble record.

13.11 If the FCG relay is nonoperated, indicating that no trouble was encountered, the operation of the LTR relay operates the GLH. The GLH operates the GLH1 to operate the line hold magnet. During the time the GLH1 relay is operating, the tip and ring conductors are grounded to discharge any conductor capacity and thus prevent false operation of the continuity test.

CONTINUITY TEST - FS48, SC109

13.12 The continuity test is made to check that the T and R crosspoints of the channels are closed; it does not require an off-hook condition to complete a satisfactory test.

13.13 The continuity test is made only on light traffic operation.

13.14 The operation of GLH1 and the channel hold magnets extends the tip and ring conductors of the line via the channel to the marker and initiates the continuity test. Ringing voltage of 20 hertz is applied to the primary of the CON2 repeating coil, which, by its transformer action, steps up the voltage. This voltage from the secondary is applied to a series circuit consisting of the CON2 capacitor, the channel crosspoints, and the line.

13.15 Before the line switch crosspoints are closed by the operation of the line hold magnet, the series circuit is open, therefore, no current flows in the repeating coil secondary circuit and the voltage drop across the CON2 capacitor is zero. The operation of the line switch crosspoints completes the path for the CON2 repeating coil secondary, therefore, alternating current flows from its secondary circuit through the CON2 capacitor, and through the channel crosspoints and the lines.

13.16 The current flowing through the CON2 capacitor, repeating coil secondary, channel crosspoints, and line causes the voltage of the secondary to be divided across the CON2 capacitor and the line; the amount of voltage across each is determined by the impedance of each. The impedance of the line is relatively low, compared to the impedance of the CON2 capacitor; therefore, the greater portion of the voltage from the CON2 repeating coil secondary appears across capacitor CON2. This voltage across the CON2 capacitor is sufficient to break down the control gap of the CON tube, which is connected across capacitor CON2. The breakdown of the control gap results in the main gap conducting, and the CON relay then operates in series with the main gap of the CON tube.

13.17 The continuity test will detect open T or R leads within the office, but it may or may not detect opens external to the office. If there is an open condition at any of the crosspoints or in any of the cabling within the office in the continuity check path, the 20-hertz ringing current will be very low, being controlled by the capacity and leakage of the switches and cables. Therefore, the voltage drop across the CON2 capacitor would be less than the voltage required to cause the breakdown of the control anode gap of the CON tube. Thus, the CON relay would not operate.

13.18 When the receiver is off the switchhook, the continuity test current is extended through the operated switchhook contacts from either the ring conductor to the tip conductor or from the tip conductor to the ring conductor according to the condition of the reverse continuity test (RCTA) relay. However, if the receiver is on the switchhook, the continuity test current flows through the ringing capacitor in the telephone set.

A. Operation of the CON Tube, CON and CONA Relays - FS48

13.19 The CON relay, in operating, indicates that a successful continuity test has been performed. The winding of the CON relay is in series with the anode of the CON tube. When the CON tube conducts, the CON relay operates. The CON relay operate path is from +130 volts through the CON8 resistor, via the CON tube anode (terminal 2) to the CON tube cathode (terminal 4), to ground. The CON tube conducts when the voltage on the control anode (terminal 1) exceeds approximately +72 volts. Relay CON operated causes the operation of CONA relay, and in turn CON1 relay which initiates the ground test by operating GT1 relay.

B. Operation of the RCTA and RCTB Relays - FS48

13.20 The continuity test on the line is made by the marker when it establishes the connection. The RCTA relay operated or released directs the marker to the side of the line that is to be tested first. Continuity test is arranged to be made over the ring side of the line, with the marker supplying the return ground on the tip side when the RCTA relay is nonoperated. The RCTA relay is operated for either originating or incoming calls to a tip party line or when a call is originated from a multiparty line and the continuity test is not satisfied. The marker is not informed which side of the line to test when a call is originated from a multiparty line and, therefore, the marker tests on the ring side first. This arrangement generally gives successful continuity test because the originating customer has the receiver off the switchhook.

13.21 On any FLG linkage the setting of the ringing combination informs the marker on which side of the line the station ringer

is located. Relay RCTA operates when the RCT7, 9, 11-15 relay (tip party ringing combination) operates.

13.22 On a call-back linkage, the RCTB relay operates from ground through the HTR relay contacts normal, and prevents the RCTA relay operation for ring party stations. On continuity test of a multiparty line, the ring side of the line is tested first. If continuity test is satisfied, the operation of the CON1 relay locks the RCTB relay operated. If continuity test is not satisfied the RCTB relay releases when the LXP1 operates, and causes the RCTA relay to operate. The operated RCTA removes the continuity test from the ring and applies it to the tip conductor.

C. Cancel Continuity Test - FS48

13.23 The continuity test may be canceled by operating the cancel continuity test key on the master test frame jack, lamp, and key circuit. The operation of this key operates the CON1 relay when the GLH1 operates, which cancels continuity test.

GROUND TEST - FS47, 48

13.24 The GT relay is provided to indicate the success or failure of the ground, loop, or receiver-off-hook test. The line is tested on the basis of holding the GT relay operated if the test is not satisfactory. If the test is satisfactory, the GT is released, permitting the marker to proceed.

13.25 The tertiary winding of the GT relay is energized by the operation of the LLC3, which biases the GT to the nonoperated position. The operation of the GTK with the GT2 nonoperated, extends ground to the primary winding of the GT relay. The current flow through the primary winding is sufficient to overcome the biasing effect of the tertiary winding and GT operates.

13.26 When ground test is being made, the primary winding of the GT relay is extended to the tip and ring conductors over the ART or BRT and ATT or BTT leads, which are extended via the TL to the tip and ring of the selected connecting path. The operation of the GT2 relay removes the local operating ground from the primary winding of the GT relay. Therefore, the primary winding is connected only to the tip and ring of the called line. The GT relay holds operated if there is a false ground on the tip or ring of the line. A successful ground test is indicated by the release of the GT relay.

13.27 Ground test is made under these conditions:

- (a) The call is FLG.
- (b) The call is to a non-PBX line or to a nonground start coin line.
- (c) Light traffic conditions exist, LTR operated.

13.28 The test is made from the TL switch via the LL switch to the customers telephone set by the operation of the GTK and GT1 relays.

13.29 Under heavy traffic conditions the cancel ground test (CGT) relay is operated when the GTK relay operates. The operated CGT relay opens the operating path for the GT relay, thereby canceling ground test.

LOOP TEST - FS48

13.30 On calls to lines which terminate on a switchboard, a loop test is required to prevent the marker from setting the connection when a plug is in the jack at the switchboard. The LGT relay operated with the CNA nonoperated indicates that a loop test instead of a ground test should be made. Relay LGT also prevents the CGT relay from operating which ensures that the loop test is made for both light and heavy traffic and that the test is not canceled by the CGT key at the master test frame jack lamp and key circuit.

13.31 When ETS operation is not provided the LGT and PBXA relays are operated by the CKR relay, which is operated when the called number is associated with a hunting group. The operate path for the GTK relay is through the LGT, PBXA, and CKR relays operated.

13.32 When ETS is provided calls can be completed to lines in a hunt group with or without a loop test. When a loop test is required, the PBX relay in the MDC is operated by the processor. The PBX relay operated operates the CKR, LGT, and PBXA relays in the marker. On calls to a hunting line which does not require a loop test, the NPBX relay in the MDC is operated which operates the CKR relay in the marker. The LGT and PBXA relays are not operated and a ground test rather than a loop test is made. A one-up check of the PBX and NPBX relays in the MDC plus a check of the proper operation of the LGT, PBXA, and CKR relays is provided in the operate path of the GTK relay.

13.33 When loop test is being made, the primary winding of the GT relay is extended to the tip over the ATT or BTT lead, which is extended via the TL to the tip conductor of the channel. Ground is extended over the ART or BRT lead to the ring through the operated PBXA and LGT relays. The operation of the GT2 relay removes the local operating ground from the primary winding of the GT relay. Therefore, the primary winding is connected only to the tip of the called line. The GT relay holds operated if there is a false ground on the tip, a false cross between the tip and ring, or if there is a plug in the jack at the PBX switchboard.

13.34 When the loop test is made to a line link pulsing line circuit, relay reverse loop test (RLT) operates to reverse the polarity of the test. This prevents a false loop test failure due to the ring trip feature in the line circuit.

RECEIVER OFF-HOOK TEST - FS48

13.35 The LGT and the CNA relays operated, indicate that the called line is a ground start coin line, and that a receiver-off-hook test instead of a ground test should be made. The GTK relay operates through the operated LGT relay and the non-operated AOA relay. This test is made under both light and heavy traffic conditions.

13.36 When receiver off-hook test is being made, the primary winding of the GT relay is extended to the tip over the ATT or BTT lead, which is extended via the TL to the tip of the channel. Ground is extended through the PBXA relay nonoperated, the LGT operated, and the winding of the PU relay over the ART or BRT lead to the ring conductor. The operation of the GT2 relay removes the local operating ground from the primary winding of the GT relay, therefore, the primary winding is connected only to the tip of the called line. Relay GT is held operated if there is a false ground on the tip or a receiver off-hook.

PLUGGED-UP LINE - FS48

13.37 After the continuity test has been completed and the CON1 relay operated, the plug-up (PU) relay is connected across the tip and ring of the channel. One side of the winding of the PU relay is extended

to the tip conductors, with the LGT relay nonoperated. The other side of the PU relay winding is extended to the ring conductor. When a plugging-up shoe is inserted at the heat coil mounting of the customers line at the MDF, the plugging-up circuit places battery on the ring and ground on the tip conductors thereby operating the PU relay.

13.38 The operation of the PU relay causes the marker to recycle, and complete the call to a trouble intercept operator.

GT RELAY RELEASE

13.39 Upon the successful release of GT relay from its use with the ground test, loop test, or receiver-off-hook test, the GTA relay operates to allow the marker to proceed.

DOUBLE CONNECTION TEST - FS47, 49

13.40 The double connection test (DCT) relay tests the sleeve conductor, associated with the selected channel, for false ground. If a double connection or cross exists between two sleeves, ground is connected from the busy sleeve to the sleeve under test.

13.41 The operation of the LXP1, JXP1, and SLA relays transfers the holding ground for the LL and TL hold magnets to the LH0-4 leads from the LL. This holding path is in series with the primary winding of the DCT. The hold magnet current thus passes through the DCT relay, if the sleeve is not falsely grounded.

13.42 The DCT relay has current flowing through its secondary biasing winding, to hold the relay nonoperated until the hold magnet holding current passes through its primary winding.

13.43 The current in the primary and secondary windings of the DCT relay is dependent upon its external circuit which essentially consists of four to seven hold magnets in parallel, as determined by office size. Series resistance is added into one winding or the other to maintain a balance so that under a double connection condition, the bias current in the secondary will keep the DCT relay unoperated. A double connection is a voltage divider circuit; the more hold magnets in the circuit, the more negative the potential on the LH- lead, and to compensate for this, resistance must be removed from the secondary or added to the

primary to satisfy nonoperate requirements. However, as more resistance is added into the primary to compensate for increases in the number of hold magnets, the capability of the circuit to keep these hold magnets operated under worst circuit conditions becomes severely limited. Seven hold magnets are the maximum number of hold magnets that can be assured of remaining operated with the present DCT circuit configuration.

13.44 An improvement is made to provide a trouble record on an open lead in the DCT primary winding. The addition of a diode in series with the DCT secondary winding prevents current surges produced by releasing hold magnets from operating the DCT relay.

13.45 Option ZPG provides the diode and wiring changes required for this improvement.

13.46 When an office is equipped with both the paired line link feature and the 12-level junctor feature, a condition could exist which will affect the DCT circuit. If the marker is establishing a connection between a line link frame which has no mate frame and a paired 12-level junctor trunk link frame, the DCT relay may not operate if the sleeve lead resistance is approaching its maximum limit. To compensate for the absence of the mate frame hold magnet, the DCT resistor will be cut in whenever the marker selects a paired 12-level junctor trunk link frame.

13.47 Option ZOV (rated Standard) provides the path for the DCT resistor when the marker is arranged for both 12-level and 10-level junctor operation, while option ZOW (rated Standard) provides the path when the marker is arranged for only 12-level operation.

13.48 When the DCT relay operates, it indicates that the double connection test is satisfactory, and that there are no false grounds on the sleeve lead.

13.49 The hold magnet of a message rate customers line is operated with -48 volt to prevent scoring the customer register, however, all other hold magnets of the channel are operated with dual voltage. This results in the SLA and JXPl relays being operated several milliseconds before the line hold crosspoints are closed. When the SLA and JXPl relays operate, the continuity transfer characteristics of contact 5 of these relays causes a momentary ground from

the DCT relay primary winding to be applied to the LXPl relay. The LXP relay will release, causing LXPl to operate. When LXPl operates, the holding path for the trunk and junctor hold magnets is removed. If the line hold crosspoints have not closed to hold the channel, the trunk and junctor hold magnets will release, causing an eventual DCT1 trouble card.

13.50 Option ZUG, rated Standard, adds a break contact of the MRA relay to the LXP circuit to prevent the ground pulse from shunting down the LXP relay on calls involving message rate lines. Option ZUF, rated Mfr Disc., is assigned to the original wiring.

13.51 The operation of the DCT operates the double connection test auxiliary (DCT1) relay; however, on calls associated with senders, it is necessary to operate the AV relay in the sender, and the AVK, AVK1 in the marker before the DCT1 relay is operated. Before the DCT1 or AV is operated, the ground test circuit is checked for proper operation.

13.52 The operation of the DCT1 relay on SOG or TER calls, releases the trunk F relay, which releases the FA-- or FB-- relay in the TL. The release of the FA-- or FB-- relay provides a 10-ohm holding ground in the trunk circuit, and causes the DCT relay to be shunted down. The marker checks that the DCT relay releases to indicate that the hold magnets are held operated by the trunk circuit.

13.53 The operation of the DCT1 relay on TOG calls, releases the incoming trunk F relay, which releases the incoming trunk TF relay. The frame hold magnets are then held operated by the holding ground in the incoming trunk. The marker then checks for the application of this holding ground and for the continuity of the crosspoints, which is indicated by the release of the DCT relay. When the DCT releases, the DCT3 operates and releases the outgoing trunk F relay. The release of the outgoing trunk F relay releases the TL FA-- or FB-- relay.

13.54 On TOG calls without a sender, operation of the DCT3 relay operates the LK1, linkage check, relay. On TOG calls with a sender, release of the TL FA-- or FB-- relay cuts the TM lead through to the sleeve. Ground on the sleeve lead operates the TMK relay which advances the sender by operating the sender AV relay.

13.55 The operating limits of the TMK relay are improved to prevent the failure of the TMK relay operation in the marker circuit. The reason for this failure was found to be caused by excessive cable resistance between incoming trunks or inter-marker group trunks, and the line link appearances used for tandem completions.

13.56 The operation of the TMK was corrected by splitting the TMK2 resistor into a series connection of two resistors, one of which may be shunted by a back contact on the DCT3 relay. The shunt is used to limit the resistance in the operate path of the TM relay in the trunk. When the shunt is removed the series combination of resistors ensures the operation of the TMK relay.

13.57 On ITR calls, the marker establishes two sets of linkages. The first linkage is the FLG linkage, which is the connection from the ITR trunk to the called line. The second linkage is the CB linkage, which is the connection from the ITR trunk to the calling line. In each case, the marker checks that the linkages are satisfactory. The hold magnets associated with the FLG linkage are held operated by ground extended to the TL over the BST lead by the DCT1 relay. The release of the DCT relay then indicates that the hold magnets are held operated. The LK1 and LK2 relays then operate to indicate that a satisfactory linkage check was made on the FLG linkage. At this point, the marker recycles and establishes the CB linkage. When the double connection test on the CB linkage is completed (DCT relay operated), the DCT2 operates. The operation of the DCT2 releases the ITR trunk F relay, which releases the TL FA-- and FB-- relays; the hold magnets are held operated by the trunk. The DCT relay releases to indicate that the linkage check is completed.

14. LINKAGE CHECK AND DISCONNECT

LINKAGE CHECK - FS49

14.01 The operation of the DCT1 relay indicates the successful completion of a number of checks and tests depending upon the type of call as follows:

- (a) Double connection test completed, DCT relay operated.
- (b) Relay RNG operated indicating NG release on TER and ITR calls.

(c) Relay RCK3 operated indicating ringing switch set of TER and ITR calls.

(d) Relay CLK operated indicating trunk class information sent to trunk on SOG calls.

(e) Relays GTK and GTA operated indicating completion of ground test, loop test, or receiver-off-hook test on any FLG linkage.

(f) Relays SK and OGC- operated indicate that sender is holding a sender link connection on a TOG call requiring a sender.

(g) Relays AVK and AVK1 operated on calls requiring a sender indicates that the sender is ready to test the trunk, and transmit; and that certain marker check relays have operated:

- (1) Sender connector released, RSC relay operated.
- (2) Holding ground for sender link, SLK2 relay operated.
- (3) Recorder number received with AMA, RNK relay operated.

14.02 The operation of DCT1 relay causes the release of the FA- and/or FB-relays in the TL which transfers the holding ground for the channel hold magnets to the 10-ohm ground in the trunk.

14.03 Relay DCT will release upon successful application of this ground and crosspoint continuity and cause the operation of the LK1 linkage check relay.

14.04 On ITR calls, the operation of LK1 relay initiates the call back operations. When the linkage check is made for the call back portion of the ITR call, the DCT2 relay operates to indicate a satisfactory linkage check, and when DCT relay releases, it directs the call to disconnect by operating the DIS1,2 relays.

14.05 On calls other than ITR, the LK1 relay operated causes the operation of the DIS1,2 relays.

MARKER DISCONNECT - FS50, 51, SC111, 123, 124

14.06 The marker may encounter numerous conditions that require disconnect,

and, consequently, the marker has various methods of disconnecting. The various types of disconnect are as follows:

- (a) DIS1,2, Normal Disconnect, SC111 - On normal disconnect, the DIS1,2 relays are operated, causing the marker to release. Operation of the DIS1,2 relays grounds the MRL lead through the connector to operate the MRL relay in the register, which opens the start lead to the marker connector. A second trial does not occur on this type of disconnect.
- (b) TRL, Trouble Release - On trouble release, the operation of the TRL causes the marker to release, and also operates the TRL relay in the IRMC or ORMC over the TRL lead. Operation of the connector TRL causes the connector to shift start leads, and seize a marker to make a second attempt to complete the call.
- (c) MRL1, Overall Time-Out Release - On overall time-out, the operation of the MRL operates the MRL1, which causes the marker to release, and also operates the BT and MRL in the originating register. The operation of the register relays removes the marker start signal, and prevents second trial.

A. Release After Trouble Record - SC123

14.07 There are many conditions where the marker detects trouble, and before disconnecting, operates the TRR or TRL to take a trouble record.

- (a) TRR, Trouble Record, Regular Release - Operation of the TRR causes the marker to take a trouble record. When the record is completed, the DIS1,2 relays are operated to give a normal marker release.
- (b) TRL, Trouble Record, Trouble Release - Operation of the TRL causes the marker to take a trouble record. When the record is completed the TRL, RAV1,2, or RBT, relays operate. A trouble release permits a second trial unless the RBT is operated. The RBT in operating causes the register BT or TRL relay to operate when the marker TRL operates.
- (c) TRL1, No Trouble Record, Trouble Release - Operation of the TRL1 on ground test failures causes the same action as the operation of the TRL except no trouble record is taken.

B. Type of Release on Time-Outs or Crosses

14.08 Time-outs or crosses may operate either the TRR or TRL relay. The relay operated is determined as follows:

- (a) If the marker usage is a second trial, TR2C operated, the TRL operates, which provides a trouble release to the register.
- (b) If the marker usage is first trial, and the originating register RL relay is not operated, the TRL is operated to permit a second trial. If the register RL relay is operated, as controlled by the marker CB, CHA, and TK relays, the TRR operates to provide a regular disconnect after a trouble record is made. Under this condition the register disconnects; a second trial is not made because the register RL relay was operated.

C. Linkage Release After a Trouble Record

14.09 Trouble records TRL, TRL1 taken because of time-outs, crosses, etc, require the release of the linkage through the frames as well as the release of the marker and associated circuits. For some cases, an early release of the TL FA-- or FB-- relay provides a holding ground to hold the linkage. In order to ensure that the linkage releases in these cases, the operation of the TRB1 relay causes the release of the HMS1, which in turn releases the frame hold magnets. The TRB2 operates the slow operate release delay (RDL) relay, which in turn operates the proper disconnect relays.

14.10 For some conditions such as permanent signal (PS), transfer start from the connector (TRS), or ground test failure (GT5), the marker takes a trouble record (TRR), but leaves the linkage established when it releases. Under these conditions the HMS1 is not released at the time the TRB and TRB1 relays operate.

14.11 The marker is arranged to prevent release of the forward linkage when a trouble record is requested on an intra-office test call. Previously the forward linkage ground on the BST lead from the marker to the trunk link connector was removed as soon as the record was completed, TRB2 relay operated. Contacts of the TRL and TRL1 relays are added to prevent removal of the ground unless a bonafide trouble is encountered. Option ZMT (rated Standard) provides these contacts.

15. ALTERNATIVE ACTIONS

15.01 The marker is arranged to complete calls on the basis that it can usually find idle trunks, lines, and channels, etc. However, there can be calls where desired idle equipment is not available, and the marker must use some alternative action in order to process the call.

15.02 The SC125 indicates the various items of information a marker must consider when an alternative action is required.

15.03 For example on a first failure to match, RF operated, the marker:

- (a) Sets the trunk to overflow on TER calls.
- (b) Causes a trunk number recycle on TOG calls.
- (c) On other types of calls the marker recycles with GP2 releases, or route advances with GP2 operated. Relay GP2 is operated when the trunk group allotter is advanced.
- (d) On TER and ITR calls to a PBX, causes a PBX recycle.

15.04 The information shown on SC125 summarizes the many actions that could occur. No attempt is made to show the various controls for operating the key relays, as the information is shown on the schematic. However, individual sequence charts show the marker operation for the various alternative actions.

MARKER RECYCLE - SC127

15.05 A marker recycles when the following conditions are encountered.

- (a) First failure to match with nonallotted trunks on SOG, ITR, or TOG calls.
- (b) PU, plugged-up line condition, when connecting to a called line.

15.06 A failure to match occurs when the marker is unable to find a channel between a line or trunk appearance on the LL and a trunk appearance on the TL. On recycles caused by failure to match, the marker makes a second attempt to complete the call by using trunks on another TL in the same route. The marker then tests the new group of channels to complete the call.

15.07 Operations that may occur on recycle are as follows:

- (a) Release sender and associated connectors.
- (b) Release LL and TL.
- (c) Release number group.
- (d) Release all frame select magnets.
- (e) Release all hold magnet and linkage control relays.
- (f) Release pattern and channel information.
- (g) Release TG-, TB-, and trunk.
- (h) Advance junctor sequence to provide new preference for junctors, trunks and senders.
- (i) Advance the trunk allotter if provided, by operating the AGP relay.

15.08 When the marker has reset to the point where it can start building up again, the selection normal check (SNK) relay releases and releases the RCY and RCY1 relays. With RCY and RCY1 released, the marker proceeds in setting the call up again using the same route information, but another TL trunk, and sender, if available. On TOG calls the NG preference is also shifted.

A. Recycle on PU, Line Plugged-Up

15.09 When the marker terminates a call to a plugged-up line, the PU operates, which causes the recycle relays to operate. Under this condition the marker must release all called line location relays and complete the call to trouble intercept TBI. The RCY and RCY1 relays are used for this purpose.

15.10 After the line location equipment has released, the TBI operates and operates the TBIB, which furnishes a new number for number group translation. The TBIB also releases the PU1, which releases the RCY, RCY1, and lets the marker complete to the TBI trunks, which appear on the LL.

ROUTE ADVANCE - SC125, SC128

15.11 As shown on SC125, there are many conditions that can result in route advance. In general, a route advance occurs if a marker cannot find an idle trunk, sender, or channel. When a route advance occurs, some of the more common marker actions are as follows:

- (a) Selects an alternate route in order to complete the call.
- (b) Selects a route to a trunk to return busy tone.
- (c) Sets the incoming trunk to return busy tone.
- (d) Sets the originating register to return busy tone.

15.12 The R-, route relays are divided into blocks with each block being wired to one of the GS- ground supply relays. Each GS- relay supplies ground to the contacts of the R- relays in the block. When the RAV1-2 relays operate they cause the operation of the one GS- relay that supplies ground to the operated R- relay. All of the relays that were previously operated by the operation of the R- relay now release. The GS- relay and the R- relay do not release. The GS- relay holds open the grounds to the contacts of all of the R- relays in the block. The RAV1-2 relays lock operated to the SNK relay. The SNK relay will release and release the RAV1-2 when the marker has been reset and is ready to operate another R- relay or take such action as determined by the cross-connection to the RA- terminal of the R- relay. The block of R- relays that are connected into GS6 can only be used for routes that do not have an alternate.

15.13 The marker provides six ground supplies. Depending on the office involved, the route relays are assigned to the ground supplies to provide the required direct and alternative routing.

15.14 Ground supplies one through four are used for direct and alternate routes. Ground supply five is used for tone trunks. Ground supply six is used for common overflow trunks.

A. Assignment of Routes to Ground Supplies

15.15 When assigning the various routes to route relays, the following must be observed, with one exception for 4-wire networks as described below in (f).

- (a) For route relays in ground supplies one through four an advance can be made to any other ground supply.
- (b) A ground supply can only be used once on any call; that is, the marker cannot route advance to a ground supply, if the associated GS- relays are operated.

(c) Routes in ground supply five can be direct routes but, in general, are alternate routes for those in ground supplies one through four.

(d) Routes in ground supply six are usually alternate routes for those in ground supply five.

(e) Route advance out of ground supply six results in setting the originating register to return busy tone.

(f) The route advance points for ground supply six may be enabled to allow 4-wire offices to provide announcement routes for TOG calls in ground supply six. This allows ground supplies one through five to be used for direct and alternate TOG routes. A route advance out of ground supply six results in setting reorder in the trunk.

B. Circuit Operation for Route Advance - SC128

15.16 The relay operation for route advance is shown on SC128. The operation of the RAV1,2 results in the operation of the RDL, RYC, GS-, and the release of off-normal control relays such as the LLC1-3, TLC1,2, CKG4, ONX, and HMS1.

15.17 The above relay action results in:

- (a) Release of trunk and TL.
- (b) Release of LL.
- (c) Release of sender and OSC.
- (d) Release of TL and LL select and hold magnet controls.
- (e) Releases all route relay information in the ground supply of the operated GS- relay except the route advance information.
- (f) Releases all linkage check and selection check relays.
- (g) Advances the junctor sequence relays.

15.18 When the marker has released to the point where functions associated with the new route can start, the SNK relay releases and permits the RAV1,2 relays to release.

15.19 The release of the RAV1,2 relays:

- (a) Releases the RYC and RDL.

- (b) Permits the ONX, TLC1,2, LLC1,2,3, and CKG4 control relays to reoperate.
- (c) Releases the RA- relay, which causes the new R- route relay to operate.

PBX RECYCLE - SC120

15.20 PBX Recycle occurs on a terminating or intraoffice call to a PBX line when the completing marker finds that the selected line has become busy while testing at the line link frame or when a first failure to match occurs with option TY provided. The marker, on the same usage, will then attempt to select another line with reversed order hunting within the tens block or blocks. If no line is found available a busy will be returned. If a second failure to match occurs an overflow will be returned.

15.21 The above sequence of events will occur on first trial calls. If the call is a second trial, in the same or another marker, the same action will occur except that reversed order line hunting will prevail throughout the call.

15.22 A no SRK trouble card may be produced when the marker attempts to perform a PBX recycle on a call involving a 2-way LLP line circuit and an incoming trunk equipped with a TC relay. If the marker detects a glare condition in the LLP line circuit, a PBX recycle is initiated to select another line. If the glare condition occurs after the line idle test was made, the marker has already grounded the TC lead to the incoming trunk. Normally, this would not cause trouble since the TC lead is under control of the ringing switch and the marker can control the ringing switch on PBX recycles. However, when the TC lead terminates on a TC relay in the incoming trunk (trunks associated with 4-wire ringing switches and some phase II centrex trunks), this relay locks operated and returns a ground to hold the marker TCK relay operated, causing an SRK failure on a PBX recycle. This condition is eliminated by bypassing the TCK relay down check on LLP calls when a PBX recycle is encountered.

15.23 Option ZPO (rated A&M Only) provides the bypass around the TCK relay break-contact.

16. MARKER CROSS-DETECTION - SC123

16.01 Cross-detection relays are designated as X-- wherever they appear in the marker, and a complete list of these appears in SECTION III.

16.02 Two types of tests are made by the cross-detecting relays, namely, standing tests and operating tests. Standing tests are made to detect a false ground or battery on certain leads between the marker and other circuits. These tests are made while the marker is idle. Operating tests are made to detect false ground or battery on certain leads or to detect the operation of more than one relay in a group. These tests are made while the marker is in use, and may be made before, after, or at the time a particular operation is being performed.

16.03 The operation of a cross-detection relay or its auxiliary operates the master cross test relay (MXT').

16.04 Relay MXT operated operates the stop progress relay (SP), and causes a trouble record to be taken by operation of the TR1 or TRR relays for trouble release or normal release respectively. (See B37.)

16.05 Previously, certain crosses encountered on incoming calls (XSL, XLV, etc.) held the MXT relay operated and prevented the marker from setting the ringing selection switch to return overflow tone to the calling party. Thus the call was left high and dry. The circuit is changed to open the MXT circuit when the RS9 relay operates except when the cross involves ringing switch information (XRS-). RS9 operates following the MXT trouble record thus releasing MXT and allowing the marker to set the overflow level on the ringing selection switch. Option ZJF (rated Standard) provides this improvement.

17. MARKER TIMING

17.01 Along with the use of cross-detection relays, the marker is also arranged to detect trouble in itself or in associated circuits by the use of a variety of timing circuits. These timers guard marker operation as certain functions are performed. If a failure or excessive delay is encountered, the timer times out to cause the operation of major or minor alarms, and under certain conditions, cause a trouble record to be taken.

17.02 The marker provides various timing circuits that function as follows:

- (a) Cause the marker to release or take an alternative action if the required operations are not completed within a specified time.

(b) Provide a sufficient interval to store and check information transmitted to connecting circuits.

(c) Delay marker operation to permit various apparatus to stabilize.

A. Types of Timing Circuits

17.03 The timing circuits are of two general types: gas-tube timing circuits and capacitor-timed relay circuits. Tube timing circuits are usually used where the interval required is greater than 100 milliseconds. They consist of a gas tube, a relay, and some capacitors and resistors. Capacitor-timed relay circuits are usually used for times less than 100 milliseconds. They consist of a double wound polar relay and some capacitors and resistors.

B. Work Timer - B84 (Typical Tube Timer)

17.04 When a marker is seized, the released MAK, MCK, or MSK, check, relay operates relay TM, timing - marker off-normal, which operates relay TMS, timing start. Relay TMS places a ground on one side of capacitor WT and opens the path through resistor WT3 which was shunting it. The WT capacitor becomes charged from the positive +130 volts battery placed on the other side of it through resistor WT1. This causes the voltage on the control anode, terminal 1, of the WT tube to gradually increase through resistor WT2. If after 0.450 to 0.605 seconds the marker does not complete the particular function that is being timed, the control anode of the WT tube is increased to positive 72 volts, thereby causing the WT tube to conduct. When the tube conducts, it operates relay WT, work timer.

17.05 Release of the TMS relay causes the WT capacitor to discharge through the WT3 resistor.

C. Outgoing Sender Registration Timer, Relay - B57 (Typical Capacitor-Timed Relay)

17.06 With the OST1 released and the BG and OGC operated, the OST relay has ground connected to both sides of its secondary winding. Current through the primary winding holds the OST nonoperated. When the OST1 operates, current flows in the operate direction in the OST primary winding, generating a flux that tends to operate the OST. However, with the OST1 operated, sufficient flux is generated by the

OST capacitor charging current flowing through the secondary winding of the OST to hold it nonoperated. As the OST capacitor charges, this flux in the secondary decreases until the flux in the primary winding operates the OST.

17.07 When the OST1 releases, this action is reversed; the primary winding tends to release the OST, but the secondary winding keeps the OST operated until the OST capacitor has discharged.

D. Timers and Their Functions

Overall Timer - B83

17.08 The overall timer is started when the marker is seized and is stopped when the marker restores to normal. The timing interval, 9.6 to 15.4 seconds, is greater than the time required on any normal marker usage. This timer guards against the failure of any of the other timers.

17.09 Operation of the OAT timer operates the MRL relay and causes the marker to release without a trouble record, SC123. A major alarm is brought in and the frame TA lamp is lighted.

Work Timer - B84

17.10 The work timer is started when the marker is seized and is stopped when the marker restores to normal. The timing interval is 450 to 605 milliseconds.

17.11 This short time is used to detect troubles as soon as possible in order to quickly release the marker.

17.12 Because many marker usages exceed the short time interval provided, this timer is recycled as the call progresses.

17.13 Operation of the WT timer causes the marker to take a trouble record before releasing, SC123.

Short Delay Timer and Long Delay Timer - B83

17.14 The SDT timer provides a delay of 2.6 to 4.25 seconds on service calls and 1.1 to 1.9 seconds on NTT calls. The LDT timer provides a delay of 4.6 to 7.5 seconds.

17.15 Both timers are started by the operation of the SF and SFT relays. They operate when a timing interval longer than that provided by the WT timer is required. The operation of the SF stops the WT timer.

17.16 The SDT timer always functions first unless the trouble recorder is busy, as indicated by the RON relay operated; under this condition the longer time provided by LDT is required.

17.17 The SF and SFT relays operate when the marker closes a start lead to select a frame such as the LL, TL, NG, OSC, or foreign area translator. They release when the frame is seized. The SF and SFT relays also operate on various test calls, and when the completion of sender TG test is checked by the marker.

17.18 The longer time intervals are required because the desired frame may be occupied by another marker and delays may be encountered before this frame is idle.

17.19 If the SDT or LDT timers operate the marker action is as shown on SC123.

Heavy Traffic Timer - B84

17.20 The sequence for operating the LL and TL hold magnets differs for light and heavy traffic.

17.21 On heavy traffic, all hold magnets are operated at the same time and the FCG and CON tests are canceled. Ground test is also canceled unless LGT is required.

17.22 On light traffic, the line hold magnet is not operated until after the other hold magnets operate and the FCG test is made. The line hold magnet is then operated and a continuity test is made, followed by a ground test on forward linkages.

17.23 The sequence of hold magnet operation is determined by whether the HTR is operated or released. When the marker releases, the HTR locks operated, and the HTT timer starts when the OAT and OAT1 relays release. If the marker is idle for 960 to 1600 milliseconds, the HTT timer operates and releases the HTR, causing the next call to be handled on a light traffic basis.

17.24 If another call comes in before the HTT operates, the OAT relay discharges the HTT capacitor and the HTR remains operated causing the marker to handle the call on a heavy traffic basis.

Trouble Recorder Trouble Release Timer - B83, SC123

17.25 When the marker requires a trouble record the TRT relay operates. The operation of the TRT starts the TRTR timer. If the trouble record is not completed within 2 to 3.25 seconds, the TRTR timer functions and causes the marker to disconnect from the trouble recorder and release.

Trunk Busy Test Timer - B40, SC125

17.26 The trunk busy test timer starts when the marker begins testing the trunk group for an idle trunk. If the marker does not detect a TL with an idle trunk within 27.5 to 30.5 milliseconds on service calls or 79.5 to 95.5 milliseconds on test calls, relay TBT operates to indicate an all trunks busy condition.

17.27 Option JC provides the standard wiring for the trunk busy test timer. This timer is started by seizure of the trunk link frame and operation of relay TBK. If a trunk is not selected, relay TBT operates to indicate all trunks busy with relay TA normal or an open BT- or TG- lead if relay TA is operated. With relay TA operated, a trouble record is requested on first trials, and a route advance is generated on second trials.

Channel Test Timer - B31, SC109

17.28 The CHT relay is operated by the TK relay, which indicates that the marker has progressed to the point of selecting a channel. The CHT provides a delay of 7 to 10 milliseconds to permit all the CHT0-9 relays to operate and stabilize before the marker selects a channel.

Hold Magnet Timer - B34

17.29 Since a hold magnet may have just released prior to a channel being selected, the marker must provide time for the hold magnet to fully release and the select finger vibration to stop before re-operating the hold magnet.

17.30 The HMT timer provides the required delay as follows:

<u>Crossbar Switches</u>	<u>Delay in Milliseconds</u>	
	<u>CB or SCB</u>	<u>FLG</u>
With damping cones	43-50	26-32
Without damping cones	63-75	42-48

Sender and Trunk Information Timers; CLT, OST, RNT - B29, B57, B58

17.31 After the marker selects a sender or trunk, information is usually transmitted by the marker to control pulsing, trunk supervision, and charging.

17.32 The marker provides three timers (CLT, OST, and RNT) for transmitting and checking the required information. The timers all function as follows:

(a) When the marker is ready to transmit information, ground is placed on the desired transmitting leads, and the slow operate relays start timing. The timers provide sufficient time to permit the operation of the sender or trunk relays.

(b) When the timers operate, they cause ground to be removed from the transmitting leads; the marker check relay holds operated to the locking ground of the operated sender or trunk relay.

(c) The timers start to release when the transmitting grounds in the markers are removed. The release time of the timing relays provides sufficient time for the check relays in the marker to release, if locking grounds are not present.

17.33 The timing intervals provided are as follows:

<u>Timer</u>	<u>Interval in Milliseconds</u>	
	<u>Opr</u>	<u>Release</u>
CLT	50-55	19-25
OST & RNT (All WS Senders)	8-10	16-21
(Any Non-WS Senders)	30-35	17-23

Number Group Translation Timer - B63, SC122

17.34 The TYM timer starts timing when the marker seizes the number group. If a full translation is not received the TYM operates in 67 to 83 milliseconds and causes one of the BN, RI, or TBI intercept relays to operate.

PBX Allotter Timer - B72

17.35 The TYM1 provides controls similar to the TYM when a PBX allotter is involved. A delay of 65 to 80 milliseconds is provided.

18. TRAFFIC REGISTER OPERATION

18.01 The marker is provided with a means of operating traffic registers. These registers supply information such as the traffic load carried by certain central office equipment and the load offered by certain types of traffic. The following tables list the various registers which are operated under control of the marker.

Traffic Registers

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
ASB0-11	One per sender group per Marker Group	* Marker finds all senders busy in a sender group.
ATT	One per marker group	Transfer calls from centrex attendants
BNA	One per marker group	**Marker encounters a blank number condition. (Non-AIS)
DCI	One per marker group	**Marker encounters a denied code intercept condition.
DR-	One per DR- per marker group	**Number of calls to diverted routes.
FAD (Mfr Disc.)	One per marker group	* DDD call originated by dial pulse dialing.
FAM (Mfr Disc.)	One per marker group	* DDD call originated by TOUCH-TONE dialing.

* Will score on test calls.

** Not scored for FULL-ETS operation.

Traffic Registers (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
FM	One per marker group	Marker encounters a second failure to match on originating or through switched call (except when call originates from paired line link frame).
FMPR	One per marker group (See 18.07 through 18.10)	Marker encounters a second failure to match on an originating or through switched call from a paired line link frame.
IB	One per marker	Incoming call, marker encounters a busy line (except when line is assigned to a paired line link frame).
IBP	One per marker (See 18.07 through 18.10)	Incoming call, marker encounters a busy line which is assigned to a paired line link frame.
IFFM	One per marker group	Incoming call, marker encounters a failure to match to an individual line or first failure to match to a PBX line (except when line is assigned to a paired line link frame).
IFFMP	One per marker group (See 18.07 through 18.10)	Incoming call, marker encounters a failure to match to an individual line assigned to a paired line link frame or first failure to match to a PBX line assigned to a paired line link frame.
IFM	One per marker group (See 18.19 and 18.20)	Incoming call, marker encounters a failure to match to an individual line or a second failure to match to a PBX line (except when line is assigned to a paired line link frame).
IFMPR	One per marker group (See 18.07 through 18.10)	Incoming call, marker encounters a failure to match to an individual line assigned to a paired line link frame or a second failure to match to a PBX line assigned to a paired line link frame.
IH	One per marker	Total incoming calls to PBX lines (except when line is assigned to a paired line link frame).
IHP	One per marker	Total incoming calls to PBX lines assigned to paired line link frames.
INC (Mfr Disc.)	One per trunk link per marker group	Counts all calls using associated trunk link frame which terminate in the office.
IPC-	One per IPC per marker	**All calls offered to route associate with IPC relay.
ITB	One per marker	* Marker encounters all intercept trunks **busy (AIS with LLP).
LCB	One per line link per marker group	Total number of originating and through switched calls which the marker establishes from associated line link frame.

* Will score on test calls.

** Not scored for FULL-ETS operation.

Traffic Registers (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
LLP	One per marker (See 18.14 through 18.16)	Total number of line link pulsing calls completed by marker.
LOF-	Ten per marker group option GP, one per LR relay per marker group (option GO)	**Marker determines that all line circuits of associated LLP route are busy.
LPC-	Ten per marker group (option GP), one per LR relay per marker group (option GO)	**Total calls offered to associated LLP route.
LTD (Mfr Disc.)	One per marker	* Local call originated by dial pulse dialing.
LTM (Mfr Disc.)	One per marker	* Local call originated by TOUCH-TONE dialing.
MFL	One per marker group	* Marker encounters mate frame lockout (paired line link operation).
OAB-	One per AGC circuit per marker group	**Total number of originating calls which the marker sets to overflow as directed by the associated AGC circuit.
OF-	One per route per marker group (See 18.02)	**Marker encounters all trunks of associated route busy (does not score if trunks are associated with first selected route of an allotted group).
OF	One per line link per marker group	Marker encounters failure to match while connected to associated line link frame.
OF	One per trunk link per marker group	Marker encounters failure to match while connected to associated trunk link frame.
OOF	As provided in number group	**Marker scores an OF- register associated with a particular customer whenever the marker encounters the customers line-busy or, for PBX customers, all PBX lines-busy.
OGR-	One per AGC circuit per marker group	**Total originating call completions by customer associated with AGC circuit.
OSG-	One per OSG per marker group (A&M Only), one per OSG per marker (Standard)	Total calls established using associated sender group.
OST-	One per AGC circuit per marker group	* Total originating call attempts by customer associated with AGC circuit.
OVF-	One per PBX allotter group per marker group	**Marker encounters all lines busy in associated allotter group.
PC-	One per route per marker group	**Total number of calls offered to associated route.
PCL (Mfr Disc.)	One per marker-group	* Total number of test calls using a line line frame.

* Will score on test calls.

**Not scored for FULL-ETS operation.

Traffic Registers (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
PCM (Mfr Disc.)	One per marker group	* Total number of test calls.
PCSC	One per marker (See 18.03 through 18.06)	* Marker establishes a channel for either channel 0 or 5 (except where a paired line link frame is involved).
PCT	One per marker	Total number of 2-wire forward linkage connections established by marker in combined 2W-4W office.
PCT-	One per PCT relay per marker group	**Total calls completed from sources associated with PCT relay.
PCV-	One per CV relay per marker group	**Code conversion calls.
PDD (Mfr Disc.)	One per marker group	* Partial dial call originated by dial pulse dialing.
PDM (Mfr Disc.)	One per marker group	* Partial dial call originated by TOUCH-TONE dialing.
PL	One per line link per horizontal group	Marker finds that the number of busy line links in a horizontal group exceeds a predetermined value.
PLSC	One per marker	**Pulse conversion calls.
POP (Special)	One per marker group	* Partial dial calls originated with special overseas person to person prefix.
POS (Special)	One per marker group	* Partial dial calls originated with special overseas station to station prefix.
PRT-	One per RT20-39 relay per marker group	**Total calls transferred to another route by associated route transfer relay.
PTCO	One per marker (See 18.07 through 18.10)	Paired line link total office overflow - counts all calls which are originated by customers on paired line link frames and routed to overflow.
PTOG	One per marker (See 18.07 through 18.10)	Paired line link total through switched - counts completed through switched calls where trunk is assigned to a paired line link frame.
RIA	One per marker group	**Marker encounters regular intercept condition (Non-AIS).
RIP	One per marker group	**Marker encounters centrex intercept which requires routing to a common centrex announcement.
RMP	One per RMP terminal per marker group	* Intended for counting originating WADS traffic (cross-connection Note 438) may be used for 4-wire polygrid routing.
S-	One per originating class of service (maximum of 10) per marker	**Total calls originated by customers with associated class of service.

* Will score on test calls.

**Not scored for FULL-ETS operation.

Traffic Registers (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
SCPR	One per marker group (Mfr Disc.) one per marker (Standard) (See 18.07 through 18.10)	* Marker establishes a channel for either channel 0 or 5 on a paired line link frame.
TAB-	One per AGC circuit per marker group	**Total number of terminating calls which the marker sets to overflow as directed by the associated AGC circuit.
TBI	One per marker group	**Marker encounters a trouble intercept condition (non-AIS).
TCB (Mfr Disc.)	One per trunk link per marker group	Total number of originating and through switched calls which the marker estab- lishes to associated trunk link frame.
TCH	One per marker (See 18.03 through 18.06)	* Total channel - counts the number of the marker establishes a linkage (except on calls where a paired line link frame is involved).
TCHPR	One per marker (See 18.03 through 18.10)	* Paired line link total channel - counts the number of times the marker establishes a linkage where a paired line link frame is involved.
TCO	One per marker (See 18.14 through 18.16)	**Total office overflow - counts all orig- inating calls which are routed to over- flow.
TDTF	One per marker group	Total dial transfer calls - counts all completed dial transfer calls originated by centrex customers.
TER (Mfr Disc.)	One per line link per marker group	Counts all forward linkage connections to associated line link frame.
TGR-	One per AGC circuit per marker group	**Total terminating call completions to customer associated with AGC circuit.
TGT-	One per AGC circuit per marker group	* Total terminating call attempts to cus- **tomer associated with AGC circuit.
TIP	One per marker	Total incoming - counts all incoming calls which terminate in the office (except where a paired line link frame is in- volved).
TIPR	One per marker (See 18.07 through 18.10)	Paired line link total incoming - counts all incoming calls which terminate to paired line link frames.
TLDN	One per marker group	Total listed directory number calls - counts all completed calls to centrex listed directory numbers.
TMOR	One per marker (See 18.11 through 18.13, and 18.21 through 18.23.)	Total originating (TOUCH-TONE) - counts all calls originated by TOUCH-TONE dial- ing when marker establishes channel be- tween a trunk and a calling line.

* Will score on test calls.

**Not scored for FULL-ETS operation.

Traffic Registers (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
TOG	One per marker	Total through switched - counts all completed through switched calls (except where a paired line link frame is involved).
TOPR	One per marker (See 18.07 through 18.10, and 18.21 through 18.23)	Paired line link total originating - counts all originating calls when marker establishes a channel between a trunk and a calling line which is assigned to a paired line link frame.
TOR	One per marker (See 18.11 through 18.13, and 18.21 through 18.23)	Total originating (dial pulse) - counts all calls originated by dial pulse dialing when marker establishes channel between a trunk and a calling line.
TPC	One per marker	* Total peg count - counts all marker seizures.
TTRF	One per marker group	Total transfer - counts all calls transferred to attendants by centrex customers.
VCI	One per marker group	**Marker encounters vacant code intercept.

Additional Traffic Registers
for Measuring
4-Wire Network Traffic

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
FM (4W)	One per marker group	Marker encounters a second failure to match on originating or through switched call.
IB (4W)	One per marker	Incoming call, marker encounters a busy line.
IFFM (4W)	One per marker group	Incoming call, marker encounters a failure to match to an individual line or first failure to match to a PBX line.
IFM (4W)	One per marker group	Incoming call, marker encounters a failure to match to an individual line or second failure to match to a PBX line.
IH (4W)	One per marker	Total incoming calls to PBX lines.
OFF	One per marker group	Marker encounters overflow condition on preempt cycle call (replaces OP00-143 peg counts).
OP- (A&M Only)	One per RM relay per marker group	Marker encounters overflow condition on preempt cycle call using associated RM-relay (replaced by OFF peg count).

* Will score on test calls.

**Not scored for FULL-ETS operation.

Additional Traffic Registers
for Measuring
4-Wire Network Traffic (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
OR- (A&M Only)	One per RM relay per marker group	Marker encounters overflow condition on routine (nonpreempt cycle) or immediate preempt cycle call using associated RM-relay (replaced by OTR peg count).
OTR	One per marker group	Marker encounters overflow condition on routine (nonpreempt cycle) or immediate preempt cycle call (replaces OR00-143 peg counts).
P- (A&M Only)	One per RM relay per marker group	Total attempted preempt cycle calls using associated RM relay (replaced by PCP peg count).
PCP	One per marker group	Total attempted preempt cycle calls (replaces P00-143 peg counts).
PCSC (4W)	One per marker (See 18.03 through 18.06)	* Marker establishes a channel for either channel 0 or 5.
PCT (4W)	One per marker	**Total number of forward linkage connections established by marker.
PLI	One per marker group	Marker encounters a priority line-busy and routes the call to a special announcement.
PTR	One per RM relay per marker group	Total attempted routine (nonpreempt cycle) or immediate preempt cycle SOG calls attempted using associated RM-relay (replaces S00-143 peg counts).
S- (A&M Only)	One per RM relay per marker group	Total attempted routine (nonpreempt cycle) or immediate preempt cycle SOG calls using associated RM relay (replaced by PTR-peg counts).
T- (A&M Only)	One per RM relay per marker group	Total attempted routine (nonpreempt cycle) or immediate preempt cycle TOG calls using associated RM-relay.
TCH (4W)	One per marker (See 18.03 through 18.06)	* Total channel - counts the number of times the marker establishes a channel.
TCO (4W)	One per marker	**Total office overflow - counts all originating calls which are routed to overflow.
TIP (4W)	One per marker	Total incoming - counts all incoming calls which terminate in the office.
TMOR (4W)	One per marker (See 18.21 through 18.23)	Total originating (TOUCH-TONE) - counts all calls originated by TOUCH-TONE dialing when marker establishes channel between a trunk and a calling line.

* Will score on test calls.

**Not scored for FULL-ETS operation.

Additional Traffic Registers
for Measuring
4-Wire Network Traffic (Cont)

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
TOR (4W)	One per marker (See 18.21 through 18.23)	Total originating (dial pulse) - counts all calls originated by dial pulse dialing when marker establishes channel between a trunk and a calling line.
TOG (4W)	One per marker	Total through switched - counts all completed through switched calls.

Additional Traffic Registers
for Measuring
Wideband/Bit-Stream Network Traffic

<u>Lead Desig</u>	<u>Peg Leads To Traffic Register Circuit</u>	<u>Conditions For Operating Traffic Registers</u>
BPCS	One per marker	* Marker establishes a bit-stream linkage using either channel 0 or 5.
BTCH	One per marker	* Total channel (bit-stream) - counts the number of bit-stream linkages established by marker.
BTOG	One per marker	Total through switched (bit-stream) - counts the number of through switched bit-stream linkages established by marker.
RLA	One per remote switch signal control circuit per marker group	* Remote link attempts - counts all marker attempts to complete a wideband call between the central office and a remote switch unit.
RLOV	One per remote switch signal control circuit per marker group.	* Marker encounters an all remote links busy condition.
WIFF	One per marker group	Incoming wideband call, marker encounters failure to match to an individual line or first failure to match to a PBX line.
WIFM	One per marker group	Incoming wideband call, marker encounters failure to match to an individual line or second failure to match to a PBX line.
WPCS	One per marker	* Marker establishes a wideband linkage using either channel 0 or 5.
WPCT	One per marker	Total number of wideband forward linkage connections established by marker.
WTCH	One per marker	* Total channel (wideband) - counts the number of wideband linkages established by marker.
WTOG	One per marker	Total through switched (wideband) - counts the number of wideband through switched linkages established by marker.
WTOR	One per marker	Total originating (wideband) - counts all originating wideband calls when the marker establishes a channel between a trunk and a calling line.

* Will score on test calls.

Additional Centrex Traffic Registers Associated
With Traffic Register Translator Circuit**
(See 18.18)

All Leads Provided One Per Marker Group
Per Customer Group (Maximum 10 Customer Groups)

<u>Lead Desig</u>	<u>Conditions For Operating Traffic Registers</u>
ADTF-	Marker establishes attendant originated dial transfer call.
DTF-	Marker establishes station originated dial transfer call.
INCG-	Marker establishes incoming call (terminating or nonintercom intraoffice) to station within the customer group.
ITCG-	Marker establishes intercom call to station within the customer group.
LDN-	Marker establishes incoming call (terminating or nonintercom intraoffice) to customers listed directory number.
ORCG-	Marker establishes originating call from line within customer group.
TRF-	Marker establishes station originated transfer call to the customers attendant.
WAT-	Marker establishes wideband call to customers attendant.
WIN-	Marker establishes incoming wideband call (terminating or non-intercom intraoffice) to station within the customer group.
WOR-	Marker establishes originating wideband from line within customer group.
ZA-	Marker establishes 0 operator call from a station to the customers attendant.

**Not scored for FULL-ETS operation.

A. Addition For ROTL

18.02 Leads RR and RRA are added (one each per route) and leads OF- are rerouted to the remote office test line trunk make-busy circuit to provide route information, under option ZQS.

B. Channel Peg Counts Delayed

18.03 The TCH (total channel) and PCSC (sample channel) peg counts are delayed until after the marker has established a cross-office linkage. This will prevent possible unwanted counts on these registers if the marker selects a channel before it determines that the line is busy and the selected channel will not be used.

18.04 Option ZRH (rated Standard) provides make-contacts of the JXPA relay in the TCH and PCSC traffic register leads.

18.05 A change is made to prevent scoring the total channel TCH and sample channel PCSC traffic registers when the marker is establishing a dial tone connection with the originating line identifier.

18.06 Option ZUV, rated Standard, provides break-contacts of the OLI relay to open these peg count leads while the marker is connected to the originating line identifier circuit. Options ZUU and ZUW, rated Standard, provide wiring necessary when the OLI is not provided.

C. Paired Line Link Peg Counts

18.07 Option ZXS is added to ensure operation of the TIPR traffic register in offices with some, but not all, line link frames paired. The option also prevents false registrations of the FM and IFM peg counts in offices with some, but not all, line link frames paired.

18.08 Option ZXD is added to provide the sample channel paired frame (SCPR) lead to the traffic register circuit on a per marker basis instead of on a marker group basis, option ZXC (rated Mfr Disc.).

18.09 On Issue 45D, the paired line link notes were changed to show that the wiring for the paired traffic register leads would always be provided with the paired line link feature. To go along with these changes, new wiring options are added to allow strapping the paired register leads to their nonpaired counterparts at the marker terminal strip. Thus, for those offices with all their line link frames paired, both the paired and the nonpaired leads will be grounded. This will allow the traffic register circuit to remain unchanged, that is, only one set of registers need be provided in the traffic register cabinet when all frames are paired.

18.10 Options ZRI and ZRF (rated Standard) provide these straps. These options will appear as part of Issue 45D.

D. DP and MF One-Up Check

18.11 In markers equipped with option IN, either the DP or the MF relay must be operated in order to score a total originating traffic register. A check circuit is provided to ensure that one of these relays is operated on each originating call.

18.12 When the originating register seizes the marker, the SCK operates along with a "type of dialing used" relay, DP or MF. Later in the call, when the marker has selected a channel, the total originating traffic register circuit is energized. At the same time, the new DP/MF check circuit is energized and if neither relay or both relays have operated, the EXA relay operates. With EXA operated, the marker will complete the call then produce a trouble record before disconnecting.

18.13 Option ZLU (rated Standard) provides this feature.

E. TCO Traffic Register Circuit Opened on Test Calls

18.14 The operate path for the TCO traffic register peg count is modified to prevent the register from scoring on test calls. the PBV make-contact is removed from ground and connected to a break-contact of the MT13 relay.

18.15 Option ZKG provides the wiring.

18.16 Option ZUC provides wiring to prevent false TCO peg counts on TOG calls to overflow.

F. Double Traffic and Plant Register Counts on Intraoffice LLP Calls

18.17 Option ZSH provides the intraoffice-forward linkage (IFLG) relay which is used to open the plant register OGO-11 and traffic register LLP on the forward linkage portion of an intraoffice call. This prevents scoring the registers on both the forward and call back linkages. In addition relay IFLG is used to control traffic registers OSG0-11 which allows options KH and KJ to be rated Mfr Disc.

G. False Peg Counts in Centrex Offices

18.18 Option ZCS, rated A&M Only, is added to prevent false peg counts in centrex offices when the traffic register translator is provided and the incoming trunks are assigned to vertical files common to centrex customers.

H. Delay of IFM Peg Count

18.19 The IFM peg count is delayed until relay OV operates and an LBTA break-contact is added to the FM relay operate path to prevent a possible IFM peg count when both a line-busy and a failure match is encountered in 10TLF size offices.

18.20 Option ZVD, rated Standard, provides an OV make-contact in the IFM peg count path an LBTA break-contact in the FM relay operate path. Option ZVC, rated Mfr Disc., is assigned to the previous wiring.

I. Originating Counts Modified

18.21 Option ZTI is added to provide a break-contact of the MT18 relay in the originating traffic peg count leads. This contact prevents the counting of originating traffic due to test calls. The peg count leads affected are TOPR, TOR(4W), TOR(2W), TMOR(4W), and TMOR.

18.22 The TOR and TOPR peg counts are staggered to ensure that both pegs are counted in offices with the traffic data processor. Relay PDL is added to the TOPR lead to provide approximately one-millisecond delay between the TOR and TOPR pegs.

18.23 Option ZTO, rated Standard, provides this relay while option ZTN, rated Standard, provides the original wiring.

19. PLANT REGISTER OPERATION

19.01 The marker is provided with a means of operating plant registers. These

registers supply central office performance information such as trouble encounters and equipment usage. The following table lists the various registers which are operated under control of the marker.

Plant Registers

<u>Lead Desig</u>	<u>Leads Furnished</u>	<u>Conditions For Operating Plant Registers</u>
AI	One per marker group (See 19.03)	Automatic Intercept sender group usage.
CW1F	One per marker group	Call-waiting call first trial failure - marker unable to obtain call-waiting line circuit information from call-waiting link (does not score on test calls).
CW2F	One per marker group	Call-waiting call second trial failure - (same as first trial failure).
CWP	One per marker group	Total call-waiting calls - marker successfully receives call-waiting line circuit information and proceeds to establish a channel to the line circuit (does not score on test calls).
DMST	One per marker group (MTF provided), one per marker (OTF provided)	Dial tone second trial failure - marker encounters trouble on a second trial dial tone call except for the following: (a) Continuity test failure (b) Test calls
DTPC	One per marker	Total dial tone - counts all marker attempts to establish a dial tone connection.
DTR	One per marker	Dial tone first trial failure - marker encounters trouble on a first trial dial tone call except for the following: (a) Continuity test failures (b) Test calls
EX	One per marker	Extra record - counts the number of times the marker encounters the selected condition set up to produce a special trouble record.
GRA	One per marker group	Glare detection (route advance) - marker encounters glare on an outgoing call using a 2-way trunk and route advances to an alternate route (does not score on test calls when option ZYB is provided).
GRO	One per marker group	Glare detection (reorder) - marker encounters glare on an outgoing call to a 2-way trunk and sets the sender to reorder (does not score on test calls when option ZYB is provided).
GTF	One per marker group	Ground test failure - marker encounters a ground test or loop test failure (does not score on test calls).

Plant Registers (Cont)

<u>Lead Desig</u>	<u>Lead Furnished</u>	<u>Conditions For Operating Plant Registers</u>
LRF	One per marker group	Link release failure - incoming register circuit indicates to the marker that a trouble was encountered with the incoming register link circuit (does not score on test calls).
MST	One per marker group (MTF provided), one per marker (OTF provided)	Marker second trial failure - marker encounters a trouble condition on second trial with the following exceptions: (a) Party mismatch (b) Permanent signal (c) Ground test or loop test failure (d) Continuity test failure (e) Test calls (f) Wideband calls
OG00-11	One per marker per sender group (See 18.14 through 18.16)	Outsender group usage - counts the number of calls the marker completes using the associated sender group (does not score on test calls).
RO	One per marker	Reorder request - counts the number of times the incoming register requests the marker to set an incoming call to reorder (with option ZVQ, does not score on test calls or second trial calls).
SS00-11	One per marker group per sender group	Stuck sender - marker encounters a trunk guard test failure from sender in associated sender group (does not score on test calls).
TLRF	One per marker group	Transfer register link release - marker receives link release indication from transfer register (does not score on test calls).
TPC	One per marker	Total peg count - total count of all marker seizures.
TR	One per marker	First trial failures - marker encounters a trouble condition on first trial with the following exceptions: (a) Party mismatch (b) Permanent signal (c) Ground test or loop test failure (d) Continuity test failure (e) Test calls (f) Wideband calls
WMST0-2	One per marker group per wideband class	Wideband marker second trial failure - marker encounters a trouble condition on second trial wideband call originating from associated wideband class except for the following audio linkage troubles:

Plant Registers (Cont)

<u>Lead Desig</u>	<u>Leads Furnished</u>	<u>Conditions For Operating Plant Registers</u>
		(a) Party mismatch (b) Ground test or loop test failure (c) Continuity test failure (d) Test calls.
WTPC0-2	One per marker per wideband class	Total wideband peg count - total count of all marker seizures for wideband calls originating from associated wideband class.
WTR0-2	One per marker per wideband class	Wideband marker first trial failures - marker encounters a trouble condition on first trial wideband call originating from associated wideband class except for the following audio linkage troubles: (a) Party mismatch (b) Ground test or loop test failure (c) Continuity test failure (d) Test calls.

A. Modification of TLR Plant Register

19.02 Option ZQX, which superseded option BA, is added to prevent scoring the TLR plant register on register time-outs other than link releases. If either the DTI or DTF relay is operated with the LRI relay, the TLR plant is not scored, register MTR (first trial or CMST (second trial) is scored instead.

B. AIS Sender Usage Plant Register Added

19.03 Option ZMV is added to provide an AIS sender usage plant register count when automatic intercept without using LLP is provided.

20. TRUNK SERVICE OBSERVING FOR DDD - FS39

20.01 The trunk service observing feature provides means for measuring the quality of service given to customers, the ability of customers to use the facilities properly, and the accuracy of billing as applied to outgoing traffic.

20.02 With this feature, an observer is able by means of lamp and tone signals to observe and time the various stages in the progress of a call and to match this information with the AMA record. The observer is also able to monitor a conversation and grade transmission, as well as see the called number displayed at the service observing desk. The observer is able to note when calls are not completed due to either distant office circuits or the called line being busy.

20.03 The marker is arranged to observe on:

- (a) Ten-digit DDD or 11 area calls, in which case a ground appears on the marker FAD lead from the service observing register connector.
- (b) Seven-digit calls having more than one message unit charge, and 10-digit DDD or 11 area calls, in which case a ground appears on the marker HFA lead from the service observing register connector.

20.04 If the marker receives a ground over the FAD lead while serving DDD calls, and if the FAC relay is operated, the TOBS, trunk observing relay operates. If the marker receives ground over the HFA lead while serving DDD calls, or 7-digit calls (ABX codes) having more than one message unit charge, and if the FAC or OR relay is operated, the TOBS relay operates. The TOBS relay, in operating, prepares the marker for trunk service observing.

20.05 The marker meanwhile has seized a trunk on a TL. If the trunk is not arranged for service observing the non-observe (NOB) relay operates. However, if the trunk is arranged for observing, and if the service observing desk is available, a ground is transmitted over the NH lead through the TL to operate the trunk observing TOB relay. The TOB transmits ground over the SOC lead to operate the service observing register connector relays. These relays transmit the called office code and number to the service observing circuit.

The service observing register connector relays in turn operate the observe (OBS) relay through the operated TOB relay. The operated OBS signals the sender that this call is being observed. This information is relayed to the AMA equipment where a service observing entry is made.

21. TEST CALLS

21.01 The marker completes test connections initiated at the master test frame, office test frame, automatic trunk test circuit, and automatic monitor as well as no-test, no-hunt, and special-hunt test calls.

21.02 The test connections that the marker completes, are the marker test connections, the register and sender test connections, the trunk test connections, the marker line verification tests, and the customer line tests.

21.03 The automatic monitor circuit provides means for automatically sampling service calls handled by registers and senders, and checks their performance. The circuit to be sampled by the monitor is selected at random.

21.04 No-test calls are originated at the local or central DSA switchboard, or at the test desk, no-hunt calls are originated at the message register rack or at the master test frame, and special hunt test calls are originated at the local or central test desk.

MASTER TEST FRAME TEST CONNECTIONS

21.05 The master test control circuit controls all of the testing functions of the master test frame. The functions of the master test frame tests with which the marker is associated are:

- (a) To test the marker and its connecting circuits.
- (b) To control the connections required by the automatic monitor, register, and sender test circuit.
- (c) To control the connections required by the trunk test circuit.
- (d) To verify line cross-connections in the number group.
- (e) To control the connections required for customer line tests.

21.06 The detailed description of the master test control circuit is contained in CD-25800-01.

21.07 In making master test frame tests, the marker is primed with information set up on keys of the master test control circuit. The test equipment is closed through on leads corresponding to those of the circuit which the test circuit is simulating.

21.08 The marker receives information through the IRMC or ORMC on service calls. Accordingly, test calls must furnish similar information to the marker.

21.09 The marker functions in accordance with the information with which it is primed, makes required translations, connects to LL, TL, number groups, registers, and senders as required and also sets up connections as required for the test.

21.10 When the marker is used on a master test frame test connection, the marker relays are operated in a manner similar to the operation under service conditions, except that the master test control circuit may simulate certain of the circuits to which the marker would normally connect under service conditions.

21.11 Since test calls in many cases require the marker to select a specific circuit within a group, such as trunks, sender, channels, lines, etc; special MT-, marker test, relays are provided. Operation of the MT- relays allows specific marker actions and permits specific selections using the additional information furnished by the master test control circuit.

