CIRCUIT DESCRIPTION

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CD-26048-01
ISSUE 5D
APPENDIX 6B
DWG ISSUE 17B
DISTN CODE 1C02

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.01 Information is provided on the drawing for the use of 711 connectors on reused frames.

D.02 The CADs 20 and 22 are modified to correct information provided on Issue 15B, and to bring CAD 22 into agreement with FS103 and WE T drawings. These changes are made on a no-record basis per agreement with WE.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5243-AWM-ABVL-MAF

CIRCUIT DESCRIPTION

CD-26048-01
ISSUE 5D
APPENDIX 5B
DWG ISSUE 16B
DISTN CODE 1C02

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.01 Modifications are made in the Dial Pulse to Multifrequency (DP-MF) conversion feature which was added to the drawing on Issue 15B. These changes are made on a no-record basis to correct miscellaneous items including the addition of loops on contacts of the RP- relays, the assignment of a new battery C for the HA5- and ARP- relays, and the correction of errors in Circuit Notes 104 and 120.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5243-AM-ABVL-VK

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CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

A. Changed and Added Features

A.01 Provision is made for converting the 120 trunk bylink frame arrangement to nonbylink operation to permit the reuse of excess bylink frames for expanding the multifrequency facilities.

B. Changes in Apparatus

B.01 Added.

[5] AK26 Relays (HA5-), App Fig. 8

[5] AK26 Relays (ARP-), App Fig. 9

[10] 185A Networks, App Fig. 8

[10] 185A Networks, App Fig. 9

D. Description of Changes

D.01 Provision made for converting the 120 bylink trunk arrangement in this circuit to nonbylink operation to permit its use with MF trunks and registers. This modification provides for the interconnection of up to four bylink trunk frames for handling a total link group capacity of 480 MF trunks served by an MF incoming register group. The purpose of this change is to provide for reuse of the bylink frames when they are no longer required to function with step-by-step offices. The modification consists of wiring changes for the conversion of one, two, three, or four bylink frames and the addition of the apparatus shown in B.01 for horizontal group and frame identification.

(a) This conversion also affects existing options Y, V, T, and S, requiring the removal of option Y and the addition of option T on all converted frames, and the removal of option V and addition of option S on the second, third, and fourth converted frames. These changes are necessary to open existing TP-- relay connections to the bylink trunks on all frames over leads RL and LK, and to the test circuits over leads ST, LK, and BL on all except the first converted frame, and for adding relay TP00 in the preference chain on all converted frames and hold magnet L00 in the link switch TP- relay chain on the second, third, and fourth converted frames.

(b) Options ZO, ZQ, ZS, ZU, and ZX, all rated after-date Standard, denote the existing wiring required for standard operation of the bylink frame. The conversion arrangement involves the use of options ZN, ZP, ZR, ZT, ZV, and App Fig. 8 and 9, all rated A&M Only.

F. Changes in CD Sections

F.01 In SECTION I, 2.3, add the following:

Provision is also made for converting the above 120 trunk capacity bylink frame to nonbylink operation when bylink trunk traffic is reduced or eliminated due to ESS replacement of step-by-step offices. The excess bylink frames realized in the manner can be converted to provide an economical expansion of the multifrequency facilities in the office. A maximum of 4 converted frames can by interconnected to provide an additional MF link group consisting of 480 trunks served by 10 MF incoming registers.

F.02 In SECTION II, add the following:

7. DP TO MF CONVERSION OF BY-LINK FRAMES

The 120 trunk capacity bylink frame can be converted nonbylink operation to provide additional MF incoming trunk facilities. This arrangement permits the conversion of one, two, three, or four bylink frames for accommodating a maximum of 480 MF incoming trunks. In the converted arrangement, each frame consists of 6 horizontal groups of trunks with 20 trunks and 1 trunk preference chain per group. Operation of this preference chain on each converted frame is similar to that on the bylink frame. The register busy and preference chains through contacts of the RB- and RP- relays, involving the LO, B, BL, LK, SM, and TF leads, are extended in series through the converted frames in various orders of frame preference as determined by the number of frames involved. This chain of register preference is basically patterned after that used for the 160 trunk capacity arrangement and is depicted in FS102 of the SD.

In the converted arrangement, indications for identifying the horizontal group being served by a register are provided over leads RP0-4 on a 1-out-of-5 basis for horizontal groups 0-4. Horizontal group 5 is identified on a 2-out-of-5 basis by indications

on the RP1 and RP4 leads. The latter indications are provided with the HA5 (0-9) relays which are equipped on the first converted frame only, with the windings multiplied to corresponding RP- relay contacts on other converted frames in the link group. One HA5- relay per register is equipped for these indications.

Converted frame identification marks are provided over leads RPB, RPAB, and RPSA. Since only three leads are available for this function and four frames must be identified, frames 00-02 are identified on a 1-out-of-3 basis and frame 03 on a 2-out-of-3 basis. The latter identification is accomplished with the ARP (0-9) relays which are only equipped on frame 03. One ARP- relay per register is provided for this purpose. The first converted frame FR00 provides an indication on lead RPB, the second FR01 on lead RPAB, the third FR02 on lead RPSA, and the fourth FR03 over leads RPB and RPAB.

Conversion of the bylink frames to nonbylink operation also involves the removal of option Y and the addition of option T on all converted frames, and the removal of option V and addition of option S on the second, third, and fourth converted frames. The removal of option Y opens connections from the TP- relays to the bylink trunks over leads RL and LK since these are not needed with MF trunks. The removal of option V severs test circuit connections from the second, third, and fourth frames. The addition of option T is required to connect relay TP00 in the trunk preference chain, and the addition of option S is necessary for connecting hold magnet L00 to the TP- relay chain.

F.03 In SECTION III under 2. FUNCTIONAL DESIGNATIONS; add the following:

Relays

HA5 (0-9)	Horizontal Group Identification - for converted bylink frames
ARP (0-9)	Frame Identification - for converted bylink frames.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5243-AWM-ABVL-PJH

CIRCUIT DESCRIPTION

CD-26048-01
ISSUE 5D
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DWG ISSUE 14D
DISTN CODE 1C02

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CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.1 Circuit Note 102 is modified to clarify that, where vertical 00 is used for testing, option "T" is required in all link groups except those link groups equipped with by-link trunks. This involves drawing changes only.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5243-EHH-ABVL-CB

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.1 Changes are made to alter the multipling arrangement used between the terminal strips, switches, and other apparatus in order to facilitate the installation of equipment in the field. This involves CAD changes only.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5141-REL-RBC-PK

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.1 A new lead, designated "F", is added to the office test frame test circuit, under feature option "2M", which is required where this circuit is associated with the office test frame test circuit.

