

PANEL SYSTEMS
DECODER CONNECTOR CIRCUIT
FOR USE WITH THREE-DIGIT SENDERS
AND DECODERS

CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Leads 7DG, SK2 and SK3, X option, are added to connect between sender and decoder when the feature is provided that requires the use of the auxiliary sender for multifrequency outpulsing.

D.2 Note 126 is added.

All other headings under Changes, no change.

1. PURPOSE OF CIRCUIT

1.1 This decoder connector is used in a panel office to connect 3-digit subscriber senders or key pulsing "A" switchboard senders with 3-digit decoders.

2. WORKING LIMITS

2.1 None.

3. FUNCTIONS

3.01 When a sender requires a decoder connector, upon receiving a signal from the sender, connects the sender to a decoder by the operation of multicontact relays, and breaks down the connection by the release of the multicontact relays when signaled by the sender.

3.02 The senders are divided into groups, each group having a separate connector to a common group of decoders. Within any one connector only one connection can be made at a time and in case of a simultaneous demand by two or more senders, they take their successive turns in a fixed order of precedence.

3.03 As many connections through different connectors can be made simultaneously as there are decoders working. In case of simultaneous demand from two or more connectors when all the decoders, or all but one, are already busy, the connectors take their turns in a fixed order of precedence. However, the order of the connectors is different with respect to each decoder, so that all connectors have a fairly equal chance to be served first as soon as a decoder becomes idle.

3.04 The decoder connector connects the decoder test circuit to the leads of

any connector in the same manner as it connects a sender to the leads of any connector.

3.05 The senders associated with the particular connector to which the decoder test circuit is connected are made busy by the operation of the timing circuit after 5 to 12 seconds have elapsed.

3.06 By the operation of relay (TH) a circuit is closed over which the test circuit can connect this connector to any decoder.

3.07 By the operation of relay (DST) a circuit is closed over which the test circuit can connect directly to the leads to the decoder by the operation of multicontact relays shown on the decoder circuit. Such a connection from the test circuit through a connector to a decoder and back to the test circuit, is made for the purpose of testing the leads through the connector. A direct connection from the test circuit to a decoder, without connection with any connector, is made for the purpose of testing the decoder.

3.08 When a decoder which has timed out connects with the trouble indicator circuit, the decoder connector records in the trouble indicator the number of the frame, the position of the connector on the frame and the order in the connector of the sender to which the decoder is connected.

3.09 A timing circuit in each connector gives an alarm and makes the associated senders busy in case the connector does not respond to a demand from a sender for connection with a decoder, or in case such a connection when established is held an excessive length of time.

3.10 A timing circuit in each decoder is started when the decoder is seized by a connector. It is also started if a decoder which is idle is made busy to all connectors by a ground on the DB lead, other than a ground applied by plugging in the DB jack.

Lamps are provided to indicate the sender involved when a connector time alarm is given.

4. CONNECTING CIRCUITS

This circuit will function with:

- 4.1 Three-digit subscribers sender arranged for use with decoder.
- 4.2 "A" switchboard sender arranged for use with decoder.
- 4.3 Three-digit decoder.
- 4.4 Decoder test circuit.
- 4.5 Trouble indicator.
- 4.6 Sender motor stop and frame busy circuit.
- 4.7 Miscellaneous alarm circuit.

DESCRIPTION OF OPERATION

5. CONNECTORS CONNECTING SENDERS TO DECODERS

5.1 There are two multi-contact relays (SF) and (SG) for each sender, and the senders are divided into a number of groups or connectors to permit of simultaneous connections to the several decoders of the common group. In each connector there are also two multi-contact relays (DF) and (DG) for each decoder, and two multi-contact relays (TF) and (TG) for the decoder test circuit.

5.2 In each connector the corresponding contacts on all the multi-contact relays are strapped together on one side except a few which are used for control purposes and some which are not used. On the other side the contacts of the sender relays are wired to their respective senders, the contacts of the test circuit relays are multiplied connector to connector and wired to the test circuit, and the contacts of the decoder relays belonging to each decoder are multiplied connector to connector and wired to the decoder.