21.12 The marker test relays provided and their general purpose are as follows:

- | | |
|------|---|
| MT | Operates on all test calls - Controls operation of other test relays. |
| MT1 | Opens circuits in marker to provide test control and blocking points. |
| MT2 | Operates only when a particular sender is to be selected. |
| MT3 | Operates on all test calls for testing of traffic sample features. |
| MT4 | Operates only when a particular TL is to be selected - Battery is supplied by test circuit on lead corresponding to frame to be selected - When MT9 is also operated, FS0-19 relays do not operate. |
| MT14 | |
| MT24 | |
| MT5, | Operates instead of TSE1 and TSE2 relays only when a particular trunk is to be selected. Test frame supplies battery on lead corresponding to trunk to be selected. |
| MT6 | |

- MT7 Operates only when a particular channel is to be selected. Test frame supplies ground on lead corresponding to channel to be selected.
- MT8 Operates only when marker is to be reset to select a particular junctor walking position.
- MT9 Operates along with MT4 and MT14 when a particular TL is to be selected without first testing for busy on outgoing, IAO (intraoffice or inter-marker group class of trunk test), etc, calls. Test frame gives frame number on FG- and TF- leads. Relay MT9 operated causes marker to select TL in same manner as it does on TER calls.
- MT10 Operates only when marker is directed to connect to a particular PBX trunk. Test frame supplies ground on lead corresponding to units digit of number.
- MT11 Operates on all test calls. Opens CGA and CGB leads. Opens class of service and line hold magnet leads to give test frame control of these leads.
- MT12 Operates only on marker test calls and certain trunk tests where marker is required to operate TT relay in trunk. Also applies operate test to GT relay. Prevents AMA relay of sender from operating on AMA calls.
- MT13 Prevents alarms and operation of traffic and plant registers on test calls.
- MT15 Operates only on tests concerned with trunk service observing. Opens HFA and FAD leads to service observing register connector to give test frame control in operating TOBS relay.
- MT16 Operates on marker test calls for use in testing no test features. Provided only in special markers.
- MT17 Opens and transfers leads for test access. Assures that senders used on AMA tests receive a TVT instead of an SC signal.
- MT18 Operates on all master test frame test calls to disable peg count.
- MT19, Operates only for line verification
MT20 test calls verifying PBX sleeve
MT cross-connections. Provided only in special markers.
- MT21 Operates for line link pulsing line circuit tests.
- MT22 Operates for no-test selection of line link pulsing circuits.
- MT25, Operates on trunk transmission tests
MT26 when associated with a trunk test register, or when intertoll trunks are tested using a 10X code. The TT0-9 and ETS- and OTS- leads are connected to the trunk test register to select the trunk; MT25 with MT26 signals the outgoing sender to delete the ABC and DEF codes, and to provide no arbitrary digit information; MT25 without MT26 changes the delete code to the 3-digit ABC code.
- MT27 Operates on paired line link feature tests in order to allow seizure of the mate LL from the master test control circuit, and also allows the operation of the PRL relay to set up the necessary marker circuit conditions for the test.
- MT28 Operates only when a particular status level is to be selected. Ground is supplied by the test frame on a lead corresponding to status level to be selected.
- MT29 Operates on all test calls for testing of the following features: automatic intercept, traffic sample, immediate ring, range extensions and dedicated message timing trunks.
- MT30 Operates only when testing storage
MT31 of priority levels in trunks and
MT32 lines. Allows the test frame in conjunction with the marker to verify proper storage of all priority levels in trunk and line circuits.
- MT33 Operates on all test calls. Used when the test frame is attempting to set a call to a previously made busy preemptible line.
- MT34 Operates along with MT33 to determine if a preemptible line circuit is made busy for maintenance purposes or is service busy.
- MT35 Operates on all test calls to control relays used for testing preemption features.
- MT36 To provide testing of direct access to 101 ESS features.
- MT37 To provide testing of marker access group controller features.

- MT38 Operates when particular access group controller circuit is to be tested.
- MT39 To provide testing of precedence level to trunk.
- MT40 To provide testing of preemption features.
- MT41 To provide testing of immediate ring feature.
- MT42 To provide testing of traffic sample feature.
- MT43 To provide testing of wideband features.
- MT44 Operates for wideband line maintenance busy control.
- MT45- To provide testing of wideband features.
49
- MT50 To provide testing of wideband remote link.
- MT51 To provide testing of wideband features.
- MT52, To provide testing of wideband continuity test features.
53
- MT54 To provide testing of wideband features.
- MT55 To provide testing of call-waiting control feature.
- MT56 Provides testing of block select feature in allotted hunting groups.
- MT57 To cancel AMA signal to sender on test calls.

OFFICE TEST FRAME TESTS

21.13 The office test frame, in conjunction with the office test frame trouble indicator, is a substitute for the master test control and connector circuits for use in small No. 5 crossbar offices. The test operations that may be performed are similar to those of the master test frame, although not as extensive. The office test frame is capable of selecting and testing a particular register, sender, marker, or trunk as required.

21.14 Marker test relays that may be operated from the office test frame circuit are the MT5, MT6, MT7, MT8, MT10, MT19, and MT20 relays. These relays perform as described in 21.05 through 21.12.

21.15 The office test frame trouble indicator provides a visual lamp display when a trouble is indicated from any of the associated circuits under test, or when trouble occurs under normal operation. When used with a marker, the trouble indicator provides a detailed record of the circuits involved, the called number, class information, calling line location, trunk location, output to sender, junctor subgroup, and a variety of signals indicating checks and call progress.

21.16 Option 20X permits the office test frame call blocking key to be effective on SOG test calls.

RINGER TEST CALL - SC130

21.17 Ringer test trunks are provided for maintenance employees use to test for proper ringing when installing or testing station equipment.

21.18 In order to reach the ringer test trunks, the maintenance employee dials a special code followed by the numerical digits of the station. After receiving a signal that a ringer test trunk has been selected, the maintenance employee hangs up and ringing starts. In order to disconnect, the maintenance employee lifts the receiver momentarily.

A. Ringer Test Codes

21.19 A ringer test code can be any 1-, 2-, or 3-digit code that does not conflict with local office or foreign area codes. If the marker group serves several office codes, one of the following methods must be used.

- (a) Provide a different ringer test code for each of the NSS0-5 relays used in service.
- (b) Screen the ringer test code point when the S- relays are arranged to indicate office distinctions. The output of the S- relays controls the selection of the proper NSS- relay.

B. Ringer Test Trunks

21.20 Ringer test trunks can be provided as a common group for coin and noncoin lines, or as separate trunk groups, one for coin and one for noncoin.

21.21 If the office is arranged for loop start coin lines, a common trunk group can be used, because the originating register is arranged to return the coin.

21.22 If the office is arranged for ground start coin lines (10 cent coin), coin class information must be transmitted to the trunk, if a common trunk group is provided.

21.23 Because separate trunk groups may be provided for various types of lines, and since a common trunk group requires class signals indicating the type of line, S- screening relays are required to control the operation of a route series relay.

21.24 The various arrangements for connecting route and route series information for ringer test trunks is shown in Notes 410 and 408.

C. Progress of a Ringer Test Call - SC102, SC130

21.25 The code point for ringer test calls is cross-connected to the primary winding of one of the LPA, LTA, etc, local completion relays. One relay may be used with one of the six possible local office codes that can be handled by a marker group. The operating path for the local completion relay is in series with the high-resistance RGT relay. Under this condition, the local completion relays will not operate, but RGT will operate, lock, and connect the primary winding of the local completion relays to the RGT punching.

21.26 As shown in Note 410, the RFT punching is cross-connected to battery on the RB punching if ground start coin lines are involved, or to an SC punching if loop start coin lines are provided. When the register must return the coin, the S- points are cross-connected to operate the RR relays as an indication for the register to return the coin. If the coin has been returned, or if the line is noncoin, the battery is furnished through the winding of the NCNC relay. The local completion relay operates from this low resistance battery.

21.27 After the operation of the RGT and local completion relays, the marker proceeds to seize the number group and obtain a translation which is recorded on the FTT-, FUT-, VGT-, HGT-, and VFT- relays. The information is then matched against the FT-, FU-, VG-, HG-, and VF- relays that indicate

the calling line location. If the match is successful, the RV1,2 relays operate and operate the RV relay.

21.28 If the match is not completed, the TYM operates and operates the TYMA relay. Operation of the TYMA causes operation of the RBT, which releases the marker after setting the originating register to return busy tone.

21.29 When the RV operates, it causes the R-, route, relay for ringer test trunks to operate and it also releases the number group. The release of the number group permits all number group information to release except the ringing information recorded on the RCT- relays, which are held by the operated RGTA relays.

21.30 The cross-connection of the route relay OS- punching to the NSO punching causes the marker to handle the call as an SOG call without a sender.

21.31 Ringing information to the trunk is transmitted and checked by the operation of the RV3 via the CL- punching associated with the route relay.

NO-TEST CALLS

21.32 A no-test call must be completed by one of the special marker 0 or 1. The trunks provide an SPL marker signal to the IR by way of the IRL, which causes the IRMC to select marker 0 or 1 in the marker group.

21.33 A no-test call is made by an operator or test desk employee to establish a connection to a busy line. A no-test call is made by a DSA switchboard operator for verification of a line-busy condition. The test desk employee sets up a no-test call to establish a connection to an individual or party line or to gain access to a line in a PBX hunting group, when such a line is to be tested. If the called line tests busy, the marker completes the call through the no-test connector and no-test vertical on the LL.

A. Setting Up the Connection

21.34 After the incoming register is attached and ready to receive pulses, the numerical digits of the called line are dialed or keyed. If the marker group serves more than one office unit, a directing digit must be dialed before the numerical

digits. In no case is the office code dialed. After receiving the necessary information, the incoming register calls for a special marker by making all regular markers appear busy in the IRMC during marker selection. The marker is informed that this is a special call by the operation of the SPL and SPL1 relays. It then cancels the ground and continuity tests normally made on the called line. These line tests are canceled to prevent a trouble record card from being produced in the event of trouble on the line.

21.35 The operated SPL1 relay opens the operate path for the PBX1 and PBX2 relays to cancel terminal hunting to ensure reaching the particular line. This number may be for an intermediate line of a terminal hunting group.

B. Preference Control - FS112

21.36 The master test frame marker lockout circuit permits one marker at a time to set up a special call. The operation of the marker SPL1 relay on a special call, operates a special call preference SP- relay in the master test frame connector circuit. The operated SP- relay extends ground over the SPC lead to the marker to operate the SPC relay. Another special marker attempting to set up a connection at this time is locked out and operates its seize frame timing (SFT) relay.

21.37 On a special call, TL seizure is not attempted until the SFR relay in the marker has operated. This checks that the marker has preference through the master test frame circuit in setting up a special call.

21.38 The trunk indicates to the marker, through the TL, the type of special call by grounding the NT lead, which operates the marker NT, no-test relay.

C. No-Test Call With Called Line Busy - FS112

21.39 The called line busy condition indicates to the marker that a connection exists between the called line on the LL and a trunk on the TL. With a called line busy condition, the marker is unable to establish a connection between the no-test trunk and the called line through the linkages on the TL and LL. A no-test connector located on the relay rack frame, provides means for connecting the no-test trunk to

the called line under such conditions. The no-test connector is a circuit which includes a crossbar switch having its horizontal terminations connected to the no-test trunks and its vertical terminations connected to the no-test verticals of the LL frames. By operating the proper no-test connector select and hold magnets and the proper LL line switch select and hold magnets used with the no-test verticals, a direct connection is made between the no-test trunk and the line link to which the busy line is connected.

D. Connection of No-Test Trunk to the Called Line Through the No-Test Connector - FS112

21.40 When the marker determines that the called line is busy, the operation of the LBTA relay operates the no-test train (NTT) relay. This initiates the operations required for connecting the no-test trunk to the called line through the no-test connector circuit.

21.41 Upon seizure of a special marker, the SPL relay operates the no-test and number check timing relay (NTC). The monitor for no-test relay (MNL) also operates if the office is equipped for message register operation. Although these relays are operated on all special calls they are only used when the marker completes a no-test call via the no-test connector.

21.42 The slow-release NTC relay must have sufficient time to become fully saturated to make its long release time effective. A shunted secondary winding on the NTC relay provides slow release characteristics. This relay is used on special calls to time the seizure of a channel from the time a low positive potential is applied to the line links until the channel is selected. Upon failure to detect a channel or if the CH- relay fails to operate, the NTC relay releases to operate relay BY and set the call to busy tone.

21.43 To provide a number of control circuits for the no-test call the NT relay operates the no test hold magnet (NTH) relay. The NTH tests for an idle junctor between the LL and the no-test connector. If the required no-test junctor is busy, the NTH relay extends the no-test connector H- hold magnet operate ground over the NT lead to operate the junctor busy JB relay. The JB operates the OV and overflow tone is returned by the trunk.

21.44 The break contacts of the OV and BY relays in the operate path of the LNT relay will prevent a condition whereby the SRK relay might remain operated and prevent the ringing selection switches from being reset for overflow or busy tone.

21.45 The no-test release relay (NTR) operates under direct control of the NTH. The NTR relay operates the NT5 with the NTT relay operated.

21.46 The NT1 through NT5 relays operate to control the circuit operations necessary when the call is to be completed via the no-test connector. When the CHT relay operates, after channel test is made, the NTT relay closes the path for operating the NT1 relay, which in turn operates the NT2 relay.

E. Identification of the Line Link

21.47 In order to make a connection between the no-test vertical and the line, it is necessary to identify the line link connected to the busy line. A positive potential of approximately 10 volts is applied to the sleeve conductor of the channel in use with the called line. The marker examines the sleeve conductors of the ten possible line links to which the called line could be connected. The line link connected to the called line is thus identified since it is marked with this 10-volt potential.

21.48 The sleeve conductors of the five lines within the selected line group are extended from the LL to the marker over the LH- leads. The NT3 and NT4 relays cause a positive 10-volt potential to appear on the one busy sleeve of the called line. This low positive voltage is obtained by the voltage divider effect of the NT1 and NT2 resistors.

21.49 Test leads designated LL- are extended to the marker from the group of ten line links, within which the line link connected to the called line is located. In the marker circuit the LF0-9 relays test for the presence of the +10 volts on the LL- leads. One LF0-9 relay is operated. The operation of a LF0-9 relay operates a CH0-9 relay and the CHA, CHA1 relays.

F. No Test With Message Register Operation - FS112

21.50 Message registers may be provided in an office for use in recording the number of calls completed in a one message unit area for purposes of charging.

21.51 A message register is associated with a particular sleeve lead. It operates in series with a cold-cathode tube when the tube is fired from a 60-cycle half-wave potential on the sleeve lead. On SOG or ITR calls, this charging potential is controlled by the trunk, and is applied to the sleeve for an interval of about 33 milliseconds when the called customer answers.

21.52 In offices equipped for message register operation, it is necessary to provide the PT0-9 and PTL tubes and the MPT relay. This apparatus is used to check that message register charging potential is not on the line links before the LF0-9 relays are connected. This is necessary to ensure that the message register charging potential is not shunted by the low-resistance operate path of the LF0-9 relays. The NT1 relay extends the LL- leads from the line links to the PT0-9 tubes in the marker. If a message register potential is applied to any of the line links to which these leads are connected, before the NT3 relay operates, the associated PT0-9 tube conducts. The MPT relay is operated in series with the PT0-9 tube and releases the NT2.

21.53 The primary function of the PTL tube is to ensure that the potential applied to the line link by the voltage divider network does not cause the operation of the called line message register. The PTL tube conducts when a high potential appears at the output of the divider network. The PTL tube also conducts in parallel with the PT0-9 tube if a message register potential is applied to the particular line link connected to the called line. The MPT relay operates in series with the PTL tube.

21.54 The MPT relay opens the operating circuit for the NT2 relay which releases, and opens the path from the voltage divider to the LH- lead. This prevents the marker from advancing to the point where the positive 10-volt potential is applied to the sleeve. When the message register potential is removed, the PT- tube no longer conducts and the MPT relay releases, re-operating the NT2 relay. The NT3 and NT4 relays then operate and cause the low positive potential to be applied to the busy sleeve via the LH- lead.

21.55 One M-, monitor for no-test, relay is provided for each pair of consecutively numbered LF- relays. If a message register operate potential is applied to any of the sleeves at the time a +10 volts is applied to the line link over the LH- lead, the monitor M- relay operates. The

line link sleeves are connected to ground through the primary windings of the LF- and M- relays. The operated M- relay releases the NT1 and locks through its secondary winding in series with the winding of the MN, which also operates. The released NT1 relay releases relays NT2, NT3, and NT4, and removes the shunting effect of the LF0-9 relays from the 10-sleeve conductors. If this shunt is not removed, the message register potential is reduced below that required for message register operation. Relay MN releases relay MN1, which releases relays M- and MN. The MN1 relay reoperates and operates relay NT1, which connects the sleeve conductors through to the PT- tubes. If the message register potential is still present on the sleeve, the associated PT-tube conducts. If no message register voltage is present the marker proceeds to identify the line link.

G. Connection to Busy Line - FS112

21.56 The marker operates the F relay in the no-test trunk via the marker connector and incoming register link. The F1 relay in the no-test trunk operates and extends a ground over the JC lead to operate the S- select magnet in the no-test connector.

21.57 The operation of the CH0-9 relay operates the line link frame L- and LJ- select magnets. The CH0-9 relay also operates the CHA, which releases the slow release NTH relay. Ground is then extended over the NT lead from the marker to operate the H- hold magnet in the no-test connector circuit. After operating, the H- hold magnet extends ground over the H lead to the LL line switch to operate the no-test vertical NT hold magnets.

21.58 The H- and NT hold magnets and the L- select magnet extend the busy line sleeve holding ground over the S lead to the no-test trunk to operate relay H. Relay H provides a holding ground over the H lead for the H- and NT hold magnets. After the marker releases, the no-test connection is maintained until either the operator or test deskman disconnects, or the busy condition on the called line is removed.

21.59 When the particular channel is selected and the NTH relay releases, it starts the release of the slow release NTR relay. The release of the NTR allows sufficient time for the operation of the hold magnets in the no-test connector and LL, and the H relay in the trunk, before the LK1 relay is operated. The LK1 causes the release of the off-normal relays and operates the DIS1 and DIS2 relays to dismiss the marker.

NO HUNT AND SPECIAL HUNT CALLS

21.60 No hunt and special hunt calls also use the special markers 0 and 1. Marker seizure and preference control is as described in 21.34 through 21.38. In this case the trunk will indicate to the marker the type of special call by grounding the NH, no-hunt lead or the NN, special hunt lead.

21.61 A no-hunt call is made by the central office maintenance force at either the master test frame or the message register frame. The call made from the master test frame is for routine testing of the line and to verify a line test failure revealed by a trouble record card. The no-hunt call made from the message register frame verifies line message register operation.

21.62 If the called line is busy, a busy tone is supplied by the no-hunt trunk and the marker does not set up the connection.

21.63 Voltmeter and other tests on a line are made on special-hunt or nonno-test calls from the test desk. The call is similar to a TER call except the CON and GT tests are canceled. The operated SPH relay closes through the operate path for the PBX1 and PBX2 relays to permit terminal hunting. A connection may be established to a called line in a terminal hunting group if the line is idle. If the called line is busy, the marker selects the next preferred idle line within the terminal hunting group. If an individual line or all lines within a hunting group are busy, the marker starts the operations required to cause the trunk circuit to transmit a busy tone signal.

22. PULSE CONVERSION

22.01 Pulse conversion calls originate from operator positions where only MF keysets are provided and it is necessary to complete calls to an office that uses dial or reverte pulsing. The No. 5 office is arranged to complete such calls by registering the MF pulses in a register and transmitting the information forward as dial or reverte pulses using a sender.

22.02 The pulse conversion trunk from the operator to the desired office has an appearance on the No. 5 office TL frame, where it is provided with trunk equipment for seizing an MF register and establishing connections to a sender. A linkage through the LL and TL is not required, but the TL is used to obtain the trunk class information and connect a sender to the pulse conversion trunk.

REGISTER SEIZURE

22.03 When the operator plugs into the pulse conversion trunk at the switchboard, it causes the trunk equipment to seize an MF incoming register through an incoming register link. The TL number associated with the trunk is recorded by the FG1 and TF2 relays. Also the type of sender ³₅ is recorded by the PCR, pulse conversion revertive, or PDC0,1, pulse conversion dial, sender group 0 or 1 relays.

22.04 When the operator completes MF pulsing, the ST, start signal, causes the register to transmit information to the marker as shown on SC101.

22.05 The information required by the marker from the register for handling a pulse conversion call is as follows:

- (a) The digits of the called number.
- (b) The type of sender required PCR, PCD0, or PCD1.
- (c) The TL number associated with the trunk.

MARKER TRANSLATION AND ROUTE RELAY OPERATION - SC102

22.06 Each of the PCR, PCD0, and PCD1 relays have punchings with corresponding designations that are treated as code points. The code points are cross-connected to RC-punchings to operate a route relay. Digit translation is not required. All contacts on the route relay are not used on pulse conversion calls.

22.07 The operation of the route relay grounds the following punchings as outlined in the cross-connection information:

- (a) OSC - Indicates the outsender group that should be used.
- (b) DL - Delete information to out sender.
- (c) CR - Compensating resistance for revertive senders.
- (d) RA - Causes marker to class advance to TER, with ROA operated, and set trunk to reorder, if all senders are busy.
- (e) TB - Operates RA- relay and bypasses NTB trunk block selection.

CLASS OF CALL - SC103

22.08 With PCR, PCD0 or PCD1, and SON, sender off-normal, relays operated, the marker operates the PCL1,2 class relays to indicate a pulse conversion call.

22.09 The PCL1,2 relays enables the various marker functions for this type of call.

DIGIT INFORMATION TO SENDER - FS71-75

22.10 The outgoing sender is selected, and the information from the register is transmitted via the marker to the sender. Since the call is non-AMA, the message billing index, line location, etc, are not transmitted.

22.11 Conversion from MF pulsing to revertive pulsing requires shifting the digits when transferring the information to the revertive sender.

22.12 The MF register records and digits consecutively on the A, B, C, and D register units. With dial pulse senders, the information is registered on similarly designated relays. On PCR calls, the digits are shifted to the D, E, F, and G register units in revertive senders arranged for 3-digit office codes and the C, D, E, and F register units on 2-digit office codes. The shift is accomplished by the operation of the KGS1,2 relays.

SEIZURE OF TL AND TRUNK - FS24

22.13 After the marker has determined that an idle sender is available as indicated by the operation of the SKA or SKB relay, the marker closes battery to the ST lead of the TL, as indicated by the operated FG- and TF- relays. Possession of the frame is indicated by the operated TFK3 relay, which in turn closes battery over the F lead to operate the pulse conversion trunk F- relay. The F- relay closes a path to permit the selected sender to be attached to the trunk through the outsender link. The F- relay also operates its associated FA-- or FB-- relay in the TL to transmit sender class information to the marker.

CLASS INFORMATION TO SENDER - FS78 - SC114

22.14 The operation of the FA-- or FB-- relay in the TL closes a ground to the RN or KT punching, respectively, which is cross-connected to one of the ONN, 2SA, 3NA, or 5ST trunk class punchings. Ground

on one of these punchings operates correspondingly designated relays in the marker, which in turn operate an associated SCL0, 2, 3, or 5 relay. The SCL- relay then transmits the class information to the outgoing sender. Such an arrangement permits a common route relay to serve a common group of senders and permits transmitting the CL-information to the sender on the trunk basis.

LINKAGE CHECK - SC112

22.15 The marker checks that the various functions are completed before disconnecting. The checks are as follows:

- (a) The operation of the RNK1,2 relays indicates that the CL- class information has been transmitted to the sender.
- (b) The operation of the SLK2 indicates that the sender is attached to the trunk through the outsender link.
- (c) The operation of the RSC indicates that the DL-, CR-, and all digits have been transmitted and checked in the sender.

22.16 If the above checks are satisfactory and the sender advance relay AV has operated and locked, the marker AVK1 relay operates.

DISCONNECT

22.17 The AVK1 in operating operates the LK1, which in turn operates the DIS1,2 relays to restore the marker to normal.

22.18 To prevent a premature marker disconnect and subsequent incomplete trouble record being taken as a result of a link release failure being encountered during a pulse conversion call with an ONN class mark, the TEA relay is operated via make contacts of the TER2 and ROA relays. The class mark is changed from PCL to TER as a result of the link release failure condition.

23. CENTRALIZED AUTOMATIC MESSAGE ACCOUNTING - SC133, 134

23.01 The Centralized Automatic Message Accounting System (CAMA) for No. 5 crossbar is designed to enable a number of central offices without means for automatic message accounting to channel all charge calls through a No. 5 crossbar office which is equipped to make a record of all such charge calls. This arrangement of centralizing the charge recording equipment for a

whole area in one No. 5 crossbar marker group will permit automatic charging and DDD operation in areas where it has been heretofore uneconomical to provide individual office AMA.

23.02 Two methods are employed by the CAMA office to identify the number of the calling customer, operator identification, and automatic identification. In the operator identified arrangement, an operator is switched into the talking path to obtain the calling number orally which the operator then keys into the charging equipment. With automatic identification, the calling number is outpulsed from the originating office directly into the charging equipment at the CAMA point without the intervention of an operator. Calls from 4-party and rural line customers in either the CAMA office or the distant local office can only be handled on an operator identified basis.

23.03 With automatic number identification (ANI) the originating office is arranged to transmit the telephone number of the calling customer to the CAMA office.

23.04 In the CAMA office, two marker usages are required on each CAMA call. The first marker usage, referred to as CAMA first, establishes a connection between the non-AMA customer in the No. 5 crossbar office or from a distant office and the CAMA equipment to record the calling customers number and the called number for accounting purposes.

23.05 The second marker usage, referred to as CAMA second, will establish a connection from the calling customers line or incoming trunk location to the called line in the No. 5 office or to an outgoing trunk if the call is to a distant office.

23.06 With the CAMA arrangement, toll test calls may be made via the incoming CAMA trunk, directly to a terminating test line without using the CAMA equipment.

23.07 The CAMA marker group is arranged to intercept denied and vacant codes as well as free (noncharge) codes which falsely enter the CAMA office over incoming CAMA trunks.

TYPE OF CALLS RECEIVED IN THE CAMA OFFICE

23.08 The CAMA feature consists of the incoming CAMA, CAMA junctor, and CAMA intermarker group calls and the operations are as follows:

A. CAMA First Operations

23.09 Incoming CAMA calls are originated by customers in distant offices not arranged for AMA service and enter the CAMA equipped No. 5 crossbar office via incoming (bylink or nonbylink) CAMA trunks. Seizure of a particular incoming CAMA trunk by the distant office will also determine the customer originating rate class and the type of customer identification information that the marker will receive. The problem of conflicting codes appearing in two or three areas is resolved by assigning the associated incoming trunk groups to different AMA recorder units.

23.10 CAMA junctor calls are originated by 4-party or rural customers associated with the CAMA equipped marker group in the No. 5 crossbar office.

23.11 When a No. 5 crossbar office is equipped with more than one marker group, the CAMA intermarker group call is originated by non-AMA customers in the marker group other than the one directly associated with the CAMA equipment.

23.12 A customer-to-customer CAMA intermarker group trunk is used when a multiparty customer in the non-CAMA marker group makes a call requiring charge billing, to a customer in the CAMA marker group.

23.13 A customer-to-trunk CAMA intermarker group trunk is used when a multiparty customer in the non-CAMA marker group makes a call requiring charge billing, to a customer in a distant office.

23.14 The CAMA intermarker group trunks may also be used for similar traffic when local automatic message accounting (LAMA) service is not provided for individual or 2-party customers in the originating marker group.

23.15 The CAMA function description of the incoming CAMA, CAMA junctor and CAMA intermarker group calls are variations of the basic PCCL, SOG, and TER or TOG calls respectively.

B. CAMA Second Operations

23.16 The second marker usage, CMS0-1 operations are similar for all three types of CAMA calls.

23.17 When the CAMA equipment has received and recorded the necessary information, it will signal the CAMA sender to seize a completing marker through the incoming register marker connector. From the information received the marker will determine whether the call is to a customer in the marker group and to be handled as a TER call or to a customer outside the marker group and to be handled as a TOG call.

CAMA INCOMING CALL

23.18 When an incoming CAMA trunk is seized by the distant office, it is connected to an incoming DP or MF register through the incoming register link. The recording of the last digit of the called number will cause the incoming register, through the incoming register marker connector, to seize an idle completing marker.

23.19 Through the incoming register marker connector leads, the marker will receive the called number, trunk link frame number, trunk class, and trunk number information from the incoming register.

23.20 Depending on the type of trunk supervision required, either of two classes of incoming CAMA trunks may be used. The CMFO class representing TOL supervision or the CMF1 class representing TOL supervision are indicated to the marker by ground on the TCB and INC or TCB and PCR leads respectively. Marker relays TCB and TSC6 or TSC7, TCCK, S-, and CMFO, CAMA first TAN class or CMF1, CAMA first TOL class, will operate.

23.21 Operation of the CMFO or CMF1 relay will cause the CMF2-3, CTF-0/7, CAMA trunk frame units, and CFG0/2, CAMA trunk frame group, relays to operate.

A. Marker Translation and Route Relay Operation - SCI33

23.22 When the marker translation of the code digits of the called number results in the grounding of a code point, the screening field of the operated S- relay associated with the CMFO or CMF1 trunk class will provide a diverted route treatment to prevent the route relay or local completion relay assigned to this code point from operating and operate instead, a CMR0 CAMA route series TAN, or CMR1, CAMA route series TOL, relay. The operated CMR- relay will cause an R- relay, representing the proper CAMA TAN or TOL route,

and the CMF relay to be operated. The operated CMF relay will prepare the marker for subsequent operations by operating the CAM, CAMA, ORC, and AMA3-5 relays.

23.23 The operated R- relay will ground the OSC- terminal to operate an OSG- relay assigned to the CAMA sender group. The OSC, OGC, SON, and CMCl-3 relays will be operated by the OSG- relay.

23.24 When foreign area translation is required for a CAMA call, provision has been made to translate 7- or 10-digit (local or area) codes, to discriminate between CAMA and non-CAMA calls, to screen vacant, denied, and free number codes from gaining access to the CAMA equipment, and where required, enable 10-digit calls to be completed locally.

B. Class of Call - FS32

23.25 To indicate to the marker that operations for a CAMA first incoming CAMA call are required, the PCLl-2, CMCl-3, TRN, and NCMJ relays will be operated. The operation of these relays will start marker operations for connecting to the incoming CAMA trunk and transfer of trunk and trunk link frame number information to the CAMA sender.

C. CAMA Sender Selection and Control - FS57, FS120, SC134

23.26 When a single CAMA sender group serves incoming CAMA calls, the OS cross-connection on the incoming CAMA route relay is cross-connected to operate the OSG- relay representing the CAMA sender group. The CAMA sender group is then selected in a manner similar to the description in 10.

23.27 If several CAMA sender groups serve incoming CAMA calls, the sender group is selected on a trunk link frame basis and the OS cross-connection terminal is cross-connected to the DK0 terminal. The CDK0 relay operating circuit is disabled when the DK0 terminal is used for CAMA sender selection because all offices reached by the CAMA operation must be on a 7- or 10-digit numbering plan basis. The OSG- relay will be operated via the CFG- and CTF relays.

D. Information to the CAMA Sender

23.28 After the CAMA sender is selected, the marker transmits to the sender the following information necessary for completion of the call:

- (a) Called number over leads A0/7 - L0/7.
- (b) Trunk number over leads AR0/7, BR0/7, CR0/7.
- (c) Trunk link frame number over leads FT0-2, FU0/7.
- (d) Class information for trunk supervision over leads CLl,2, and 5.
- (e) Type of call served over lead SC (service call).
- (f) Originating rate class over leads ORC0-2.
- (g) Type of customer identification over leads AD or OD.
- (h) Recorder number over leads RN0/7.
- (i) Trunk observing information over leads OBS or NOB.

23.29 This information is transmitted to the sender and its registration in the sender is checked in a manner similar to that described in 10. The originating rate class, customer identification, recorder number, and trunk observing information is transmitted to the sender after the marker has connected to the incoming CAMA trunk. Since receipt of this information may be late subject to trunk link frame delays, it is transmitted to the CAMA sender through the control connector of the outgoing sender connector under control of the RNT timer.

E. Seizure of the Trunk Link Frame and the Incoming CAMA Trunk - FS24, FS33

23.30 After the marker has determined that an idle CAMA sender is available as indicated by the SKA or SKB relay operation, the marker closes battery to the ST- lead of the TL connector indicated by the operated FG- and TF- relays. Possession of the connector is indicated by the operated TFK3 relay, which in turn closes battery over the F lead through the IRMC and incoming register link to operate the trunk LF and TF relays. The operated LF and TF relays close a path to allow the selected CAMA sender to be connected to the incoming CAMA trunk via the outsender link.

23.31 As noted previously, when the marker connects to the incoming CAMA trunk, the originating rate class, customer identification, recorder number, and trunk observing information will be received and transferred to the CAMA sender as follows:

<u>TLF Lead</u>	<u>MKR Relays</u>	<u>Out SDR Conn Leads Grounded</u>	<u>For</u>
NT	ORC0	ORC0	(Customer Originating
NN	ORC1	ORC1	(Rate Class
HF	ORC2	ORC2	(
AD	AD	AD	(Automatic or Oper- (ator CAMA Identifi- (cation of Calling (Customer
ONN- 9NP	RN0-7	RN0-7	(Associated Recorder (Number

F. Linkage Check - FS61, 77, 78

23.32 The marker checks that the various operations have been completed before disconnecting. The checks are as follows:

- (a) The operation of the SLK2 relay indicates that the sender is attached to the trunk through the outsender link.
- (b) The operation of the RSC relay indicates that the called number, trunk number, trunk link frame number, service call, and class information has been registered in the CAMA sender.
- (c) The operation of the RNK1-2 relays indicate that the customer originating rate class, type of customer identification, recorder number, and trunk service observing information has been registered in the CAMA sender.

23.33 If the above checks are completed and the sender advance (AV) relay has operated and locked, the marker AVK and AVK1 relays will be operated.

G. Marker Disconnect - FS50, SC111

23.34 The operation of relay AVK1 will cause the LK1 and DIS1-2 relays to operate releasing the various connecting circuits and restore the marker to normal. This operation is similar to that described in 14.

CAMA JUNCTOR CALL

23.35 The registration of information from the originating register for a CAMA junctor call is similar to the registration of information for an SOG call, except that a CAMA sender and CAMA junctor circuit are used instead of an outgoing sender and an outgoing trunk.

A. Marker Seizure, Translation, and Route Relay Operation - SC133

23.36 When an idle completing marker is seized by an originating register handling a CAMA junctor call, the marker will perform seven major functions as follows:

- (a) Registration of information from the originating register required to establish a CAMA junctor call.
- (b) Identification of the type of connection the marker will assist.
- (c) Selection and connection of a CAMA sender to the marker and the selected CAMA junctor.
- (d) Registration of recorder number information from the trunk link connector circuit.
- (e) Selection of a channel between the calling customer line and the selected CAMA junctor.
- (f) Connection of the calling customer line to the selected CAMA junctor through the selected channel.
- (g) Release of the marker and associated circuits.

23.37 The marker translation grounding a code point associated with the called number and the S- relay operation is similar to the SOG class call description. Where separate TAN or TOL CAMA junctor routes are required for each area served, the class of service assigned to the multiparty customers in one area is different than the class of service assigned to multiparty customers in the other area(s). Where this discrimination is not required, a common TAN or TOL CAMA junctor route is associated with all areas served.

23.38 If the grounded code point is cross-connected to the winding of an R- relay representing a route requiring TAN supervision, the operated S- relay connects the CAMA preroute, CMRO, relay in series with the route relay. If TOL trunk supervision is required, the operated S- relay connects the CMR1 relay in series with the route relay. The CMRO or CMR1 relay operates, but its high-resistance winding prevents the R- relay from operating.

23.39 The operation of the CMRO or CMR1 relay operates another route representing a CAMA junctor route. The CAMA junctor route

series relay, CMJ, operates in series with the new route relay. The operated CMJ relay will cause the CAM, CAMA, AMA3-5, GTL, GTL2, and NOC or CLK relays to operate.

23.40 Provision for foreign area translator operations for the CAMA junctor call are similar to those described for the incoming CAMA call.

23.41 Seizure of the TL and LL, establishing a channel between the calling customer and CAMA junctor, and selecting a CAMA sender is similar to the same operations for a SOG call. On CAMA junctor calls, the NOC relay is operated to indicate no class information to be transmitted to the sender.

B. CAMA Sender Control - FS78, FS120

23.42 The CAMA sender group selected can serve all of the junctors and when it is necessary to select another sender group, access to the second group is available by use of the allotter or on a route advance basis.

23.43 With relay AMA5 operated, the operation of relay OGC will operate relay ORC to extend ground from one of the ORC0-2 cross-connection terminals to operate the ORC relay. The operation of relay RN in parallel to the ORC relay, will extend ground from the CMJ relay to operate the OD relay. The operation of the ORC and RN relays will also extend ground over the ORC- and OID leads to register corresponding information in the selected CAMA sender.

23.44 Although the CAMA junctors have no provision for rate class discrimination and since the CAMA common control equipment expects a rate class indication on every call, the CAMA marker is arranged to generate such a signal on CAMA junctor calls. The signal is the same on all calls and may be any one of the available ORC0-2 signals as determined by a cross-connection in the marker.

C. Information to the CAMA Sender

23.45 After the CAMA sender is selected, the marker transmits to the sender the following information:

- (a) The office code and numericals of the called line.
- (b) Type of customer identification.
- (c) The CAMA trunk class (TAN or TOL) information for setting the proper trunk supervision.

(d) The originating rate class information required by the CAMA equipment for establishing charges to the calling customer.

(e) The recorder number required by the CAMA equipment to identify the calling area.

(f) The service or test call information.

(g) Service observing signal.

23.46 This information is transmitted to the sender and its registration checked in the sender.

D. Linkage Check

23.47 On a CAMA junctor call, the operation of relay AVK depends on the operation of the sender AV relay and the following check relays:

(a) The operation of the SLK2 relay indicates that the CAMA sender is connected to the CAMA junctor through the outsender link.

(b) The operation of the RSC relay indicates that the called number information, trunk number, trunk link frame number, and service or test call information has been registered in the CAMA sender.

(c) The operation of the RNK1-2 relays indicates that the customer originating rate class, type of customer identification, recorder number, and trunk service observing information has been registered in the CAMA sender.

23.48 If the above checks are completed and the sender AV relay has operated and locked, the marker AVK and AVK1 relays will be operated.

23.49 The operation of relay AVK1 will cause the LK1 and DIS1-2 relays to operate releasing the various connecting circuits and restore the marker to normal.

CAMA INTERMARKER GROUP CALL

23.50 As previously described, the CAMA equipped marker group is arranged to provide message accounting service for non-AMA customers in the marker group other than the one directly associated with the CAMA equipment.

23.51 Two types of intermarker group trunks are required for CAMA intermarker group

operation. The types of trunks and types of marker operation involved are as follows:

Type of Trunk	Type of Call	
	Calling Mkr Grp	Called Mkr Grp
Sub to Sub	SOG	CMF0
Sub to Trk	SOG	CMF0 (For out trk requiring TAN Supv)
Sub to Trk	SOG	CMF1 (For out trk requiring TOL Supv)

23.52 The marker in the originating marker group, after receiving the necessary information from the originating register, selects and connects to an idle intermarker group sender and CAMA intermarker group trunk. After connecting the intermarker group sender to the CAMA intermarker group trunk through the outgoing sender link, the marker establishes a channel from the calling line to the CAMA intermarker group trunk.

23.53 The intermarker group sender functions similar to an incoming register and transmits the necessary information to a marker in the CAMA marker group. The marker selects a CAMA sender and connects the CAMA intermarker group trunk to the CAMA sender through an outgoing sender link. After checking that the necessary functions have been completed, the marker releases.

CAMA COMPLETING CALLS

23.54 When the registration of the information in the sender is checked by the marker, the marker transmits an advance signal to the CAMA sender, and releases. The CAMA sender upon receipt of this signal, signals the calling office to transmit the calling number on automatically identified calls, or signals the CAMA position link to establish a connection between sender and operator for operator identified calls.

23.55 After the sender has received the calling number, it connects to a CAMA transverter which controls the initial entry on the AMA tape, and makes certain check on the calling and called numbers. Upon a satisfactory check, the transverter releases, and the sender seizes a completing marker through the IRMC for a second marker usage which is required to complete the call. This seizure is similar to a seizure by an incoming register. If a completion of the call is to a

customer within the marker group, the call is handled as a TER call. If completion of the call is to a customer outside the marker group, the call is handled as a TOG call.

23.56 After seizing the marker through the incoming register marker connector, the CAMA sender transfers the following information to the marker:

- (a) Called office code.
- (b) Called customers line number.
- (c) The trunk link frame number on which the CAMA trunk appears.
- (d) The area in which the calling customer appears.
- (e) Whether the dialed code is a working code, vacant code, denied code, or free code.

23.57 The CAMA trunks are arranged for line link frame and trunk link frame access, or trunk link frame access only. For the CAMA completing call that is to terminate within the office, the marker must set up a connection between the CAMA trunk appearance on the trunk link frame and the called customers line appearance on the line link frame.

A. Call Directed to a Distant Office

23.58 For a CAMA completing call that is to terminate in a distant office, the CAMA sender seizes the marker through the incoming register marker connector. After seizing the marker, the CAMA sender transfers the same items of information transferred on the CAMA completing terminating call.

23.59 On this call, the marker sets up a connection between the line link frame appearance of the CAMA trunk and the trunk link frame appearance of an outgoing trunk. This type of connection is similar to a tandem or intertoll connection.

B. Identification of CAMA Completing Call - FS31, 121

23.60 In order to identify this call as a CAMA completing call, it is necessary to operate one of the CMS0-1 relays in the marker. The CMS0 relay identifies the call as a CAMA completing call that entered the office over a CAMA trunk requiring TAN supervision. The CMS1 relay identified the call as a CAMA completing call that entered the

office over a CAMA trunk requiring TOL type supervision. The type of supervision required is information that the CAMA sender has stored from the previous marker usage. In that usage, the marker sent this information to the CAMA sender over the CL1 and CL5 leads to indicate TAN supervision or over the CL2 and CL5 leads to indicate TOL supervision. On the CAMA completing usage, this information is sent back to the marker over leads TCB and TSC8 for TAN supervision or leads TCB and TSC9 for TOL supervision. The TCB, TSC8, and TSC9 leads each operate similarly designated relays in the marker.

23.61 A combination of TCB and TSC8 relays operates the CMS0 relay while a combination of TCB and TSC9 operates the CMS1 relay in the marker. The operation of TCB and TSC8 or TCB and TSC9 also operates S- relays to provide a code point screening field for the CMS0 and CMS1 call classes.

C. Completion to Distant Destination

23.62 If the dialed number is for a destination other than any of the three areas served by the CAMA office, the CAMA sender grounds the ACD lead to the marker. If no area code is dialed, one of the LCD0-2 leads is grounded, the particular lead depending on the area in which the calling customer is located. The LCD0 represents the home area and the LCD1-2 represent the two remaining areas served by the CAMA marker group. On calls with an area code, operation of the marker relay ACD over the ACD lead activates the marker code translator. The area code of the called number is thereby translated. If a single route to the called area exists, the translator operates a route relay; if several routes to the called area are available, the translator selects the proper foreign area translator where the office code digits of the called number are translated.

23.63 Where 7 digits are dialed, and where a single route to the called area exists, the route is selected by cross-connections on an LCD- relay. If several routes exist, a foreign area translator must be used. In this case, the LCD- relay causes the foreign area translator to translate the office code, thereby determining the route for the call.

23.64 Translation causes the operation of a route relay which in turn requests a sender, indicated by the operation of relay SON. The combination of an outgoing sender request and CMS- trunk class causes relay TOG1-2 to operate as in a tandem or intertoll connection, and the call is completed in this manner.

23.65 The CAMA sender also grounds the WKC lead to the marker, if the dialed code is a working code in the area to which the call is directed. Ground on the WKC lead will operate the WKC relay in the marker.

D. Local Completion

23.66 If the call is a local completion call, the LCDO relay cross-connection enables the marker translator, resulting in the operation of one of the local completion relays. Relays TER1,2 operate and the call is completed as a normal TER call. Relay WKC will operate if the code is a working code.

E. CAMA Completing Calls Encountering Non-working Codes

23.67 On 7-digit calls it is impractical in the CAMA first operation to detect codes that are nonworking in some but not all areas served by the CAMA center. Such codes are detected by the billing indexer or by the foreign area translator on the CAMA second operation.

23.68 If the billing indexer recognizes a nonworking code, the CAMA sender indicates this fact to the marker by grounding one of the VTC, DNC, or FC leads. These leads indicate that a vacant terminating code, a denied code, or a free code has been dialed rather than a working code. Operation of the VTC, DNC, or FC relays from the corresponding leads disables the translator in the marker and closes circuits to the VTC, DNC, or FRC punchings which are cross connected to operate the proper route relays for the desired intercept treatment.

23.69 If CAMA service is suspended in the office, the CAMA sender grounds the WKC, working code, lead to the marker on all CAMA completing calls. At such time, vacant codes, free codes, or denied codes must be recognized in the marker, foreign area translator, or at the distant office to which the call is directed.

23.70 When the foreign area translator recognizes a code as a vacant code, it grounds the FAR- code point assigned to vacant codes. This code point will be cross-connected to the VCG terminal. Treatment then varies on a class of call basis.

23.71 The marker is changed to provide cross-connectable selection of either local charge or toll charge conditions for local completing CAMA calls. Cross-connecting for a toll charge condition will permit charging on CAMA calls completing locally to free numbers.

23.72 Option ZWI (rated Standard) provides the CCH cross-connect punching and option ZWH (rated Mfr Disc.) is assigned to the previous wiring.

23.73 Free codes denied codes recognized in the foreign area translator are indicated by grounding one of the FAR leads assigned to free or denied codes. The FAR-punchings are cross-connected in the marker to give the desired intercept treatments.

MISCELLANEOUS CAMA OPERATIONS

A. Trunk Service Observing on CAMA Calls

23.74 The trunk service observing feature provides facilities for observing customer, operator, and equipment performance on CAMA calls.

23.75 Preparation of the various circuits for trunk service observing signals on CAMA calls occurs during the marker CAMA first operation (ie, when a CAMA junctor is chosen, when the CAMA intermarker trunk is connected to a CAMA sender, or when an incoming CAMA trunk calls for the services of a marker).

23.76 When observing on CAMA calls is desired, the CAMA lead to the marker from the service observing trunk selection and control circuit is grounded. With this lead grounded, if the marker is called on to connect to a CAMA sender, the TOBS relay is operated. Operation of the TOBS relay indicates that the call being served is of the type upon which trunk service observing is desired.

23.77 After the call has proceeded to the point where the trunk link frame is seized, the marker inspects the NH lead from the trunk link and connector circuit to determine whether or not the particular CAMA junctor, CAMA intermarker, or CAMA incoming trunk is requesting service observing. Ground on the NH lead indicates that the junctor, intermarker, or incoming trunk is requesting service observing and the absence of ground indicates that there is no service observing request. If ground is present on the NH lead, relay TOB in the marker operates.

23.78 The operation of the TOB relay operates the connector relays in the service observing register connector circuit. Operation of these connector relays cuts through the called code and number registration leads from the marker to the service observing register connector, for recording such information at the service observing desk. Operation of the connector relays also grounds the CK lead to the marker to operate the OBS relay indicating that the call is to be observed.

23.79 If, upon seizing the trunk link frame, no ground on the NH lead is present, relay TOB in the marker does not operate. With TOB nonoperated, relay NOB operates. On junctor calls, the operating circuit of NOB is through TOB nonoperated, ORC0-2, CAMA, and CHA1 operated. On intermarker or incoming CAMA calls, the operating circuit is through TOB nonoperated, ORC0-2 and CMF2 operated.

23.80 Operation of either the NOB or OBS relays grounds similarly designated leads to the CAMA sender to inform that circuit whether or not a service observing record is required. Check for the passage of this information to the CAMA sender is made under control of the RNT timer.

B. CAMA Testing

23.81 Tests of the CAMA sender and CAMA trunks are provided and the procedures necessary to make these tests are included in the test circuits. In addition, a trunk test relay associated with the CAMA feature has been added to the marker.

23.82 When the marker operates to complete a CAMA test call to an outgoing trunk, the automatic progression trunk test circuit or the master test control circuit operates the trunk test auxiliary TTA relay.

23.83 The operated TTA relay operates the OTT and NDL relays, aids in subsequent operation of the DIS1 and DIS2 relays, and provides preference lock-out paths from the test circuits to the trunk link frame associated with the trunk under test.

23.84 If the automatic progression trunk test circuit is making a trunk test, the operated OTT relay operates the TTA relay in the associated trunk link frame and prevents the master test control circuit from gaining access to this same trunk link frame.

23.85 In a similar manner if the master test control circuit is making a trunk test, the TTM relay in the trunk link frame operates to lockout the automatic progression trunk test circuit.

C. Reorder, Link Release Failure, or a Double Connection

23.86 A reorder request from an incoming register serving an incoming CAMA trunk or from a CAMA sender on a completing CAMA call operates the RO relay over the RO lead from the incoming register marker connector. The ROA, TER-, and OV relays operate as on other incoming calls to set overflow in the CAMA incoming trunk.

23.87 Requests from the incoming register to take trouble records of incoming link release failures or double connections as indicated by ground over the LR and DCK leads from the incoming register marker connector are handled in the same manner as for other types of incoming trunks. These grounds operate the LR or DCK relays to prepare the marker for properly disposing of the call.

D. Recycle and Route Advance

Recycle

23.88 Because no channel is established between the line link frame and trunk link frame on CAMA first, incoming CAMA, and CAMA intermarker group calls, matching failures are nonexistent and, therefore, the recycle feature (RCY- relays) is not brought into play.

23.89 Since a channel is established between the line link frame and trunk link frame on all CAMA second calls, matching failures are counted and the recycle RCY- relays function.

23.90 Operation on junctor calls in the CAMA marker group and on intermarker group calls in the originating marker group is similar to the SOG (outgoing) call.

23.91 CAMA second operation is similar to TER (terminating) or TOG (tandem or toll outgoing) operation depending upon whether the call completes to an office in the home marker group or to a distant office.

Route Advance

23.92 The route advance feature (RAV relays) functions when all CAMA sender busy condition is encountered on an incoming CAMA call. Class advance to TER and setting of reorder in the incoming trunk takes place as on a pulse conversion call.

23.93 On a CAMA junctor or CAMA intermarker group call, the route advance on an all trunks busy, all senders busy, or after a matching failure takes place in the same manner as on an SOG call. The call is then terminated in some form of tone, machine announcement, or intercept trunk appearance on the trunk link frame.

23.94 Route advance on CAMA second operation is similar to TER or TOG operation depending upon whether the call is to complete to an office in the home marker group or to a distant office.

E. CAMA Calls Under Failure Conditions

23.95 The action taken by the marker serving a CAMA call on which a failure occurs depend on the type of CAMA call involved, how far the call has progressed, and whether the call is a first or second trial.

23.96 If a failure occurs on a first trial, second trial is requested only if failure occurs before the AV relay in the CAMA sender operates. Beyond this point, the marker sets reorder in the trunk. This difference in operation is due to the introduction of the automatic identification feature. When this feature is provided, the sender AV relay operates a relay in the trunk to signal the automatic identification circuits in the distant office to start pulsing. Once this point is reached, it is impractical to restore the circuits to their original condition for a second trial attempt.

23.97 On CAMA second operations encountering failures, the marker functions as it does on TAN or TOL class calls encountering similar failures.

23.98 On CAMA junctor calls or CAMA intermarker group calls (SOG usage), if a trouble is encountered, the marker treats the call in a manner similar to the treatment given SOG calls.

AUTOMATIC NUMBER IDENTIFICATION

23.99 Arrangements for ANI are provided in the originating office in order to identify the calling customer and to transmit this information to the CAMA office, either over an outgoing trunk, or intermarker group trunk. If the originating customer is in the CAMA marker group, the call would normally be handled by LAMA in that marker group, or by CAMA junctor operation (operator identification).

23.100 An ANI call will be from a calling customer within the No. 5 office and reach the marker from the originating register. The marker will translate the office code and ground some code point to operate a diverted route relay DRR0,1 which in turn operates a route relay. In any case the R-punching of any route relay associated with an ANI route will be connected to the ANIS punching to operate the route series, ANIS, relay. The ANI relay will then be operated to open leads to apparatus provided for AMA operation but not required for an ANI call.

23.101 When the route relay operates for the ANI call its cross-connections will be used as follows:

- (a) TB-, TG-, RA-, CR-, and DL-. Use standard information.
- (b) CP, MBS-. Omit cross-connections.
- (c) CL-. The CL- information requires sending on the CL3 and CL5 leads.

23.102 This is a new combination and requires the use of an added CL6 relay.

23.103 The new CL- information is as follows:

- (a) CL- to CL4S. ANI, Operator identification of calling line. Transmits on CL5 lead to sender.
- (b) CL- to CL6S. ANI, Automatic identification of calling lines. Transmit on CL3 and CL5 leads to sender.

23.104 Marker operation for an ANI call is essentially the same as an SOG (SON) call and local AMA charging except for the amount of information transmitted to the sender.

23.105 A summary of the information that the marker transmits to the sender for the AMA and ANI conditions is as follows:

Type Information	<u>SOG Call With Sender Operation</u>			
	No AMA	Local AMA	ANI	Note
Called Number	Yes	Yes	Yes	
Arb Dig	Yes	Yes	Yes	
Send 11	Yes	Yes	Yes	
Delete	Yes	Yes	Yes	
Class	Yes	Yes	Yes	
AMA	No	Yes	No	1
Calling Line Location	No	Yes	Yes	
TP, RP	No	Yes	Yes	
OBS, NOB	No	Yes	Yes	
TVT, SC	No	Yes	Yes	
Recorder No.	No	Yes	No	1
Mess. Billing Index	No	Yes	No	1
Code Pattern	No	Yes	No	1
Number Structure	No	Yes	No	1

Note 1: Functions canceled by the operation of the ANI relay.

24. PBX, TRUNK AND SENDER GROUP ALLOTING

PBX ALLOTTER - SC119

24.01 The PBX allotter feature provides means of recognizing calls to as many as 10 PBX terminal hunting groups. The lines of each terminal hunting group may be distributed over as many as 8 NGs. For this description, the lines of a PBX terminal hunting group are referred to as an allotter group, and the lines of this allotter group may be referred to as belonging to line groups on each NG containing lines of the allotter group.

24.02 As many as 5 such line groups, each associated with a different allotter group may appear on one NG. Only 4 of the possible 10 allotter groups may have lines distributed over 8 NGs. The other 6 allotter groups must have its lines confined to 4 or less NGs.

24.03 In these offices equipped with the PBX allotter feature, the marker first examines the called number to see if the number is an allotted directory number. Only the thousands, hundreds, and tens digits of the directory number can be so recognized. If the number is allotted, the marker tests for an idle line in same line group of this allotter group before seizing an NG. When the marker subsequently seizes the NG containing an idle line, it is prepared to hunt for the idle line.

24.04 If a call is made to a number in the allotter group other than the directory number, the marker does not recognize it as an allotted number, and treats it as an ordinary PBX line. In this case, the NG is seized first and ringing combination 10 indicates a PBX line. The marker then proceeds to select an idle line by the terminal hunting operation as described in 9.

24.05 Option ZLS is provided to ensure number group reseizure on a PBX allotter call after route advance to an alternate IAO trunk group. The ANON relay is released on route advance to release all locked operated allotter relays, which enables number group reseizure after route advance.

A. Identification of Allotted Number

24.06 Various operating grounds for the allotter operation are supplied by the allotted number off-normal (ANON) relay, which is operated by the CKG6 relay, when the marker is seized, B72.

24.07 The marker is arranged to handle a maximum of 40,000 lines distributed over as many as six number series. To indicate

the office number series of a called number, the marker operates on NSS0-5 relay. An ALS0-5, allotter start, relay is operated in parallel with the NSS- relay and starts the PBX allotting functions for the particular office number series B60.

24.08 Where particular office number series do not contain any allotted numbers, cross-connections are provided for seizure of an NG without any allotter functions. The ALS0-5 cross-connection terminal is cross-connected to the NAN terminal for those number series containing no allotted numbers. This cross-connection provides a saving of marker holding time when no allotting is necessary in a particular number series.

24.09 Where office number series contain allotted numbers, the PBX allotter must first determine if the called number is or is not in an allotted hunting group.

24.10 An allotted directory number is indicated by the operation of the allotted number (AN) relay, B74. The ANA0-9 relay, operating in series with the AN relay, indicates the hunting group to be selected. The PBX allotter feature is canceled for special calls when the SPL1 relay operates.

24.11 To direct the marker in selecting the particular ANA0-9 relay that contains the directory number, the thousands THT0-9, hundreds HBT0-9, and tens TBT0-9 cross-connection terminals are cross-connected to the ATH- and ATB- terminals, respectively. See Note 411.

24.12 If LLP line circuits are allotted, the number group start punching off the LR relay is cross-connected to operate the ANA-relay.

24.13 As an indication of whether the allotted number is distributed over a maximum of 4 or 8 number groups, the 4NG or 8NG relay operates from the ANA- relay.

24.14 To provide for auxiliary contacts for the ANA- relay, the ANB0-9, ANC0, 4, 5, 9 and AND0, 4, 5, 9 relays are provided. They operate when the ANA0-9 relay operates B74.

B. Allotted Number Timing

24.15 Sufficient time must be allowed for the operation of the AN and ANA- relays if the called number is in an allotted hunting group.

24.16 The allotter start ALS0-5 relay operates the allotted number series auxiliary (ADVA) relay which in turn operates the allotted number timer (ANT) relay, B60, B72. The operate time interval of these two relays allows enough time for the AN and ANA- relays to operate if the number is allotted. If the called number is in an allotted hunting group, the ANT relay operates the ANS relay.

24.17 Failure to operate the AN relay, by the time the allotter timing relay ANT operates, causes the operation of the nonallotted number series (NANS) relay. This indicates that the called number, within the number series containing allotted numbers, is not an allotted hunting group. For this condition the start battery for seizure of the NG is extended through the operated ANT relay contacts and nonoperated AN relay contacts, B61. The NG is then seized in a manner similar to that used when no allotted PBX is provided. The hundreds, tens, and units information is passed to the NG through the operated NANS relay contacts, B67, B68, and B69.

C. Allotted Number Operation and Busy Test

24.18 If the called number is an allotted directory number, the allotter tests to determine which number groups have idle lines, and then causes the marker to select one of these number groups for service. This arrangement saves marker and number group holding time, since the marker causes line busy to be returned to the calling customer without seizing a number group when all lines of the PBX are busy. The marker is then provided with the thousands, hundreds, tens, and units digit information of the first line of this allotted PBX in the selected number group. To accomplish the seizure of an idle NG after the allotter has determined that the called number is allotted, relay ANS operates the no allotter recycle NAR1,2 relays, B72. The NAR2 closes ground to operate the CKO relay, which in turn operates the CKR relay, B64. The start battery path through the allotter for seizure of the selected NG is closed when CKR relay operates relay PBX1, B61.

24.19 The operation of the ANA-, ANB-, ANC-, and AND- relays close the windings of the NGTA-H, number group test, relays to the AN- leads of all number groups of an allotted hunting group. If all the lines in a number group in this allotted PBX are busy, battery is extended from the NG over the AN lead operating the associated NGTA-H relay. The operated NGTA-H relays indicates that all the lines are busy by operating the AB relay.

24.20 An NGA-NGH terminal is cross-connected to an AN- terminal for each NG with which the allotted number is associated. See Note 412. There is one AN test lead for each NG. When the marker is arranged to work with nonwire spring relay type number groups, there is a maximum of four PBX allotter groups per NG; therefore, four test leads, AN0-3, are extended to the marker. When arranged to work with wire spring relay type number groups, five test leads, AN0-4 are extended to the marker. These leads permit a maximum of five PBX allotter groups to be served by one number group.

24.21 The PBX allotter selects one of a maximum of 8 line groups, A-H, contained within the allotter group, by the operation of one NGSA-H, number group selected relay. See Note 413. The ANS relay furnishes a ground to the NGSA-H relays through normal contacts of the line group test relays NGTA-H. The selection of the preferred allotter line group is controlled by the NS1 to A1-H1 cross-connections as indicated in Note 400.

24.22 If all lines in all number groups in this allotted PBX are busy, the ground, which otherwise operates one of the NGSA-H relays, is extended to operate the all allotted number busy (AB) relay. The operation of the AB relay indicates that busy tone should be transmitted to the calling customer. The AB relay operated also extends ground over one of the OVFO-9 leads to operate an overflow traffic register.

D. Listed Directory Number Line Group Selected

24.23 If the NGSA relay has operated, the selected NG contains the directory number. For this condition the marker selects and controls the NG in accordance with the dialed number. The marker extends battery over the NG start ST0-9 lead, through the operated TH 2/5 relays corresponding to the thousands digit of the dialed number, and through the selected NSS0-5 relay contacts. The number group MP- relay operates after relay PBX1 has operated, B61. Battery is also extended over the HB0-9 and TB0-9 leads, through the operated HN 2/5 and T 2/5 relay contacts, respectively. The hundreds block HB0-9 relay and tens block TB0-9 relay that operate correspond to the hundreds and tens digit of the dialed number, B67, B68. An allotted number (AN) relay is connected in parallel with the TB- relay in the NG for the directory number tens block only. The AN relay operates in parallel with the TB- relay in the NG and extends ground back

to the marker over the ANK lead to operate the allotted hunting group (AHG) relay, B72. With the AHG and NGSA relays operated, battery is extended to the UO lead for the units digit information. The first trial TRIA relay is operated and one or more SA0-9, sleeve test auxiliary, relays are operated to cause the marker to hunt from 0 to 9 for the first idle line, B69.

24.24 In the case of LLP line circuits, an operated NGSA relay indicates that the selected NG contains the generated number for the line circuits. Since the regular NG start through the LR- relay contacts is used to operate the allotted PBX relays, a THA- punching is provided for seizing the A choice number group.

E. Other Than Listed Directory Number Line Group Selected

24.25 If an NGSB-H relay operates, the selected NG does not contain the listed directory number. The PBX1 relay closes the start lead corresponding to the thousands digit of the first line in the B-H number groups, to operate the MP- relay in the number group, B61. See Note 414.

24.26 The NGSB-H relays and the ANA-, ANB-, ANC-, and AND- relays control the selection of the NG hundreds and tens block relays. Battery is extended over the HB0-9 and TB0-9 leads corresponding to the hundreds digit and tens digit, respectively, of the first line of the hunting group in the B-H number groups, B67, B68. These leads are extended to the NG to control the selection of the NG hundreds block and tens block relays. With the AHG and NGSA nonoperated, battery is extended over the UO lead for the units digit information.

F. Recycle

24.27 Conditions that cause recycle are:

- (a) Marker fails to find an idle line when hunting in the NG.
- (b) Marker finds the chosen line busy when testing the line at the LL. This may occur if another marker selects the line between PBX idle test and line busy test.
- (c) Marker finds it necessary to reroute the call to intercept or no-such-number trunk.
- (d) Marker finds the selected NG made busy.
- (e) Marker finds the LL made busy.

(f) Marker encounters a failure to match.

24.28 When the marker encounters a recycle condition the NG is released.

24.29 The allotted number recycle (ANR), relay operates the ANR2 relay, B72; which in turn releases the operated NGSA-H relay. This causes the release of the thousands, hundreds, tens, and units information B76.

24.30 After the marker has completed this recycle, the ANR1 relay operates and again initiates the selection of a NG containing the allotted PBX by reoperating an NGSA-H relay. The preference for operating the NGSA-H relays is changed by the operation of the ANR2 relay.

G. Test Call Functions - B72, B75

24.31 The TNA, test number group allotter, relay is operated from the master test control circuit when it is desired to operate the NGTA-H relays for a test call. The TNA relay extends the operating circuit for the NGTA-H relays to the master test control circuit. By the operation of associated keys in the master test control circuit the NGTA-H relays may be operated for test calls.

H. Trouble Detecting

24.32 If an allotted hunting group is falsely identified as a nonallotted hunting group, the marker detects this condition while terminal hunting in the first tens block of the NG. Under this condition, the ANS relay in the marker is nonoperated. Since the hunting group is allotted, the NG grounds the ANK lead to operate the AHG relay in the marker. Therefore, with the ANS nonoperated and the AHG operated, the cross allotted hunting group (XAH) relay is operated. The operation of the XAH relay indicates failure for the first trial only. For second trial, this trouble detection feature is canceled by the operation of relay TR2B. This opens the XAH relay operating circuit and results in the completion of the call.

24.33 The XAN trouble recorder card indication is punched, but the AN indication is not punched, when this type of failure occurs. This indicates that the call has progressed into or beyond NG seizure.

24.34 The marker is prevented from completing the connection when false allotting of a nonallotted hunting number occurs. This condition is detected while hunting in the

first tens block of the NG. For this condition the NGSA relay is operated, but the AHG relay is nonoperated; therefore, the operating path of the units digit relay in the NG is opened, resulting in a marker time-out.

24.35 The AN trouble recorder card indication is punched, but the U indication is not punched. This indicates that the number should not be treated as an allotted number, and that the call has progressed into or beyond NG seizure.

24.36 A crossed allotted number is indicated by the operation of the XAN relay when the ANA0-9, ANB0-9, ANC0, 4, 5, 9 and AND0, 4, 5, 9, relays, associated with two or more hunting groups, are operated B72. This prevents seizure of any NG by opening the operate circuit to the NGSK relay and results in a marker time-out, B76. Both the XAN and AN trouble recorder card indications are punched, indicating that the call has not progressed to NG seizure.

24.37 When both a nonallotted and allotted number identification is made, the XN relay operates, B63. This produces a trouble record card on which the XN indication is punched.

24.38 When more than one number series identification is made, the XNS relay operates B60. The XNS relay operates the XN relay, which causes a trouble record to be taken. The XN indication is punched.

I. Provisions for Testing Block Select Feature of Allotted PBX Groups

24.39 The MT56 relay provides for testing of the block select feature in allotted PBX groups. With MT56 operated, the operation of the SLCK relay is delayed by the test frame so that control relays in the number group have sufficient time to operate.