D.11 Existing leads "BL", "ST", "CO", "D", "T" and "R", provided under feature option "V", are shown connecting to the office test frame test circuit.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5611

KWH-MFF-AH

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK
CIRCUIT
WITH BY-LINK OPERATION

TABLE OF CONTENTS

SECTION I - GENERAL DESCRIPTION

1. GENERAL

1.1 In the No. 5 Crossbar office all incoming trunks appear on incoming register link frames. The incoming register link frame connects the trunk to incoming registers which receive the called number from the distant office. Other information required for setting up the call is obtained from the incoming register link. The register is connected to a marker through the incoming register marker connector. The marker then connects to the trunk link frame indicated by the register link and operates the trunk F relay over a lead through the incoming register marker connector and incoming register link. The connector register and register link circuits are held by the marker until it has completed its function.

2. The register link can be divided into the following functional parts:

2.1 Link Switches

Trunks are connected to the verticals of the switches, twenty to a switch. Registers are connected to the horizontals, with a maximum of ten registers. A 160 trunk capacity frame consists of up to eight switches and a 120 trunk frame may consist of up to six switches.

The switches of a link group are subdivided into horizontal groups by the control circuit making it possible to serve calls simultaneously from each of several groups. In frames with 120 trunk capacity each switch is a horizontal group. In frames of 160 trunk capacity either one or two switches, called basic and supplementary, comprise a horizontal group.

2.2 Trunk Preference, Register Preference, Busy and Connector

The trunk preference circuit consists of one TP- relay for each trunk. Each horizontal group contains one trunk preference chain. Trunks within the chain are served one at a time and when competing, will be served according to their position in the chain. Several work leads are carried on each TP- relay.

The register control circuit consists of relays RP and RB which are furnished one per register per horizontal group. The register preference relays RP carry a number of work leads in chains and the register busy relays RB perform the function of controlling the start lead from the trunk preference relays.

One connector relay C- is furnished per horizontal group per register. When it is necessary to furnish trunk number information to the register an auxiliary connector relay CA- is provided. These connector relays transmit the frame number, trunk class and trunk number information to the register.

2.3 Types of Frames

Provision has been made for two types of 120 trunk capacity frames. One type is for dial pulse link groups where any or all of the trunks are of the by-link type. The other type is the combined link group frame serving dial pulse trunks and multifrequency trunks. The combined link group provides access to a maximum of seven dial pulse and three multifrequency registers.

Provision has been made for two types of 160 trunk capacity frames. One type is for dial pulse (non by-link), revertive pulse or multifrequency trunks. The other type is the combined link group serving dial pulse (non by-link) and multifrequency trunks or revertive pulse and multifrequency trunks. The combined link group provides access to a maximum of seven dial pulse or revertive pulse registers and three multifrequency registers. A minimum of two registers of each type must be supplied in the combined link group.

In the 160 trunk frame there are 8 switches and since some groups may exceed this capacity, provision has been made to connect two or three such frames together to the same group of registers.

2.4 Trouble Recorder

To aid in finding trouble, the trouble recorder card carries a punch for the link horizontal group and frame number. The leads are carried from the register preference relays through the incoming register marker connector to the trouble recorder.

2.5 Testing

The 00 vertical of the switch in horizontal group 0 in each link group is reserved for use as a register test vertical. In the combined link group frame of 120 trunk capacity, the 00 vertical in horizontal group 2 is also used as a test vertical. Through the test verticals, the automatic monitor or the incoming register test set may obtain access to any register.

2.6 General Operation

Trunk preference relay TP- operating from a trunk circuit closes the circuit to operate the register preference relay RP- of the first idle register. The register then operates its register busy RB- relays in all other horizontal group appearances. Control leads through TP- and RP- relays are closed for operating the register select magnet and connector relays in the horizontal

B

group. Trunk frame, class and trunk number information passed through the connector is received in the register and checked. The hold magnet of the trunk is then operated, after which the TP- and RP- relays are released under control of the register. The RB- relay in the horizontal group in which the trunk is located is then operated. The connection through the link switch is held by the register. Registration of digits and control of the trunk is accomplished over the leads through the switch crosspoints. On by-link trunks pulsing can take place over the by-link lead BL through the TP- and RP- relays before closure of the crosspoints.

2.7 Phase I and II Centrex

In Phase I and II Centrex, the TP- relay associated with a trunk could be required to operate three times on a Centrex call. The first operation is on the incoming call. The TP- relay will operate a second time when a transfer to the attendant is requested, and a third time when the attendant requests a register to complete the transfer call.

The operation of the TP- relay causes the operation of the associated RP- relay over the "PRA" or "PRB" lead depending on the setting of the trunk control relays.

For by-link trunk operation in Centrex, the trunk will be associated with two TP- relays. One of the TP- relays will be located on the by-link frame and associated with a dial pulse register and the other TP- relay will be located on a multifrequency frame. Only one TP- relay will operate at a time however and the trunk will control the selection of the proper TP- relay.

SECTION II - DETAILED DESCRIPTION

1. OPERATION OF TRUNK PREFERENCE RELAYS

When a trunk requires connection to a register it connects battery to the ST- lead to operate its trunk preference relay TP- as shown in FS1.

Since all the TP- relays in a horizontal group are in a chain of preference only one trunk call can proceed at a time. The operation of a TP- relay such as the one shown for an intermediate trunk opens ground from the windings of all the higher numbered TP- relays. Lower numbered TP- relays may operate but can do no work since all of the work leads are in a chain running in the opposite direction and these are therefore opened at the higher numbered relays. If, during the time one call is being served other TP- relays should operate, these trunks will be served in order starting from the highest number. Trunks which are not able to operate their TP- relays must wait until the last operated TP- is released before being served.

2. SELECTION OF IDLE REGISTER

2.1 Start Chain (ZF Option)

Referring to FS2 or FS7, ground from the operated TP- relay operates the register preference relay RP- of the first idle register in the chain of preference through the register busy relay RB- contacts.

It will be noted that this chain of preference is different in each of the horizontal groups, the object being to distribute the traffic over the registers in such a way that there is a minimum of interference between horizontal groups. Since this is a closed chain, i.e., it progresses from the last register in the chain back to the first, these chains may be thought of as rings with the start leads entering the chain at different points in each horizontal group. The purpose of closing the ring is to permit shifting the starting point if this becomes necessary because of wear on the preferred circuit. It is also to be observed that the number sequence of the registers is the same in each horizontal group.

Start Chain (ZG and ZI options)

When FS2 is equipped with ZG and ZI options, it will be noted that there are now two different chains of RB- relay contacts associated with two different types of registers. The two different chains of RB- relay contacts allow the transfer type trunk to be associated with either of two types of registers depending on the setting of the control relay in the trunk.