5.3 A particular sender is connected to a particular decoder by operating multi-contact relays (SF) and (SG) of the sender and (DF) and (DG) of the decoder, in the same connector.

5.4 The test circuit is connected to a particular decoder through a particular connector by operating multi-contact relays (TF) and (TG) in that connector of the test circuits and by operating relay (TH) and closing ground to the "DR" lead for operating multi-contact relays (DF) and (DG) of the particular decoder in the same connector. The test circuit is connected directly to a particular decoder by operating relay (DST) which closes a circuit for operating multi-contact relays in the decoder circuit.

5.5 The sender and decoder control circuits are so arranged that only one pair of sender or test circuit multi-contact relays and one pair of decoder multi-contact relays in a particular connector can be operated at one time, and only one pair of decoder multi-contact relays belonging to a particular decoder can be operated at one time.

5.6 The sender control circuit for each connector is so arranged that in case of simultaneous demand by the test circuit and a sender, or by two or more senders in the group served by the connector, they take their turns in a definite order, the test circuit having last choice.

5.7 The connectors are divided into as many blocks as there are decoders, and each block takes a particular different one of the decoders by preference, but if that decoder is busy it then takes the next decoder which happens to be idle. If several connectors are seized by senders while the decoders are all busy, each decoder as it becomes idle is seized by a connector in the block which has that decoder for its first choice, or by a connector in the nearest block that is waiting for a decoder to become idle. In case two connectors in that block are awaiting service they take their turns in a definite order. The test circuit can seize any decoder at will, but if the seized decoder is serving a connector at the time it is selected by the test circuit, the test circuit is required to wait until the decoder is released by the connector before it can proceed with the test.

6. SEIZURE AND RELEASE OF CONNECTOR

6.1 The control circuit for each connector consists of one sender start relay (SS) for each sender in the connector, and test start relay (TS). In addition each connector has connector alarm relays (CA1), (CA2), (CA3), (CA4) and (CA5) the functions of which will be described later.

6.2 When a sender is ready for a decoder, it connects battery to its start lead "ST" and to lead "CBS" and if the connector is not engaged, relays (SS), (CA1) and (CA2) will operate to ground through the windings of relays (CA1) and (CA2). The multi-contact relay (SF) associated with the sender is operated by relay (SS) and connects the sender to the receiving leads of the connector. The operation of relay (SF) closes a circuit for operating relay (SG) which connects the sender to the transmitting leads of the connector.

6.3 When the sender has finished with a decoder, it removes battery from lead "ST", and relays (SS), (CA1) and (CA2) release, followed by relays (SF) and (SG), leaving the connector free for other senders of the test circuit.

6.4 If one or more senders call while their connector is engaged their (SS) relay may operate, depending upon the position of preference of the calling senders with respect to the sender engaging the connector, but the calling senders must wait until the connector is freed and relay (SS) released before connection with the receiving and transmitting leads can be established.

6.5 If two or more senders in the same connector call when the connector is disengaged, or if they call while it is engaged and wait together for it to be freed, the (SS) relays may operate and lock depending upon the position of preference. But the (SS) relay in the preferred position will operate its multi-contact relays (SF) and (SG) and also open the circuit for operating the multi-contact relays of the waiting senders until the connector is freed and relay (SS) released. Operate its multi-contact relays (SF) and (SG) and also open the circuit for operating the multi-contact relays of the waiting senders until the connector is freed and relay (SS) released.

6.6 When the test circuit calls for a particular connector it connects battery to the associated start lead "SR" and to lead "CBS". The operations are then the same as in the case of a sender calling, so far as the seizure and release of the connector is concerned.

7. SEIZURE AND RELEASE OF DECODER

7.1 The control circuit for each decoder consist of one decoder start relay (DS) for each connector and one (DST) relay for the test circuit, one connector busy relay (CB), for each connector busy relay for each six connectors designated (CBR) to (CBZ) Fig. 12 or for each four connectors designated (CBN) to (CBZ) Fig. 13 or for each twelve connectors designated (CBR) to (CBV) Fig. 14 and one decoder busy relay (DB). In addition each decoder has decoder alarm relays (DA1) and (DA2) and make busy jacks, (CB) and (DB) the functions of which will be described later.