24.40 Option ZVR provides the MT56 relay and option ZVG provides the wiring for this feature. Option ZVF is assigned to the previous wiring.

TRUNK AND SENDER GROUP ALLOTTING - SC129

24.41 Where an office requires a trunk group with over 20 trunks per TL or over 10 senders per sender group, or both, the marker is arranged to provide two route relays for a given route. The additional route relay expands the facilities to two groups of 20 trunks per TL and two groups of senders, 10 senders per sender group. When these allotted trunk and sender groups are provided,

the marker is arranged to select one trunk group, and, if required one sender group for testing; it then advances to the other if no trunks or senders are available in the first.

A. Route Relays for Allotted Trunk Groups - FS40, FS55

24.42 Whenever a route is associated with allotted trunks or senders, the code point grounded by translation and screening, is cross-connected to operate one of the pre-route AL0-3 relays. The AL- relay then grounds its LA- or LB- punching, which is cross-connected to the RC- punching of a route relay. Each AL- relay is associated with two route relays in the same ground supply.

24.43 The route relay used depends on the setting of the GPA or GPB relays, which alternate their setting on each marker usage as controlled by the GW, GZ relays.

24.44 The AL- relays provide a ground for operating the GP1,2 and GPA,B relays if an allotted route is involved.

24.45 When option YD (Mfr Disc.) is provided there can be only one allotted route in each of the one through four ground supplies. Option YE (Standard) provides cross-connections to permit assignment in different ground supplies as required. In a marker group with flat spring and wire spring markers all allotted routes are restricted to ground supply four.

24.46 A break contact of the GP1 relay added to the operate path of the OF register will prevent scoring of this register on allotted trunk groups when the first group is found busy.

B. Allotter Operation - FS55

24.47 An allotter advance requires the marker to release the original R-, route, relay and associated information, and then make a second attempt to complete the call using the other R- relay.

24.48 The allotter group preference (AGP) relay operates to advance the allotter, whenever the marker finds one of the following:

- (a) All trunks busy in the first trunk group.
- (b) All senders busy in the first sender group.
- (c) Marker encounters a recycle.

24.49 The AGP relay in operating:

- (a) Releases the GPA or GPB, which releases the route relay.
- (b) Locks the AGP and GP1 operated until the GW operates or releases, and the GP2 relay operates.

24.50 The release of the route relay or the operation of the RCY and RCY1 relays, releases information associated with the route, which in turn releases the SNK relay.

24.51 The release of the SNK causes the GP2 to operate, which in turn causes the GW to operate or release.

24.52 With the GW and GZ, in opposite conditions and GP2 operated; the AGP and GP1 relays release. The AGP in releasing, permits the GPA or GPB, and the alternate R- relay to operate, which gives the marker access to the same route information, but different trunks and senders.

C. Route Advance With Allotter - FS26

24.53 A route advance on an allotted route is similar to a route advance on a non-allotted route. The main difference is that the RAL0-3 punchings associated with the AL0-3 relay contacts are used, instead of the RA- punchings of the associated R- relays. The RAL0-3 punchings are cross-connected in the same manner as the RA- punchings.

24.54 The operation of the GS- relay on route advance also opens the ground for operating the GP1,2 and GPA,B relays, which indicate an allotted route. If route advance is to another allotted route, the operation of the AL- relay in another ground supply reoperates the GP- relays.

24.55 The marker is equipped to provide an improved testing arrangement for the group allotter feature in offices equipped with office test frame. This change allows a particular group (GPA or GPB) to be selected for testing.

24.56 Option FU provides the new arrangement and option DI must be removed when option FU is applied.

24.57 Trunk number recycle is used only when establishing a linkage from an incoming toll or tandem trunk to an outgoing trunk (TOG, toll or tandem outgoing, call).

24.58 The linkage is from the appearance on the LL associated with the toll or tandem incoming trunk to the outgoing trunk appearance on the TL.

24.59 The line location on the LL is obtained from a number group translation of the trunk number, which was received from the incoming register.

24.60 When the marker encounters a first failure to match on TOG calls or finds the LL plugged busy on toll calls; the TNR relay is operated to cause a trunk number recycle. The operation of the TNR:

- (a) Releases the number group connector and the FTM-, FUN-, VGN-, HGN-, VFN-, and RCN-, relays, B62.
- (b) Releases the FLG1 relay, which releases the LLI relay, which in turn releases the FTL, FUL, etc, relays that lock in the NG translation.
- (c) Operates the RCY and RCY1 relays, when the lock relays release to cause the marker to recycle.
- (d) Operates the NGP to obtain the other number group translation. On toll class calls this results in using another LL appearance.
- (e) If both number groups are made busy, the marker causes a trouble record to be taken.

24.61 When the marker has restored to the point where new selections can start, the SNK releases and releases the RCY and RCY1, relays. The marker then makes new selections, giving preference to an outgoing trunk on another TL; to other channels; and using the other LL on toll class calls.

24.62 If the marker operates the NGP relay, or the call is a second trial, TR2 operated, the number group preference is transferred.

25. FOUR-WIRE NETWORK OPERATION

25.01 The No. 5 crossbar office may be arranged to operate with 4-wire trunks, line links, trunk links, senders, and registers. The office may be arranged for 4-wire operation alone or it may be arranged for combined 2W-4W operation. A maximum of 40 line links and 20 trunk links may be provided for a 4-wire network. Within the maximum of 60 line links and 30 trunk links of both types, the office may have two office sizes, one for the 2-wire network and one for the 4-wire network. Four-wire networks are used where system transmission requirements exceed the capabilities of the 2-wire networks.

CONTROL DIGITS - FS122, 123

25.02 Four-wire network stations may be provided with a feature that gives calling stations control over marker and network action in processing their calls. The control digits are keyed or dialed prior to the keying or dialing of the called number. They are registered in the originating registers and forwarded to the marker where they are registered in what are called; for convenience, slot one and slot two. Slot one contains relays that record one of four precedence levels as keyed or dialed by the customer. The second slot contains relays that record what network is wanted on the call. The control digits are not limited to the above and can be used as desired to furnish other instructions as dictated by customer needs.

25.03 There are 16 usable control digits in slot one with 10 usable in slot two. Dial stations can use 10 of the 16 control digits in slot one. Key set stations may be provided with 16 button keysets and can use all 16 control digits in slot one. Both may use the 10 control digits in slot two.

25.04 If no control digits are dialed or keyed by the customer into the originating register, the slots are automatically filled to give a routine or precedence level and basic network routing to the call.

25.05 The class-of-service of the line originating the call is received by the marker and is used in conjunction with the control digits to determine which privilege group to use.

25.06 Each line is limited to its privilege determined by the privilege group relay cross-connections. Lines that are equipped with a keyset station and a dial station may use two privilege groups, one for the keyset station and one for the dial station.

25.07 The marker makes use of the control digits to determine its actions and when an outgoing call is made, forwards the control digits to an outgoing sender. The forwarded control digits may be altered by the marker as determined by cross-connections. The outgoing sender pulses the control digits forward into an incoming register in a connecting office. The incoming register forwards the control digits to a marker in the distant office where they are used in conjunction with the trunk class to determine the privilege group to be used on this incoming call. The control digits are used in a similar manner in each office used in the completion of the call.

A. Control Digit Registration

25.08 Control digit information is received on the CDP0,1,2,4,7,10, and 15 and CD0,1,2,4,7,10, and 15 leads from the originating or incoming registers through their connectors. For ease of description, the control digits and called number format are shown below:

<u>Slot 1</u>	<u>Slot 2</u>	<u>7 or 10 Digit No.</u>
CDP2/7	CD2/7	A B C D etc

Only slots one and two contain precedence and privilege information. Slot one may consist of a precedence level indication, or if no special precedence is requested, a network indication. Slot two control digits can only indicate a network routing request, and is used in conjunction with a precedence level request in the first slot.

25.09 If no precedence level is requested, the lowest, or basic precedence is generated in the marker. If no control digits are requested in either slot, the basic precedence level, and basic network routing are generated in the marker.

25.10 For originating calls, the priority level control digit combinations are assigned to the first slot. Certain routing and privilege control digit combinations may be assigned to both slots, or to the second slot only.

25.11 In any case, the following dialing format is used to provide a variety of priority and routing access.

<u>Prefix</u>	<u>Priority and/or Routing Access Requested</u>
None	Basic Priority - Basic Routing
P ₁	Requested Priority - Basic Routing
R ₁	Basic Priority - Requested Routing
P ₁ + R ₂	Requested - Requested Priority Routing
P ₁ + P ₂ or R ₁ + P ₂	Dialing irregularities resulting in overflow, or announcement.
P = P, I, F, or FO key, or 1(X) assigned to priority level.	
R = 1(X) assigned to routing such as voice grade, special grade, etc.	
1,2 = Subscript denoting first or second slot.	

25.12 Basic priority and basic routing would normally be the lowest priority, and most common routing such as voice grade and basic network. However, this is dependent on the CDS- relay screening, and for a particular customer class, may be assigned differently if desired.

25.13 The interoffice signaling format is somewhat different in that priority only is assigned the first slot, and routing only, the second slot. The trunk class indication received determines whether priority and/or routing digits are required or not, depending on the network. Five priority levels, 0-4 are provided, in which level 4 is the routine, or no priority level. Levels 0-3 correspond to the FO, F, I, and P key assignments respectively.

B. Control Digit Screening

25.14 One of the CDS 00-39 control digit screening relays is operated by the customer class-of-service in the case of an originating call, or by the incoming trunk class in the case of an incoming call. The control digit information is screened through the contacts of the operated CDS- relay to operate a PRE- precedence relay and a PG- privilege group relay.

25.15 Relay PRE4 is allocated to the lowest precedence level, and relays PRE3 to PRE0 are progressively higher levels. An operated PRE- relay, besides indicating the precedence level of the call, allows preemption of a trunk handling a lower precedence call if no idle trunks are available.

25.16 An operated PG- relay controls the marker action for the various special services which may be provided, such as operating S- screening relays, grade relays, or others required for the particular privilege. Each PG- relay contains all the information, except for precedence level, for the type of call requested. Both PG- and PRE- relay operation depend upon the inclusion of the requested precedence and privilege in the customers class-of-service.

25.17 Precedence level and privilege group signals for outgoing calls are transmitted to the outgoing sender circuit on the CDP- and CD- leads respectively, with route control information on the CDA- leads. The trunk class forwarded to the outgoing sender will determine how this information will be used for the particular network.

C. Call Privilege Control - B94

25.18 Maximum flexibility of assigning control digit combinations is achieved by the control digit and screening cross-connection fields. Unused combinations or

screening outputs may be connected to a control digit grouping terminal (CDG-) for any desired treatment such as vacant code or announcement. Valid combinations will be connected from the CDP- and CD- terminals to the SR- terminals for screening according to the customers class-of-service. Outputs from the CDS- screening relays will be connected to either allow or restrict the privilege and precedence requested.

25.19 Control digit combinations for precedence levels must have their valid CDS- screening outputs connected to PRE- terminals. Valid control digit combinations for network routing must have their outputs connected to PG- terminals. Control digit information in slot one will be examined first to determine a precedence or a network routing request. In the case of a precedence digit, the PRE- and PRI relays will operate.

Relay PRI operated:

- (a) Disables the NET relay.
- (b) Enables the control digit translation and screening for slot two, allowing a PG- relay to operate.

25.20 If no network routing was requested in the second slot, the code combination CD15, CD1 is received and by screening will enable a basic network routing for the call.

25.21 In the case of a network routing control digit in the first slot, a PG- relay and the NET relay will operate.

Relay NET operated:

- (a) Disables the PRI relay thus preventing any codes in the second slot from being recognized.
- (b) Cuts in code point CDP16 which is screened for the basic precedence level of the call and operates a PRE- relay, normally PRE4.

25.22 In the case of no precedence, or network routing requested, the code combination of CDP15, CDP1; sets up basic priority, and the combination of CD15, CD1 sets up basic network routing.

D. Priority and Privilege

25.23 Contacts of the PRE- relays are used to enable routing and preemption controls for the trunks, and to transmit precedence level to the outgoing sender circuit.

Contacts of the PG- relays form a cross-connection field to transmit privilege group information to the outgoing sender, and to provide access to the various combinations of voice grade or special grade facilities, screening and grading relays, immediate pre-empt etc, for whatever specific privileges are associated with a PG- relay.

E. Relay CDS Operation - B94

25.24 The CDS- relay operates from the class-of-service of the originating customer, or incoming trunk class. For outgoing calls, cross-connections may be made to change the customer class depending on the use of a TOUCH-TONE keyset or a dial pulse set. Use of this feature is limited to access by two classes of service, and is enabled by operation of the MF or DP relay.

F. No Such Service Codes and Traffic Delays

25.25 Unassigned and restricted code combinations may be cross-connected from the control digit, and screening fields to a CDG-grouping point to enable a route to a "no such service" announcement. The NSS terminal may also be connected to enable this announcement. Relay NSS will operate on customer dialing irregularities when a network routing control digit is indicated in the first slot and is followed by another routing indication in the second slot. Ordinarily, with this type of request, no second control digit is dialed, and the CD15 and CD1 relays operate to indicate no control digit in the second slot, since all the information required is present in the first slot. However, with the CD15 and/or CD1 relays normal the high-resistance NSS relay operates, preventing operation of the PG- or NET relays, and establishing a route to the announcement.

25.26 For certain other dialing irregularities recognized by the originating register, a CDP15-CDP2 code combination is received by the marker. An example of this irregularity would be the reception of a TOUCH-TONE digit of 10 to 16 after other called digits have been registered. The CDP15-2 combination is wired to the NSS terminal for access to the "no such service" announcement.

25.27 For traffic delay conditions, the last route advance point may be steered by the PRE- relay cross-connection field, and S-screening relays to route precedence calls to an announcement trunk. Basic precedence calls would route to a tone trunk. (See Note 442.)

MULTILEVEL PREEMPTION

25.28 The 4-wire network may be used to carry important messages or data. There are five levels of importance that may be attached to a call. The use of a control digit when the call is made determine the level of importance attached to the call by the customer. These levels are called priority or precedence levels in this description. These levels are recorded on precedence level relays PRE0-4 with PRE0 being the highest level and PRE4 being routine or lowest level. The precedence level is stored in a line or a trunk when a call is made. Under busy conditions the level of an established connection is compared to the level of the call being processed to determine whether the existing connection should be released so that the trunk or line can be reused on the call being processed. The process of releasing a line or trunk for reuse is called preemption.

A. Status Connector Lead Test - SC155, FS151

25.29 Before determining the status levels of preemptible trunks or lines via the status connector, the marker first checks for false crosses or grounds on the leads to the status connector. This test is initiated by the operation of the TSTS relay and ends with the operation of TOK test clear, relay.

25.30 A standing cross check for false grounds on the status TS1-5 and TSG leads is maintained by relay XST through back contacts of relays STXA and TOK when the marker is idle. Operation of XST will operate MXT to request a trouble record.

25.31 When the marker is seized, standing cross auxiliary STXA relay is operated immediately. The operation of SXTA removes the XST relay from the TS1-5 and TSG leads, and operates the crossed status XSTG relay, and the XST- relays, each in turn, to prepare for cross test of the status multiple.

25.32 On a call to a preemptible PBX hunting group, relay SCA- in the status connector associated with the PBX, operates when the NG TB- relay is operated, and the ringing translation will operate relays RCT10, PML, and PMLL. With RCT10 and PML operated, the SCA- relay places 300-ohm ground on the SCAK lead and locks over the SCA lead through the winding of the SCAL relay. Relay SCAK operates and closes ground to the TSTS relay.

25.33 If the call is to a preemptible trunk group, the TGC- relay of the status connector will be operated from the route relay

for the selected trunk group. If no other marker is attempting to test the same trunk group, the TGBK relay will operate, and ground will be extended from the status connector on the TGG lead toward the TSTS relay.

25.34 Relay TSTS operated connects the windings of relays XST1-5 and XSTG to the TS1-5 and TSG leads to the status connector, and removes the operating ground from relay XSTG. If no ground remains on the TSG lead after TSTS operates, indicating that the lead is clear, XSTG releases. With the release of the XSTG relay, the XST- relays release in turn, checking each lead individually for false cross or ground conditions. If a cross or ground occurs on any of the TS1-5 or TSG leads, the associated XST- relay will fail to release and time out will occur to produce a trouble record.

25.35 The release of XST1 operates the TOK and TOKL, test clear relays. Relay TOK in operating, transfers the TS1-5 and TSG leads from the XST- relays to the windings of the status relays ST0-5 and grounds lead TSG to the status connector to determine the status of the PBX lines or trunks. With a preemptible trunk group, relay TOKA, test clear auxiliary, will operate to check that ground has been placed on the TGB lead and battery on the TOK lead to the status connector. Failure of TOKA relay results in a trouble record.

25.36 If two or more markers should simultaneously test the TGB lead for battery and operate their TSTS relays, the test of the status leads will be automatically synchronized in each marker for the same trunk group. At the end of the test, TOK and TOKL will be operated in each marker. Relay TOKL is very fast and operates before any TOK relay can operate. Relay TOKL in locking bypasses the contacts of XST1. This is done to prevent blocking the operation of a slow operating TOK by the possible reoperation of relay XST1 from a faster marker.

25.37 If ground is found initially on the TGB lead to the status connector, indicating that another marker is testing or using the connector multiple, for the same trunk group, relay TGBK will remain normal, grounding the TGG lead to the TOKA relay. When the other marker has completed test of the multiple, its TOK relay will place battery on the TOK lead to operate TOKA. Relay TOKA in turn operates TOK relay to enable the status level test in this marker at the same time it is enabled in the other marker(s). Relay TOK

operated maintains ground to the TGB lead and battery to the TOK lead, and opens the operate path of TSTS. On PBX recycles and second trials with number group usage, the cross test is omitted and the operating ground for relay TSTS is transferred by the TR2D or RCY5 relay to operate TOK directly.

B. Determining Status Level - SC156, 158, FS151

25.38 When relay TOK operates, the STS0-5 relays are closed to leads TSG and TS1-5 (or LSG and LS1-5) respectively to the status connector. Ground on the TSG lead is extended through the status connector to all of the lines or trunks of the group. Each line or trunk extends the ground to one of the ST-leads according to the status of the P-relays in each circuit. The TS5 lead will be grounded by any idle circuits. Leads TS1-4 are grounded by busy circuits according to the status memory in each. Ground on lead TS4 indicates circuits with routine calls, ground on TS3 indicates lowest priority traffic, TS2 the second level and TS1 the highest level that may be preempted. Grounds on any leads TS1-5 attempt to operate the associated STS-relay. However, only the higher numbered (lowest level) relay can operate. If none of the STS1-5 relays operate, indicating no circuits available, relay STS0 will operate to the TSG ground. When one, and only one of the STS-relays is operated, indicating the lowest level of lines or trunks available (idle being lowest), status check STSK relay operates.

25.39 Thus, if there is one or more idle circuits (lines or trunks), an idle circuit will be selected for the call. If all circuits are busy, the lowest level of traffic being carried by the group is determined by the status relays of the marker, and each circuit that is carrying this level is made available for preemption.

C. Selection of Line in Preemptible Hunting Group - SC158, FS149

25.40 With an STS-relay operated, indicating the status level of available lines, the corresponding STL-status level relay operates, and with SCAK operated, operates the status check STK relay. Operation of STK locks the operated STL- and provides a locking path for the status maintained STM relay. Relay STKA operates and opens the operate path of the STM which should remain locked to the STS-relay corresponding to the locked

STL-relay. If the STS-relay releases, indicating a change occurred in the status level of the lines, STM will release as an indication that the status was not maintained after STL- was locked.

25.41 Operation of STK also closes battery to a P lead to the status connector. Battery on the P leads to the status connector is extended through the connector to all of the lines of the hunting group. Each line of the same level as the operated STL-relay will extend the battery to its S1 and NS-terminal of the number group to operate marker SL-sleeve relays.

25.42 On second trials, battery is applied to the P4 lead to make lines carrying routine calls available along with idle lines for priority calls. This is done to attempt to complete a priority call if a false idle condition exists, or the last idle line cannot be selected due to trouble. When routine lines are made available with idle lines, no preference is given to the idle lines.

25.43 At the same time STK closes battery to the status connector to make lines available, the status level is matched with the priority level of the new call to operate either the no line available NLA relay, or the select line SLN relay. (See FS87.) When the marker was seized, the priority level of the new call operates one of the precedence level PRL-relays. With PMLL and STK operated ground is closed towards the NLA and SLN relays. If the priority level is not greater than the status level, NLA relay operates. Relay NLA opens the operate path of relay SAE, and forces operation of relays EG and GB to operate relay LB or PLB for line busy indication.

25.44 If the priority level is greater than the status level, relay SLN operates to permit selection of a line. Relay SLN closes a check path through PMLL and SCAK to permit operation of relay SAC. This check path assures that SCAK has locked. The operation of SAC permits line selection in the normal manner.

25.45 To check the validity of the status information, check paths are placed in the operate paths of the EG, RCL, and GB relays. Operation of the EG relay is prevented by PMLL and STM. With STM operated on all levels except STL0 at least one line should appear available. Therefore, if no line is available, either a line is indicating a false level or its battery to the SL-relay is

open, and the call blocks to give a trouble record. If the status is not maintained or STLO is operated, relay STM will release, and the call will be completed to LB or PLB. When STLO is operated indicating no lines available, no line should be found. Relay STLO operated allows SLN to operate but opens the operate path of relay RCL and allows STM to release. The release of STM permits completion of LB or PLB. If a line is found, either it is not indicating its status or false battery is closed to the SL- relay, and the call will be blocked by the RCL to produce a trouble record with the line location. If STS5 should operate, indicating the line became idle, RCL operates for selection.

25.46 To assure that the SCA- relay of the status connector circuit is locked operated when it is necessary to block hunt (status connector must be held) a check path is placed in the GB relay operate path. With PMLL operated, SCAL in series with the SCA- lock path must be operated to close ground to relay GB. If no lines in the first tens block, and SCAL is not operated, the call will block at the GB and produce a trouble record. This check cannot be passed, and will limit line selection to the first tens block if the SCA- lock path is open.

25.47 On PBX recycle, PMLL is not released and SCAK is operated as soon as the SCA- relay in the status connector operates. Check of the status leads is omitted and line selection is the same as for the first cycle.

D. Connection to Preemptible Lines - SC159, FS150, 129

25.48 On calls to preemptible lines, relays PML and PMLL are operated from the ringing translation of the number group. When the line link LG- relay is operated, relay PML closes +130 volts on the VF lead to the line to operate the line F relay and the line sleeve is closed to the windings of the LIT and LBT relays. Relay PML also operates relay KLPR and the line F relay operates relay PLFK which in turn operates MS.

25.49 If the line is idle, relay LIT operates and in turn operates LITA. With LITA and PLFK operated, the CHT relay operates and a channel is selected to complete the call. Relay LITA also closes ground through the KLP0-2 break contacts to operate LI when CHA operates on channel selection.

25.50 If the line is busy, relay LBT operates and in turn operates LBTB. When the F relay in the line operated, the PRO, PRI, and PRE leads from the line are closed to the KLP0-2 relays respectively, which operate according to the status level of the line. When the match status MS relay is operated from PLFK, ground is closed to contacts of the precedence relays PRE0-3 to determine if the line may be preempted. Relay MS is provided to allow time for any KLP- relays to operate.

25.51 If the precedence level of the new call is not higher than the status level of the line, ground is extended through the KLP- and PRE- relays to operate relay LBTA. Relay LBTA operates relay LB or PLB for routing to line busy or announcement, and enables the CHT relay to allow channel selection.

25.52 If the level of the new call is higher than the line status, ground is extended through the KLP- and PRE- relays to operate relay RLL. Relay RLL grounds the RL lead to the line to operate an RL relay in that circuit. The RL relay of the line signals the connected trunk that the call is being preempted and the trunk removes the channel holding ground to the line sleeve. When ground is removed from the line sleeve, relay LBT releases and relay LIT operates. The release of LBT releases LBTB and LIT operates LITA. With LITA and PLFK operated, the CHT relay is enabled, and the call is completed as for an idle line.

25.53 Preemptible lines may be locked out or made busy without a ground on the line sleeve. In this case, when the KTPR relay operates, all three KLP0-2 relays will operate and extend ground through the line preemption control to operate the LBTA relay.

25.54 Four-wire lines that are not equipped with F relays and require ringing from the trunk do not use relay LNP or PML. These lines, however, may be locked out. In this case, the line connects ground to its T1 lead and battery to the R1 lead. Relay LI operates through back contacts of relays LNP and PML, and the marker sets the channel in the normal manner to operate GTK and GT1. With GTK and GT1 operated, the T1 and R1 leads from the line are connected across the winding of the lockout LOL relay. If the line is locked out, relay LOL operates and opens the ground to the DCT1 and operates relay PBL or LB. Relay PLB or LB recycles the marker for completion to line busy or announcement.

E. Storage and Check of Precedence Level
in Multilevel Lines - SC160, FS129

25.55 On calls to preemptible lines, the operation of PML or LNP relay will have already extended the VFT lead to the line circuit to operate the line F relay. Relay CNA is cross-connected to operate on calls from preemptible lines to perform the same function. The line F relay must be operated in order to store the precedence level in the line on the PR- leads. Relay CNA operated also operates the store line precedence (SLPR) relay following channel selection when the CHAL relay operates. If KLPR relay was operated on a call to a preemptible line, it is released by the operation of SLPR relay, thus preparing the PR- leads to precedence level storage.

25.56 Relay SLPR, and the line F relay close grounds from the PRL0-3 relays over the PRO, PRI, and PRE leads to the precedence memory relays P0-2 in the line circuit. The memory relays of the line circuit operate and lock according to the precedence level indicated by the operated PRL- relay. When HMS1 operates following hold magnet timing, relay KLPR operates. Relay KLPR transfers the PRO, PRI, and PRE leads from the PRL- relays to the windings of the KLP0-2 relays respectively. If the KLP- relays operate in accord with the operated PRL- relay, the line precedence memory check relay LPMK operates. Relay LPMK locks when DCTA operates to release the line F relay and closes part of the operate path of the DIS1,2 relays.

25.57 If relay LPMK fails to operate, indicating a failure in storing the precedence level in the line, ground from relay LK1 or DCT2 operates relay TRRA. Relay TRRA operates TRR to produce a trouble record with normal release.

25.58 On intraoffice calls, relay LPMK is used to check the called line, and relay TPMK is used to check the calling line. Relay TPMK functions the same as LPMK. When no precedence level is to be stored in the line, relay CNA normal, operation of HMS1 operates LPMK, and also TPMK on intraoffice calls to bypass these checks.

F. Selection of Trunk in Preemptible Group -
SC156, 157, FS151

25.59 When the route relay of a preemptible trunk group is operated, the associated TGC- relay of the status connector is operated by the CP- cross-connection of the route

relay. Operation of the TGC- relay in the status connector connects the trunk group multiple to the status relays to operate an STS- status relay, and STSK status check relay. The STS- operates the corresponding STL- to indicate the status level of the trunk group.

25.60 If there is one or more idle trunks in the preemptible group, one or more FTC- relays will operate to operate FTCK and an FS-. At the same time, STL5 will be operated by the trunk status to operate relay STK. Relay STK locks to STL5 and closes start battery to seize the trunk link frame. Following trunk link frame seizure, trunk selection is the same as for regular trunks, and the precedence level of the call will be stored in the trunk.

25.61 If all trunks are busy, but one or more trunks are available for preemption, one of the STS1-4 relays will be operated by the trunk status. When STSK operates, ground is extended through the operated STS- relay to a group of TP leads to the status connector to make trunks of the corresponding level available. Ground on the TP leads is extended through each trunk of the group carrying the same level of traffic as the operated STS-, and is returned to the marker on the FTC- leads to operate one or more FTC- relays, FTCK, and an FS- relay. Relay STK operates, and dependent on the preemption indications, a TL may be seized. (See B16.)

25.62 If NPRC is operated, indicating no preemption should be made, the no trunks available relay NTA is operated when all trunks are busy. Relay NTA grounds the RA lead to operate RAV1,2 for route advance.

25.63 If PRC is operated, indicating preemption may be applied, the contacts of the PRL0-4 are enabled for matching with the status level.

25.64 If the operated PRL- relay is not lower in number (higher status) than the operated STL0, NTA operates for route advance. If the operated PRL- relay is lower in number than the operated STL-, the trunk link frame is seized. (See B16.)

25.65 Selection of a busy trunk in a preemptible trunk group is different than the normal selection of idle trunks of a group. An operated STL- relay directs the trunk selection to those trunks of a trunk group

that have a stored precedence level corresponding to the STL-. There should be no trunks in the group having a lower status, as the STL- relay was selected for the lowest status available, and trunks in the group having a higher status must not be preempted. (See B18.)

25.66 The TGA lead corresponding to the operated STL- relay is extended to the trunks of the trunk group through contacts of the operated trunk link TG- relay. Ground on the TGA lead is closed through all trunks of the group having the corresponding STL- status, through the trunk FP relay and back to the marker on a BT lead in the selected trunk block. A trunk is selected as normal, resulting in an operated TT- and TS- relay.

25.67 The TS- relay releases TSE1,2 to close a high-current circuit through the winding of STOK and the trunk FP relay to operate both. Relay STOK locks and the trunk FP relay signals preemption to the connected line and to the distant office. When the line has disconnected and, the trunk supervisory relay released, the trunk operates the FR- or FS- relay of the trunk link which causes operation of FAK or FBK relay. Operation of FAK or FBK permits channel selection for completion of the call, and storage of the new precedence level in the trunk.

25.68 The TGA leads for lower status than the selected STL- relay are also grounded and closed to trunks of the trunk group. It is possible that a trunk lower in status than the operated STL- may become available after STL- is locked. If this happens, the trunk can be selected, but relay STOK will not operate. This will not prevent completion of the call. If STOK is not operated, then a trunk of a lower level than the status indication was selected. If STM is operated, the trunk is not indicating its correct status, and a trouble record is taken.

25.69 If no trunks are available for preemption, STS0 will be operated. Relay STS0 operates TBTB to start trunk busy timing. If no trunk becomes available in approximately 30 milliseconds, TBT will operate to cause route advance.

G. Storage and Check of Precedence Level in Trunks - FS129

25.70 On calls to or from multilevel trunks, the precedence level of the call is stored in the trunk through the STPR or SLPR

relays. Storage is made through the STPR relay to the PRO, PRI, and PRE leads to the trunk link connector on outgoing, tandem outgoing, and incoming local completion calls. The SLPR relay and PRO, PRI, and PRE leads to the line link connector are used on incoming through switched calls.

25.71 Relay STPR is operated by CHA1 through STKA or 2LV on outgoing and TOG calls, and through RTN operated on incoming local completion. Relay RTN is operated from the incoming trunk class on the trunk link. When HMS1 operates following hold magnet timing, KTPR relay operates. The KPT- relays operate in accord with the locked memory relays in the trunk, and if they are in accord with the operated PRL- relays, the trunk precedence memory check TPMK relay operates. If TPMK fails to operate, indicating storage failure, a trouble record is made before operating DIS1,2 for normal release.

25.72 On through switched calls, the precedence level is stored in the incoming trunk through SLPR and the line link connector. The class-of-service of the line link appearance of the trunk operates relay CNA. Storage and check of the level in the incoming trunk is the same as that described for multilevel lines.

25.73 When no precedence level is to be stored, relay NST will be operated with 2LV relay normal on outgoing calls, or RUN and TER4 will be operated on incoming local completion. Relay NST operated also bypasses the trunk status match before TL seizure. In either condition, TPMK is operated by HMS1 to bypass this check. On through switched calls, CNA will be normal for the incoming trunk and LPMK is operated by HMS1 to bypass the check.

25.74 On calls to trunks that cannot recognize line preemption, relay NPC is operated by the route relay. Relay NPS operates NPCA relay to cancel the precedence level of the call and forces status level P0 to be stored in the line circuit.

H. Trunk Available Timing - FS149, FS54

25.75 The trunk available TA relay is operated when a trunk is available for selection.

25.76 Relay TA has the following functions:

- (a) Controls the TBT timer to check status level indications, and initiate TL frame tests.

(b) Indirectly controls the TBT timer a second time by requiring the operation of either TE or OT relay to seize the trunk and cancel timing.

(c) In combination with TSEL relay, determines on first trial operation, whether a time out will cause a trouble release and trouble record, or a route advance.

25.77 Following the frame test, the TA relay should operate through FTCK operated with associated FTC- and FS- relays operated. Relay TA starts the TBT trunk busy timer. If the FTCK relay should fail, TA will be held operated through an STL1-5 relay operated, or if the status check (STK) relay fails to operate, TA will be held through STK released. Relay STK should operate with FTCK operated causing the release of TA relay, and end of TBT timing.

25.78 The TBT timer is enabled a second time with the operation of the TBK relay. This timing interval guards the period after TL frame seizure until a trunk has been definitely seized, TE or OT relay operated, which should occur before TBT relay operates. With TBK relay operated, TA relay should remain operated, and the TBT timer controlled by the TSEL, and TE or OT relays.

25.79 A time out may occur as follows:

- (a) A trunk is not selected, indicating an open BT or TG lead.
- (b) A trunk has been lost because of seizure or preemption from a distant office. The FTC- relay releases and releases TA relay. Relay TA released prevents operation of TE or OT relay.
- (c) If the status changes before trunk selection, the release of STM relay releases TA relay, preventing trunk selection and causing time out. If the trunk has already been selected, TSEL released, the release of STM reoperates TA to allow trunk seizure.

I. Miscellaneous Operations

25.80 If the call is to a line of a preemptible PBX hunting group, seizure of the NG, and operation of the RCN- relay results in the operation of one of the LNPR, LNP, or PML relays. The LNPR relay operates on all lines that require ringing. Relay LNP operates for nonpreemptible lines that require ringing to be canceled. The PML relay operates for preemptible lines and cancels

ringing. Relays LNP and PML transfer the operating ground for the RS- relays to the winding of relay CSW. Relay CSW cancels the setting of ringing in the trunk.

25.81 On calls to operator lines, the ringing combination operates directory number DN relay. Relay DN grounds the CN lead to the incoming trunk to permit flash recall by the trunk.

25.82 On calls to lines with off-hook service, the ringing translation from the number group operates relay OHS or RI through cross-connections on the privilege group PG-relays. Operation of OHS permits completion to the line. Operation of RI directs the call to intercept.

25.83 On calls to test lines, the ringing translation from the number group operates relay KM. Relay KM operates NPCA to cause preemption level PO to be stored in the incoming trunk. Relay NPCA may also be operated by the master test control circuit.

25.84 On test calls to made-busy lines MT35 operates MT33. When LITA operates, ground through KLP0-2 operated, operates MT34. Relay MT34 removes ground from the BYP lead to the line to release the busy condition and releases MT33. Relay MT33 is slow release to allow time for release of the KLP0-2 relays.

25.85 When a route relay operates, grounds on the FTC leads from the trunk links operate their corresponding FTG- relay. The FTG- relays operate their corresponding FTC- relay. The FTG- relays are provided to reduce the current through trunk and status connector contacts.

POLYGRID ROUTING NETWORK

25.86 A 4-wire polygrid switching network is composed of all equal rank switching centers. This means that no subset of switching centers are dependent on the remainder for their communications. In addition to the equal rank switching centers there will also be PBX stations that are either singly homed on one of the equal rank centers or possibly dual homed on two of the equal rank centers. Of the equal rank centers there are two categories:

- (a) Home grid - A set of switching centers surrounding and directly connected to a destination switching center. These home grid centers have sufficient inter-connection among themselves to permit a

call arriving at anyone of these centers to be routed laterally to at least two other centers in the home grid if the call cannot be completed directly.

(b) External grid - Any equal rank switching center that is not in the home grid for any destination is an external grid center for that destination.

(c) The 4-wire routing control digit and polygrid routing control features must be provided at each office for both home and external grids.

25.87 The polygrid network was designed to provide a more reliable and survivable military communications system. Since every equal rank switching center has trunk groups to a large number of other switching centers, extensive alternate routing is possible.

A. Route Control

25.88 Route program (RM) relays operated from code points or screening points control the selection of routes. Each program relay controls the selection of up to three route relays directly and a possible six more route relays indirectly. Thus, on a call up to nine routes may be controlled by one RM relay. These routes are divided into groups called triples as follows:

- (a) Most Direct Triple (MDT) - Three best routes to a destination.
- (b) Best Alternate Triple (BAT) - Next three best routes to a destination.
- (c) Second Best Alternate Triple (SBAT) - Three additional routes.

Route Control Principles Forward and Lateral Routing

25.89 Forward routing may be defined as advancing a call to a switching center which is one link nearer the destination. To meet the definition of forward routing, there must be no traffic programmed for that destination in the reverse direction over the trunking group in question. Lateral routing may be defined as routing a call to a switching center which is in terms of numbers of links away from the destination, neither nearer or further than the switching center from which the call was routed. In this case there may be traffic for the same destination

programmed in the reverse direction of the trunk group in question. Lateral routing has to be distinguished from forward routing for the same destination to prevent "shuttle" and "ring-around-the rosie" where a call could possibly double back to the originating office. No routing to offices that are more linkages away from the destination will be allowed as this could also result in "shuttle" or "ring-around-the rosie".

25.90 Routing from external grid offices may look at a maximum of three triples. The first is the most direct triple which represents a set of three forward routes. The second is the best alternate triple and the third is the second best alternate triple. Both the best and second best alternate triples represent lateral routes.

25.91 Routing from home grid offices look at the destination first and then look at the best alternate triple and second best alternate triple. Again the best alternate and second best alternate routes represent lateral triples. Any call arriving at or originating in a home grid does not leave the home grid in further routing. It can, therefore, be seen that trunk groups from an external center will not be programmed with reverse traffic for the particular destination center in question.

Precedence Levels and Routing Information

25.92 The military network has five levels of precedence - P0-P4 with P0 being the highest level of precedence. The P0-P3 calls may preempt calls of lower precedence levels if all selected routes are busy. This is accomplished by two separate marker usages.

- (a) Polite or nonpreempt cycle routes are tested for idle trunks only.
- (b) Preempt cycle routes are tested for idle or preemptible trunks. Calls having a higher precedence level than other calls in a trunk group will preempt the lowest level of call in that trunk group. (Idle trunks are preferred to busy, preemptible trunks.)

25.93 In the external grid the most direct triple has the best routing to a destination. The polite cycle limits the alternate routing by selecting only routes in the most direct triple (MDT) to avoid excessive linkages being established on a priority call.

On the preempt cycle, the most direct, best alternate and second best alternate triple routes may be looked at, depending on the route control digits received and priority level of the call.

25.94 In the home grid the routing is slightly different than in the external grid. Rather than having a direct triple there is a direct route only. The best alternate and second best alternate triples are still used. The direct route is looked at on the polite and preempt cycle. The best alternate and second best alternate triple may be looked at on both the polite and preempt cycle depending on the route control digit received and priority level of the call.

External Grid Routing

25.95 Cross-connection Information Note 445 shows a typical routing pattern for voice grade priority (P0-3) traffic from office (1) to (17). If there is a direct trunk group to (17) this would, of course, be tested first. If a direct trunk group is not available or if it is busy the marker will try to route the call to an office in the MDT on the polite cycle. If all these trunks are busy the marker will release and a second marker will be seized for the preempt cycle. Again if a direct trunk group is available it will be tested first and if it is preempt busy (all calls in the group of equal or higher precedence level than this call) the marker will try to route the call to the MDT, BAT, and SBAT in that order. Once a call arrives at 6, 7, 8, 12, 13, 15, or 21 it is then in the home grid for destination 17.

25.96 If the call does not find a route available to a home grid office (MDT from office 1) the call would then route to its, BAT (3, 4, or 5) or SBAT (9, 10, or 11). If the call were routed to office (3, 4, or 5) the call would then have access only to its MDT (6, 12, or 15) or the SBAT (9, 10, 11). If the call were routed from 1 through the BAT (3, 4, or 5) to a SBAT office (9, 10, or 11), the call would only then have access to its MDT (8, 13, or 21). This results in looking at 9, then 6, and then 3 possible routes while zeroing in to the destination until the call arrives at the home grid. Special grade routings are an exception to this. Only the MDT routes are looked at on special grade calls on both polite and preempt cycles to limit the number of linkages between offices.

25.97 To accomplish this zeroing in, and to prevent a call from switching back on itself, (returning to an office it has already been switched through) a routing control digit

is transmitted with each call. This digit informs the connecting office which, if any, alternate triples may be used. (See cross-connection Information Note 445.)

Home Grid Routing

25.98 Cross-connection Information Note 444 shows a typical routing pattern for voice grade or special grade traffic (home grid routing uses the same routing pattern for voice grade and special grade calls) with a table showing the routing for calls originating or tandeming through any office to destination 7. A routing control digit is transmitted with each call as in external grid routing. However there is one difference. For home grid routing each route in a triple has individual control digits while for external grid routing each route in a triple receives the same control digit.

Route Control Digits

25.99 The route control digits (RCD-) transmitted from an office are as follows:

- (a) RCD0 - Test both alternate triples.
- (b) RCD1 - Test the best alternate triple.
- (c) RCD2 - Test the second best alternate triple.
- (d) RCD3 - Test no alternate triples.

25.100 With any RCD- received the most direct route and/or triple would be tested first. Relay RCD0 received means to route freely. This digit would be sent to the most direct route and/or triple since this is forward type of routing and, therefore, there would be no routing from any of these MDT offices back to any of the BAT or SBAT offices since this would be backward type routing which is not allowed. Relay RCD1 allows the best alternate triple to be tested. Relay RCD2 allows the second best alternate triple to be tested. To decide which digit to transmit the routing program at the connecting office must be considered.

25.101 The routing illustrated in cross-connection Information Note 445 shows the proper routing control digits assigned to office one with the routing program at the BAT and SBAT offices also shown.

25.102 Cross-connection Information Note 444 lists the routing control digits to be sent when within a home grid, assuming the call arrived or originated at an office in the grid.

B. Route Control Digits and Screening - FS140, 143, 145

25.103 The incoming register passes the routing control digit information over the CDA0/7 leads to operate the CDR- relays, on a 2-out-of-5 basis. On originating calls, the CDR 4 and 7 are operated directly. Contacts of CDR- relays operate CDRA0-3 relays through a 2-out-of-5 check of the CDR- relays. An integrity (only one-up) check is performed on the CDRA0-3 relays before the marker attempts to select a MDT route (FS143).

25.104 Voice grade and special grade screening on a code point basis may be obtained by using the GR0-7 multicontact screening relays or S- relays. Sixty GC (grade common) punchings, which appear on the program routing frame, have access to code points. The GC punchings 00-29 are multiplied across the fixed contacts of relays GR0-3 and GC30-59 across relays GR4-7. The make contacts, wired to punchings G00-29 (0-7), have access to RC-, SC- (routing control digit received), and RMW-points. See Note 435.

C. Routing Program Relay - FS144 and 145

25.105 The RM00-143 relays are operated from code points or screening points and provide polygrid routing by controlling the following functions:

- (a) The MD--, BA--, and SBA-- terminals off the RM-- relay provide selection of up to three route relays in sequence as directed by the marker route advance functions. If all three routes are not provided, an early route advance or early group advance is initiated.
- (b) The GA--, group advance terminals control the selection of an additional R- or RM- relay, or extends ground to the FSP (final screening point) terminal. (See 25.122 through 25.125.
- (c) In external grid offices the FGA-- and SGA-- terminals control the operation of a second and third RM-- relay (the best alternate and second best alternate triples) as directed by the received route control digits and marker group advance functions. An exception to this is special grade routings. Special grade routings are limited to the most direct triple to limit the number of linkages between offices, and do not use the FGA-- and SGA-- terminals.
- (d) In home grid offices the most direct route relay operates the BAT RM- relay from its RA- point. If route control digit

2 or 3 is received the route relays selected by this RM- relay are skipped by the initiation of an immediate group advance. If route control digit 0 is received the BAT route relays are examined for idle or preemptible trunks. If a route control digit 1 is received the BAT route relays may or may not be examined for idle or preemptible trunks depending on the priority level of the call (see 25.145). The FGA-- terminals control the operation of the SBAT RM-- relay as directed by the received route control digits and marker group advance functions. The SGA-- terminals control the selection of the MD special grade route for priority levels desired on voice grade calls. (Refer to Note 435.)

(e) The RS-, route series terminal provides selection of the proper route series relay (see 25.126).

(f) In a home grid, the RM- relay contacts associated with the CDM-, CDB-, and CDS-, routing control digit terminals, select the proper routing control digit to be transmitted to the sender for the corresponding MD, BA, and SBA route.

(g) In external grid offices, the RM- relay contacts associated with the CDM-, CDB-, and CDS- terminals select the proper route control digit to be sent to the corresponding MDT, BAT, and SBAT in a routing pattern. These contacts select the proper route control digit to be transmitted to the sender for as many as three triples in a preempt cycle. In the polite cycle, only CDM- is used and, route control digit zero is sent to all offices in the most direct triple.

D. Routing Groups 1-6

25.106 Each RM-- relay is associated with one of six routing groups by cross-connections to an RG- relay. Only one RM- relay in a group may be operated at any one time, therefore, if a second RM-- relay is operated on a call it must be in a different routing group. The routing group (RG1-6) relays, operated in series with an RM-- relay, perform the following functions:

- (a) Operates the SRL relay to select the first route in a triple.
- (b) Operates one of the auxiliary RGA (1-6) relays that is associated with the first RM- group operated on a call.
- (c) Operates the auxiliary RGA relay.

(d) Operates the HGD (home grid) relay or EGD (external grid) relay associated with the first RM-- relay operated on a call.

25.107 The RGA- that operates performs the following functions:

- (a) Locks itself operated and prevents operation of any other RGA- relay.
- (b) Controls the selection of the additional RM- relays until the LGA relay operates.
- (c) Controls operation of a route series relay if one has not been previously operated (see 25.126).
- (d) Controls the selection of the route control digits to be outpulsed until the LGA (last group advance) relay is operated.
- (e) Controls the selection of the traffic registers that may operate for peg count and overflow.

25.108 The RGA relay performs the following functions:

- (a) Prevents the operation of the GS-- relays on route advance.
- (b) Transfers control for the operation of the route control digit to be outpulsed, to the RM- relays.

Home Grid or External Grid Routing - FS143, 145

25.109 The group of RM- relays that are associated with home grids have an RG- relay in series with them that operates at the same time the RM- relay operates. The HGD relay operates through a RG- contact and locks through a CKG3 contact. If the first RM- relay operated on a call is in an external grid group then the EGD operates through a RG- contact and locks through a CKG3 contact. The selection of either the HGD or EGD relay must be made before a group advance occurs which would operate an AGA- relay and open the HGD and EGD operate paths. This allows the selection of a RM- relay for an alternate triple for one code point even if it is used for a most direct triple for some other code point. Operation of the HGD or EGD relay determines the routing pattern to be used.

E. Route Selection - FS143, SC138

25.110 The SR1-2 and 3 relays are wired in a chain walking circuit to control the selection of the 3 route relays available through an RM-- relay. Relay SR1 operates when any RG- operates and locks through contacts of SR2, SR3, and CKG3 ground. On a route advance, SR2 operates through make contacts of SR1, and transfers the locking path of SR1 to the operated RAV1. When RAV1 releases, SR1 releases. On the next operation of RAV1, SR3 will operate. Relay SR2 will release when RAV1 releases. On the next route advance an AV- relay will operate initiating a group advance.

25.111 Relay SR1, SR2, and SR3 sequentially extend a ground through RM-- contacts to operate one of the route relays in a triple. On different marker usages the order of selection of these route relays in a triple is rotated. All three routes are tested in a triple regardless of the route control digit received. After these three routes are tested the marker will group advance.

Rotation - FS143

25.112 The rotate ROT relay is controlled by the precedence PRA0-4 relays. The levels of precedence that require rotation will have an associated P0-4 punching cross-connected to the ROT punching.

25.113 The RO1, RO2, and RO3 relays are operated from the JSQ-5 relays (FS14). If the ROT relay is operated, the RO1-03 relay that is operated controls the order of selection of route relays in a triple. This results in a different order of selection of routes on successive marker usages on priority calls.

F. Group Advance - FS143-145, SC138

25.114 Group advance is an extension of the marker route advance feature. After a triple has been tested for idle or pre-emptible trunks without success, the SR-(1-3) relays are released and the routing group associated with the triple tested is locked out. An RM-- relay in another routing group or an R- relay may then be operated.

25.115 A group advance is initiated when all routes controlled by a program relay are examined or when a BA or SBA punching is cross-connected to EA or ERA punching. (See

Note 435 and 25.139 and 25.140.) The AV- relay operates at this time which in turn operates the corresponding AG- and AGA- relays. This opens the wiring to the contacts of the associated RM-- relay that controls operation of the route relays through MD--, BA, and SBA-- punchings. The reset (RS) relay operates to release any operated SR- relays.

External Grid Special Grade Calls

25.116 With RAV1 and SRL-3 normal, and AG- operated, AV- releases to extend ground to the GA-- punching which may be treated the same as a route relay route advance point. The LGA relay operates at this time. Relay RGA and RST releases when AV- releases.

External Grid Voice Grade Calls

25.117 On a first group advance, with RAV1 and SRL-3 normal, and AG- operated, AV- releases causing FGA to operate. The FGA, SGA, and TGA are wired in a chain walking circuit to control the selection of the best alternate triple and second best alternate triple program relays and to provide access to the GA-- punchings through RM-- relay (most direct triple) contacts. When FGA operates it locks through contacts of SGA, TGA, and CKG3 ground.

(a) Polite Cycle - When FGA operates, ground is extended to the GA- punching or FSP as directed by the priority level of the call. If ground is extended to a GA- punching the LGA relay will be operated and control of any additional routes selected is removed from the group advance relays FGA, SGA, and TGA and transferred to the AG- and AV- relays through the GA- points.

(b) Preempt Cycle - When FGA operates ground is extended to the FGA-, SGA-, GA-, or FSP punching as directed by the priority level of the call and routing control digit received. If ground is extended to a GA- punching the LGA relay will be operated and control of any additional routes selected is removed from FGA, SGA, and TGA relays and transferred to the AG- and AV- relays through the GA- points. If a GA- punching is not grounded, the SGA- relay will control the selection of any additional routes.

(c) Second Group Advance - (LGA not operated) When AV- releases, SGA operates through a make contact of FGA and transfers the locking path of FGA to the second group advance relay operated. When SGA operates

it breaks the holding path of the last RM- relay operated and its routing group RG- relay. The RG- relay released causes the AG- associated with this RM- relay to release, and to release FGA. When FGA releases, ground is extended to the SGA-, GA-, or FSP punching as directed by the priority level of the call and routing control digits received. Since the previously operated RM- and RG- relays have released the next RM-- relay operated may be in the same routing group (RG-) as the previous RM-- relay. If the LGA relay is not operated, control of any additional routes to be selected is transferred to the TGA relay.

(d) Third Group Advance (LGA not operated) - When AV- releases, TGA operates through a front contact of SGA and transfers the locking path of SGA to the third group advance relay operated (there are only two group advance relays operated at this time).

25.118 When TGA operates it breaks the holding path of the last RM-- relay operated and its routing group RG- relay. Relay RG- released causes the AG- associated with this RM- relay to release which releases SGA. When SGA releases, a ground is extended through the GA-- punching which may be treated as a route relay RA- point, and the LGA relay will operate at this time.

25.119 In all group advances in the preempt cycle RGA and RST release when AV- releases.

Home Grid Voice Grade or Special Grade

25.120 The best alternate triple RM- relay controls the selection of additional routing through the FGA-, SGA-, and GA- points for the polite or preempt cycle in the same manner that the external grids most direct triple RM- relay contacts control the selection of additional routing in the preempt cycle.

Last Group Advance - FS145

25.121 Operation of LGA removes control of the route control digits to be outpulsed from the RGA- relay that has been previously operated, and from the first RM-- relay. Any additional RM-- relays that are operated through GA-- punchings would then control their own route control digits to be outpulsed.

Final Screening Point - FS145

25.122 When the last route is tested for idle or preemptible trunks ground is extended through the GA-- punchings or a RA-- punching to the FSP punching.

25.123 If the call is a P4 (routine) level, ground is extended to the PB punching to operate the PB relay indicating that all paths are busy.

25.124 If the call is a P0-P3 (priority) level, polite cycle, ground is extended to operate the RR relay. This results in the call advancing to the preempt cycle.

25.125 If the call is in the preempt cycle, ground is extended to operate an R-relay associated with an announcement trunk to indicate a busy condition on a preempt basis.

Route Series Operation, FS143-145

25.126 Punchings RS-- are used to associate a route series relay with each RM-- relay. Since more than one RM-- relay may be operated on a call, the RG1-6 relays remember which RM-- operated first, and prevents operation of a second route series relay. Relay PRR prevents operation of any route series relay associated with an RM-- relay if a route relay and associated route series relay was operated first, and the RM-- relay operated as a result of a route advance.

Route Relays Used for Polygrid Routing

25.127 Ground supply assignments need not be considered when selecting R- relays for use with the polygrid network trunk groups. All 3-route relays associated with each routing program relay that is operated on a call could be in the same ground supply. The GS-relays will not operate on a route advance to a route relay operated from a RM- relay. The RA- cross-connection may be omitted on route relays operated only from RM-- relays.

Route Advance

25.128 With polygrid routing the maximum number of route advances has been significantly increased on a single marker usage. Three routes in each of the six routing groups RG1-6 and one route in each ground supply could be tested for idle trunks.

G. Routing Control Digit - FS141, 144-145

25.129 The routing control digit (RCD), transmitted to the sender on all calls, may be derived in any one of the following ways:

1. Relay RM-- Operated for Home Grid

(a) All SOG calls, and TOG calls arriving with CDR digit of "0", will use the CDM--, CDB--, and CDS-- cross-connections.

(b) All TOG calls arriving with a CDR digit other than "0", the RM-- contacts are bypassed and RCD3 is generated directly.

(c) The generated RCD digit may be deleted by cross-connecting the route relay CL-- punchings to CL1P. An arbitrary digit may then be generated to replace the RCD- by connecting the route relay CR- punchings to CR0P-3P.

2. Relay RM-- Operated for External Grid

(a) All voice grade SOG calls, and TOG calls arriving with CDR digit of "0", will use the CDM--, CDB--, and CDS-- cross-connections on the preempt cycle. Special grade calls and all calls in the polite cycle will use the CDM-- cross-connection only.

(b) All TOG calls arriving with a CDR digit other than "0", will use the CDM-- cross-connection for the most direct triple. On alternate triples the RM-- is bypassed and RCD3 is generated directly.

(c) The generated RCD digit may be deleted by cross-connecting the route relays CL-- punchings to CL1P. An arbitrary digit may then be generated to replace the RCD- by connecting the route relays CR- punchings to CR0P-3P.

3. Relay RM-- Not Operated

(a) When an RM-- relay is not operated or polygrid routing control is not provided RCD0 is always generated but the method described above in Relay RM-- Not Operated, part (c), may be used to alter the digit transmitted to the connecting office.

H. Miscellaneous OperationsPeg Count and Overflow - FS144, 145

25.130 With option ZZF, peg count of all polygrid routing calls attempted are broken down into the following three categories:

(a) Polite cycle TOG calls.

(b) Polite cycle SOG calls.

(c) Preempt cycle all calls.

25.131 The control path for the operation of the traffic register circuits is through contacts of an operated RGA-- relay, an RM-- relay associated with the RGA-- relay (the first RM-- relay operated on a call) and screening relays TOG-, SOG-, or PE- in the Auxiliary Peg Count Circuit SD-27745-01. The selected register is operated when PEG1 or RAV1 is operated if RA6 is operated or when TOA or RBT is operated.

25.132 Peg counts of all polygrid routing calls that overflow are broken down into the following categories:

- (a) Polite cycle all calls.
- (b) Preempt cycle all calls.

25.133 The control path for the operation of the overflow traffic register circuits is through contacts of the operated RGA-, AGA-, and RM-- relays associated with the RGA- relay (the first RM-- relay operated on a call) and screening relays OFR- or OFP- in the auxiliary peg count circuit. The selected traffic register is operated under any of the following conditions.

- (a) The call has route advanced to a tone trunk route relay in ground supply six (operation of RA6) and PEG1 or RAV1 operates.
- (b) If RBT operates (no tone route available).
- (c) If TOG operates (no trunks available on TOG calls).

25.134 With option ZZG, the peg counts for polygrid routing calls attempted are broken into two categories:

- (a) Polite cycle SOG calls.
- (b) Preempt cycle all calls.

25.135 The control path for the operation of the SOG polite cycle traffic register (PTR-- leads) is through contacts of an RM-- relay, an associated RGA-- relay, through SOG1 and NPROC or PRC and IPR contacts through RGA, CKG3 contacts. The operating ground is provided when PEG1 or RBT is operated.

25.136 Control path for the operation of the traffic register (PCP lead) for all preempt calls is through the back contact of relay IPR, through PRC, RGA, CKG3 and either RBT, TOA, or PEG1 relay contacts.

25.137 With option ZZG, the peg counts of all polygrid routing calls that overflow are broken into two categories:

- (a) Polite cycle all calls.
- (b) Preempt cycle all calls.

25.138 The operate path for overflow traffic register (OTR lead) for all polite cycle calls is through RGA--, AGA-- relay contacts operated, through back contact of DIS2, and either NPROC or PRC and PRA4, RGA, and CKG3. Operate ground is provided by RA6 and PEG1 or RAV1, or RBT, or TOA contacts.

25.139 Operate path for overflow traffic register (OTP lead) for all preempt cycle calls is through the back contact of PRA4, contacts of relays PRC, RGA, and CKG3. Operate ground is provided by the RA6 and PEG1 or RAV1, or RBT, or TOA relay contacts.

Immediate Preempt Cycle - FS143

25.140 Polygrid routing priority calls normally cause the marker to go into a polite cycle first and then finding no idle trunks go into a preempt cycle. Exceptions to this are:

- (a) Voice alert calls - The IPR relay is operated from PG-- relays. Operation of IPR results in operation of the PRC relay.
- (b) An IPR key in the master test frame, jack lamp, and key circuit may be operated. This will operate the IPR relay. Operation of IPR results in operation of the PRC relay on each marker usage.
- (c) Immediate preempt cycle for specific code points - The IPR relay may be operated from PC- (preroute) relays which result in operation of the IPR relay.

25.141 When the PRC relay is operated the marker immediately goes into preempt operations on 4-wire calls.

Early Route Advance or Early Group Advance

25.142 If the most direct or best alternate route of a triple is not provided the MD- or BA- punching is connected to the ERA punching. If the SBA route is not provided the SBA- punching is connected to the EA punching.

25.143 If the ROT relay is not operated then when a ground is extended to the EA punching, an AV- relay operates. This initiates a group advance (see 25.114 through 25.128). If the ROT relay is operated then a ground being extended to the EA punching has the same results as a ground on the ERA punching.

25.144 When a ground is extended to the ERA punching the RAV1 relay operates. This steps the walking circuit to prepare for the next route selection and opens the ground to the ERA punching. The RAV1 relay releases and ground is extended to the next route relay in the sequence.

Priority Level Screening

25.145 Screening is provided in the polygrid routing control circuitry to control the selection of alternate routes by priority levels. The P(0-4)1-7 punchings have access to various other punchings to control the number of routes looked at for different priority levels (see Note 400, Part 71, and Note 435).

Precedence Level and Route Control Digit Screening

25.146 Marker translation consists of changing the office code digit information into a single indication, which is called a code point. However, a route is not necessarily identified by the code point or a route advance point alone, but at times requires additional translation. Polygrid routing employs screening by route control digit received and precedence level of the call. The CDR0-3 (route control digit received) and PRA0-4 (precedence level) punchings may operate S- relays. Cross-connections between code points, route advance, or group advance points and precedence level or route control digit screening points control the selection of route and route program relays when this type of screening is required.

I. Routing Program Frame

25.147 The RM-- frame provides a method of segregating the routing and rating for originating traffic when the complexity of the job exceeds the capability of the S- screening field. This frame provides up to 155 RM-- relays and associated cross-connection fields. These relays are provided in single mounting plate units. Each unit has 12 relays. Twelve make-contacts are multiplied across the 12 relays and brought out to the RMC- (00-11) punchings. The fixed contacts are wired to the RM-- (00-143 punchings. The windings appear on punchings RMW00-143.

25.148 Cross-connecting a RMW- to a code point(s) or S- point(s) will associate a RM- relay with a code point or group of code points. Connecting an S- point to a RMC- point provides a RM-- point through 12 RM-- relays for the service represented by the S- punching. By connecting like numbered RMC- points together, this one S- punching can operate route relays for up to 114 separate code points or groups of code points. Thus one SC point and its associated S- points can be multiplied up to 114 times through the use of these relays. A second SC point and associated S- points may be connected to other RMC- punchings on the same RM-- relays to determine the required charging treatment. Secondary screening may be required between the RM-- punchings and the route series relay when the charge pattern is complex.

J. Cancel Ringing Switch Operation on 4-Wire Line Intercept

25.149 Option ZOP is added to provide a cross-connect field for ringing selection on 4-wire line intercept. A separate terminal is provided for 4-wire regular, blank number, and trouble intercept. Each may be cross-connected to the no ringing NRG terminal to cancel the operation of the ringing switch or to the intercept ringing IRG terminal to provide ringing from the ringing switch. With this feature, the 4-Wire Intercept Line Circuit, SD-27647-01, can be arranged to not return a short off-hook to trip ringing in the incoming trunk. This off-hook, if returned, could be reflected back to the calling office. If the call originated from a 757, No. 1A ESS, or No. 101 ESS PBX the customer could be left high-and-dry or is connected to dial tone depending on the PBX.

K. Non-Autovan 4-Wire Permanent Signal Lockout

25.150 The permanent signal lockout feature is available to non-Autovan 4-wire offices. A break-contact of the NRS relay is added to prevent grounding the RL lead to the originating register when all permanent signal trunks are busy. The BT lead will be grounded as usual and the register will be able to send a lockout indication to the line circuit. Option ZRW provides this feature.

L. Control of Route Control Digit by Selected Route - FS167 - Polygrid Routing

25.151 This feature allows the route control digit to be determined by the route selected on calls to a triple in an external grid. It cannot be used for calls within the home grid.

Route Control Digit Patterns

25.152 With this arrangement the route control digit sent forward depends on which route is selected. For example, if the first route to an external triple is selected an "0" may be sent forward, if the second route is selected a "2" may be sent, and if the third is selected a "1" may be sent. Any pattern (or combination) of the numbers 0, 1, and 2 is possible. The RD-- terminal numbers correspond to the pattern, eg, RD021 is the terminal for the 0-2-1 pattern described above.

Operation

25.153 When the route control digit is to be the same for all three routes to a triple (eg, a 1-1-1 pattern) the RCD- and RCDP relays are operated directly from the CDM---, CDB---, or CDS--- terminal via a cross-connection to the RD0P or RD1P, etc, terminal. For a varied (pattern such as 0-2-1) the pattern relay (001 or 002, or 021, etc) is operated from the CDM---, CDB---, or CDS terminal via a cross-connection to the RD001 or RD002, etc, terminal. If the first route is selected the pattern relay connects the ground on the R1 lead through to the primary winding of the appropriate RCD- relay. Ground on R2 or R3 is connected through to a different, or the same, RCD- relay if the second or third route is selected. Operation of RCD- and RCDP causes the corresponding route control digit to be forwarded.

M. Four-Wire Testing Improvements

25.154 The marker is changed to provide improvements in 4-wire testing. Option AU provides these improvements and option AR is also required if the marker is arranged for control digit screening precedence and privilege controls (App Fig. 117). These improvements include the following:

- (a) The marker is arranged for using the automatic monitor register and sender test circuit for testing 4-wire.
- (b) The marker is changed to prevent a false trouble indication when register tests require the marker to advance to preempt cycle.
- (c) The marker is changed to provide a longer route advance signal to the master test control circuit on test calls, thus enabling that circuit to count the route advances.

N. Check for False Ground on TGA1-4 Leads - Option ZYO

25.155 Option ZYO enables the XTG1 circuitry to check for false ground on the TGA1-4 leads (part of multilevel preemption) on status 5 calls.

O. Release of SCA in the Status Connector Circuit (Multilevel Preemption) - Option ZYO

25.156 A PMLL contact is added to the SCA lead to the status connector circuit to delay closing through a locking path for the SCA- relay in the connector. This gives more time for the SCA- relay to release if operated earlier by another marker.

P. Increased Flexibility for Polygrid Routing - Option ZYL

25.157 An arrangement is provided whereby home grid calls with control digit 0 may select or skip the second best alternate triple. Whether the second best alternate is selected or skipped depends on the marker cross-connection between the HGC and the HSA or SKS punchings.

26. CENTREX SERVICE

26.01 Centrex service provides a means whereby No. 5 crossbar is used to provide centrex customers with essentially the same services given by an automatic PBX, plus direct inward dialing, transfer of direct in-dialed calls, and identified outward dialing. In this description, a centrex customer is one who subscribes for the service offered. Centrex customers are identified by class-of-service; up to 100 separate centrex customers can be handled by one marker group; the number of centrex customers is limited by the number of classes of service used by the regular lines.

26.02 Twenty rate treatments in addition to class-of-service are provided. Rate treatments are used to discriminate between various routes and charges that may be associated with the different stations of a centrex customer. When regular lines and centrex lines are mixed in the same marker group, one rate treatment is reserved for regular lines.

26.03 The provision of centrex has resulted in three phases of development. Phase I offered centrex features with attendant controlled transfer as the basic mode of operation. A station requesting transfer is connected to an attendant, and the call is completed by the attendant. Phase II centrex was essentially phase I with improvements in maintenance and in service features. Phase III centrex offers either attendant controlled transfer, or transfer controlled by the station requesting a transfer (dial transfer). Both types may be provided in a marker group.

26.04 Phase I and II centrex have been rated A&M Only, with Phase III the standard centrex feature for the system. This description will be mainly concerned with standard phase III centrex. Dial transfer may be added to existing phase I or II offices on an optional basis.

26.05 The type of transfer is determined by the class-of-service; all stations of a centrex customer must have the same type of transfer. Although several class-of-service arrangements are available for use in centrex offices, dial transfer is limited to application in those offices with class-of-service selection on a units and tens basis.