Start Chain (ZG and ZH Options)

When FS2 is equipped with ZG and ZH options, there is only one chain of RB- relay contacts associated with seven registers available to the trunk. This allows the transfer and non-transfer type trunks to be mixed in the same horizontal group on a Centrex frame.

It will also be noted that the battery for operating the RP- relay, supplied by the associated incoming register over lead B is taken through a chain of contacts on the RP- relays associated with that register. Thus if during a period of heavy load two different horizontal groups should be directed toward the register preference relays for the same register and simultaneous calls should occur, only one RP- relay would operate. The battery chains through the RP- relays are so arranged that the initial preference of a register for a horizontal group is the same as the initial preference of a horizontal group for a register, for instance horizontal group 0 has register 0 as first choice and the RP0 relay in register 0 is nearest to battery. This results in distributing the register choices for horizontal groups for the purpose of minimizing what might be called "grooving" under heavy load conditions. When all registers are busy and calls are waiting, the same horizontal group will not usually be preferred as successive registers become free even though all waiting calls are directed to the same register. Since generally, there are more registers than horizontal groups the RP- battery chains are necessarily in the same order in more than one register control, for instance, as shown in FS2, control relays for register 0, 4 and 8 have the same order of preference and 0, 4 and 8 are the first, second and third choices respectively in horizontal group 0.

Referring now to the sequence chart, the operation of the RP- relay starts several circuit operations. (1) On a by-link trunk, battery on the LK lead operates RL in the trunk as a signal that the by-link (BL lead) is closed (FS1). (2) The off normal and register busy relays in the register and in the automatic monitor when furnished, are operated over the ON lead, FS2. (3) The select magnets for the switch level with which the register selected is associated, on the switch or switches associated with the horizontal group in which the trunk is located are operated. See FS5 and FS6 or FS9. (4) The connector relays C- and CA- are operated.

2.2 By-Link Lead Closure and Control of Trunk Preference Relays

Closing of the LK lead also gives control of the TP- relay to the register.

B

The subsequent operation in by-link trunks will be found by reference to one of these circuits.

2.3 Register Made Busy

Closure in the register of the RB- relays operates the RB- relays (FS3 and 8) in the link on all horizontal groups except the one being served. That RB- relay is held shunted down by ground on the LO lead. Thus in all other horizontal groups the start chain is advanced beyond the register selected.

2.4 Closure of Switch Crosspoints

Operation of the register off normal relay and a link select magnet closes a circuit through the operated trunk preference relay to operate the hold magnet for the trunk being served. This operating ground is extended through the crosspoints to operate relay H which opens the circuit through the trunk preference relay and closes the circuit to the double connection check relay DCK. DCK operates unless there is a ground already on the crosspoint such as would occur if two crosspoints were closed to the same register. Then, DCK would be shunted down and a marker would be called in for a trouble record. Otherwise, the DCK locks and the hold magnet is held over the HM lead through the crosspoint. Register relay H releases the select magnet.

2.5 Connector Functions

Connector relays C- and CA- remain operated until the information transmitted through their contacts is received and checked by the register after which relay CK or ON1 in the register operates to release these relays. Lead information through the connector relays is as follows:

Trunk Link Frame Number. This is in two parts, the tens number and the units number. The tens number is on a horizontal group basis. All trunks in a horizontal group must be associated with the same group of ten trunk link frames. Cross connections from terminals FG to G0, G1 or G2 determine the first, second or third group of ten trunk link frames respectively. Terminal G2 is provided as ZA option.

One out of ten leads "TF0-9" is grounded by a TP- relay to indicate the trunk link frame units number. This indication is determined by cross-connections from terminals TPU- to TFU0-9.

Trunk Class. One out of eleven leads is grounded by a TP- relay to indicate the trunk class to the register. In all cases except for Phase I and II Centrex transfer-type trunks and 2 way operator office trunks the class indication is determined by a cross-connection from TPC- to CL00-10. In the case of a Phase I and II Centrex transfer type trunk, ZC option and CLA- punching will be provided, 1 per trunk. CLB- and CLC- punchings will also be provided 1 per horizontal group. A cross connection must be provided from each CLA-, CLB- and CLC- punching to the CL00-10 required to give class indication for incoming trunk, transfer or attendant class respectively. The TP- relay of the transfer type trunk will then ground one of the class punchings over the CLA-, CLB- or CLC-leads depending on the setting of the control relays in the trunk.

For by-link trunk operation in Centrex, the TP- relay associated with the by-link appearance will ground the TPC punching. When the TP- relay associated with the MF appearance of the by-link trunk operates, it will ground either a CLB- or CLC- punching depending on the setting of the control relay in the trunk.

When 2 way operator office trunks are furnished a CLB and a CLC punching will also be provided, 1 per horizontal group. The CLB punching will be cross connected to the class for an incoming call and the CLC punching will be cross connected to the class associated with a no-test call.

Where by-link and direct pulsing trunks are in the same link group the trunks are assigned to different horizontal groups and an indication is given to the register when the TP- relay operates. This indication is determined by cross-connecting terminals B to BL or DP.

Trunk Number. For trunks having line link appearances the register requires a ground indication on one lead out of each of three sets of leads. These three ground indications are translated in the register to the trunk number group number. All transfer type trunks in Phase I and II Centrex require trunk number indication for the MF registers.

The trunk hundreds is indicated by the cross-connection of terminal A for trunks on basic switches or terminal B for trunks on supplementary switches to terminals LH0-3 (FS1). In dial pulse link groups with any or all by-link trunks, terminal A of horizontal groups 0-4 is cross-connected to terminal LH0 and terminal A of horizontal group 5 is cross-connected to terminal LH1. The choice of terminals to be used is indicated in the cross-connecting information and depends upon the translation in the register and the number group hundreds and tens block to be used for these trunks.

One of the leads LT0-9 is grounded by a TP- relay to indicate the half switch on which the trunk is located.

One of leads LU0-9 is grounded by a TP- relay to indicate the vertical on a half switch on which the trunk is located.

3. RELEASE OF CONTROL CIRCUIT

When the register has been satisfied as to the completeness of the information received and the closure of the crosspoints (the detailed relay operations vary in

different types of registers) the RLK operates and opens the LO and LK leads to the link. LO opened removes the shunt on RB- allowing it to operate; LK opened releases TP-. The register start is thus advanced and the trunk preference circuit freed for a new call.

