PBX SYSTEMS
NO. 756A
DIAL PULSE REGISTER CIRCUIT

CHANGES

B. Changes in Apparatus

B.1 Added

STR Network, 186A, App Fig. 3, Option WA

SW Network, 186A, App Fig. 3, Option WA

D. Description of Changes

D.1 Option WA is added as Standard to provide 186A networks across the windings of relays STR and SW to reduce transient voltage that causes erratic TOUCH-TONE receiver operation.

D.2 The rating of this circuit is changed from AT&TCo Standard to A&M Only.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 3224-WVS-RVL

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PBX SYSTEMS
NO. 756A
DIAL PULSE REGISTER CIRCUIT

CHANGES

A. Changed and Added Functions

A.1 The dial pulse register circuit is modified to function with the Traffic Measurement System No. 1A Remote Scanner Circuit.

D. Description of Changes

D.1 Option XZ is added and rated Standard to provide a new TU(R-) lead for connection to the TMS Remote Scanner.

D.2 On sheet A1, the Sheet Index is brought up-to-date.

D.3 On sheet A2, the TMS Remote Scanner lead TU(R-) is added to the Lead Index and option XZ is added to the Option Index.

D.4 On sheet B3, contacts 1,10 and windings 1L,U of relay SW are interchanged to read 10,1 and U, 1L respectively, to indicate proper coordination with options XL and XM.

D.5 On sheet D1, Circuit Note 104 is revised to reflect changes in this issue.

D.6 On the E sheets the sequence charts are modified to reflect the addition of option XZ.

F. Changes in CD Sections

F.1 In SECTION II - DETAILED DESCRIPTION change 1.07 to read as follows:

Relay SR operated:
(g) extends ground over lead TU(R-) to the TMS Remote Scanner.

F.2 In SECTION II - DETAILED DESCRIPTION change 7.02 to read as follows:

Relay SR released:
(g) removes ground from lead TU(R-) to the TMS Remote Scanner.

F.3 In SECTION II - DETAILED DESCRIPTION change 7.06 to read as follows:

Relay DC releases relay L. Relay L releases relay SR. Relay SR releases relay ON, both register hold magnets in the marker and removes ground from lead TU(R-) to the TMS Remote Scanner.

F.4 In SECTION III - REFERENCE DATA 3. FUNCTIONS, add:

3.23 To provide for operation of the register with the Traffic Measurement System No. 1A Remote Scanner.

F.5 In SECTION III - REFERENCE DATA 4. CONNECTING CIRCUITS, add the following to paragraph 4.01:

(m) Traffic Measurement System No. 1A Remote Scanner and Encoder Circuit Portable Type - SD-3B200-01.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5122HW-SHA-WEA
DEPT 5331-SGS

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PBX SYSTEMS
NO. 756A
DIAL PULSE REGISTER CIRCUIT

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 The dial pulse register functions as a dial pulse counter and digit and class information store on all calls passing within the PBX. It is not operative on outgoing central office calls after the central office has been engaged.

1.02 When either a station or a trunk originates a call into the PBX, the marker selects and connects an idle dial pulse register to it. The register receives and stores the originating line or trunk class information from the marker and then transmits dial tone to the line or trunk. After dialing is completed, the register engages the marker to terminate the call and transmits the information needed to establish a connection to the called station or trunk to the marker. When the connection has been established, the marker releases the register.

1.03 If the marker finds the busy tone trunk busy when trying to complete a call to it, it notifies the register to return the busy tone to the calling line.

1.04 The register allows from 8 to 16 seconds after seizure during which dialing must be completed. If dialing is not completed in this time, the register signals the marker to route this call to an attendant trunk.

1.05 The register is arranged to receive either dial pulses, direct station selection key signals, or the output of a TOUCH-TONE calling receiving circuit.

1.06 The dial pulse register functions to receive units and tens information from a direct station selection console key and transmit this information to the marker in the regular manner.

1.07 When a station is provided with the necessary auxiliary equipment, the dial pulse register functions to receive units and tens information from a direct station selection key in the telset. This information is transmitted to the marker in the regular manner.

1.08 The dial pulse register may be arranged for connecting to certain station lines by dialing a single digit. The proper tens digit is dialed, and after a timed interval of 3 seconds, the digit 0 is automatically set up in the register with a 2-digit code being transmitted to the marker in the regular manner.

1.09 A single digit code may be used for a trunk to the toll operator. When the single digit is dialed and a timer operates, the register functions to set up a 2-digit code, which when transmitted to the marker, causes the marker to connect to a central office trunk that has been connected to the toll switchboard.

1.10 The dial pulse register circuit is arranged to function with the make busy and busy display circuit.

2. GENERAL METHOD OF OPERATION

2.01 When the receiver is lifted off-hook at a station, or a trunk circuit requests inward PBX service, the respective line or trunk tens relay in the marker operates. This operation sets off a train of events that result in the marker connecting the line through an idle link to an idle register.

2.02 As soon as the class identity of the calling circuit is known, after the register has been allotted, the marker transmits originating class information which is stored in the register for use when dialing is completed. The following classes of service exist:

(a) Restricted Line or Dial Repeating Tie Trunk: All restricted lines are restricted from central office trunks, and may or may not be restricted from dial repeating tie trunks.

(b) Restricted Central Office Trunks and Ringdown Tie Trunks: All central office and ringdown tie trunks are restricted from other central office and ringdown tie trunks and may or may not be restricted from dial repeating tie trunks.

(c) Nonrestricted Central Office Trunks and Ringdown Tie Trunks: All central office and ringdown tie trunks are permitted access to other central office trunks, ringdown tie trunks, and dial repeating tie trunks.

(d) Toll Denied Line or Dial Repeating Tie Trunks: The line or trunk can dial intralocal central office and extended area central office calls but not toll calls.

(e) Toll Allowed Line or Dial Repeating Tie Trunk: The line or trunk can dial all calls.

2.03 When the register hold magnet closes the tip, ring, and sleeve of the line through to the register, the register off-normal relay operates. The off-normal relay furnishes holding battery and ground for most of the register and closes the dial tone path to the calling line. This connection is known as the dial tone connection and is an indication that dialing may proceed.

2.04 The dial pulse register is arranged to receive 1- or 2-digit codes for station lines, ringdown tie trunks, miscellaneous trunks, or central office trunks, and a 1-digit code for attendant trunks or long distance trunks.

2.05 Access to trunk code 8- may be restricted or nonrestricted without regard to the access to the central office code. Thus, a line may be restricted from both codes 8- and 9-, or it may be restricted from code 9- only.

2.06 After the calling line dials the one or two digits required for identification of the called line, the register recognizes dial completion and engages the marker for termination of the call.

2.07 The digit steering relays determine when the tens and units digits have been registered; the tens digit being stored in the TD register relays and the units digit in the pulse counter and the UD register relays.

2.08 If a 1-digit central office trunk code is provided and a 9 or 0 is dialed, the steering circuit recognizes that only one digit will be dialed, and therefore engages the marker to either a central office or attendant trunk to complete the call. If a restricted line dials codes 8- or 9- (code 8- being restricted) or should an unequipped code be dialed, the call will be diverted to an attendant trunk. If code 8 is used for long distance, a code 8 will be translated into a 2-digit code 90. With single digit dialing, any tens digit so arranged will be translated into a 2-digit code by the addition of a zero.

2.09 The number dialed determines the terminating class of call, which directs the marker in its method of call completion. There are two terminating classes of calls:

(a) Junctor Class - Calls which require a junctor.

(b) Trunk Class - Calls which do not require a junctor.

