CROSSBAR SYSTEMS
NO. 3
2-WAY PLUG-ENDED TRUNK
CIRCUIT
DIAL PULSING USING BYLINK
E&M LEAD SUPERVISION

CHANGES

B. Changes in Apparatus

B.01 Added

R Diode, code 533K

D. Description of Changes

D.01 More than one incoming register was being attached to the bylink trunks. Bylink trunks connect the primary coil of relay R in parallel with relay TP_ in the incoming register link, which slows down the release of relay TP_. If upon release relay TP_ is slowed sufficiently, another relay RP_ in the link may operate, causing the link to connect another register to the trunk. Diode R is added to the RL lead in the trunk to correct this problem. This diode electrically splits relays R and TP_ during link release, allowing relay TP_ to release normally.

D.02 On an outgoing call, where the trunk is connected to a sender, if a carrier failure occurs, and the failure lasts longer than the charge timing interval, a low-resistance ground is connected to the AB lead from the sender. The low-resistance ground causes the MRS-RP fuse to operate. Loss of the MRS-RP potential results in coins not being collected at the pay station and the sender times out and sticks. To prevent this trouble a break contact of relay B is added in the AB lead to the sender.

AT&T BELL LABORATORIES

DEPT 55212-RBC

AT&T NETWORK SYSTEMS
DEPT 20610-JAM-RW-JLP

CROSSBAR SYSTEMS
NO. 3
2-WAY PLUG-ENDED TRUNK
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CHANGES

B. CHANGES IN APPARATUS

B.1	Superseded	Superseded By
	R,T - 442E Capacitor - App Fig. 1 - U Option	R,T - 535BS Capacitor - App Fig. 1 - T Option
	M - 19BM Resistor - App Fig. 1 - W Option	M - 18BM Resistor - App Fig. 1 - V Option and M - 533A Diode - App Fig. 1 - V Option

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

C.1 Blocking information has been added in the circuit requirements for the RL relay.

D. Description of Changes

D.1 The FS1, has been revised to show the addition of N,R,T, and V options. The P,S,U, and W options were not formerly designated and are rated Mfr Disc.

D.2 Contact 2 of the R relay is connected to 2U of the R relay; it formerly connected to 2L of the R relay.

D.3 Circuit Note 104 has been revised.

D.4 FS1 and CAD 2, reference to signaling and transmission facilities with type I interface is added.

F. Changes in CD Section II

F.1 Add 1.04 (f) as follows:

(f) Closes ground through 2 make, and signals the incoming register circuit over lead CO that the R relay is operated.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-GFC

WE DEPT 25820-JRF-GWC-VK

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This 2-way interoffice trunk circuit completes calls from step-by-step (SXS) offices on a bylink basis. It also is used to complete locally originated calls to SXS offices.

2. GENERAL DESCRIPTION OF OPERATION

INCOMING CALLS

A. Seizure

2.01 Seizure of the trunk is made by the step-by-step office during an interdigital interval, making it necessary that an incoming register be attached and ready for pulses before the end of the interval. The incoming register link (IRL) provides a bylink path to the register so that pulses, repeated by the supervisory relays, may be received before the register is attached to the trunk through the link switch. In the event that pulsing commences prior to closure of the bylink path (this may occur on delay in obtaining a register), a means is provided to return overflow to the calling customer.

B. Completing the Connection

2.02 When pulsing is completed the incoming register summons a marker. The marker seizes the trunk via the incoming register link but places the ringing code information in the trunk through the trunk switch and connector circuit. The marker sets up the connection to the called line, makes checks of the T, R, and S, turns supervision of the connection over to the trunk and releases both itself and the incoming register. Ringing of the called station is now started by the trunk.

C. Answer and Disconnect

2.03 When the called customer answers, ringing is tripped, the talking path is cut through and answer supervision is returned to the calling end. At the end of conversation if the calling party disconnects first, the trunk releases the connection to the called line and returns to normal. Should the called party disconnect first, the trunk sends on-hook supervision to the calling end and awaits their disconnect. Additionally after a timed interval the trunk will release the local (called) customers line should disconnect supervision not be returned by the step-by-step office. The time out causes a permanent signal alarm to be activated. The trunk will remain in this state until the step-by-step office releases the incoming seizure of the trunk.