4. RELEASE OF REGISTER

On release of the register the hold magnet of the switch is released. The RB- leads to the RB- relays are also opened but only those RB- relays release that are associated with horizontal groups in which no TP- is operated. In groups where a TP- is operated all operated RB- relays are held in order to keep the start chain closed to the register being selected at the moment. See FS3 or 8. Thus overlapping calls in a group will progress thru the start chain to successive registers. When the last register in the chain is selected the RB- relays of all preceding idle registers will release, redirecting the start circuit to the beginning of the chain.

5. TROUBLE INDICATION

The register is arranged to call in a marker to take a trouble record in the event of certain link troubles. Location of the trouble condition is facilitated by identifying the horizontal group and frame being served. Two ground circuits are closed by the RP- relays for this purpose, one multiplied by horizontal groups and the other by frames. These leads connect directly to the incoming register marker connector.

The trouble recorder card provides for five horizontal groups, these being used for the older register link frames per SD-25585-01. For the new link frames with four horizontal groups only four punches are used. However, for the frames with 6 horizontal groups the indications for the first five are given along with RPB frame punch and for the sixth horizontal group as horizontal group 0 with a RPAB frame punch. See FS2 and FS7. That is, the sixth group is treated as the first of a second frame and since a second frame is never furnished with the 120 trunk size frame there is no conflict.

6. TEST VERTICAL FOR REGISTER TESTS

The 00 vertical in horizontal group 0 of the first frame is used as a test vertical. In the combined link group frame, the 00 vertical in horizontal group 2 is also used as a test vertical. These verticals are used by either the automatic monitor or the incoming register test circuit for testing incoming registers. The TP- relay wiring is modified to open the register start circuit, and to extend this function to the test circuit.

The particular incoming register to be tested is selected by the test circuit and is made busy by operating the associated RB- relays in the link. The TP- relay is then operated and when all calls in the horizontal group are served ground will be connected to the test circuit on the B- lead as a signal to go ahead. Relay RP- is then operated from the test circuit and performs its usual functions. RB- releases due to the shunting ground on the LO lead. The automatic monitor will check for this release but the incoming register test circuit will not.

The closure of the hold magnet and crosspoints is controlled in the automatic monitor to permit testing the link release, double connection and by-link lead features when required.

In links with by-link trunks and direct pulse trunks where the DP and BL terminals are cross-connected, the ground signal through TP- is omitted and the register is primed directly by the test circuit for either condition.

The test circuit can test any register class relay as the leads for all class relays are brought into the test circuit and no permanent cross-connection is made to the TP- relay as on other trunks.

The trunk link frame tens is the same as the other trunks in the horizontal group and 0 is arbitrarily used for the units.

When trunks with trunk numbers are in the link group, test is made of this feature in the register by treating the test vertical as though it were a trunk with a trunk number. The CA- relay will then be furnished in the horizontal group whether there are trunks requiring a trunk number in the horizontal group or not.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.1 None.

2. FUNCTIONAL DESIGNATIONS

Relays

TP00-19	Trunk Preference -	First 20 trunks in a horizontal group
TP20-39	Trunk Preference -	Second 20 trunks in a horizontal group
RB-	Register Busy	
RP-	Register Preference	
C-	Connector -	for trunk frame and class leads
CA-	Auxiliary Connector -	for trunk number leads

Switches

L	Link Switch -	for first 20 trunks in a horizontal group
SL	Supplementary Link Switch -	for second 20 trunks in a horizontal group

3. FUNCTIONS

3.1 To operate the associated trunk preference relay TP- when battery is closed to the start lead ST by the trunk.

3.11 To prevent higher numbered TP- relays in the horizontal group from operating and to open all work leads in the chain from lower numbered relays.

3.2 With TP- operated.

3.21 To connect battery to the RB- lead to hold any operated register busy relays RB- in the horizontal group from releasing.

3.22 When the last RB- relay in a horizontal group operates to release the previously operated relays not held by busy registers.

3.23 To ground a start lead, ST, PRA or PRB depending on the type of trunk, and operate the register preference relay RP- of the first idle register in the start chain.

3.24 To prevent operation of other RP- relays associated with the same register.

3.3 With RP- operated.

3.31 To ground the ON lead to the register selected as a seizure signal.

3.32 To ground the ON lead to the automatic monitor circuit when furnished, as a seizure signal.

3.33 To hold the TP- relay over the LK lead.

3.34 To close the BL lead from trunk to register to provide by-link pulsing path where required, or a check path for CO relays in direct pulsing trunks.

3.35 To operate connector relay C- and when furnished relay CA-, associated with the register and horizontal group.

3.36 To close a path for operating the select magnet on the link switch or switches associated with the trunk being served and the level corresponding to the register selected.

3.4 When the register circuit busy relay RB- operates.

3.41 To operate all link RB- relays associated with that register except the one in the horizontal group in which the call originated and to prevent that one from operating by means of shunting ground on the LO lead from the register circuit.

3.42 To pass the register start leads in the horizontal group made busy to the next succeeding idle register preference relay in the chain.

3.5 With C- and CA- operated.

3.51 As determined by cross-connections to ground one of the 10 trunk link frame units leads "TFO-9", one of class leads "CLO-10" to the register.

3.52 As determined by cross-connections to ground the FG0, 1 or 2 leads to the register. Lead FG2 is ZA option.

3.53 In horizontal groups where relay CA- is furnished to ground one "LT-" lead to the register depending on the half switch on which the trunk is located.

3.54 In horizontal groups where relay CA- is furnished to ground one "U-" lead to the register depending on the vertical on which the trunk is located.

3.55 As determined by cross-connections to ground one of leads "REG", "REG 1", "BLG" or "DPG" and one of leads "SUP" or "SUP 1" to the register.

3.6 After select magnet operation to operate the hold magnet associated with the trunk being served.

3.7 When the crosspoints of the link switch have closed to connect the "T", "R", "D", and "CO" leads from the trunk to the register and the "F" lead from trunk to incoming register marker connector, register part and to hold the hold magnet through the crosspoints under control of the register.

3.8 When the hold magnet has been checked operated by the register to release the select magnet, release the TP- and RP- relays and operate the remaining RB- relay.

3.9 Test Vertical

3.91 When the register to be tested is made busy at the Master Test Frame to operate the RB- relays associated with that register in the link.

3.92 To operate the TPOO relay in the 0 or 2 horizontal group from battery on the "ST" lead in the automatic monitor or incoming register test circuit and when all other TP- relays in the horizontal group are normal to return ground on the "B" lead to the automatic monitor or incoming register test circuit.

3.93 To operate the RP- relay associated with the register to be tested when ground is connected to the RP- lead by the automatic monitor or incoming register test circuit.

3.94 When the automatic monitor is used to extend control of the hold magnet to that circuit.

3.95 To extend the BL and LK leads to the automatic monitor or incoming register test circuit.

3.96 To extend control of the class leads "CLO-10" to the automatic monitor or incoming register test circuit.

4. CONNECTING CIRCUITS

When the circuit is listed on a key sheet the connecting information thereon is to be followed.

