

CROSSBAR SYSTEMS
NO. 3
INCOMING REGISTER LINK CIRCUIT
COMBINED MF, DP AND BYLINK OPERATION

CHANGES

B. Changes in ApparatusB.1 Added

EL - CD1 Crossbar Switch - App Fig. 5

D. Description of Changes

D.1 The FS1 and FS3 have been revised to show the addition of apparatus option 5.

D.2 The FS2, FS3, FS4, FS5, and FS6 have been rated Mfr Disc.

D.3 The FS2A, FS3A, FS4A, FS5A, and FS6A has been added.

D.4 In FS1 the note associated with and multiple symbol has been added to TU0 and TUL leads, also, the note associated with and multiple symbol has been added to the leads associated with A ground on contact 8 of (C-) relay.

D.5 In FS3 the note associated with and the mult symbol has been added to the CO, CT, F, R, and T leads.

D.6 Circuit Notes 101, 102, 105, and 107 have been modified.

D.7 Equipment Note 202 has been modified.

D.8 Information Note 302 has been modified.

D.9 The SC1 has been modified.

D.10 CAD 1 and CAD 2 are modified; CADs 3, 4, 5, 6, 7, 8, and 9 are added to reflect changes noted in D.1, D.3, D.4, and D.5.

F. Changes in CD Section

F.1 In SECTION I, Change 1.02 to read:

1.02 The trunk capacity is 192 incoming trunks.

F.2 In SECTION I, Change 2.01 to read:

2.01 Trunks are connected to the horizontal of the switches, 48 to a switch. Registers are connected to the verticals, with a maximum of seven registers. There are a maximum of four switches, and each switch constitutes a trunk group.

F.3 In SECTION II, Change 2.01 "FS4" to read "FS4A".

F.4 In SECTION II, Change 2.07 "FS5" to read "FS5A".

F.5 In SECTION III, 2.02 Switches, add:DesignationMeaning

EL

Extension Link Switch

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5245-GFC

WE DEPT 25820-AJE-GWC-BT

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CIRCUIT
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<u>3. RELEASE OF CONTROL CIRCUIT</u>	4	ter is connected to a marker through the	
<u>4. RELEASE OF REGISTER</u>	4	incoming register marker connector. The	
<u>5. TROUBLE INDICATION</u>	4	marker then connects to the trunk switch and	
<u>6. REGISTER TESTS</u>	4	connector circuit indicated by the register	
<u>SECTION III - REFERENCE DATA</u>	4	link and operates the trunk F relay over a	
<u>1. WORKING LIMITS</u>	4	lead through the incoming register marker	
		connector and incoming register link. The	
		connector, register and register link cir-	
		cuits are held by the marker until it has	
		completed its function.	
		1.02 The trunk capacity is 96 incoming	
		trunks.	

2. GENERAL DESCRIPTION OF OPERATION

LINK SWITCHES

2.01 Trunks are connected to the horizontals of the switches, 48 to a switch. Registers are connected to the verticals, with a maximum of five registers. There are a maximum of two switches, and each switch constitutes a trunk group.

TRUNK PREFERENCE, REGISTER PREFERENCE, REGISTER BUSY, AND CONNECTOR

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

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

2.04 One connector relay C- is furnished per trunk group per register. These connector relays transmit the frame number, trunk class, and trunk type MF, DP, or BL to the register.

TYPES OF PULSING

2.05 Cross-connect punchings are provided so that any of the three types (multi-frequency, dial pulse, and bylink) of incoming trunks can be mixed in any trunk group.

TROUBLE RECORDER

2.06 To aid in finding trouble the trouble recorder provides an indication of the register position in the incoming register marker connector. This indication comes from leads from the incoming register marker connector carried through the incoming register connector relay in the trouble recorder.

