STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A OR 35E97
PULSE GENERATOR
AND COUNTING CIRCUIT
FOR USE WITH
INTERCEPTING TRUNK CIRCUITS
USING E AND M LEAD SUPERVISION

7

CHANGES

B. Changes in Apparatus

B.1 AL & FG Lamps, App. Fig. 1, changed from code 2Y to M1 on a line out basis.

D. Description of Changes

D.1 Option X is designated and rated "Mfr. Disc."

D.2 Option W is added and rated Standard to prevent a false pulse on lead PLS- when relay EP operates.

BELL TELEPHONE LABORATORIES, INCORPORATED

Dept 5245-GFC
WECO Dept 5152-RWH-WEA

Printed U.S.A.

STEP-BY-STEP SYSTEMS
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CHANGES

D. Description of Changes

D.1 The last sentence in note 305 is changed from "Each Pulse Generator Unit Common Equipment provides for Max of 25 Trunk Circuits," to read, "Each Pulse Generator Circuit provides connections for a Maximum of 25 Trunk Circuits."

D.2 Added Keysheet and BSP information to supporting information table.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 5225-LCB
WECo DEPT 5152-CGK-WEA

STEP BY STEP SYSTEMS
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CHANGES

B. Changes in Apparatus

B.1 ADDED

1 - KS-8512, L4B
Resistor A
Y Option

D. Description of Changes

D.1 In FS5, resistor A (Y option) is added and Z and Y wiring option is added.

D.2 Reference to Z and Y options is added to Notes 102 and 103 and the Options Used Table, added on this issue.

D.3 Reference to resistor A is added to the Apparatus Index and APP 1 and connecting information to the 35E97 office is added to the Lead Index.

D.4 Connecting information for 35E97 is added to FS5 and CAD1.

D.5 This circuit is rated A&M Only for 350A on this issue.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT 2363-WCB-RJJ, Jr

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A OR 35-E-97
PULSE GENERATOR
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CHANGES

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 Prior to Issue 2A information Note 304 reads, "connect leads A through K of one circuit to leads A through K respectively of other circuit on some equipment unit."

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2335-MPC-FBB-ES

STEP-BY-STEP SYSTEMS
NO. 1, 350A, 355A OR 35-E-97
PULSE GENERATOR
AND COUNTING CIRCUIT
FOR USE WITH
INTERCEPTING TRUNK CIRCUITS
USING E AND M LEAD SUPERVISION

1. PURPOSE OF CIRCUIT

1.1 This circuit furnishes pulses for use with E and M lead trunks which must indicate to the far end the type of terminal facility required.

2. FUNCTIONS

2.01 To furnish a ground to the associated trunk circuits as a signal when this circuit is available for pulsing.

2.02 To start the pulse generator upon receipt of the ground over the start lead from the associated trunk circuits.

2.03 To count the output (number of pulses) of the pulse generator on counting relays.

2.04 To delay start of pulsing of the PLS-leads until the completion of two pulses to allow sufficient soak of a slow release relay in the incoming trunk at the far end.

2.05 To simultaneously pulse five leads to the associated E and M lead circuits at approximately ten pulses per second.

2.06 To ground one of three cut-off leads at a time in sequence to stop pulsing of the M lead to the associated E and M lead trunk circuit.

2.07 To operate an end-of-pulsing relay at the end of five pulses.

2.08 To give an alarm in the event of trouble encountered in either one or both circuits on a unit.

2.09 To give an alarm and transfer calls from the disabled circuit to the other circuit on a unit in the event of trouble, and to give an alarm when false ground is encountered on lead ST or PU. In the latter case, the circuit is not transferred to the other circuit.

2.10 To transfer calls from one circuit to the other circuit on a unit in the event that maintenance must be performed.

2.11 To furnish an alarm release key to restore the alarm relay to normal.

2.12 To provide a visual indication that this circuit is out of service.

2.13 To light a lamp to indicate which circuit has given the alarm indication.

3. CONNECTING CIRCUITS

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

3.01 Outgoing Intercepting Trunk Circuit - SD-32309-01.

3.02 Audible and Visual Alarm Circuit - SD-96188-01.

3.03 Pilot Lamp Circuit No. 1 - SD-31548-01.

3.04 Pilot Lamp and Power Alarm Circuit (350A) - SD-31573-01.

3.05 Miscellaneous Alarm Circuit (Alm. Cont. - 355A) - SD-32192-01.

3.06 Miscellaneous Alarm Circuit (Cont. and Sdr. Ckt. - 355A) - SD-31980-01.

3.07 Miscellaneous Alarm Circuit (Aisle Pilots - 355A) - SD-31970-01.

3.08 Power Ringing Circuit - SD-81225-01.

3.09 30, 60 and 120 IPM Interrupter Circuit (No. 1 and 350A) - SD-31606-01.