26.06 Dial transfer makes it possible for a centrex customer to function without a console, since a station with the listed directory number of the centrex customer can essentially perform the attendant functions. The attendant at the attendant station serves dial zero or incoming listed directory number calls and when necessary extends the LDN calls to other stations on a dial transfer basis.

26.07 Calls made between stations of the same centrex customer are on a 4- or 5-digit basis, and there may be duplications of station numbers among two or more centrex customers. A different class-of-service is assigned to each centrex customer so that calls or transfers between stations of one centrex customer are kept from other customers by the assigned class or classes of service. In all transfer arrangements, a means is provided to obtain the class-of-service of a called centrex station, in order to ensure this.

26.08 Phase III dial transfer uses a method of essentially waiting until a transfer request is recognized, then identifying the transferring station directly, connecting it to a transfer trunk, and transmitting its class to a transfer register. After the

dial digits are received the transfer register seizes another marker to connect the dialed station to the incoming trunk. The two stations are thus connected together, and a subsequent switchhook flash adds on the original calling party. The specialized circuits required to handle this transfer traffic, and store class information, are generally on a common control nature, and used only for transfer functions.

26.09 Phase I and II transfer (dial or attendant) uses a method of storing class information initially, for use if the called station should subsequently request a transfer. In this case, all incoming and ITR trunks that can connect to stations capable of transferring a call, must be arranged to store the stations class-of-service for possible future use.

DIRECT INWARD DIALED CALLS - FS148

26.10 An incoming call to a centrex station will be handled by the marker as a normal ITR or TER call except as follows:

26.11 On the FLG linkage, after the marker has determined the LL location of the called station and the LL frame is seized, the marker records the class-of-service of the called station. This class of service will indicate that the stations of the called centrex customer are arranged for DLT or 5DLT relay operated, or for manual transfer, MLT relay operated. With one of these relays operated, and the line idle, LI, LIA relays operated, a signal will be transmitted back to the incoming or intraoffice trunk to operate its DTF relay thus enabling the trunk to initiate a transfer if requested by the called station.

26.12 Relay DTLK operates to check that DTF has locked operated in the trunk, and operates DLTC relay. The call is completed as normal to the called station.

A. DID to Listed Directory Number - FS148

26.13 When a console is provided, a call to a listed directory number is recognized in the NG, and a terminating treatment mark operates LDN relay in the marker. Relay LDN operated transmits a signal on the CDN lead to the trunk and CDNK relay operates to check this transmission. This signal is used by the trunk identify the call to the console as a LDN from outside the centrex.

26.14 A DTR signal is also transmitted to the trunk and the call is completed as described in the previous paragraph.

26.15 If a console is not provided, and some centrex station is performing the function of the console, an LDN call will complete to this station. The NG cross-connections may be arranged to complete the LDN call to any station desired within the centrex customer. The call will be handled as a normal DID call to a centrex station.

B. Restricted Incoming Service

26.16 Restricted incoming service, permits only intra-PBX calls to terminate to a centrex station, see Note 428.

26.17 On a TER or ITR call the marker and number group proceed to translate the called number in the standard manner. However, after the equipment location and ringing combination of the called line have been received the marker recognizes from the ringing combination or terminating treatment mark that a restricted incoming call is being handled. If the call is to be denied, the output of the screening is cross-connected to operate the PAN relay which gives a common PBX announcement.

26.18 The marker is arranged for fully restricted and semirestricted service. On fully restricted terminating service, attendant calls and any 4-digit call that could tie this station to one outside of the PBX are denied. As examples, the conference circuit or tie lines having access to other Bell System customers cannot complete calls to this station. On semirestricted terminating service all ATT and 4-digit calls can complete to this station in any desired arrangement. As an example of different semirestricted terminating service, some stations may be able to receive calls from certain tie lines while other stations may not. On calls to the conference circuit a unique mark is required since this circuit can be reached by the operator but not be fully restricted stations. Provision is made for seven types of restricted terminating service which can be used in any combination of fully restricted or semirestricted service. Additional screening by class-of-service can be applied to these seven types to vary the treatment between customers. On all restricted stations, the denial of the 4-digit calls is dependent upon the rate treatment of the originating station. Option ZOY provides access from the IO-6 to the SC- cross-connect terminals

to permit screening of centrex restricted stations by incoming trunk class to deny completion of calls to restricted stations from selected trunk classes such as TOLL class. Denied calls are routed to PAN for the common centrex recorded announcement. Note 400, Part 69, and Note 428 shows typical treatment.

STATION-TO-STATION (INTERCOM) CALL

26.19 The station-to-station (intercom) call requires the marker to connect two stations of the same centrex customer group via an intraoffice trunk. When call transfer for station-to-station calls is provided, two intercom trunk groups are provided. One with and one without transfer features. The marker processes the call as an ITR call except as follows:

- (a) The translation mark received from the register is X11 or FVD.
- (b) Intraoffice trunks without transfer features are selected if the centrex customer is not arranged for call transfer for station-to-station calls (add-on).
- (c) A class-of-service match is required to confine the call to the originating customer group.
- (d) When the calling station has call transfer for station-to-station calls, the DTF relay in the transfer trunk is operated and checked locked.

A. Intraoffice Route Relay Operation (Cross-Connect Note 403)

26.20 When an X11 or FVD translation mark is received with the OR1 relay operated, the X11A and X11B relays are operated. The X11B relay transfers the intraoffice route relay operate ground from the cross-connect terminals used for the 7- or 10-digit POTS intraoffice route (terminals APR, BPR, etc) to the terminals used for the intercom (station-to-station) route. The FL0-5 and FLP terminals are screened by rate treatment when busy line verification (BLV) or call transfer for station-to-station calls (add-on) is provided. The BLV rate treatment is further screened by class-of-service, if required, for selection of the 4-, 5-, and 7-digit busy line verification routes. All other rate treatments are cross-connected to operate the intraoffice route relay for the station-to-station (intercom) trunk group. When station-to-station transfer is provided, two

intercom trunk groups are provided. One with, and one without transfer features. Selection of the proper intercom route is determined by class-of-service when all lines for the centrex customer have the feature or by rate treatment when some but not all lines for the same centrex customer have the feature.

B. Call Transfer for Station-to-Station Calls (Add-On)

26.21 When call transfer for station-to-station calls is provided, the feature is enabled by the operation of the ADD relay. The ADD relay is operated either by the class-of-service when all stations for the same centrex customers have the feature or by the rate treatment when some but not all stations for the same customer have the feature. All other rate treatments or classes-of-service operate the NAD for those stations without the feature. Operation of the ADD relay on station-to-station calls will cause the DTR lead to be grounded to the intraoffice trunk when the LIA relay operates which will operate the DTR relay in the trunk. The locking ground for the DTR relay will operate the DLTK relay and the DLTK is checked operated in the operate path of the RCK3 relay. The operation of the NAD relay will not operate the DTR relay in the trunk and the DTLK check is bypassed.

C. Class Match for Single Class-of-Service per Centrex Customer - Option SN - FS133

26.22 With the X11 or FVD relay operated, X11A relay and ICC relay operate to indicate an intercom call. Relay ICC operated operates RIK relay. The class-of-service of the calling station is registered on the CT-, and CUA- relays as received from the OR. The class of the called station is registered on the CST- and CSU- relays as received from the LL. Each station will have the same class if both are in the same PBX, and a match should result. A class match of the tens digit operates the CTK1,2 relays and a class match of the units digit operates the CUK1,2 relays.

26.23 The operated CTK-, CUK- relays operate the class tens units check relay CTUK, which is checked by DVO relay operating, B34B. This allows the call to complete as a ITR call.

26.24 A class mismatch will operate relay XCS which operates the RAV1,2 relays to route the call to tone trunks.

D. Class Match for Multiple Class-of-Service Per Centrex Customer - Option SP, Fig. 96 - FS138

26.25 The match circuit is arranged to compare classes of service within four groups; CS00-09, SC10-39, CS40-69, and CS70-99. The match is made by comparing the class tens digits of the calling and called line, then if required, a pattern relay is operated to initiate the units digit match. A pattern relay is associated with all combinations of tens digits requiring the same units match pattern.

26.26 In the following discussion the class of service of the calling line is referred to as "originating class of service". The class of service of the called line is referred to as the "terminating class of service".

26.27 The mismatch relay MM is operated directly when the operated originating and terminating tens digit relays are not in the same group. When the tens digits being matched are in the same group an OT- punching is grounded. The numerical designation of the OT- punching represents the originating and terminating class of service tens digits respectively. The OT- punching is cross-connected as follows:

- (a) To punching CM when all the units digits associated with the two tens blocks match.
- (b) To punching MM when none of the units digits associated with the two tens block match.
- (c) To punchings MP0-2 when some of the units digits associated with the two tens blocks match, so therefore a units digit match is required.

26.28 One of the MP0-2 relays is operated to establish the pattern of the units digit match. The same pattern relay can be operated from any number of OT- punchings as long as the match pattern of the units digit is the same. Relay MPO is wired to match corresponding units digits only. The contacts of the MP1,2 relays are brought out to punchings OU0-9, MMU0-9 which are cross-connected to the TU0-9 or MM punchings so that the pattern may be arranged to match single or multiple units digits as required.

26.29 The method of cross-connecting the pattern relays is such that the originating units digit is compared serially to all terminating units digits to be matched before the mismatch indication is obtained. The OU0-9 punchings, representing the originating units digits, are cross-connected to punchings TU0-9 or punching MM. The TU- punchings represent the terminating units digit. When an OU-punching for this pattern is to match one or more TU- punchings, the cross-connection is made from the OU- punching to the TU- punching of the first units digit to be compared. If an OU- punching cannot match any TU-punching then the cross-connection is made from the OU- punching directly to the mismatch punching MM. The MMU0-9 punchings, representing a mismatch of the correspondingly numbered terminating units digit, are cross-connected to punching TU- when another terminating digit is to be compared or cross-connected to punching MM if all terminating digits in the series have been compared. Note 431 shows some typical cross-connections and when they may be used. Operation of the class match relay CM allows the call to complete as a normal TER or ITR call. A class mismatch, MM relay operated, will cause the marker to recycle and route the call to a PBX announcement machine.

26.30 The marker is arranged to provide the multiple class-of-service match feature in offices with less than 100 classes of service. Option ZMM is added for offices with 30 classes and option ZMB for offices with 60 classes.

DIAL ZERO CALLS TO CENTREX ATTENDANT

A. Attendant With Console

26.31 When the service request is a dial zero call, originated by a centrex station, the marker processes the call as a SOG call. The class-of-service of the calling station directs the call to a route to the attendant in the same PBX as the calling station. The marker connects the calling station to the TL appearance of the attendant trunk. The marker, while connected to the attendant trunk, will ground the CN lead to operate a class relay in the attendant trunk. The class relay will signal the attendant that the call is a dial zero call.

B. Attendant Without Console - FS146

26.32 When dial transfer is provided the zero output of the X11 and FVD translators are screened and the class-of-service associated with centrex customers not equipped with a console is cross-connected to operate the DZ relay. The DZ relay and the class-of-service is then used to operate a line route relay, LR which generates a 4- or 5-digit listed directory number. The marker then seizes a number group for translation of the listed directory number and then establishes an intraoffice connection from the calling station to the station serving as the attendant facility.

C. Temporarily Disconnected Line Routed to Attendant

26.33 For temporarily disconnected lines, special cross-connections are required in the NG, see Note 400 and Note 439. The cross-connections operate the centrex temporary intercept (CTI) relay and a line route relay (LR-). The CTI relay will cause a marker recycle. After the operation of the CKR relay, indicating a completed recycle, the ALN relay is operated to activate the LR- relay contacts which generate the listed directory number. The number group is seized and the call is completed as a listed directory number.

TRANSFER CALLS

26.34 The marker serves four type of transfer calls. The following table lists these calls showing the phase of centrex in which they are used, the type of traffic served, and the linkage set.

26.35 The description in this paragraph will be concerned with phase III centrex transfer calls (dial transfer) since this is the standard feature. Phase I and II transfer calls will be covered in a subsequent paragraph.

<u>Type of Transfer Call</u>	<u>Phase</u>	<u>Transfer From</u>	<u>Linkage Set From</u>
TRF	I,II*	Station to Attendant Don't Answer Transfer	LL appearance of INC, ITR trunk to TL appearance of ATT trunk
ATT	I,II	Attendant to Station	TL appearance of INC, ITR trunk to station.
DTI	III	Station to Attendant Station to Station Attendant to Station Don't Answer Transfer	TL appearance of TRF trunk to trans- ferring station or attendant No linkage set
DTF	I,II**	Station to Station	TL appearance of INC, ITR, or TRF trunk to station
	III	Station to Station Station to Attendant Attendant to Station Don't Answer Transfer	TL appearance of INC, ITR trunk to station or LL appearance of ATT trunk

* Used for all transfer calls to the attendant, including dial transfer calls.

** When dial transfer is provided.

26.36 The dial transfer call consists of the DTI call, followed by the DTF call. The DTI results in returning dial tone to a transferring station, and allows a third party to be dialed. The DTF results in completion of the transfer to the third party.

26.37 A dial transfer request may be initiated by a centrex station that has received a call from outside the PBX. This could be from the outside world or from a station in some other PBX. The request is initiated when the transferring station flashes the switchhook.

A. Dial Transfer Identification

26.38 In order to provide the features required for dial transfer (transfer, consultation, and add-on), a secondary switching network is provided for access to the transfer circuits. A transfer line link frame, TLL, has second appearances of the incoming (or ITR) trunks. A transfer trunk link frame, TTL, has transfer trunks connected to it. The connection of incoming trunk to transfer trunk is under control of the dial tone marker. The other end of the transfer trunk is on the regular TL frame.

26.39 The sequence for the DTI call is as follows:

(a) Upon recognizing a switchhook flash, the incoming trunk initiates a bid for an idle transfer trunk on the TTL. This is done through the TTL appearance of the incoming trunk and a connection is made between the two trunks under control of the dial tone marker.

(b) The transfer trunk seizes a transfer register via a transfer register link and stores in it the TL numbers of the incoming trunk and the transfer trunk.

(c) The transfer register seizes a transfer line identifier, TLI. The TLI then transmits a special signal back through the transfer register, transfer trunk, and incoming trunk to cause the incoming trunk to connect a 60-hertz line identity signal to the sleeve of the established connection.

(d) This signal is extended to the LL where it is detected and identified by the TLI. The TLI then transfers the line link location of the transferring station back to the transfer register.

(e) The transfer register seizes a completing marker which establishes a connection between the transferring station and the TL appearance of the transfer trunk; and releases the connection between the

transferring station and the TL appearance of the incoming trunk. The transferring stations class of service, and type of transfer is also passed to the transfer register, either dial or manual, see 26.43 through 26.57.

B. Dial Transfer Call

26.39 If the type of call is dial transfer, dial tone is returned to the transferring station by the transfer register, and the dialed digits are registered in the transfer register.

26.40 The transfer register seizes a completing marker for the second time, which establishes a connection between the TL appearance of the incoming trunk and the dialed stations LL location, see 26.58 through 26.64.

26.41 From this point, the connection is under control of the trunks. Initially, the transferring station is connected to the dialed station and the original calling party is on hold. A switchhook flash will add the calling party for a 3-way conference. Either the transferring, or dialed station may subsequently go on-hook and again, the transfer feature is enabled for the remaining party.

C. Manual Transfer Call (Attendant Call)

26.42 If the class-of-service of the transferring station indicates a manual type of transfer rather than dial transfer, dial tone is not returned to the transferring station. Instead, the transfer register generates a digit 0, and seizes a completing marker to complete the connection to the attendant, see 26.31 through 26.33.

FIRST MARKER USAGE (DTI)

26.43 A DTI call requires a marker to connect the station requesting transfer to a transfer trunk. This transfer trunk is associated with the incoming or ITR trunk which is connected to the calling station. In the DTI call, the LL location of the line, and the TL location of the transfer trunk are already established, thus neither selection of a route, nor NG translation is required. The connection is processed by the marker as a call-back linkage between the two points.

26.44 The information received from the transfer register is:

- (a) Trunk link frame number of transfer trunks, FG-, TF-.

(b) Type of Call - DTI

(c) Class of Call - ATT/DAT/AOT.

(d) Line location of station requesting transfer - VG-, HG-, VF-, FT-, FU-, LL-.

26.45 The operation of the DTI1, FG-, and TF- relays will cause the marker to seize the TL frame on which the transfer trunk appears. After the marker has possession of the required TL, battery is applied to the F lead which is connected to the trunk F relay via the TRMC and TRL.

26.46 The F relay operates the FAK or FBK relay to provide TL control.

A. LL Seizure and Control - SC143

26.47 After the TFK3 relay operates to indicate the possession of the TL and after the RK3 operates to indicate the line location information check, the marker connects to the required LL. The CB- relays are operated on a DTI call causing the equipment location of the line requesting transfer to be recorded on the FTT-, FUT-, etc, relays which control the selection of the LL and the line hold magnet.

26.48 If the RK3 relay is not operated the marker will block, take a trouble record and disconnect from the transfer register by grounding the TIR lead. This signals the transfer register to seize another line identifier and request another identification.

B. Release of Initial Linkage - SC109

26.49 With the completion of channel test, TK relay operated, a channel is selected, CHA operated, and at the same time the select magnets for the new linkage are operated. With CHA relay, DTI relay, and TK relay operated, the TP lead to the transfer trunk is grounded (see B38, B30). This operates the RL relay in the transfer trunk which signals the incoming trunk to release the initial linkage between the incoming trunk and transferring station. Following hold magnet timing, the new connection is established.

C. Class-of-Service Read-In - SC153, FS133, FS148

26.50 The class-of-service, CST- and CSU- relays operate from the transferring stations class as obtained from the LL-. With the DTI relay operated, and the channel

selected CHA relay operated, the RDI, RDIA, and RDS relays operate to control the read-in function. With the operation of CGS relay, the class will be read into the transfer trunk. Following the check of this read-in, CTUK relay operated, the RDR and RDRI relays operate to recycle the read-in control, and read the class information into the transfer register.

26.51 The class information stored in the transfer register will be used on the completion of the call to ensure a class match between the transferring station and the dialed station.

26.52 The class information stored in the transfer trunk will be used if a subsequent transfer is requested by the original transferring station (the dialed party answered and disconnected).

26.53 A T4 or T5 mark will also be transmitted to the transfer trunk, and transfer register. This mark is derived from the class-of-service to indicate dial transfer (as distinguished from manual transfer), and the number of digits to expect.

D. Linkage Check and Disconnect

26.54 After the TL and LL hold magnets operate, the DCT operates and if the read-in information has been checked, a path is closed to operate the disconnect, DIS1,2, relays.

E. Subsequent Transfer

26.55 If a dialed party answers and disconnects, the original transferring station may request a subsequent transfer by flashing the switchhook.

26.56 In this case the DTI call sequence will not be required again, since the transferring station has been identified, and is already connected to the transfer trunk. Also, the incoming trunk is still connected to the transfer trunk through the TLL-TTL linkage.

26.57 Thus, the switchhook flash is recognized by the transfer trunk, a transfer register is seized directly by the trunk and dial tone returned. The transferring stations class-of-service is already stored in the transfer trunk, and is transmitted to the transfer register.

SECOND MARKER USAGE (DTF) - SC11

26.58 Upon receiving the 4, 5 or 7 digits dialed by the transferring station, the transfer register seizes a marker to connect the TL appearance of the incoming trunk, to the called (dialed) station, and thus complete the transfer.

26.59 The marker processes the call as a TER call. Relay DTF operates from the transfer register to control the dial transfer functions. Relay ICC and RIK are operated in preparation for class match. The CT- and CUA- relays operate from the class-of-service as received from the transfer register.

26.60 When the call has progressed to the point of receiving the class-of-service from the called station, the CST- and CSU- relays operate. Relay CSK operates, and the class match is made to ensure that the transferring, and dialed stations are in the same customer group. This class match operation is similar to that described for the intercom call, 26.19 through 26.30.

26.61 Busy or overflow signals are transmitted to the transfer trunk via the T and R leads through the TRMC and TRL, see B115.

26.62 If the call is to the attendant, dial 0, the class-of-service and the DZ relay operates a line route relay, LR-, which generates the 4 or 5 digit listed directory number.

26.63 Option ZUK is added to improve marker operation on DTF calls routed to allotted attendant lines. Contact 1(ALN1) is moved from ground, option ZUJ rated Mfr Disc., to 10(TER4) to delay the operate of the ANON relay until the trunk link frame is seized. This change prevents false operation of the NANS relay when trunk link frame seizure is delayed which results in the operation of the XN relay. Option ZUK also opens the operate path of the NR relay with a break-contact on the DZ relay to prevent operation of the NR relay when the RNG relay is operated. This prevents marker blockage on DTF calls when attendant lines are allotted and the marker finds the lines busy at the line link frame.

26.64 The marker is arranged to ground the MTR lead to the automatic monitor circuit on phase III centrex DTF calls when the

transfer register is handling a "manual" call. This change is to prevent nonproductive trouble records in phase III centrex offices when the automatic monitor is arranged to monitor transfer registers. Option CC (rated Standard) is added.

ADDITIONAL CENTREX FEATURES

26.65 The following features are provided on an optional basis in offices with centrex:

A. Busy Line and Don't Answer Transfer

26.66 The busy line, don't answer transfer feature is provided on a customer group basis. It may be applied to any station in a customer group that has no other special terminating treatment, ie, LLP, restricted service, LDN, 2LN, etc. The marker proceeds to set up the call to the called centrex station in the regular manner. The marker seizes a number group to determine the equipment location of the called station.

26.67 The number group terminals of the stations in a customer group arranged for the busy line or don't answer transfer feature are cross-connected via the tens block screening field to operate one of the following relays:

- (a) BLT - station has busy line transfer.
- (b) DAT - station has don't answer transfer.
- (c) BLDA - station has both busy line and don't answer transfer.

26.68 After number group translation is completed, the marker tests to determine if the called station is busy or idle. At the same time, the marker reads out the class-of-service of the called line and a line route relay is operated. If the marker finds the called station busy and that busy line transfer is required, LBTA and BLTL relays operated, it recycles and activates the LR-relay contacts which generate the 4- or 5-digit listed directory number. A number group is seized and the call is handled like a listed directory number call.

26.69 If the called station is part of a hunting group and all lines in the hunting group are busy the recycle nonhunt (RNH) relay operates and the marker recycles, seizes the number group and translates the called number, this time the hunting features are disabled and the marker seizes the LL frame on which the called station appears to test for idle or busy and to read out the

class-of-service to operate the line route relay. If the line tests busy then the marker will recycle again and generate the listed directory number to complete the call.

26.70 When the called station tests idle and the DAT or BLDA relay is operated the marker grounds the DAT lead to the trunk circuit to inform the trunk to start timing when the call cuts through ringing to the called station. If the trunk should time out before the call is answered, it will initiate a listed directory number call.

26.71 Option ZSL cancels the busy line transfer feature on special calls to prevent routing busy calls to the centrex attendant.

B. Centrex Intercept - Route to Recorded Announcement

26.72 Apparatus Figure 137 provides for a maximum of five recorded announcements for use with centrex numbers wired for intercept. When a customers line is to be routed to announcement trunks, the three initial number group cross-connections are removed and the F to RF cross-connection associated with that customer is added to operate the CI0-4 relay which identifies the called customer. The CI0-4 relays can be operated in the following ways:

- (a) Option ZWD: From terminating treatment mark. One mark is required per customer.
(A&M Only)
- (b) Option ZWE: Operates CI relay from single terminating treatment mark. Individual CI0-4 relay is operated from the vertical file information.
(A&M Only)
- (c) Option ZSW: Operates CI relay from LLPX mark from the number group, a terminating treatment mark is not required. Individual CI0-4 relay is operated from the vertical file information.
(STD)

26.73 Operation of the CI- relay causes a PBX recycle by operating the PBX announcement relay (PAN). After completion of the recycle, CIA and CKR relays operated, the number group containing the announcement trunks is seized and the CI- line number information is transmitted to the number group. The call is then completed as a standard intercept call.

C. Intercept Treatment for Centrex CU Customers

26.74 Option ZRE is added to provide arrangements for routing calls to disconnected centrex CU customers, which are reached via LLP on either a thousands or hundreds digit basis, to a Bell System intercept operator for referrals. When ZRE is provided, the RI relay can be operated directly from either the number group start, or from the LLP hundreds block translator.

D. Busy Line Verification

26.75 The busy line verification feature provides a means for a centrex attendant to verify the busy condition of the stations. The attendant can connect to a station and listen to determine whether the station is actually busy or out of service because of trouble, or receiver-off-hook. The marker attempts to connect to the line, and if it tests busy, the no-test feature is used to connect to the line link being used by the busy line.

26.76 The verification call is originated on a dedicated line having a special rate treatment reserved for this purpose. Recognition of this rate treatment in the marker establishes the request for a no-test connection to the called line.

26.77 An outgoing-incoming trunk has been developed for busy line verification. The no-test request is initially handled as a SOG call to this trunk. A second marker usage is then initiated by the trunk to establish an incoming no-test call similar to the present no-test call. If the called line is busy, the no-test connector provides access to the line. If the called line is idle, a terminating call is made to the line.

26.78 Since busy verification is for use with centrex operation, the attendant must be restricted to one PBX. On the SOG part of the call, the attendants class of service is read into the trunk, and on the TER part of the call, this same class information is read out of the trunk, and matched with the called customers class-of-service.

26.79 Busy verification trunks are provided for common use by all centrex attendants associated with a marker group. Regular no-test calls will be made with existing no-test facilities, and the no-test connector is arranged to accommodate both the regular no-test trunks and the busy verification trunks.

26.80 A busy verification call cannot be made to an LLP station, but can be made to a restricted centrex station.

Recognition of Busy Verification Call

26.81 The FL0-5, BLP code points are screened by rate treatment when BLV is provided. See Note 403 in SD for typical cross-connections. All rate treatments except the one assigned to the attendant BLV line appearance are cross-connected to the route relay for the intercom trunk group. The attendant BLV rate treatment is screened by class of service to operate a separate BLV route relay for 4-, 5-, and 7-digit customers. The CP-terminal for all BLV route relays are cross-connected to operate the CNT0, centrex no-test originating relay.

26.82 Relay CNT0 operated:

- (a) Selects a route to a busy verification trunk.
- (b) Enables the TK, channel test relay, check circuit to require the CTUK relay operated to check read-in to the trunk.
- (c) Disables the called number connector used with FLG connections to prevent an XN relay operation when a sender is selected.
- (d) Enables the trunk read-in control relays.

26.83 The call progresses to the point where the attendants class-of-service is received from the LL frame. When CGS relay operates, this class information is read into, and locked in the trunk. The RIK, read-in check relay operates and checks that the class is stored in the trunk in 2-out-of-5 code, by the operation of the CTK- and CUK-relays. Relay CTUK operates as a check that the read-in functions are completed. The call completes to the busy verification trunk in a manner similar to SOG call completion.

26.84 The trunk is arranged to handle 5 digits on all calls; thus when a 4-digit call is received by the marker, a CR-arbitrary digit must be transmitted to the sender.

Completion of Busy Verification Call

26.85 When the trunk is seized and the sender is attached, the trunk requests an IR

through an IRL. When the register is attached the sender outpulses a 1-digit office indication plus the 4 digits of the called number to the IR.

26.86 A special marker is seized and receives the 5-digit called number, an FVD mark, the incoming class, and a CNT1, centrex no-test incoming mark.

26.87 The call proceeds as a TER no-test call, with the exception that a class-of-service match check is required.

Recognition of Centrex No-Test Call

26.88 The call will initially be set up as a special call, SPL relay operated. After the TL connector operates, and the F relay in the trunk operates, the CNT lead from the trunk is grounded and operates the CNT1 relay.

26.89 Relay CNT1 operated:

- (a) Operates the read-out (RDO) relay to prepare for the class-match operation.
- (b) Enables the crossed class-of-service (XCS) or MM mismatch relays to set up overflow if the class match is not made.
- (c) Enables the class match for either multiple, or single class-of-service match.
- (d) Operates the NT relay to initiate a no-test call.
- (e) Requires that a class match check be obtained before the NTT relay can be operated on a line busy condition.

Class Match

26.90 When the RDO relay operates, the class information stored in the trunk operates the CT- and CUA- class relays. When the TER no-test call has progressed to the point of receiving the class-of-service of the called station from the LL frame, the CST- and CSU- relays operate.

26.91 This class information from the trunk, and from the called station is matched, and if successful, either CM or CTUK relay operates. (See 26.20 and 26.21 for details of class match).

Call Completion

26.92 About the same time the class information is received from the LL, a test is made to determine if the called line is idle (LIT relay operates), or busy (LBT, LBTA relays operate).

26.93 With a successful class match, and LIT relay operated, the marker waits for the completion of channel timing, and then completes the call as a TER call.

26.94 With a successful class match, and LBTA relay operated, the NTT relay operates. The call is completed as a no-test call using the no-test connector to gain access to the called line.

26.95 If the class match is not successful, overflow tone is returned to the centrex attendant.

E. Centralized Centrex Attendant

26.96 The marker is arranged to provide centralized attendant operation in offices arranged for phase III centrex. This feature allows a single centrex customer to be served by more than one switching machine. The main switching machine (primary office) is usually the largest and provides all the attendant services. The satellite machines (secondary offices) provide line concentration, intra-switching, and sometimes direct switching to and from other machines. Both primary and secondary locations are arranged for direct in-dialing and listed directory numbers (LDN) may be associated with secondary as well as primary offices. The LDN calls as well as attendant directed transfer calls from a secondary office are completed to the attendant at the primary office via attendant LLP line circuits which are common to both LDN and transfer traffic. Station-to-station dialing may be provided on a 5- or 7-digit basis. Five-digit dialing can be used to serve a maximum of six office codes with non-conflicting C digits; office codes with 0, 1, 8, or 9 for a C digit cannot be used. When more than six office codes are required or conflicting C digits exist within the complex, 7-digit dialing of intra-PBX calls (option ZLK) may be provided or more than one dialing zone must be established. When more than one dialing zone is provided, intercom calls within a zone are on a 5-digit basis and calls between zones are on a 9+ 7-digit direct out-dialed basis using DDD exchange

facilities. Extension of LDN and transfer calls by the attendant may be on a 5-digit basis for a single zone complex with 5-digit dialing or on a 7-digit basis for either a multizone complex or a single zone complex with 7-digit dialing of intra-PBX calls. When 7-digit call transfer attendant is provided in a marker group without 7-digit dialing of intra-PBX calls the attendant start-out calls are restricted to intercom codes only, since the means to distinguish between 7-digit intercom and 9+ 7-digit DIOD calls is not provided.

Routing Control for Intercom and Attendant Controlled Transfer Calls (Note 460)

26.97 Intercom calls, which complete locally, are routed via the intercom trunk group common to all centrex customers in the marker group. Intercom calls between offices in the complex require a dedicated interoffice trunk group to mark the calls in the terminating office as incoming intercom calls. The trunk group may be outgoing to incoming trunks or LLP line circuits to incoming trunks. Calls transferred to a different office must use a LLP line circuit to route to the other office since a linkage must be established from the incoming trunk to a line link frame in the office originating the transfer. Intercom and transfer calls may be routed over the same interoffice trunk group provided the LLP line circuit to incoming trunk arrangement is used.

Routing Control - Five-Digit Dialing

26.98 Typical cross-connections for the FVD and LT translators used for intercom routing are shown in cross-connection Note 460 in the SD. Codes associated with other offices in the centrex complex must be screened by customer and trunk class to determine routing. For the FVD translator, the customer class for the centralized attendant customer group, S-(CAC) is cross-connected to operate either the LR- relay for the LLP intercom trunk group or the R- relay for an outgoing trunk group. If more than one zone is provided it is given vacant code treatment since extension of LDN and transfer calls is then done on a 7-digit basis by the attendant. All other classes, S-(AO), are given vacant code treatment. The LT translator code points associated with other offices in the complex must also be screened when more than one dialing zone is provided. The trunk class received on transfer calls, S-(DTF), is cross-connected from the various code points to

their respective intercom routing. The intercom trunk group within a local zone can be the same trunk group as that used for intercom calls. Screening must be provided behind all other routes to prevent extension of calls to the Bell System network.

26.99 The S-(AIN) class represents the class assigned to the start-out appearance of the attendant trunks in the primary office only. This class is used in the dial tone marker to ground the NPBX lead to the originating register so the attendant does not have to prefix the digit 9 before the 7 digit station number. In the completing marker it is used to restrict the start-out calls to intercom codes only.

Routing Control - Seven-Digit Dialing

26.100 When 7-digit dialing of intra-PBX calls (option ZLK) is provided, the output of the 3-digit translator must be screened by incoming trunk class on transfer calls and by type of translation on intercom calls. Local completion code points are cross-connected as usual to local completion relays, code points associated with other offices in the centrex complex are screened, as shown in Note 460C, first by trunk class and then by type of translation. The trunk class for transfer calls, S-DTF, is cross-connected to the LR- relay for the associated intercom trunk group. All other trunk classes, S-AO, are cross-connected to the associated route relay for standard routing. The S-(OR) operated on originating calls, is cross-connected to another SC- point for type of translation screening. The screening relay, S-(11B), operated on intercom calls, is cross-connected to the LR- relay for the intercom trunk group. All other types of translation classes, S-(OA), are cross-connected to the associated route relay for standard routing. Screening must be provided behind all other routes associated with the working codes to prevent extension of intercom calls to the Bell System network.

Incoming Intercom Calls

26.101 The incoming intercom call (INI) is used for termination on interoffice intercom traffic and for termination of transfer requests from secondary offices to the attendant in the primary office. The call is processed as a TER call except as follows:

- (a) Completion is restricted to stations or the attendant associated with the centrex complex.

- (b) Transfer is disabled.
- (c) Completion to incoming restricted stations is allowed.

26.102 Cross-connection of the TCA- or TCB-terminal associated with the incoming intercom trunk class to the INI terminal is required for identification of the call. Relay INI operated:

- (a) Cancels the transfer signal to the incoming trunk by operating the ICC relay.
- (b) Allows completion of calls to restricted stations by transferring the operate path of the PAN relay to the POTS relay.
- (c) Prevents routing centrex temporary intercept calls to the attendant by transferring the operate path of the CTI relay to the PAN relay.

Routing Control for Transfer Request

26.103 In secondary offices transfer request for call transfer attendant customers or call transfer - individual customers when 0 is dialed require routing via a dedicated trunk group, consisting of ATT LLP line circuits in the secondary and ATT INC trunk circuits in the primary offices, for completion to the attendant facilities. The transfer call to the attendant is processed in the secondary office in the standard manner up to the point where the completing marker receives the zero from the transfer register on the DTF marker usage. The DTZ- terminal associated with the centrex complex is cross-connected to the LR- relay which generates the pilot number for the attendant LLP line circuits, see Cross-Connection Note 439. The LRU- terminal for the LR- relay is cross-connected to LPN to indicate LLP mode of operation. After selection of the line circuit and sender, the marker transmits the zero to the sender along with the delete-none signal. When listed directory numbers (LDN) are associated with the secondary as well as the primary offices (option ZOF) the LDN calls are routed to the primary office via the same trunk group used for transfer traffic. Centrex Temp. Intercept (CTI) is used for the LDN in the secondary office to operate the associated LR- relay. The LR- relay used cannot be the one used for transfer traffic since an LDL- to LOPO cross-connection is required to cause the sender to delete 4 and

output the digit 8. Cross-connect Note 400 part 95 shows the cross-connections required for routing transfer and LDN traffic to the primary office.

26.104 The incoming trunks in the primary office are assigned the same trunk class used for the intercom trunk groups. When the completing marker at the primary office receives the zero with the INI relay operated, the DZ relay is operated which grounds the INL and INZ terminals. The INC terminal is cross-connected to operate the local completion relay associated with the customer group and the INZ terminal is cross-connected to the LR- relay used to generate the listed number for transfer request originating in the primary office. After the call is set up to the attendant trunk, ringing is applied to the ring side of the line, relay RSL operated, which is the signal to the attendant trunk that a transfer call is being received. When LDN traffic is received from the secondary offices (option ZOG) the digit 8 indicates a LDN call. When 8 is received the IDN relay is operated. The IDN operates the DZ relay and the call is routed as a transfer call to the attendant, however, the IDN relay will cause the RSO relay to be operated, rather than relay RSL. Operation of RSO will cause ringing to be applied to the tip side of the line, which is the signal to the attendant trunk that a LDN call is being received.

Seven-Digit Call Transfer

26.105 Option ZXM provides 7-digit call transfer attendant, which is a subfeature of centralized centrex attendant operation, available only for phase III offices. This feature can be provided with or without 7-digit call transfer - individual (option ZLL), however, 7-digit call transfer - individual cannot be provided without 7-digit call transfer - attendant.

26.106 When 7-digit call transfer is provided, the type of line cross-connection which uses the class of service received from the line link frame, identifies the lines with this feature. The CS- terminal for the 7-digit call transfer - attendant classes are cross-connected to the 7MT terminal. With this cross-connection, when the associated class is received, the MLT relay is operated unless the call is a transfer call from an attendant, ATT relay operated, in which case the 7DLT is operated. The CS- terminals for the 7-digit call transfer - individual classes

are cross-connected to the 7DT terminal. This cross-connection allows the 7DLT relay to operate whenever the associated class is received except when the call is a don't answer transfer call, DAT1 relay operated, in which case the MLT relay is operated. Relay 7DLT operated:

- (a) Operates the CGS relay to enable the centrex functions required to complete the call.
- (b) Causes the DTR lead to the incoming intraoffice trunk to be grounded on calls incoming to a customer group. This informs the trunk that the call can be transferred.
- (c) Causes the DTR and CDN leads to the transfer trunk and the T7 lead to the transfer register to be grounded on the DTI marker usage. This informs the trunk and the register that dial tone should be returned and to wait for 7 digits before seizing the marker for the DTF usage.
- (d) Modifies the CTUK operate path to check the receipt of the information transmitted to the transfer trunk and transfer register on the DTI usage.

F. Code Point Access to Manual PBX Lines on the Line Link Frame

26.107 The marker is arranged to route centrex tie line codes to manual PBX systems via the line link frame in offices with phase III centrex. The tie lines are assigned line link frame appearances with the same class of service of the customer group, rate treatment can be used for restrictions of outgoing traffic. Access to the tie lines is restricted to LXX traffic only. The LXX codes requiring routing to the PBX lines are cross-connected to LR- relays to obtain the pilot number of the group of PBX lines. These LR-relays are cross-connected to the line route series relay EGN.

26.108 Relay EGN operated:

- (a) Operates the desired route relay on intraoffice calls, or operates the TER1 and 2 relays on incoming calls.
- (b) Operates the ALN relay to activate the LR- contacts which provide the pilot number for the PBX lines.
- (c) Cancels the physical and theoretical math by operating the PTK relay.
- (d) Cancels the transfer signal to the trunk by operating the ICC relay.

26.109 A terminating treatment mark, provided by tens block screening, is assigned to the PBX lines to restrict the incoming calls to LXX traffic. The RNB- terminal associated with the PBX lines is cross-connected to the PAN terminal, when this mark is received from the number group and the EGN relay is not operated, the PAN relay is operated and the call is routed to the common PBX announcement. If the EGN relay is operated, the POTS relay is operated and the call is completed to the PBX lines.

PHASE I AND II CENTREX (A&M ONLY FEATURES)

26.110 The basic mode of operation for phase I and II centrex was attendant transfer rather than dial transfer. However, the dial transfer feature may be added to phase I and II centrex, and provided in the same marker group with attendant controlled transfer. A centrex customer must have one or the other feature not both.

A. DID to a Centrex Station

26.111 A call to a centrex station from outside of the centrex customer is handled as a regular TER or ITR call except as follows:

- (a) The class-of-service of the called station is stored in the incoming or intra-office trunk. If the station has dial transfer the marker grounds a DTR lead to the trunk.

(b) After the marker has determined that read-in may be required, as indicated by the operation of the RDI, RDIA relay and that the called line is provided with centrex service, as indicated by the operation of the CGS relay, the class of service of the called line, registered on the CST-, CSU- relays, is transmitted to the trunk circuit. The CGS relay also grounds the winding of the read in check relay RIK. The minimum operate time of the RIK relay is such that sufficient time is allowed for the memory relays CT-, CU- in the trunk circuit to operate. Operation of the RIK relay removes the operating grounds from the class leads CTT-, CUT- to the trunk and cuts through the CTK1,2 and CUK1,2 relays to check for return grounds on the proper leads. If the proper class relays are operated and locked in the trunk circuit the class tens units check relay CTUK operates to allow completion of the call. A false ground or a cross on the class leads will operate the cross relay XCS.

- (c) This class-of-service read-in is dependent on a line idle condition, LIA relay operated. The read-in check contacts on the RDI and CTUK relays are in the RCK3, ringing switch check relay, operate path.

B. DID to the Listed Directory Number

26.112 The call to a centrex listed directory number when a console is provided is handled as a regular TER or ITR call except as follows:

(a) The listed directory number indication received from the number group, blocks hold magnet operation; FLG linkage is not set. The marker receives the listed numbers class-of-service from the LL, and stores it and a LDN mark in the incoming or intraoffice trunk. After the check that this information is locked in the trunk the marker disconnects on a TER call or advances to CB on an intraoffice call to set the connection from the intraoffice trunk to the calling line. After the CB linkage check the marker disconnects. When the marker has released from the incoming or intraoffice trunk, the trunk seizes an incoming register and the call is completed as a transfer call, from the LL appearance of the incoming or ITR trunk to the TL appearance of the attendant trunk. A temporarily disconnected line is routed to the attendant in a similar manner.

C. Restricted Incoming Service

26.113 Stations with restricted incoming service can receive calls from the other stations within the customer group or calls extended by the attendant. The DID calls to restricted stations are routed to the PBX announcement RIP. Ringing combination nine (RCN9) is assigned to stations with restricted incoming service. When the RCN9 is operated, if either the X11A relay (intra-PBX call) or ATT relay (start-in call from the attendant) are operated the RCT9 relay is operated and the call is completed with the ringing switch being set level six.

26.114 If the X11A and ATT relays are both released, indicating a DID call, the RIP relay is operated and the call is intercepted and routed to the common PBX announcement.

26.115 Option ZMG provides cross-connection terminals in the operate path of the RIP relay which permits screening of the RCN9 ground by incoming trunk class to allow completion of various calls, such as CCSA calls the restricted lines.

D. Features With Operation Similar to Phase III Centrex

26.116 Intercom Calls, see 26.19 through 26.30.

26.117 Dial 0 to attendant, see 26.31.

E. Transfer Call - SC8, SC139

26.118 The TRF call is originated by an incoming or intraoffice trunk receiving a signal from a called centrex station with attendant controlled transfer or from a completing marker processing a call terminating to a listed directory number. The incoming or intraoffice trunk seizes an incoming register for a transfer connection. The incoming register seizes and transmits to the marker the type of call, TRF, the trunk link frame location, FG-, TF-, and trunk number HT-, TT-, UT- of the incoming or intraoffice trunk.

26.119 The marker TRF and TRF1,2 relays operate indicating a transfer type of call. The operation of the TRF2, FG-, and TF- relays direct the marker to seize and connect to the trunk link frame where the incoming or intraoffice trunk appears. The operation of the TRF1 relay applies a +130 volt battery to the F lead in the incoming register link that operates the TF relay in the trunk circuit.

26.120 The operated TF relay in the trunk cuts through the class-of-service information which is recorded on the CT- and CUA- relays. A check that the class information is registered in the marker causes the marker to release the TL frame.

Route Relay Operation - SC140

26.121 After the marker has disconnected from the trunk link frame, the release of the TFK3 relay releases the TRF2 relay which grounds code point TRA. The screening field of the operated S- relay provides for the operation of the route relay associated with the proper attendant trunks. The operation of the relay NSO operates the marker TRF3,4 relays which direct the marker in setting up the connection to the selected attendant trunk. The operation of the TRF3 relay operates the FLG relay indicating the type of linkage.

Number Group Seizure and Translation

26.122 The operated FLG relay signals the marker to seize a number group. The FG- relay directs the number group seizure. The TRN relay, operated by relay TRF3, closes through the HT-, TT-, and UT- leads to operate the HN-, T-, and U- relays which transmits the trunk number of the incoming or intra-office trunk to the number group. The marker receives the line link appearance and ringing combination of the trunk number.

Call Completion

26.123 Following the NG translation, the marker seizes the LL and establishes the connection between the LL appearance of the incoming trunk, and the TL appearance of the attendant trunk. A grounded TP lead to the attendant trunk indicates a centrex station transfer, and a grounded TC lead, a LDN call. The call is completed as on a normal FLG call.

F. Attendant Call - SC9

26.124 The ATT call is used by the attendant to complete a transferred call or a listed directory number call. The attendant starts the call by seizing an incoming register via the attendant and incoming or intra-office trunk connection set up by the transfer call. The attendant pulses the stations line number into the incoming register. The incoming register seizes and connects to the marker and transmits the line number, the class of call ATT, the FVD translation mark and the trunk link frame number of the incoming trunk.

26.125 The marker processes the call as a TER call except as follows. When the marker connects to the trunk link frame where the incoming or intraoffice trunk appears, the marker CT- and CUA- relays read the class-of-service that is stored in the trunk.

26.126 The marker matches the class-of-service of the called line against the class-of-service that is stored in the trunk circuit.

26.127 On a line busy, the marker grounds the OV lead and sets the incoming trunk ringing switch to transmit the busy signal.

G. Dial Transfer

26.128 The provision of dial transfer requires similar equipment to that of phase III

centrex, except that a transfer line identifier is not used. The transferring station remains connected to the incoming trunk, and its class-of-service is stored in the incoming trunk as previously described. Thus the DTI marker call is not required.

26.129 The incoming or ITR trunk has an appearance on the TLL frame, and under dial tone marker control, is connected to a transfer trunk appearing on the TTL. The other end of the transfer trunk is on the TL.

26.130 The transfer trunk seizes a transfer register which returns dial tone to the transferring station. After receiving the dialed 4- or 5-digit number a completing marker is seized and the following transmitted to the marker:

- (a) The TL frame number of the transfer trunk.
- (b) The class-of-service of the transferring station.
- (c) The dialed number.

26.131 The marker DTF relay operates and the call is completed similar to the DTF call described previously for phase III centrex.

H. Centrex With Sixty Classes of Service, No Rate Treatment

26.132 Offices with 30 classes-of-service provide the class information from the LL to the marker on the CS0-29 leads. If rate treatment is added, 10 of these leads (CS20-29) are reserved for this feature thus leaving CS0-19 for 20 classes of service. Because of this, the class of service received from the originating register is also restricted, a maximum of 20 classes of service under these conditions.

26.133 The "60 classes-of-service with no rate treatment" feature was provided to eliminate this reduction in available classes and to reduce office modifications. However, with this feature, each different dialing privilege desired for the centrex customers stations will require a separate class of service. In order to keep the centrex customers separated, the multiple class-of-service match feature must be provided. This allows a group of classes to be assigned to a centrex customer, with matching between any classes in the group, and mismatch between classes of different groups (see 26.21). For example:

Customer	Class-of-Service Number	Dialing Privilege
A	1	Intra-PBX (IAX) only
A	2	IAX plus dial 9
A	3	Full dialing privileges
B	4	Full dialing privileges
B	5	IAX plus dial 9
C	6	IAX only

I. Multiple Class Match Feature in Phase I or II Centrex Offices with Airport Dialing Service

26.134 Option ZXB (rated Special) is added to permit the addition of the multiple class match feature to a phase I or II centrex office without changing the class of service or the ringing combination of lines having intramarker group flat rate service (airport dialing). The AUS (airport service) relay is added to operate the MRI relay to cancel the class match on 4- or 5-digit intraoffice calls from stations with intramarker group FR service to stations without incoming restrictions. If the called station has incoming restricted service the MRI relay is not operated and a class match is required for the call to complete.

ACCESS GROUP CONTROLLER

26.135 The marker is arranged for operation with the access group controller (AGC). This circuit provides a means for limiting the number of calls at any one time to or from CCSA network trunks, according to a pre-set maximum, as subscribed for by the CCSA network customer.

26.136 The AGC feature is intended for use with CCSA network customers having centrex CO features. One AGC circuit is required for each CCSA network-centrex customer, thus eliminating the need for a physical access line group (ONAL).

26.137 Upon recognition of a network call to or from a centrex station (by digit 8 on originating calls and the combinations of an incoming trunk class mark and the NNX code on terminating calls) the marker operates an OAC0-4 relay on originating calls and a TAC0-4 relay on terminating calls. An OAC0-4 or TAC0-4 relay operated will direct an "add" indication from the marker to the proper AGC circuit which in turn sends back a ground to operate the AGCK check relay in the marker. This verifies that the AGC circuit has received the add indication.

26.138 The AGC circuit will count the add indications received from the marker for the CCSA customer. These indications will be added as received, and subtracted after a predetermined time (based on trunk average holding time). If the total count registered in the AGC circuit becomes equal to or exceeds the predetermined setting of the counter in the AGC circuit, an inhibit indication is sent to the marker. This indication makes the CCSA customers route appear busy. When the total count becomes less than the predetermined setting, the inhibit indication is removed, and the marker may again set up network calls between CCSA trunks and centrex stations.

26.139 If the AGC circuit does not verify the receipt of an add indication from the marker by operating the marker AGCK relay at the proper time, the marker will request a trouble record under light traffic conditions. Under heavy traffic conditions the trouble record request is bypassed. However, under either light or heavy traffic conditions the call in progress will be completed.

26.140 When the marker finds a partial dial, paths busy, busy line, vacant code, or intercept condition an add indication is not sent to the AGC circuit. Instead, the marker immediately operates the AGCK check relay and proceeds with the call. This prevents a false add indication from being counted in the AGC circuit under these conditions.

26.141 The marker provides a peg count of the total number of originating calls and terminating calls routed to overflow due to the AGC circuit. The AGC circuit provides a peg count of the total number of add indications received from the marker.

MULTIPLE AGC CIRCUITS PER NETWORK

26.142 The marker is equipped to work with an additional five AGC circuits. This change allows a total of ten AGC circuits to be provided in a marker group. These circuits may be assigned on a one per network basis as in the past, or assigned in a new configuration where a single network uses multiple AGC circuits.

26.143 The typical cross-connections Note 450 has been modified to illustrate the hookup of a multiple AGC arrangement. This arrangement allows all AGC circuits assigned to a given network to be checked for an inhibit condition. In a given network, the first idle AGC circuits that is looked at by the marker is used to count the incoming or outgoing call. When an AGC circuit is in an inhibit state the associated ART- relay diverts the AGC circuit selection path to another, OAC- or TAC- relay in that network. If all AGC circuits in a given network are in an inhibit state, the call will be set

up to paths busy or reorder. To distribute the traffic evenly over all AGC circuits assigned to a network, the order of selecting the AGC circuits should be varied between markers.

26.144 To provide a better means of traffic data analysis on AGC circuit usage additional traffic registers leads are provided. The existing peg counts, OAB- and TAB-, provide a count of all originating and terminating calls that are blocked due to the AGC circuit. New leads provide counts of all offered originating and terminating AGC traffic, and provide originating and terminating counts of all completed calls involving an AGC circuit.

26.145 These changes are provided by option ZVW and App Fig. 164 and will be the new standard arrangement. Option ZVX (A&M Only) represents the old wiring.

27. ORIGINATING LINE IDENTIFIER

27.01 In small package offices the marker will operate in conjunction with the originating line identifier circuit to serve dial tone requests. The combined operation of the two circuits is similar to the dial tone marker operation.

27.02 In order to establish a dial tone connection the originating line identifier determines:

- (a) The location of the customer line on the line link frame.
- (b) The customer class of service.

27.03 The completing marker determines:

- (a) The location of an idle originating register, if available.
- (b) Selects and idle channel between the customer and the originating register.

SELECTION OF AN IDLE ORIGINATING REGISTER

27.04 Originating registers are associated with the trunk link frame and connector circuit. Therefore, it is necessary for the marker to determine by means of test leads which trunk link frames are idle and have idle originating registers. The marker receives ground on lead D or MF from the originating line identifier. Leads D and MF are brought out to punchings which are cross-connected to operate route relays to test for dial pulse (D) or multifrequency (MF) originating registers. The selection of an idle register is similar in operation to selecting a trunk.

LINE LINK FRAME AND CONNECTOR SEIZURE AND IDENTIFICATION OF VERTICAL FILE AND CLASS OF SERVICE

27.05 Before the OLI can complete the identification of the customer line the marker must seize the line link and connector circuit. When the marker connects to the line link and connector circuit many leads are cut-through to the originating line identifier for vertical file identification and for performing the dial tone connection functions.

SELECTION AND TEST OF THE CONNECTING PATH

27.06 After the horizontal group has been determined and an originating register seized, the marker selects one of the connecting paths which may be available to connect the calling customer to the originating register. The marker tests the junctor, line link, and trunk link of each possible connecting path to determine which junctors, line link, or trunk links are in use on other calls and therefore unavailable for this dial tone connection. The marker selects the preferred connecting path which is available for use, and with the vertical file identification operates the select and hold magnets on the crossbar switches to establish the connecting path. The marker will then transfer the supervision for holding the connecting path to the originating register.

ROUTE ADVANCE

27.07 If the marker finds all originating registers busy, relay TBTA operated, or has a second failure to match it operates the RAV1 and 2 relays and disconnects. The RA punching associated with the route relays for originating registers is cross-connected to DIS to operate the disconnect relays DIS1,2.

RECYCLE

27.08 A marker recycle on dial tone calls, relays RCY and RCV1 operated, occurs only on a failure to match. A failure to match is indicated by the operation of the FMP relay.

27.09 On second failures to match or dial tone calls the marker will route advance and disconnect.

28. LINE LINK PULSING - SC144

28.01 Line link pulsing is a feature that provides inward dialing, and centrex features for satellite PBX equipment. The No. 5 crossbar office is enabled to work directly into the PBX to automatically select lines to the PBX, and by pulsing over these lines, to select a PBX station corresponding to the

called number. A common group of lines on the LL frame is assigned to the satellite, and is arranged for PBX terminal hunting and allotting if required. The station numbers of the satellite are assigned 7-digit numbers in a marker group number series. However, the line equipment location information received from the NG that contains the called number indicates the location of a line in the hunting group to the satellite, and is not in any way related to some terminal location of the called station.

28.02 A call to a satellite station is handled as a TER or ITR call to an idle line in the group of lines to the satellite. A sender is then attached to the selected line, and the required number of digits of the called number are pulsed into the equipment of the satellite to select the called station.

28.03 The numbers assigned to lines to the satellites may be in a regular number series or they may be in a number group outside of the Bell System numbering plan since customers should not dial these numbers directly. If the line number is in a regular number series and is dialed by a customer, the call is routed to intercept.

28.04 It is necessary that the marker first examine the called number to determine if it belongs to a station of a particular satellite. This information is made available in the marker if a route to the stations at the satellite can be identified by one of the following:

- (a) The called office code.
- (b) The called number thousands digit.
- (c) The called number hundreds digit.

28.05 If the identification of the satellite route requires more information than the above, an NG must be used. The NG can identify the stations of a satellite on an individual line basis. In this latter case the NG is used twice; the first time to identify the route, and if a satellite station is indicated, then a second usage is required to obtain the LL location of the hunting group of lines to the satellite.

RECOGNITION OF LLP CALL AND ROUTE SELECTION - FS136

28.06 A call to a satellite requiring LLP completion will be recognized from the called number digits. Depending on the number of stations in the satellite, a varying degree of translation of the called number digits will be required to select an LLP route to the satellite.

28.07 Normally one line link pulsing route (LR-) relay is assigned to route calls to each satellite. However, if the information furnished by the LR- relay can vary on calls to different stations within the same satellite more than one LR- relay can be used to serve the stations of that satellite.

28.08 The LR- route relay will be selected as follows:

- (a) If an entire block of line numbers represented by a single code point requires the operation of the same LR- relay, the LR- relay can be operated from that code point. The code point is cross-connected to operate the LR- relay, and its route series LPN relay which in turn operates the LRS relay. Relay LPN is actually a special local completion relay and operates in place of any of the other series relays NSS0-5 are disabled, and a start signal is canceled to the NG through any NSS- contacts, B60, B103.
- (b) If an entire block 1000 line numbers represented by a thousands digit requires the operation of the same LR- relay, the LR- relay can be operated from a NG start punching, ST0-9 for each number series. The ST- punching is cross-connected to the LR- relay instead of to a NG, causing the LR- and route series LRS relays to operate, B61, B103.
- (c) If an entire block of 100 line numbers represented by a hundreds digit requires the operation of the same LR- relay, the LR- relay can be operated from a hundreds block LR-- punching. As many as 10 ST-punchings may be cross-connected to operate LRST- relays. The hundreds digit number information is separated through LRST- contacts to present 100 hundreds block terminals. A hundreds block LR-- terminal may be cross-connected as follows:

<u>Terminal</u>	<u>Condition</u>
LRW--	Hundreds block associated with single LR- relay.
ST00-39	LLP hundreds block and more than one LR- relay is required.
AS	LLP hundreds block requiring more than one LR- relay is assigned to partially filled number group.
PHB	Option ZMK provided non-LLP (POTS) hundreds block.
BNTH	Blank number treatment.
RITH	Option ZQQ provided regular intercept treatment - route to Bell System operator.

AREA CODE TRANSLATOR (FIG. 170) - FS175

28.09 Apparatus Fig. 170 provides a translator for translating NO/1X area codes. In addition, option ZQO may be provided for translating NNO codes. The translator provides for translation of all 160 NO/1X codes and all 64 NNO codes.

28.10 Operation of the ACT relay connects the A-, B-, and C-digit information to the translator. When the translator is used for DDD only, the ELT relay operates the ACT relay. When DDD and PPCS are required, screening relays are operated, causing ACT to operate (see typical cross-connection Note 463).

28.11 Operation of the ACT relay causes the XOX, X1X, or XNX relay to operate, depending on whether the B digit is 0, 1, or N(2-9), respectively. Operation of XOX or X1X connects the 20X-90X or the 21X-91X relays to the A-digit leads (A2-9). The 20X-90X or 21X-91X relay corresponding to the A digit will operate. Thus the first two digits of the designation of the operated relay correspond to the A and B digits dialed. Ground on one of the C0-9 leads is connected through a contact of the operated relay to the code point (AC---) associated with the 3-digit area code. The code point is cross-connected via AGC-- and ACR-- terminals to a route relay, the foreign area translator or to vacant code treatment.

28.12 If the B digit is not 0 or 1, ground on the BN lead operates the XNX relay after ACT operates. If translation for NNO codes (option ZQO) is not provided, operation of XNX applies the ground on the A- lead to the ACV terminal. The ACV terminal is cross-connected for vacant code treatment.

28.13 If option ZQO is provided and the B digit is not 0 or 1, the XNX relay operates, and the XXO relay should operate, indicating that the C digit is 0. These two relays operated connect the A2-9 leads to the 2NO-9NO relays. The first digit of the designation of the operated 2NO-9NO relay corresponds to the A digit dialed. Ground on the B digit lead B- is connected through a contact of whichever 2NO-9NO relay is operated to the associated code point (AC---).

28.14 If the XXN relay operates, indicating that the C digit is not 0, and XNX operates, indicating that the B digit is not 0 or 1, the ground on the A- lead is applied to the ACV terminal for vacant code treatment. The AC--- terminals corresponding to unused area codes should also be cross-connected for vacant code treatment.

IDENTIFICATION OF LLP LINE GROUP ON LL

28.15 When the LRS relay operates, indicating that the LR- route relay has been selected, the CKO relay operates to release the LLI and SNG1,2 relays. If the NG has been used for LR- route relay identification as described for individual line numbers, the line identification relays and the NG, MC-relays will be released. Relay CKR operates to indicate this release. If the NG was not used because the LR- route relay identification was obtained directly, then CKR relay operates immediately following the operation of CKO relay.

28.16 The LRS in operating also causes LLP2 relay to operate in preparation for selecting a NG to obtain the line location of the group of lines belonging to the LR- route relay operated, B60.

28.17 The operation of the CKR relay, with LRS relay operated, operates the LRA relay. Relay LRA operated:

- (a) Operates the LSC1,2 relays which prepare the outgoing sender control for operation with an LLP line, and provide additional contacts for checks of LLP operation.
- (b) Along with LLP2 relay operated, seizes an NG as directed by the operated LR- route relay, B61. If the LR- route is allotted, the LN-- terminal is connected to an ANA- relay to identify the terminal hunting group, instead of directly to the NG start lead, B74.
- (c) Enables the PBX allotting functions by operating the ANON relay on TER calls.
- (d) Reoperates the SNG1,2 relays to allow operation of the NG connector relays.
- (e) Along with the LLP2 relay operated, transmits the hundreds, tens, and units digits for first line of the hunting group to the NG, as described by cross-connections off the operated LR- route relay contacts. With PBX allotter operation, these functions are handled by the allotter.

28.18 A hunting indication is given to the NG immediately by operation of PBX1,2 relays from CKR relay operated. The NG functions as with PBX terminal hunting or PBX allotting. The line number generated by the LR- relay cross-connections, or by the allotter cross-connections, is translated into the equipment location of a line to the satellite. The marker and NG are cross-connected to give the silent ringing level for ringing selection switch control.

28.19 If an NG is required to identify the LR- route relay, then any rate discriminating mark derived from this NG must be the same as the rate discriminating mark provided by the NG used to identify the LLP line location, or else the nondiscriminating PTN mark must be used.

OUTGOING SENDER SELECTION CONTROL

28.20 The terminating treatment mark derived from tens block screening is used to operate the OSG- relay for the sender group required for the selected line. This allows a group of line circuits serving one PBX to be spread across more than one sender group. Other cross-connections from the line route relay permit desired information to be transmitted to the sender. When an OSG relay is operated from the number group on a TER or ITR call, the TTL relay is operated and locked if the LLP2 relay is operated. This indicates that the line link route relay is operated. If a customer dials the number of this line circuit directly, the LLP2 relay is not operated and LPI relay operates which routes the call to intercept.

28.21 When operating with line circuits, the marker off-normal OGC relay operates the called number digit cut-in relays KGS3 and 4 if the last four digits are to be transmitted to the sender (OP- relay operated) or the OGC relay operates the cut-in relay KG if the full seven or ten digits are to be transmitted to the sender (OP- relays released).

28.22 The OP01-4 punchings are added to the marker to permit transmitting the CL1 mark to the outsender on LLP calls. This informs the sender to transmit XX, the first two digits of the mobile radio stations home area code, ahead of the last four digits.

28.23 The number of digits to be outputted by the sender may be controlled by the delete code information to the sender. This can be controlled either directly by cross-connections of an LR- relay contact, or if the LR- is identified by the NG, then this information is stored on the OP- relays by the NG, VF information. One arbitrary digit can be generated and passed to the sender as cross-connected off an LR- relay contact. The outsender class information is obtained in a similar manner. See B45 and B47.

28.24 After the marker SKA or SKB operates, to indicate possession of an outsender connector, the marker connects to the required line link. Relays are operated in the line link to give the marker access to the line circuit. Relay F is operated in the line circuit and the marker proceeds to connect the selected sender and line circuit together through the sender link.

28.25 From this point on, the functions are the same as those listed for a terminating or intraoffice call.

TWO-WAY LINE CIRCUIT BUSY CONTROL - FS137

28.26 Ground on the LF lead is extended to seize the line circuit as directed by the LL. The line circuit returns a signal on the FK lead to indicate its successful seizure and operate the FK relay which enables a linkage check on the LLP call. See B36. However, if an incoming seizure from the PBX has selected this line circuit, ground on the BY lead operates the LBTA relay. Relay LBTA operated initiates a PBX recycle to select another line circuit for the call.

AMA WITH LLP

28.27 If an AMA record is desired on an ITR call to a LLP station, an outgoing-incoming route will be necessary. The required AMA record will be indicated either by the selected AMA route relay, or by a traffic sample request (see 30.18 and 30.19). Since a sender is required for the AMA entry, and a sender is required for LLP, the outgoing call handles the AMA record, and the incoming call handles the LLP function.

28.28 On the FLG linkage, after the NGC relay operates followed by CKR operated, as described, the operated AMA relay will transfer the operate path from the LRA relay to the LRD relay. Relay LRD operated will cause a route advance by operating RAV1,2 relays.

ENSURE TEST CIRCUIT RELEASE ON LINK PULSING TEST CALLS

28.29 The marker is arranged to ensure that the test circuit is released when line busy is encountered on a test call to a particular LLP line circuit which is assigned to a block select hunting group. A contact of the MT21 relay is added to provide a path to operate the EG relay, simulating that the marker is hunting in the last tens block of the block select hunting group. If the line selected by the test circuit is found busy, the marker will not attempt to advance, but will immediately indicate a line-busy condition to the test circuit. The option ZLD (rated Standard) is assigned to the previous wiring, option ZLE (rated Standard) to provide the MT21 contact.

INTERCEPT TREATMENT FOR CENTREX CU CUSTOMERS

28.30 Option ZRE provides arrangements for routing calls to disconnected centrex CU customers, which are reached via LLP on either a thousands or hundreds digit basis,

to a Bell System intercept operator for referrals. When ZRE is provided, the RI relay can be operated directly from either the number group start, or from the LLP hundreds block translator.

ALTERNATE ACTIONS SELECTED WHEN ALL LLP SENDERS ARE BUSY AND THE INTRAOFFICE TRUNKS ARE ALLOTTED

28.31 The trunk group allotter cross-connection notes specify a SAL- to LSG cross-connection for intraoffice trunk allotters when LLP lines are served. This will allow the marker to route advance to tone trunks if it encounters all LLP senders busy on intraoffice LLP calls where the intraoffice trunks are allotted.

28.32 In the case where LLP lines are served by two sender groups, a wiring modification is added to move the LLP contact ahead of the trunk group allotter contact in the sender busy circuit. Then if the marker encounters all LLP senders busy, a path is provided for the ASB ground to operate the RC42 relay and initiate a PBX recycle.