GENERAL OPERATION

2.07 Trunk preference relay TP- operating from a trunk circuit closes circuits to operate the select magnet for the trunk and to

operate the register preference relay RP- of the first idle register. The register then operates its register-busy (RB-) relays in both trunk group appearances. Control leads through TP- and RP- relays are closed for operating the register hold magnet and connector relays in the trunk group. Trunk frame, class, and trunk type MF, DP, or BL information passed through the connector is received in the register and checked. The hold magnet of the register is then operated, after which the TP- and RP- relays are released under control of the register. The RB- relay in the trunk group in which the trunk is located is then operated. The connection through the link switch is held by the register. Registration of digits and control of the trunk is accomplished over the leads through the switch crosspoints. On bylink trunks pulsing can take place over the bylink lead BL through the TP- and RP- relays before closure of the crosspoints.

SECTION II - DETAILED DESCRIPTION

1. OPERATION OF TRUNK PREFERENCE RELAYS

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

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

2. SELECTION OF IDLE REGISTER

START CHAIN

2.01 Referring to FS4, ground from the operated TP- relay operates the register preference relay RP- of the first idle register in the chain of preference through the RB- relay contacts.

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

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

2.04 Three types of pulsing, as previously stated, will be received in the No. 3 System, multifrequency (MF), dial pulse (DP), and bylink (BL) dial pulsing. When the incoming register is seized it must be conditioned for one of these three modes of operation by grounding one of three leads from the register MFG, DPG, or BLG which terminate in the incoming register link on cross-connect terminals MF, DP, and BL, respectively. Each TP- relay has an associated TM- cross-connect terminal that is cross-connected to one of the above three terminals, depending on the type of pulsing that will be received from the associated incoming trunk. The ground is provided through the operated TP- relay.

2.05 Referring now to the sequence chart, the operation of the RP- relay starts several circuit operations.

- (a) On a bylink trunk, battery on the LK lead operates R in the trunk as a signal that the bylink (BL lead) is closed, FS1.
- (b) The off-normal and register-busy relays in the register are operated over the ON lead, FS4.
- (c) The connector (C-) relay is operated, operating the select and hold magnets associated with the trunk and register, respectively.

BYLINK LEAD CLOSURE AND CONTROL OF TRUNK PREFERENCE RELAYS

2.06 Closing of the LK lead also gives control of the TP- relay to the register. The subsequent operation in bylink trunks will be found by reference to one of these circuits.

REGISTER MADE BUSY

2.07 Closure in the register of the RB- relays operates the RB- relays, FS5, in the link on all trunk groups except the one being served. The RB- relay is held shunted down by ground on the LO lead. Thus in the other trunk group the start chain is advanced beyond the register selected.

CLOSURE OF SWITCH CROSSPOINTS

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

CONNECTOR FUNCTIONS

2.09 Connector (C-) relay remains operated until the information transmitted through its contacts is received and checked

by the register after which relay CK in the register operates to release these relays. Lead information through the connector relays is as follows.

TRUNK SWITCH AND CONNECTOR CIRCUIT NUMBER

2.10 One-out-of-two TUO-1 leads is grounded by a C relay to indicate the trunk switch and connector circuit.

TRUNK CLASS

2.11 One-out-of-four leads is grounded by a TP- relay to indicate the trunk class to the register. In all cases except for 2-way operator office trunks the class indication is determined by a cross-connection from TPC- to OA, OB, AB, or SPL. For 2-way operator trunks arranged for no-test access the TP punching is provided one per trunk group. A cross-connection must be provided from NT- to the TP punching to give the class indication for incoming 2-way operator trunks arranged for no-test access.

3. RELEASE OF CONTROL CIRCUIT

3.01 When the register has been satisfied as to the completeness of the information received and the closure of the crosspoints (the detailed relay operations vary with the different modes of register operation), the RLK operates and opens the LO and LK leads to the link. The LO opened removes the shunt on RB- allowing it to operate; LK opened releases TP-. The register start is thus advanced and the trunk preference circuit freed for a new call.

4. RELEASE OF REGISTER

4.01 On release of the register the hold magnet of the switch is released. The RB- leads to the RB- relays are also opened but only those RB- relays release that are associated with the trunk group in which no TP- is operated. In groups where a TP- is operated all operated RB- relays are held in order to keep the start chain closed to the register being selected at the moment, see FS5. Thus overlapping calls in a group will progress through the start chain in successive registers. When the last register in the chain is selected the RB- relays of all preceding idle registers will release, re-directing the start circuit to the beginning of the chain.