4.01 Incoming Trunk Circuits - SD-25581-01, SD-25583-01, SD-26077-01, SD-27580-01, ES-26257, ES-26282. (Typical)

4.02 Intertoll Trunk Circuits - SD-25843-01, SD-25844-01. (Typical)

4.03 Incoming Register Circuits - SD-25729-01, SD-25730-01, SD-26041-01, SD-26042-01, (Typical).

4.04 Inc. Register Marker Conn.- SD-25586-01, SD-26026-01.

4.05 Link Reseizure Delay Ckt. - SD-25941-01.

4.06 Automatic Monitor Circuit - SD-25680-01.

4.07 Incoming Register Test Circuit - SD-25988-01.

4.08 2 Way Operator Office Trunks - SD-27593-01.

4.09 Intraoffice Trunk - SD-26259-01.

4.10 Office Test Frame Test Circuit - SD-27633-01.

5. TAKING EQUIPMENT OUT OF SERVICE

5.1 Link Frame

If an entire link frame is to be taken out of service it will be necessary to have all of the trunks which are assigned to the frame made busy at the distant offices.

When there are other frames in the link group in addition to the frame being taken out of service, precautions should be taken to avoid interference with calls in the other frames when working on switch multiple and on chain circuits through the RP- relays.

5.2 Link Switch

When a switch is to be taken out of service all the trunks assigned to the switch must be made busy at the distant office. If there is another switch in the horizontal group, precautions must be taken to avoid interference with calls from trunks on the other switch when working on the common switch multiple.

5.3 Hold Magnet and Vertical Unit

When a hold magnet or a vertical unit is to be taken out of service the associated trunk must be made busy at the distant office.

5.4 Select Magnet and Selecting Unit

Block operated the RB- relay associated with the select magnet or the two RB- relays associated with the selecting unit to be removed from service.

5.5 TP-Relay

To remove a TP- relay from service make busy the associated trunk at the distant office. Precautions should be taken when working on the chain circuits through this relay to avoid interference with calls from other trunks in the horizontal group.

5.6 RP- Relay

This relay may be removed from service by blocking the associated RB- relay operated. When working on the chain circuits through the contacts of this relay precautions must be taken to avoid interference with calls to the associated register from other horizontal groups. It may be necessary to busy the associated register in this case.

5.7 RB- Relay

Block operated the RB- relay to be removed from service.

When working on the register start chain through the "8" contact, precautions must be taken to avoid interference with calls to other registers.

5.8 C- and CA- Relays

Block operated the associated RB- relay. These relays carry leads multipled to C- and CA- relays associated with other horizontal groups and with other registers. Precautions should be taken to avoid interference with other calls when working on this multiple.

SECTION IV REASONS FOR REISSUE

D. Description of Circuit Changes

D.1 Note 102 is revised to restrict the use of the combined incoming register link to Phase I and II Centrex.

D.2 FS1 is revised to clarify the use of option V.

D.3 CAD 2 is revised to show connections to the office test frame.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2311-GJK-MFF-LH

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CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.1 Changes are made to alter the multipling arrangement used between the terminal strips, switches, and other apparatus in order to facilitate the installation of equipment in the field. This involves CAD changes only.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5141-REL-RBC-PK

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CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK CIRCUIT
WITH BY-LINK OPERATION

CHANGES

D. Description of Changes

D.1 A new lead, designated "F", is added to the office test frame test circuit, under feature option "2M", which is required where this circuit is associated with the office test frame test circuit.

D.11 Existing leads "BL", "ST", "CO", "D", "T" and "R", provided under feature option "V", are shown connecting to the office test frame test circuit.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 5611

KWH-MFF-AH

CROSSBAR SYSTEMS
NO. 5
INCOMING REGISTER LINK
CIRCUIT
WITH BY-LINK OPERATION

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SECTION I - GENERAL DESCRIPTION

1. GENERAL

1.1 In the No. 5 Crossbar office all incoming trunks appear on incoming register link frames. The incoming register link frame connects the trunk to incoming registers which receive the called number from the distant office. Other information required for setting up the call is obtained from the incoming register link. The register is connected to a marker through the incoming register marker connector. The marker then connects to the trunk link frame indicated by the register link and operates the trunk F relay over a lead through the incoming register marker connector and incoming register link. The connector register and register link circuits are held by the marker until it has completed its function.

2. The register link can be divided into the following functional parts:

2.1 Link Switches

Trunks are connected to the verticals of the switches, twenty to a switch. Registers are connected to the horizontals, with a maximum of ten registers. A 160 trunk capacity frame consists of up to eight switches and a 120 trunk frame may consist of up to six switches.

The switches of a link group are subdivided into horizontal groups by the control circuit making it possible to serve calls simultaneously from each of several groups. In frames with 120 trunk capacity each switch is a horizontal group. In frames of 160 trunk capacity either one or two switches, called basic and supplementary, comprise a horizontal group.

2.2 Trunk Preference, Register Preference, Busy and Connector

The trunk preference circuit consists of one TP- relay for each trunk. Each horizontal group contains one trunk preference chain. Trunks within the chain are served one at a time and when competing, will be served according to their position in the chain. Several work leads are carried on each TP- relay.

The register control circuit consists of relays RP and RB which are furnished one per register per horizontal group. The register preference relays RP carry a number of work leads in chains and the register busy relays RB perform the function of controlling the start lead from the trunk preference relays.

One connector relay C- is furnished per horizontal group per register. When it is necessary to furnish trunk number information to the register an auxiliary connector relay CA- is provided. These connector relays transmit the frame number, trunk class and trunk number information to the register.

2.3 Types of Frames

Provision has been made for two types of 120 trunk capacity frames. One type is for dial pulse link groups where any or all of the trunks are of the by-link type. The other type is the combined link group frame serving dial pulse trunks and multifrequency trunks. The combined link group provides access to a maximum of seven dial pulse and three multifrequency registers.

Provision has been made for two types of 160 trunk capacity frames. One type is for dial pulse (non by-link), revertive pulse or multifrequency trunks. The other type is the combined link group serving dial pulse (non by-link) and multifrequency trunks or revertive pulse and multifrequency trunks. The combined link group provides access to a maximum of seven dial pulse or revertive pulse registers and three multifrequency registers. A minimum of two registers of each type must be supplied in the combined link group.

In the 160 trunk frame there are 8 switches and since some groups may exceed this capacity, provision has been made to connect two or three such frames together to the same group of registers.

2.4 Trouble Recorder

To aid in finding trouble, the trouble recorder card carries a punch for the link horizontal group and frame number. The leads are carried from the register preference relays through the incoming register marker connector to the trouble recorder.