2.10 When the digit registration is completed and the marker engaged, the register transmits the class information and the called number data to the marker.

2.11 When a dial tone call is established, the register memory hold magnet in the marker remembers which link was used for the connection from the calling line to the register, so that the same link can be reused when the call is later terminated via a junctor or a trunk.

2.12 After the marker performs its functions in terminating the call, it transmits a release signal to the register. The register then opens the tip, ring, and sleeve connections to the link, restores to normal, makes itself available to the marker for reseizure, and releases the register work and memory hold magnets.

2.13 If the marker encounters a busy condition and the busy tone trunk is also busy, it signals the register to transmit busy tone to the calling line.

SECTION II - DETAILED DESCRIPTION

1. REGISTER SEIZURE

A. Register Selection

1.01 When a register is idle, battery and ground through break contacts of relay ON operate the associated register allotter relay in the marker. Operation of the allotter relay prepares an operating path for the register hold magnets and the class relays. In the process of link selection, the marker operates the register hold magnets.

B. Registration of Class

1.02 As soon as the class and originating line selection circuits have operated in the marker, an operate path for the class relays in the register is established through the make contacts of the register allotter relay in the marker. The following is a tabulation of class conditions that can exist for incoming calls to the register.

Class Relays Operated	Originating Class of Service
None	Restricted Station, or an Attendant Trunk
TT	Restricted Dial Repeating Tie Trunk
TLD	Toll Denied Station
TT & TLD	Toll Denied Dial Repeating Tie Trunk
TLA & TLD	Toll Allowed Station
TT, TLA & TLD	Toll Allowed Dial Repeating Tie Trunk
COT	Restricted Incoming Central Office or Ring-down Tie Trunk
COT, TLA & TLD	Nonrestricted Incoming Central Office or Ring-down Tie Trunk

1.03 These class relays operate on signals from the marker and hold through their own contacts to off-normal battery.

C. Dial Tone Connection Established (SC1)

1.04 While the originating class information is being transmitted to the register from the marker, the marker is selecting an idle link. When the select magnet timing relays operate in the marker, the register work and memory hold magnets THM-8 and THM-9 operate.

1.05 Operation of hold magnet THM-9 prepares paths in the marker that are used when the marker terminates the call, and also prepares a holding path for relays RRL (A, B).

1.06 Operation of hold magnet THM-8 closes register leads T, R and S to the calling line circuit via a link in the marker. The tip and ring closure operates relay L in series with the tone coil (FS1). Relay L operated, operates relay SR.

1.07 Relsy SR operated:

(a) Operates relay ON.

(b) Connects resistance ground (resistor S) to lead S toward the marker to hold the station hold magnet operated.

(c) Grounds lead RHM toward the marker to provide a holding ground for hold magnets THM-8 and THM-9.

(d) Removes ground from lead RHM toward the make busy and busy display circuit, lighting the register busy lamp.

(e) Prepares an operating path for pulse counting relay P1.

(f) Prepares an operating path for relay AC-

(g) Lights the all registers busy lamp at the attendants console (if direct station selection by the attendant feature is provided and if the other register is in use).

1.08 Relay ON operated:

(a) Completes a path to supply dial tone to the calling station via transformer TN.

(b) Prepares operate and holding paths for relays DC, PU, RRL (A, B), STR, UD and pulse counting relays.

(c) Connects battery to lead PR (option ZE).

(d) Provides an operating path for relay RA.

(e) Prepares operate and holding paths for relays TD- and UD-.

(f) Prepares holding paths for relays BY, OT, OTA, TMO & TR.

(g) Opens the operate path of the register allotter relay in the marker by removing battery and ground from leads ONB and ONG respectively, thus preventing the marker from selecting the same register for the next call.

1.09 NOTE: Relays operated: L, SR and ON.

2. DIAL PULSE COUNTING AND REGISTRATION

A. General

2.01 For any digit, a train of pulses consisting of one to ten equally spaced momentary line openings is generated by the dial on the calling line. The number of opens corresponds to the number dialed, one for the number 1, two for the number 2, etc. Between these trains of pulses there is an interdigital interval during which the line remains closed.

2.02 The pulsing relay L responds to these pulses and the counting circuit counts the number of pulses in each digit. In the interdigital time, the tens digits information is transferred to the tens digit register and the counting relays are released preparing the circuit for receipt of the units digit. The units digit is counted and registered by the pulse counter relays.

B. Pulsing Relay (FS1)

2.03 Relay L is a magnetically biased polarized mercury contact relay with three windings. The primary winding is in series with the customers line and dial contacts and operates the relay on line closure.

2.04 When relay L operates, its contact furnishes ground to the secondary winding which is poled oppositely to the primary winding. This opposition of ampere turns, when the relay is operated, tends to aid the release of the relay when the primary winding is opened.

2.05 The tertiary winding acts as a pulse aiding winding. The winding is wired in series with the pulse helping capacitor PH and a make contact of relay L. When relay L operates, its operated contact closes ground to capacitor PH which charges through the tertiary winding, causing an instantaneous current in a direction to hold relay L operated. As the capacitor charges, the current is reducing until, when fully charged, it is zero at which time the other windings have full control.

2.06 Relay L releases when the circuit of the primary winding is opened. Capacitor PH discharges through the winding of relay SR. This discharge current flows through the tertiary winding and is such a direction as to hold relay L released.

2.07 The tertiary winding and capacitor PH thus act to insure that once relay L operates it will remain operated for a definite minimum time, and that once it releases it will remain released for a definite minimum time. This pulse correcting action permits longer maximum loops to be used than would otherwise be possible.

2.08 Capacitor LW and resistor LW are connected to the line side of the primary winding of relay L to prevent the premature release of the relay when dialing over a line which has high capacity ringing bridges. On each open pulse on these lines, the line current momentarily dips and then increases as the bridged capacitor charges in series with the inductive ringer. Capacitor LW holds relay L over the dip in line current.

2.09 Capacitor LW and resistor LW also prevent a false momentary release of relay L which may otherwise occur if a retard coil holding bridge in the attendants console is reinserted in loop at the end of each dialed digit.

C. Supervisory Control (FS1)

2.10 Relay SR is under control of relay L. Relay SR remains operated when relay L releases during dial pulses. Relay SR will release when the calling line disconnects before completion of dialing, when register time out occurs, or when the register is dismissed by the marker after completion of dialing.

2.11 Relay RA operates when relay L releases. It is made slow release by short circuiting its secondary winding through its own make contact. It operates on the first dial pulse open and remains operated until the interdigital interval at which time relay L is held operated and relay RA releases. When it releases, it causes the digit register relays and the digit steering relays to function.

D. Dial Pulse Counting (FS2)

2.12 The pulse counting circuit consists of relays P1 to P5 and P2A. Relays P1 to P5 count the number of dial pulses received for each digit. The sequence of operation of these relays is shown in SC26. The table below shows which of these relays remain operated after each digit.

Digit Dialed	Relays Remaining Operated
1	P1, P2
2	P3
3	P1, P2, P3, P4
4	P3, P4
5	P1, P2, P4
6	P4, P5
7	P1, P2, P4, P5
8	P3, P4, P5
9	P1, P2, P3, P5
0	P3, P5

2.13 The auxiliary counting relay P2A operates at the start of the second pulse of the first digit. Its functions include removing dial tone from the calling line, and preventing the registration of preliminary digits which may be caused by fumbling the switchhook dialing a one as the first digit.