28.33 Option ZJM provides this modification.

29. TWO-LINE NUMBER

29.01 The 2-line number feature provides customers with 2-line service without the need for regular terminal hunting. The two line numbers must be assigned within the same tens block. Any number of service groups, within the same tens block, may have the same second line. The first line of these groups must have a special terminating treatment mark. This mark informs the marker that it is handling a call to a 2-line number and indicates to the marker the units digit of the second line. Both lines use any desired non-hunting ringing combination. If the first line is found busy the marker uses this information to examine the second line. If the second line is found busy the calling customer will receive busy tone. Calls to either line are capable of being rerouted to the other line.

29.02 The marker is informed that the call being handled is to a 2-line number by means of the terminating treatment mark provided by tens block screening. The RNB-punching associated with the called 2-line number is cross-connected to a 2L- punching. The numerical designation of the 2L- punching indicates the units digit of the second line. A separate treatment mark is required whenever a different units digit is assigned.

Ground on any RNB- punching associated with 2-line numbers, will operate the treatment relay 2L. The 2L relay cuts through the ground on the RNB- punching to operate a particular SA- relay to indicate the units digit of the second line. Relay TTL (terminating treatment lock) checks the operation of the 2L and SA- relays. The marker proceeds to seize the line link frame and performs the line busy test. If the line is found idle the call proceeds. If the line is found busy, as indicated by the operation of the LBTA relay, the RCY2 relay is operated to cause a PBX recycle. As the marker recycles, the SAK relay checks that not more one SA- relay is operated. Failure of the SAK relay to operate will cause the cross relay XN to operate.

29.03 When the PBX recycle is completed, the units advance relay (UA) is operated and the number group is resealed for the translation of the second number. With the UA relay operated and the UC relay released, the units digit given to the number group is determined by the SA- relay operated from the translation of the first number. If the second line is found busy it is treated as an ordinary line.

29.04 If either line must be routed to intercept, the two line number feature must be removed from these lines.

29.05 Option ZKD provides a hunt indication to the test desk when a 2-line number is called. On special calls to a 2-line number, the 2LH relay is operated by ground on any of the 2L- terminals. The 2LH relay:

- (a) Locks operated to the LLIA relay.
- (b) Grounds HF lead to the trunk link connector to indicate that the line is arranged for hunting.
- (c) Extends its operate ground to operate the 2L relay on special hunt (SPH) or the POTS relay on no-test (NT) or no-hunt (NH).

30. TRAFFIC SAMPLING

CUSTOMER CLASS-OF-SERVICE TRAFFIC SAMPLING

30.01 Traffic sampling is a feature that periodically causes an AMA record to be made on certain SOG or ITR calls. The information obtained in this manner from a call can be used as a basis for allocating revenue within and beyond certain geographical areas, or as required by CCSA networks. The AMA record sample indicates the following:

- (a) Conversation time.
- (b) Where the call originated.
- (c) Where the call terminated.

30.02 The ability to sample a call is determined by screening and by code pattern: screening to detect the class or classes requiring sampling; and code pattern to ensure that trunks are selected to permit an AMA record on calls requiring sampling.

30.03 Sampling is controlled by a traffic sample circuit which contains a reverse counting counter. This counter is manually set to a predetermined number, and as each call of the desired type is completed, the counter in the traffic sample circuit decreases its count by one digit. When the predetermined number of calls have been counted, the counter reaches zero and signals the marker to request a sample. The next call of the desired type is sampled, and calls for an AMA record to be made. If, at the end of this call, a sender has been selected, and the AMA- relays in the marker operated, the counter is reset to its predetermined number. Subsequent calls will be counted and another sample taken as described above.

30.04 Requests for sampling are handled for both chargeable and nonchargeable calls. Charge calls result in the operation of a message billing index route series relay MBS1-9. This in conjunction with the sample mark indicates a sampled, billed call to the accounting center. For noncharge calls, the operation of the sample relay, and AMA code pattern relays, causes the operation of the MBS0 route series relay. Along with the sample mark, this combination indicates a sampled, nonbilled call to the accounting center.

30.05 As many as five traffic sample circuits may be associated with each marker for sampling different services.

A. Operation of Traffic Sample Circuit - FS147

30.06 The class or classes of calls that require sampling are indicated by the combination of code point and class-of-service screening relay which is cross-connected to a TS- terminal for one of the traffic sample circuits. Ground on the TS lead connects the sample circuit to the marker. At the completion of the call, ground is placed on the CT lead to the sample circuit, which causes the counter to decrease its count by one. The CT lead is grounded either by the operation of AVK1 relay when a sender is attached, or by operation of DCT2 and PEG1 relays on ITR calls without a sender.

30.07 The counter mechanism in the traffic sample circuit is back acting, thus when the counter approaches "0", the transfer contact in the counter does not operate until ground is removed from the CT lead. Ground on the CT lead is removed on marker release. When the counter reaches "0", then the next time that the TS relay operates to connect the sample circuit to the marker, the SA lead will be grounded to operate the SA relay in the marker.

B. Sample Control

30.08 Requests for sampling may be made by two different means:

- (a) By cross-connections of S- to SAC terminal to sample every call of that type in which case no traffic sample circuit is required.
- (b) By cross-connection of S- to TS- terminal to sample calls periodically as directed by the traffic sample circuit.

In either case, SA relay operates to initiate sample functions in the marker.

30.09 Relay SA operated:

- (a) Transfers the no-sample NSP lead from the sender, to the XT2 cross-detection relay, B114.
- (b) Transfers the sample SPC lead from the sender to control of the TGS2 relay.
- (c) Partly closes an operating path for the MBS0 relay, or route advance, or cancel request, as determined by operation of the CP10 code pattern relay on noncharge calls, B28, 29.

30.10 If the call is noncharge, and if the trunks of the selected route are arranged for AMA (CP10 relay normal), the operation of one of the route series relays (ie, NCNC) directs the class check ground to the MBS0 relay. Relay MBS0 operated operates the AMA relay and associated AMA- relays which further extends the class check ground toward the class check CLK relay, through a contact of the operated MBS0 relay, and a contact of the originally operated route series relay NCNC.

30.11 If the trunks of the route are not equipped for AMA, CP10 relay operates. This results in one of two alternate actions:

- (a) The request for AMA is canceled.
- (b) The route advance relay operates.

30.12 These actions are dependent upon the CPP and CPS relays in conjunction with the CP10 relay as described in the 400 series notes on cross-connection information.

30.13 If the call is billed, one of the MBS 1-9 relays operates, causing the AMA-relays to operate. In this case, a flat-rate route series relay will not operate, and the path through the SA relay contact and CP- relay contacts to the MBS0 relay is disabled.

C. Check of Sample Mark to Sender

30.14 When the sample (SPC) or no sample (NSP) mark is transmitted to the sender, the MBK6 relay operates, and should remain held operated from the sender when TGS2 relay releases.

30.15 Contacts of the MBK6 relay are included in the sender OST check circuit to check this operation (see B57).

30.16 CAMA senders are not arranged to provide sampling, or a holding ground for the MBK6 relay. Since this relay will operate on CAMA as well as AMA calls, the check contact of the MBK6 relay is bypassed on CAMA calls (option KQ).

D. Counter Reset

30.17 During a sampling condition, the SA relay is operated and the following operations are required to reset the counter:

- (a) The AVK1 relay must be operated to check that a sender has attached to the marker.
- (b) The AMA3 relay must be operated. This indicates that the AMA-relays have operated and an AMA record requested.
- (c) The TS relay in the traffic sample circuit is operated.

If any of the above conditions are not met, the counter will not be reset and the sample request signal from the traffic sample circuit will be repeated on the next call of that type. A sample will again be attempted on the next call of the class or classes desired.

E. Sampling on ITR Calls

30.18 If an intraoffice route uses flat-rate trunks, the CP10 relay will be operated. If a sample is to be taken, operation of the SA relay causes a route advance by operating RAV1,2 relays and a new ITR route may be selected, see Note 403.

30.19 If the new route is an ITR, AMA route, then at the end of the FLG part of the call, the DCTL relay operates, and with AMA3 relay operated will select a sender group by operating an OSG- relay, see B42. In this case, the sender is required only for transmitting information for the AMA record. The ITR call proceeds with the call-back portion, with the sender attached, similar to an SOG call with a sender. The linkage check circuit required for DCT2 relay operation requires AVK1 and OGC relays operated in this case, B36.

F. Sampling on LLP Calls

30.20 Sampling on LLP calls will usually be limited to CCSA network customers where sampling is required to determine charges allocated for calls originating from these networks. When the LLP calls are intraoffice, the routing must be changed in order to result in an outgoing-incoming trunk arrangement. This is necessary because the sample function requires a sender for AMA recording on the outgoing part of the call, and the LLP function requires a different sender on the incoming part of the call.

30.21 Whenever an ITR call uses a flat-rate route, a sample request will cause a route advance before the call can be recognized as LLP or not. Whether the route advance will be to another ITR route or directly to the outgoing-incoming trunking arrangement will depend upon the route advance assignments as determined by LLP traffic requirements.

G. Trouble Detection with Customer Class-of-Service Traffic Sampling Features

30.22 The marker is arranged to provide a more complete trouble detecting circuit for use with customer class-of-service traffic sampling features. Provision is also made for operation with the traffic sample monitor circuit.

30.23 A translation mark from the register or customer class of service indicates that a CCSA or WATS customer is to be served. The originating classes are screened from the incoming classes for the purpose of traffic sampling. Those classes to be sampled will cause the CSA marker relay and the TS- relay in a traffic sample circuit to operate. After a sender is connected and the linkage through the office completed on SOG and on the call back portion of ITR calls, a ground is sent to the STEP or RESET winding in the traffic sample circuit counter. The CTK marker relay is in series with these windings and is used to verify whether or not the counter windings have been energized. The CSA and CTK relays provide a check on the operation

of the traffic sampling features. If the check fails, the call is completed and the marker disconnect is blocked until a trouble record is taken, after which the marker returns to normal.

30.24 The IAO and CT cross-connections are provided for those customers requiring traffic sampling on intraoffice calls.

30.25 Two methods are available for testing the traffic sample circuits associated with a marker. A key in the master test control circuit allows the associated traffic sample circuits to be operated on marker test calls. No error is introduced in the traffic sample count during test calls if the marker is made service busy and if the number of test calls made is equal to one more than the number set on the CTR counter in the traffic sample circuit being tested. The results of these test calls may be determined by observing the CTR counter of the traffic sample circuit under test or by using the traffic sample monitor and test circuit.

30.26 When the traffic sample monitor circuit is provided the marker sends a ground to it each time an SPC is sent to an outsender circuit. The traffic sample monitor also monitors the inputs and outputs of the traffic sample circuit to and from the marker. This allows a matching check to be made on the counter mechanism in the traffic sample circuit. If, when the marker is associated with a traffic sample monitor, a trouble is encountered and a trouble record is taken, the marker will ground the TBR lead to the traffic sample monitor. This results in the traffic sample monitor restarting its matching tests from the beginning of its testing sequence.

30.27 Option AV provides for 7- and 10-digit SOG and ITR traffic sampling with improved trouble detection circuitry, and the required leads to the traffic sample monitor circuit.

SELECTED TRUNK GROUP TRAFFIC SAMPLING

30.28 For traffic sampling by selected trunk group (TGTS) rather than by customer class of service, the requirement for sampling and the selection of the sample circuit is determined by the R- relay. The selected trunk (or lunk) group, as determined by the route relay, may be fully or partially AMA equipped. Those trunks not equipped should be arranged to give a 19 RN recorder number if available or a 9 RN if the marker group is equipped for only 10 AMA recorder numbers. Route advancing to AMA equipped trunks is not normally necessary.

30.29 The TGTS circuit will contain two transistorized counters. The first will receive add pulses only and will output these add pulses to the other counter only when the number specified for the sampling ratio have been registered. The second counter will be capable of both adding and subtracting.

30.30 If the recorder number indicates that the selected trunk is not AMA equipped or that no sample is being requested by the sample circuit then one is added to the first counter. When an AMA record (sample) is taken, one is subtracted from the second counter.

30.31 When the number registered in the second add-subtract counter in the TGTS circuit is positive (0 through 7), a sample will be requested from the marker. When the number is negative (-1 through -4) no sample is requested. When the number is greater than plus seven or minus four a minor alarm is brought in at the TGTS circuit and the TGTS circuit will hold itself out of service until it is manually restored.

30.32 The TGTS circuits normally will be provided on the basis of one circuit per trunk group per marker group. More than one trunk group may be served by a traffic sample circuit if all trunks in each group are AMA equipped. A maximum of 100 traffic sample circuits may be provided per marker group.

30.33 Control between the markers and the TGTS circuit is over two leads, P and SA. The SA lead will indicate when a sample is requested. The P lead will permit the marker to add or to subtract from the counters. The need for preference circuitry is eliminated by using only one lead from the marker to indicate both add, a positive 130-volt pulse, and subtract, a negative 130-volt pulse. With the relatively short pulses, the error, due to overlapping add and/or subtract pulses from more than one marker working with a TGTS circuit simultaneously, is negligible.

30.34 A positive 130-volt pulse is sent to the TGTS circuit for each marker usage of that trunk group when no sample (AMA record with a grounded SPC lead) is taken. A negative 130-volt pulse is sent each time a sample is taken. The P (pulse) lead from the marker to the TGTS circuit is closed through for a very brief period by the transmit count (TCT) relay. For IAO calls this relay is operated when ground is supplied to the DCT2 and released when the DCT2 operates. For SOG or TOG calls the TCT relay operates when ground is applied to the AVK1 relay and released when the AVK1 relay operates. The TCT relay will remain operated for only 2 to 8 milliseconds.

30.35 When a C- relay closes an SA lead to a TGTS circuit, plus 130 volts or minus 48 volts will operate an RCR or NRR relay.

30.36 This will operate and lock an RCD or NRD relay. One of these relays must be operated, indicating that a TGTS circuit is connected, before the TCT relay will operate.

A. Testing Improvements for Trunk Group Traffic Sampling

30.37 A crossed code pattern condition existing during marker testing of trunk group traffic sampling will result in a trouble record followed by a marker disconnect. Previously this condition caused the marker to block and disconnect after timing out which was unnecessary. The marker is now arranged to go directly to a trouble disconnect after the trouble record has been taken. Option ZMD provides the new wiring. Option ZMC represents the old arrangement.

TRAFFIC SAMPLING ON ROUTES USING BOTH AMA AND CLOCK TIMERS

30.38 Improvements have been made to the traffic sampling feature to allow its use on routes that require both AMA and trunk class information on the same call. In some offices there are conditions where a CCSA customers call will have alternate routes using measured time WATS trunk that require clock timers for charging, AMA records for the division of WATS revenue, and AMA traffic sampling records for the customers use. Options ZPV and ZOA provide the necessary revisions to the traffic sampling circuitry in the marker.

31. AUTOMATICALLY IDENTIFIED OUTWARD DIALING, AIOD; AND TANDEM AMA OPERATION

AIOD - B30, B114

31.01 The AIOD is a feature available in the No. 5 crossbar system 2-wire and 4-wire, to permit the identification of individual stations in an associated PBX. This identification allows calls made from the PBX station to be charged to the PBX station as determined by the AMA record made on the call.

31.02 In order for the marker to recognize PBX, AIOD calls, the group of lines from the PBX is assigned a special class of service. The special class is cross-connected to operate the AIOD relay and all other classes operate the OC relay. Option ZXV provides the one upcheck on the AIOD and OC relays in RK1,2 check path on test calls.

This provides a check on the cross-connections that operate the AIOD and OC relays. When the AIOD class is recognized, the AIOD relay operates to prime the marker for handling this type of call. An AMA route is selected to allow an AMA entry by operation of the MBS9 relay.

31.03 Since the identification of the calling station cannot be derived from the LL frame line appearance, a data link is provided to transmit an office index and the four directory digits of the PBX station to a special AIOD, AMA translator. Through this translator, the calling station number is made available to the AMA transverter for the AMA record.

REQUEST FOR AIOD, AMA RECORD

31.04 In order for the transverter to handle the call in the above manner, it must know if the calling station is arranged for AIOD, and it must also know that the particular call in progress requests AIOD as determined by code point and class of service.

31.05 The group of lines from the PBX that handle all AIOD calls must be assigned to three vertical files in one vertical group on the LL frame. When the transverter receives the frame number and vertical group information it determines from this information if the calling station is arranged for AIOD.

31.06 All lines arranged for AIOD must also be ring party lines. When the AIOD relay in the marker operates, it reverses the TP and RP leads to the outgoing sender, and the RP relay operated grounds the TP lead. Thus when the transverter receives a tip party indication on an AIOD station call, it recognizes that an AMA record is to be made and that a PBX, AIOD translator must be used to receive the calling station number through the data link.

31.07 All other information required for AMA operation such as recorder number (RN-), message billing index (MBS-), code pattern (CP-), and number structure, is unchanged and is sent to the transverter via the outgoing sender. The marker makes a one-up check to require that either the AIOD relay or the OC (other classes) relay is operated. Relay AIOD operated also operates HTR relay for heavy traffic operation in order to cut down the call-back interval by eliminating certain line tests.

TANDEM AMA OPERATION

31.08 The tandem AMA feature permits an AMA record to be made on 2-wire or 4-wire TOG calls. In place of the calling number identification, the incoming trunk number is recorded on the AMA tape. This allows charges to be made against certain "dedicated" trunks generally associated with CCSA customers.

31.09 These TOG calls requiring AMA are identified by the MBT9, message billing relay, which may be operated from a combination of code point and tandem screening.

31.10 Operation of MBT9 relay also reverses the 4DG and 5DG number structure leads. When the transverter receives a 5DG mark instead of 4DG, and a ring party indication, it proceeds to make an AMA record for the TOG call.

31.11 The tandem AMA feature has been made considerably more flexible by having the "billing or route series relay controlled by route ground supply" feature coordinated to it. The use of the MBT9 relay (option WT) is no longer essential to the tandem AMA operation. Information Notes 467 and 468 in the SD illustrates the typical routing for tandem AMA traffic.

31.12 The tandem AMA trunk is identified by either the trunk number, option ZPR, or by the incoming trunk class, option ZRS. When option ZRS is provided a 000X number is generated and transmitted to the sender rather than the incoming trunk number. Cross-connections enable the incoming trunk class to determine the "X" digit of the 000X number to identify the call source.

32. ECHO SUPPRESSION AND PAD CONTROL - SC128

32.01 The marker is arranged to determine when certain devices known as echo suppressors or pads are associated with trunks. These devices may be a part of the trunk or may be a separate circuit connected to a trunk. They are used to improve the overall transmission characteristics of the various interconnections of trunks and lines.

32.02 The marker obtains information to control its action from six sources. These sources are the class of service, the

terminating rate treatment, the incoming trunk, the outgoing trunk, the intraoffice trunk, and the control digit as used in 4-wire offices.

32.03 When a line requiring suppressor or pad control is assigned, its class-of-service or rate treatment terminal is cross-connected to cause the operation of one of the marker relays 2WD-. The control digit is also cross-connected to cause marker relay SG to operate with certain 4-wire lines. Optional wiring and apparatus provided for trunks or lines indicate to the marker whether they have suppressors or pads associated with them.

32.04 A 2WD relay in the marker when operated causes the marker to consider echo suppressor or pad control. The signal is permissive and causes the marker to use the control if such control is also provided in the trunks. In 4-wire operation the control request is canceled if a special grade signal (SG relay operated) is present.

32.05 Lead ES from the trunk link frame when grounded causes the operation of relay TLES (trunk link echo suppressor). Similarly the line link ES lead when grounded causes the operation of relay line link echo suppressor (LLES).

32.06 Lead ESK to the trunk link is used by the marker to operate an echo suppressor or pad control relay in the trunk. If the trunk relay is not to be operated the marker checks that it is not operated. The signals over the ES and ESK leads from any one trunk are compared by the marker to ensure their validity. Lead ESK to the line link is used in a similar manner.

32.07 The 2-wire intraoffice trunks are arranged to accept enable signals through the called trunk link appearance and the calling trunk link appearance. Enablement through either appearance inserts a pad. Enablement through both appearances does not insert a pad.

32.08 When echo suppressors or pads are provided their functions are normally disabled. The marker is required to cause their enablement under the conditions shown in the following table.

Marker Operation Class	Marker Relays Operated			
	2WD1-3	TLES	LLES	Enable Through
SOG	X	X		TL
ITR(CF)	X	X		TL
ITR(CB)	X	X		TL
TER	X	X		TL
TOG		X		TL
TOG			X	LL
TOG		X	X	(not enabled)

32.09 The ESK relay (echo suppressor check) and wiring is provided together with contacts of other relays to detect improper conditions. This check is made on first trial and is canceled on second trial. When echo suppressor control is provided the ESK relay is required to operate on all uses of the marker if a link is set up.

32.10 Improper conditions which will cause a first trial failure are shown in the following table.

Marker Operation Class	Marker Relays Operated						
	2WD	TLES	LLES	ESK	ECK	ENES	
SOG- ITR TER	X	X	-	-	-	X	
TOG-	-	-	X	X	X	X	

33. RECORDS OF SELECTED TRAFFIC CONDITIONS - FS50

33.01 A record of selected traffic conditions can be made with peg count registers and with the trouble recorder for traffic study or maintenance purposes. The EX relay is a high-resistance, polar relay that may be used to detect the particular traffic conditions. The EX relay has a high-resistance winding to minimize the interaction between

the EX relay and the existing circuits; however, when 130-volt circuits, polar relay circuits, or timing circuits are considered as detection points the circuits should be carefully analyzed for possible interaction.

33.02 The EX relay closes the EX lead to the plant register circuit to operate a register for each EX relay operation on both first and second trial marker usages. An EX key is provided in the jack, lamp, and key circuit that may be closed to cause a record to be made with the trouble recorder in addition to the peg count record. The record will be identified with an EX punch on the card. When the EX relay operates with the EX key closed an auxiliary relay in the marker, EXA, will be operated to force a start to the trouble recorder. The EXA relay can be operated only on first trial operations.

33.03 If the condition to be detected occurs before the trunk link frame has been seized, such as the operation of a particular route relay, the start lead, ST, to the trunk link will be opened by the EXA relay and the marker will block. The trouble recorder will be called in to make a record and the call may then complete on a second trial basis.

33.04 If the condition to be detected occurs after the trunk link has been seized but before a channel has been selected, two possibilities exist:

(a) Without the EX and EXA punchings cross-connected the call will complete on first trial, but the record will not be taken until the point of marker disconnect. The EXA relay forces the operation of the TRS relay which diverts the operating ground on the DIS1,2 relays, to operate the TRR relay. The TRR relay forces a record by the trouble recorder and gives a normal release.

(b) With the EX and EXA punchings cross-connected, a record by the trouble recorder is called for immediately after detection of the selected traffic condition and the call may then complete on a second trial basis.

33.05 If the condition to be detected occurs after a channel has been selected the call will complete on first trial and the operating ground for the DIS1,2 relays will be diverted by the TRS relay to force a record to be taken by the trouble recorder, and give a normal release.

(a) The varied uses that can be made of this circuit arrangement present a difficult standardization problem as cross-connections cannot be determined in advance. The EXA relay is, therefore, provided with reserved spare contacts that may be used as needed to block marker action at selected points.

33.06 Connector relays of the marker connectors do not close all contacts simultaneously therefore, it is possible to select a detection point that is grounded before the marker has received complete information. The use of such points can interfere with normal marker operation.

33.07 The forcing of a second trial shall be avoided if it is possible to obtain the desired information on first trial attempts.

34. PAIRED LINE LINK OPERATION

34.01 The paired line link feature (PRL) provides for the sharing of two full sized junctor groups in the serving of calls by two line link frames. The reduction in the possibility of matching failures by this arrangement allows an increase in the call carrying capacity of the mated frames.

34.02 The feature is particularly applicable to offices that have grown to a maximum size with paired trunk link frames, or with triple trunk link frames. This feature may also be desirable for certain offices where the existing junctor pattern offers less capacity than this system will provide. However, in cases of partially equipped installations, it is necessary to change the junctor distribution to a full size, as in the 20LL-10TL, 40LL-20TL, or 60LL-30TL size before the feature may be applied.

34.03 Option ZSF is provided so that the paired line link frame feature may be added in the marker at anytime, but will not be operational until a cross-connection to the SZ10 terminal, 10TLF seize, is provided. With this arrangement contacts of the 10TLF relay are provided in series with the PRL relay contacts. This arrangement provides for an easier transition paired line link frame operation.

GENERAL OPERATION

34.04 The paired line link feature makes available, on a junctor step basis, the junctor subgroup from a numerically adjacent "mate" line link frame. The junctor pattern required provides only first junctor subgroups, each containing ten juncors.

34.05 This mate operation is made possible by the addition of auxiliary junctor switches on a new auxiliary line link frame. This frame contains ten 200 point crossbar switches, with their horizontal multiples split into left and right halves, one-half of a frame serving one line link frame of a pair.

34.06 The horizontals of the junctor switches on the even frame of a pair of the line link frames are extended to the horizontals on the left side of the auxiliary frame. Similarly, the horizontals on the odd frame are extended to the horizontals on the right side of the auxiliary frame. The auxiliary junctor switches may be considered as extension junctor switches.

34.07 The verticals of the left auxiliary junctor switches are connected to the verticals of the odd line link frame junctor switches. The verticals of the right auxiliary juncors are connected to the verticals of the even line link frame junctor switches.

34.08 This vertical multiple of the juncors to the line link frame junctor switch verticals, and to the auxiliary junctor switch verticals provides the cross-over to allow the juncors of a subgroup to be used for mate operation through the cross points of the auxiliary junctor switch.

34.09 In the required 10TLF junctor pattern, the junctor subgroup from an even line link frame terminates on the left half of a trunk switch. The junctor subgroup from the adjacent higher numbered odd line link frame terminates on the right half of the same trunk switch.

34.10 Thus by controlling the selection of either right, or left trunk switch, the junctor subgroup of the mate line link frame is selected. By operating the crosspoints of the appropriate auxiliary junctor switch, this mate junctor subgroup is enabled.

34.11 The control for this selection is provided by the junctor step mechanism in combination with the paired line link indication in the marker.

IDENTIFICATION AND REQUEST FOR MATE OPERATION - FS5, FS44

34.12 In a particular office, the marker recognizes a paired line link frame by the presence of solid ground on the LFK lead when the associated line link connector is closed. This ground operates the PRL and LFK relays. A nonpaired line link frame

will have resistance ground on its LFK lead, in which case only the LFKA relay operates. Relay LFKA operated operates the LFK relay and marker operation continues.

34.13 Relay PRL operated operates PRL relay.

These relays have no effect until such time that a channel test is made. With the 10TLF relay operated, and no channels available; the operate path for the FMP relay is diverted by the PRL relay to the STP relay. Relay STP operated, with the sequential release of GC relay and operation of STP3 relay initiates the junctor step. Subsequently, STP1 relay releases, relay STP2 operates. Relay JGO releases and JG1 relay operates.

MATE FRAME SEIZURE - FS5, FS44

34.14 Relay STP3 operated with PRL relay operated and MFK relay normal operates the STPA relay. Relay STPA operated locks around the contact of MFK relay, and places resistance battery on the MPP lead toward the line link connector. This MPP lead connects to the MPP relay in the line link preference control circuit of the mate line link frame.

34.15 Relay MPP operated has two functions:

(a) It closes its contact in the work preference chain of that preference control circuit in order to seize the auxiliary line link frame when preference is gained.

(b) It closes solid ground toward the line link connector for the line link frame associated with that preference control circuit. If this particular line link frame would have its connector closed to some other marker, solid ground on the MFK lead will operate the MFK and MFL relays in that marker, opening the operate path for the STPA relay and preventing that marker from attempting mate operation.

34.16 When preference is gained in the mate line link frame preference control circuit, the auxiliary line link frame associated with this pair of line link frames is seized. Relays operate in this frame to cut through the select magnet leads from the line link frame to the select magnets of the auxiliary frame junctor switches. The choice of select magnets will be controlled by the horizontal group relays in the line link frame, and will correspond to those select magnets that can be chosen on the line link frame junctor switch.

34.17 Seizure of the auxiliary line link frame will transmit resistance ground on the MFK lead through the connector to the marker. Relay MFK alone operates and with STPA relay operated, completes the operate path for the TK relay.

34.18 During this time, the STP2 and JG1 relays, in combination with the PRL and PRL relay operated, have selected the opposite half of the trunk switch, and reoperated those relays, such as the PNR pattern normal relay, in the junctor step and control circuits in preparation for channel test. With the operation of the TK relay, channel test is again made.

34.19 If no channels are available on this second attempt, a failure to match results and the marker recycles.

MATE LL BUSY

34.20 When the marker is in the process of completing a call, and its MFK and MFL relays operate as described in 34.13, the marker will be prevented from attempting mate operation. If the call can be completed using the first junctor subgroup, it will do so. The other marker (attempting mate operation) will wait until it has work preference before it can complete.

34.21 Should this marker attempt a junctor step because of a channel busy condition, the combination of STP3 and MFL relays operated will force a failure to match, and subsequent recycle by operating the FMP relay. This action is necessary because use of the mate line link frames junctor subgroup is denied. Each line link frame of the pair would wait for release of the other line link frame to use its junctor subgroup.

34.22 Marker recycle causes this marker to drop its line link and trunk link connectors, and allows the other marker to gain preference, seize its mate line link frame and complete the call.

34.23 The condition is also possible that two markers will attempt mate operation with each one of a pair of line link frames at such time that the STPA relays in both markers operate. In this case, operation of the MPP relay in each of the associated preference

control circuits returns solid ground to operate the MFK and MFL relays in each marker. With the STP3 relay also operated in each marker, both will experience a failure to match and recycle.

34.24 The seize frame timer is started each time the marker attempts mate operation, and is canceled upon seizure of the auxiliary line link frame.

DCT CIRCUIT CONSIDERATIONS - FS47

34.25 Ordinarily, the marker is arranged to change the bias on the double connections test, DCT relay, as the number of hold magnets vary. As this number is increased from 4 hold magnets (STF size) to 5 hold magnets (PR size) to 6 hold magnets (TTF size), resistance is taken out of the secondary bias circuit and added to the primary operate circuit. This switching of bias, maintains the nonoperate requirements of the DCT relay, while maintaining adequate capacity to hold the hold magnets operated for each TL frame size.

34.26 With the addition of the PRLI feature, the hold magnet of the auxiliary line circuit is added to the sleeve circuit, increasing the number of hold magnet on each

TL frame size by one. Thus the biasing resistance provided for the PR and TTF trunk link frame sizes becomes the next higher bias in order to maintain the DCT nonoperate requirements. In offices where not all LLs are paired, the number of hold magnets may be one less than the DCT relay expects, however the DCT relay will still operate because the increase in total hold magnet resistance is not that critical between 7 and 6, or between 6 and 5 hold magnets.

34.27 The increase in total hold magnet resistance is critical between 5 and 4 hold magnets, and the DCT relay might not operate if it expects 5 hold magnets when there are actually 4. Thus with PRLI operation for this office size (20LL-10TL), the DCT circuit configuration includes a 1510-ohm resistor attached to the sleeve which looks like an additional hold magnet to the DCT relay. Since this resistor is only switched into the circuit on STF, single TL frame size, its effect on the DCT relay is the same as with the circuit configuration of the PR, paired TL frame size.

34.28 These biasing arrangements are tabulated as follows:

LLFR Size	TLFR Size	DCT Ckt Bias Resist		No. of Hold Mags				
		Primary	Secondary	LL	Aux LL	TL	Sim- ulated	Total
Nonpaired	STF	5	0	2	0	2	1	5
Paired	STF	5	0	2	1	2	1	6
Nonpaired	PR	5	0	2	0	3	0	5
Paired	PR	5	0	2	1	3	0	6
Nonpaired	TTF	14	0	2	0	4	0	6
Paired	TTF	14	0	2	1	4	0	7

PRLI TRAFFIC REGISTRATIONS

34.29 For the mate frame lockout conditions a traffic register is provided to count the number of times that STP3 and MFL relays operate together during paired line link operation. This register will provide data on the occurrence of this lockout condition.

34.30 Traffic registers are also provided in partially paired line link offices as described in 18.

IMPROVED PAIRED LINE LINK TESTING

34.31 A method of simulating a "mate frame early busy" condition is added to provide positive control from the master test control circuit (MTC). The MTC will be able to directly control the marker MFK relay, instead of controlling it indirectly via the line link frame. This will prevent a possible race condition which allowed the marker STPA relay to operate on a test call designed to verify marker actions when mate frame operation is attempted and the mate frame busy. Option ZSP provides this improvement.

35. TRAFFIC DATA PROCESSOR

35.01 The traffic data processor (TDP) is an electronic data collection system that replaces the traffic registers in a No. 5 crossbar office. Marker operation with the TDP differs in two significant ways from operation with traffic registers.

(a) The inputs to the TDP must be separated to ensure proper counting. This makes it necessary to prevent one event in the marker from simultaneously grounding several traffic register leads.

(b) A much shorter input pulse is sufficient for use by the TDP. This requires that precautions be taken to ensure that no short false pulses are applied to the traffic register leads.

35.02 The marker has been modified to stagger the application of ground to leads previously grounded by the PEG and PEG1 relays. This is done by using a PEG contact to initiate the operation of a series chain of reed relays. Each reed relay grounds one traffic register lead and operates the next relay in the chain, thus causing the inputs to the TDP to be spaced by the relay operate time. Leads grounded by the parallel combination of RBT and TOA relays have been similarly arranged.

35.03 The modifications for use of the TDP allow the marker to function with either the TDP or with regular traffic registers or both. The feature can be installed in offices not equipped with the TDP system.

36. DIRECT ACCESS TO NO. 101 ESS

36.01 Direct inward dialing may be provided for the stations of a 101 ESS satellite via the No. 5 crossbar office. Calls made to a satellite station will be handled as a variation of a TER or ITR call. The stations of the 101 ESS satellite are assigned 7-digit numbers in a number series associated with the marker group and are reached by a common group of trunks from the line link frame. When a call is received for one of these stations, the marker connects to a direct access pre-translator (DAP through a direct access pre-translator connector (DAPC) instead of the regular number group, to obtain a translation of the called number. The DAP circuit on receiving the called number, transmits it to the 101 ESS control unit which returns information concerning the location of an idle trunk in a trunk group serving the called station. The DAP circuit transfers this information to the marker which sets up a linkage to the idle trunk. The 101 ESS control unit extends the call from the line link trunk to the station at the satellite.

36.02 The marker may have access to as many as three 101 ESS control units, each serving different satellite stations. Access to a particular control unit, through its associated DAP and DAPC, is determined by the thousands digit of the called number in combination with the selected number series.

CONNECTION TO DIRECT ACCESS PRETRANSLATOR - FS83, 152

36.03 Marker action at the beginning of the call is normal until a number group translation of the called number is required. Instead of going to an NG start terminal, the ST0-9 per NSS0-5 terminals are connected to one of the ten start leads associated with a direct access pretranslator connector. When the connector is cut through the DAC relay in the marker is operated as an indication that the call is to a 101 ESS satellite, and the marker proceeds to transmit the called number information to the direct access pre-translator.

36.04 In addition to the hundreds, tens, and units, the DAP circuit requires a thousands digit and an indication of the type of call; POTS, CCSA, or one of three test calls. The thousands digit information is included with the start indication and the DAP circuit determines which digit is represented by each start lead. If traffic to the PBX is either all POTS or all CCSA, the marker determines which indication to transmit to the DAP by a fixed cross-connection to the BSN, or NBS (Bell System or non-Bell System) terminal. If the traffic is mixed, the indication is determined by cross-connection off a pre-route relay ahead of the local completion relay associated with numbers served by the 101 ESS (see Note 448). Test call indications; TCA, TCB, or TCC are controlled by the test frame when making tests of the direct access circuitry and equipment.

36.05 When a thousands digit and a type of call indication is received by the DAP circuit, it immediately returns a PN, TN, EN, or PTN indication for the marker to make its physical, theoretical check and transmit the tens digit of the DAP.

36.06 After the DAP circuit is satisfied that it has received all the information from the marker, it calls in the 101 control unit for a translation.

NO. 101 ESS CONTROL UNIT OPERATION

36.07 The 101 ESS control unit determines the called station by the called number received from the marker, selects an idle trunk associated with this called station, and returns to the DAP, the location of this trunk on the line link frame.

36.08 The control unit maintains a record of the state of each trunk and once it has assigned an idle trunk circuit to a call, it reserves the trunk and associates it with the called station for four seconds. This allows sufficient time for the marker to complete the connection through the crossbar office. If for some reason, the marker establishes this connection after the four second interval, the control unit will direct the call to the PBX attendant.

36.09 Once the DAP circuit is satisfied that it has received all the information concerning the idle trunk, it sends it to the marker via the DAPC. The information will be similar to that normally received from the number group plus an additional TLK mark which is an indication from the DAP circuit that the translation is valid.

36.10 Upon receiving a LL location from the DAP circuit, the marker proceeds to establish the connection from the incoming or intraoffice trunk, to the selected trunk to the satellite in the normal manner. Ringing and busy tones are controlled at the satellite, thus the marker sets the ringing switch to a silent level, either level five or level seven depending on the local office arrangements. The 101 ESS trunk circuit will satisfy normal continuity and ground tests and will go off-normal when linkage is established, thus signaling the 101 equipment to extend the call to the called station.

ALTERNATE ACTIONS

A. Free Numbers

36.11 If the called number is free, the 101 control unit will send an FNA or FNB indication to the marker via the DAP circuit. The DAC relay transfers the ground for the RS- relays to contacts of the FNA and FNB relays. This will result in operation of the CSW relay on calls with a local charge condition while the RS- relays are operated on calls with a toll charge condition. Operation of the CSW relay prevents setting the ringing switch and contacts of the relay are used to satisfy checks of ringing switch operation.

B. Intercept

36.12 Treatment of unassigned, changed, or disconnected numbers within a partially used hundreds block assigned to the 101 ESS satellite is provided by the 101 system. If an entire hundreds block is unassigned, the control unit gives the marker a BNTH indication instead of the location of an idle trunk. This indication, along with TLK and DAC, will cause the marker to set the call to intercept.

C. All Trunks Busy

36.13 If the 101 ESS control unit is unable to find an idle trunk, it will ground the PMO lead to the marker via the DAP circuit. The TLK and UK relays are also operated as a verification of the PMO. The marker will then set an overflow condition in the incoming trunk or route-advance, and set the call to a tone trunk, depending on the type of call, TER or ITR. It may be noted that the UK relay is operated only as a verification of PMO. The UK relay indirectly controls the TYM, number group timer, used to detect various intercept conditions, none of which are needed on calls to 101 ESS.

D. Line-Busy or Failure to Match

36.14 If the marker encounters a line-busy or failure to match condition when attempting to set a channel, it will perform a PBX recycle and return to the DAP for another idle trunk location. The PBX recycle is modified slightly since calls to 101 ESS are non-hunting. Operating the SPT relay with DAC provides a nonhunting type recycle by disabling the PBX 1 and 2, CKO, and CKR relays. A second line-busy or failure to match will result in setting the call to reorder.

E. Trouble Indications

36.15 One of the following trouble indications may be received when the marker is requesting a translation.

- (a) PTM - indicates that the DAP circuit failed to receive the proper information from the marker.
- (b) TLT - indicates that the DAP circuit detected a trouble in the information returned by the 101 control unit.

Either of these indications will result in a trouble record and second trial.

F. Ringer Test Call

36.16 Option ZPP is provided to route ringer test calls for direct access to No. 101 ESS numbers to RBT. An operate path for the RBT relay is added through the RGTA and DAC1 relays operated.

37. RANGE EXTENSION FOR UNIGAUGE LINES

37.01 Arrangements are provided in the No. 5 crossbar office to allow the use of uniform 26-gauge wire lines, referred to as Unigauge lines, for all PBX customer loops, and 1- or 2-party loops, up to 30,000 feet

in length and 2500-ohms resistance. In order to provide Unigauge, the long-loop lines, these lines having over 1300-ohm loops are provided with range extender amplifiers and a 105-volt ringing supply.

37.02 A range extender is an amplifier which is provided for each line link of a particular horizontal group on the LL frame. Long-loop customers, requiring range extension, must be assigned to verticals in this, or similar horizontal groups. The range extender is located at the point in a channel where the line link connects to the junctor, and is enabled by the marker if the associated line is a long-loop line.

37.03 The 105-volt ringing supply is connected to level four of the ringing switch. Therefore, when completing a call to a long-loop customer, the marker must set the ringing switch to level four.

LONG-LOOP INDICATION TO MARKER

37.04 The horizontal groups within a line link frame may or may not be equipped with range extender amplifiers. Those that are equipped will indicate this fact to the marker by operating the marker LOLF relay when the line link frame HG- relay operates. Whether or not the particular line requires the amplifier to be cut in, is determined on a line group (LG-) basis in the line link frame. Those requiring the amplifier will operate a LOL relay in series with the line link frame LG- relay, all other line groups within the horizontal group will operate a NOL relay in series with the LG-. The LOL relay will operate the marker LOLA relay which provides various off-normal functions used later for controlling the amplifier cut-in sequence. The NOL relay operates the marker NOLA relay to indicate that no amplifier is required.

RINGING SWITCH LEVEL SELECTION

37.05 In order to ring a long-loop customers phone, the voltage drop resulting from the extended loop must be compensated for by a higher voltage ringing supply. This supply (105 volts) is connected to level 4 of the ringing switch and may be selected by the marker in one of two ways.

(a) Option ZQK Provided: All 1- and 2-party long-loop customers are assigned a separate ringing combination in the number group which will operate the marker RS4 relay. This will set the ringing switch to

level 4. For long-loop PBX customers, the marker LOLC relay must be operated to operate RS4. If the office is equipped with tens block screening (Fig. 86), the REH cross-connection is used to operate LOLC. If tens block screening is not provided, a new F- cross-connection is added to the number group to operate a LLPX relay in the marker. The LLPX then operates the LOCL relay.

(b) Option ZQL Provided: All 1- and 2-party and PBX long-loop customers are assigned standard ringing combinations in the number group. Upon receiving the number group translation, the marker begins to set the ringing switch to level 6. The call proceeds to the point where the line link indicates whether the line is long-loop or not. If not, the NOLA relay operated and the call completes with level 6 set on the ringing switch. However, if LOLA operates, the marker will release level 6 and operate level 4. When LOLA operates, the RS0 or 1 and RS6 relays are released which in turn releases the ringing switch select magnets. This opens the select off-normal contacts which releases the marker RSK and in turn, the SRK. With the RSK and SRK relays released, the LOLC relay operates and causes the ringing switch to be set to level 4.

RANGE EXTENDER CONTROL

37.06 A call to a long-loop customer proceeds normally through hold magnet operation and marker linkage checks to the point where the DCTL relay would normally operate. A contact of the LOLA relay has the DCTL operate path diverted to the DCTK relay which operates instead of the DCTL. The DCTK closes through the operate path for the LOLB marker relay in series with the CIC- (range extender connector) relays in the line link frame. The CIC- opens the LB- leads in the line link frame, releasing the marker LLT relay. The LOLB operating with LLT released will operate the marker LOLE relay which closes through the operate path for the CI- (range extender cut-in) relay in the line link frame. The CI- relay operates from the voltage surge supplied by the LOLK capacitor through the marker LOLK relay. Relay LOLK also operates from the surge and operates relay LLKA. The operated CI- relay returns a locking ground back to the marker over its operate path, causing the LOLK relay to release. The LOLK released with LLKA operated, operates relay LLKB to signify proper completion of the range extender cut-in function. The LLKB operates the DCTL relay and the marker completes the call and releases.

LONG LOOP INDICATION TO TRUNK

37.07 On some calls originated by long-loop customers, the trunk requires a long-loop indication. Those trunks requiring this indication will have their route relay CP-cross-connection assigned to the LOLD terminal. This will cause the LOLD relay to operate which grounds the LOLP lead to the outgoing trunk through the primary of the LOLP relay. The trunk locks in this indication and sends a ground back to the marker over the LOLP lead, operating the marker LOLP relay. The LOLP is then checked operated in the CHA relay operate path.

37.08 It may be noted that when the trunk circuit requires a long-loop indication, LOLD operated, the line link range extender should not be cut in. This requirement is checked in the DCTL operate path. If LOLD is operated, the LLKB relay must not be operated in order for the DCTL to operate and complete the call.

TEST FRAME SELECTION OF MADE BUSY RANGE EXTENDERS

37.09 The marker makes an initial test to the line link sleeves over the LL0-9 leads to determine busy and/or idle conditions. A range extender when plugged-busy grounds its corresponding LL0-9 lead to indicate a busy condition. Range extender testing requires that access be provided to made busy range extenders. The test equipment is therefore arranged to cause the operation of a marker LL0-9 relay to cancel the initial busy test when an individual plugged-busy range extender is to be tested. The marker makes a secondary busy test using the LB- leads and the LLT relay. The lead ordinarily will be found free of ground when the range extender is made busy and the LLT relay does not operate. If it should operate during this test the marker does not complete the test connection and will cause a trouble record request to be made, indicating that the range extender is service busy or is supplying a false ground to the LB- lead.

FALSE LOLD PUNCH

37.10 Option ZXX, rated Standard, is added to prevent a false LOLD punch when range extension is provided and the marker takes a trouble record on a special call. Option ZXW, rated Mfr Disc., provides the old arrangement.

38. DUPLICATE NUMBER GROUPS - FS83

38.01 Duplicate number group operation provides continuity of service for important numbers if an associated number group should become inoperative. The line location for these numbers appear in a pair of number groups, and traffic is divided equally between the two. The number group used is determined by the register marker connector used on the call; even connectors prefer one while odd connectors prefer the other. The preference is reversed on second trials or when the selected number group is plugged busy. Arrangements are provided for ten pairs of number groups to be used in this fashion.

38.02 The start lead for the pair of number groups is cross-connected to one of the ten DNG0-9 terminals. Battery applied to any DNG- terminal operates the duplicate number group relay DNG to determine which number group of the pair should be used. Operation of the DNGA or DNGB relay will cut the number group start lead through to the associated number group. If the selected number group is plugged busy, NGP relay operated, the start lead is transferred to the other number group of the pair.

39. AUTOMATIC INTERCEPT SERVICE - FS154

AUTOMATIC INTERCEPT USING LINE-LINK PULSING

39.01 The marker is arranged to route line intercept calls to an automatic intercept center, AIC. The calls are switched to an outgoing intercept trunk on the line link frame, and an outgoing MF sender is attached to the trunk. The 7-digit intercepted number plus an arbitrary digit to indicate the class of intercept is transmitted to the sender. The ringing selection switch is not operated; audible ringing is returned from the AIC.

39.02 Automatic intercept features apply to 2-wire Bell System network intercept calls only. Cross-connections are provided to permit routing trouble intercept calls to the local DSA switchboard or to transmit them to the AIC. The automatic intercept center will provide recorded messages for intercepted calls where applicable, or route the call to an intercept operator, depending on the nature of the intercept condition.

A. Generation of Intercepted Number Office Code

39.03 Operation of the AIS relay, for the line intercept conditions indicated on B121, informs the marker that the call is to be routed to the AIC. Upon receipt of this information the office code of the intercepted number is identified by the operation of one of the OFC0-5 relays. The operated OFC- relay generates the office code of the intercepted number in order to transmit it to the AIC where it may be used in determining the intercept condition - such as a changed number, etc.

39.04 An OFC- relay is operated from the local completion relay on originating or 5- or 7-digit incoming calls. On 4-digit incoming calls the OFC- relay is operated from the OA or OB mark plus the trunk class mark received from the IR.

39.05 When trunk class 2SA or 3NA is received, indicating a common trunk group for more than one office code, the PN, TN, or EN mark from the number group is used with the OA or OB mark to identify the office code. The hundreds block may be marked PTN, a nondiscriminating mark where the number may be either physical or theoretical; or the number group or hundreds block may be unequipped, BNTH relay operated. For these conditions, terminal UOA or UOB, unknown office A or B, will be grounded. These terminals are cross-connected to their associated OFC- relays to identify the office code within office A or office B, as assigned to the office that receives the most intercept traffic.

B. Selection of Intercept Trunk on LL

39.06 Relay OFC- operated will cause a number group recycle. When the recycle is complete, an auxiliary intercept relay associated with the route to the AIC is operated, see FS89. This operated auxiliary intercept relay controls the seizure of a NG containing the LL locations of the group of intercept trunks, and controls seizure of an idle trunk by generating the thousands, hundreds, and tens digits of the group. This information, and a hunting indication is passed to the number group. The line link frame location of an idle trunk and the trunk number indication TNK is obtained from the number group. Receipt of the TNK mark causes the marker to seize the MF sender group associated with the intercept trunks.

C. Outgoing Sender Control

39.07 After the marker SKA or SKB operates, to indicate possession of the outsender connector, the marker connects to the required line link. Relays are operated in the line link to give the marker access to the F relay in the intercept trunk circuit for control of the outsender link.

39.08 Digit steering relays KGS5 and KGS6 are operated to transmit the thousands, hundreds, tens, and units digits to the D, E, F, and G slots in the sender. The KGS7 relay is operated to transmit the office code information from the OFC- relays to the A, B, and C slots in the sender.

39.09 One arbitrary digit is transmitted to the sender to inform the AIC of the class of intercept associated with the intercepted number. As shown in part 22 of Note 400, cross-connections are made to prefix the digit 0 for blank number treatment, digit 3 for regular intercept, and digit 1 for trouble intercept.

39.10 Class leads CL1 and CL3 are grounded to the sender to disable the inter-sender timing circuit in the sender.

39.11 Controls of the sender advance and sender checks are the same as those for a line link pulsing call.

AUTOMATIC INTERCEPT SERVICE WITHOUT USING LINE LINK PULSING

A. General Operation

39.12 When the marker encounters an intercept condition it recycles and bids for an AIS sender through the AIS sender connector. When an AIS sender is obtained and connected to the marker, the marker primes the sender with information to be transmitted to the AIS center. The sender then selects an idle line circuit and provides the line link location of the selected circuit to the marker. The marker connects the intercept call to the selected line circuit and disconnects from the sender. The sender then outputs to the AIS center.

B. Type of Intercept - FS89

39.13 The type of intercept is controlled by omitting certain cross-connections in the number group and by making cross-connections in the marker. The table below indicates certain intercept conditions that are

controlled by the number group cross-connections. Operate ground is provided by the TYMA timer operation when a complete translation is not obtained.

NUMBER GROUP CROSS- CONNECTIONS MADE	INTERCEPT PUNCHINGS ENABLED
G	GI
G,F	TI
None	NI

The TBI relay is operated by TYMA when only the L cross-connection is made in the number group. In addition to the above conditions that are controlled by the number group, there are three intercept conditions which are generated as follows:

TERMINAL GROUNDED	CONDITION
TNI	Trunk Number
BTI	Blank Number
NMI	Class-of-Service Mismatch

Typical cross-connections made in the marker for AIS treatment are as follows:

CROSS-CONNECT	
FROM	TO
NI, TI	RI
TNI, BTI, NMI	BN
GI	VCI or DCI

Three intercept conditions, RI, BN, and TBI, are generated (FS89, FS175) that may route calls via one of two punchings; AIS- which routes to the automatic intercept center, or NAI- which is processed locally. In addition to the three intercept conditions listed above, VCI or DCI may be used to route certain intercept calls to local processing. The circuit is also arranged so that RIP, RIW, and 4WC intercept calls always route to local processing.

C. Marker Recycle for AIS Conditions - SC122, SC168

39.14 When one of the intercept conditions is generated in the marker, the cross-connections shown on FS175 determine whether the intercepted call will route to the intercept center AIS or be processed locally NAI. If the call is routed to AIS, then relay AIC will be operated which starts the marker AIS recycle action. The AIC relay operates RCY2 which releases the number group and all line memory information. Operation of the SPT relay blocks the operation of the PBX- and CKO relays thus preventing terminal hunting. Relay AIC1 is operated after NGK returns to normal. Operation of AIC1 relay prevents the selection of an NSS- relay, thus preventing another bid to a number group.

D. Marker Bid for AIS Sender - SC168

39.15 When the marker checks that the number group and line memory have been released, relay RCY4 operates. This action releases relay RNG and operates relays SNG- to bid for an AIS sender through the AIS sender connector. The connector is arranged to permit only one marker to have use of the connector which serves a maximum of three AIS senders. The start (AICS) lead extends NGS battery through an AIC1 relay contact to the preference circuit. When preference has been obtained by the marker, MCA and MCB connector relays operate which operate NGK relay. Start battery for the sender half of the connector is extended over lead BS41 after NGK relay has been operated.

39.16 Traffic considerations arising as a result of using only two or three senders indicate that the marker holding time awaiting an idle sender may exceed the short delay (SDT) time of the marker. Because of this, the SDT timer is stopped by operation of the RON relay if no sender is available to the marker when it obtains preference in the sender connector. If no sender is available for a period of 1.25 to 1.5 seconds, the sender-connector ASB timer will operate which will operate relay PMO in the marker. Operation of PMO will cause the intercept call to be set to reorder.

39.17 If a sender becomes idle before the timer operates, then the sender half of the AIS sender connector is operated which releases the ASB timer and causes NGK1 relay operation. Operation of relay NGK1 causes

relay AIC3 to operate which provides a circuit to hold part of the sender connector operated after relay RNG operates. This sequence will be described below. The SF and SFT relays are also released which releases the SDT and LDT timers and starts the work timer.

E. Line Circuit Identification by AIS Sender - SC168

39.18 Each of the AIS senders perform three major functions:

- (a) Selects idle line circuit.
- (b) Provides line number translation to the marker.
- (c) Completes the sender functions.

39.19 When an idle sender has been selected the marker transmits information to the AIS sender. The class of intercept, BN, RI, or TBI; 4-digit line numerical; and information that can be used to reconstruct the office code (AAN, AEN, APN, ATN, BAN, BEN, BPN, BTN, BNTH, EN, PN, PTN, and TN) is transmitted through the AIS sender connector to operate corresponding relays in the selected sender. When a check has been completed on the transmitted information, relay UK is operated in the marker and the sender bids for an idle AIS line circuit. If no idle AIS line circuits are available, the AIS sender connector will operate the PMO relay in the marker causing the marker to set the intercept call to reorder, after which the marker will disconnect.

39.20 If an idle line circuit is obtained, the AIS sender will provide line number translation of the selected line circuit to the marker. When the translation is complete, the marker RNG relay will operate which permits a partial release from the AIS sender connector. The operation of RNG relay releases SNG- relays. This action opens the battery supplies NBS1,2,3 which release connector relays MCB, MCC, and MCD. Relay MCA and all of the sender half of the AIS sender connector relays are held operated by batteries NBS4 and NGS through AIC3 relay contacts.

39.21 As soon as the line number translation has been received and checked by the marker, selection the line link frame and channel is made for the forward linkage. A ringing code (RC-1) is also returned to the marker to operate relay RCL even though the CSW relay is operated on all AIS calls.

F. AIS Sender Advance - SC168

39.22 When the marker has completed its channel tests and selections and has operated the hold magnets, the DCT relay operation signals the completion of the forward linkage. With an AIS call, the DCT relays ground an AIS sender advance (AIV) lead. If the call is a TER call, the AIV ground is provided through AIC3 and TER5 make contacts. If the intercept call is an ITR call, the DCT ground is provided through make contacts of relays AIC3 and SCB2 and a break contact of TER5 after the call-back linkage has been set.

39.23 If the AIS sender has satisfied its line circuit (LR) check, then the ground from the marker AIV lead will cause the AIS sender to supply a KP start via the line circuit to the distant AIS center.

G. Advance Check and Disconnect - SC168

39.24 When the AIS sender receives a ground on the AIV lead from the marker, the sender will return a ground on the advance check (AICK) lead to the marker providing the conditions in either (a) or (b) are met:

- (a) If the marker is on heavy traffic operation or is serving an intraoffice call, a ground is returned immediately after the advance (AV) relay operates in the sender.
- (b) If the marker is on a light-traffic operation and is serving a terminating call, then the sender will delay returning a ground on the AICK lead until the AV relay, the TCT timer, and either the TGI or the OF1 relay operates in the AIS sender.

If either of the conditions under (a) or (b) is met and a ground is provided on the AICK lead, the marker AICK relay will operate and cause the final release from the AIS sender connector by releasing relays AIC2 and 3. AICK relay operation extends the DCT ground to operate DCT1 relay for a TER call or DCT2 relay for an ITR call. Operation of one of these relays permits the marker to disconnect from the call. If the conditions listed under (a) and (b) are not met, the WT timer will operate and cause a timeout disconnect. Under this condition, the marker will ground the reorder (RO) lead to the AIS sender to release it from the line circuit. In addition, a trouble record will be made and the intercept call will be routed to overflow.

H. Marker Test of AIS Feature - FS89

39.25 The marker may be tested for operation of the AIS feature by one of two general methods:

- (a) By forcing regular intercept (RI) AIS condition from MTC, or OTF.
- (b) By selecting assigned directory numbers from the MTC or OTF that will cause an AIS intercept of any of the intercept classes, BN, RI, or TBI.

39.26 When the AIS intercept has been operated, the call will progress as described above; however, a specific sender or line circuit may be selected. The method to do this is discussed below.

39.27 The method of forcing RI intercept condition permits using any combination of digits for the line numerics. This allows the AIS sender operation to be checked for correct outpulsing using any combination of digits. Included in these combinations are the AIS center test codes of which the last three numerics are 10X.

I. Testing of AIS Sender and Line Circuit Selection - FS106

39.28 The marker and other circuits associated with the AIS service are arranged to perform certain tests. Whenever an AIS test is performed that uses the marker, a ground is passed to the MTC or OTF from the marker through the AIS sender connector. The ground is used in the selection of a particular AIS sender or line circuit. Alternatively, a specific sender or line circuit may be selected for testing.

39.29 When a specific circuit is selected, the selection circuit will override a maintenance busy, but not a service busy, condition in order to select the circuit for test.

J. Sender Tests Requiring No Digit Operation

39.30 The marker operation with the AIS sender is more similar to number group operation than it is to sender operation. The exception to this is the sender advance and check operation. As a result of the unique arrangement, the ND indication to the marker is blocked when making an AIS test since the marker has no indication that a sender is involved in the normal sense. The circuitry to provide an ND indication directly to the AIS sender and prevent marker interaction is provided.

K. Line Test Operation Using Dedicated AIS Senders - FS65

39.31 The line circuit selection with AIS is accomplished by the AIS sender and the marker is not involved in the usual selection sense. Therefore, on line test calls, the line test indication to the marker is blocked and is passed directly to the AIS sender for line circuit control.

L. Automatic Monitor Register-Sender Test Circuit Operation With AIS Line Circuits - FS106

39.32 The automatic monitor register-sender test circuit (AMRST) is used in conjunction with the MTC to select and test the AIS sender and line circuits. The MT relay in the AMRST is connected to the MON lead in the MTFC. When the connection is established to the marker, the MON relay in the marker is operated. Operation of the marker MON relay prepares the marker for operation with the monitor by connecting control leads between the monitor and marker.

39.33 When the marker selects the outgoing sender through the sender connector, the M relay of the sender operates from ground supplied from the marker and connected through the AIS sender connector. The sender M relay serves as cut-in relay for leads from the sender to the monitor.

M. Automatic Intercept Testing from Office Test Frame

39.34 Provision is made for selection of an automatic intercept trunk from the office test frame (OTF) if the AIS feature is provided with LLP. This is controlled by operation of test relay MT23 from the OTF. On AIS calls, the operation of MT23 permits a particular LLP trunk to be selected for test.

39.35 Provision is also made for control of the MT25 test relay from the OTF if the AIS feature is provided by LLP. Operation of MT25 permits (ND) testing of a sender from the office test frame.

N. Message Register Lines in Offices With Automatic Intercept Without Using LLP

39.36 To prevent marker blockage on intraoffice calls from message register lines to numbers routed to the automatic intercept center, option ZPT is added. The FNA relay is operated on calls to the AIS center, which bypasses the TC check in the CLK operate path. The TC lead will not be grounded on these calls since the ringing select switch is not operated.

O. Unequipped Number Groups in Offices With AIS Without Using LLP

39.37 Option ZMX is added to prevent trouble record on calls to unequipped number groups when AIS without using LLP is provided and blank number intercept is not routed to the AIS center. This option ensures the release of the BNTH relay before the reoperation of the LLI relay on BN intercept. If the LLI relay should reoperate before BNTH is released, BNTH is locked operated and the marker will block when attempting to route the call locally.

P. Extra Trouble Card

39.38 Option AE is added to prevent an extra trouble card when the REC key (MTC) is operated on AIS marker test intraoffice calls and to ensure the operation of the LT relay in the line circuit on AIS marker test intraoffice calls.

40. WIDEBAND SWITCHING (STANDARD)

WIDEBAND REQUESTS

A. Register Information to Marker - FS30

40.01 The TOUCH-TONE originating registers, and transfer registers arranged to recognize the wideband prefix, cause the PP relay to be operated in the marker on wideband calls. For these wideband requests, the register grounds the PK1 lead rather than the PK. The PP relay, which operates from the PK1 ground, forces operation of the PK relay.

40.02 Incoming wideband calls are denoted by the trunk class obtained from the incoming register.

40.03 Transfer calls from wideband trunks are denoted by the WDTI and WDTF marks from the transfer register.

B. Operation of NW/WB- Relays - FS170 - Note 430

40.04 The wideband WB- and nonwideband NW relays indicate a wideband or nonwideband linkage. They are operated, in general, by the contacts of screening relays which represent customer or trunk class information (for originating calls, screening may be bypassed if the office has only one wideband service).

40.05 On originating calls the OPP terminal is grounded when a wideband request has been received by the register (PP relay operated). When more than one wideband class is

used, or when many classes of service not associated with wideband lines are provided, the OPP terminal is screened by customer class. Customer classes associated with wideband lines are cross-connected to the associated WB- relay; all other classes are cross-connected to the NW relay. With PP and NW relays operated, indicating a wideband request from a nonwideband line, the WPP terminal is grounded. This terminal is cross-connected to the paths busy PB terminal to route the call to overflow.

40.06 Option ZQV provides sender operation for calls from PICTUREPHONE stations which request wideband service but are completed on a nonwideband basis. This feature is added for the routing of No. 911 calls from PICTUREPHONE stations on an audio only basis.

40.07 On calls from the incoming register, the IWS terminal is grounded (PK and PP nonoperated). This terminal is screened by incoming trunk class; the wideband trunk classes are cross-connected to the associated WB- relays and all other classes are cross-connected to the NW relay.

40.08 On the DTI usage of a phase III centrex transfer call, the transfer register will ground the WDTI lead instead of the DTI lead to indicate that the call is associated with a wideband trunk. If the wideband audio transfer WAT relay is not operated, the TWB terminal is grounded. This terminal is cross-connected to the WB- relay associated with the centrex customer groups. The marker is arranged to transfer only a single wideband class. If the WAT relay is operated, indicating that the call has previously been transferred on an audio only basis, the NW relay is operated.

40.09 On the DTF usage of a phase III centrex transfer call, the transfer register will ground the WDTF lead instead of the DTF lead to indicate that the call is associated with a wideband trunk. When the wideband prefix is received by the transfer register, the PK1 lead is grounded rather than the PK. The PP relay, which operates from the PK1 ground, forces operation of the PK relay. With PK and PP relays operated and WAT relay nonoperated terminal TWB is grounded. This terminal is cross-connected to the WB- relay associated with the centrex customer groups. If the wideband prefix is not received, PK operated and PP not operated, the store wideband audio transfer SWAT relay is operated, which operates the NW relay causing the audio linkage only to be set. After the

called line is found idle, LIA relay operated, the operated SWAT relay will operate the WAT relay in the wideband incoming trunk via the CN lead. This mark is used on retransfers for control of the NW and WB- relays.

40.10 Once a call has been transferred on an audio only basis, subsequent transfers from stations to stations are restricted to nonwideband request only; if a wideband request is received the call is routed to overflow. Retransfers to the attendant are always switched wideband whether the wideband request is received or not.

THE WIDEBAND LINKAGE - NOTE 304

A. Wideband Link Circuit

40.11 The central office portion of the wideband linkage is set in a three-stage low-blocking crossbar switch network. The line and trunk terminations of the wideband link circuit are logically slaved to their audio counterparts on the standard network (ie, each wideband line or trunk termination is uniquely associated with a similar audio termination with the exception of test lines.)

40.12 Local wideband lines and links to remote switches appear on the verticals of the wideband line switches while wideband trunks appear on the horizontal levels of the wideband trunk switches. Junctor switches, which permit access between any line and trunk switch, have their verticals distributed over line switch horizontals and their horizontals distributed over trunk switch verticals.

40.13 Each wideband line switch is uniquely associated with one standard line link frame and derives its marker lockout from this association. Similarly, each wideband trunk switch is associated with only one trunk link frame (a maximum of four wideband trunk switches may be associated with a given trunk link) and marker lockout is assured by standard trunk link connector preference circuit action. The wideband junctor switches, however, have no association with any part of the standard network and the wideband junctor switch marker lockout circuit (SD-27904-01) is used to prevent more than one marker from working in a particular junctor switch at a time.

B. Wideband Remote Switch

40.14 This remotely located portion of the wideband linkage is a one-stage network

with wideband lines connected to the verticals while remote links (to the wideband link circuit) and remote wideband ITR trunks appear on the horizontals. The wideband line appearances have audio counterparts on the standard network and the remote wideband ITR trunks have audio counterparts on trunk link frames in the central office. The remote links, however, have no corresponding part in the standard linkage, they only act as concentrating paths between remote wideband lines and the wideband link circuit in the central office.

40.15 Since the remote switch may be located at some distance from the central office, control signals from the central office are encoded to reduce the number of leads to each remote switch. Supervisory signals for the links and trunks are not coded but are carried on dedicated leads.

C. Types of Wideband Linkage

40.16 Depending upon the type of call and the location of the wideband line appearance, a wideband linkage may exist:

- (a) Solely in the wideband link circuit.
- (b) Solely in the remote switch.
- (c) As a tandem linkage requiring both the wideband link circuit and remote switch.

The LSW (locally switched wideband) relay is operated whenever the wideband linkage must be set in the wideband link circuit as in cases (a) and (c) above. The LSWR (locally switched wideband-remote line) relay is operated together with LSW if the wideband line has a remote appearance as in (c) above. The RSW (remotely switched wideband) relay is operated only on wideband ITR calls between lines on the same remote switch where the wideband is switched via a remote trunk as in (b) above.