2.5 Testing

The 00 vertical of the switch in horizontal group 0 in each link group is reserved for use as a register test vertical. In the combined link group frame of 120 trunk capacity, the 00 vertical in horizontal group 2 is also used as a test vertical. Through the test verticals, the automatic monitor or the incoming register test set may obtain access to any register.

2.6 General Operation

Trunk preference relay TP- operating from a trunk circuit closes the circuit to operate the register preference relay RP- of the first idle register. The register then operates its register busy RB- relays in all other horizontal group appearances. Control leads through TP- and RP- relays are closed for operating the register select magnet and connector relays in the horizontal

group. Trunk frame, class and trunk number information passed through the connector is received in the register and checked. The hold magnet of the trunk is then operated, after which the TP- and RP- relays are released under control of the register. The RB- relay in the horizontal group in which the trunk is located is then operated. The connection through the link switch is held by the register. Registration of digits and control of the trunk is accomplished over the leads through the switch crosspoints. On by-link trunks pulsing can take place over the by-link lead BL through the TP- and RP- relays before closure of the crosspoints.

2.7 Phase I and II Centrex

In Phase I and II Centrex, the TP- relay associated with a trunk could be required to operate three times on a Centrex call. The first operation is on the incoming call. The TP- relay will operate a second time when a transfer to the attendant is requested, and a third time when the attendant requests a register to complete the transfer call.

The operation of the TP- relay causes the operation of the associated RP- relay over the "PRA" or "PRB" lead depending on the setting of the trunk control relays.

For by-link trunk operation in Centrex, the trunk will be associated with two TP- relays. One of the TP- relays will be located on the by-link frame and associated with a dial pulse register and the other TP- relay will be located on a multifrequency frame. Only one TP- relay will operate at a time however and the trunk will control the selection of the proper TP- relay.

SECTION II - DETAILED DESCRIPTION

1. OPERATION OF TRUNK PREFERENCE RELAYS

When a trunk requires connection to a register it connects battery to the ST- lead to operate its trunk preference relay TP- as shown in FS1.

Since all the TP- relays in a horizontal group are in a chain of preference only one trunk call can proceed at a time. The operation of a TP- relay such as the one shown for an intermediate trunk opens ground from the windings of all the higher numbered TP- relays. Lower numbered TP- relays may operate but can do no work since all of the work leads are in a chain running in the opposite direction and these are therefore opened at the higher numbered relays. If, during the time one call is being served other TP- relays should operate, these trunks will be served in order starting from the highest number. Trunks which are not able to operate their TP- relays must wait until the last operated TP- is released before being served.

2. SELECTION OF IDLE REGISTER

2.1 Start Chain (ZF Option)

Referring to FS2 or FS7, ground from the operated TP- relay operates the register preference relay RP- of the first idle register in the chain of preference through the register busy relay RB- contacts.

It will be noted that this chain of preference is different in each of the horizontal groups, the object being to distribute the traffic over the registers in such a way that there is a minimum of interference between horizontal groups. Since this is a closed chain, i.e., it progresses from the last register in the chain back to the first, these chains may be thought of as rings with the start leads entering the chain at different points in each horizontal group. The purpose of closing the ring is to permit shifting the starting point if this becomes necessary because of wear on the preferred circuit. It is also to be observed that the number sequence of the registers is the same in each horizontal group.

Start Chain (ZG and ZI options)

When FS2 is equipped with ZG and ZI options, it will be noted that there are now two different chains of RB- relay contacts associated with two different types of registers. The two different chains of RB- relay contacts allow the transfer type trunk to be associated with either of two types of registers depending on the setting of the control relay in the trunk.

Start Chain (ZG and ZH Options)

When FS2 is equipped with ZG and ZH options, there is only one chain of RB- relay contacts associated with seven registers available to the trunk. This allows the transfer and non-transfer type trunks to be mixed in the same horizontal group on a Centrex frame.

It will also be noted that the battery for operating the RP- relay, supplied by the associated incoming register over lead B is taken through a chain of contacts on the RP- relays associated with that register. Thus if during a period of heavy load two different horizontal groups should be directed toward the register preference relays for the same register and simultaneous calls should occur, only one RP- relay would operate. The battery chains through the RP- relays are so arranged that the initial preference of a register for a horizontal group is the same as the initial preference of a horizontal group for a register, for instance horizontal group 0 has register 0 as first choice and the RP0 relay in register 0 is nearest to battery. This results in distributing the register choices for horizontal groups for the purpose of minimizing what might be called "grooving" under heavy load conditions. When all registers are busy and calls are waiting, the same horizontal group will not usually be preferred as successive registers become free even though all waiting calls are directed to the same register. Since generally, there are more registers than horizontal groups the RP- battery chains are necessarily in the same order in more than one register control, for instance, as shown in FS2, control relays for register 0, 4 and 8 have the same order of preference and 0, 4 and 8 are the first, second and third choices respectively in horizontal group 0.

Referring now to the sequence chart, the operation of the HP- relay starts several circuit operations. (1) On a by-link trunk, battery on the LK lead operates RL in the trunk as a signal that the by-link (BL lead) is closed (FS1). (2) The off normal and register busy relays in the register and in the automatic monitor when furnished, are operated over the ON lead, FS2. (3) The select magnets for the switch level with which the register selected is associated, on the switch or switches associated with the horizontal group in which the trunk is located are operated. See FS5 and FS6 or FS9. (4) The connector relays C- and CA- are operated.

2.2 By-Link Lead Closure and Control of Trunk Preference Relays

Closing of the LK lead also gives control of the TP- relay to the register.

The subsequent operation in by-link trunks will be found by reference to one of these circuits.

2.3 Register Made Busy

Closure in the register of the RB- relays operates the RB- relays (FS3 and 8) in the link on all horizontal groups except the one being served. That RB- relay is held shunted down by ground on the LO lead. Thus in all other horizontal groups the start chain is advanced beyond the register selected.

2.4 Closure of Switch Crosspoints

Operation of the register off normal relay and a link select magnet closes a circuit through the operated trunk preference relay to operate the hold magnet for the trunk being served. This operating ground is extended through the crosspoints to operate relay H which opens the circuit through the trunk preference relay and closes the circuit to the double connection check relay DCK. DCK operates unless there is a ground already on the crosspoint such as would occur if two crosspoints were closed to the same register. Then, DCK would be shunted down and a marker would be called in for a trouble record. Otherwise, the DCK locks and the hold magnet is held over the HM lead through the crosspoint. Register relay H releases the select magnet.