E. Digit Steering and Registration

2.14 The digit steering circuit functions to connect the output of the pulse counting relays to the proper digit register relays. If advances successively as each digit is recorded. The steering relays are under control of the register advance relay RA.

2.15 At the end of the last pulse of the tens digit, relay RA releases and causes the operation of relays SW and TD3. Relay TD3 operated locks to off-normal ground under control of relays TMO, ON and RRL-, and grounds lead T3 to the line, link and marker circuit.

2.16 Relay SW operated:

(a) Releases relays P1, P2, P3 and P4.

(b) Operates relay STR.

2.17 Relay STR operated:

(a) Locks under control of relay ON

(b) Prepares the operating paths for relays UD-.

2.18 Relay L follows the dial pulses of the units digit and, when at normal, operates relays P1 and RA. Relays P1 and RA operate on the first pulse.

2.19 Relay RA operated:

(a) Operates relay UD.

(b) Releases relay SW (if relay PU is not operated).

2.20 Relay UD operated:

(a) Locks under control of relay ON.

(b) Prepares an operating path for relay DC.

(c) Prepares a holding paths for relays P- when relay RA releases.

2.21 At the end of the last pulse of the units digit, relay L reoperates. Relay L operated, operates relay P-, and slow releases relay RA.

2.22 Relay RA released:

(a) Operates relay UD-.

(b) Operates relay DC.

2.23 Relay DC operated:

(a) Releases relay PU (if operated).

(b) Connects battery to leads JTA, JTB and DC (2, 4) toward the marker.

(c) Grounds lead DC (1, 3) toward the marker.

2.24 The marker now functions to terminate the call.

F. Intercept of Tens Digit 6 and 7 or 8 Calls - Options Z, W (SC 9)

2.25 Option Z provides for routing tens digit 6 and 7 calls to the attendant on an intercept basis and is furnished when the PBX is equipped with only 40 lines.

2.26 Option W provides for routing tens digit 8 calls to the attendant on an intercept basis and is furnished when the PBX is not equipped with circuits using codes beginning with 8.

2.27 At the end of the last pulse of the tens digit 6, 7 or 8, relay L reoperates, slow releasing relay RA, and operating or/and releasing the appropriate P- relay(s).

2.28 Relay RA released:

(a) Operates relay TD (6,7,8).

(b) Operates relay SW.

2.29 Relay SW operated, operates relay STR, and releases relays P-. Relay TD- operated, starts the timer, operates relay OT, grounds its associated tens lead T- to the marker, and extends ground over lead TO toward the marker.

2.30 Relay OT operated:

(a) Locks under control of relay ON.

(b) Operates relay UD.

(c) Operates relays UD1 and UD4.

(d) Transfers lead DC (2,4) from leads JTA and JTB to leads RCTA and RCTB.

(e) Releases relay SW (if relay PU is not operated).

2.31 Relays UD1 and UD4 cperated:

(a) Connect ground to their associated units leads U1 and U4 toward the marker.

(b) Operate relay SW.

2.32 Relay UD operated:

(a) Locks under control of relay ON.

(b) Operates relay DC.

2.33 Relay DC operated:

(a) Releases relay PU (if operated).

(b) Releases relay SW (if relay PU is not operated).

(c) Stops PS & PD timing.

(d) Grounds lead DC (1,3) toward the marker.

(e) Connects battery to leads RCTA, RCTB and DC (2,4) toward the marker.

2.34 The marker functions to complete the call to an attendant trunk on an intercept basis, and releases the register.

G. Restricted Station or Dial Repeating Tie Trunk Denied Access to Code 8 or 9 Calls (SC 30)

Code 8 Trunk Call - Option Y

2.35 Option Y provides for routing tens digit 8 calls to the attendant on an intercept basis for a call originated by a restricted station or a restricted dial repeating tie trunk.

2.36 At the end of the last pulse of the tens digit 8, relay L re-operates, slow releasing relay RA, and releasing relay P2. Following operation is the same as described in sections 2.28 through 2.34.

Code 9 Trunk Call

2.37 At the end of the last pulse of the tens digit 9, relay L re-operates, slow releasing relay RA, and operating relay P2. Relay P2 operated, releases relay P4. Following operation is similar to that described for intercept of tens digit 8 except when relay RA releases it operates relay TD9 instead of relay TD8 since digit 9 is dialed. Relay TD9 operated, operates relay OT and extends ground over lead T0 to the marker. Register action proceeds as described for intercept of tens digit 6, 7 and 8 calls as described in section 2F.

2.38 NOTE: Relay TLD is not operated when a restricted station or a restricted dial repeating tie trunk seizes the register.

H. Restricted Station or Dial Repeating Tie Trunk Provided Access to Code 8 - Option X (SC 8, SC 15)

2.39 Option X is furnished when a restricted station or a restricted dial repeating tie trunk is allowed access to codes beginning with 8. Stations and dial repeating tie trunks that are not restricted are allowed access at all times. Option X provides a path through relay TD8 operated to operate relay TR and extends ground to the marker over lead T8.

2.40 Relay TR locks operated and prepares a path to signal the marker over leads RCTA and RCTB to establish a trunk class call connection in place of a junctor class call connection. The units digit is counted and registered; and the register functions to complete to the marker.

I. Toll Denied Station to Central Office or Ringdown Tie Trunk Call - Option V or T provided (SC 7)

2.41 The register may be arranged for one digit (option V) or two digit (option T) access to code 9 central office trunks or code 9 incoming ringdown tie trunks.

2.42 Option V provides one digit access to code 9 trunks. When a nonrestricted station or dial repeating tie trunk dials 9, the register functions to operate relay TD9. With relay TLD operated, relay TD9 operates relay OTA, and extends a ground over lead T9 toward the marker. Relay OTA operated, locks under control of relay SR, and operates relay OT.

2.43 Relay OT operated:

(a) Locks under control of relay ON.

(b) Operates relays UD, and UD4.

(c) Prepares a path to connect battery to leads RCTA and RCTB to signal the marker for establishing a trunk class call connection.

(d) Opens the paths to the marker via leads JTA and JTB that are used to signal the marker to establish a junctor class call connection.

2.44 Relay UD operated locks under control of relay ON, and operates relay DC. Relay UD4 operated, grounds its associated lead U4 toward the marker, and prepares paths used to signal the marker to function and seize an idle central office trunk.

2.45 Relay DC operated:

(a) Releases relay PU (if operated).

(b) Releases relay SW (if relay PU is not operated).

(c) Stops PS & PD timing.

(d) Grounds lead DC(1,3) toward the marker.

(e) Connects battery to leads RCTA, RCTB and DC(2,4) toward the marker.

2.46 The marker functions to complete the call to a central office trunk and releases the register.

2.47 Option T provides two digit access to code 9 trunks. With option T, relay TD9 operates relay TR in place of relay OTA. Relay TR locks operated under control of relay ON, and prepares a path to signal the marker to establish a trunk class call connection in place of a junctor class call connection. The units digit is counted and registered; and the register functions to complete to the marker. The marker functions to complete the call to a central office or ringdown tie trunk, and releases the register.

J. Attendant Trunk Dialed (SC23)

2.48 When the attendant trunk code 0 is dialed, the slow release of relay RA at the end of the tenth dial pulse operates relays TD0 and SW. Relay TD0 operated, operates relay TR.

2.49 Relay TR operated:

(a) Locks operated under control of relay ON.

(b) Extends ground over lead T0 toward the marker.

(c) Operates relay OT.

(d) Prepares operating paths for relays UD5 and UD9.

2.50 Relay OT operated:

(a) Locks under control of relay ON.