OUTGOING CALLS

A. Seizure

2.04 The marker determines from the calling registrations that a call is outgoing and selects an idle sender. It also seizes an idle trunk for the desired route. The marker attaches a sender, completes tests of the connection to the calling line, connects the line to the trunk, and then releases.

SENDER FUNCTIONS

2.05 After the marker disconnects, the sender dial pulses the called number into the trunk on a loop basis. The trunk converts the loop pulses to pulses on the E and M signaling channel for transmission to the step-by-step office. The sender disconnects when it has completed outpulsing and turns supervision of the call over to the trunk.

A. Answer and Disconnect

2.06 When the called customer answers, an off-hook signal is returned to the trunk. Answer supervision starts a short, charge timing interval in the trunk at the end of which message register potential (MRP) is applied to the sleeve to score a register if the customer is not flat rate or to set the auxiliary coin line circuit to the coin collect state. From this point on nothing further happens in the trunk until disconnect.

2.07 The calling customer disconnecting first causes the trunk to release the connection to the calling line, to send an off-hook supervisory signal, to the step-by-step office which releases its selectors and to cause the trunk to return to idle after a timed cover up interval. The called customer disconnecting followed by the local customer will result in the trunk returning to idle but if the local customer does not disconnect, the trunk time out feature will function to release the connections in both the No. 3 crossbar office and the step-by-step office and restore the trunk to normal.

ABANDONED CALLS

2.08 The trunk is arranged to release if the step-by-step or local originating

customer abandons the call at any time after the marker has disconnected. If the sender is attached the trunk delays timing the cover-ups interval prior to release, until the sender releases.

OVERFLOW

2.09 If during an outgoing call the sender is not able to complete its functions, it will open the sleeve lead. This removes ground from the sleeve of the channel to the calling line releasing the connection. The line is set to line lock out and reorder tone is returned to the customer.

SIMULTANEOUS SEIZURE

2.10 If the trunk is seized simultaneously by a marker and by the step-by-step office, it will allow the incoming call to proceed to completion. The marker is allowed to complete its functions, however an on-hook supervisory signal is maintained toward the step-by-step office. When the marker releases, the trunk forces an abandoned call signal to the sender. The sender releases and the local calling customer is returned to line lock and receives reorder tone.

MAKE-BUSY AND TEST CALLS

2.11 A jack for each trunk is provided at the test circuit to make each trunk busy. If the trunk is in use when a make-busy plug is inserted, the call is not affected. However, at the end of the call, the trunk will be made busy immediately. Two jacks per trunk permit tests to be made. One is bridged across the tip and ring circuit and the other is in the E and M signaling leads.

SECTION II - DETAILED DESCRIPTION

1. INCOMING CALLS - SC1

SEIZURE

1.01 The step-by-step office seizes this trunk, during an interdigital interval, by operating the E relay. Relay E operated:

(a) Prepares the pulsing paths to the incoming register by grounding leads R and BL.

(b) Connects battery to the ST start lead to the incoming register link.

(c) Operates slow-release relay B which remains operated while the E relay follows dial pulses, thereby holding the trunk busy during the digit dialing interval.

(d) Opens the FT lead to the trunk switch and connector circuit removing the indication of the trunks availability to the marker for outgoing calls.

(e) Operates the BSY relay which locks under control of the G relay. The BSY further opens the FT lead and also opens the TF and TT leads to prevent an outgoing seizure by the marker. The BSY also enables the TMB time delay control circuit.

The B relay operated further opens the TF and TT leads, partially closes the operate path of the BY relay and prevents the TMB timer from timing by grounding its I lead.

1.02 As soon as the trunk gains preference in the IRL, the link grounds lead RL which operates relay R on its primary winding to resistance battery from the incoming register on the LK lead. Relay R operated is the signal to the trunk that a register is available to the trunk and that the bylink pulsing path over lead BL is closed through to the register.

PULSING

A. Bylink Failure

1.03 Should there be a delay in seizing a register and the bylink pulsing path is not cut through, the R relay will not be operated at the end of the interdigital interval when the E relay releases from the first pulse of the digit pulsing. With E and R released, ground on 2 make B through 7 break E, 4 break SG and 5 break R operates the BY bylink failure relay. With BY operated:

(a) It locks operated to 2 make B.

(b) It grounds the ST lead to the interrupter circuit and connects 120-IPM overflow tone through its 2 make-contact and the T1 capacitor over the tip lead to the step-by-step customer.

(c) It removes ground from the bylink pulsing path to leads BL and R.