SEIZURE AND CONTROL OF THE WIDEBAND LINK CIRCUIT - FS170

40.17 The wideband trunk link connector is operated together with its associated audio trunk link connector on all wideband calls. The operate path for the wideband trunk link connector is enabled by a contact of WTC which is operated by TLC1 if any WB-relay is operated. The connector operate path also contains initial down checks on certain checking relays which are operated later in the call. The wideband trunk link connector permits marker access to:

- (a) An associated wideband trunk switch.
- (b) A wideband remote switch signal control circuit.

A. Seizure of the Wideband Trunk Switch

40.18 If the RSW relay has not operated by the time the WRFK indicates successful connector operation, the LSW relay operates and extends battery to an F-- relay in the wideband link circuit. The ground for this F-- relay has already been supplied by the wideband trunk F relay which is slaved to the associated audio trunk F relay. The F-relay operates a T- relay (in the wideband link circuit) which serves as an auxiliary connector to reach one of the four wideband trunk switches associated with the trunk link frame. Operation of one T- relay is checked by the TSK and XTC relays in the marker.

B. Wideband Line Link Connector

40.19 The wideband line link connector (WLLC) is operated from the associated audio line link connector on all wideband calls. The WLLC permits marker access to:

- (a) A line switch in the wideband link circuit.
- (b) The associated wideband line control circuit.
- (c) A wideband remote switch control circuit.

40.20 The operate battery for the WLLC is provided by the marker when any WB- relay is operated. The ground for the WLLC is provided by a contact on the audio line link connector. If the WLLC is plugged busy the make-busy jack opens the lead supplying ground from the audio line link connector and prevents the WLLC from operating. The make-busy jack places battery on the WLLB lead to the marker and operates the LLB relay. The marker then processes the call in the same manner as when an audio line link frame is maintenance busy.

40.21 Audio line link connectors that are associated with wideband line switches operate the line frame check (LFK) relay over the WLK lead instead of the LFK lead. Audio connectors not arranged for wideband operate the LFK relay over the LFK lead. However, WBA and VWC contacts in the LFK lead will cause the NWT relay to operate instead of LFK when a wideband call is directed to a nonwideband line link frame. The failure to match wideband classes will operate the wideband mismatch relay and cause the call to be set to overflow or announcement.

C. Functions of the Wideband Line Control Circuit

40.22 Line link vertical group and vertical file information is passed to the wideband line control circuit over the VG0-11 and VF0-4 leads. The line control circuit uses this information to operate one of its WVF-relays which yields certain class information about wideband lines in a given vertical file. Contacts of the WVF- relays:

- (a) Can indicate a local wideband line to the marker.
- (b) Can operate an auxiliary connector to a wideband remote switch signal control if the line is remote.
- (c) Direct the wideband line hold magnet control paths to the wideband line switch or to the wideband remote switch signal control circuit.

40.23 The wideband line control circuit also indicates the type of wideband service to which a line is entitled. The vertical group and vertical file translations may operate a WBT- or NWT relay in the marker to indicate a wideband or nonwideband class. The NWT relay may be operated by vertical group information alone if no wideband lines exist in that vertical group.

D. Type of Wideband Line Appearance - FS168

40.24 A local wideband line is indicated directly by the WVF- contact (in the wideband line control circuit) which operates the LWL relay in the marker. For remote lines, the same WVF- contact operates the auxiliary connector relays RA, RB, and RC in a wideband remote switch signal control circuit. The marker RWL relay is then operated by contacts of RA, RB, and RC to indicate a remote wideband line.

E. Wideband Line Tests - FS169

40.25 When the WVF- (wideband line control circuit) and HGT- relays have operated, the marker has a control path to one wideband line hold magnet. In the case of a remote wideband line, this control path is via a coded multilead facility to the remote switch; for a local wideband line, the control path reaches a hold magnet directly on the line switch.

40.26 In either case, the control path is used to make a wideband busy/idle test and to determine, on an individual line basis, whether the line is truly equipped for wideband service. This information is determined by the WLBT, WLIT, NWL, and WMB relays in

the following manner. The polar WLBT and WLIT (wideband line busy/idle test) relays are connected to a resistive biasing circuit such that WLIT operates from the hold magnet battery when the wideband line is idle and WLBT operates from the sleeve ground if the line is busy.

40.27 If the WLBT operates, it operates WLB which inhibits CHA on wideband calls. The audio line idle test, made after operation of the LG- in the line link, should also indicate a busy line. If the audio line test shows an idle line, however, a trouble condition exists and the open CHA operate path blocks marker progress.

40.28 The NWL or WMB relay may be operated by a path through the WLIT and WLBT relays; the NWL relay, denoting a nonwideband line, is operated via an L- to NWL cross-connection in the wideband line control circuit and the WMB relay, indicating a wideband maintenance busy condition, is operated via a make contact of the corresponding MB- relay. The WLIT and WLBT relays do not operate if either NWL or WMB are enabled since WLIT is reverse biased and WLBT has insufficient current to operate in series with the WMB/NWL resistor and relay.

NUMBER GROUP TERMINAL HUNTING - FS85

40.29 If a terminal hunting group contains both wideband and nonwideband lines, the marker must indicate to the number group which type of line is required. The NWB and WB relays in the number group cause the sleeves of nonwideband lines to be tested if NWB is operated or sleeves of wideband lines to be tested if WB is operated. These relays are controlled in the marker by a transfer contact of WBA which operates on all wideband calls.

SELECTION OF A WIDEBAND CONNECTING PATH

A. Wideband Channel - Note 460

40.30 Each wideband line switch in the wideband link circuit has its ten levels equally distributed over the ten wideband junctor switches. Similarly, each wideband trunk switch has its ten verticals distributed over all ten wideband junctor switches. An idle wideband channel between a given line switch and trunk switch is composed of an idle "A" link to a particular junctor switch and an idle "B" link from the same junctor switch.

40.31 The wideband channel numbers 0 through 9 correspond to the "A" link number, the "B" link number, and the junctor switch

number. For a marker to be able to set channel 5, for example, "A" link 5 must be idle, "B" link 5 must be idle, and junctor switch 5 must have no other marker in the process of setting a linkage through it.

B. Wideband Channel Testing - FS169

40.32 Each wideband channel test relay WCT0-9 can be operated by a ground on any of three inputs. Two of these inputs are taken from the "A" and "B" link sleeves and the third is obtained from the wideband junctor switch marker lockout circuit. The sleeve connections yield busy/idle information about the links while the third input indicates whether a junctor switch is being controlled by another marker. A ground of any of the inputs operates the WCT- relay, indicating that some part of the channel is busy.

40.33 The "A" link sleeves are accessed via the wideband line link connector and the "B" link sleeves via the wideband trunk link connector. The ground from the wideband junctor switch marker lockout circuit is supplied by the marker through a contact of WBC2 (FS171).

C. Wideband Channel Selection - FS171

40.34 Prior to making a channel selection, the WTK operates a check that all channel testing paths are cut through to the WCT-relays. The WTK operate path consists of:

- (a) The VWC, which operates from WBC2, indicating that the ground supply is cut through to the wideband junctor switch marker lockout circuits.
- (b) The WTFK and TSK, operated by the wideband trunk link connector, indicating that the "B" link sleeves are cut through.
- (c) The WLFK, operated by the wideband line link connector, indicating that the "A" link sleeves are cut through.
- (d) Other contacts which check for proper combinations of RSW, LSW, RWL, and LWL and act as initial down checks on RUK, WCHA, and WLA. The WSRK relay, also required for channel selection, operates as a check on the initial release condition of WSLA, WLK, WJGK, and WTGK.

40.35 Enabled in part by the LSW relay, the wideband channel selection chain can now cause a WCH- relay to be operated by WTK. Channels with operated WCT- relays are bypassed in this selection since they have busy links or "busy" junctor switches. If all wideband channels are busy, the WFMP relay is operated rather than a WCH-.

40.36 The selected channel relay, WCH-, operates WCHA, indicating that wideband channel selection is completed. The operated WCH- relay enables paths to the required select and hold magnets on the wideband line, junctor, and trunk switches. It remains for the wideband channel check, WCK, to be completed before the select magnets may be operated.

D. Wideband Channel Check - FS171

40.37 The operated WCH- relay extends a battery start lead to the proper wideband junctor switch marker lockout circuit. The marker preference relay (MP-) in the lockout circuit operates and:

- (a) Sends a check ground back to the same marker over the CK- lead.
- (b) Enables a "switch busy" indication to the other wideband marker over the SB- lead.

The returned ground on the CK- lead may then operate the WCK relay provided the wideband continuity test on the trunk facility has been satisfied or canceled.

E. Failure to Seizure Junctor Switch - FS171

40.38 If both wideband markers should put out junctor switch start signals at the same time, only one of the markers will receive a ground on its CK- lead. The other marker will receive a ground on the similarly numbered SB- lead. This ground will pass through the operated WCH- contact to operate the JSSF relay which locks operated to a contact of LSW. The JSSF opens the ground path to the operated WCH- relay and, when WCH- releases, WCHA releases and SFNK operates. The SFNK, which locks operated to LSW, reapplies ground to the wideband channel selection chain and a new WCH- relay is operated. Circuit operation can now proceed as if no seizure failure has occurred.

F. The Remote Link - Note 460

40.39 A maximum of ten remote links may exist between a wideband remote switch and a line switch of the wideband link circuit. When required, they are tested for busy/idle status and selected on a fixed preference similar to that used for selecting channels.

G. Remote Link Testing - FS169

40.40 The link sleeves are accessed for testing via the wideband line link connector and the RB relay of the wideband remote switch signal control circuit. The remote

link testing relays, WLTO-9, are operated over the R0-9 leads from the wideband line link connector by the grounds on busy link sleeves (at the line switch vertical) or grounds from cross-connections denoting nonexistent links. Nonoperated WLT- relays indicate available links.

H. Remote Link Selection - FS168

40.41 With LSWR operated, the remote link is selected at the same time as the channel through the wideband link circuit. When WTK operates, the remote link selection is completed by the operation of a WL- relay. The operation of WLA, which indicates the selection of only one link, is required to extend the start lead to a wideband junctor switch marker lockout circuit on calls involving remote wideband lines. This is done to prevent false starts for junctor switches if all remote links are busy. When all links are busy, except on WDTI calls, the WLKB relay is operated rather than a WL- relay. On WDTI the operate path of the WLKB is opened. If all links are busy initially, one will become available when the linkage to the wideband incoming trunk is released. If for some reason the link does not become idle, the operate of the WHS1 relay is blocked and the wideband linkage is not set. The audio linkage, however, is set and the marker block at the DCT1 relay operate. A trouble record is taken and a regular release is given to the register.

WIDEBAND HOLD MAGNET OPERATION - FS171

40.42 Since the wideband and standard linkages are set up simultaneously, the marker can make use of the existing hold magnet timing. This timing is guaranteed by the following sequence of operations:

- (a) The CHA relay can operate only after WCK on wideband linkages.
- (b) The CHA operation starts hold magnet timing.
- (c) Operation of the HMS1 relay is required for operation of the WHS1,2 (wideband. hold magnet start) relays.

A. Operation of WHS1,2 for Locally Switched Wideband

40.43 Operation of the WHS1,2 relays depends on a normal condition of the linkage check relays WCN, LXWA, LXW1, JXWA, JXW1, and WSLA together with a secondary busy check (WJGK and WTKG) on the selected "A" and "B" links. Contacts of WHS1 then operate the trunk and junctor switch hold magnets by

closing their operate leads to the WJH- and WTH capacitors and diodes. The line switch hold magnet is not operated at this time since a wideband false cross-check (WFCK) is required on the central office linkage before extending the call to the line.

B. Operation of WHS1,2 with Remote Wideband Lines - FS168, 171

40.44 When the wideband line involved in the connection is remotely terminated, the marker requires an additional check, RSMK, for WHS1,2 operation. The remote select magnet check, RSMK, indicates that the select magnet signal encoding was accomplished correctly and that one select magnet was operated at the wideband remote switch. The RSMK relay is operated by:

- (a) The MMK, multilead message check, which verifies correct coding in the wideband remote switch signal control circuit.
- (b) The RUK which, at this point in the call, verifies that one remote select magnet has operated.

40.45 In addition to operating the junctor and trunk switch hold magnets (on locally switched wideband), the WHS1 relay grounds an LH- lead through the wideband line link connector. Ground on this lead starts the signal encoding for the remote line hold magnet by operating a U- and T- relay in the wideband remote switch signal control circuit.

WIDEBAND LINKAGE TESTS

40.46 Sleeve crosspoint checks are made on the wideband link circuit and the wideband remote switch when linkages are set through them. These tests verify that a control path to a hold magnet exists and that the crosspoint closed when the hold magnet was operated. Before the wideband line hold magnet is operated, a crossed line hold test is made to verify that only one hold magnet is accessed on the line switch.

40.47 A false cross and ground test is made on the linkage in the wideband link circuit. This tests verifies:

- (a) That there are not false grounds on the transmission pairs.
- (b) That there exists no tip-to-tip or ring-to-ring cross between sending and receiving pairs of the same channel.
- (c) That there are no crosses to transmission leads of an existing channel.

40.48 Wideband continuity testing, also made in the wideband link, differs from the standard network continuity test in two ways:

- (a) A transmission-level measurement is made around a loop formed by the sending and receiving pairs.
- (b) The test is made over the trunk facility to a distant office (where applicable) as well as being made on the customer loop.

On a wideband SOG call, for example, the first continuity test is made to the distant office as soon as the wideband trunk switch is seized; the second test is made over the customer loop after the wideband line hold magnet is operated.

40.49 A double-connection test is made to determine if the linkage being set is falsely bridged into an existing linkage. The method of testing in the wideband link circuit makes use of the sleeve lead while the test at the remote switch uses a separate "sixth wire". The double-connection test at the remote switch also tests for crossed line hold magnets. The test for crossed line hold magnets in the wideband link circuit is a separate test made prior to wideband line switch hold magnet operation.

40.50 Successful completion of all wideband linkage checks is indicated by operation of relay WDCl. The WDCl is the incorporated into standard marker linkage tests required for a normal disconnect.

A. Crosspoint Checks in the Wideband Link Circuit - FS169, 171

40.51 Sleeve crosspoint checks are made on all wideband link crosspoints immediately following their operation. In the case of the junctor and trunk switches, the crosspoints are closed when WHS1 operates. Closure of the line switch crosspoints, however, must wait for operation of WFCK.

40.52 Both wideband line and junctor switch crosspoints are checked in the same manner:

- (a) The LXW/JXW relay in the hold magnet operate path operates from hold magnet battery when the circuit closes.
- (b) The LXW/JXW relay releases by shunt-down when the corresponding crosspoint closes and returns the trunk switch hold magnet ground (via the WTXP lamp) to the marker.

Counting circuits consisting of LXWA, LXW1, JXWA, and JXW1 record the operate and release of the LXW and JXW relays and indicate successful tests by operation of LXW1 and JXW1.

40.53 Checking of the wideband trunk switch crosspoint is accomplished by operating relay WSL from the same ground that shunts down LXW and JXW.

B. Crossed Line Switch Hold Magnet Test - FS169

40.54 Prior to line switch hold magnet operation, WHS1 cuts through a path from the XWLH relay to the line switch hold magnet. The charging current for the XWH capacitor, which was initially discharged, provides a current pulse through the series combination of the XWLH relay and a hold magnet. If the control path accesses only one hold magnet, the current pulse is insufficient to operate XWLH. However, if more than one hold magnet is accessed, the resulting current pulse operates the XWLH by its primary winding and locks by a change of bias on its secondary winding. Operation of this relay is treated as other marker cross relay operations.

C. Sleeve Crosspoint Checks and Double-Connection Test in the Wideband Remote Switch - FS168

40.55 A sleeve crosspoint check is made in the remote switch by a sequence similar to that required for operation of LXW1 or JXW1 in the wideband link. A successful remote crosspoint check is denoted by operation of the LXPL relay in the remote switch circuit.

40.56 The crosspoint check is not returned uniquely to the marker, however, but is combined with the indication of a successful double-connection test to operate marker relay RUK for the second time. The double-connection test, checking for a cross of two sleeves in the remote switch, denotes success by operation of remote switch relay HMK.

40.57 When the hold magnet control signals were decoded at the remote switch, a hold magnet operating path was cut through causing HMS (in the remote switch circuit) to operate. This caused RUK to release and operate RUK1 which locked operated to WLC1. When the crosspoint and double-connection checks caused RUK to be reoperated, RDCK was operated and locked, indicating that both checks were completed successfully at the wideband remote switch.

D. False Cross and Ground Check in the Wideband Link - FS174

40.58 The operation of WHS1 cause WFC1 to operate and it, in turn, operates WFC2. WFC2 then operates WFCT, which cuts through the send and receive pairs of the wideband channel from the trunk circuit to the checking relays, WFC1,2.

40.59 When JXW1 and WSLA operate, indicating a sleeve crosspoint check, ground is removed from the WFC1 winding. If no other ground exists on the T or R leads - either from false grounds or from crosses to T₁ or R₁ - WFC1 will release. Similarly, WFC1 removes the ground from WFC2 winding and the T₁ and R₁ leads. If no false ground exists on the T₁ and R₁ leads, the WFC2 relay will release, thereby operating the WFCK relay. The operation of WFCK releases WFCT which cuts the wideband pairs into the wideband continuity oscillator and detector.

E. Wideband Continuity Testing - FS174

40.60 The continuity of the wideband linkage is verified by the marker and the wideband continuity circuit by transmitting a 12-kHz signal over the "send" pair of the channel and detecting the level of the same signal as it is returned on the "received" pair via a loop-back connection at the distant end. Depending on the type of call and type of wideband linkage one, two, or no wideband continuity tests may be made while setting a call.

40.61 For any given test, the marker determines whether the linkage being tested requires "loop" or "trunk" limits (ie, broad or narrow tolerance) on the level of the received signal. If the level of the received signal is within the selected limits, the WCN relay is operated by the wideband continuity circuit.

40.62 Access to the linkages is through the wideband trunk circuits. The trunk S relay is operated by the marker in order to test the channel between offices (SOG and TOG calls) or the cross-office linkage from the trunk to the called station (LAO calls).

40.63 On terminating calls and for tests of the channel between the trunk and the calling station (call-back linkage), the trunk S is released and the direction of the test is reversed by relay RWCN. The following table lists the S and RWCN relay states and the level limits required for the various types of wideband calls.

TYPE OF CALL	TYPE OF WIDEBAND LINKAGE	TEST*	STATE OF RWCN	STATE OF S (TRK)	"LIMITS" LEAD GROUNDED
DTI	Locally Switched	1 2	Normal Operated	Operated Normal	TB LB
SOG	Locally Switched	1 2	Normal Operated	Operated Normal	TB LB
TOG	Locally Switched	1 2	Normal Operated	Operated Normal	TB TB
TER	Locally Switched	2	Operated	Normal	LB
ITR	Locally Switched	2	Normal (Fwd Linkage)	Operated	LB
		2	Operated (Call Back Linkage)	Normal	LB
ITR	Remotely Switched	0	--	--	--

Note:

*Test 0 - No continuity test made

Test 1 - Made between seizure of wideband trunk switch and operation of WCK

Test 2 - Made after operation of WWS1

F. Testing Linkage Between Offices

40.64 When the marker determines that it is switching a wideband call, relay WBC2 operates and grounds the TB lead to the wideband continuity circuit. This causes the continuity circuit to go off-normal and sets the level discriminator to the limits required for trunk linkages. On SOG and TOG calls, a continuity test of the trunk facility is made as soon as the outgoing trunk is seized.

40.65 When the S relay in the wideband trunk circuit operates, the 12-kHz signal from the wideband continuity circuit is transmitted via the T1 and R1 leads to the wideband trunk and out over the send pair of the transmission path to the distant office. A loop-back connection in the distant trunk returns

the signal over the receive pair. The signal then passes through the marker on the T and R leads from the trunk, and into the wideband continuity circuit for level checks. If the level of the returned signal is within the limits acceptable to the continuity circuit, the WCN relay is operated, permitting WCK to operate so that the marker can continue with the call. If the level is not within limits, the WCN relay does not operate, and the marker work timer will function, causing a trouble record and a trouble release.

40.66 With this continuity test completed, WCN operated, the marker releases the trunk S relay to prepare for testing of the cross office linkage. When the trunk S relay releases, the path to the distant office is opened and relay WCN releases, allowing later operation of the WWS1,2 relays.

G. Testing Cross Office Linkages

40.67 The marker prepares for the second continuity test on SOG and TOG calls or for the first test on ITR and TER calls while the first cross office linkage is being established. On all calls except TOG, the operation of the WHS2 relay removes ground from the TB lead to the wideband continuity circuit and applies it to the LB lead, setting the level discriminator for loop limits. For TOG calls, the TB lead remains grounded since both tests require trunk tolerances. On SOG and TOG calls, the WHS2 relay also operates the RWCN relay to reverse the direction of the continuity test. With RWCN operated, the signal is transmitted over the T and R leads to the trunk and received on the T₁ and R₁ lead.

40.68 Upon closure of the first linkage cross-points, the continuity signal is passed through the linkage to a wideband line or incoming tandem trunk and returned to the marker and continuity circuit for level checks. If the level of the received signal is within the selected tolerance, WCN will operate and close a path to WDC1.

40.69 On ITR calls, the trunk S relay is released after WDC1 operates and the RWCN relay is operated by the SCB3 relay when the marker starts into the call-back portion of the call. When the crosspoints of the call-back linkage close, the continuity signal is transmitted to the calling station and returned for level checks as was done for the first cross office linkage test.

H. Alternate Actions

40.70 The wideband continuity circuit performs self-checking functions during idle periods to verify the validity of the continuity tests. If the circuit detects a malfunction, it will generate an alarm and ground the TRB lead to the marker. If the marker is processing a wideband call and is in a "first trial" mode, ground on the TRB lead will operate the TRL1 relay. This causes a trouble release and instructs the marker connector to try for a different marker on a "second trial" basis.

40.71 With the wideband marker in a "second trial mode, ground on the TRB lead will operate the cancel wideband continuity (CWCN) relay. The CWCN relay cancels all checks of the WCN relay states and allows the call to be completed without performing any continuity tests.

I. Double-Connection Test in the Wideband Link - FSI69, 170

40.72 The method for the double-connection test in the wideband link circuit is the same as that used in the standard network. When the LXW1 relay operates, it removes all grounds from the wideband sleeve except one which passes through the primary winding of WDCT. If there are no false grounds on the sleeve, the WDCT will operate, thereby operating the WDCA.

40.73 When the marker releases the trunk F relay on all except ITR calls, the F-relay (auxiliary) in the wideband link circuit transfers the sleeve from the holding ground in the marker to a holding ground in the trunk. The shunt-down release of WDCT verifies that the trunk is providing its own holding ground. On ITR calls the F- (auxiliary) relays are released when the marker removes the battery from the FB lead to the wideband trunk link connector by operation of DCTA. This is done to check the trunk holding ground for the forward linkage before the call-back linkage is set.

J. Testing Linkages on DTI Calls

40.74 Circuit operation in the marker for continuity testing on DTI calls is similar to that for SOG type calls. The transmission path, however, over which the first test is made differs significantly from the path on SOG calls.

40.75 The wideband transfer network is not checked for continuity on the dial tone marker transfer usage as is the audio network. Instead, the identification of the 2-way or intraoffice trunk is generated and stored in the transfer trunk by the dial tone marker. This identification permits the continuity test to be made from the completing marker on the DTI usage. If a failure occurs, the identification of the trunk initiating the transfer is read out of the transfer trunk and punched on the trouble card. Identification of the wideband transferring trunk will also be available on the trouble card for other trouble conditions occurring on a wideband DTI marker usage.

40.76 When the S relay in the wideband transfer trunk operates, the continuity test signal is transmitted out from the transfer trunk, through the transfer network to the 2-way or intraoffice trunk requesting transfer. A loop back in that trunk returns the signal to the continuity test circuit where it checks the signal as previously described

under F. Testing Linkages Between Offices. The second, or cross office linkage test, is the same as that described under G. Testing Cross Office Linkages for SOG type calls.

CHANNEL MATCHING FAILURES WITH WIDEBAND SWITCHING

A. Failure to Match Remote Link - FS168, 44, 55

40.77 Operation of WLKB indicates that there are no idle remote links available between a given remote switch and its associated line switch in the wideband link circuit. Since no substitution of a line or trunk switch can provide an idle link, this failure is treated as a second failure to match for the standard network.

40.78 WLKB operates the FMP and 2FA relays, the combination giving overflow on TER calls and a RBT release to the register on SOG and IAO calls.

B. Failure to Match Wideband Channel - FS171, 44

40.79 Operation of WFMP indicates that there are no idle channels between the given wideband line and trunk switches. If the line is locally terminated, WFMP operates FMP directly. If the wideband line is remotely terminated, no action will be taken on this failure until an idle wideband link is selected. Thus, the WFMP requires the operation of WLA or LWL before it can operate FMP. The FMP then initiates the alternate action as it would on a failure to match in the standard network.

C. Standard Channel Match Failures with Wideband Calls - FS44

40.80 Under standard (nonwideband) operation, the marker operates FMP upon failure to match after a junctor step. If the marker is switching a wideband call, the WLA contact requires that a wideband link be selected (where a remote link is required) before FMP can be operated. This prevents conflicting alternate actions from being initiated by channel match failure and link match failures.

WIDEBAND MISMATCH WMM - FS170

40.81 A wideband mismatch occurs for any of the following calls or conditions:

- (a) A wideband call to a nonwideband line, indicated by NWLA being operated on a forward linkage.

(b) A wideband request by a nonwideband line, indicated by NWLA being operated on a call-back linkage.

(c) A wideband call to or from a station made maintenance busy, indicated by WMBA being operated.

(d) A mismatch of calling and called line wideband services, indicated by differing WB- and WBT- classes.

A. Wideband Announcements - FS170, 89, 57

40.82 If the calling customer has wideband service operation of WMM initiates a connection to one of two wideband announcements; the "denied wideband" or "wideband maintenance busy" announcement. These announcements appear on the trunk link as well as the line link frames to permit access on either call-back or call-forward linkages.

40.83 On terminating calls, WMM operates PUL to start a recycle. When the recycle release sequence is complete the marker operates the RIW and TBI relays. With WMBA normal the line number for the "denied wideband" announcement will be generated and with WMBA operated the line number for the "wideband maintenance busy" announcement will be generated. The TBI operates IPT which operates CWB and cancels the wideband linkages.

40.84 On SOG and ITR calls, WMM operates WRA which starts a route advance. WMM and WRA will cause RAV1,2 to operate on each alternate route until WRM is operated upon reaching an announcement route (Note 430). The route to be used is determined by the WMBA contact reached from the PBV relay operate path. If WMBA is normal the "denied wideband" route is selected and if it is operated the "wideband maintenance busy" route is used. The WRM operates CWB which cancels the wideband linkages.

40.85 In all cases, the marker proceeds to set the call to the announcements using the standard network only.

B. WMM Operation with Nonwideband Customers - FS170

40.86 If the calling customer has no wideband service, operation of WMM initiates a route advance to common overflow. This is accomplished by WMM sending a ground through break contacts of TER6 and FLGA and a make contact of NWLA or NWT.

WIDEBAND MAINTENANCE BUSY FEATURE

40.87 Every line with wideband service has an associated magnetically latching relay to indicate a wideband maintenance busy condition for that line. These MB- relays are located in the wideband line control circuit for local lines and in the wideband remote switch signal control circuit for remote lines. The marker is arranged to set, release, or interrogate the state of any MB-relays as determined by the master test control or trunk test register circuits.

A. Interrogating the State of an MB- Relay -
FS173, 47, 9, 169

40.88 In addition to making a terminating test call to the desired line, the master test control or trunk test register operates the MT43 and MT44 relays. One contact of MT44 prevents the setting of any linkage by keeping LHT operated, thereby preventing operation of HGK. The call can proceed as far as accessing the wideband line hold magnet since VFT-, VGT-, and HGT- will be operated. The WMB relay can then indicate the state of the MB- relay: WMB and WMBA operate if MB- is operated and remain normal if MB- is released.

40.89 Other contacts of MT44 cut through the VTR and VTS leads to the master test control or trunk test register so that the state of WMBA can be sent to these circuits when WCV operates. A ground on the VTR lead indicates MB- released and a ground on the VTS lead indicates MB- operated.

40.90 When either circuit receives ground on the VTR or VTS lead, it operates the DS1,2 relays via the MTFC to allow the marker to disconnect.

B. Operating or Releasing of MB- Relay -
FS173, 169

40.90 To operate or release an MB- relay, the master test control or trunk test register operates the VLB or VLR relays in addition to establishing the previously described conditions for interrogating the state of an MB-relay. The MBC relay, which operates from WCV and a one-up check of VLB and VLR, opens the path between the WLBT and WLIT relays and the wideband line hold magnet. Opening this path causes the release of WLIT, WLBT, or WMB, one of which was operated in order to get WCV. When WCV releases, ground is extended over the MBC lead through the wideband line link connectors to operate the MBC0-7 relays in the wideband line control or wideband remote switch signal control circuit.

40.82 The MBCK relay, which verifies that all MBC- relays are operated, reestablishes the path between the WLBT and WLIT relays and the wideband line hold magnet. The WLBT and WLB then operate to verify that a path exists to the MB- relay. The operation of WLB re-operates WCV which provides a path to SMB. The SMB opens the hold magnet path again and connects it to positive or negative battery (depending on VLB or VLR) to operate or release the MB- relay.

40.93 With its operate path open again, WLBT releases and thereby drops WLB, releasing WCV. This establishes a path to slow-operating TMB which removes the operating or releasing battery to the MB- relay, starts the release of the MBC0-7 relays in the wideband line control or remote switch signal control circuit, and reestablishes the hold magnet path. WCV reoperates when either WLIT, WLBT, or WMBA operate and provides a ground to be sent out on the VTR or VTS leads to the master test control or trunk test register when MBCK releases. The signal on these leads indicates the final state of the MB- relay and causes the test circuit to start a marker disconnect by operating the DS1,2 relays via the MTFC.

PLANT REGISTER PEG COUNTS FOR WIDEBAND CALLS

40.94 Peg count leads to the plant register circuit are provided for total wideband usage and for first and second trial trouble conditions on wideband calls. Each of the three indications are provided on a wideband class basis (WB0,1,2) making a total of nine new leads to the plant register circuit. The wideband total usage peg count (WTPC-) is pegged on every marker seizure with a wideband request. The WTPC- totals must be deducted from the TPC total to obtain a non-wideband marker usage total. The WTR- and WMST- leads are pegged instead of the TR and MST leads when any type of trouble is encountered on a wideband call.

ENSURE RELEASE OF AUDIO-LINKAGE AFTER TROUBLE RECORD ON WIDEBAND IAO CALL

40.95 The marker is arranged to ensure that the audio linkage is released following a trouble record on the call-back portion of a wideband intraoffice call. Contacts of the WBC3 and DS1 relays are provided in the HMS1 circuit to cause the HMS1 to release when the wideband linkage is released following a trouble record DS1 operated. The result will be returning the calling party to a dial tone connection, indicating that the call encountered trouble and did not complete. This is provided by option ZNE (rated Standard).

BIT-STREAM SWITCHING

40.96 This option is an addition to the wideband switching feature provided for markers 0 and 1. It will allow the marker to control the bit-stream link circuit in addition to the wideband link circuit. The bit-stream link is a 3-state crossbar network whose control is similar to the wideband network. Only through-switched, TOG, type calls will be handled by the bit-stream link. Apparatus Fig. 167 provides the additional apparatus required by this feature.

40.97 The identification of the network to be used on a call is provided by the WBL and BSL relays. They are selected by the WBO-2 relays which are operated from the trunk class on incoming calls. The network distinction is necessary in order to vary the type of continuity test and for other network control checks.

40.98 The control leads for both the wideband and bit-stream networks are steered through the same connector circuits. In the wideband trunk link connector the T relays are provided on a one-per-trunk-switch basis. They are operated from the trunk circuit involved in the call and are used to steer control leads to the proper trunk switch which can be on either network. In the WLLC, L relays have been added on a one-per-line-switch basis to steer control leads to the proper switch. They are operated from the wideband line control circuit where they are selected by the vertical file indication. Since one WLLC now serves more than the one line switch, an L relay must be operated on wideband as well as bit-stream calls. The LSK and XLSS relays have been added to provide a one-up check on the L relays in the connector.

40.99 The bit-stream network has a set of relays in the transmission path in addition to the three stages of crossbar switches. These relays, called cut-through C- relays, are used to connect each A link between the line and junctor switches to 1-out-of-4 possible junctor switches within one junctor switch group (see Note 304 in the SD). The switch to be used is determined by the trunk switch group (1/4) in which the bit-stream trunk is located. Identification of the group is provided by the WTG 0-4 relays, which are operated from a T- relay cross-connect field located in the wideband trunk link connector. The operate path for the C- relay is completed when the WTG- relay operates. A check for continuity of the operate path and for the absence of a false

ground is completed by the operation of the WCGK relay. The C- relay is operated by WHS2 and a check for crossed leads is made by XLLC. Crosses between the operate path of the relay being operated and any other relay on the same line switch level or to any other C- relay already operated on a different level will cause the operation of the XLLC relay. The holding ground for the C- relay is provided by a junctor switch hold magnet off-normal contact. It is checked by removing the operate ground in the marker when the junctor hold magnet operates and checking that the LLCK relay remains operated.

40.100 Several new checks have been added to the WTK operate path for this feature. A one-up check on the WBL and BSL relays must be satisfied on all calls involving either the wideband or bit-stream network. On all these calls a check is also made to ensure that the L- relay in the wideband line link frame is operated. For bit-stream calls the LLCK relay is checked down and a one-up check is made on the WTG 0-4 relays.

40.101 The wideband class obtained from the incoming trunk class is checked against the wideband line class received from the wideband line control circuit. Any mismatch results in a trouble condition and causes the marker to request a trouble record and disconnect.

CONTINUITY TESTING

40.102 Continuity testing for bit-stream calls requiring one pass through the office is provided by the bit-stream transmission terminals. The false cross and ground test is made in the marker circuit and as soon as it is successfully completed the marker operates the S relay in the trunk circuit. The S relay opens the transmission path to the marker and restores continuity through the trunk circuit. When the network linkage is complete, the integrity of the cross office connection is verified by the outgoing terminal and indicated to the trunk circuit by ground on the CCK lead. This signal is passed on to the marker where it operates the WCN relay indicating a successful continuity test. Failure to receive the CCK mark from the trunk will cause the marker to time out and take a trouble record.

40.103 Continuity testing of calls requiring two passes through the office (operator calls) is provided by the bit-stream continuity test circuit. This circuit is provided on a one-per-marker basis and the trunks connect to them through a connector

which is logically equal to the wideband trunk link connector. The test circuit functions similarly to the transmission terminals but the CCK mark is passed directly into the marker instead of through the trunk circuit. The trunk circuit indicates to the marker that the test circuit should be used for continuity testing by placing ground on the CCK trunk lead before the WCK relay in the marker operates. Trouble in the bit-stream continuity test circuit will place ground on the DF lead to the marker. This lead is connected to the TRB lead from the wideband continuity test circuit by the BCN on calls to an operator and by TCNC on calls from an operator. Marker action is the same as for trouble in the wideband continuity test circuit.

INDICATION TO OUTGOING TRUNK WHEN CALL IS FROM AN OPERATOR

40.104 The outgoing bit-stream terminal requires a mark from the trunk circuit when it must encode an audio signal from that office. This results in the necessity for the marker to indicate to the trunk whenever a call is from an operator in that office. The indication is obtained by assigning a separate trunk class to the operator trunks and using this class to operate the TCNC route series relay. This relay grounds the TC lead to the trunk which causes the trunk to generate the "encode audio" signal to the outgoing bit-stream transmission terminal.

WIDEBAND CONTINUITY TESTING IN OFFICES WITH SOME WIDEBAND TRUNKS CONNECTING TO BIT-STREAM FACILITIES

40.105 Option ZRQ must be provided in offices that have trunks on the wideband link circuit connecting to bit-stream facilities. This option will cause the marker to make a wideband continuity test on incoming calls back over 2-way trunks toward the originating end. The test will be made on all terminating calls and must be successfully completed before a linkage is set. Trunks that do not connect to bit-stream facilities will have a loopback provided locally in the trunk circuit. This loopback will be used to satisfy the continuity test.

"DATA-PHONE®" 50

40.106 The marker is equipped to provide a type of wideband service, DATA-PHONE 50. DATA-PHONE 50 traffic can be switched

through the same network as PICTUREPHONE traffic. However, wideband trunks will be dedicated to either DATA-PHONE 50 or PICTUREPHONE and will be identified by incoming trunk classes. Line loops will be dedicated to either DATA-PHONE 50 or PICTUREPHONE and will be identified by the customers class of service.

40.107 Normal screening capability will prevent calls between DATA-PHONE 50 lines and POTS or PICTUREPHONE lines. Blocked DATA-PHONE 50 calls will be routed to its own "denied service" and "maintenance-busy" announcements.

40.108 DATA-PHONE 50 has its own AMA rate structure and will be identified on the AMA record tape by a calling class index 7 placed in the station digit location.

40.109 Option ZRR provides the feature. Apparatus Fig. 169 may be provided when additional intercept trunk groups are required.

41. WIDEBAND SWITCHING (SPECIAL)

41.01 Apparatus Fig. 133 and options GS, EQ, and EP provide wideband switching for the expanded PICTUREPHONE product trial. Wideband switching, an arrangement to provide a 4-wire wideband transmission path along with the standard 2-wire voice path between wideband stations, is rated AT&TCo Special.

41.02 Dedicated voice routes, used for WB traffic, are selected by screening the wideband code points. On TOG calls the trunk class assigned to the dedicated trunks is used; on originating calls, two screening relays are associated with the WB class of service.

41.03 The S(WB) relay is operated when a wideband prefix has been received, otherwise the S(NWB) relay is operated. Route relays for voice traffic only are also screened to route wideband request to these routes to a recorded announcement. The CP- terminal of the wideband route is cross-connected to the WBR relay to enable the wideband match on IAO calls and to provide wideband link controls. Note 451 shows typical cross-connections for wideband screening.

41.04 The wideband match is made when the class of service of the called station is received from the line link frame. The

WB classes are cross-connected to the WBA terminal, and the other classes to the AOA terminal. If the AOA terminal is grounded when the WBR relay is operated, the PUL relay operates and the call is routed to line intercept. If the WBA terminal is grounded, the AOA relay is operated and the WBS relay operates to cut through the select magnet operate leads and the check leads to the wideband link circuit. The WBS relay also grounds the WBS lead to the trunk link frame, which causes the operation of the level relay PL- in the wideband link circuit. Battery on the AS or BS lead to the wideband link, through the operated PL- relay, operates the proper select magnet. The hold magnet on the wideband link is operated in parallel with the line hold magnet. A double connection test is made by the wideband link

circuit and the WBK relay in the marker operates if the check is satisfactory, allowing the call to continue by enabling the DCTL operate path. A double connection test failure causes the XWB relay to operate which releases the linkage and causes a trouble record request.

41.05 When phase I or II centrex lines are arranged for PICTUREPHONE the type of line cross-connection field is expanded to provide the wideband match for centrex lines. The following table lists the cross-connections for the type of line relays and which relay is operated for wideband and nonwideband calls.

TYPE	ARRANGED FOR WIDEBAND	CALLED LINE		WIDEBAND CALL BEING SERVED	TYPE OF LINE RELAY OPERATED
		CROSS CONNECT CS- TERMINAL TO			
CENTREX	NO	CTX		NO	CGS
CENTREX	NO	CTX		YES	MRA
CENTREX	YES	WCG		NO	CGS
CENTREX	YES	WCG		YES	AOA
COIN	NO	CNA		NO	CNA
COIN	NO	CNA		YES	MRA
MES REG	NO	MR		NO/YES	MRA
ALL OTHER	NO	AOC		NO	AOA
ALL OTHER	NO	AOC		YES	MRA
ALL OTHER	YES	WBA		NO/YES	AOA

42. DIRECTORY ASSISTANCE CHARGING

42.01 The marker is arranged to request either a bulk-billed or detail-billed AMA record on directory assistance routes. Calls for local information (411) will be bulk-billed calls for home NPA information (555-1212) may be either bulk-billed or detail-billed, and calls for foreign NPA information (NPA+555-1212) will be detail-billed.

42.02 The type of AMA billing required on directory assistance calls is indicated to the sender by the CP1, CP2, and LST leads on bulk-billed calls. Detail-billed calls are indicated by the CP2, CP7, and 4DG leads to the sender. Apparatus Fig. 175 (Standard) provides the directory assistance charging feature. Apparatus Fig. 136, required for AMA recording of NPA+411 calls is rated Mfr Disc., and options FA, FB, FC, and FW are rerated to Standard.

43. CAROT-ROTL OPERATION

43.01 The marker is equipped to switch test calls initiated by test circuits which allow trunks in several connecting offices to be tested on a remote basis. This ROTL arrangement allows some of the trunk testing equipment to be centralized and provides more centralized results of routine and trunk trouble testing and test results analysis.

43.02 In general the marker is accessed via the MTFC, however, several new leads are provided to the remote office test line register circuit for class-of-service functions and trunk selection.

44. MULTIPLE CLASS MATCH FEATURE EXPANSIONMULTIPLE CLASS MATCH FEATURE IN NONCENTREX OFFICES

44.01 The marker is arranged for the provision of the multiple class-of-service match feature (App Fig. 96 and options SP and ZWG) in noncentrex offices. This is done to provide a means of restricting completion of noncentrex 4- or 5-digit calls. When option ZQZ is provided, the operation of the X11 relay, indicating a 4- or 5-digit call, will operate the MCS relay. The MCS relay operated requires a class match (CM relay operated) for completion of the call. If the class does not match (MM relay operated) the call is routed to line intercept by the operation of the RIP, RIPA relays. See 26.25 through 26.30 for operation of multiple class match circuit.

INCOMING TRUNK CLASS TO SUBSCRIBER CLASS MATCH

44.02 This feature makes it possible to give terminating calls a class of service match that is equivalent to the match for originating ITR calls presently provided in the class of service match feature (FS138). The two cross-connection fields (TUA/B0-9, TMU0-9, and TTA/B0-9, MT0-9) allow any terminating trunk class mark to be given the same treatment on a tens and units basis as an originating class of service. The match pattern and multiple class of service match cross-connection are not changed from the description in 26.25 through 26.30.

44.03 A cross-connection in the TTA/B0-9, MT0-9 field will operate the TMR relay, indicating that a terminating match is required. As a positive check, trunk class marks not requiring a terminating class match will cross-connect from TUA/B0-9 to NTMR and will operate the NTMR relay. No terminating match.

44.04 Option DX (rated Standard) provides cross-connections fields (TUA/B0-9, TMU0-9, TTA/B0-9, MT0-9, NTMR) and provides relays TCAA (trunk class A auxiliary), TCBA (trunk class B auxiliary), TMR (terminating match required), and NTMR (no terminating match required). Option DY (rated Standard) was a part of option SP and is provided when DX is not specified.

44.05 Option ZSA is added to cancel the terminating class match on calls to incoming trunk test lines. With this arrangement relays ITM, incoming test line - manual; and ITD, incoming test line - dial, are added. These relays are operated from the class of service of the called incoming trunk test line. Relay ITD operates relay DLT, while ITM operates MLT, and either ITD or ITM relay operated will cancel the terminating class match by releasing the MCS relay.

45. PERMANENT SIGNAL TEST

45.01 When the permanent signal test feature is provided, the line on which a permanent signal call is detected can be tested to determine whether the permanent signal is due to a receiver off-hook or a trouble on the line. The call can then be switched to an appropriate termination depending on the outcome of the test. This feature may or may not be used in conjunction with overflow links.

ALL LINES EXCEPT COIN AND TWO-PARTYA. Ground Test

45.02 When the completing marker is seized on a permanent signal call, no line except coin and 2-party lines should be grounded on either the tip or ring. Consequently, a test employing the GT relay is made to detect trouble grounds on noncoin and non-2-party lines. The test is performed much like the usual ground test on the called line, as described in SECTION II, 13.24 through 13.29, except that different biasing circuitry is used.

45.03 Shortly after the marker is seized, the GT3 relay is operated by the CKG2, and the LLC3 relay negatively biases the GT relay by energizing its tertiary winding. The negative bias on the GT relay is increased when the PST preroute relay energizes the GT secondary through the PGL and 2 bias resistors. The PST relay also energizes the GT primary, which develops enough current to overcome the combined negative bias of the secondary and tertiary windings, causing the GT to operate.

45.04 The PST relay also operates a route relay to select a special test trunk. After the hold magnets for a channel to the special trunk are operated, the GT1 relay operates and connects the primary of the GT relay to the ring over the ART or BRT leads. The GT1 also operates the GT2 relay, which removes the ground applied to the GT primary by the PST relay and removes power from the GT3 slow-release relay. If there are 4500 ohms or more to ground on the ring, the GT relay releases and reenergizes the GT3 relay. The marker then proceeds with the short test. If there are less than 3000 ohms to ground on the ring, the GT does not release. Consequently, the GT3 eventually releases and causes the PSG relay to operate and lock which indicates that the permanent signal is due to a trouble ground on the line.

B. Short Test

45.05 The purpose of this test is to detect excessively low resistance between the tip and ring (such as a short in or near the office). The resistance is measured by a bridge network composed of resistor ST1, 2, and 3, the line, and the ST relay. When the GT relay releases in the previous test, it operates the PS1 relay, which prevents the GT3 relay from releasing. The PS1 relay also operates the ST relay by applying ground to the line side of the bridge. The ST relay operates a slave relay, STA, which diverts the hold ground for the PS1 through the PS2 relay, causing the PS2 to operate. The PS1 also connects the tip to ground and transfers the ring from the GT primary to the grounded side of the bridge.

45.06 The PS2 relay removes the operate ground applied to the bridge by the PS1 and it also removes power from the slow-release GT3 relay. If the resistance between the tip and ring is greater than 150 ohms, the ST and STA relays will release. Upon releasing, the STA reapplies power to the GT3 relay and operates the ROH relay, which locks up. If the line resistance is less than 100 ohms, the ST and STA will hold operated. In this case, the GT3 will eventually release, causing the PSG relay to operate and lock.

45.07 When either the ROH or PSG is operated, the PSA will operate. The PSA initiates a route advance by operating the RAV1 relay, which in turn causes the PSA1 to operate and lock. The marker then route advances to set up the linkage to an appropriate trunk. The PSA also operates PSL to hold the line link connector.

COIN LINES

45.08 Although coin lines may or may not be grounded, depending on the presence of a coin, the marker treats coin line permanent signals the same as in 45.02 through 45.04 for noncoin lines. When an originating register recognizes a permanent signal on a coin line, it attempts to return the coin. If the coin is successfully returned and there are no trouble grounds on the line, the marker concludes that the permanent signal is due to a receiver off-hook. If the coin return is unsuccessful or if a trouble ground is present, the marker considers the permanent signal to be due to a trouble.

TWO-PARTY LINES

A. Ground Test

45.09 On 2-party lines, the tip parties station set applies ground to the tip when its receiver is off-hook in order that it might be distinguished from the ring customer. The originating register tests for the presence of this ground on all 2-party calls, and it operates the TPT relay in the marker if the ground is present. Since this ground is intentional and should not be treated as a trouble, the ground test in 45.02 through 45.04 is modified by the TPT relay such that the GT relay will release when the GT2 operates only if there is approximately the same resistance to ground on both the tip and ring. The TPT relay accomplishes this by connecting the tip through the PG3 bias resistor to the GT relay secondary and the ring directly to the GT primary. If the ground is due to a receiver off-hook, the current will be the same in the primary and secondary and will cancel since the coil polarities are reversed, causing the GT relay to release when the GT2 operates. The marker will then proceed to the second test. If the ground is due to a trouble, it probably will be unbalanced, causing the GT relay to remain operated. As in 45.02 through 45.04, the GT3 relay will eventually release, causing the PSG to operate. All steps in the GT sequence are the same as for a non-2-party call. The only difference is the way in which the tip and ring are connected to the GT relay. Bias resistors PG1 and 2 are not used. Since no ground is applied by the ring party, the TPT relay does not operate and the call is treated as a non-2-party call.

B. Second Ground Test

45.10 If no fault on the line is found in the previous test, a second test is made to

determine if the balanced ground is of the proper resistance. Since the ground applied at the station set is through at least 1000 ohms, this test will cause the PSG to operate if the resistance on either the tip or ring is less than 800 ohms to ground. This test is nearly identical to that of D.14 except that both the tip and ring are connected to the GT primary, a different amount of negative bias is provided by the GT secondary, and the controlling circuitry is like that of 45.05 through 45.07.

45.11 The release of the GT relay in 45.09 through 45.11 operates the PS1 relay, which connects the PG2 bias resistor to the GT secondary, ties the tip and ring together, and operates the GT by applying direct ground to the primary coil. When the GT operates, the PS1 hold current is diverted through the PS2 relay, which operates. The PS2 relay removes the operate ground from the GT relay. If the GT releases, the ground on the line is of reasonable resistance and the ROH relay operates. If the GT relay does not release, the ground resistance is too low. The GT3 relay eventually releases and operates the PSG relay. The PSA, RAV1, and PSAL relays are operated and a connection is set up to an appropriate termination as in 45.05 through 45.07.

46. OPERATION WITH OVERFLOW LINKS

46.01 When overflow links are provided, overflow may be connected directly to any of 20 selected links (10 left and 10 right) of a trunk link frame. The connection of overflow to the links is established by the operation of a relay in the trunk link, S-relay, associated with each of the 20 overflow links. This S-relay connects an auxiliary overflow circuit directly to the link to provide tone and supervision, requiring no trunk to be used.

46.02 Selection of an overflow link is initiated in the marker by the operation of a route relay that is cross-connected to operate relays TBX and NSO. Since no trunk is to be selected, the TG- cross-connection is omitted. The FTC- leads associated with the route relay are tested to select a trunk link frame with an idle overflow link. Relay NSO sets up a normal SOG-NSO type call, but trunk selection is bypassed by relay TBX.

46.03 Relay TBX in the marker operates the TBA relay, which grounds the TBK lead to the trunk link and causes the TBX in that circuit to operate when the trunk link connector operates. The TBX in the trunk link connects the S- relays of the overflow links to the BT- leads to the marker and operates the overflow link choice OLC relay in the trunk link frame. The OLC relay closes the 20 overflow link hold magnets through the L and R relays and over the LH- leads to the marker, and it grounds the LCK lead to operate the marker LCK relay.

46.04 At the same time, relay TBX closes the LKA and RKA relay windings to the LK and RK leads from the trunk link frame to operate the LKA or RKA relay in parallel with relay LK or RK. Operation of either the LKA or RKA releases the TSEL-2 relays, closes BT leads 0-9 LKA or 10-19 RKA to contacts of the CH- relays, and bypasses the FAK and FBK contacts to operate relay TK.

46.05 Operation of the TK permits normal channel selection utilizing an idle overflow link of the trunk link. In order for completion of the channel tests to occur without a trunk link FA- or FB- relay, the TBX relay cancels the continuity tests and causes the SLA relay to operate from the JXPL to allow the DCT relay to operate. The TBX also bypasses contacts of the CLK to permit the DCT to operate the DCT to operate the DCTL relay.

46.06 When the DCTL operates, it closes ground through CH- and LKA or RKA contacts to a BT- lead to operate the trunk link S-relay associated with the selected overflow link. The trunk link S-relay cuts the tip and ring of the overflow link through to the auxiliary overflow circuit and applies a 10-ohm ground to the sleeve lead. The grounded sleeve shunts down the DCT to operate the LKD relay, which extends its operate ground to operate the LK1 followed by the DIS1. The LKD relay is inserted in the operate path of the LK1 by the TBA relay to allow time for detection of crossed trunk link S- relays by the XCHS relay. The XCHS grounds the XCH punch lead and operates the TRR relay directly to produce a trouble record and normal release in the case of a cross.

47. PERMANENT JUNCTOR DISTRIBUTION

47.01 Option ZSQ is added so that the marker may work with permanent junctor distribution when less than four trunk link frames are provided. Option ZSQ is required to select the correct junctors when using junctor subgroup 2. Option ZSQ is not required for permanent junctor distribution when four or more trunk link frames are provided.

48. LAMA-C OPERATION

48.01 The marker is arranged to allow service observing and PBX-AIOD features to be provided in a LAMA-C office. Arrangements are made to provide these features in new offices and in offices converted from ANI or LAMA or ANI-LAMA to LAMA-C.

48.02 The service observing feature is arranged to permit the continued use of existing apparatus in markers being converted to LAMA-C operation. A new arrangement will provide the required apparatus in markers not equipped with LAMA or CAMA. Options ZJD and App Fig. 178 provide the arrangement.

48.03 The PBX-AIOD feature in the marker is not required in a LAMA-C office. If provided, this marker feature must be disabled in offices converting to LAMA-C operation. This feature can be disabled by cross-connection changes as specified in the SD cross-connection notes. Disabling this marker feature does not prevent PBX-AIOD operation in a LAMA-C office.

49. GLARE DETECTION - APP FIG. 135

49.01 Glare is a condition encountered on 2-way trunks when the trunk is simultaneously selected for use at both ends. The senders "glare" at each other awaiting a start dial signal which never comes. The senders eventually time out and set the trunk circuits to reorder. The effects of glare are stuck senders and lost calls.

49.02 While establishing outgoing linkages to 2-way trunks, the marker monitors the trunk supervision for an incoming seizure. If one is detected, alternate actions are taken. The detection interval is 100 milliseconds maximum after a trunk is selected. During this period, glare detected on a TOG call will cause the marker to route advance and select a different trunk. The incoming call can then proceed in a normal manner. Glare detected on SOG calls will

cause a route advance only if a channel is not yet selected. After a channel is selected, the dialing linkage is released and the call is committed to using the selected trunk. Detection after channel selection will result in canceling the sender timing period, and returning an immediate reorder to the calling customer. Glare that occurs after the 100-millisecond period of the GLT timer or after hold magnet operation will be undetected.

49.03 The trunk E lead is extended to the marker via the GL lead through the trunk link frame and trunk link connector. Ground on this lead represents an off-hook signal from the distant office. During the recognition period, this ground will operate the GL relay in the marker. On TOG calls and SOG calls before channel selection, GL in operating causes operation of relay GLA.

49.04 The GLA relay stops the marker progress at the point of channel selection (CHA), or if that point has been passed on TOG calls, at the point of hold magnet operation (HMS1). Sender setup functions will block after the connection through the sender link switch has been established, (SLK1 operated and SLK normal). A check for the continued presence of the glare signal is then made. If the signal has disappeared, marker progress is resumed and the call completes. If the signal is still present, relay GLC operates and sends a reorder signal to the sender. The sender then sets the trunk to overflow, causing the GL relay to release. Relay GL releasing indicates that sender and trunk functions are completed and the marker route advances and selects a different trunk.

49.05 On SOG calls when glare is detected after release of the dialing linkage, relay GLB will operate. The call is allowed to continue and after giving the advance to the sender it is also given a reorder signal. The marker checks the trunk and sender reorder functions by holding the trunk F relay operated until relay GL releases. Release of relay GL allows the marker to disconnect and the call is completed.

49.06 Provisions are made for taking trouble records of glare conditions, under key control at the master test frame, jack, lamp, and key circuit. With the GLR key operated, relay GLR will operate when a glare is encountered. On TOG calls and SOG calls before channel selection, instead of route advancing, GLR operated causes a trouble record and trouble release. On SOG calls after channel selection, GLR opens the disconnect path and causes a trouble record and regular release.

49.07 The glare detection circuitry is arranged to provide a down check for the GLT timer, to prevent scoring the GRA and GRO plant registers on glare test calls, and to prevent a possible false NGK1 trouble punch as the result of double use of the SNG and NGK1 punches for the GLA and GLB punches. Option ZYB provides this arrangement.

50. MARKER CONTROLLED IMMEDIATE RING FEATURE - APP FIG. 138

50.01 A feature is available that provides for immediate ringing at the time the connection to the called line is completed. This feature may be used on lines requiring code 1 ringing.

50.02 The ringing machine has three outputs, designated brush 1, brush 2, and brush 3, for code 1 ringing. Each output is connected to a different level on the ringing selection switches, thus, the marker can select the proper level to provide for immediate ringing on one and 2-party lines. The brush 1 output of the ringing machine is connected to level 6 of the ringing selection switch, the output of brush 2 is connected to level 2, and the brush 3 output is connected to level 3. The RS- marker relays are used to control the operation of the levels on the ringing selection switches.

50.03 The immediate ring control circuit monitors the ringing machine outputs and from this determines the level on the ringing selection switches that must be used to provide immediate ringing on the called line. This information is then passed to the marker via the BR1-3 leads to be used whenever immediate ringing is required.

50.04 In establishing the terminating portion of a call, the SNG2 relay in the marker operates, causing the BRG relay to operate (FS104). The BRG relay closes through the BR1-3 leads to the immediate ring control circuit which indicates the outputs of the ringing machine that must be used to provide immediate ringing on the called line. One or two of the BR1-3 relays will operate via the BR1-3 leads.

50.05 The BR1-3 relays control the operation of the levels on the ringing selection switches by operating the RS- relays (FS105). The BR1-3 relays are operated in the order 1, 2, 3, 1, 2, etc, and as the ringing machines outputs are changing from one brush

to another, the immediate ring control circuit outputs overlap, resulting in two BR- relays operated. The BR- relay operating latest in the sequence of operation takes control in this situation and determines the ringing selection switch level that will be used.

50.06 The marker provides a one-up and two-up check on the BR1-3 relays and if all three or none of the relays operate, the TIR relay operates and causes a trouble record to be taken. If an alarm condition exists in the immediate ring control circuit, or if the circuit is under test, the CIR marker relay operates.

50.07 When the CIR or TIR relay operates, the immediate ring feature is canceled for that call, and ground is transferred to the CIR terminal. The CIR terminal is to be cross-connected to one of the BR1-3 terminals to determine which of the RS- relays will be operated under a cancel immediate ring condition. These cross-connections must not be the same in all markers so that the ringing machine load will be distributed across all three brushes.

50.08 The MT41 test relay allows the master test control circuit to test the immediate ring feature in the marker.

51. INCREASED NUMBER OF MARKERS

51.01 Due to increased traffic demands, the maximum number of markers in a marker group is increased to 12 completing and 6 dial tone markers. The previous maximum was 8 and 4, respectively.

51.02 This arrangement can be provided only in 2-wire, wire spring marker groups. Only wire spring circuits have been modified for this expansion with the exception of the following flat spring circuits: master test frames, connectors, and other test circuits, foreign area translator and connectors, all marker busy, traffic register, and plant register circuits.

51.03 When an office is equipped with more than 8 completing markers and also is equipped with transfer register marker connectors, then marker connectors only work with the first 8 completing markers. Therefore, the associated equipment is only provided in the first 8 completing markers and the AB lead to the all-markers-busy circuit

is disconnected from the first marker and connected to the last marker. This arrangement allows a ground on the AB lead through the first marker to be sent to the master traffic control circuit when a transfer register marker connector is provided.

51.04 Offices equipped with 12 or less markers (dial tone and completing) is equipped with one fuse in the power ringing circuit to provide the ringing voltage for continuity testing in all markers. When more than 12 markers are provided, one fuse is provided for completing markers and another fuse for dial tone markers.

52. CALL-WAITING SERVICE - APP FIG. 160

52.01 When call-waiting service is provided, relay XVGB is used to detect a line link frame equipped with call-waiting service, and relay CWL is operated over the CWL lead from the line link connector to indicate that the call-waiting link circuit is attached through the connector. If the called line is found busy, the operation of relay LBTA will operate relay CWS. The CWS closes battery to the CWS lead and ground to one of the VF-leads to the line link connector to operate a CWS and LP- relay in the call-waiting link circuit. If the line does not have call-waiting service, or the line has call-waiting service and is already connected to a call-waiting circuit, or none are available, the call-waiting link will return ground on lead NCW to operate relay NCW. The NCW closes ground to relay LB to set the call to line busy. If the called line has call-waiting service and is to be connected to a call-waiting circuit, the call-waiting link will select a call-waiting circuit, attach the called line to the call-waiting circuit, and pass the line number of the call-waiting circuit to the marker over the CWN-, CWH-, CWT-, and CWV- leads to operate correspondingly designated relays in the marker. Operation of relay CWN- operates CWC1 which in turn operates CWC2. The CWC1 and CWC2 cause release of the operated N- relay to release the HN-, T-, and V- relays associated with the called number, and close the outputs of the CWH-, CWT-, and CWV- relays to the HN-, T-, and V- relays to indicate the line number of the selected call-waiting circuit. When the call-waiting link has finished connecting the call-waiting circuit to the called line and checked the connection, ground is received on the CWK lead to operate relays CWK and CWR. Operation of relay CWR operates

relay RCY2 to recycle the marker for connection to the call-waiting circuit associated with the called line. The recycle causes the release of the line link connector and reseizure of a number group connector to determine the line location of the selected call-waiting circuit. Completion is the same as for a regular line.

52.02 Option ZML provides an arrangement to prevent loss of dialing protection for call-waiting customers on permanent signal calls using the marker permanent signal test features.

53. PBX TOLL DIVERSION - FS166 AND FIG. 147

53.01 The PBX toll diversion feature provides a means of screening out PBX originating calls requiring toll diversion. If the marker determines that a call fits in the toll diversion category, a ground signal is sent to the originating register over the RV1 lead. The originating register sends a reverse battery signal to the PBX. The PBX then decides whether to permit the call or abandon it to the No. 5 office, diverting it to the PBX operator. The marker continues to establish the call, assuming it to be valid unless it is abandoned.

SCREENING - SEE NOTE 456

53.02 Relay S- contacts are used to screen out toll diversion calls. An NCNC call requiring toll diversion (call to an operator, for example) operates the NCTD route series relay via the contacts of screening relays associated with PBX requiring toll diversion. In a similar manner, ANI calls requiring toll diversion operate the ANTD route series relay.

SCREENING WITH AMA

53.03 If the office is arranged for AMA, contacts of the MBS- relays and the MBK relay are used in conjunction with screening relay contacts to determine which calls require toll diversion. Calls requiring toll diversion operate the TD relay and calls not requiring toll diversion operate the NTD relay.

53.04 A positive check in the operate path of the CHA relay requires either a toll diversion or a no-toll diversion indication on AMA calls. Therefore, all AMA calls must operate the TD relay or the NTD relay.

SIGNAL TO REGISTER AND CHECK CIRCUITRY

53.05 When one of the relays indicating toll diversion (NCTD, ANTD, TD) operates it sends a ground to the originating register over the RV1 lead. This ground also operates the TDK relay in the marker. The TK relay in the marker operates before CHA. The TK removes the operate ground from the TDK relay and TDK must then depend on the locking ground from the register. Since TDK must remain operated to operate the CHA, it provides a check on the RV1 lead. Calls not requiring toll diversion require TDK to be unoperated in order to operate CHA, thus providing a check for false ground on the RV1 lead.

CAMA JUNCTOR TOLL DIVERSION

53.06 The CAMA junctor operation is provided for the PBX toll diversion feature. If CAMA junctor operation is used to identify PBX stations originating toll calls, toll diversion may be provided by using screening contacts to operate either the CMJ or the CMJT relay. The CMJT performs the same functions as CMJ, but also provides a toll diversion signal to the register. Option ZTE provides this feature.

54. PREROUTE CONTROL OF CL- INFORMATION TO REVERTIVE SENDERS

54.01 This feature provides preroute relays to control CL- information to the outgoing revertive pulsing sender corresponding to differences in incoming group information required in the distant No. 1 crossbar office for office A and B distinction. Control of the CL- information by preroute rather than route relays allows office to conserve route relays. Provisions are made such that a maximum of 36 route relays may be conserved.

54.02 When two code points are identical except in their high and low incoming group distinctions, the SC- preroute relay may be used to control the high and low group distinction by screening of the CL- information to the revertive senders.

54.03 Code points in the low incoming group are treated normally and the SC- relay is not operated. In this case, the CL2 secondary winding is activated through a break-contact of the SC- relay and the proper CL- leads to the revertive sender are grounded.

54.04 Code points in the high incoming group will operate and lock the SC- relay. The CL3 secondary winding is now activated through a make-contact of the SC- relay and the proper CL- leads to the sender for high incoming groups are grounded.

55. DIAL-TONE FIRST

55.01 Option DK is provided to route coin class calls with or without coin deposits. The originating register grounds the SCK lead when a coin is present and the SCN lead when a coin is not present. Cross-connections are provided (SWT4, SWR4) to drive S- relays from these signals which are used to vary the routing of the call.

56. CSACS OPERATION

56.01 Option ZQA provides operation with the Centralized Status, Alarms and Control System (CSACS). Leads are provided to the interface and control circuit that allow marker usage, first and second trial failures, and "made-busy" conditions to be monitored from some distant location. If a marker failure is detected, the monitoring station has the capability of taking the marker out of service.

57. REDUCTION OF SECOND TRIAL TROUBLE RECORDS AND "HIGH-AND-DRY" CONDITIONS ON INCOMING CALLS - OPTION ZYJ

57.01 This feature limits route advances, due to trouble on TOG calls, thereby reducing the number of trouble records on TOG calls under trouble conditions. The first second trial failure on a TOG call may route advance by operating the RAV1,2 relays through the break contacts of GSAL-5 and SR2,3. This route advance causes a GSA-, SR2, or SR3 relay to operate. If the call encounters failure on this route advance, ground through the operated GSA- or SR- relay operates TOA, causing the call to be set to reorder.

57.02 This feature also reduces the number of "high-and-dry" conditions on incoming calls. If the TCCK and TCCA relays operate, but there is no translation, the RAV2 relay operating causes TEA to operate.

57.03 This arrangement also provides reorder for terminating calls receiving an insufficient number of digits. The 2-out-of-5 check in the operate path of the NSS- relays is arranged to switch ground to the TEA relay on terminating calls with insufficient digits, thus providing reorder instead of a trouble record.

57.04 Also included in this arrangement is an MSK break contact in the holding path of the OAT relay. This contact prevents OAT from releasing due to the MB relay operating when the marker is service busy.