(b) Operates relays UD5 and UD9.

(c) Operates relay UD.

(d) Releases relay SW (if relay PU is not operated).

2.51 Relays UD5 and UD9 operated, extend ground over their associated leads U5 and U9 toward the marker, and operate relay SW. Relay UD operated, operates relay DC. Relay DC operated functions as described in section 2.33 to complete to the marker.

2.52 The marker functions to complete the call to an attendant trunk (as a service appearance), and releases the register.

K. Central Office or Ringdown Tie Trunk Class of Service (SC12, SC13)

2.53 Option J provides for nonrestricted incoming central office trunk calls or incoming ringdown tie trunk calls. With this option, incoming call can be completed to central office trunks on a toll allowed basis and to ringdown tie trunks. Incoming calls from central office trunks or ringdown tie trunks can also be completed to code 8 trunks. The marker operates relay COT when establishing a dial tone connection to the central office or ringdown tie trunk. Relay COT operates relay TLA. Relay TLA operates relay TLD. Relays TLA and TLD operated provide the above class of service.

2.54 When option J is not provided, central office trunks and ringdown tie trunks are restricted in regard to the completion of incoming calls by the attendant. Code 9 calls are routed to intercept. Code 8 calls are completed if option X is provided, or routed to intercept if option Y is provided. The register functions as previously described for restricted and non-restricted stations.

2.55 Option YP prevents the transient current generated by the battery and ground reversal signal sent via lead T and R to the central office trunk circuit from causing an error in the units digit stored in the register when the attendant extends in incoming central office call to a PBX station.

L. Tens and Units Digit Register (SC1)

2.56 Register relay units TD and UD consist of five dry reed relays each enclosed in a sealed container. Each relay consists of an operating coil surrounding two dry reed switches. One of these switches performs the function of holding the relay operated and the other acts as a load contact. One side of each coil is wired internally to one side of its respective holding contact. The load contact pair, one side of the holding contact, and the winding pairs are all brought out on individual terminals which have appearances on both front and back sides of the container. For ease of wiring, three sets of these terminals are strapped internally.

M. Preliminary Pulses

2.57 Since the number 1 is not assigned as a tens digit and since means for eliminating single pulses due to accidental momentary line opens must be provided, the pulsing circuit is designed to refuse registration of the tens digit 1. Relay P2A accomplishes this task by keeping the information ground path for relay TD open until it operates, and by not providing the locking ground path for relays P1 and P2 when relay RA restores to normal. Relay P2A remaining inoperative also maintains the dial tone output to the calling line.

3. DIRECT STATION SELECTION

A. Attendant Direct Station Selection (SC27)

3.01 With direct station selection, the attendant may enter a call into the PBX over an attendant trunk or complete a call into the PBX from a central office, long distance, or ringdown tie trunk.

3.02 The attendants direct station selection keys are located at the attendants console. A maximum of two consoles may be provided, but at any time only one may be in use. Relays POS1 and POS2 prevent interference if the direct station selection keys at the console not in use are operated. The cordless position circuit operates only relay POS1 or POS2 corresponding to the console in use.

3.03 When the attendant depresses a direct station selection key, ground is connected to lead H1. Relay POS1 or POS2 operated completes a path between leads H1 and HA to signal the cordless position circuit that the attendant has operated a direct station selection key. Ground on lead HA results in the same function as when the hold key at the attendants console is momentarily operated to initiate a request for a dial tone connection to a central office or ringdown tie trunk.

3.04 Marker relay TRC0 or TRC1 operates when an attendant trunk, ringdown tie trunk, long distance trunk, or central office trunk initiates a request for dial tone. The marker register allotter relays RA0- or RA1- determine the register to be used for the dial tone connection, operate relay COT, and possibly operate relays TLA & TLD. Marker relays RG(A,B) operate when the marker functions to establish the dial tone connection, and with relay TRC- and RA-- prepares a path to operate relay AC in the register the marker selects. The marker completes the connection through a link and relay L operates over the path completed by leads T and R. Relay L operated, operates relay SR.

3.05 Relay SR operated:

(a) Operates relays ON and AC-.

(b) Removes ground from lead RHM toward the make busy and busy display circuit.

(c) Extends ground over lead RHM toward the marker.

(d) Connects resistance ground (resistor S) to lead S toward the marker.

(e) Lights the all registers lamp at the attendants console via lead ARB (if the other register is in use).

3.06 Relay ON operated:

(a) Prepares operate and holding paths for relays PU, UD, TD-, UD-, DC, RRLA, and RRLB.

(b) Opens the operate path of the register allotter relays in the marker by removing battery and ground from leads ONB and ONG, respectively.

(c) Starts PS & PD timing.

3.07 Relay AC- operated:

(a) Operates relay UD via lead HA1.

(b) Operates one of the TD2 to TD8 relays.

(c) Operates one of the UD0 to UD9 relays.

3.08 Relay UD operated:

(a) Locks under control of relay ON.

(b) Operates relay DC.

3.09 Relay TD- and UD- operate and ground their associated leads T- and U- to the marker.

3.10 Relay DC operated:

(a) Locks operated under control of relays RRLA and RRLB.

(b) Holds relay L operated over its tertiary winding.

(c) Connects battery to leads RCTA, RCTB and DC(2,4) toward the marker.

(d) Grounds lead DC(1,3) to the marker.

(e) Releases relay AC-.

3.11 NOTE: Relays operated: COT, ON, SR, DC, UD, POS-, L, TD- and UD-; and possibly TLA and TLD.

3.12 The marker functions to connect the trunk to the called party and releases the register.

3.13 When the attendant originates a call via an attendant trunk or uses an attendant trunk for busy verification, the action is as described above except that relay AC- is operated when the attendant depresses a direct station selection key. Relay AC- operates at the time the attendant seizes the trunk and the dial tone connection is automatically established.

B. Station Direct Station Selection - Option ZE

3.14 Station direct station selection feature requires that the auxiliary relay circuit for direct station selection from stations be provided. A station arranged to select other stations by direct station selection obtains a dial tone connection in the normal manner.

3.15 A DSS key is operated and the auxiliary relay circuit function to connect ground to one of leads T0 to T9, one of leads U0 to U9, and completes a path between leads UD1 and UD2.

3.16 The tens digit is registered by operating a TD- relay and the units digit by operating a UD- relay.

3.17 Relay UD operates from ground supplied by relay ON over the path completed by leads UD1 and UD2. Relay UD operates relay DC, and the register functions to complete to the marker.

4. SINGLE DIGIT DIALING

A. Single Digit Dialing for Stations - SC28 (MD), SC31

App. Figs. 10, 11 & 12

4.01 The register may be arranged so that stations 20, 30, 40, 50, 60 and 70 may be called by dialing only the tens digit. Dialing the normal tens digit results in operating relay SW, and the corresponding TD- relay as previously described.

4.02 Relay TD- operated:

(a) Locks operated under control of relays RRLA and RRLB.

(b) Grounds its associated lead T- to the marker.

4.03 Relay SW operated:

(a) Locks under control of relays ON and PU (if operated).

(b) Releases relay(s) P-.

(c) Operates relay STR.

(d) Starts the timer.

4.04 After a delayed time, the timer extends ground over lead SD-, operating relay SD.

4.05 Relay SD operated:

(a) Locks under control of relay ON.

(b) Operates relay UD0

(c) Operates relay UD.

4.06 Relay UD0 operated, locks under control of relay ON, and extends ground over lead U0 toward the marker. Relay UD operated, locks under control of relay ON, and operates relay DC.