(d) Its 3 break-contact removes battery from the ST lead to the link, removing the bid for a register.

(e) Opens the R relay operate path to the LK lead from the register.

The trunk remains in this state until the calling customer hangs up. Then the E relay releases followed by the B which releases the BY cutting off the overflow tone. Ten make of the B removes ground from the control lead to the TMB timer which starts timing a cover up interval. The cover up interval insures that when the trunk releases that the step-by-step trunk is also released. At the end of the interval, G relay operates and releases BSY which releases G. The trunk is now normal and ready for another call.

B. Register Attached

1.04 If the trunk gains preference in the link before pulsing begins, relay R is operated by the link. Relay R operated:

(a) Removes battery from the ST lead to the link and connects the ST and LK lead.

(b) Contact 5 break opens the operate path to the BY relay to prevent it from operating during digit pulsing.

(c) Partially closes a locking path to its secondary winding from resistance battery.

(d) Connects resistance battery from the CT relay winding to the sleeve of the T2 jack as a signal on test calls that the register is attached.

(e) Closes, through 10 make, a path to ground which will keep the BSY relay operated while the E relay is following dial pulses.

The dial pulsed digits are received by the trunk E supervisory relay and transmitted to the incoming register first over the BL lead bylink path and then, after the register is attached, over the R lead through the link switch crosspoints.

1.05 After the calling customer has dialed the remaining digits into the register, it makes a marker start and also grounds the CT lead to the trunk. The CT relay in operating:

(a) Locks the R relay operated through 3 make CT.

(b) Prepares a locking ground for RC.

(c) Closes ground, through its 4 make-contact, to the path which will later connect to the S sleeve lead and hold the connection to the called line. This ground will also be used to lock the PU relay when ringing starts.

(d) Partially closes the operate path of the DS relay.

The CT relay locks under control of 5 break G relay. The register checks for the appearance of the CT locking ground on lead CT. Absence of the ground indicates an abandoned call to the register.

MARKER OPERATIONS

1.06 The marker seizes the trunk through crosspoints in the incoming register link circuit. Resistance battery from the marker over lead F operates the LF relay. Relay LF operated:

(a) Operates the LF1 relay which cuts through to the trunk switch and connector circuit the operate paths of the R2, R3, RC, and TPR relays and grounds the TT1 lead to that circuit.

(b) Opens the operate path to the PU pick-up relay.

(c) Connects ground to the JC and SW leads to the trunk switch and connector circuit.

(d) Transfers the T, R, and S leads to the marker over the T1, R1, and SL leads. The marker performs a trouble, ground test on the sleeve and controls the channel over the SL lead. After the channel has been set up, the marker checks tip and ring continuity using the T1 and R1 leads.

(e) Operates the DS relay.

1.07 Relay DS operated locks through its 10 make-contact to ground. Contact 8 make prepares a path to ground for the S sleeve lead.

1.08 The marker operates the RC ringing control relay. It checks that RC operates and that its locking path is intact by checking for ground on RA lead. The path is from lead RA through 8 make LF, 5 make RC, 6 break RT, and 5 make CT to ground. The marker stores the called party ringing information in the trunk by operating the proper combination of R2, R3, and TPR relays. These relays lock to ground on 4 make RC.

1.09 The marker sets up the channel from the called line to the trunk, performs its tests on the T, R, and S and prepares to release by releasing the trunk LF relay. The released LF relay transfers the T, R, and S from the line into and under control of the trunk. The marker checks for ground on the sleeve from 4 make CT, 8 make DS, 10 break CH, 2 break D, and 5 break LF and then releases. When it releases, the marker dismisses the incoming register which releases.

LINE-BUSY OR OVERFLOW - SC2

1.10 If the called line is busy or if there are no paths through the switches, the marker releases the RC relay. The released RC removes locking ground from the R2, R3, and TPR ringing combination relays which release. The RC released transfers the called end tip and ring leads from the ringing potential leads and cuts them through to the calling end. The marker connects the trunks vertical appearance on the trunk switch to level 9 of that switch. If it selects appearance A on level 9, 60-IPM line-busy tone will be sent to the calling end and selecting appearance B will send 120-IPM overflow tone. When the marker releases the LF relay the tones will be cut through to the calling customer and relay S will not operate to send answer supervision.