57.05 Option ZRD is added to provide an improved arrangement for link release when option ZYJ is provided. Option ZRD provides an LR and DCK contact to allow the TEA relay to operate on link release when the TCCA relay is not operated. This change permits the marker to set the call to reorder on link release when TCCA is not operated. Option ZRD also provides an LR break-contact to prevent operating the TEA relay before the trouble record is taken due to partial digit information on link release.

57.06 Option ZNG is added to eliminate route advance on a TOG call after second trial failure due to mutilated digits when option ZYJ is provided. When option ZNG is provided, if the OSC relay is operated and neither the OST1 nor OST2 relays are operated, indicating mutilated digits, the TOA relay rather than the RAV1 relay will be operated after the trouble record is made on second trial. This will cause the call to be routed directly to overflow after the trouble record is taken.

58. CALLING LINE IDENTIFICATION - APP FIG. 144

58.01 The marker is arranged to cause a trouble record to be made on calls to called stations. Where the call is completed on an intraoffice basis the trouble record will show the equipment location of the calling line. Where the call is completed on a terminating basis, the trouble record will show the equipment location of the incoming trunk.

58.02 The marker determines when to make a record from information received from the number group circuits. Two individual number terminal cross-connections in each number group frame may be changed to cause records to be made. In conjunction with an external circuit (called number detector circuit) the marker will cause a record to be made on outgoing calls as determined by the switch settings of the detector circuit.

58.03 When calling lines are to be identified on intraoffice or terminating calls to a called number the F to RF terminal cross-connection for the called number is made through one of the two diode arrangements provided in a number group. When a marker closes battery to the F terminal, a portion of the battery is returned to the marker over the UK lead resulting in the release of the UKA relay. Subsequent operation of the marker VFL relay causes a trouble record to be made prior to the markers normal release.

58.04 When calling lines are to be identified on outgoing calls, the called number detector circuit switches are set to the desired called number. The marker called number leads are extended into the detector circuit and are compared against the switch settings. If a match is made, the marker NCRA relay is operated over the M- lead from the detector circuit resulting in a trouble record.

58.05 Option ZUY is provided to prevent possible excessive trouble indications on calling line identification on terminating calls in offices equipped with SD-25805-01 MTFC. This change does not need to be applied in offices equipped with SD-27718-01 MTFC, except as an after-date Standard. The change prevents a false XAF or XAJC trouble indication due to a race condition on terminating calls to a number set up for calling line identification. It also prevents the TRB1, TRB2, and NCRA relays from being held operated after a calling line identification record has been taken. This allows another record to be taken if a trouble condition occurs.

58.06 A GT3 make-contact is added in the operate path of the XAF and XAJC relays to prevent them from operating when the TRSA relay releases. A TRB2 break-contact is added to the hold path of the NCRA relay to keep NCRA from holding TRB1,2 operated too long.

58.07 The circuit in the secondary winding of relay SPT is modified to prevent the NCRA relay from falsely operating and producing a false nuisance call (LVM) record when a busy line transfer call is initiated by the marker encountering line busy on a line assigned to a "split tens block" hunting group. The SPT would reoperate when the marker returned to the number group, causing SNG1 to release and then SNG1 reoperated with VFL operated, thus operating NCRA. The SPT is prevented from reoperating by removing ground from the secondary winding and connecting the winding to contacts which remove ground on a busy line transfer recycle. Option ZJH removes the ground and is required when the marker is equipped with busy line transfer and calling line identification features. Option ZJG provides the original wiring.

58.08 The marker is changed to prevent the possibility of disabling the marker because of a trouble in the called number detector circuit. A make contact of the OST2 relay is added to the NCRA operate path

to prevent any false "Trap Call" indication, whether it be a false ground on an M- lead or a falsely operated detection in the called number detector circuit, from locking up the marker NCRA relay. Option ZMI (rated Standard) provides this contact while option ZMH (rated Mfr Disc.) is assigned to the previous portion of ES wiring.

58.09 Option ZMS is added to provide the line location of the PBX line used on intra-office nuisance call trouble records. This change will cause the nuisance call record to be made on the forward linkage portion of the intraoffice call to provide the called line location. This information can be used to associate trouble records with lines in a PBX hunting group.

59. INTERNATIONAL DIRECT DISTANCE DIALING

59.01 Option ZXI provides for international direct distance dialing (IDDD) station-to-station calls. With this arrangement a customer may dial an IDDD call by dialing a "011" prefix plus the country code and the national number. The customer must also dial an end-of-dialing signal (twelfth button on TOUCH-TONE) since the IDDD number (country code plus national number) may vary between 7 and 11 digits. The country code may be 1, 2, or 3 digits.

OPERATION OF THE IDDD RELAY

59.02 The originating register indicates an IDDD call to the marker by grounding the "11" and FAC leads. This combination grounds the ALT4 terminal, which is cross-connected to operate the IDDD relay.

59.03 The IDDD relay serves three purposes:

- (a) It prevents the INT (intercept) relay from operating if "0" or "1" is present in the D or E digit since international numbers may contain an "0" or "1" in these positions.
- (b) It switches the CPX cross-connection to CP2P, thus supplying a CP2 indication to the sender. The CP2 indicates to the sender that the call is an IDDD call.
- (c) It operates a translation relay for translation of the "A" digit.

ROUTE TRANSLATION (NOTE 459)

59.04 The country code dialed by the customer must be translated by the marker to determine the gateway office to be used.

This translation operates a route relay for that gateway. The route relay will cause a CR- mark (corresponding to the gateway required) to be transmitted to the sender. Translation may also be required for vacant code routing when invalid country codes are dialed.

59.05 Route translation may be accomplished using the auxiliary limit A-, B-, and C- digit translator (App Fig. 159) or by using an available A-digit translator relay such as X11, 4LT, or 11X. However, if 2- or 3-digit translation is required, or if the invalid country codes are to be trapped, the auxiliary translator must be provided.

59.06 If a customer dials a "01" prefix instead of "011", the register will ground the FAC and FVD leads to the marker. The ALT6 terminal in the marker should be cross-connected to route such calls to intercept.

TSPS OPERATION FOR IDDD

59.07 The TSPS arrangement for international direct distance dialing IDDD is provided in the marker. Included in this arrangement is the capability for handling 12-digit numbers since some international numbers will contain 12 digits.

59.08 The originating register indicates an IDDD station-to-station call by grounding the FAC and 11 leads to the marker which operates the IDS marker relay. The IDDD person-to-person calls are indicated by grounding the FAC and FVD leads to the marker which operates the IDP marker relay. With either IDS or IDP relay operated, the output ground from the A-digit translator FS34 is transferred to the IDS or IDP cross-connect terminal. These terminals are cross-connected to operate the required route relay.

59.09 The marker indicates IDDD calls to the TSPS via an outgoing sender by grounding the CL1 and CL8 leads to the sender. Provision is made to allow either individual or common trunk groups to be used on domestic and IDDD calls.

59.10 When a common trunk group is used, the TSPS route relay DL- contact is connected to the DLAO cross-connection terminal. The operated IDS or IDP relay transfers the ground from the DLOS cross-connection terminal to the DLOP terminal. Grounding the DLOP terminal operates the DLP relay which grounds the CL1 lead to the sender. The TSPS route relay CL- contacts cause the CL8 lead to the sender to be grounded. With individual trunk

groups, the TSPS route relay DL- contact would be directly connected to the DLOP cross-connection terminal to cause the CL1 and CL8 leads to the sender to be grounded on IDDD calls. Apparatus Fig. 161 provides the apparatus and wiring required for this feature.

60. AUXILIARY LIMITED A-, B-, AND C-DIGIT TRANSLATOR - FIG. 159

60.01 An auxiliary limited A-, B-, and C-digit translator is provided. Operation of the IDA relay provides for A-digit translation. Each of the ten translations for the A digit may be used directly or cross-connected to any of the eight LAT- relays for B-digit translation. The IAT- relays provide up to 80 translations (ten for each A digit up to eight A digits). Two of these 80 translations may be cross-connected to the IBT-relays for C-digit translation.

60.02 The translator is limited since it can translate no more than 80 of the 100 possible AB combinations and no more than 20 of the 1000 possible ABC combinations.

61. ARRANGEMENTS FOR NEW NUMBERING PLAN

61.01 The marker is arranged to translate interchangeable local office and numbering plan area (NPA) codes, special codes "00", "01", "10" and NPA information code "411".

61.02 Translation of interchangeable local office and NPA codes is provided by App Fig. 143 and options PM and FT.

61.03 Relays ORA and FACA operate from ground on the OR and FAC leads from the originating registers.

61.04 Relays ORA and FACA operate the relays OR and FAC respectively, close the LT, LT1, LT2, LT3, 11, FVD, and 2DT leads from the originating registers for selection of a translator relay, and may operate screening relays for separation of local and NPA codes. Relay ORA operates on local codes, and FACA on NPA codes. Separate translators may be used with or without screening.

61.05 Relay INCT operates from ground on the TCA or TCB leads from the incoming registers and closes the LT, 11, FVD, and 2DT leads from the incoming register for selection of a translator relay. Relay INL operates from ground on the LT lead through contacts of relay INCT to indicate local

codes. Relay TT operates from ground on the TT lead from the incoming registers to indicate NPA codes. Relays INL and TT control the code pattern selected from ground on terminal CPX and may operate screening relays for separation of interchangeable local and NPA codes.

61.06 Relays 2WS and 4WS operate from ground on the 2W and 4W leads respectively from the ORMC or IRMC and provide for selection of separate translator relays for 2-wire and 4-wire offices.

61.07 Relay PR1 operates from relay PK on originating calls and provides for separate originating and incoming translation of the "A" digit "0".

62. ELECTRONIC TRANSLATION SYSTEM

62.01 When arranged for ETS operation the marker can function in one of three modes: non-ETS, ETS-AMA only, and full-ETS. Operation in the non-ETS mode is the same as when ETS is not provided. In the ETS-AMA only mode, AMA functions are provided by the ETS processor. Marker actions remain unchanged but the processor has the ability to stop marker progress, prior to the operation of the CHA relay, if the trunk selected by the marker cannot be identified by the processor.

62.02 In the full-ETS mode, route and line translation, screening, routing, call recording, trunk selection, and hunting line selection functions are provided by the ETS processor. Upon detection of marker seizure, the processor will scan the marker, process the information and distribute to the marker, via the MDC circuit, information required to complete the call. When an alternate action is required, the marker will signal the processor and the marker is scanned to obtain information to determine what action is required. The previously distributed information is removed and a new distribute is made to enable the marker to complete the call.

62.03 Initially, when the marker distributor circuit (MDC) is added, option R is provided and the transition relays are blocked operated which cause the marker to operate in the non-ETS mode. Control of marker mode of operation can be passed to the ETS power and data interface circuit (PDI) by removing option R and unblocking the transition relays in the MDC. When the processor is not operational the transition relays are held operated and the CHA relay is operated in the PDI

which closes the markers CHA relay operate path and the marker operates in the non-ETS mode. When the processor becomes operational the CHA relay in the PDI is released and the marker operates in the ETS-AMA only mode. To provide full-ETS operation the ETS relay in the PDI circuit must be manually operated by depressing the associated ETS key. Operation of the ETS key releases the transition relays associated with that marker, causing that marker to operate in the full-ETS mode.

62.04 If for any reason the processor should become nonoperational, all markers are automatically restored to the non-ETS mode. When the processor becomes operational again, the markers are automatically changed to ETS-AMA only operation. However, each marker must manually be changed to full-ETS operation by the operation of the associated ETS key in the PDI.

62.05 When transition to ETS operation is completed, the mode control feature in the PDI circuit is disabled and the marker functions only in the full-ETS mode. Any transition apparatus in the MDC circuit may be removed and marker cross-connections required for non-ETS operation need no longer be maintained.

ETS-AMA ONLY OPERATION

62.06 When the marker is seized, the DR scan point is grounded which causes the processor to scan the marker for input data to be used for billing. The marker proceeds with the call as for non-ETS operation. When the LCK relay operates, the LCK scan point is grounded which causes the processor to scan the marker to identify the trunk selected for the call. After this information is obtained and checked, the processor activates the CHA distribute point which operates the CHA relay in the MDC circuit which allows the CHA relay in the marker to operate when a channel is selected. At the end of the call, when the marker disconnects, ground is removed from the DR scan and the processor deactivates the CHA distribute point. Failure of the CHA distribute to deactivate or failure of the CHA relay in the MDC to release at the end of the call will keep the SNK relay in the marker operated which will cause the overall timer to operate and the marker will be taken out of service. If the trunk cannot be identified by the processor, the CHA is not distributed causing the marker work timer to operate and the marker will take a trouble record.

62.07 If the processor should become nonoperational, the CHA relay in the PDI circuit is operated to change the marker to the non-ETS mode of operation.

FULL-ETS OPERATION

62.08 Operating in the full-ETS mode the marker translators are disabled. When the marker is seized the overall and work timers are started and the data ready DR status scan point is activated by the operation of the CKG6 relay. This causes the processor to scan the data scan points. The information is processed and distribute points are activated to cause the marker to complete the call. The following paragraphs define all scan and distribute points then a detailed description of full ETS marker operation on a functional and on a call basis is provided.

A. Scan Points

62.09 Marker status points are divided into two groups: status scan points which are scanned periodically, and data scan points which are scanned when a change from non-activated to activated (lead grounded by marker) is detected on any status scan point.

Status Scan Points

62.10 Marker status information is passed to the processor via the following status scan points:

- (a) Data Ready (DR): Grounded on marker seizure by the operation of the CKG6 relay. Ground is removed on disconnect by the operation of the DIS1 relay on regular release, by the DISA on trouble release, or by the release of the CKG6.
- (b) Observe (OBS): Grounded when ground is applied to the OBS relay. Indicates that call is being serviced observed. Ground is removed on route advance or recycle.
- (c) Link Connector Check (LCK): Grounded when LC-relay (TLF) operates. Indicates that outgoing trunk identification is available or that information received through the trunk link connector is available. LCK ground is delayed on centrex no-test incoming CNTI calls until customer identity information is stable. Ground is removed when TLF or trunk is released on route advance or recycle except on TER, DTI, PC, TRF, or CMF calls.

(d) Overflow Hold (OFH): Grounded when ground is applied to the OFH relay. Indicates that marker is setting the ringing selection switch to overflow or line busy. Once grounded, will remain grounded until end of call.

(e) Recycle (RCY): Grounded by the operation of relay RDL on marker recycle. Remains grounded until release of RCY relay. Marker recycle results from the following conditions:

- (1) First FM on TOG call.
- (2) Plugged-up line (PUL) on TER or IAO call-FLG linkage.
- (3) On no-test (NT) calls when positive potential is present on sleeve lead (in phase III centrex office only).
- (4) The LLF maintenance busy on TOG calls serving TOL class incoming trunks and NGP relay is not operated.

(f) Route Advance (RAV): Grounded by the operation of the RDL relay on route advance. Remains grounded until release of RAV1 relay. Route advance results from the following conditions:

- (1) When marker cannot seize trunk selected by processor (ATB).
- (2) When all non-LLP senders are busy (ASB).
- (3) Glare encountered on TOG or SOG call before channel set.
- (4) When LB or OV tones must be returned to calling customer on ITR call.
- (5) The LLF maintenance busy on TOG calls serving TAN class trunks or TOL class trunks when NGP relay is operated.
- (6) On ITR call when calling and called line equipment locations match (RV).
- (7) On first FM for ITR call-CB linkage or SOG call.
- (8) On second FM on all but TER calls.
- (9) On third or more FM on TOG calls.
- (10) After trouble record is taken on various calls from IRMC or TRMC.

(g) PBX Recycle (RCY2): Grounded by the operation of the RCY2 relay. Ground removed when RCY4 operates. The PBX recycle results from the following conditions:

- (1) Line test busy at the line link frame and:

(a) Call is to a hunt line (CKR relay operated) and there has been no previous PBX recycle (RCY4 not operated). If busy line transfer is provided a PBX recycle will occur anytime a line in a hunt group (CKR operated) is found busy at the line link frame.

(b) All LLP senders are found busy and there has been no previous PBX recycle (RCY5 not operated).

(c) Call is direct access to 101 ESS PBX (DAC operated) and there has been no previous PBX recycle (RCY4 not operated).

(h) Trouble Recorder Start (TRST): Grounded when ground is applied to the TRST relay. Ground is removed when the trouble record is complete.

(i) Data Check (DK): Grounded on ITNP test by the operation of the K1,2 relays in the MTC circuit. Indicates that data is available for ITNP test call.

(j) Read End (RE): Data ready for phase I or II centrex transfer call (TRF). Lead is grounded by after customer identity is readout of incoming or intraoffice trunk arranged for transfer (RE relay operated) and trunk link frame has been released (TRF2 relay released). Remains grounded throughout call.

Data Scan Points

62.11 The following information is supplied to the processor via the data scan points for call processing:

<u>Information</u>	<u>Data Scan Points</u>
Called Number	A2/5-H2/5, J2/5-M2/5, N7
Type of Translation	11, 2DT, X11, FVD, LT, LT1-3, TT, PHC, THC, OA, OB
Type of Call	OR, FAC 2W, 4W

<u>Information (Cont)</u>	<u>Data Scan Points</u>
Type of Call (Cont)	SCK, SCN, CR PK, PS, PD RO LR LRI DTF, DTI AOT, ATT, DAT1 CDN TRF, TRA, LDA TRK, TR2
Alternate Action Conditions	ATB, ASB, RV, GLC, OV, LB, PUL, NPU, PS1, ROH, PSG
Call Not Observed	NOB
Mutilated Digit Intercept Key Operated	MDI
Start CB Linkage	SCB
Sender Idle Indication	SIA 0-11, SIB 0-11
Outgoing Trunk Identification	FS0-29, TB0-9, TBX, TS0-19
Free Number Indication	FN, FNA, FNB
Transition Relays Not Operated	NTR
Transition Relays Operated	TR
Calling Party Indication	TP, RP
Type of Dialing Reg Received	DP, MF
Line Equipment Number From Originating or Transfer Register	FT0-3, FU2/5, VG2/6, HG2/5, VF1/5
Incoming Trunk Class Via TLF	INC, TOL, TAN, TAN1-4, PCR, PCD, PCD1 TCA, TCB
Incoming Trunk Class Via TLC	RN0-9
Trunk Number	FG0-2, THT0-3, HT2/5, TT2/5, UT2/5

<u>Information (Cont)</u>	<u>Data Scan Points</u>
Odd or Even Connector	OCN, ECN
Special Call Indicator	SPL, SPK
Special Call Type	NT, NH, NN, CNTI
Centrex Customer Identification	CTT2/5, CUT2/5
Test Call	MT, MTK, MT13
ITNP Test	TST
Register Test Set Test	ORT, IRT
Monitor	MON, RTST

B. Distribute Points

62.12 The following information is distributed to the MDC circuit where the information is decoded and gated to the marker when the information is required.

Type of Call and Outsender Group

62.13 The marker determines the type of call being handled from the following information:

<u>Distribute Points</u>	<u>Lead Grd to Mkr</u>	<u>Meaning</u>
OSG2/6 (0-11)	OSG0-11	Outsender group number. This information combined with source of call determines type of call.
OSG2,10	NSO	No Sender Outgoing
OSG4,10	NSR, RGT	Call set to ringer test trunk.
OSG7,10	NSR	Call set to reverting trunk.
NSI	NSI	Intraoffice Call
TER	TER	Terminating Call
DR0,4	RBT	Register Return Busy. Used on calls from ORMC when all trunks, including common overflow trunks, are busy.

<u>Distribute Points</u>	<u>Lead Grd To Mkr</u>	<u>Meaning (Cont)</u>	<u>Distribute Points</u>	<u>Leads Grd To Mkr</u>	<u>Meaning</u>
DR1, 4	TOA	TOG or TRF call when all alternate trunk groups are all busy. This is used only on TOG or TRF calls when marker returns to processor for alternate routing.	TLG0-2, TLF2/5	FS0-29	Trunk link frame number
			TB2/6	TB0-9, TBX	Trunk Block
			TS2/5, ODT, EVT	TS0-9, ETS, OTS	Trunk Select
DR2, 4	RR	Register return coin. Used on calls to free trunks not arranged for coin control and coin must be returned.	<u>Route Series Control</u>		
XTRK	XTRK	Processor input data check failure. Returned alone on calls from ORMC or returned with TER on calls from IRMC or TRMC.	62.15 The route series relays are operated by the processor to control the class signals to trunks, lines, or registers and to control information passed to the sender on ANI or CAMA calls for calling customer identification. The distribute points are divided into three groups:		
			(a) NCNC, TCNC, NCCN, TCCN, NCTD, TOS, PCD0, PCD1		
			(b) KTP, NTP		
			(c) ANIS, CMJ, CMF, RB		

Trunk Select

62.14 Outgoing trunk selection is done by the processor. The distribute points activated to cause the marker to seize the trunk are:

62.16 One distribute point in each group is activated when a trunk is selected. The association of distribute points activated and class leads grounded is shown below:

<u>Distribute Point</u>	<u>Leads Grd To Trunk</u>	<u>Leads Grd To Register</u>	<u>Leads Grd To Line Ckt</u>
NCNC	None	None	None
TCNC	TC	None	None
NCCN	CN	None	None
TCCN	TC, CN	None	None
NCTD	None	RV1	None
TOS	RC	None	None
PCD0	CN, CDN	None	LF
PCD1	CN, CDN	None	None
KTP	TP	None	None
NTP	None	None	None
ANIS	None	None	None
CMJ	None	None	None
CMF	None	None	None
RB	None	None	None

Outgoing Sender Information

62.17 The digits to be outpulsed, sender class, and arbitrary digits, if required, are provided by the processor. Delete information is not passed to the sender; deletion or digit shifting is provided by the processor before the information is distributed. Gating of the sender information to

the senders is provided by the KN- relays in the MDC. The sender class and arbitrary digits passed to the sender are checked by the MDC while the marker checks the transmission of the digits.

62.18 The distribute points for outgoing sender information are:

<u>Distribute Point</u>	<u>Meaning</u>	<u>Distribute Point</u> (Cont)	<u>Meaning</u>
SDK	Sender Used on Call	AR2/5	Arbitrary "A" Digit (Optional)
A2/5-H2/5, J2/5-M2/5, N7	Dialed Digits	ND	Signals Sender Not to Outpulse
CL1-8	Sender Class	<u>Number Translation</u>	
CLQ0-2	Number (Binary) of Class Leads Grounded	62.19 Translation of the called number or trunk number to line equipment number and type of line information is provided by the processor. The information is distributed to the MDC and gated to the marker when required. The information returned for number translation is as follows:	
CR2/5	Arbitrary "C" Digit		
BR2/5	Arbitrary "B" Digit (Optional)		
<u>Information</u>		<u>Distribute Points</u>	<u>Leads Grd To Mkr</u>
Line Equipment Number		FTT2/4 FUT2/5 VGT2/6 HGT2/5 VFT1/5	FTN1/6 FUN1/10 VGT1/12 HGT1/10 VFT1/5
Ringing Combination		RCT1-9 RCT RCT11-15	RCT1-9 RCT RCT11-15
Charge Condition Charge Free		TC FNA, FNK	- FNA
Terminating Treatment Listed Dir. No. (CTX Phase II or III) Test Line Call Forward-Do Not Answer All Others		LDN TST DAT POTS	LDN TST DAT POTS
Line Link Pulsing Automatic Intercept Using LLP Centralized Att Operation-LDN or Transfer- Call Routed via LLP from Secondary to Primary Office		LLP AIS CATT (DR0,2)	LSC1, TTL, RLT LSC1, TTL, RLT LSC1, TTL, RLT
Line in Hunting Group Loop Test No Loop Test		CKR, HF, LGT CKR, HF, PBX	CKR, HF, LGT, PBX CKR, HF
Permanent Overflow Number		PMO, HTUK	PMO, HTUK
Permanent Busy Number		PBN, HTUK	PBN, HTUK
Automatic Intercept Without Using LLP		RI, BN, TBI, HTUK	RN, BN, TBI, HTUK
Called Number Office Code		APN, ATN, AEN BPN, BTN, BEN	APN, ATN, AEN BPN, BTN, BPN

<u>Information (Cont)</u>	<u>Distribute Points</u>	<u>Leads Grd To Mkr</u>
Direct Access to 101 ESS		
Bell System Call	BSN	BSN
CCSA Call	NBS	NBS
Trunk Number Translation	TOG	RCL,POTS
Nuisance Call Trace	DR0,7	NCRA
Nuisance Call Trace and CATT.	DR1,2	LSC1,TTL,RLT,NCRA
Type of Line		
All Others	AO	AO
Coin	CN	CN
Call Transfer - IND 4 Digits	DLT	DLT
Call Transfer - IND 5 Digits	5DLT	5DLT
Call Transfer - IND 7 Digits	7DLT	7DLT
Call Transfer - Attendant	MLT	MLT
Phase I or II Centrex Line (When Call Transfer - IND is Not Provided)	CGS	CGS

Miscellaneous

62.20 The following miscellaneous distribute points are not covered in the preceding paragraphs:

<u>Meaning</u>	<u>Distribute Point</u>	<u>Leads Grd To Mkr</u>
Call Enable	CHA	CHA
Calling Line Has Add-On (Transfer of Station-To-Station Calls)	ADD	ADD
Calling Line Does Not Have Add-On	NAD	NAD
Pad Control Required		
Calling Line	2WDC	2WD
Called Line	2WD	2WD
Centrex Customer Identification	CST2/5 CSU2/5	CST1/10 CSU1/10
Centrex Busy Verification Outgoing	DR4,10	CNT
Outgoing Trunk Requires Long Loop Signal	DR4,7	LOLD

<u>Meaning (Cont)</u>	<u>Distribute Point</u>	<u>Leads Grd To Mkr</u>
Intermarker Group Call		
Not 10 Digits	DR2,7	IMG
10 Digits	DR1,7	IMG, DL1
Call Set to Tone Trunk for Paths Busy Condition	DR0,1	PBY, PN
DR2/5 Distribute Points not Used	DAO	-
Distribute Point Interpret		
Sender Used on Call	SDK	-
Call is Direct Access to 101 ESS without Using LLP	GK	-
All Others	NGK	-
Calling Line is:		
Coin Line	CNS	CNS
PBX Line	HTR	HTR
Not to be Monitored	MTR	MTR
Call is to be switched light traffic	LTR	LTR
Call set to trunk apparatus circuit	DR7,10	PST
Distribute Point Testing	DST, DSTA	-

MARKER OPERATION ON A CALL BASIS

62.21 As described in 1.07, the DR status scan point is activated upon marker seizure causing the processor to scan the data scan points. The information is processed and, when required, data is distributed to cause the marker to complete the call. The typical distribute points activated on the various calls and the marker functions required after distribution are listed in the following paragraphs.

A. Subscriber Outgoing Call

62.22 A subscriber outgoing call requires the calling line to be connected to an outgoing type trunk. A sender may be attached to the trunk for outpulsing to a distant office. If the marker cannot set the linkage, a status scan point will be activated to signal the processor that an alternate action is required. The processor will remove the data previously distributed and will distribute alternate data to enable the marker to complete the call.

SOG Call With Sender - SC1B

62.23 The data distributed on a SOG call with a sender (SC174) is as follows:

(a) Type of Call and Outsender Group:

- (1) Outsender Group - OSG2/6 (0-11)
- (2) Sender Used - SDK

(b) Trunk Select

- (1) Trunk Link Frame - TLG1/3, TLF2/5
- (2) Trunk Block - TB2/6
- (3) Trunk Select - TS2/5, ODT or EVT

(c) Trunk Class Control - NCNC, TCNC, NCCN, TCCN, or NCTD; KTP or NTP; RB, ANI, or CMJ

(d) Sender Information

- (1) Digits - A2/5-M2/5, N7
- (2) Arbitrary Digits - CR2/5, BR2/5, AR2/5
- (3) Class - CL1-8
- (4) Class Check - CLQ0-2
- (5) Signals sender not to outpulse - ND

(e) Miscellaneous - Any of the following may be distributed if required for the call:

- (1) Calling line is:
 - (a) Coin - CNS
 - (b) PBX Line - HTR
 - (c) Not to be monitored - MTR
- (2) Call is to be switched light traffic - LTR
- (3) Calling line requires pad control - 2WDC
- (4) Calling line has Add-On - ADD
- (5) Calling line does not have Add-on - NAD
- (6) Call to Busy Verification Trunk - DR4,10
- (7) Centrex Customer Identification - CST2/5, CSU2/5
- (8) Call to trunk which requires long loop signal - DR4,7
- (9) Call to Intermarker Group trunk and:
 - (a) 10 digits not received - DR2,7
 - (b) 10 digits received - DR1,7
- (10) DR2/5 not used on call - DAO

62.24 Distribution of the OSG2/6 operate the OSG2/6 relays in the MDC circuit which operate the corresponding outsender group OSG0-11 relay in the marker through a two-up check in the MDC. Any OSG- relay operated in the marker operates the sender off normal SON relay which operates the subscriber outgoing

call SOG1-2 relays on calls from the ORMC (relay OR or FAC operated). The operation of the OSG- relay cuts through the associated sender idle SIO or SIE leads for the sender group. An idle sender in the A or B subgroup will operate the corresponding SIA or SIB relay. If the associated outsender connector is idle (GBA, GBB relays nonoperated), the marker will bid for the outsender connector. Outgoing sender selection and control is described in 10.

62.25 When the marker gains preference to the sender connector (SKA or SKB relay operated) the bid is made for the trunk link frame. Seizure of the trunk link frame and the selected trunk is described in 5.04 through 5.29.

62.26 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame associated with the calling line is seized as described in 6.12 through 6.16.

62.27 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class Information - SC114 or 137
- (b) Control for Channel Test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Linkage Checks - SC110
- (e) Disconnect - SC111

SOG Call Without a Sender - SC4B

62.28 The data distributed on a SOG call without a sender (SC173) is as follows:

- (a) Type of Call
 - (1) No Sender Outgoing - OSG2,10
 - (2) Sender not used - NGK
- (b) Trunk Select
 - (1) Trunk Link Frame - TLG1/3, TLF2/5
 - (2) Trunk Block - TB2/5
 - (3) Trunk Select - TS2/5, ODT or EVT

(c) Trunk Class Control - NCCN, NCNC, TCNC, TCCN, or NCTD; NTP or KTP; RB

(d) Miscellaneous - Any of the following may be distributed if required for the call.

(1) Calling line is:

- (a) Coin - CNS
- (b) PBX line - HTR
- (c) Not to be monitored - MTR

(2) Call is to be switched light traffic - LTR

(3) Calling line requires pad control - 2WDC

(4) Calling line has Add-on - ADD

(5) Calling line does not have add-on - NAD

(6) Call to trunk which requires long loop signal - DR4,7

(7) Call to tone trunk for all paths busy - DR0,7

(8) DR2/5 not used on call - DAO

62.29 Distribution of the OSG2 and 10 operate the corresponding OSG- relays in the MDC which operates the no sender outgoing NSO relay in the marker through a two-up check in the MDC. NSO operated on a call from the ORMC (OR or FAC operated) operates the type of call relays SOG1,2. With NSO operated the marker bids for the trunk link frame. Seizure of the trunk link frame and the selected trunk is described in 5.04 and 5.24 through 5.29.

62.30 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame associated with the calling line is seized as described in 6.12 through 6.16.

62.31 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class Information - SC114 or 137
- (b) Control for Channel Test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Linkage Checks - SC110
- (e) Disconnect - SC111

Ringer Test Call - SC13

62.32 The data distributed on a ringer test call (SC182) is as follows:

(a) Type of Call

- (1) No Sender Outgoing - OSG4,10
- (2) Sender not used - NGK

(b) Trunk Select

- (1) Trunk Link Frame - TLG1/3, TLF2/5
- (2) Trunk Block - TB2/6
- (3) Trunk Select - TS2/5, ODT or EVT

(c) Trunk Class Control - NCNC, NTP, RB

(d) Ringing Combination - RCT-, TC

(e) Miscellaneous - Any of the following may be distributed if required for the call:

- (1) Calling line is Coin - CNS
- (2) Call is to be switched light traffic - LTR
- (3) Calling line requires pad control - 2WDC
- (4) Calling line has add-on - ADD
- (5) Calling line does not have Add-on - NAD
- (6) Call to trunk which requires long loop signal - DR4,7
- (7) DR2/5 not used on call - DAO

62.33 Distribution of the OSG4,10 operate the ringer test RGTA relay in the marker which operates the LLI relay in the MDC. Operation of the LLI recycles the marker work timer by operating the RYT relay in the marker and causes the ringing combination RCT- relay in the marker to operate. The RCT- operated operates the RCL relay which operates the markers RV3 and RV relays and activates the RV data scan point. Operation of the RV relay operates the RNG relay which releases the LLI relay in the MDC. Relay RV3 operated operates the marker type of call relays SOG1,2 which control the call-back linkage CB- relays. Relay RV3 also operates the NSO relay which causes the marker to bid for the trunk link frame associated with the selected ringer test trunk. Seizure of the trunk link frame and selected trunk is described in 5.04 and 5.24 through 5.29.

62.34 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame associated with the calling line is seized as described in 6.12 through 6.16.

62.35 All other marker functions for the call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class information - SC114 or 137
- (b) Control for Channel Test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Ringing Switch Control - SC117
- (e) Linkage checks - SC110
- (f) Disconnect - SC111

Reverting Call - SC14

62.36 A reverting call begins as an intra-office call. The processor translates the called number, selects an intraoffice trunk and distributes the information to the marker. When the information is received (SC183) and the line equipment number of the called line matches the line equipment number of the calling line the RV1,2 relays are operated which operates the RV relay and activates the RV data to scan point. Relay RV operated causes the marker route advance (RAV1,2) relays to operate which activates the RAV status scan point. The processor removes the data previously distributed and all the information in the marker except the

ringing combination RCT- is released. When the information is all released the SNK relay releases which releases the RAV1,2 relays and deactivates the RAV status scan point. The processor then makes the following distribution (SC184):

(a) Type of Call

- (1) Type of Call - OSG2,10
- (2) Sender not used - NGK

(b) Trunk Select

- (1) Trunk Link Frame - TLG1/3, TLF2/5
- (2) Trunk Block - TB2/6
- (3) Trunk Select - TS2/5, ODT or EVT

(c) Trunk Class Control - NCNC, NTP, RB

(d) Miscellaneous - Any of the following may be distributed if required for the call.

- (1) Call is to be switched light traffic - LTR
- (2) Calling line requires pad control - 2WDC
- (3) Calling line has Add-on - ADD
- (4) Calling line does not have Add-on - NAD
- (5) Call set to trunk apparatus circuit - DR7,10

62.37 Distribution of the OSG7 and 10 operate the corresponding OSG- relays in the MDC which operates the RV3 relay which operates the NSO relay in the marker. The NSO operated operates the type of call relays SOG- which operate the call-back linkage CB- relays. The NSO operated also causes the marker to bid for the trunk link frame associated with the reverting trunk. Seizure of the trunk link frame and the selected trunk is described in 5.04 and 5.24 through 5.29.

62.38 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame is seized as described in 6.12 through 6.16.

62.39 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class Information - SC114
- (b) Control for Channel test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Ringing Switch Control - SC117
- (e) Linkage Checks - SC110
- (f) Disconnect - SC111

B. Terminating Call

62.40 A terminating call requires the incoming trunk to be connected to a line associated with the called number. A sender may be required for line link pulsing to a distant location. If the call cannot be completed because of line busy or failure to match and the called number is associated with a hunting group, a status scan point will be activated to signal the processor that another line within the hunting group is needed. If the line is not associated with a hunting group, the ringing selection switch is set to return overflow or line busy tone to the calling party.

62.41 If the called number is arranged for intercept, the processor will distribute the line location of the proper intercept trunk if automatic intercept service (AIS) is not provided. If AIS is provided the line location of the AIS trunk will be distributed along with the information to be outpulsed to the AIS office.

Terminating Call - SC3B

62.42 The data distributed on a TER call (SC175) is as follows:

- (a) Type of Call
 - (1) Terminating - TER
 - (2) Sender Not Used - NGK
- (b) Number translation
 - (1) Line Equipment Number - FTT2/4, FUT2/5, VGT2/6, HGT2/5, VFT1/5
 - (2) Ringing Combination - RCT1/15
 - (3) Charge Condition - TC or FNK, FNA
 - (4) Terminating Treatment

(a) Listed Directory Number - LDN
(Phase II or III Centrex)

(b) Test Line - TST

(c) Call Forward-Don't Answer - DAT

(d) All others - POTS

(5) Type of Line

(a) Coin - CN

(b) Call Transfer- Individual, 4 digits - DLT

(c) Call Transfer - Individual, 5 digits - 5DLT

(d) Call Transfer - Individual, 7 digits - 7DLT

(e) Phase III Call Transfer-Attendant - MLT

(f) Phase I or II Call Transfer Attendant - CGS

(g) All Others - AO

(6*) Permanent Overflow Number - PMO, HTUK

(7*) Permanent Busy Number or all hunt lines busy - PBN, HTUK

*If PMO or PBN is distributed, the line equipment number, ringing combination, charge condition, terminating treatment and type of line are not distributed. The PBN is distributed when the called number is arranged as a permanent busy number or when the processor finds all lines in a hunt group busy. The PMO is distributed for any of the following conditions:

(a) Calling number arranged for return overflow.

(b) All lines in a hunt group are busy and overflow rather than line busy must be returned.

(c) On CMF or pulse conversion calls when all senders are busy.

(d) When all outgoing tandem trunks are busy (only when trunk has not already been distributed).

(e) On TRF call when all attendant trunks are found busy (only when trunk has not been distributed). When PMO or PBN is distributed the marker sets the ringing selection switch to the proper level and disconnect (SC117).

- (c) Miscellaneous - Any of the following may be distributed if required for the call: TER- Special - SC3G

- (1) Called line is in hunt group - CKF, HF
 - (a) Requires loop test - LGT
 - (b) Does not require loop test - PBX
- (2) Called line requires pad control - 2WD
- (3) Nuisance call trace required - DR0,7
- (4) Centrex Customer Identification - CST2/5, CSU2/5
- (5) Call is to be switched light traffic - LTR
- (6) DR2/5 not used on call - DAO

62.43 Distribution of the TER operates the TER1,2 relays in the marker which causes the marker to bid for the trunk link frame associated with the incoming trunk. Trunk link frame and trunk seizure is described in 5.30 through 5.32. The TER- relays operated also operate the forward linkage FLG, FLG1, FLGA relays which operate the LLI relay in the marker and in the MDC. Operation of the LLI in the MDC recycles the work timer and causes the line location, ringing combination, and terminating treatment to be passed to the marker. When the information is locked operated in the marker, the RNG relay is operated and the LLI relay in the MDC is released.

62.44 When the marker gains preference to the trunk link frame (TFK3 operated) the line link frame is seized if a line location has been distributed. Line link frame seizure is described in 6.06 through 6.10.

62.45 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Channel Selection and Hold Magnet Operation - SC109
- (c) Ringing Switch Control - SC117
- (d) Linkage Check - SC110
- (e) Disconnect - SC111

62.46 Two distributions are required for special calls. The first distribution TER (SC190) enables the marker to seize the trunk link frame associated with the incoming trunk (see 5.30 through 5.32) so that the type of special call (NT, NH, or NN) can be determined. When the trunk link frame and trunk are seized the LCK in the marker operates and the LCK status scan point is activated. The processor scans the data scan points, processes the information and the following distribution is made:

(a) Type of Call

- (1) Terminating - TER
- (2) Sender not used - NGK

(b) Number Translation

- (1) Line Equipment Number - FTT2/4, FUT2/5, VGT2/6, HGT2/5, VFT1/5
- (2) Ringing Combination - RCT1/15
- (3) Charge Condition - TC or FNK, FNA
- (4) Terminating Treatment

- (a) Phase II or III Centrex Listed Directory number - LDN
- (b) Test line - TST
- (c) Call Forward - Don't Answer - DAT
- (d) All others - POTS

(5) Type of Line

- (a) Coin - CN
- (b) Call Transfer-Individual, 4 digits - DLT
- (c) Call Transfer-Individual, 5 digits - 5DLT
- (d) Call Transfer-Individual, 7 digits - 7DLT
- (e) Phase III Call Transfer-Attendant - MLT
- (f) Phase I or II Call Transfer-Attendant - GGS

- (g) All Others - AO
 - (6) Permanent Overflow Number - PMO, HTUK
 - (7) Permanent Busy Number or all hunt lines busy (only on NH or NN) - PBN, HTUK
 - (c) Miscellaneous
 - (1) See terminating call under 62.41 for miscellaneous distribution.
- 62.47 Distribution of the line equipment number will cause the marker to seize the line link frame as described in 6.06 through 6.10.
- 62.48 All other functions for this call, listed below, are not changed for ETS operation.
- (a) Control for Channel Test - SC108
 - (b) Channel Selection and Hold Magnet Operation - SC109
 - (c) No Test Train - SC132
 - (d) Ringing Selection Switch Operate - SC117
 - (e) Linkage check - SC110
 - (f) Disconnect - SC111

TER - LLP - SC3C

62.49 The data distributed on a TER call to a LLP line circuit (SC176) is as follows:

- (a) Type of Call
 - (1) Terminating - TER
 - (2) Sender Used - SDK
- (b) Number Translation
 - (1) Line Equipment Number - FTT2/4, FUT2/5, VGT2/5, HGT2/5, VFT1/5
 - (2) Charge Condition - TC or FNA, FNK
 - (3) Terminating Treatment - LLP
 - (4) Type of Line
 - (a) Call Transfer-Individual, 4 digits - DLT

- (b) Call Transfer-Individual, 5 digits - 5DLT
- (c) Call Transfer-Individual, 7 digits - 7DLT
- (d) Phase III Call Transfer-Attendant - MLT
- (e) Phase I or II Call Transfer-Attendant - CGS
- (f) All Others - AO
- (5) Outsider Group - OSG2/6 (0-11)
- (6) Sender Information
 - (a) Digits to be outputted - A2/5-D2/5, E7 (Typical)
 - (b) Arbitrary Digit - CR2/5
 - (c) Class - CL1-8
 - (d) Class Check - CLQ0-2
 - (e) Signal sender not to output - ND
- (c) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Called line requires pad control - 2WD
 - (2) Nuisance call trace required - DR0,7
 - (3) Centrex Customer Identification - CST2/5, CSU2/5
 - (4) DR2/5 not used on call - DAO
 - (5) Call is to be switched light traffic - LTR

62.50 Distribution of the TER operates the TER1,2 relays in the marker which causes the marker to bid for the trunk link frame associated with the incoming trunk. Trunk link frame and trunk seizure is described in 5.30 through 5.32.

62.51 The TER- relays operated also operate the forward linkage FLG, FLGI, FLGA relays which operate the LLI relay in the marker and in the MDC. Operation of the LLI in MDC recycles the marker work timer and causes the line location of the line link pulsing line circuit to be passed to the marker.

62.52 Distribution of the terminating treatment LLP operates the LLP and LLP1 relays in the MDC. LLP relay operated:

- (a) Operates the ringing combination relays RCT5 or RCT7 in the marker, to cause the marker to set the ringing switch to the silent level.
- (b) Operates the terminating treatment lock TTL relay in the marker if no other terminating treatment relay is operated.
- (c) Operates the CKR relay in the marker to cause a PBX recycle if the line is found busy at the line link frame.
- (d) Operates the SLK1 relay which grounds the HF trouble punch to provide the hunting indication.
- (e) Operates the NPBX relay in the MDC which causes the marker to make a ground test rather than a loop test on the called line.
- (f) Operates the line sender control LSC1-2 relays in the marker to control the marker LLP outsender functions.
- (g) Operates the line link control LLC4 relay which delays line link frame seizure until the marker has outsender connector preference and controls LLP functions associated with the line link frame.

62.53 The LLP1 relay operated:

- (a) Operates the reverse loop test RLT relay to reverse the polarity of the ground test.
- (b) Grounds the LRA trouble punch to indicate a call to a LLP line circuit.
- (c) Causes the all sender busy condition to be routed to OVC rather than to route advance.
- (d) Steers the LLP outsender link select magnet operate levels to the LLC rather than the TLC.

62.54 Distribution of the OSG2/6 operate the OSG2/6 relays in the MDC circuit which operate the corresponding outsender group OSG0-11 relays in the marker. The operation of the OSG- cuts through the associated sender idle SIO or SIE leads for the sender group.

An idle sender in the A or B subgroup will operate the corresponding SIA or SIB relay. If the associated outsender connector is idle (GBA, GBB relays nonoperated), the marker will bid for the outsender connector. Outgoing sender selection and control (SC145) is described in 10.

62.55 When the marker gains preference to both the trunk link frame (TFK3 operated) and the outsender connector (SKA or SKB operated) the line link frame associated with line link pulsing line circuit is seized as described in 6.06 through 6.10.

62.56 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Channel selections and Hold Magnet Operation - SC109
- (c) Ringing Switch Control - SC117
- (d) Linkage Check - SC110
- (e) Disconnect - SC111

TER - Direct Access To 101 ESS - SC3E

62.57 When the No. 5 ETS processor determines that the called number is associated with a 101 ESS arranged for direct access, the marker is directed to seize the associated direct access pretranslator DAP circuit and pass the station digits to the DAP circuit. The 101 ESS processor selects an idle line serving the called number and the line equipment number is distributed to the DAP which passes it to the marker. The marker then establishes a linkage to the selected line circuit.

62.58 The data distributed by the ETS processor on this type of call (SC181) is:

- (a) Type of Call
 - (1) Terminating - TER
 - (2) Gate Check - GK
 - (3) Bell System or CCSA Call - BSN or NBS
- (b) Called Number

- (1) Office Code - APN, ATN, AEN, BPN, BTN, or BEN
- (2) Station Digits - A2/5-D2/5
- (c) Terminating Treatment - POTS
- (d) Type of Line - AO, 5DLT, 7DLT, MLT, or CGS
- (e) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Called line requires pad control - 2WD
 - (2) Centrex customer identification - CST2/5, CSU2/5
 - (3) Nuisance call trace required - DR0,7
 - (4) Call is to be switched light traffic - LTR
 - (5) DR2/5 not used on call - DAO

62.59 Distribution of the TER operates the TER1,2 relays in the marker which causes the marker to bid for the trunk link frame associated with the incoming trunk. Trunk link frame and trunk seizure is described in 5.30 through 5.32.

62.60 The TER- relays operated also operate the forward linkage FLG, FLGI, and FLGA relays which operate the LLI relay in the marker and in the MDC. Operation of the LLI in the MDC recycles the marker work timer and grounds one of the six office code indications, APN, ATN, AEN, BPN, BTN, or BEN to the marker which will operate the associated number series NSS0-5. With both LLI and GK relays operated in the MDC, the digit cut through KN5 is operated and the A2/5 through D2/5 distributes are cut through to operate the TH2/5, HN2/5, T2/5, and U2/5 relays in the marker. Either the Bell System number BSN relay (for non-CCSA calls) or the non-Bell System number NBS relay (for CCSA calls) operated will operate the seize number group SNG1,2 relays in the marker which causes the marker to bid for the direct access pretranslator through the operated NSS-, TH2/5 relays. When the connector to the DAP circuit is operated (SC170) the station digits plus the CCSA or POTS signal are passed to the DAP. The information is obtained by the 101 ESS processor and the line equipment number to be used is returned to the marker as described in 36.07 through 36.10.

62.61 When the line equipment number is received by the marker, the line link frame is seized as described in 6.06 through 6.10.

62.62 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Channel Selection and Hold Magnet Operation - SC109
- (c) Ringing Switch Control - SC117
- (d) Linkage Check - SC110
- (e) Disconnect - SC111

TER - AIS Without Using LLP - SC3D

62.63 When the No. 5 ETS processor determines that the called number is arranged for intercept and the call must be routed to an automatic intercept center via AIS without using LLP, the following distribution (SC180) is made.

- (a) Type of Call
 - (1) Terminating - TER
 - (2) Gate Check - GK
 - (3) Type of Intercept - BN, RI, or TBI and HTUK
- (b) Called number
 - (1) Office Code - APN, ATN, AEN, BPN, BTN, or BEN
 - (2) Station Digits - A2/5-D2/5
- (c) Terminating Treatment - POTS
- (d) Number Translation
 - (1) Type of Line - AO
- (e) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Nuisance call trace required - DR0,7
 - (2) Call is to be switched light traffic - LTR
 - (3) DR2/5 not used on call - DAO

62.64 Distribution of the TER operates the TER1,2 relays in the marker which causes the marker to bid for the trunk link frame associated with the incoming trunk. Trunk link frame and trunk seizure is described in 5.30 through 5.32.

62.65 The TER- relays operated also operate the forward linkage FLG, FLGI, and FLGA relays which operate the LLI relay in the marker and in the MDC. The gate number group GNGL in the MDC is operated from the operated GK relay. When the LLI relay operates ground is applied to operate the HTUK relay in the marker through the associated distribute point. Relay HTUK operated operates the timer relays TYM and TYMA. Relay TYMA closes through ground to operate the type of intercept RI, BN, or TBI relay. The operate path for the type of intercept relay (FS89) is from the winding of the RI, BN, or TBI to the MDC through the GNGL operated, through the activated distribute point, through LLI operated back to the marker over the ING lead through PMO, PBN, FTL, FUL, VGL, HGL, VFL, and RCL relays nonoperated through HTUK, TYMA, and NGC operated to ground. Operation of the BN, RI, and TBI relay operates the automatic intercept AIC relay which causes a PBX recycle. The RCY2 status scan point is activated at this time but the ETS processor takes no action. When the recycle is completed, RCY4 operated, the AIC1 relay is operated and the bid is made for the AIS sender (SC168). Seizure and control of the AIS sender is described in 39.15 through 39.17. When the line equipment number of the line circuit to the AIS center is returned to the marker from the AIS sender, the line link frame is seized as described in 6.06 through 6.10.

62.66 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Channel Selection and Hold Magnet Operation - SC109
- (c) Ringing Switch Control - SC117
- (d) Automatic Intercept Using Dedicated Senders - SC168
- (e) Disconnect - SC111

TER - Phase I or II Listed Directory Number - SC3F

62.67 A TER call to a phase I or II LDN does not require a linkage to be set. A line location associated with the LDN is distributed to the marker together with the centrex customer identification and a listed directory number indication. The line link frame is seized and when the appearance tests idle, the centrex customer identification and the LDN mark is transmitted to the incoming trunk and the marker disconnects. The information distributed (SC175) by the ETS processor for this call is as follows:

- (a) Type of Call
 - (1) Terminating - TER
 - (2) Sender Not Used - NGK
- (b) Number Translation
 - (1) Line Equipment Number - FTT2/4, FUT2/5, VGT2/6, HGT2/5, VFT1/5
 - (2) Ringing Combination
 - (a) Phase I centrex - RCT 4, 5, or 15
 - (b) Phase II centrex - RCT 1
 - (3) Charge Condition - TC or FNK, FNA
 - (4) Terminating Treatment
 - (a) Phase I centrex - POTS
 - (b) Phase II centrex - LDN
- (5) Type of Line
 - (a) Call Transfer - Individual not provided - CGS
 - (b) Call Transfer Individual provided - MLT or DLT
- (c) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Called line is in hunt group - CKR, HF
 - (a) Requires loop test - LGT

- (b) Does not require loop test - PBX
- (2) Called line requires pad control - 2WD
- (3) Nuisance call trace required - DR0,7
- (4) Centrex Customer Identification - CST2/5, CSU2/5
- (5) Call is to be switched light traffic - LTR
- (6) DR2/5 not used on call - DAO

62.68 Distribution of the TER operates the TER1,2 relays which causes the marker to bid for the trunk link frame associated with the incoming trunk. Trunk link frame and trunk seizure is described in 5.30 through 5.32.

62.69 The TER- relays operated also operate the forward linkage FLG, FLG1, and FLGA relays which operate the LLI relay in the marker and in the MDC. Operation of the LLI in the MDC recycles the marker work timer and causes the line location, ringing combination, and terminating treatment to be passed to the marker. When this information is locked in the marker, the RNG relay is operated and the LLI relay in the MDC is released.

62.70 When the marker gains preference to the trunk link frame (TFK3 operated) the line link frame is seized as described in 6.06 through 6.10.

62.71 All other functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Ringing Switch Control - SC117
- (c) Linkage Check - SC110
- (d) Disconnect - SC111

Terminating - Dial Transfer Call - SC11B

62.72 A DTF call requires the marker to set the incoming or ITR trunk to the "transferred to" station. The marker processes the call as a TER call, but the transferring and "transferred to" lines must be associated

with the same centrex customer. The match function is performed by the processor. If a mismatch occurs, the line equipment location of an announcement circuit is returned rather than the line equipment location of the called number. The data distributed and marker action for a DTF call is the same as that shown for 62.42 through 62.45, 62.49 through 62.56, 62.57 through 62.62, and 62.63 through 62.66. Additional information for DTF calls is provided in 26.58 through 26.64.

C. Intraoffice Call Without a LLP Sender - SC10B

62.73 The data distributed on an ITR call without a LLP sender (SC177) is as follows:

(a) Type of Call

- (1) No Sender Intraoffice - NSI
- (2) Sender not used - NGK

(b) Trunk Select

- (1) Trunk Link Frame - TLG1/3, TLF2/5
- (2) Trunk Block - TB2/6
- (3) Trunk Select - TS2/5, ODT, or EVT

(c) Trunk Class Control - NCCN, NCNC, TCNC, TCCN, or NCTD; NTP or KTP; RB

(d) Number Translation

- (1) Line Equipment Number - FTT2/4, FUT2/5, VGT2/6, HGT2/5, VFT1/5
- (2) Ringing Combination - RCT1/15
- (3) Charge Condition - TC or FNK, FNA
- (4) Terminating Treatment

(a) Phase II or III Centrex
Listed Directory Number - LDN

(b) Test Line - TST

(c) Call forward-Don't Answer - DAT

(d) All others - AO

(5) Type of Line

- (a) Coin - CN
- (b) Call Transfer-Individual, 4 digits - DLT

- (c) Call Transfer-Individual, 5 digits - 5DLT
- (d) Call Transfer-Individual, 7 digits - 7DLT
- (e) Phase III Call Transfer-Attendant - MLT
- (f) Phase I or II Call Transfer-Attendant - CGS
- (g) All others - AO
- (e) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Calling line is:
 - (a) Coin - CNS
 - (b) PBX line - HTR
 - (c) Not to be monitored - MTR
 - (2) Calling line requires pad control - 2WDC
 - (3) Calling line has Add-On - ADD
 - (4) Calling line does not have Add-On - NAD
 - (5) Call to trunk which requires long loop signal - DR4,7
 - (6) Called line is in hunt group - CKR, HF
 - (a) Requires loop test - LGT
 - (b) Does not require loop test - PBX
 - (7) Called Centrex Customer Identification - CST2/5, CSU2/5
 - (8) Call is to be switched light traffic - LTR
 - (9) DR2/5 not used on call - DAO

62.74 Distribution of the NSI operates the NSI relay in the marker which causes the marker to bid for the trunk link frame associated with the selected intraoffice trunk. Trunk link frame and trunk seizure is described in 5.04 and 5.24 through 5.29.

62.75 Relay NSI operated also operates the ITR- relays which operate the forward linkage FLG, FLG1 and FLGA relays. Relay FLG

operated operates the LLI relay in the MDC which recycles the marker work timer by operating the RYT relay and causes the line location, ringing combination, and terminating treatment to be passed to the marker. When the information is locked operated in the marker the RNG relay is operated which releases the LLI relay in the MDC.

62.76 When the marker gains preference to the trunk link frame (TKF1,2 operated) the line link frame associated with the called line is seized as described in 6.06 through 6.10.

62.77 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Control for Channel Test - SC108
- (b) Channel Selection and Hold Magnet Operation - SC109
- (c) Ringing Switch Control - SC117
- (d) Call Forward Linkage Checks - SC110
- (e) Intraoffice Advance to Call Back Linkage - SC105
- (f) Line Link Frame Seizure and Control - SC106
- (g) Channel Selection and Hold Magnet Operation - SC109
- (h) Trunk Class Information - SC114, 137
- (i) Call Back Linkage Check - SC110
- (j) Disconnect - SC111

D. Tandem Outgoing Call - SC5

62.78 A tandem outgoing call requires a connection to be set from the line link appearance of an incoming tandem or toll trunk to the trunk link appearance of an outgoing type trunk. A sender may be attached to the outgoing trunk for outpulsing to a distant office. If the marker cannot set the linkage, a status scan point is activated to signal the processor that an alternate action is required. The processor will remove the data previously distributed and will distribute alternate data to enable the marker to complete the call.

62.79 The data distributed on a TOG call with a sender (SC178) is as follows:

- (a) Type of Call and Outsender Group
 - (1) Outsender Group - OSG2/6 (0-11)
 - (2) Sender Used - SDK
 - (3) Type of Call - TOG
- (b) Trunk Select
 - (1) Trunk Link Frame - TLG1/3, TLF2/5
 - (2) Trunk Block - TB2/6
 - (3) Trunk Select - TS2/5, ODT, or EVT
- (c) Trunk Class Control - NCNC or TOS, NTP and RB
- (d) Sender Information
 - (1) Digits - A2/5-M2/5, N7
 - (2) Arbitrary Digits - CR2/5, BR2/5, AR2/5
 - (3) Class - CL1-8
 - (4) Class Check - CLQ0-2
 - (5) Signals sender not to outpulse - ND
- (e) Number Translation
 - (1) Line Equipment number - FTT2/4, FUT2/5, VGT2/6, HGT2/6, VFT1/5
- (f) Miscellaneous - Any one of the following may be distributed if required for the call:
 - (1) Call is to be switched light traffic - LTR
 - (2) DR2/5 not used on call - DAO

62.80 Distribution of the OSG2/6 operate OSG2/6 relays in the MDC circuit which operate the corresponding outsender group OSG0-11 relay in the marker through a two-up check in the MDC. Any OSG- relay operated in the marker operates the sender off normal SON relay which operates the tandem outgoing TOG1,2 relays on calls from the IRMC when any of the following incoming trunk class relays are operated: INC, TAN, TOL, CMS0,1 or CMF2 (without CMF).

62.81 Operation of the TOG1,2 relays operate the forward linkage FLG, FLG1, and FLGA relays which operate the LLI relays in the marker and the MDC circuits. Operation of the LLI in the MDC recycles the work timer and causes the line location of the incoming tandem or toll trunk to be passed to the marker. The TOG relay operated in the MDC operates the terminating treatment POTS relay (if provided) and operates the RCL relay. When the line location is received the RNG relay is operated and the LLI relay in the MDC is released.

62.82 The operation of the OSG- relay cuts through the associated sender idle SIO or SIE leads to the sender group. An idle sender in the A or B subgroup will operate the corresponding SIA or SIB relay. If the associated outsender connector is idle (GBA, GBB relays nonoperated), the marker will bid for the outsender connector. Outgoing sender selection and control is described in 10.

62.83 When the marker gains preference to the sender connector (SKA or SKB relay operated) the bid is made for the trunk link frame. Seizure of the trunk link frame and the selected trunk is described in 5.04 through 5.29.

62.84 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame associated with the incoming trunk is seized as described in 6.06 through 6.10.

62.85 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class Information - SC114 or 137
- (b) Control for Channel Test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Linkage Check - SC110
- (e) Disconnect - SC111

E. Pulse Conversion - SC6B

62.86 A pulse conversion call requires the marker to connect a sender to the incoming pulse conversion trunk, prime the sender with the information to outpulse, advance the sender and disconnect.

62.87 The data distributed on a pulse conversion (SC179) call is as follows:

(a) Type of Call and Outsender Group

(1) Outsender Group - OSG2/6 (0-11)

(2) Sender Used - SDK

(b) Sender Information

(1) Digits - A2/5-M2/5, N7

(2) Arbitrary Digits - CR2/5, BR2/5, AR2/5

(3) Class - None

(4) Class Check - CLQO

(c) Miscellaneous - The following may be distributed if required for the call:

(1) DR2/5 not used on call - DAO

62.88 Distribution of the OSG2/6 operate OSG2/6 relays in the MDC circuit which operate the corresponding outsender group OSG0-11 relay in the marker through a two-up check in the MDC. Any OSG- relay operated in the marker operates the sender off normal SON relay which operates the pulse conversion PCL1,2 relays when the PCD0, PCD1, or PCR trunk class relay is operated.

62.89 The operation of the OSG- relay cuts through the associated sender idle SIO or SIE leads to the sender group. An idle sender in the A or B subgroup will operate the corresponding SIA or SIB relay. If the associated outsender connector is idle (GBA, GBB relays nonoperated), the marker will bid for the outsender connector. Outgoing sender selection and control is described in 10.

62.90 When the marker gains preference to the sender connector (SKA or SKB relay operated) the bid is made for the trunk link frame associated with the pulse conversion trunk. Seizure of the trunk link frame and trunk is described in 5.30 through 5.32.

62.91 All other marker functions for this call, which are listed below are not changed for ETS operation.

(1) Linkage Check - SC110

(2) Disconnect - SC111

F. CAMA First - SC7B

62.92 A CAMA first call, like a pulse conversion call, requires the marker to connect a sender to an incoming CAMA trunk, prime the sender with the information required for billing, advance the sender and disconnect.

62.93 The data distributed on a CAMA first call (SC185) is as follows:

(a) Type of Call and Outsender Group

(1) Outsender Group - OSG2/6 (0-11)

(2) Sender used - SDK

(b) Trunk Class Control - NCNC, NTP, and CMF

(c) Sender Information

(1) Digits - A2/5-M2/5, N7

(2) Class - CL1-8

(3) Class Check - CLQ0-2

(d) Miscellaneous - The following may be distributed if required for the call:

(1) DR2/5 not used on call - DAO

62.94 Distribution of the OSG2/6 operate OSG2/6 relays in the MDC circuit which operate the corresponding outsender group OSG0-11 relay in the marker through a two-up check in the MDC. Any OSG- relay operated in the marker operates the sender off normal SON relay which operates the CAMA call CMCL-3 and pulse conversion PCL1,2 relays through the incoming trunk class relay CMF2 and the CAMA route series CMF relays operated.

62.95 The operation of the OSG- relay cuts through the associated sender idle SIO or SIE leads to the sender group. An idle sender in the A or B subgroup will operate the corresponding SIA or SIB relay. If the associated outsender connector is idle (GBA, GBB relays nonoperated), the marker will bid for the outsender connector. Outgoing sender selection and control is described in 10.

62.96 When the marker gains preference to the sender connector (SKA or SKB relay operated) the bid is made for the trunk link frame associated with the incoming CAMA trunk. Seizure of the trunk link and trunk is described in 5.30 through 5.32.

62.97 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Linkage Check - SC110
- (b) Disconnect - SC111

G. Dial Transfer Identification - SC12B

62.98 A DTI call requires the marker to connect the station requesting transfer to a transfer trunk. The transfer trunk is associated with the incoming or ITR trunk which is connected to the station requesting transfer. For the DTI call, the line link location of the line and the trunk link location of the trunk are already established, thus neither selection of a trunk nor number translation is required of the ETS processor. The processor does, however, translate the line location of the transferring station and distributes the centrex customer identification and the type of line. The distribution is as follows:

- (a) Centrex Customer Identification - CST2/5, CSU2/5
- (b) Type of Line
 - (1) Call Transfer - Individual, 4 digits or Call Transfer - Attendant, ATT Class - DLT
 - (2) Call Transfer - Individual, 5 digits or Call Transfer - Attendant, ATT Class - 5DLT
 - (3) Call Transfer - Individual, 7 digits or Call Transfer - Attendant, ATT Class - 7DLT
 - (4) Call Transfer - Attendant or Call Transfer - Individual, DAT Class - MLT
- (c) Miscellaneous - Any of the following may be distributed if required for the call:
 - (1) Call is to be switched light traffic - LTR
 - (2) DR2/5 not used on call - DAO
 - (3) Sender not used - NGK

62.99 Marker operation on the call is as described in 21.43 through 21.57 except the class-of-service CST2/5 and CSU2/5 relays and the type of line relays are operated from the MDC when the line link frame is seized (LFK operated).

H. Transfer Call - SC8B

62.100 A transfer call TRF requires the marker to connect the line link appearance of the incoming or ITR trunk to the trunk link appearance of the attendant trunk and signal the attendant trunk whether the call is a listed directory number or a transfer call. When the marker activates the DR status scan point together with the TRF data scan point, the processor takes no action. The marker seizes the trunk link frame associated with the incoming or ITR trunk requesting transfer. The marker TRF1 relay operated applies a +130 volt battery to the "F" lead to the incoming register link that operates the TF relay in the trunk circuit.

62.101 The operated TF relay in the trunk cuts through the class-of-service information which is recorded on the CT- and CUA-relays. The CDN relay in the marker is also operated if the transfer call is a result of a listed directory number call. A check that the class information is registered in the marker causes the marker to release the trunk link frame (RE relay operated). When the trunk link frame is released, the TRF2 relay releases, activating the RE status scan point through RE operated. If the CDN relay is operated, the LDA data scan point is activated, otherwise the TRA data scan point is activated. The processor scans the marker, processes the information, and makes the following distribution (SC186):

- (a) Type of Call
 - (1) No Sender Outgoing - OSG2,10
 - (2) Sender Not Used - NGK
 - (3) Type of Call - TOG
- (b) Trunk Select
 - (1) Trunk Link Frame - TLG1/3, TLF2/5
 - (2) Trunk Block - TB2/5
 - (3) Trunk Select - TS2/5, ODT, or EVT
- (c) Trunk Class Control
 - (1) Transfer Call - NCNC, KTP, RB
 - (2) Listed Directory Number Call - TCNC, NTP, RB
- (d) Number Translation
 - (1) Line Equipment Number - FTT2/5, FUT2/5, VGT2/6, HGT2/5, VFT1/5

(e) Miscellaneous - Any of the following may be distributed if required for the call:

- (1) Call is to be switched - LTR
- (2) DR2/5 not used on call - DAO

62.102 Distribution of the OSG2 and 10 operate the corresponding OSG- relays in the MDC which operates the no sender outgoing NSO relay in the marker through a two-up check in the MDC. NSO operated with the incoming trunk class relay TRF1 operated operates the TRF3 and TRF4 relays. Operation of the TRF3 relay operates the forward linkage FLG, FLG1, and FLGA relays to operate the LLI relays in the marker and the MDC.