5. TROUBLE INDICATION

5.01 The register is arranged to call in a marker to take a trouble record in the event of certain link troubles.

6. REGISTER TESTS

6.01 The particular incoming register to be tested is selected by the test circuit by making all registers busy except the one selected by operating their RB- relays. The test circuit then seizes the selected register that is not busy and immediately releases all the other registers it momentarily made busy. The test call proceeds as does any other incoming call.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

1.01 None.

2. FUNCTIONAL DESIGNATIONS

2.01 Relays

Designation	Meaning
TP00-47	Trunk Preference - The 48 Trunks in a Trunk Group
RB-	Register Busy
RP-	Register Preference
C-	Connector - For Trunk Frame, Class Leads, and Trunk Types (MF, DP, and BL)

2.02 Switches

Designation	Meaning
L	Link Switch - For the 48 Trunks in a Trunk Group

3. FUNCTIONS

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

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

3.03 With TP- operated.

(a) To connect battery to the RB- lead to hold any operated register-busy relays RB- in the trunk group from releasing.

- (b) When the last RB- relay in a trunk group operates to release the previously operated relays not held by busy registers.
- (c) To ground a ST lead and operate the register preference (RP-) relay of the first idle register in the start chain.
- (d) To prevent operation of other RP- relays associated with the same register.

3.04 With RP- operated.

- (a) To ground the ON lead to the register selected as a seizure signal.
- (b) To hold the TP- relay over the LK lead.
- (c) To close the BL lead from trunk to register to provide bylink pulsing path where required, or a check path for CO relays in direct pulsing trunks.
- (d) To operate connector C- relay associated with the register and trunk group.
- (e) To close a path for operating the select magnet on the link switch associated with the trunk being served and the vertical corresponding to the register selected.

3.05 When the register circuit-busy (RB-) relay operates.

- (a) To operate all link RB- relays associated with that register except the one in the trunk group in which the call originated and to prevent that one from operating by means of shunting ground on the LO lead from the register circuit.
- (b) To pass the register start leads in the trunk group made busy to the next succeeding idle register preference relay in the chain.

3.06 With C- operated.

- (a) As determined by cross-connections to ground one of the two trunk switch and connector circuit units leads TUO-1, one of class leads OA, OB, AB, SPL, to the register.
- (b) As determined by cross-connection to ground one of BLG, MFG, and DPG leads.

3.07 After select magnet operation associated with the trunk being served, to operate the hold magnet of the register selected.

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

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

4. CONNECTING CIRCUIT

4.01 When the circuit is listed on a key-sheet the connecting information thereon is to be followed:

- (a) Incoming Trunk Circuits - SD-26399-01, SD-26417-01, SD-26419-01, SD-26418-01, SD-26420-01 (Typical).
- (b) 2-Way Operator Office Trunk - SD-26429-01,
- (c) Incoming Register Circuit - SD-26386-01.

5. MANUFACTURING TESTING REQUIREMENTS

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

6. TAKING EQUIPMENT OUT OF SERVICE

LINK CIRCUIT

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

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

LINK SWITCH

6.03 When a switch is to be taken out of service all the trunks assigned to the switch must be made busy at the distant office. Precautions must be taken to avoid interference with calls from trunks on the other switch when working on the common switch multiple.

HOLD MAGNET AND VERTICAL UNIT

6.04 When a hold magnet or a vertical unit is to be taken out of service the associated register must be made busy. Block operated the RB- relay associated with the hold magnet or the two RB- relays associated with the register to be removed from service.

SELECT MAGNET AND SELECTING UNIT

6.05 When a select magnet is to be taken out of service all of the trunks associated with that magnet level must be made busy at the distant office.

RELAY TP-

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

RELAY RP-

6.07 This relay may be removed from service by blocking the associated RB- relay operated. When working on the chain circuits

through the contacts of this relay precautions must be taken to avoid interference with calls to the associated register from the other trunk group. It may be necessary to busy the associated register in this case.

RELAY RB-

6.08 Block operated the RB- relay to be removed from service. Also, block operated all RB- relays which do not have an associated incoming register initially equipped (remove block when adding the associated register).

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

RELAYS C-

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

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