1.11 The trunk remains in this state until the calling customer hangs up. Relay E releases releasing slow-release relay B which starts the TMB timer to timing the trunk cover up interval, at the end of which G relay operates. The G releases CT which releases the trunk switch hold magnet removing tone. The DS and R also release as do BSY and G which returns the trunk to normal.

RINGING - SC1

1.12 The marker released the trunk LF relay when it prepared to release. One break LF completes a path from the PU pick-up relay coil to either ground or to the PU lead from the PRTD circuit. The combination of transfer contacts, 11 on R2 and 2 on R3 relays and options Y and Z, provide that, if code 1 ringing is to be applied to the tip or ring, the operate path of the PU relay will be grounded through 6 make RC and 6 break S1. Thus, when code 1 ringing is required the PU relay is allowed to operate immediately after the marker releases. If any other code of ringing is to be applied, the operate path will be brought out to the PU lead. The 250-millisecond pulse of ground, which appears on the PU lead near the end of the 6-second ringing cycle, operates the PU at a time which assures that ringing codes 2, 3, or 4 are applied at the beginning of their sequences. In any event the PU relay operates and locks through its 5 make-contact to ground on 6 make RC. One of the ringing potentials coming from the PRTD over leads C1, C2, C3, or C4 is applied through the RT ringing trip relay and 3 make PU to either the tip or ring of the called customers line. The following chart specifies the ringing codes sent to the called customer for the various combinations of operated R2, R3, and TPR relays.

Ringing Combinations

Called Party	Relays Oper	Ringing		Applied To
		Super Imp	Coded	
1	-	Code 1-	Code 1	Ring
2	TPR	Code 1-	Code 1	Tip
3	R2	Code 1+	Code 2	Ring
4	R2, TPR	Code 1+	Code 2	Tip
5	R3	Code 2-	Code 3	Ring
6	R3, TPR	Code 2-	Code 3	Tip
7	R2, R3	Code 2+	Code 4	Ring
8	R2, R3, TPR	Code 2+	Code 4	Tip

ANSWER - SC1

1.13 Ringing potential is applied to the ring lead of the customers line through 7 make RC or to the tip lead through 2 make RC. Ringing ground through either 3 break or 2 make TPR is applied to the side of the line opposite from the ringing potential. Some of the ringing potential is fedback as audible tone to the calling customer through the T and R capacitors. When the called customer answers, the impedance of the line is reduced so that the resultant current flow operates the RT ringing trip relay. Contact 6 break of the operated RT opens the lock path of the RC ringing control relay causing it to release. The RC released:

(a) Releases the ringing combination relays R2, R3, and TPR.

(b) Opens both an operating path and the locking path of the PU relay releasing it.

(c) Partially completes, through its 8 break-contact, a path from ground to later control the sleeve lead.

(d) Removes the A idle circuit termination from the T and R.

(e) The 2 and 7 transfer contacts remove ringing from the called line and cut-on the S supervisory relay, which supplies talking battery and ground to the called party; operating the S relay and releasing RT.

1.14 The S relay operates over the called customers loop and maintains supervision of the line throughout the call. The S operates the SA which removes ground through its 9 break from the I lead to the TMA timer which starts a 750-millisecond charge timing interval. The SA also completes path from resistance battery through 10 make CT, 12 make SA, X option, 12 break LF and 8 break D to the P relay. If X option is not applied P will operate through

8 make CH when that relay operates at the end of the charge timing interval. Relay P operated applies resistance battery to the M signaling lead as off-hook answer supervision to the step-by-step office.

1.15 The trunk is now in the state in which conversation can take place between the calling and called customer. It will remain in this state until disconnect.

DISCONNECT

A. Calling Customer First - SC3

1.16 The calling station hanging up causes E relay to release from the on-hook supervisory signal sent by the originating end. Relay E releasing releases slow-release B relay which starts the TMB timer timing the trunk cover up interval, at the end of which G relay operates. The G releases CT which:

(a) Removes ground from the sleeve releasing the connection to the called customers line.

(b) Releases relay P which returns the on-hook, disconnect supervisory signal to the step-by-step office.

(c) Releases DS relay.

(d) Releases relay R which releases BSY which releases G.

The release of the connection to the called line opens the T and R releasing relay S which releases SA. The SA released reapplies ground to the I lead of the TMA timer which causes CH to release. The trunk is now idle and available for another call.