62.103 Operation of the LLI in the MDC recycles the work timer and causes the line location of the incoming or ITR trunk arranged for transfer to be passed to the marker. The TOG relay operated in the MDC operates the terminating treatment POTS relay (if provided) and operates the RCL relay. When the line location is locked in the marker the RNG relay is operated and the LLI relay in the MDC is released.

62.104 With relay NSO operated the marker bids for the trunk link frame. Seizure of the trunk link frame and trunk is described in 5.04 and 5.24 through 5.29.

62.105 When the marker gains preference to the trunk link frame (TFK1,2 relays operated) the line link frame associated with the incoming or ITR trunk is seized as described in 6.06 through 6.10.

62.106 All other marker functions for this call, which are listed below, are not changed for ETS operation.

- (a) Trunk Class Information - SC142
- (b) Control for Channel Test - SC108
- (c) Channel Selection and Hold Magnet Operation - SC109
- (d) Linkage Check - SC110
- (e) Disconnect - SC111

SECTION III - REFERENCE DATA1. WORKING LIMITS

1.01 The working limits for the marker are as follows:

<u>Conditions</u>	<u>Allowable Earth Potential</u>	<u>Resistance</u>
Max Ext Ckt Loop		7150 ohms
Max Ext Ckt Res to Ground	0 volt or positive	7150 ohms
Max Ext Ckt Res to Ground	20 volt negative	3250 ohms
Max Ext Ckt Res Through 1000-ohm Ringer to Ground (See Note A)	12 volt negative	1750 ohms
Min Ins Res (See Note B)		10,000 ohms

Notes

- (a) Requirement to detect tip party subset if capacitor is short-circuited.
- (b) For PBX trunks having battery connected to the tip through a 5500- or 6000-ohm relay, the following working limits apply.
- (1) For the 5500-ohm relay, the earth potential should not exceed 10-volts positive or 20-volts negative.
- (2) For the 6000-ohm relay, the earth potential should not exceed 13-volts positive or 20-volts negative.
- (3) Minimum insulation resistance of 20,000 ohms.
- (4) Minimum PBX battery voltage of 44 volts.

2. FUNCTIONAL DESIGNATIONS2.01 Relays

<u>Designation</u>	<u>Meaning</u>
ONN	AMA Recorder Number and Incoming Auxiliary
1F	First Failure to Match
1FA	First Failure to Match Auxiliary

Designation (Cont)Meaning

1SE	AMA Recorder Number and Incoming Trunk Class
2F	Second Failure to Match
2FA	Second Failure to Match Auxiliary
2G	Two Junctor Subgroups
2L	Two Line
2LA	Two Line Auxiliary
2LN	Two Line Number
2LV	Two Level Trunk
2SA	AMA Recorder Number and Incoming Trunk Class
2TLF	Two-Trunk Link Frames
2-3TLF	Two-Three Trunk Link Frames
2W	Two-Wire Network
2W-	Two-Wire Network Auxiliaries
(2-9)0X	Area Code Translator
(2-9)1X	Area Code Translator
(2-9)NX	Area Code Translator
3G	Three Junctor Subgroups
3NA	AMA Recorder Number and Incoming Trunk Class
3TLF	Three Trunk Link Frames
4BK	Four Digit - Busy Check
4BKC	Four Digit - Busy Check Auxiliary
4NE	AMA Recorder Number and Incoming Trunk Class
4NG	Four Number Groups
4TLF	Four Trunk Link Frames
4LT	Four-Wire Local Translator
4W	Four-Wire Network
4W-	Four-Wire Network Auxiliaries

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<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
5DLT	Dial Transfer - Five Digit	40F	Maximum 40 Line Link Frames
5IK	Five-Digit Idle Check	60F	Maximum 60 Line Link Frames
5IKC	Five-Digit Idle Check Auxiliary	A	Advance
5ST	AMA Recorder Number and Incoming Trunk Class	A0,1,2,4,7	"A" Digit Check
5TLF	Five Trunk Link Frames	AB	All Allotted Numbers Busy
6NT	AMA Recorder Number and Incoming Trunk Class	AC0,1,2,4,7	"A" Digit Code
6TFA	Six Trunk Link Frames Auxiliary	ACD	Area Code (Ten Digits Dialed)
6TLF	Six Trunk Link Frames	AD	Automatic Identification
7DLT	Dial Transfer - Seven Digit	ADD	Add-On Customer
7Q	Seven Quad	ADVA	Allotted Number Series Auxiliary
7RN	AMA Recorder Number and Incoming Trunk Class	AG1-6	Advance Group
7TFA	Seven Trunk Link Frames Auxiliary	AGAL-6	Advance Group Auxiliary
7TLF	Seven Trunk Link Frames	AGC	Access Group Control
7TR	Seven-Digit Transfer Check	AGCF	Access Group Control Failure
7TRC	Seven-Digit Transfer Check Aux	AGCK	Access Group Control Check
8NG	Eight Number Groups	AGP	Allotter Group Preference
8SP	AMA Recorder Number and Incoming Trunk Class	AHB0-9	Allotted Number Hundreds Block
8TLF	Eight Trunk Link Frames	AHG	Allotted Hunting Group
9NP	AMA Recorder Number and Incoming Trunk Class	AIC	Automatic Intercept Center Without Using LLP
9TLF	Nine Trunk Link Frames	AIC1-3	Automatic Intercept Center Auxiliaries
10TLF	Ten Trunk Link Frames	AICK	Automatic Intercept Center Check
11	11 Foreign Area	AIF0	Area Information Orig.
11X	Service Codes or CDOs and Foreign Area	AIF1	Area Information Inc.
20F	Maximum 20 Line Link Frames	AIOD	Automatic Identified Outward Dialing

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
AIS	Automatic Intercept Service	ARK1,2	"A" Arbitrary Digit Check
AIS1-3	Automatic Intercept Service Auxiliaries	ARN0-5	"A" Arbitrary Digit
AK	Advance Check	ARP	"A" Arbitrary Digit Primary
AL0-3	Allotter Operation	ARS	"A" Arbitrary Digit Secondary
ALN	Activate Line Number	ART0-9	AGC Route Transfer
ALN1	Activate Line Number Auxiliary	ARTA	AGC Route Transfer Auxiliary
ALS0-5	Allotter Start	ARTC	AGC Route Transfer Control
AMA	Automatic Message Accounting	ASB	All Senders Busy
AMAl, 3-5	Automatic Message Accounting	AST	Additional Start
AMB	All Markers Busy	AT0-9	"A" Digit Translator
AN	Allotted Number	ATB0-9	Allotted Number Tens Block
ANA0-9	Allotted Number Hunting	ATT	Attendant Class
ANB0-9	Allotted Number Hunting	ATT1	Attendant Class Auxiliary
ANC0-4,5,9	Allotted Number Hunting	AUS	Airport Service
AND0-4,5,9	Allotted Number Hunting	AV1-6	Advance 1-6
ANI	Automatic Number Identification	AVK	Advance Check
ANIS	Automatic Number Identification - Route Series	AVK1	Advance Check
ANON	Allotted Number Off-Normal Relay	B0,1,2,4,7	"B" Digit Check
ANR	Allotted Number Recycle	B147	"B" Digit Group Translation
ANR1,2	Allotted Number Recycle Auxiliary	B258	"B" Digit Group Translation
ANS	Allotted Number Series	B369	"B" Digit Group Translation
ANT	Allotted Number Timer	BC0,1,2,4,7	"B" Digit Code
ANTD	ANI Toll Divert	BC00	Busy Cut-In (2W)
AOA	All Other Class Auxiliary	BC10	Busy Cut-In Auxiliary (2W)
AOC	All Other Classes	BC20	Busy Cut-In Auxiliary (2W)
AOT	All Other Transfer Class		

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<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
BCA0	Busy Cut-In (4W)	BSL1	Bit-Stream Link Auxiliary
BCA10	Busy Cut-In Auxiliary (4W)	BT00,10, etc, to 90	"B" Digit Translator
BCN	Bit-Stream Continuity Test Circuit Required	BTOR,S,T to BT9R,S,T	"B" Digit Translator
BG	Battery and Ground Supply	BX	Bias Cross Detecting
BG1	Battery and Ground Supply	BY	Busy Line
BL	Busy Line	BYK	Busy Check
BLDA	Busy Line and Don't Answer Transfer	C0,1,2,4,7	"C" Digit Check
BLR	Billed Route	C4D	Conflicting Four Digit Dialing
BLS0-9	Busy Line Transfer Sort	CAA	Catch-All Auxiliary
BLT	Busy Line Transfer	CAM	CAMA
BLTL	Busy Line Transfer Lock	CAMA	CAMA Auxiliary
BLTR	Busy Line Transfer Recycle	CAU0-9	Class Units Auxiliary
BN	Blank Number	CB	Call Back
BNA	Blank Number Auxiliary	CB1-6	Call Back
BNB	Blank Number Auxiliary	CC0,1,2,4,7	"C" Digit Code
BNTH	Blank Number Thousands or Hundreds	CD0,1,2,4,7 10,15	Control Digit
BRL-3	Brush 1-3	CDA0-4	Control Digit
BRA	Busy Line Recycle Start	CDAP	Control Digit Primary
BRB	Busy Line Recycle End	CDAS	Control Digit Secondary
BRG	Brush Ground	CDB0-4	Control Digit
BRK1,2	"B" Arbitrary Digit Check	CDBP	Control Digit Primary
BRL	Busy Release	CDBS	Control Digit Secondary
BRN0-4	"B" Arbitrary Digit	CDK0,1	"C" Digit Check
BRP	"B" Arbitrary Digit Primary	CDN	Centrex Listed Directory Number
BRS	"B" Arbitrary Digit Secondary	CDNC	Listed Directory Number Check Auxiliary
BSL	Bit-Stream Link	CDNK	Listed Directory Number Check

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<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
CDP0,1,2,4,7 10,15	Priority Control Digit	CL0-9	Class
CDR0-2,4,7	Routing Control Digit	CLG	Class Grounds
CDRA0,1,2,3	Routing Control Digit Auxiliary	CLK	Class Check
CDS00-39	Control Digit Screening	CLK1-3	Class Check
CDT1-4	Control Digit Trans- mitting Check	CLP	Class Check Primary
CE	Connection Established	CLS	Class Check Secondary
CFG0-2	CAMA Trunk Group	CLT	Class Timing
CGA	Class Group "A"	CLT1,2	Class Timing
CGA1	Class Group "A"	CM	Class Match
CGB	Class Group "B"	CMC1-3	CAMA Class
CGB1	Class Group "B"	CMF	CAMA First (Route Series)
CGRA	Class Group "A"	CMF0	CAMA First (TAN Super- vision)
CGRB	Class Group "B"	CMF1	CAMA First (TOL Super- vision)
CGS	Customer Group Service	CMF2,3	CAMA First
CGT	Cancel Ground Test (Non- PBX)	CMJ	CAMA Junctor
CH0-9	Channel Selector	CMJT	CAMA Junctor Toll Divert
CHA	Channel Selector Aux- iliary	CMR0	CAMA Route
CHA1	Channel Selector Aux- iliary	CMR1	CAMA Route
CHT	Channel Timer	CMS0,1	CAMA Second
CHT0-9	Channel Test	CMU0,1,2,4,7	Class Match Units
CI	Centrex Intercept	CN	Coin
CI0-4	Centrex Intercept 0-4	CNA	Coin Auxiliary
CIA	Centrex Intercept Acti- vate	CNC	Coin Class
CIR	Cancel Immediate Ring	CNK	Coin Signal Check
CKG1-8	Connector Check Ground	CNP	Coin Not Present
CKO	Check Relays Operated	CNT	Centrex No Test
CKR	Check Release	CNTA	Centrex Not Test Recycle Check
		CNTI	Centrex No Test Incoming

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
CNTO	Centrex No Test Originating	CST0-9	Class of Service Tens
CON	Continuity	CSU0-9	Class of Service Units
CON1	Continuity	CSW	Cancel Ringing Switch
CON2	Continuity	CT0,1,2,4,7	Class Tens
CONA	Continuity	CTA0-9	Class Tens A Auxiliary
CONB	Continuity	CTB0-2	Class Tens B Auxiliary
COX	Cut-Off Cross	CTF0,1,2,4,7	CAMA Trunk Frame Units
CP	Coin Present	CTGS	CAMA Transmitting Ground Supply
CP0-10	Code Pattern	CTI	Centrex Temporary Intercept
CPG	Cancel Permanent Signal Ground Record	CTIL	Centrex Temporary Intercept Lock
CPK1,2	Code Pattern Check	CTK	Counter Check
CPMA	Code Pattern Modifier A	CTK1,2	Class of Service Tens Check
CPMB	Code Pattern Modifier B	CTKA	Counter Check Auxiliary
CPML	Cancel Preemption of Line	CTP0,1,2,4,7	Class Tens for Person-to-Person
CPNT	Register Test	CTUK	Class Tens Units Check
CPP	Code Pattern Primary	CU0-9	Class Units
CPS	Code Pattern Secondary	CUA0,1,2,4,7	Class Units "A"
CR	Coin Return	CUB0,1,2,4,7	Class Units "B"
CR0-5	Compensating Resistance or Code Route	CUK1,2	Class of Service Units Check
CRK1-2	Compensating Resistance or Code Route Check	CUP0,1,2,4,7	Class Units for Person-to-Person
CRP	Compensating Resistance or Code Route Primary	CV00-95	Code Conversions
CRS	Compensating Resistance or Code Route Secondary	CVS	Code Conversion Series
CRU0,1,2,4,7	Class Rate Units	CWB	Cancel Wideband Linkage
CSA	Customer With Sampling	CWCl,2	Call Waiting Call
CSK	Class of Service Check	CWCN	Cancel Wideband Continuity Test
CSP	Class of Service Primary	CWHO,1,2,4,7	Call Waiting Hundreds
CSS	Class of Service Secondary		

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
CWK	Call Waiting Link Check	DCTK	Double Connection Test Check
CWK1	Call Waiting Link Check Auxiliary	DIRA	Directory Number Auxiliary
CWL	Call Waiting Link	DIS1,2	Disconnect
CWL1	Call Waiting Link	DISA	Disconnect Auxiliary
CWN0,1	Call Waiting Number	DL	Display Lost
CWNT	Call Waiting No Test	DL0-6	Delete Digit
CWR	Call Waiting Recycle	DLK1,2	Delete Digit Check
CWS	Call Waiting Link Start	DLP	Delete Digit Primary
CWT0,1,2,4,7	Call Waiting Tens	DLS	Delete Digit Secondary
CWU0,1,2,4,7	Call Waiting Units	DLT	Dial Transfer Four Digit
CZ	Coin Zone (No Tip Party)	DLTC	Dial Transfer Auxiliary
CZT	Coin Zone (Tip Party)	DLTK	Dial Transfer Check
DO1,2,4,7	"D" Digit Check	DN	Directory Number
DAC	Direct Access Control	DNC	Denied Code
DAC1	Direct Access Control Auxiliary	DNG	Duplicate Number Group
DAHA	Directory Assistance Home Area	DNGA,B	Duplicate Number Group Auxiliaries
DAL	Directory Assistance Local	DNRA	Listed Directory Number Route Advance
DAT	Don't Answer Transfer	DP	Dial Pulse
DAT1	Don't Answer Transfer Class	DR0-19	Diverted Service Reroute
DATK	Don't Answer Transfer Check	DRR0,1	Diverted Route
DCI	Denied Code Intercept	DS1	Disable Sleeve
DCIA	Denied Code Intercept Auxiliary	DTF	Dial Transfer Call
DCK	Double Connection Check	DTF1-3	Dial Transfer Call Auxiliary
DCT	Double Connection Test	DTI	Dial Transfer Identification
DCT1-3	Double Connection Test	DT1-4	Dial Transfer Identification Auxiliary
DCTA	Double Connection Test Auxiliary	DTK	Dial Tone Check

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
DTS0-9	Dial Transfer Sort	FB0-29	Frame Busy (Trunk Line Frame)
DVO	Dual Voltage Operation	FBK	Frame B (Appearance) Check
DVA	Dual Voltage Operation	FBKA	Frame B (Appearance) Check Auxiliary
DX0,1,2,4,7	"D" Digit Code	FC	Free Code
DZ	Dial Zero	FC000-399	Frame Test Lead Cut-In
E0,1,2,4,7	"E" Digit Check	FCG	False Cross and Ground
ECK	Echo Suppressor Check	FCGA	False Cross and Ground Auxiliary
ECN	Even Connector	FD0-1	Foreign Area "D" Digit Intercept
EG	End PBX Group	FE0,1	Foreign Area "E" Digit Intercept
EGD	External Grid	FF1	Foreign Area "F" Digit
EGN	Extra Generate Number	FG0,1,2	Trunk Frame Group
ELL	Eliminate Line Link	FGA	First Group Advance
ELT	Extra Local Translation	FGT	F,G Digit Translator
EN	Extratheatrical Number	FK	Line Link F Relay Check
ENES	Enable Echo Suppressors	FLG	Forward Linkage Ground
ESCK	Echo Suppressor Check	FLG1	Forward Linkage Ground
ESK	Echo Suppressor Check	FLGA	Forward Linkage Ground Auxiliary
ET	Extra Translation	FM	Failure to Match
ET0-9	Extra Translation	FM0-4	Frame Memory
ETS	Even Trunk Selection	FMG	Frame Memory Guard
EX	Extra Record	FMG0,5,10,15 20, 25	Frame Memory Group
EX7	"E" Digit Check	FMK	Frame Memory Check
EXA	Extra Record Auxiliary	FML	Frame Memory Lock
F0,1,2,4,7	"F" Digit Check	FMP	Failure to Match Peg Count
FA	Fuse Alarm	FN	Free Number
FA1	Fuse Alarm	FNA	Free Number
FAC	Foreign Area Class	FNB	Free Number
FAC1,2	Foreign Area Code Auxiliary		
FACA	Foreign Area Code Auxiliary		
FAK	Frame A (Appearance) Check		

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
FS0-29	Frame Selection	GLC	Glare Present
FSA	Frame Selection Auxiliary	GLH	Ground Line Hold Magent
FT0-3	Frame Tens	GLH1	Ground Line Hold Magnet Auxiliary
FTA0-4	Frame Tens Auxiliary	GLHA	Ground Line Hold Magnet Auxiliary
FTB0-5	Frame Tens	GLR	Glare Record
FTC0-29	Frame Test Common	GLT	Glare Timer
FTCK	Frame Test Check	GLTA	Glare Timer Auxiliary
FTCK1	Frame Test Check	GN	Generate Number
FTG0-29	Frame Test Ground	GP1,2	Group Test
FTK1	Vertical File Test Check	GPA	Subgroup A
FTL	Frame Tens Lock	GPB	Subgroup B
FTN0-5	Frame Tens Number	GR0-7	Grade
FTS0-3	Frame Tens Test (4W)	GS1-6	Ground Supply
FTT0-5	Frame Tens Test	GSA1-5	Ground Supply Auxiliary
FTTB	Auxiliary to XFTN and XFUN	GSA11-15	Ground Supply Auxiliary
FU0,1,2,4,7	Frame Units	GSA21-25	Ground Supply Auxiliary
FUL	Frame Units Lock	GSB1-4	Ground Supply Auxiliary
FUN0-9	Frame Units Number	GT	Ground Test
FUT0-9	Frame Units Test	GT1-3,5	Ground Test Auxiliary
FVD	Five-Digit Translation	GTA	Ground Test Auxiliary
FX0,1,2,4,7	"F" Digit Translate	GTK	Ground Test Check
G0,1,2,4,7	"G" Digit Check	GTL	Ground Transmitting Lead
GB	PBX Group Busy	GTL2	Ground Transmitting Lead
GBA	Sender Subgroup A	GW	Group (W)
GBB	Sender Subgroup B	GX0,1,2,4,7	"G" Digit Translate
GC	G0/4 Lead Connector	GZ	Group (Z)
GCA	G0/4 Lead Connector Aux	H0,1,2,4,7	"H" Digit Check
GLA	Glare Before CHA or HMS1	HFA	High Voltage (+130 Volt) Fuse Alarm
GLB	Glare After Linkage Release	HG0,1,2,4,7	Horizontal Group

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<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
HGD	Home Grid	IMG	Intermarker Group Call
HGK	Horizontal Group Check	IMT	Intermarker Group Test Call
HGL	Horizontal Group Lock	INC	Incoming Class
HGN0-9	Horizontal Group Number	INCT	Incoming Trunk
HGT0-9	Horizontal Group Test	INI	Incoming Intercom Call
HMS1	Hold Magnet Start	INFO	Information Route
HMT	Hold Magnet Timing	INFR	Information Record
HMT1	Hold Magnet Timing Auxiliary	INL	Incoming Local - Non NPA Code
HNO,1,2,4,7	Hundreds	INT	Intercept (Misdialed Calls)
HT	Home Triple	IOD	Identified Outward Dialing
HTK1	Horizontal Group Test Check	IPC0-9	Individual Peg Count
HTR	Heavy Traffic	IPR	Immediate Preempt
HTT	Heavy Traffic Timing	IPRS	Immediate Preempt Series
HTUK	Hundreds, Tens, Units Check	IPT	Intercept
HVT0-11	Horizontal Vertical Check	IRT	Incoming Register Test
IAO	Intraoffice	ITBA	Idle Test Trouble Auxiliary
IAT2-9	International Dialing "B" Digit Translate	ITD	Incoming Test Dial Transfer
IBT0,1	International Dialing "C" Digit Translate	ITM	Incoming Test Manual Transfer
ICC	Intercom Call	ITNA	Intercept Trunk Number A
IDA	International Dialing "A" Digit Translate	ITNB	Intercept Trunk Number B
IDD	International Distance Dialing	ITNC	Intercept Trunk Number C
IDN	Incoming Directory Number	ITND	Intercept Trunk Number D
IDP	International Dialing Person-to-Person	ITR1,2,3	Intraoffice Class
IDS	International Dialing Station-to-Station	ITRA	Intraoffice Class
IFLG	Intraoffice Forward Lkg	J0,1,2,4,7	"J" Digit Check
		JB	No Test Junctor Busy
		JCK	Junctor Connector Check

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
JG0-4	Junctor Subgroup	KLPR	Check Line Precedence
JGCK	Junctor Group Ground Check	KM	Cancel Match
JLE	Junctor Lock Even	KTP0-2	Check Trunk P- Relay
JLO	Junctor Lock Odd	KTPR	Check Trunk Precedence
JSE	Junctor Sequence Even	L0,1,2,4,7	"L" Digit Check
JSO	Junctor Sequence Odd	LA	Line Auxiliary
JSQ0-5	Junctor Sequence	LB	Line Busy
JSSF	Junctor Switch Seizure Failure	LB0-9	Line Busy
JXP	Junctor Crosspoint	LBT	Line Busy Test
JXP1	Junctor Crosspoint Auxiliary	LBTA,B	Line Busy Test Auxiliary
JXPA	Junctor Crosspoint Auxiliary	LCD0-2	Local Code
JXW	Junctor Crosspoints - Wideband	LCH	Local Charge
JXW1	Junctor Crosspoints - Wideband Auxiliary	LCK	Trunk Link Connector Check
JXWA	Junctor Crosspoints - Wideband Auxiliary	LDN	Listed Directory Number
K0,1,2,4,7	"K" Digit Check	LDT	Long Delay Timing
KA	"A" Digit Cut-In	LEA	Local Extratheoretical "A" Office
KBC	"B" and "C" Digit Cut-In	LEB	Local Extratheoretical "B" Office
KCV	Cancel Code Conversion	LF0-9	Line Frame Link Identifier
KDE	"D" and "E" Digit Cut-In	LFK	Line Frame Check
KFG	"F" and "G" Digit Cut-In	LFK1	Line Link Connector Relay Operate Check
KG	Grounding Relay for KA, KBC, KDE, KFG, KHJ, and KKL Relays	LFKA	Line Frame Check Auxiliary
KGS-	Digit Cut-In and Shift	LGA	Last Group Advance
KHJ	"H" and "J" Digit Cut-In	LGT	Loop Ground Test
KK	Check Relay for KA, KBC, KDE, KFG, KHJ, and KKL Relays	LHT	Line Hold Magnet Test
KKL	"K" and "L" Digit Cut-In	LI	Line Idle
KLPO-2	Check Line P- Relay	LIA	Line Idle Auxiliary
		LIN	Local Incoming
		LIT	Line Idle Test

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<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
LITA	Line Idle Test Auxiliary	LOLA,B,C,D, E,F	Long Loop Lines
LK	Left Half Frame Check	LOLK	Long Loop Check
LK1,2	Linkage Check	LOLP	Long Loop Ringing
LKA	Linkage Check Auxiliary	LOT	LO Lead Test
LKC	Linkage Complete	LOT1	LO Lead Test
LKD	Overflow Link Linkage Check	LP	Progress Lamp Control
LKC	Linkage Complete	LPA	Local Physical "A" Office
LL0,1,2,4,7	Line Link	LPB	Local Physical "B" Office
LLB	Line Link Frame Plugged Busy	LPI	Line Link Pulsing Intercept
LLC1-4	Line Link Control	LPMK	Line Precedence Memory Check
LLCK	Line Link Cut-Through Relay Check	LPN	Line Pulsing Number
LLES	Line Link Echo Suppressors	LR	Link Release-Incoming Link
LLI	Lock Line Identification	LRC0-119	Line Route
LLIA	Lock Line Identification Auxiliary	LRA	Line Route Activate
LLKA,B	Long Loop Check	LRA1	Line Route Activate Auxiliary
LLP1	Line Link Pulsing - Stage 1	LRD	Line Route Denied
LLP2	Line Link Pulsing - Stage 2	LRI	Link Release Identifier
LLPX	Long Loop PBX	LRS	Line Route Series
LLS	Line Link Selections	LRST0-9	Line Route Start
LLT	Line Link Test	LSC1,2	Line Link Sender Control
LLTA	Line Link Test Auxiliary	LSK	Line Switch Check
LNA	Listed Directory Number Auxiliary	LST	Lock Status
LNPN	Line Nonpreemptible	LSW	Locally Switched Wideband
LNPR	Line Prescribes Ringing	LSWR	Locally Switched Wideband - Remote Line
LNT	No-Test Line Check	LT	Local Translation
LOF	Overflow - LLP	LT2-4	Local Translator
LOL	Locked Out Line	LTA	Local Theoretical "A" Office

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
LTB	Local Theoretical "B" Office	MF	Multifrequency
LTI	Lock Trunk Identity	MFK	Mate Frame Check
LTR	Light Traffic	MFL	Mate Frame Lockout
LWL	Local Wideband Line	MLT	Manual Transfer
LXP	Line Crosspoints	MM	Mismatch
LXP1	Line Crosspoints Auxiliary	MMK	Multilead Message Check
LXPA	Line Crosspoints Auxiliary	MN	Monitor For No Test
LXW	Line Crosspoints - Wideband	MN1	Monitor For No Test
LXW1	Line Crosspoints Wideband - Auxiliary	MON	Monitor
LXWA	Line Crosspoints Wideband Auxiliary	MON1	Monitor
M0-9	Monitor For No-Test	MP0-2	Match Pattern
MAK	Marker Connector Cut-Through	MPT	Monitor Register Potential
MAK1	TL Connector Operate Check	MR	Message Register
MB	Marker Busy	MRA	Message Register Auxiliary
MBC	Maintenance Busy Connector	MRI	Match Restricted Incoming
MBCK	Maintenance Busy Connector Check	MRL	Marker Release
MBK	Message Billing Check	MRL1	Marker Release
MBK1-6	Message Billing Check	MS	Match Status
MBS0-9	Message Billing Series	MSK	Marker Connector Start Relay Check
MBT9	Message Billing Tandem 9	MT	Marker Test
MCB0,1	Marker Connector Busy	MT-	Marker Test
MCK	Marker Connector Cut-Through	MXT	Master Cross Test
MCS	Match Class of Service	N1-4	Number Translator Cut-In
MD0,1,2,4,7	"M" Digit Check	NAD	Nonadd-On Customer
MDI	Mutilated Digit Intercept	NAI	Nonautomatic Intercept
MDK	Marker Connector Cut-Through	NAIC	Nonautomatic Intercept Center
		NANS	Nonallotted Number Series
		NAR1,2	Number Group Allotter Recycle
		NCCN	Noncharge Coin

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<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
NCMJ	Non-CAMA Junctor	NPRC	Nonpreempt Cycle
NCNC	Noncharge Noncoin	NR	Number Release
NCRA	Nuisance Call Record	NRD	No Record
NCTD	Noncoin Toll Divert	NRR	No Record Required
NCW	Noncall Waiting	NRS	No Ringing Switch
NCWL	Noncall Waiting Auxiliary	NSA	No Sampling
NDI	No Digit	NRS	No Ringing Switch
NDK	No Digit Check	NSI	No Sender Intraoffice
NE	Number End	NSK1	Number Structure Check
NET	Network	NSO	No Sender Outgoing
NGB	Number Group Plugged Busy	NSS0-5	Number Series Start
NGC	Number Group Control	NSS	No Such Service
NGK	Number Group Check	NST	No Status
NGK1	Number Group Check	NT	No Test Class
NGP	Number Group Preference	NT1-6	No-Test Class
NGSA-H	Number Group Selected	NTA	No Trunks Available
NGSK	Number Group Selected Check	NTB	No Test Busy
NGTA-H	Number Group Test	NTC	No-Test Timing
NH	No-Hunt	NTD	No Toll Deversion
NID	Nonidentified Dialing	NTH	No-Test Hold Magnet
NLA	No Line Available	NTL	No-Test Long Loop
NMR	No Match Required	NTMR	No Terminating Match Required
NOB	Nonobserved	NTR	No-Test Release
NOC	No Class	NTT	No-Test Train
NOLA	No Long Loop Lines	NW	Nonwideband Request
NPC	Nonpreemptible Connection	NWB	Nonwideband
NPCA	Nonpreemptible Connection Auxiliary	NWL	Nonwideband Line
NPM	No Precedence Memory	NWLA	Nonwideband Line Auxiliary
		NWT	Nonwideband Class

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
OA	Office "A"	ORC0-2	Originating Classes
OAC0-9	Originating Access Control	ORI	Originating Class Auxiliary
OAT	Overall Timing	ORK1,2	Outgoing Registration Check
OAT1	Overall Timing	ORT	Originating Register Test
OB	Office "B"	OS0-4	Outgoing Sender Selection
OBS	Observing Service	OSC	Outgoing Sender Control
OC	Other Classes	OSE	Outgoing Sender End
OCN	Odd Connector	OSE1	Outgoing Sender End
OD	Operator Identification	OSG0-11	Outgoing Sender Group
OFC0-5	Office Code 0-5	OSK	Outgoing Sender Check
OFH	Overflow Hold Magnet	OSKA	Outgoing Sender Selection Check
OFH1	Overflow Hold Magnet Operate	OST	Outgoing Sender Registration Timing
OFK	Line Overflow	OST1,2	Outgoing Sender Registration Timing
OGC	Outgoing Class	OT	Odd Trunks
OGR1,2	Overflow Gate Relay 1,2	OTF	Office Test Frame
OHS	Off-Hook Service	OTS	Odd Trunk Selection
OLI	Originating Line Identifier	OTT	Operates TT (Trunk Test) Relay in Trunk
OLIA	Originating Line Identifier Auxiliary	OTTA	Operate TT Auxiliary
OLIT	OLI Transmitting Ground Supply	OV	Overflow
ONX	Off-Normal Cross	OVC	Overflow Control
OP0-4	Outpulse 0-4	OVK	Overflow Check
OPE	Operator Error	OVP	Overseas Person-to-Person
OPR	Operator (Operator Assistance)	OVS	Overseas Station-to-Station
OPS0-3	Operator (Assistance Preroute)	P0-9	Pattern 0-9
OR	Originating Class	P0A-P2A, P5A,P9A	Pattern Auxiliary
ORA	Originating Class Auxiliary		
ORC	Originating Class		

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
PA	Pattern "A"	PKL	Pulse Check Wideband Request
PAN	PBX Announcement	PL	Percent Load (Link Busy)
PB	Pattern "B"	PLl	Percent Load (Link Busy)
PBN	Permanently Busy Number	PLB	Priority Line Busy
PBX1,2	Private Branch Exchange	PLBl	Priority Line Busy Aux- iliary
PBXA	Private Branch Exchange Auxiliary	PLBA	Priority Line Busy An- nouncement
PBY	Paths Busy	PLFK	Preemptible Line F Relay Check
PC	Pattern "C"	PLSA	Priority Line
PC00-39	Peg Count (Preroute)	PML	Preemptible Line
PCCL	Pulse Conversion Class Lead Connector	PMLL	Preemptible Line Auxiliary
PCD0,1	Pulse Conversion Dial	PMO	Permanent Overflow
PCK	Priority Check	PN	Physical Number
PCL1,2	Pulse Conversion Marker Class	PNC	Permanent Signal Noncoin
PCN	Permanent Signal Coin	PNR	Pattern Normal
PCR	Pulse Conversion Re- vertive	POTS	Ordinary Terminating Service
PD	Partial Dial	PP	Wideband Prefix
PDC0,1	Pad Control	PPX	Permanent Signal PBX
PDK	Pad Control Check	PR	Paired TL Frames
PDKA	Pad Control Check Aux- iliary	PRA0-4	Priority Auxiliary
PDL	Peg Delay	PRC	Preempt Cycle
PE	Pattern "E"	PRE0-4	Priority Level
PEG, PEG1,2	Peg Count	PREA	Preempt Auxiliary
PEG20,30	Peg Count	PRI	Priority
PG00-14	Privilege Group	PRL	Paired Line Link
PGR00-14	Peg Gate Relay 00-14	PRL0-4	Precedence Level 0-4
PHB	POTS Hundreds Block	PRLl	Paired Line Link
PHC	Physical Code	PRLLA	Paired Line Link Aux- iliary
PK	Pulse Check - No Partial Dial, No Permanent Signal	PRR	Routing Group Recycle

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
PS	Permanent Signal	RCN1-15	Ringing Combination Number
PS1,2	Permanent Signal Test	RCR	Record Requested
PSA	Permanent Signal Test	RCT1-15	Ringing Control
PSA1-3	Permanent Signal Test	RCTA	Reverse Continuity Test
PSG	Permanent Signal Ground	RCTB	Reverse Continuity Test Auxiliary
PSL	Permanent Signal Lock	RCTC	Reverse Continuity Test
PSR	Permanent Signal Record	RCTS	RC Through Switch
PST	Permanent Signal Test Route	RCY	Recycle
PSTA	Permanent Signal Test Route Auxiliary	RCY1-4	Recycle
PTK	Physical and Theoretical Check	RCY5	Recycle
PTM	Pretranslator Timeout	RDCK	Remote Double-Connection Check
PTN	Physical and/or Theoretical Number	RDI	Read-In
PU	Plug Up	RDIA	Read-In Auxiliary
PUL	Plugged Up Line	RDK1,2	Routing Control Digit Check 1 and 2
PX	Priority Cross	RDL	Release Delay
R-	Route	RDL1	Release Delay Auxiliary
RA1-6	Route Advance	RDO	Readout
RAV1,2,3	Route Advance	RDR	Read-In Recycle
RBT	Register Return Busy	RDR1	Read-In Recycle Auxiliary
RCK	Recorder Check	RDS	Read-In Start
RCD	Record	RE	Read-End
RCD0-4	Routing Control Digit	RF	Route Failure to Match
RCDP	Routing Control Digit Primary	RFA	Route Failure to Match Auxiliary
RCDS	Routing Control Digit Secondary	RG1-6	Routing Group 1-6
RCK1-3	Ringing Switch Check	RGA	Routing Group Auxiliary
RCL	Ringing Switch Lock	RG1-6	Routing Group Auxiliary
		RGT	Ringer Test

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
RGTA	Ringer Test Auxiliary	RO1-3	Rotate 1-3
RI	Regular Intercept	ROA	Reorder Auxiliary
RIA	Regular Intercept Auxiliary	ROH	Receiver Off Hook
RIB	Regular Intercept Auxiliary	RON	Recorder Off-Normal
RIK	Read In Check	ROT	Rotate
RIP	PBX and Restricted Intercept	RP	Ring Party
RIPA	PBX and Restricted Intercept Auxiliary	RPA	Ring Party Auxiliary
RIW	Regular Intercept - Wideband	RPB	Ring Party Auxiliary
RK	Right Half Frame Check	PRK	Ring Party Check
RK1-3	Line Link Location Check	RQ	Regular Quad
RKA	Right Half Frame Check Auxiliary	RR	Register Return
RLG	Return Lock Guard	RRC	Register Return Coin
RLL	Release Line	RRK	Register Return Coin Check
RLT	Reverse Loop Test	RS0-9	Ringling Select Magnet
RM--	Routing Program	RSC	Release Sender Connector
RN	Recorder Number	RSK	Ringling Switch Select Magnet Check
RN0,1,2,4,7	Recorder Number	RSMK	Remote Select Magnet Check
RN2K	Recorder Number Tens Two Check	RST	Reset
RN2T	Recorder Number Tens Two	RSW	Remotely Switched Wideband
RNG	Release Number Group	RT0-9	Route Transfer
RNH	Recycle Nonhunt	RT20-39	Route Transfer
RNK1,2	Recorder Number Check	RTA	Register Test Auxiliary
RNT	Recorder Number Timer Check	RTC	Route Transfer Control
RNT1,2	Recorder Number Timer Check	RTCl-5	Route Transfer Control Auxiliaries
RNT20	Recorder Number Tens	RTN	Recorder Tens Number
RO	Reorder	RTNA	Recorder Tens Number Auxiliary
		RTST	Register Test Start Lead
		RUK	Remote Switch Check

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
RUK1	Remote Switch Check Auxiliary	SCC	Service Call
RUN	Recorder Units Number	SCCK	Subscriber Class Check
RUNA	Recorder Units Number Auxiliary	SCK	Stuck Coin Check
RV	Reverting	SCL	Sender Class
RV1-3	Reverting	SCL0,2,3,5	Sender Class
RVT	Reverse Trunk	SCN	Stuck Coin
RWCN	Reverse Wideband Continuity Test	SCR	Number Group SC Release Check
RWL	Remote Wideband Line	SCT	Stop Connector Timing
RYC	Recycle Control	SDT	Short Delay Timing
RYC1	Recycle Control Auxiliary	SF	Seize Frame
RYK	Read In Recycle Check	SFNK	Seizure Failure Normal Check
RYT	Recycle Timing	SFR	Seize Frame Timer Release
RYT1	Recycle Timing	SFT	Seize Frame Timer
S00-239	Service Screening	SG	Special Grade
SA	Sample	SGA	Second Group Advance
SA0-9	Sleeve Test Auxiliary	SHK	Sender Link Hold Check
SAC	SA- Connector	SHKA	Sender Link Hold Check Auxiliary
SAC1	SA- Connector Auxiliary	SIA	Sender Idle (A Subgroup)
SAE	Sleeve Auxiliary End	SIB	Sender Idle (B Subgroup)
SAK	Sleeve Test Auxiliary Check	SK	Sl Relay (Trunk) Check
SAR	Sample Always Required	SKA	Sender Connector Check (A Subgroup)
SC0-3	Screening Class	SKB	Sender Connector Check (B Subgroup)
SCAK	Status Connector Check	SL	Sleeve
SCAL	Status Connector Locked	SL0-9	Sleeve Test
SCB1,2,3	Start Call Back	SLA	Sleeve Auxiliary
SCBA0-3	Marker Make Busy For Sender Connector (A Subgroup)	SLCK	Number Group SC Operate Check
SCBB0-3	Marker Make Busy For Sender Connector (B Subgroup)	SLCK1	Number Group SC Operate Check Auxiliary
		SLK	Sender Link Check

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
SLK1,2	Sender Link Check	ST	Short Test
SLN	Select Line	ST7	Eleven Digits
SLPR	Store Line Precedence	STA	Short Test Auxiliary
SLRK	Sleeve Release Check	STF	Single Trunk Frame
SMB	Start Maintenance Busy	STK	Status Level Check
SMC	Sample Cross	STKA	Status Level Check Auxiliary
SMK	Sample Check	STL0-5	Status Level
SMP	Sample Check Aux	STM	Status Maintained
SMR	Sample Route	STOK	Status OK
SMT	Sample Trunk	STP	Stepping
SNG1,2	Seize Number Group	STP1-3	Stepping
SNK	Selections Normal Check	STP2A	Step 2 Auxiliary
SOG1,2	Subscriber Outgoing Class	STPA	Step Auxiliary
SON	Sender Off-Normal	STPR	Store Trunk Precedence
SP	Stop Progress	STS0-5	Status
SP1	Stop Progress Auxiliary	STSK	Status Check
SPC	Special Call	STX	Standing Cross Test
SPH	Special Hunt	STXA	Standing Cross Test Auxiliary
SPL	Special Class	SWAT	Store Wideband All Other Transfer Class
SPL1,2,3	Special Class	T0,1,2,4,7	Tens
SPT	Split Tens Group	TA	Trunk Available
SQO	Sequence	TAC0-9	Terminating Access Control
SQ1	Sequence	TAL	Overall Time Alarm
SQA	Sequence Advance	TAM1,2	Tandem AMA
SR1-3	Series Select	TAN	Tandem Trunk Class
SPK	Start Ringing Check	TB0-9	Trunk Block
SSA	Sender Link Select Magnet - A Subgroup	TBA	Overflow Link Trunk Block Auxiliary
SSB	Sender Link Select Magnet - B Subgroup	TBC	Trunk Block and RA-Check
SSU0,1,2,4,7	Second Sort Units Selection		

<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
TBH	Trouble Intercept - Ringing Switch Hold Magnet Operate	TCHK	Test Channel Check
TBI	Trouble Intercept	TCK	Talking Charge Check
TBI1	Trouble Intercept Aux- iliary	TCNC	Talking Charge Noncoin
TBIA	Trouble Intercept Aux- iliary	TCT	Transmit Count
TBIB	Trouble Intercept Aux- iliary	TD	Toll Diversion
TBK	Trunk Block Check	TDK	Toll Diversion Check
TBS0-3	Tens Block Screening	TE	Trunks Even
TBT	Trunk (or Register) Busy Timing	TEA	Terminating Auxiliary
TBTA	All Trunk (or Register) Busy	TER1-7	Terminating Class
TBTB	Trunk Busy Timing Start	TF0,1,2,4,7	Trunk Frame Units
TBW	Tens Block	TFK1-3	Trunk Frame Check
TBX	Overflow Link Trunk Block	TG	Trunk Guard
TC	Talking Charge	TG0-9	Trunk Group
TCA	Trunk Class A	TGA	Third Group Advance
TCAA	Trunk Class A Auxiliary	TGBK	Trunk Group Battery Check
TCB	Trunk Class B	TGCK	Trunk Ground Check
TCBA	Trunk Class B Auxiliary	TGP	Trunk Group Primary
TCC	Talking Charge Check	TGS	Trunk Group Secondary
TCCA	Trunk Class Check Aux- iliary	TGS1,2,3	Transmitting Group Supply
TCK	Trunk Class Check	TGT	Trunk Guard Test
TCCN	Talking Charge Coin	TGTS	Trunk Group Traffic Sample
TCGA	Terminating Class Group A	TH0,1,2,4,7	Thousands
TCGB	Terminating Class Group B	THC	Theoretical Code
TCH	Toll Charge	THK0,1,2,3	Thousands Check
TCH0-9	Test Channel	THT0-3	Trunk Number Thousands
		TID	Transmitting Class Identification
		TIN	Toll Incoming
		TIR	Trouble Immediate Ring
		TK	Total Check

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<u>Designation</u> (Cont)	<u>Meaning</u>	<u>Designation</u> (Cont)	<u>Meaning</u>
TKT	Translator Check	TPMK	Trunk Precedence Memory Check
TLC1,2	Trunk Link Control	TPS	Tip Party Auxiliary
TLES	Trunk Link Echo Suppressor	TPT	Tip Party Test
TLK	Translator Check	TPYK	Tip Party Signal Check
TLS	Trunk Link Selections	TR1	Take Trouble Record and Give Trouble Release
TLT	Translation Trouble	TR1A	First Trial
TM	Marker Off-Normal Timing	TR2	Second Trial
TMB	Time Maintenance Busy	TR2A	Second Trial
TMK	Tandem Check	TR2B	Second Trial
TMR	Terminating Match Required	TR2C	Second Trial
TMS	Timing Start	TR2D	Second Trial
TN	Theoretical Number	TR2E	Second Trial
TNA	Test Number Group Allotter	TR2F	Second Trial
TNAN	Tone and Announcement	TRA	Trouble Recorder Time Alarm
TNK	Trunk Number Check	TRB1,2,3	Trouble Recorder Busy
TNR	Trunk Number Release	TRC	Trunk Confirm
TOA	Tandem Outgoing Auxiliary	TRF	Transfer Class
TOB	Trunk Observing	TRF1-4	Transfer Class
TOBS	Trunk Observing	TRL	Trouble Release
TOG1-6	Tandem and Toll Outgoing Class	TRL1	Trouble Release Without Taking Trouble Record
TOK	Status Test OK	TRN	Trunk Number
TOKA	Status Test OK Auxiliary	TRR	Take Trouble Record and Give Normal Release
TOKL	Status Test OK Lock	TRRA	Trouble Record Request Auxiliary
TOL	Toll Class	TRS	Transfer Start
TOS	Toll Route Series	TRSA	Trouble Recorder Start Auxiliary
TP	Tip Party	TRST	Trouble Recorder Start
TPA	Tip Party Auxiliary	TRT	Trouble Recorder Timing
TPB	Tip Party Auxiliary		
TPK	Tip Party Check		

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
TRTR	Trouble Recorder Trouble Release	UK	Units Check
TS0-9	Trunk Selected	UKA	Units Check Auxiliary
TSC0-9	Trunk Screening	UT	Units Transfer
TSE1,2	Trunk Select Enable	VC1	Vacant Code Intercept
TSK	Trunk Switch Check	VCIA	Vacant Code Intercept Auxiliary
TST	Test Call	VF0-4	Vertical File
TSTS	Test Status	VFL	Vertical File Lock
TT	Toll Translation	VFNO-4	Vertical File Number
TT0-9	Test Trunk	VFT0-4	Vertical File Test
TTA	Test Trunk Auxiliary	VG	Voice Grade
TTF	Tripled Trunk Link Frames	VG0,1,2,4,7,10	Vertical Group
TTK	OTT Relay Check	VGL	Vertical Group Lock
TTL	Terminating Treatment Lock	VGN0-11	Vertical Group Number
TVA	Transverter Test Call	VGT0-11	Vertical Group Test
TW	Trunk Preference (W)	VLB	Video Line Busy Set
TWT0-4	Two-Way Trunks	VLO	Video Line Override
TX	Test Cross Relays (Manually Operated to Remove Battery For Current Flow Tests)	VLR	Video Line Busy Release
TX1	Test Cross Relays (Manually Operated to Remove Battery For Current Flow Tests)	VP	Vacant Code, Partial Dial
TXC0-9	TX Code Translator	VTC	Vacant Code
TXD	Translate "D" Digit	VTK1	Vertical Group Test Check
TYM	NG Timing	VWC	Verify Wideband Class
TYM1	Timing For PBX Allotter	WAT	Wideband Allotter Transfer
TYMA	Auxiliary to TYM	WB	Wideband
TZ	Trunk Preference (Z)	WB0-2	Wideband Request
U0,1,2,4,7	Units	WBA	Wideband Request Auxiliary
UA	Select Route Units Advance	WBA1	Wideband Request Auxiliary
UC	Units Cut In	WBC1,2,3	Wideband Control
		WBK	Wideband Check
		WBKA	Wideband Check Auxiliary
		WBL	Wideband Link
		WBL1	Wideband Link Auxiliary

<u>Designation (Cont)</u>	<u>Meaning</u>	<u>Designation (Cont)</u>	<u>Meaning</u>
WBR	Wideband Route	WKC	Working Code
WBS	Wideband Start	WLO-9	Wideband Link Selector
WBT0-2	Wideband Class	WLA	Wideband Link Selector Auxiliary
WCGK	Wideband C- Lead False Ground Check	WLB	Wideband Line Busy
WCH0-9	Wideband Channel Selector	WLBT	Wideband Line Busy Test
WCHA	Wideband Channel Selector Auxiliary	WLC,WLC1	Wideband Line Link Control
WCK	Wideband Channel Check	WLPK	Wideband Line Frame Check
WCN	Wideband Continuity Test	WLGK	Wideband Line Ground Check
WCT0-9	Wideband Channel Test	WLIT	Wideband Line Idle Test
WCV	Wideband Class Verified	WLK	Wideband Line Check
WDC1	Wideband Double-Connection Test Auxiliary	WLKB	Wideband Links Busy
WDCA	Wideband Double-Connection Test Auxiliary	WLT0-9	Wideband Link Test
WDCT	Wideband Double-Connection Test	WMB	Wideband Maintenance Busy
WDP	Wideband DATA-PHONE	WMBA	Wideband Maintenance Busy Auxiliary
WDTI	Wideband Dial Transfer Identification	WMM	Wideband Mismatch
WDTF	Wideband Dial Transfer	WMXT	Wideband Master Cross Test
WDZ	Wideband Dial Zero	WONX	Wideband Off-Normal Cross
WFA	Wideband Fuse Alarm	WPG0-2	Wideband Peg Count
WFA1	Wideband Fuse Alarm Auxiliary	WPP	Wideband PICTUREPHONE
WFC1,2	Wideband False Cross	WPR	Wideband Paired Line Link
WFCk	Wideband False Cross-Check	WRA	Wideband Route Advance
WFCT	Wideband False Cross-Test	WRM	Wideband Route Memory
WFMP	Wideband Failure to Match Path	WRM1	Wideband Route Memory
WHS1,2	Wideband Hold Magnet Start	WRV	Wideband Link Reverse
WJGK	Wideband Junctor Ground Check	WSL	Wideband Sleeve
		WSLA	Wideband Sleeve Auxiliary
		WSRK	Wideband Sleeve Release Check

<u>Designation (Cont)</u>	<u>Meaning</u>	
XTG1	Cross on TG0-19 Leads to Trunk Link	(a) Continuity Test Circuit - SD-1C292-01.
XTRK	False Ground on TRK Lead to Marker Connectors	(b) Line, Line Link, and Connector Circuit - SD-25548-01.
XTRL	False Ground on TRL Lead to Marker Connectors	(c) Trunk Link and Connector Circuit - SD-25549-01.
XTS	Crossed Trunk Switch Select Magnets	(d) Number Group and Connector Circuit - SD-25556-01.
XTS1	False Ground on Trunk Switch Select Magnets	(e) Miscellaneous Circuit - SD-25574-01.
XTV	Crossed TVA and SCC Relays	(f) Marker Connector Circuit - SD-25586-01.
XVF	Crossed Vertical File	(g) Outgoing Sender Connector Circuit - SD-25587-01.
XVGB	Crossed VGB Relays	(h) Power Ringing and Tone Distribution Circuit - SD-25599-01.
XWB	Crossed Wideband Link	(i) Automatic Monitor, Register, and Sender Test Circuit - SD-25680-01.
XWBA	Crossed Wideband Link Auxiliary	(j) All Markers Busy on All Transverters Busy Circuit - SD-25695-01.
XWCH	Crossed Wideband Channel	(k) Master Test Frame Jack, Lamp, and Key Circuit - SD-25762-01.
XWJS	Crossed Wideband Junctor Select Magnet	(l) Master Test Frame Plant Register Circuit - SD-25793-01.
XWLH	Crossed Wideband Line Hold Magnet	(m) Group Busy Circuit - SD-25795-01.
XWLS	Crossed Wideband Line Select Magnet	(n) Master Test Control Circuit - SD-25800-01.
XWSL	Crossed Wideband Sleeve	(o) Master Test Frame Connector Circuit - SD-25805-01.
XWTS	Crossed Wideband Trunk Select Magnet	(p) Foreign Area Translator Connector Circuit - SD-25864-01.
XWVG	Crossed Wideband Vertical Group	(q) Traffic Register Circuit - SD-25892-01.
XXN	Area Code Translator "C" Digit Not 0	(r) Automatic Progression Trunk Test Circuit - SD-25938-01.
XXO	Area Code Translator "C" Digit Not 0	(s) Incoming Register Test Circuit - SD-25988-01.
		(t) Service Observing Register Connector Circuit - SD-26015-01.
		(u) Master Traffic Control Circuit - SD-26020-01.
		(v) Originating Register Marker Connector Circuit - SD-26023-01.
		(w) Incoming Register Marker Connector Circuit - SD-26025-01.

3. FUNCTIONS

3.01 None.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet, the connecting information thereon is to be followed.

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- (x) Preference Control Circuit for Marker Connectors - SD-26029-01.
- (y) Line Link Connector Circuit - SD-26031-01.
- (z) Trunk Link Circuit (2W) - SD-26032-01.
- (aa) Trunk Link Connector Circuit - SD-26033-01.
- (ab) Number Group Circuit - SD-26034-01.
- (ac) Number Group Connector Circuit - SD-26035-01.
- (ad) Trunk Link Circuit (4W) - SD-26037-01.
- (ae) Preference Control and Make-Busy Circuit for Number Group, Line Link, Outgoing Sender, and Trunk Link Connector - SD-26039-01.
- (af) Outgoing Sender Circuit (typical) - SD-26050-01.
- (ag) Outgoing Sender Group Release Circuit - SD-26055-01.
- (ah) Outgoing Sender Connector Circuit - SD-26059-01.
- (ai) Service Observing Trunk Selection and Control Circuit - SD-26205-01.
- (aj) Originating Line Identifier Circuit - SD-27606-01.
- (ak) Traffic Register Translator Circuit - SD-27616-01.
- (al) Office Test Frame Test Circuit - SD-27633-01.
- (am) Office Test Frame Trouble Indicator Circuit - SD-27634-01.
- (an) Sender Group Busy Circuit - SD-27638-01.
- (ao) Trunk Test Register Circuit - SD-27643-01.
- (ap) Transfer Register Marker Connector Circuit Marker Part - SD-27680-01.
- (aq) Traffic Sample Circuit - SD-27681-01.
- (ar) Status Connector Circuit - SD-27739-01.
- (as) Peg Count Auxiliary Circuit - SD-27745-01.
- (at) Access Group Controller Circuit - SD-27748-01.
- (au) Route Translator - SD-27781-01.
- (av) Route Distributor Circuit - SD-27783-01.
- (aw) Route Translator Connector - SD-27784-01.
- (ax) Direct Access Pretranslator Connector Circuit - SD-27801-01.
- (ay) Immediate Ring Control Circuit - SD-27820-01.
- (az) Selected Trunk Group Traffic Sampling Circuit - SD-27826-01.
- (ba) Automatic Range Extension Test Circuit - SD-27831-01.
- (bb) Called Number Detector Circuit for Calling Line Identification - SD-27833-01.
- (bc) Traffic Sample Monitor and Test Circuit - SD-27876-01.
- (bd) Trunk Link Circuit (12 Level) - SD-27879-01.
- (be) Trunk Test Register (Arranged for Wideband) - SD-27881-01.
- (bf) Automatic Intercept Sender Connector Circuit - SD-27888-01.
- (bg) Wideband Junctor Switch Group Marker Lockout Circuit - SD-27904-01.
- (bh) Wideband Line Link Connector - SD-27905-01.
- (bi) Wideband Trunk Link Connector - SD-27906-01.
- (bj) Interface and Control Circuit - SD-28075-01.
- (bk) Distributor and Scanner Application for ETS - SD-28113-01.
- (bl) ETS Power and Data Interface Circuit - SD-28114-01.
- (bm) Marker Distributor Circuit - SD-28115-01.
- (bn) Distributor and Scanner Circuit - SD-28083-01.

- (bo) Computer Line Verification Access Circuit - SD-28084-01.
- (bp) Ringing Circuit 800 Type Plant - SD-80978-01.
- (bq) Time Delay Control Circuit - SD-94820-01.
- (br) Traffic Usage Recorder Circuit - SD-95738-01.
- (bs) Traffic Data Processor No. 1A - SD-95968-01.
- (bt) Wideband Link Circuit - ES-27811-01.

- (b) Test 1. Reduce 213,000 ohms to 183,000 ohms $\pm 1\%$.
- (c) Test 2. Reduce 183,000 ohms to 173,000 ohms $\pm 1\%$.
- (d) Test 3. Reduce 173,000 ohms to 141,000 ohms $\pm 1\%$ and change ground potential to a negative potential obtained from the mid-point of a voltage divider made up of 456 ohms $\pm 1\%$ to ground and 4008 ohms $\pm 1\%$ to -48.5 volt battery.
- (e) Test 4. Same as Test 3, with 141,000 ohms reduced to 130,000 ohms $\pm 1\%$.

The tests should be applied in sequence.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 The marker is capable of performing all the service functions specified in this circuit description and meeting all the requirements of the circuit requirement tables.

5.02 The marker is capable of performing its functions when the voltages are within the limits specified in the SD. The timing requirements are met when the voltages are within the following limits.

	<u>Min Voltage</u>	<u>Max Voltage</u>
-48 Volt Signaling	-48.5	-50.0
+130 Volts	+133.0	+135.0
20 Cycle Ringing	86.0	87.0

5.03 Contact protection networks are capable of meeting an electrical check (tone or equivalent) to verify the presence and proper wiring of each capacitor, resistor, retard coil, or combination of these that is provided for contact protection or surge absorption purposes.

5.04 The crosspoint continuity test feature of the marker should be made as follows:

- (a) Apply 20-cycle ringing to the frame.
- (b) Place marker in a position to make continuity test with the RCTA relay blocked operated.

5.05 The test conditions applied to the ART lead should be as follows:

- (a) Normal condition before start of test. Ground through 213,000 ohms $\pm 1\%$.

5.06 The CON tube and relay should not operate at the end of Test 2, but should operate when Test 4 is applied.

5.07 With markers arranged for wideband switching, the wideband continuity testing feature may be checked by the following procedure:

(a) With the oscillator detector in the idle state (its ON relay normal), its CON relay should be operated. If CON is not operated, verify that the oscillator and detector level adjustments are set to provide the detector with -20 dBm before proceeding.

(b) Operation of the oscillator detector relays in a certain sequence should cause the marker WCN relay to operate and release according to the following table.

OSCILLATOR DETECTOR RELAYS OPERATED	OSCILLATOR DETECTOR RELAYS RELEASED	STATE OF WCN
TB,MT60	A,B,C,D,MT61,LB	Released
TB,MT60,A,C	B,D,MT61,LB	Operated
TB,MT60,C	A,B,D,MT61,LB	Released
TB,MT60,D	A,B,C,MT61,LB	Operated
TB,MT60,A,D	B,C,MT61,LB	Released
LB,MT60,MT61,A	B,C,D,TB	Operated
LB,MT60,MT61	A,B,C,D,TB	Released
LB,MT60,MT61,B	A,C,D,TB	Operated
LB,MT60,MT61,A,B	C,D,TB	Released

6. ALARM INFORMATION

TROUBLE RECORDER REQUESTS

6.01 When the marker encounters a trouble, as indicated by the operation of a cross detecting relay, the work timer, the short delay timer, or the long delay timer, an alarm is sounded and the trouble recorder is seized. A minor alarm is sounded on first trial calls, and a major alarm is sounded on second trial calls. Both the major and minor audible alarms are accompanied by the lighting of the red trouble recorder request (TRR), lamp on the control bay at the master test frame. Also, a white or red main aisle pilot lamp and a white or red aisle pilot lamp lights at the aisle location of the trouble recorder frame for either minor or major alarms, respectively.

6.02 The trouble recorder timer (TRTR) circuit in the marker is started when the trouble recorder is summoned; it allows 2.0 to 3.5 seconds for the trouble recorder to take a trouble record. If the trouble recorder is busy, a display lost (DL-) lamp on the control bay lights. Momentary operation of the TRR- AR, alarm release, key on the master test frame retires the alarm and lamp signals.

6.03 The trouble recorder is also summoned when any of the following conditions occur:

- (a) A ground test failure on second trial (with the CGT key unoperated at the master test frame).
- (b) The marker is ready to disconnect when setting up a connection from a line to a permanent signal trunk. (This is dependent upon the position of the APS/NPS key at the master test frame.)
- (c) The marker is ready to disconnect when a marker connector reports a transferred start lead.
- (d) An incoming register reports a link release failure.

TROUBLE RECORDER TIME-OUT ALARM

6.04 If the TRTR circuit is not stopped within the allotted time by the trouble recorder restoring to normal, the marker attempts to release itself by operating the DIS1 and DIS2, disconnect, relays. These relays ground the release lead to the register through the marker connector. The register and marker connector then release, in turn releasing the marker.

6.05 If the trouble recorder timer completes its cycle, it causes the following:

- (a) The major alarm is sounded.
- (b) The red time alarm (TA) and red trouble recorder time alarm (TRT) lamps on the marker frame are lighted.
- (c) A red main aisle and red aisle pilot lamp light.

6.06 The alarm is retired and the lamps extinguished by the momentary operation of the AR key on the marker frame.

OVERALL TIME-OUT ALARM

6.07 The marker OAT, circuit is started when a marker is seized by a marker connector, when the MB lead to a marker connector is grounded or when a cross detecting relay operates. It is stopped when the marker is returned to normal, or when the marker is made busy by inserting a No. 322A plug into the marker make-busy jack at the master test frame.

6.08 If the marker OAT completes its timing cycle the following occurs:

- (a) The major alarm is sounded.
- (b) The red TA lamp on the marker frame lights.
- (c) The red main aisle and aisle pilot lamps light.

6.09 The alarm is retired and lamp extinguished by momentary operation of the AR key on the marker frame.

ALL MARKERS BUSY ALARM

6.10 Whenever a marker is seized, or if off-normal for any reason, except a test call from the master test frame, or when a fuse is operated the white M-C-, marker is use, lamp lights on the jack bay at the master test frame.

6.11 When all markers in a group become busy the white CAMB lamp on the jack bay lights at the master test frame. If a group of markers remain busy for 40 to 68 seconds, a minor alarm sounds, a white main aisle, a white aisle, and the white CAMB lamps on the jack bay light. The alarm and the lamps, with the exception of the CAMB lamp, lock under control of the AMB- AR key. The CAMB lamp remains lighted as long as all markers in the group are busy.

FUSE ALARM

6.12 Operation of the marker 48-volt or 130-volt fuses causes the MB relay to operate. The major alarm sounds, the red main aisle and the red aisle pilot lamps and the red fuse alarm (FA) lamp on the marker frame lights. The removal of the operated fuse retires the major alarm and extinguishes the FA and red aisle pilot lamps. The fuse guard (FG) lamp on the marker frame and the associated amber marker fuse guard (MFG) lamp on the master test frame then light. The momentary operation of the AR key restores the marker to service and extinguishes the FG and MFG lamps.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 When necessary, a marker may be taken out of service by inserting a 322A plug

into the M-C- MB, make-busy jack associated with this marker at the master test frame jack bay. On the master test frame bay one M-C- MB jack is provided for each completing marker.

7.02 If the marker is in use when the plug is inserted, the white M-C-, marker in use lamp associated with the particular marker remains lighted until the marker completes its function, at which time the lamp is extinguished.

7.03 Inserting the 322A plug into the M-C- MB jack operates the make busy (MB) relay in the marker. Relay MB operate the marker connector busy (MCB-) relays which ground the CB lead to the marker connectors. The marker then appears busy to the connectors, thereby preventing seizure of the marker.

SECTION IV - REASONS FOR REISSUEB. Changes in ApparatusB.01 Added

RBT - 446F Diode - Option ZKC -
App Fig. 7

TNK - 446F Diode - Option ZIA -
App Fig. 45

PSG - 59H Resistor - App Fig. 172

LT - 426G Diode - App Fig. 180

LTL - 426G Diode - App Fig. 180

D. Description of Changes

D.01 First and Second Trial Trouble Indications to OTTIC - Option ZJZ is added to provide required wiring when option ZME is added to offices without option LM.

D.02 Marker Blockage in Autovon Office when Option ZYJ Added - The TOG calls selecting A triple in which the most direct route is cross-connected to early route advance fail, when option ZYJ is provided, because a route advance is made without a route relay being operated. With option ZYJ provided the TEA relay is operated on route advances (through the TCCA operated and TOGS nonoperated) when a route relay is not operated. The TEA relay locks operated and operates the TER relay. After completion of the route advance the TOG route relay is operated, which operates TOG relay. The call cannot be completed with both the TER and TOG relays operated. To prevent this condition, the TEA operate path is opened by a break contact of the SRL (early route advance) relay.

D.03 The AI Lead Added to Office Test Frame Trouble Indicator and Connector - The AI plant register lead is extended from the marker to the office test frame trouble indicator and connector circuit to provide a count of automatic intercept sender usage. This is necessary in offices which do not have a plant register circuit.

D.04 Trouble Permanent Signal Requires Ground on TC Lead to Common Overflow Trunk - When the permanent signal test feature is provided (App Fig. 172) the marker determines if a permanent signal is a receiver off-hook ROH or a trouble condition PSG. The ROH is routed to a permanent signal holding trunk while PSG is routed to a common overflow trunk. The common overflow trunk must be informed that a permanent signal is being connected in order to return the proper tone to the customer and light a PS lamp at the jack lamp and key circuit. This requires a ground on the TC lead. In order to obtain the ground, two route series relays are required in the marker. This modification provides an operate path for the PCN route series relay; and it, along with the normal common overflow route series relay CAA, will provide a path to ground the TC lead.

D.05 Correction for Trunk Service Observing in ETS/LAMA-C Offices - The marker is changed to provide a direct wire connection around the MBS1-9 contacts in the operate path of the TOBS relay. This change is required when ETS/LAMA-C is added to an office already equipped with App Fig. 40, since the MBS relays provided with Fig. 40 do not operate in ETS/LAMA-C offices.

D.06 Additional Changes for ETS Operation - Additional wiring changes are made for ETS operation.

D.07 AIS Sender Plant Usage Correction in Offices with Options ZMV and LL - When option ZMV was added for AIS sender usage plant register count, the wiring associated with contacts 11B (IFLG) and 9B (MT13) was changed from option LM to option LM and ZMV. This was done to cover the condition where option ZMV is provided without option LM. However, when option LM is not provided contact 9B (MT13) is used elsewhere in the circuit with option LL, the alternate to option LM. To avoid this conflict option ZIV is added to be used when option ZMV is added to offices with option LL.

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