4.07 Relay DC operated:

(a) Holds relay L operated over its tertiary winding.

(b) Connects battery to leads RCTA, RCTB and DC(2,4) toward the marker.

(c) Grounds lead DC(1,3) to the marker.

(d) Releases relay PU (if operated).

(e) Releases relay SW (if PU is not operated).

(f) Stops PS & PD timing (if SW is operated).

4.08 NOTE: Relays operated: L, SR, ON, P2A, TD-, SW, STR, SD, UD, UD0 and DC; and possibly TLA and TLD.

4.09 The marker functions to complete the call and releases the register.

APP. FIG. 5 & ZC OPTION (MD)

4.10 The register may be arranged so that stations 20, 30, 40, 50, 60 and 70 may be called by dialing only the tens digit. Dialing the normal tens digit results in the corresponding TD- relay operating as previously described. Relay TD- locks operated and connects ground via isolating diode SD- to relay SD. Relay SD does not operate since transistor T is not conducting.

4.11 Transistor T is a PNPN transistor that requires a current of a specified amount in the base for turn on. Transistor T is off since zener diode Z is prevented from conducting due to the negative bias supplied by resistor RB and relay STR normal. Negative battery supplied through resistor RB holds capacitor C charged to full battery voltage.

4.12 The release of relay RA at the end of the tens digit causes the register to function to operate relay STR. Relay STR removes negative battery from resistor RB. The voltage across capacitor C descreases as the capacitor discharges through resistor RE and potentiometer R. Zener diode Z starts to conduct when the difference between battery voltage and capacitor voltage exceeds the breakdown voltage of the zener diode.

4.13 The base potential starts to rise. Resistor RC drains off a fixed amount of current and thereby sets the minimum amount of current required to turn on

transistor T over the range of base turn on currents encountered in this type of transistor. The base becomes forward-biased turning on transistor T which operates relay SD.

4.14 The difference in time between the operation of relay STR and the operation of relay SD may be adjusted to 3 seconds using potentiometer R. Capacitor C remains charged to full battery voltage during the idle state so that it will remain properly formed. Resistor RF limits the current through diode Z and transistor T to a safe value when battery is applied to the single digit dialing timing and control circuit.

4.15 Relay SD operates relay UDO and relay UD. Relay UD operates relay DC, and the register functions to complete to the marker. Relay DC reconnects battery to resistor RB. Relay SD remains operated since the battery is insufficient to cause transistor T to cease conducting. Relay SD remains operated until relay TD- releases removing the operating ground. The early make-break relay contacts in series with the winding of relay SD are for test purposes.

B. Single Digit Dialing 8 for Long Distance - Option ZK

4.16 Option ZK provides access to the long distance operator by dialing the single digit 8. Relay TD8 operated connects ground to the timer (App. Fig. 10 & 11 used) or, connects ground to relay SD (App. Fig. 5 used). After a delayed time relay SD operates in the same manner as occurs for single digit dialing for stations.

4.17 Relay SD operated:

(a) Operates relay OT.

(b) Connects ground to the marker via lead T9.

(c) Removes the ground that had been applied to the marker via lead T8.

(d) Operates relay UDO.

(e) Prevents the operation of other UD- relays by opening the operate paths provided when relay OT operates.

(f) Extends the LD leads from central office trunks 8 and 9 to the marker.

(g) With option XT, extends the LD leads from central office trunks 6 and 7 to the marker.

(h) Operates relay UD.

4.18 Relay UD operates relay DC, and the register functions to complete to the marker. The marker establishes a connection to one of the trunks in the group 6, 7, 8 and 9. Trunks 6, 7, 8 and 9 are connected to a toll subscriber line circuit. They are removed from the regular hunting arrangement used for one or two digit code 9 dialing and are placed in their own hunting group. The trunks are arranged so that the only access to them is by dialing 8.

5. OPERATION WITH "TOUCH-TONE" CALLING RECEIVING CIRCUIT (SC 29)

A. Type A3 Receiver

5.01 Options YJ and YL provide a TOUCH-TONE calling translation circuit to arrange the register for use with a type A3 TOUCH-TONE calling receiving circuit.

5.02 The station or attendant obtains dial tone in the usual manner when making a TOUCH-TONE call. To place the call, the pushbuttons are depressed in a sequence corresponding to the digits of the called number. Depressing the button causes a two frequency tone to be generated within the station set or attendants console.

5.03 The receiving circuit responds to the TOUCH-TONE signals by operating relay STR1 and delivers output signals via the digital leads, one lead for each of the signaling frequencies. The output signals one of the relays in the L1 to L4 relay group and one of the relays in the H1 to H3 relay group.

5.04 Relays L- and H- operated complete a path to operate one of the ten TD- relays. Relay TD- locks operated and connects ground to the corresponding T-lead to provide the marker with tens digit information.

5.05 Relay STR1 operates relay KRA. Relay KRA operates relay P2A. Relay P2A locks operated under control of relay ON, opens the path supplying dial tone, and prepares the operate path for relay SW.

5.06 Releasing the pushbutton causes the receiving circuit to release relays STR1, L-, and H-. Relay STR1 releases relay KRA. Relay KRA releasing operates relay SW. Relay SW operates relay STR. Relay STR locks under control of relay ON, prepares an operate path for relay UD, and prepares the operate paths of the ten UD- relays.

5.07 Depressing the pushbutton corresponding to the second digit of the called stations code causes the receiving circuit to again operate relay STR1 and one relay in both the L1 to L4 relay group and the H1 to H3 relay group. Relays L- and H- complete a path to operate one of the ten

UD- relays. Relay UD- locks operated and connects ground to the corresponding U-lead to provide the marker with units digit information.

5.08 Relay STR1 operates relay KRA. Relay KRA operates relay UD and opens the operate path for relay DC. Relay UD locks under control of relay ON and prepares the operate path for relay DC.

5.09 Releasing the pushbutton causes the receiving circuit to release relays STR1, L-, and H-. Relay STR1 releases relay KRA. Relay KRA releasing operates relay DC. The register functions to complete to the marker.

B. Type C1 Receiver

5.10 Option 9 provides a connector to arrange the register for use with a type C1 TOUCH-TONE calling receiving circuit.

5.11 Register circuit action is the same as described for operation with a type A3 receiver except that relay KRA, relay TD-, and relay UD are operated directly from the type C1 receiver.

6. REGISTER COMPLETES TO THE MARKER

A. Dial Completion

6.01 Relay DC operates indicating that the register is ready to transmit its stored information to the marker.

6.02 Relay DC operated:

(a) Locks under control of relay RRLA, RRLB and BY normal, and relay ON operated.

(b) Holds relay L operated through its tertiary winding.

(c) Connects battery and ground to leads DC(2,4) and DC(1,3), respectively to signal the marker that the register is requesting service.

(d) Connects battery via leads JT(A,B) or RCT(A,B) to signal the marker that a junctor should or should not be used by the marker in terminating the call.

(e) Connects resistor H across leads T and R. This is required by the junctor in the establishment of junctor class calls.

(f) Releases relay AC- (if operated).

(g) Releases relay SW (if relay PU is not operated) or, releases relay PU which in turn releases relay SW. This prepares the register for dial completion time-out.

(h) Prevents operating relay OT and connecting ground to marker lead TO should dial completion time-out occur.

(i) Prepares to operate relays RRLA and RRLB should dial completion occur.

(j) Completes a path between leads RT and RT1 to the alarm, transfer and test circuit.

B. Transfer of Registered Digits and Class Information

6.03 Relay DC operated signals the marker that the register is requesting service. The marker when ready to function with the register connects to the register information leads. The marker accepts the digit information and functions to terminate the call.