B. Called Customer First - SC4

1.17 When the called station hangs up first, the S, SA, and P relays release. Relay P sends the disconnect supervisory signal to the originating end. The SA completes a path from ground on 11 make CH through 6 make B, the PS diode, 10 break SA, and 1 break RC to the heater of the RL thermal time delay relay. The RL takes up to 32 seconds before operating. If the step-by-step customer hangs up during that interval, the E relay will release and the trunk will return to the idle state, after the trunk cover up interval.

TIME-OUT AND PERMANENT SIGNAL ALARM

1.18 As described in 1.17 when S and SA release, the heater of thermal time delay relay RL is grounded and the timed release timing interval is begun. If time-out occurs before disconnect supervision is received from the step-by-step office, relay RL operates and operates relay RC. Relay RC operated:

(a) Removes ground from the RL relay heating element allowing it to cool.

(b) Removes ground through its 8 break-contact from the S sleeve lead dropping the connection to the called line.

(c) Locks to ground on 5 make CT.

(d) Through its 9 make-contact connects ground to the PS lead from the alarm circuit. This starts a permanent signal alarm as a warning of possible trouble in the step-by-step office switch train.

The trunk remains in this state waiting for the disconnect signal from the step-by-step office. When E releases the trunk releases in the same sequence as before except that CT releases RC instead of the already released channel and B releasing removes ground from the PS lead.

2. OUTGOING CALLS - SC5

TRUNK SELECTION

2.01 There is one FT lead per trunk switch and connector circuit per outgoing route associated with these 2-way trunks. If there is at least one idle trunk for the desired route, there will be ground on the FT lead to the trunk switch and connector circuit serving the idle trunk(s). The marker selects a trunk switch and connector circuit which is ready to handle a call and applies ground through the selected circuit to the TT leads of all of the trunks on the route. The ground is returned to the marker by each idle 2-way trunk over individual TG leads. The marker selects a trunk and operates its F relay by applying resistance battery to the trunk TF lead. The F relay operated:

(a) Locks to the TF lead through its 6 make-contact.

(b) Connects the SSB lead from the trunk switch and connector circuit to the SS lead to the outgoing sender link (OSL) circuit. The marker will use this path to operate the select magnet for the level on the link switch where the trunk appears.

(c) Grounds the VG lead to the OSL.

(d) Connects resistance battery to the M lead of the signaling circuit as off-hook seizure supervision to the step-by-step office.

(e) Partially closes a path from ground to the I lead of the TMB time delay control circuit.

(f) Opens the operate path the CH relay insuring its release.

(g) Operates the LF, MRP, S1, and SG relays.

Relay LF operated:

(h) Transfers the T, R, and S leads to the marker over the T1, R1, and SL leads. The marker performs a trouble ground test on the sleeve and controls the channel over the SL lead. After the channel has been set up, the marker checks tip and ring continuity using the T1 and R1 leads.

(i) Cuts through the operate path of the TPC relay.

(j) Opens an operate path to the P relay through contact 12 break.

2.02 The F relay operating operated S1 relay which partially closes a lock path to ground which when the marker releases, will place the S1 under control of 6 make S. The S1 is slow to release to hold from the time the marker releases the F relay until S relay operates over the customer loop. One make S1 supplies a ground for the S sleeve lead by which the S1 will control the channel after the marker releases. The 4 contact of S1 transfers control of the TMA timer to 9 break B relay.

2.03 The F relay operates SG which:

(a) Shortened the timing interval of TMB timer by opening the discharge path of the E capacitor and transferred control of the timer to contacts on the D, F, and SA relays.

(b) Opens the operate path to the BY relay.

(c) Partially opens the path from battery to the ST start lead from the IRL.

(d) Locks operated under control of 2 break G.

SENDER ATTACHED

2.04 At the same time that is is establishing the calling line connection, the marker operates the select magnet controlling the level on the OSL switch on which the trunk appears. Ground on the VG lead to the OSL leads to the operation of the hold magnet on which the idle sender seized by the marker appears. The hold magnet operating closes the crosspoints which attach the sender to the trunk. The hold magnet locks under control of the sender which now operates the trunk D relay. Relay D operated:

(a) Splits the tip and ring circuit to the step-by-step office from the calling line.

(b) Prevents the TMB timer from timing by grounding its I lead.

(c) Connects the A idle circuit termination across the tip and ring. This termination prevents the transmission facilities from singing when the tip and ring are opened.