2.5 Connector Functions

Connector relays C- and CA- remain operated until the information transmitted through their contacts is received and checked by the register after which relay CK or ON1 in the register operates to release these relays. Lead information through the connector relays is as follows:

Trunk Link Frame Number. This is in two parts, the tens number and the units number. The tens number is on a horizontal group basis. All trunks in a horizontal group must be associated with the same group of ten trunk link frames. Cross connections from terminals FG to G0, G1 or G2 determine the first, second or third group of ten trunk link frames respectively. Terminal G2 is provided as ZA option.

One out of ten leads "TF0-9" is grounded by a TP- relay to indicate the trunk link frame units number. This indication is determined by cross-connections from terminals TPU- to TFU0-9.

Trunk Class. One out of eleven leads is grounded by a TP- relay to indicate the trunk class to the register. In all cases except for Phase I and II Centrex transfer-type trunks and 2 way operator office trunks the class indication is determined by a cross-connection from TPC- to CL00-10. In the case of a Phase I and II Centrex transfer type trunk, ZC option and CLA- punching will be provided, 1 per trunk. CLB- and CLC- punchings will also be provided 1 per horizontal group. A cross connection must be provided from each CLA-, CLB- and CLC- punching to the CL00-10 required to give class indication for incoming trunk, transfer or attendant class respectively. The TP- relay of the transfer type trunk will then ground one of the class punchings over the CLA-, CLB- or CLC- leads depending on the setting of the control relays in the trunk.

For by-link trunk operation in Centrex, the TP- relay associated with the by-link appearance will ground the TPC punching. When the TP- relay associated with the MF appearance of the by-link trunk operates, it will ground either a CLB- or CLC- punching depending on the setting of the control relay in the trunk.

When 2 way operator office trunks are furnished a CLB and a CLC punching will also be provided, 1 per horizontal group. The CLB punching will be cross connected to the class for an incoming call and the CLC punching will be cross connected to the class associated with a no-test call.

Where by-link and direct pulsing trunks are in the same link group the trunks are assigned to different horizontal groups and an indication is given to the register when the TP- relay operates. This indication is determined by cross-connecting terminals B to BL or DP.

Trunk Number. For trunks having line link appearances the register requires a ground indication on one lead out of each of three sets of leads. These three ground indications are translated in the register to the trunk number group number. All transfer type trunks in Phase I and II Centrex require trunk number indication for the MF registers.

The trunk hundreds is indicated by the cross-connection of terminal A for trunks on basic switches or terminal B for trunks on supplementary switches to terminals LH0-3 (FS1). In dial pulse link groups with any or all by-link trunks, terminal A of horizontal groups 0-4 is cross-connected to terminal LH0 and terminal A of horizontal group 5 is cross-connected to terminal LH1. The choice of terminals to be used is indicated in the cross-connecting information and depends upon the translation in the register and the number group hundreds and tens block to be used for these trunks.

One of the leads LT0-9 is grounded by a TP- relay to indicate the half switch on which the trunk is located.

One of leads LU0-9 is grounded by a TP- relay to indicate the vertical on a half switch on which the trunk is located.

3. RELEASE OF CONTROL CIRCUIT

When the register has been satisfied as to the completeness of the information received and the closure of the crosspoints (the detailed relay operations vary in

different types of registers) the RLK operates and opens the LO and LK leads to the link. LO opened removes the shunt on RB- allowing it to operate; LK opened releases TP-. The register start is thus advanced and the trunk preference circuit freed for a new call.

4. RELEASE OF REGISTER

On release of the register the hold magnet of the switch is released. The RB- leads to the RB- relays are also opened but only those RB- relays release that are associated with horizontal groups in which no TP- is operated. In groups where a TP- is operated all operated RB- relays are held in order to keep the start chain closed to the register being selected at the moment. See FS3 or 8. Thus overlapping calls in a group will progress thru the start chain to successive registers. When the last register in the chain is selected the RB- relays of all preceding idle registers will release, redirecting the start circuit to the beginning of the chain.

5. TROUBLE INDICATION

The register is arranged to call in a marker to take a trouble record in the event of certain link troubles. Location of the trouble condition is facilitated by identifying the horizontal group and frame being served. Two ground circuits are closed by the RP- relays for this purpose, one multiplied by horizontal groups and the other by frames. These leads connect directly to the incoming register marker connector.

The trouble recorder card provides for five horizontal groups, these being used for the older register link frames per SD-25585-01. For the new link frames with four horizontal groups only four punches are used. However, for the frames with 6 horizontal groups the indications for the first five are given along with RPB frame punch and for the sixth horizontal group as horizontal group 0 with a RPAB frame punch. See FS2 and FS7. That is, the sixth group is treated as the first of a second frame and since a second frame is never furnished with the 120 trunk size frame there is no conflict.

6. TEST VERTICAL FOR REGISTER TESTS

The 00 vertical in horizontal group 0 of the first frame is used as a test vertical. In the combined link group frame, the 00 vertical in horizontal group 2 is also used as a test vertical. These verticals are used by either the automatic monitor or the incoming register test circuit for testing incoming registers. The TP- relay wiring is modified to open the register start circuit, and to extend this function to the test circuit.

The particular incoming register to be tested is selected by the test circuit and is made busy by operating the associated RB- relays in the link. The TP- relay is then operated and when all calls in the horizontal group are served ground will be connected to the test circuit on the B- lead as a signal to go ahead. Relay RP- is then operated from the test circuit and performs its usual functions. RB- releases due to the shunting ground on the LO lead. The automatic monitor will check for this release but the incoming register test circuit will not.

The closure of the hold magnet and crosspoints is controlled in the automatic monitor to permit testing the link release, double connection and by-link lead features when required.

In links with by-link trunks and direct pulse trunks where the DP and BL terminals are cross-connected, the ground signal through TP- is omitted and the register is primed directly by the test circuit for either condition.

The test circuit can test any register class relay as the leads for all class relays are brought into the test circuit and no permanent cross-connection is made to the TP- relay as on other trunks.

The trunk link frame tens is the same as the other trunks in the horizontal group and 0 is arbitrarily used for the units.

When trunks with trunk numbers are in the link group, test is made of this feature in the register by treating the test vertical as though it were a trunk with a trunk number. The CA- relay will then be furnished in the horizontal group whether there are trunks requiring a trunk number in the horizontal group or not.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.1 None.

2. FUNCTIONAL DESIGNATIONS

Relays

TP00-19	Trunk Preference - First 20 trunks in a horizontal group
TP20-39	Trunk Preference - Second 20 trunks in a horizontal group
RB-	Register Busy
RP-	Register Preference
C-	Connector - for trunk frame and class leads
CA-	Auxiliary Connector - for trunk number leads

Switches

L	Link Switch - for first 20 trunks in a horizontal group
SL	Supplementary Link Switch - for second 20 trunks in a horizontal group

3. FUNCTIONS

3.1 To operate the associated trunk preference relay TP- when battery is closed to the start lead ST by the trunk.

3.11 To prevent higher numbered TP- relays in the horizontal group from operating and to open all work leads in the chain from lower numbered relays.