6.04 A junctor class of call exists when the call is from a station to a station or from a code 8 tie trunk to a station. This is indicated to the marker by a battery signal on leads JT- when relays COT, OT, TR, and TMO are normal.

6.05 A trunk class of call exists for all other types of calls. This is indicated to the marker by a battery signal on leads RCT when relays COT, OT, and TR are operated alone or in combination.

6.06 Relay COT is operated when the call originates in a central office trunk or ringdown tie trunk.

6.07 Relay COT operated:

(a) Locks under control of relay ON.

(b) Operates relay TLA, when option J is provided, to store in the register the information central office trunks and ringdown tie trunks are not restricted.

(c) Signals the marker that a trunk class of call exists.

(d) Prepares a path to operate marker relays COT- via leads CT-.

(e) Prepares an operating path for relay RV.

(f) Prepares an operating path for relay TT.

(g) Completes a path between marker leads PCG and CPC to operate originating peg count traffic registers.

(h) Prevents relay DC from connecting resistor H across leads T and R.

6.08 The marker operates relay RV when it is processing the call stored in the register. Relay RV operated connects bat-

tery through resistor T to lead T and ground through transformer TN to lead R. This battery and ground reversal on leads R and T is a signal to the trunk that the marker is engaged in terminating the call that the trunk originated.

6.09 Battery is supplied through resistor T in place of the winding of relay L to insure that transient currents generated by the reversal will not release and reoperate relay L causing an error in the digit stored.

6.10 When a central office trunk or ringdown tie trunk dials a trunk code, relay TR operates relay TT.

6.11 Relay TT operated:

(a) Locks under control of relay ON.

(b) Signals the marker via leads TR- to cause the marker to operate the pad control relays in the originating ringdown tie trunk, the terminating ringdown tie trunk, or in both ringdown tie trunks.

(c) Signals the marker via leads TR- to cause the marker to extend the signal to the originating central office trunk or the originating ringdown tie trunk.

(d) Completes a path between marker leads PCG and TPC to operate originating peg count traffic registers.

6.12 Incoming calls originating in code 8 tie trunks cause the marker to operate relay TT.

C. Register Returns Busy Tone To Calling Line (SC 20)

6.13 When a calling station or dial repeating tie trunk dials a busy line, the marker routes the call to the busy tone trunk to supply busy tone to the calling line. If the busy tone trunk is engaged when the marker finds the called line busy, the marker signals the register to return busy tone to the calling line by operating relay BY.

6.14 Relay BY operated:

(a) Locks under control of relay ON.

(b) Supplies busy tone to the calling station or trunk through transformer TN.

(c) Releases relay DC which places relay L under control of the calling line.

(d) Opens the marker leads RR- to prevent releasing the register when the marker releases.

(e) Prepares operating paths for relays RRL- to allow the register to release if time-out occurs.

(f) Opens marker lead DC1 or DC3 to prevent the register from seizing the marker if time-out occurs.

6.15 The register releases when the calling station disconnects or when time-out occurs, whichever occurs first.

7. RELEASE OF REGISTER

A. Abandoned Call (SC 2)

7.01 Relay L releases when the calling line disconnects before relay DC operates. Relay L slow- releases relay SR.

7.02 Relay SR released:

(a) Releases relay ON.

(b) Removes the 100 ohm ground from lead S, releasing the calling line hold magnet or causing the originating circuit to release.

(c) Removes ground from marker lead RHM, releasing both register hold magnets in the marker.

(d) Extinguishes the all registers busy lamp at the attendants console if the other register is in use.

(e) Releases relay AC- if the call was originated by the attendant.

(f) Opens the operate path for relay P1.

7.03 Relay ON released restores the register to normal, removes dial tone, and provides a signal via leads ONG and ONB that is used by the marker as it allocates calls to the two registers.

B. Normal Release

7.04 The marker operates relays RRLA and RRLB when it has completed its function of terminating the call.

7.05 Relay RRLA or RRLB operated:

(a) Locks under control of relay ON and the marker.

(b) Releases relays DC, TD-, and UD-.

(c) Opens the relay L operate path over leads T and R.

7.06 Relay DC releases relay L. Relay L releases relay SR. Relay SR releases relay ON and both register hold magnets in the marker. Relay ON released restores the register to normal and sends a signal that is used by the marker as it allocates calls to the two registers.

7.07 Relays RRLA and RRLB release when both relay ON and the crosspoints in the marker release.

C. Time-Out Release

7.08 The marker operates relays RRLA and RRLB when it completes its function of terminating the call to an attendant trunk after register permanent signal or partial dial time-out occurs. Relays RRLA and RRLB lock under control of relay ON and the marker, release relay TMO, and release relay L. Further register action is as described under normal release.

7.09 Relay TMO operates if the marker after being seized by the register completes its functions and fails to release the register or if the register is supplying busy tone to the calling line and the calling line does not disconnect. Relay TMO operates RRLA and RRLB. Further register action is as described under normal release.

8. REGISTER TIME-OUT (SC 10, SC 11, SC 24, SC 25)

A. General

8.01 To be sure that the register will not be permanently engaged by a receiver off-hook or by incomplete dialing, a timing circuit operates on every register seizure to insure that suitable terminating action occurs to release it within a nominal period of time. This timing circuit consists of relays PU and TMO, which operate from timed pulses originating in the power plant.

8.02 The power plant furnishes two timing pulses, TM and PU, which are of 1/4 second duration and are separated in time by approximately 1/5 second, each of which has cyclic rate of one pulse every 8 seconds. Sequence Chart SC-25 diagrams this grounded timing pulse action.

8.03 Because of the pulse stagger, two timing extremes are possible. The first condition, for minimum time-out, occurs when the PU pulse coincides with the seizure of the register. The PU pulse duration is long enough for the slow operate relay PU to function. Relay PU prepares the operate path for relay TMO. Eight seconds later, the TM pulse occurs, operating relay TMO.

8.04 The second condition, for maximum time-out, occurs when the tail end of the PU pulse is just passing as the register is seized. Under these conditions, the register has to wait approximately 7.5 seconds before the next PU pulse arrives. When the PU pulse does arrive, relay PU operates preparing the operate path for relay TMO. Eight seconds later the TM pulse occurs, operating relay TMO. The time-out extremes are approximately 8.0 and 15.5 seconds.

B. Permanent Signal Time-Out

8.05 Relay ON operates when the register is seized and prepares the operate path for relay PU. The ground pulse over lead PU operates relay PU. Relay PU locks under control of relay ON and prepares the operate path for relay TMO. The ground pulse over lead TM operates relay TMO.

8.06 Relay TMO operated:

(a) Locks under control of relay ON.

(b) Operates relay OT and connects ground to the marker via lead TO.

(c) Operates relay UD1.

(d) Prevents relay UD from operating when relay OT operates.

(e) Connects resistor H across leads T and R to insure the operation of attendant trunk relay A.

(f) Signals the marker via leads DC- that the register is requesting service.

8.07 The marker routes the call to the attendant as an intercept call.

C. Partial Dial Time-Out

8.08 The first dialed digit of a directing code is registered by the operation of a TD- relay. If the second digit is not dialed, relay TMO operates and functions as described for permanent signal time-out. Relay TMO also releases any operated TD- or UD- relays and opens the normal ground supply for the marker T- leads to insure the only leads grounded are leads TO and UO.