(d) Places control of the ground to the sleeve lead in the sender by transferring the ground to the AB lead from which it will be returned on the SL lead.

2.05 The marker operates the TPC relay in the trunk if the calling party is a message register customer on tip side of the line. The TPC controls the message register potential which is applied to the sleeve after the call is answered. After the marke completes its functions, it releases releasing the F and LF relays which cut the calling line into the trunk. The S relay provides talking battery and ground to the calling line and operates over the loop. The S operates the SA.

2.06 After the OSL crosspoints closed attaching the sender to the trunk, the sender closes a loop between the T and R leads through the link. The closure operates the P relay which maintains the off-hook supervision to the step-by-step office. When the marker releases, the sender dial pulses the digits of the called number. The P relay follows the dial pulses and transmits them to the step-by-step office by applying them to the M signaling lead. At the end of outpulsing the sender releases the trunk D relay. The sender then releases removing the loop from the T and R leads. The P relay which earlier operated over the loop does not release but maintains the off-hook supervision forward by remaining operated over a path which includes 8 break D, 12 break LF, 8 break CH, 12 make S1 and the 400-ohm half of the P resistor to battery.

A. Call Abandoned While Sender Attached

2.07 if the calling customer abandons the call before the sender has completed

its functions, the S relay releases releasing S1 and SA relays. The S1 relay removes ground from the AB lead to the sender indicating that the call is abandoned and causing the sender to release. The ground removed from the AB lead was also the ground to the sleeve holding the connection to the calling line which is also released. When the sender releases it releases the D and P relays. Relay P sends on-hook abandon supervision to the step-by-step office while the D relay starts the TMB timer which upon time out starts the trunk release sequence at the end of which the trunk is in the idle state.

B. Sender Reorder

2.08 If the sender encounters a condition which prevents the connection from being set up, it splits the AB and SL leads. With ground removed from the SL lead it is also removed from the sleeve and the connection to the calling line is released placing the line on line lock out from which the calling customer receives reorder tone.

ANSWER

2.09 When the called customer answers, the E relay operates operating the B relay. With B relay operated ground is removed from the I control lead to the TMA timer. That circuit begins the charge timing interval at the end of which it operates the CH relay. The CH operated:

(a) Twelve make grounds the A lead to the trunk switch and connector circuit. Later ground on the B lead from an MR timer will operate the MRP relay to additionally score the customers message register.

(b) Partially closes ground to the RL relay operate path.

(c) Transfers control of the P relay operate path to 12 make SA.

(d) Through its 10 make-contact applies message register potential (either ring party or tip party potential according to the setting of the TPC relay) to the calling party sleeve. This potential is used to score a message register for a MR customer or to set the auxiliary coin line circuit to the coin collect state.

(e) Opens the lock path of the MRP relay.

The MRP is a slow-release relay which insures, that when it has released and moved the MR potential from the sleeve, that the potential has been applied for sufficient time to perform its task. Eight break of the MRP places solid ground on the sleeve through 8 break RC and 1 make S1. The trunk is now in the conversation mode and remains in that state until either party disconnects.

DISCONNECT

A. Calling Customer First - SC6

2.10 Disconnection by the calling customer releases relay S. Relay S releases the S1 and SA relays. Relay S1 releases the connection to the calling line. Relay SA released:

(a) Releases the P relay which sends on-hook disconnect supervision to the step-by-step office causing it to release the connection to the called customer. The step-by-step returns on-hook supervision releasing the E and B relays.

(b) Starts the TMB timer which functions to return the trunk to idle.

B. Called Customer First - SC7

2.11 When the called customer goes on-hook first, E relay releases followed by the slow-release B relay. The B relay completes a path from ground through its 6 break-contact to the heater of the RL thermal time delay relay. The RL delays an interval of 13 to 32 seconds before it operates. If the calling customer does not hang-up before the end of the interval, RL operates operating relay RC. Relay RC removes ground from the sleeve releasing the connection to the calling line. When the connection is broken relay S is released which releases the S1 and SA relays. The SA releases relay P which sends on-hook supervision to the step-by-step. The trunk times its cover interval then returns to idle.

3. SIMULTANEOUS SEIZURE - SC8

3.01 A simultaneous seizure occurs during an outgoing call when the marker has control of the trunk, F relay operated, and the step-by-step office also seizes the trunk by sending forward off-hook seizure supervision which operates the E relay. Relay B follows relay E. Ground through 2 make B, 10 make E, and 8 make F operates the SS simultaneous seizure relay. Relay SS operated:

(a) Inhibits the TMA timer by grounding the I lead to the timer.