3.2 With TP- operated.

3.21 To connect battery to the RB- lead to hold any operated register busy relays RB- in the horizontal group from releasing.

3.22 When the last RB- relay in a horizontal group operates to release the previously operated relays not held by busy registers.

3.23 To ground a start lead, ST, PRA or PRB depending on the type of trunk, and operate the register preference relay RP- of the first idle register in the start chain.

3.24 To prevent operation of other RP- relays associated with the same register.

3.3 With RP- operated.

3.31 To ground the ON lead to the register selected as a seizure signal.

3.32 To ground the ON lead to the automatic monitor circuit when furnished, as a seizure signal.

3.33 To hold the TP- relay over the LK lead.

3.34 To close the BL lead from trunk to register to provide by-link pulsing path where required, or a check path for CO relays in direct pulsing trunks.

3.35 To operate connector relay C- and when furnished relay CA-, associated with the register and horizontal group.

3.36 To close a path for operating the select magnet on the link switch or switches associated with the trunk being served and the level corresponding to the register selected.

3.4 When the register circuit busy relay RB- operates.

3.41 To operate all link RB- relays associated with that register except the one in the horizontal group in which the call originated and to prevent that one from operating by means of shunting ground on the LO lead from the register circuit.

3.42 To pass the register start leads in the horizontal group made busy to the next succeeding idle register preference relay in the chain.

3.5 With C- and CA- operated.

3.51 As determined by cross-connections to ground one of the 10 trunk link frame units leads "TFO-9", one of class leads "CLO-10" to the register.

3.52 As determined by cross-connections to ground the FGO, 1 or 2 leads to the register. Lead FG2 is ZA option.

3.53 In horizontal groups where relay CA- is furnished to ground one "LT-" lead to the register depending on the half switch on which the trunk is located.

3.54 In horizontal groups where relay CA- is furnished to ground one "U-" lead to the register depending on the vertical on which the trunk is located.

3

3.55 As determined by cross-connections to ground one of leads "REG", "REG 1", "BLG" or "DPG" and one of leads "SUP" or "SUP 1" to the register.

3.6 After select magnet operation to operate the hold magnet associated with the trunk being served.

3.7 When the crosspoints of the link switch have closed to connect the "T", "R", "D", and "CO" leads from the trunk to the register and the "F" lead from trunk to incoming register marker connector, register part and to hold the hold magnet through the crosspoints under control of the register.

3.8 When the hold magnet has been checked operated by the register to release the select magnet, release the TP- and RP- relays and operate the remaining RB- relay.

3.9 Test Vertical

3.91 When the register to be tested is made busy at the Master Test Frame to operate the RB- relays associated with that register in the link.

3.92 To operate the TPOO relay in the 0 or 2 horizontal group from battery on the "ST" lead in the automatic monitor or incoming register test circuit and when all other TP- relays in the horizontal group are normal to return ground on the "B" lead to the automatic monitor or incoming register test circuit.

3.93 To operate the RP- relay associated with the register to be tested when ground is connected to the RP- lead by the automatic monitor or incoming register test circuit.

3.94 When the automatic monitor is used to extend control of the hold magnet to that circuit.

3.95 To extend the BL and LK leads to the automatic monitor or incoming register test circuit.

3.96 To extend control of the class leads "CLO-10" to the automatic monitor or incoming register test circuit.

4. CONNECTING CIRCUITS

When the circuit is listed on a key sheet the connecting information thereon is to be followed.

4.01 Incoming Trunk Circuits - SD-25581-01, SD-25583-01, SD-26077-01, SD-27580-01, ES-26257, ES-26282. (Typical)

4.02 Intertoll Trunk Circuits - SD-25843-01, SD-25844-01. (Typical)

4.03 Incoming Register Circuits - SD-25729-01, SD-25730-01, SD-26041-01, SD-26042-01, (Typical).

4.04 Inc. Register Marker Conn.- SD-25586-01, SD-26026-01.

4.05 Link Reseizure Delay Ckt. - SD-25941-01.

4.06 Automatic Monitor Circuit - SD-25680-01.

4.07 Incoming Register Test Circuit - SD-25988-01.

4.08 2 Way Operator Office Trunks - SD-27593-01.

4.09 Intraoffice Trunk - SD-26259-01.

4.10 Office Test Frame Test Circuit - SD-27633-01.

5. TAKING EQUIPMENT OUT OF SERVICE

5.1 Link Frame

If an entire link frame is to be taken out of service it will be necessary to have all of the trunks which are assigned to the frame made busy at the distant offices.

When there are other frames in the link group in addition to the frame being taken out of service, precautions should be taken to avoid interference with calls in the other frames when working on switch multiple and on chain circuits through the RP- relays.

5.2 Link Switch

When a switch is to be taken out of service all the trunks assigned to the switch must be made busy at the distant office. If there is another switch in the horizontal group, precautions must be taken to avoid interference with calls from trunks on the other switch when working on the common switch multiple.

5.3 Hold Magnet and Vertical Unit

When a hold magnet or a vertical unit is to be taken out of service the associated trunk must be made busy at the distant office.

5.4 Select Magnet and Selecting Unit

Block operated the RB- relay associated with the select magnet or the two RB- relays associated with the selecting unit to be removed from service.

5.5 TP-Relay

To remove a TP- relay from service make busy the associated trunk at the distant office. Precautions should be taken when working on the chain circuits through this relay to avoid interference with calls from other trunks in the horizontal group.

5.6 RP- Relay

This relay may be removed from service by blocking the associated RB- relay operated. When working on the chain circuits through the contacts of this relay precautions must be taken to avoid interference with calls to the associated register from other horizontal groups. It may be necessary to busy the associated register in this case.

5.7 RB- Relay

Block operated the RB- relay to be removed from service.

When working on the register start chain through the "8" contact, precautions must be taken to avoid interference with calls to other registers.

5.8 C- and CA- Relays

Block operated the associated RB- relay. These relays carry leads multipled to C- and CA- relays associated with other horizontal groups and with other registers. Precautions should be taken to avoid interference with other calls when working on this multiple.

SECTION IV REASONS FOR REISSUE

D. Description of Circuit Changes

D.1 Note 102 is revised to restrict the use of the combined incoming register link to Phase I and II Centrex.

D.2 FS1 is revised to clarify the use of option V.

D.3 CAD 2 is revised to show connections to the office test frame.

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