8.09 The marker routes the call to the attendant as an intercept call.

D. Time-Out After Dial Completion

8.10 If the marker fails to release the register after being called to complete a call, or if the calling line does not disconnect when receiving busy tone from the register, the register times itself out and releases.

8.11 If relay PU is operated at the end of the last digit dialed, relay SW is locked operated under control of relay PU. Relay DC operates to call in the marker. Relay DC releases relay PU. Relay PU releases relay SW. Relay SW prepares the operate path for relay PU, thus starting another complete timing cycle for the PU and TMO relay combination.

8.12 The ground pulse on lead PU operates relay PU. Relay PU locks under control of relay ON and prepares the operate

path for relay TMO. The ground pulse over lead TM operates relay TMO. Relay TMO operates relays RRLA and RRLB. Relays RRLA and RRLB cause the register to restore to normal.

9. REGISTER TESTING

9.01 The number 310 plug of the test cord is inserted into jack TST when the register is to be tested. The action operates relay RT, opens the tip and ring towards the marker, and closes the tip and ring toward the register through to the test cord.

9.02 Relay RT operated:

(a) Prevents marker hold magnets THM-8 and THM-9 from operating.

(b) Prevents relay DC from holding relay L operated.

(c) Prepares a path to light the ARB lamp at the attendant position when the other register is in use.

(d) Lights lamp RT.

(e) Lights lamps TR in the cordless position circuit and alarm circuit to indicate that there is an off normal condition in the PBX.

(f) Prevents marker seizure by opening the ground to lead DC1 or DC3.

(g) Makes the register busy to the marker by opening lead ONG ground.

9.03 Caution: When testing the 293A (TD- or UD-) relays, avoid the use of any testing equipment which might permit currents over 0.5 ampere to pass through the reeds. Do not use headsets with low resistance receivers, such as the 56-ohm 528 receiver or the 1011G hand set, unless a 1000-ohm resistor is put in series with the unit. Such a resistor has been made available in SD-66796-01, the alarm, transfer, and test circuit, as the RB resistor (terminal HRB) located on slide 6 of the PBX. When using a lamp as the testing device, take particular care that tungsten filament lamps are not used.

10. FUNCTION OF MAKE BUSY AND BUSY DISPLAY CIRCUIT

A. Register key Normal

10.01 With the register key (REG- key) normal in the make busy and busy display circuit, the register busy lamp (REG- lamp) will light when the marker operates relay SR in the dial pulse register circuit. This indicates that the register has been made busy by the marker through normal operations.

B. Register Made Busy

10.02 If it is desired to make a register busy to the marker, key REG- in the make busy and busy display circuit is operated. Key REG- operated, operates register relay RT. Relay RT operated makes the register busy to the marker by removing ground from leads ONG and RHM in the register circuit.

10.03 Removing the ground from lead RHM lights lamp REG- in the make busy and busy display circuit, indicating that the register has been made busy. Removing the ground from lead ONG prevents the operation of register allotter relays (RA-) in the marker circuit thereby preventing the use of the register by the marker.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 Maximum External Loop Resistance - 2000 ohms.

1.02 Voltage Limits

Voltage	Minimum	Maximum
-48	-45	-52

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
AC(0,1)	Attendant Connector
BY	Busy
COT	Central Office Terminating
DC	Dial Completion
H1-H3	High Tone
KRA	Register Advance
L	Line
L1-L4	Low Tone
ON	Off-Normal
OT	Only Tens
OTA	Only Tens Auxiliary
P1-P5	Pulse Counter
P2A	Pulse Counter Auxiliary
POS (1, 2)	Position
PU	Pick Up
RA	Register Advance
RRL (A,B)	Register Release
RT	Register Test
RV	Reversing
SD	Single Digit
SR	Supervisory
STR	Steering
STR1	Translator Steering
SW	Switching
TD (0-9)	Tens Digit Register
TLA	Toll Allowed
TLD	Toll Denied
TMO	Time-Out
TR	Two-Digit Trunk
TT	Trunk Terminating
UD	Units Digit
UD (0-9)	Units Digit Register

3. FUNCTIONS

3.01 Make itself busy either with the register engaged on a service call, or with the register under test, by means of a plug in the test jack.

3.02 Time and then generate a units digit 0 when single digit dialing is required.

3.03 Hold the register work and memory hold magnets in the marker under control of a slow release supervisory relay when the marker releases.

3.04 Register originating class of service and/or class of call when seized by the marker. This data may be retransmitted to the marker on completion of the call for terminating circuit usage.

3.05 Transmit dial tone to the calling line when the register has been connected to the line and is ready to receive dial pulses.

3.06 Disconnect dial tone after the second pulse of the tens digit has been received.

3.07 Count the number of pulses in each digit.

3.08 Register the units digit count on a group of 10 tens register relays on a 1 out of 10 basis.

3.09 Register the units digit count on a group of 10 units register relays on a 1 out of 10 basis.

3.10 Recognize that only one digit is to be received on calls to the attendant.

3.11 Recognize that one or two digits are to be received on calls to a central office or ringdown tie trunk depending upon the option provided.

3.12 Engage the marker after the units digit has been dialed or after a single digit central office or attendant code has been dialed.

3.13 Hold the register after dial completion so that the calling subscriber cannot release the connection while the marker is engaged.

3.14 Transfer the class of call and class of service indication to the marker.

3.15 Reverse battery and ground to the link connection upon receiving a signal from the marker on a call to be terminated from a central office or ringdown tie trunk.

3.16 Release when the marker grounds the RR- leads and return to normal.

3.17 Measure time, 8 seconds nominal, while waiting for the two digits to be dialed. If the digits are not dialed, or are only partially dialed, when the register times out, the line is connected to intercept.

3.18 Measure the time between dial completion and release of the register, 8 seconds nominal. If the register does not release in this time due to release ground signals from the marker, the register releases itself and is reallotted for subsequent usage.

3.19 Route unequipped number codes to intercept.

3.20 Supply busy tone to the calling line when the busy tone trunk is engaged.

3.21 Operate a traffic register to record the originating trunk traffic.

3.22 Translate a single digit 8 into 90 when long distance dialing is required.

3.23 To provide for a busy indication to the make busy and busy display circuit.

3.24 To provide for being made busy by the make busy and busy display circuit.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a keysheet, the connecting information thereon is to be followed.

(a) Line, Link and Marker Circuit - SD-65741-01.

(b) PBX Cabling Diagram - SD-65746-01.

(c) Two-Way Trunk Circuit to Central Office - SD-65752-01.

(d) Cordless Position Circuit - SD-65757-01.

(e) Auxiliary Relay Circuit for Direct Station Selection by Stations - SD-65942-01.

(f) Alarm, Transfer, and Test Circuit - SD-66796-01.

(g) TOUCH-TONE Calling Receiving Circuit - Type C1 - SD-67027-01.

(h) Power Supply Circuit - SD-81326-01.

(i) Power Supply Circuit - SD-81600-01.

(j) Signaling Circuit - Tone Generator for PBX TOUCH-TONE Calling - SD-81719-01.

(k) TOUCH-TONE Calling Receiving Circuit-Type A2 - SD-95287-01.

(ℓ) TOUCH-TONE Calling Receiving Circuit-Type A3 - SD-98148-01.

(m) Make Busy and Busy Display Circuit - SD-5E029-01.

(n) Relay Delay Timer Circuit - SD-99361-01.

5. MANUFACTURING TEST REQUIREMENTS

5.01 The dial pulse register shall be capable of performing all the service functions specified in this circuit description and meeting all the requirements of the Circuit Requirements table and also shall be capable of functioning under test conditions listed below.