(b) Configures the TMB timer so that when it is enabled it will immediately operate the G relay:

(c) Applies steady on-hook supervision on the T and R leads to the sender overriding the E relay contacts and insuring that the sender will not trouble release.

(d) Maintains steady on-hook supervision to the step-by-step office by grounding the M lead to the signaling channel.

(e) Provides a path through its 7 make-contact to enable the BY relay should it be needed during the progress of the incoming call.

3.02 In the meantime the marker functions normally with the sender and trunk while at the same time, the incoming call progresses in the normal fashion, that is an incoming register is seized and dial pulses are received. The marker which seized the trunk for an outgoing call completes its functions before the incoming dial pulsing can be completed. As the marker prepares to release, it releases the F relay in the trunk. When F releases opening the operate path of S1 and with SS operated opening the lock path of S1, an abandoned call indication is forced in the trunk which is signified by S1 releasing.

3.03 The S1 releasing removes ground from the AB lead to the sender and also from the sleeve lead. Removal of the ground is an abandoned call signal to the sender which releases. The connection to the calling customer is also disconnected by removal of the ground. The line is returned to line lock out and reorder tone is sent to the customer. The sender releasing releases the D relay in the trunk which enables the TMB timer. With SS operated the TMB timer does not delay but immediately operates relay G which releases the SG, SS, and TPC relays causing in turn G to release. The trunk is now in the incoming call mode and the incoming call is able to proceed.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 See the No. 3 crossbar keysheets for customer working limits.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
B	Traditional
BSY	Busy
BY	Bylink Failure
CH	Charge (Call Established)
CT	Cut Through
D	Sender Attached
DS	Delay Sleeve
E	Traditional
F	Traditional
G	Traditional
LF	Traditional
LF1	LF Auxiliary
MRP	Message Register Potential
P	Pulsing
PU	Pick Up
R	Incoming Register Attached
R2	Ringing Combination
R3	Ringing Combination
RC	Ringing Control
RT	Ringing Trip
S	Supervisory
S1	Sleeve
SA	S Auxiliary
SG	Outgoing Call
SS	Simultaneous Seizure
TPC	Tip Party Calling
TPR	Tip Party Ringing

3. FUNCTIONS

INCOMING CALLS

3.01 To serve bylink pulsing calls from a step-by-step office.

3.02 To receive pulses over the E and M signaling facilities and to convert them to dial pulses to the incoming register.

3.03 To appear busy to originating traffic by removing ground from the FT lead, splitting the TG and TT leads and opening the F relay operate path from lead FT.

3.04 To send dial pulses to the incoming register over the BL lead bylink path until the register is attached and then over the ring lead.

3.05 To return 120-IPM overflow tone to the calling end in the event that pulsing starts before the trunk has gained preference in the link circuit.

3.06 To operate a slow-release relay to hold the trunk busy over the dial pulsing interval.

3.07 To remove battery from the ST lead and transfer control of the lead to the LK lead.

3.08 When the register is attached to apply resistance battery to the sleeve of the T2 jack for test purposes.

3.09 To provide a locking ground for relay CT under control of relay G and extend this ground to the register as a check that the call has not been abandoned.

3.10 For test purposes to ground the sleeve of the T2 jack when pulsing is completed.

3.11 To operate the LF and LF1 relays when the marker applies resistance battery to the F lead of the incoming register.

3.12 To ground leads JC, SW, and TT1 to the trunk switch and connector circuit.

3.13 To cut through to the marker the operate paths of the R2, R3, RC, and TPR relays.

3.14 To return the RC relay locking ground to the marker over lead RA.

3.15 To transfer the T, R, and S leads to the T1, R1, and SL leads to the marker for tests and control of the channel.

3.16 To prepare a circuit to ground for the S sleeve lead.

3.17 When the marker releases the LF relay, to connect ringing current of the proper code and polarity on the side of the line to which the called customers ringer is attached.

3.18 To apply ringing immediately on calls requiring code 1 ringing.

3.19 To delay the start of ringing to the beginning of the ringing cycle for other than code 1 ringing.

3.20 To return audible ringing tone to the calling customer.

3.21 When the called customer answers, to trip ringing, release the ringing combination relays, cut through the called to calling customers, supply transmitter battery and ground to the called customer and send to the step-by-step office answer, supervisory signal.