7.2 We will consider first the case where a sender has seized its connector, the first choice decoder of that connector is idle, and no other connectors are calling for decoders. The operation of the sender multi-contact relay (SF) connects the sender start lead "ST" through to the winding of the (DS) relay of the first choice decoder. This relay operates to ground through the normal contacts of the other (DS) relays of this decoder. When the (DS) relay opens its normally closed contacts relays (DA1) and (DA2) release closing ground to the decoder alarm lead "ST". Relay (DS) operates the multi-contact relay (DF) which in turn operates the (DG) relay associated with the decoder, connecting the decoder to the connector and therefore the sender. Relay (DF)

opens the operating circuit for the (CB) relay associated with this decoder and relay (DG) operates relays (CBR) to (CBZ) Fig. 12 or (CBN) to (CBZ) Fig. 13 or (CBR) to (CBV) Fig. 14 and they in turn operate the (CB) relays in all other connectors. The (CB) relays cut off the operating windings of their respective (DS) relay and advance the operating start leads to the next decoder in all connectors.

7.3 When the sender has finished with the decoder, it removes battery from lead "ST" as previously described. Relays (DS), (DF), and (DG) in the connector release, relays (DA1) and (DA2) operate, and relays (CBR) to (CBZ) Fig. 12 or (CBN) to (CBZ) Fig. 13 or (CBR) to (CBV) Fig. 14 and the (CB) relays for all other connectors release, thus leaving the decoder as well as the connector free.

7.4 In case the first choice decoder is busy, its operating start leads in all connectors, except the one engaging the connector, are advanced by the (CB) relays being operated and the next idle decoder is seized. When a sender multi-contact relay is operated, all operated (CB) relays in the connector are held up by their locking windings, unless all of them are operated. The reason for locking them is to prevent a connector which has started to seize a other than its first choice from abandoning that decoder and going back to an earlier choice decoder if one becomes idle at the critical time. The locking circuit is broken when all (CB) relays in the connector are operated in order to prevent their being held permanently.

7.5 If more than one connector up to as many as there are idle decoders call simultaneously and their choices fall on different idle decoders, all connections are made at once without interference. If their choice falls on the same decoder, all (DS) relays will operate and lock. But the (DS) in the preferred position will open the operating circuit for the other (DS) relays and when the (CB) relays, except the one associated with the (DS) relay in the preferred position, operate they will cause the release of the (DS) relays that were locked up and advance the start wires for these connectors. The unsuccessful senders will be connected to the succeeding idle decoders without appreciable delay, provided there are other decoders available. If there are no available idle decoders the connectors will be required to wait until decoders are available.

7.6 If a number of connectors call while all decoders are busy, they will get service as decoders are freed in a regular order, each freed decoder serving by preference one of the connectors which make it their first choice, and the several connectors in such a group taking turns among themselves.

7.7 In case a connector is seized by the test circuit instead of by a sender, the start lead is not extended to seize the first idle decoder and attach it to the connector. Instead, the test circuit, which has already connected directly to any decoder desired, as described in the next paragraph, grounds the "DR" lead corresponding to that decoder, operating the multi-contact relays in the desired connector.

7.8 The test circuit connects directly to any decoder desired by means of relay (DST) and multi-contact relays in the decoder circuit. The test circuit must wait until relay (DS) releases if the decoder is connected through a connector to a sender before a ground circuit is closed for operating the multi-contact relays.

8. DECODER BUSY

8.1 A decoder when seized by a connector for connection to a sender, or when seized directly by the test circuit, is guarded against intrusion by the (DS) relay in the preferred position opening the chain circuit over which ground for operating the multi-contact relays is furnished.