(a) The pulsing and counting functions of the register shall be checked with the following conditions: A precision pulse generating circuit such as SD-25680-0113 or equivalent capable of generating dial pulses within the limits of accuracy given in Fig. 1 in the Information Note 301 on the SD.

(b) Nominal circuit conditions may be employed in these tests except as specified in (d) and (e).

(c) The pulsing and counting features of the register circuit under test shall be checked using the pulsing and loop conditions covered in Note 301 on the drawing. Two digits, a digit of less than five pulses (preferably a 2 or 3) followed by a digit of more than five pulses (preferably a 9 or 0), shall be dialed under each condition and all digits dialed shall be correctly registered.

(d) The test circuit shall provide an interdigital interval of 183 ±13 msec for the pulsing conditions of Fig. 1C. For other pulsing conditions this time may be exceeded.

(e) All timing and operation tests shall be performed with the test voltages within the limits of 45 to 52 volts.

6. TAKING EQUIPMENT OUT OF SERVICE

Register Circuit

6.01 When the make busy and busy display circuit is not provided, the register can be taken out of service by inserting a No. 258 plug in jack TST.

NOTE: Make sure that the register is not in use before inserting the No. 258 plug.

6.02 When the make busy and busy display circuit is provided, the register can be taken out of service by operating the register busy key (REG key) in the make busy and busy display circuit.

NOTE: Make sure that the register busy lamp (REG lamp) is not lit in the make busy and busy display circuit before operating key REG.

SECTION IV - REASONS FOR REISSUE

B. Changes in Apparatus

B.1 Added

Diode L, 446F, option XO, App. Fig. 3
Relay AC(0,1), AJ202, option XP, App. Fig. 4
Relay SD, AJ83, App. Fig. 10
Diode SD, 458A, App. Fig. 10
Capacitors SDO & SD1, 535EA, App. Fig. 11
Connector J2, 910A, App. Fig. 11
Resistors SDO & SD1, 221A, App. Fig. 11
Time Delay Unit T, ED-99555-( ), App. Fig. 12
Diodes ST-, 458A, App. Fig. 13
Relay OTA, 1/2AK30, Option XW, App. Fig. 1

B.2 Removed

Relay AC, AJ202, option ZB, App. Fig. 2
Relay SD, AJ83, App. Fig. 5
Capacitor C, KS-14105, option YA, App. Fig. 5
Capacitor T, KS-16742, L1, App. Fig. 5
Diode SDA, 446F, option YW, App. Fig. 5
Diode Z, 446N, Option YW, App. Fig. 5
Potentiometer R, KS-13790, L30, App. Fig. 5
Resistor RB, 146C, App. Fig. 5
Resistors RC & RE, 145C, App. Fig. 5
Resistor RF, KS-13490,L1, option YN, App. Fig. 5
Transistor T, 27A, App. Fig. 6
Diodes SD-, 446F, option YY, App. Fig.7

B.3

Superseded	Superseded By
Relay KRA AF16, Option ZB, App.Fig.2	Relay KRA, AF20, Option XP, App. Fig. 2
Relay RT, AF63, Option XL, App.Fig.2	Relay RT, ½AK7, Option XM, App. Fig. 2
Relay TLD, AF52, Option XL, App.Fig.2	Relay TLD, ½AK7, Option XM, App. Fig. 2
Relay SW, AF114, Option XL, App.Fig.3	Relay SW, ½AK6, Option XM, App. Fig. 3
Relay UD, AF57, Option XL, App.Fig.3	Relay UD, ½AK6, Option XM, App. Fig. 3
Capacitor LW, 542G, Option XN,App.Fig.1	Capacitor LW, 705G,Option XY App. Fig. 1

C. Changes in Circuit Requirements Other Than Those Caused by Changes in Apparatus

C.1 On sheet F2, Test Note 4 is added.

D. Description of Changes

D.1 Option XL is designated and rated Manufacture Discontinued. Option XM is added and rated Standard to show recoding of relays RT, TLD, SW & UD on a cost reduction basis.

D.2 Relay L tends to produce oscillating transients and split pulses when combined with 24V4 repeaters. Option XN is designated and rated Standard. Option XO is added and rated Standard. Option XO adds diode L (App. Fig. 3) in series with the primary (10-11) winding of relay L to prevent pulse splitting when the dial pulse register circuit is being used with 24V4 repeaters.

D.3 Option ZB is rated Manufacture Discontinued. Option XP is added and rated Standard to show recoding of relay KRA from AF16 to AF20. Option XP also transfers relay AC- from App. Fig. 2 to App. Fig. 4. This places all the attendant direct station selection relays in one App. Fig. instead of two App. Figs.

D.4 Option XQ is designated and rated Manufacture Discontinued. Option XR is added and rated Standard to prevent a buzzing condition of relay TR when the register circuit is strapped for two digit code 9 operation (option T provided). Option XR insures that the lock path of the TR relay on two digit code 9 operation is present before the operate path is removed.

D.5 Options XK, YA, YN, YW, YY, ZC, ZS, and App. Figs. 5, 6 & 7 are rated Manufacture Discontinued. Option XS, XT, and App. Figs. 10, 11, 12 & 13 are added and rated Standard. Option XU is added and rated Manufacture Discontinued. App. Fig. 10, 11 & 12 replace App. Fig. 5 & 6. App. Fig. 13 replaces App. Fig. 7.

Option XS is provided when only one of the tens group is arranged for single digit dialing. If more than one of tens group is arranged for single digit dialing, App. Fig. 13 must be provided. App. Fig. 13 adds ST- diodes (type 458A). Option XT provides single digit dialing for central office trunk units 6 & 7.

D.6 A misdirected call condition exists when the PBX is arranged for single digit 8 & 9. The call may be routed to the attendant on an intercept basis under an all-trunks-busy condition.

Option XV is designated and rated Manufacture Discontinued. Option XW is added and rated Standard. Option XX is designated and rated Standard. Option XW adds a new relay OTA(½AK30) and associated wiring to prevent the call from being routed to the attendant and is returned busy tone under an all-trunks-busy condition. Option XX must be specified where ZI

option has been provided. (Single digit code 8 not used or used for reaching station tie trunk or miscellaneous trunk).

D.7 The pigtail leads of capacitor LW(542G) tend to break during shipment of 756A PBX system. Vibrations occuring during shipment causes the mass of capacitor to bend the pigtail leads to the point of fatigue. Option ZN is rated Manufacture Discontinued. Option XY is added and rated Standard to recode capacitor LW from 542G to 705G, thus eliminating lead breakage during shipment of 756A PBX system.

D.8 On sheet D1, under Circuit Note 104, option XK is added under the Standard column to correct a drafting error.

D.9 On sheet D1, under Circuit Note 102, option XX is added.

D.10 On sheet D1, Circuit Note 106 is rated Manufacture Discontinued; and Circuit Notes 119, 120, 121 & 122 are added. On sheet D2, Information Notes 302 & 303 are rated Manufacture Discontinued; and 304 & 305 are added and rated Standard.

D.11 Sheet G1 is added to show CAD Fig. for Miscellaneous Terminal Strip.

D.12 Sheet G1 is added to show CAD 1 for App. Figs. 1, 2, 3 & 10.

D.13 Circuit Notes 101, 102 & 104; App. Figs; Sequence Charts; Circuit Requirements Table; Sheet Apparatus, Lead & Option Indices have been changed to reflect the added options.

BELL TELEPHONE LABORATORIES, INCORPORATED

(WECo 5120HW-SHA-RHP)
DEPT 5337-RVL