3.22 When the calling customer disconnects first, to release the called line and return to normal.

3.23 When the called customer disconnects first, to send an on-hook supervisory signal to the step-by-step office and await disconnect from that end.

3.24 While waiting for the calling end to disconnect, to time for an interval of 13 to 32 seconds and upon time-out to release the called line.

3.25 To cause a permanent signal alarm on time out when waiting for disconnect from the step-by-step office.

3.26 To provide access for testing the trunk; to cut off the T and R and signaling leads.

3.27 To bridge the T and R leads with an idle circuit termination when they are cut off.

OUTGOING CALLS

3.28 To serve outgoing flat rate, message register and coin calls.

3.29 To appear idle to a marker by the presence of ground on the FT lead.

3.30 To allow a marker to seize this trunk by providing continuity between the TG and TT leads and when busy to split these leads.

3.31 To send and receive supervisory signals and send dial pulses on an E and M signaling basis.

3.32 To provide a means to pass supervisory signals to the sender.

3.33 To provide the sender with control of the sleeve lead so that if it should time out it can release the connection to the calling line placing it on line lock out with reorder tone.

3.34 To recognize an abandoned call and release the connection to the calling line and to cause the sender to release.

3.35 To provide a means to time release the connection to the calling line when the called party disconnects first.

3.36 When the calling party disconnects first, to send an on-hook supervisory to the step-by-step office and to hold the trunk busy during a cover-up timing interval before returning to idle.

SIMULTANEOUS SEIZURE

3.37 To recognize a simultaneous seizure, that is, seizure by a marker and at the same time seizure by the step-by-step office.

3.38 To allow the incoming call to proceed to completion.

3.39 To allow the marker to complete its functions but when it releases to force an abandoned call indication to the sender; to release the connection to the local calling line returning it to lock out and reorder tone and to reset itself in the incoming call mode.

3.40 To give an indication to the traffic usage recorder when the trunk is serving a call.

3.41 To provide a means for the trunk to be made busy from the test circuit.

4. CONNECTING CIRCUITS

4.01 When this circuit is listed on a key-sheet the information hereon is to be followed.

(a) Trunk Switch and Connector Circuit - SD-26383-01.

(b) Incoming Register Link Circuit - SD-26394-01.

(c) Outgoing Sender Link - Trunk Identifier Circuit - SD-26395-01.

(d) Power, Ringing and Distribution Circuit - SD-26414-01.

(e) Alarm Circuit - SD-26393-01.

(f) Test Circuit - SD-26411-01.

(g) Message Register Power Supply Circuit - SD-26408-01.

(h) Traffic Usage Recorder - (Typical) SD-96494-01.

(i) Auxiliary Coin Circuit - SD-26409-01.

(j) Interrupter Circuit - SD-26407-01.

(k) CX Set and Repeat Coil Circuit - (Typical) SD-95004-01.

(ℓ) N1 Carrier Applique Schematic - (Typical) SD-95121-01.

(m) 2-Way Interlocal Trunk Circuit - SD-31867-01.

5. MANUFACTURING TESTING REQUIREMENTS

5.01 This circuit shall be capable of performing all of the functions listed in the Circuit Description and the requirements listed in the Circuit Requirements Tables.

6. ALARM INFORMATION

6.01 When the trunk times out awaiting disconnect from the step-by-step office, it causes a permanent signal alarm. This alarm indicates a possible trouble in the step-by-step office switch train, such as a selector hung-up. The trunk will remain out of service until the problem is cured and/or on-hook disconnect supervision is returned by the step-by-step office.

7. TAKING EQUIPMENT OUT OF SERVICE

7.01 A jack per trunk is provided at the test circuit for making the trunk busy. When a sleeve-ring shorting plug is inserted in the jack, ground is applied to the MB lead to the trunk which operates BSY relay making the trunk busy. If the trunk is busy with a call, insertion of the plug will not interfer as the BSY will already be operated. At the end of the call the BSY relay will remain operated thus keeping the trunk busy.

7.02 To take this trunk out of service, have the associated 2-way trunk circuit in the step-by-step office made busy.

7.03 Test jacks T1 and T2 provide access to this circuit for test purposes. Insertion of a plug in the jacks disconnects the trunk circuits from the cable pairs.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-LCB

WE DEPT 355-JRF-KLF-MH