8.2 A busy decoder is further guarded against intrusion and at the same time calls from senders which would normally go to it are passed on to other decoders, by the operation of the (CBR) to (CBZ) Fig. 12 or (CBN) to (CBZ) Fig. 13 or (CBR) to (CBV) Fig. 14 and all (CB) relays except the one associated with the (DS) relay engaging the connector. These are all operated or held whenever the decoder multi-contact relays in any connector operate, also over the "DB" lead from the decoder under certain trouble conditions in the latter, and also when a plug is inserted in the (DB) jack associated with that decoder to operate the (DB) relay.

8.3 A decoder may be rendered busy to any particular connector by inserting a plug in the (DB) jack associated with the decoder and the connector.

9. CONNECTOR LEADS TO SENDER AND DECODER

9.1 When a pair of sender multi-contact relays and a pair of decoder multi-contact relays in the same connector operate, their contacts make the following connections to the sender and the decoder.

9.2 Twenty receiving leads, those appearing consecutively on the drawing from "A1" to "D3" "D4" and also leads "PS" "KS", "EA" and "LA" are connected through from sender to decoder. Over them the decoder receives from the sender the office code and the class of the calling subscriber.

9.3 Two check leads, "CK1" and "CK2", are connected through from sender to

decoder, and a third lead "CK3" to the decoder is grounded.

9.31 Leads "CK1" and "CK2" are used to pass a temporary ground from the decoder to the sender, in order to ground all of the receiving leads which are not grounded by operated relays in the sender, and thereby to check their continuity. The "CK1" and "CK2" leads to each sender are normally grounded by the multi-contact relay, so that the receiving leads to each sender are normally through back contacts in the sender. The purpose of this is in case one of the contacts on the multi-contact relay becomes short-circuited, the corresponding wire in the connector will be grounded when this sender is not connected, and will stick decoders on most of the calls from other senders in the same connector, thus calling attention to the fault.

9.32 Prior to Issue 7-D of this circuit, the preceding paragraph applied only to lead "CK1" and lead "CK2" was used by the sender to notify the decoder in case it was making a second trial on the same call, the decoder first seized having timed out and sent a trouble release to the sender. This notified the decoder not to check the receiving leads.

9.33 Lead "CK3" is used to operate relays in the decoder after it has checked the receiving leads. On breaking down the connection this lead is broken at the same time as the receiving leads, which prevents the decoder from making false operations when the relay connected to the receiving leads release.

9.4 Thirty-six transmitting leads, those appearing consecutively on the drawing from "CL1" to "ND" with the exception of EA and LA and also ZC1 and ZC2, are connected through from sender to decoder. Over these the decoder transmits to the sender the decoded information for establishing a call.

9.5 Two release leads "RL" and "TRL" are connected through from sender to decoder. The decoder sends the regular signal to the sender over lead "RL", after sending information over the transmitting leads. When the decoder times out on account of some trouble preventing it from sending the regular release signal and being disconnected in the normal time allowed, it sends a trouble release signal over the "TRL" lead, thus making a separate attempt to disconnect itself, and notifying the sender to make a second trial.

9.6 Lead "ND" is used to notify the sender in case the incoming call is one on which no district selections are required.

9.7 Lead "KS" is used to notify the decoder in case the incoming call is being made by a key pulsing "A" operator and that leads "0" and "6" in the decoder should be separated to allow the operator to employ codes the second and third digit of which may be zero.

9.8 Lead OB5 provides for high five office brush selection. Leads EA and LA are required when toll directing codes having prefix 11 are used. These leads signal the decoder to use local area (LA) or extended area (EA) translation.

9.9 Lead TDV is required when the decoders are arranged for diversion of restricted PBX traffic for extra charge calls. This lead signals the sender to reverse the polarity of tip and ring to the calling subscriber.

9.10 Leads 7DG, SK2 and SK3 are required when decoders are arranged to translate codes that require the auxiliary sender for multifrequency outpulsing. These leads are used to signal the auxiliary sender through the subscriber sender as to the number of digits to be multifrequency outpulsed.

10. CONNECTOR LEADS TO TROUBLE INDICATOR

10.1 When a decoder, which is connected to a sender by the operation of sender and decoder multi-contact relays, times out and seizes the trouble indicator for the taking of a record, the connection with the sender is held momentarily.

10.2 The trouble indicator closes ground over leads "FRC", "SNC" and "CNC" to contacts on the (DG) multi-contact relays associated with this decoder in all connectors. This ground returns to the trouble indicator over leads "FR", "SN" and "CN". The "CN" lead is connected to the "CNC" lead through the front contact of the "DG" relay of the connector involved, and the "SN" lead is connected to the "SNC" lead through the front contact of the (SG) relay of the sender in the connector involved, and the FR lead is connected to the "FRC" lead through a contact on the (DG) relay. This records in the trouble indicator the number of the frame, the position of the connector on the frame, and the position of the sender in the connector.

11. TIME ALARMS AND TROUBLE LAMPS

11.1 When a connector is idle and receptive to a call, all its relays (SS), (TS), (SF), (SG), (TF) and (TG) are normal. If then a sender on the test circuit connects battery to its start lead, connector alarm relays (CA1) and (CA2) operate in series with relay (SS) or (TS).

11.11 If on account of a trouble condition a multi-contact relay fails to op-

erate, interrupter (CA3) operates relay (CA3) and then relay (CA5), the latter in from 5 to 12 seconds after the operation of relays (CA1) and (CA2).

11.12 If a multi-contact relay operates, but on account of a trouble condition it fails to release promptly, interrupter (CA4) operates relay (CA4) and then relay (CA5), the latter in from 5 to 12 seconds after the operation of the multi-contact relay.

11.13 If relay (CA5) operates from either of the above causes, it lights a connector time alarm lamp which is common to all connectors, rings the decoder direct current bell, and makes all senders associated with the connector busy.

11.2 When a sender seizes its connector and operates its (SG) multi-contact relay a circuit is closed for operating the (DS) relay of the decoder seized. The operation of relay (DS) causes the release of relays (DA1) and (DA2), which close ground to decoder alarm lead "ST" for operating relay (ST) of the decoder circuit. As long as relays (DA1) and (DA2) are released on multi-contact relay (DG) is operated, relay (ST) in the decoder will remain operated from ground over lead "ST".

11.21 Relay (ST) in the decoder actuates a time measure circuit which gives a trouble release if it is held from 1 to 2.3 seconds, and gives a decoder time alarm if it is held for a total of from 2.3 to 3.6 seconds. The decoder time alarm lights a lamp individual to the decoder, and rings the decoder direct current bell.

11.3 If relays (CBR) to (CBZ) Fig. 12 or (CBN) to (CBZ) Fig. 13 or (CBR) to (CBV) Fig. 14 are operated by a false ground, no (DG) relay being operated and no plug being in the (DB) jack, the false ground will connect to the decoder over the "DB" lead and will actuate the time measure circuit in the decoder. When a plug is in the (DB) jack, operating relay (DB), the latter cuts off the "DB" lead to decoder.

11.4 It will be seen from the above that any trouble which ties up a connector will give the connector time alarm and if it also ties up a decoder it will also give the decoder time alarm. If a decoder alone is tied up, as by a false ground on the winding of a (DG) relay, the decoder alarm only will be given.

11.5 By operating the (BAT) key on receipt of a connector alarm, the location of the trouble will be disclosed by the steady lighting of one or two lamps depending upon the location of the trouble.

11.51 One lamp (C) for each connector is lighted by the operation of relay (CA5) or any (DG) multi-contact relay in the connector.

11.52 One lamp (S) for each position of a sender in its connector or one lamp (T) is lighted by the operation of an (SG) or (TG) multi-contact relay in the same position and in any connector.

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12. PROTECTION

12.1 (P) condenser 1 MF in series with (P) 18-FB resistance 900 ohms is used as protection on the operating lead of the (CB-) relays when there are 12 senders in a connector and there are over 9 (CB-) relays in multiple.

12.2 (ST) condenser 0.5 MF in series with (ST) 18-BH resistance 1000 ohms is used on lead ST to protect the contacts of sender relays.