3.10 Interrupter Relay Circuit (355A) - SD-31868-01.

3.11 Audible Alarm Circuit (No. 1) - ES-30294-01.

4. DESCRIPTION OF OPERATION

This circuit has three major functions. First, pulse generation and counting; second, pulse cutoff; and third, alarm and transfer.

4.1 Pulse Generation and Counting

The pulse generator consists of relays (P) and (PG) and the associated network provided to give proper pulsing speed and per cent break adjustments. (PG) is a

double-wound polarized mercury-contact relay which is biased on its back contact during circuit idle condition from ground furnished through a back contact of relay (ST). Relay (P) is a low distortion wire spring relay.

If this circuit is available, a ground will be connected on lead "PU" to the associated trunks. When pulsing is required, ground from an associated trunk on lead "ST" operates relay (ST). Relay (ST) operated starts the pulse generator, furnishes ground from the counting relays, partially closes a circuit for operation of relay (PO), starts the alarm timer, and operates relay (P1).

When relay (ST) first operates ground is applied to terminal 7 of relay (PG) to energize the secondary winding in an operate direction and the primary winding in a non-operate direction. Initially the ampere-turns of the primary exceed the ampere-turns of the secondary to keep the mercury relay on its back contact. As condenser (PG) charges in series with the primary winding and (PG1) resistance, the primary ampere-turns decrease to cause relay (PG) to operate. This operates relay (P) which in turn operates relay (P2) and transfers ground from terminal 7 of relay (PG) to condenser (PG) to effectively shunt the battery through resistor (PG1). The (PG) condenser begins to discharge and charge to the opposite polarity. At first, the primary winding ampere-turns are in such a direction to keep relay (PG) operated and is high enough to overpower the secondary ampere-turns which were changed to a nonoperate direction by the operation of relay (P). As condenser (PG) continues to charge, the primary ampere-turns decrease to a value enough below the secondary ampere-turns to cause relay (PG) to release. This releases relay (P) and the cycle repeats.

(P) released, releases (P1) and operates (PG) which, in turn, again operates (P) which releases (P2) and (PG). (P2) and (P1) released, operate (PO) which locks under control of (ST). With (PO) operated, (P) pulses leads PLSO through PLS4 by placing ground on these leads during the time it is on its back contact. On the third cycle, (P1) and (P2) operate, grounding lead CO1. When (P1) releases on the fourth cycle and with (P2) operated, (P3) operates. When (P2) releases, ground is placed on lead CO2. On the fifth cycle, (P1), (P2) and (EP) operate grounding lead CO3.

The per cent break and pulses-per-second output of the circuit can be varied by changing the settings of potentiometers (PG3) and (PG4). The per cent break is varied by adjusting potentiometer (PG4). The pulsing speed is varied by adjusting potentiometer (PG3).

4.2 Pulse Cutoff

Relays (P1), (P2) and (P3) comprise a pulse counter to count the output of the pulse generator. These relays operate and release (See Note 301 on SD) to connect ground in the indicated sequence to one of three cut-off leads. This stops pulsing in the associated trunk by releasing its pulsing relay. The counter recycles after five pulses and at the same time relay (EP) operates to release relay (ST) and relay (P) if it is operated. Relay (EP) operated insures that this circuit cannot be reselected until all of the relays restore to normal. Relay (EP) is fast operate - slow release to insure its operation within approximately 40 ms and to make certain that all relays are released before making this circuit available for new calls. With all counting relays and the pulse generator released, relay (EP) releases and the circuit is normal.

4.3 Alarm and Transfer

This circuit is arranged to give an alarm indication in the event that if fails to restore momentarily to normal after a complete cycle.

When relay (ST) operates at the start of a cycle, the circuit to the 60 IPM source is closed. Relay (A) follows the ground on the "60 IPM" lead. Assuming that an abnormal condition exists which means that (EP) does not operate and (ST) does not release in a normal length of time after the start of a cycle, (W) will operate the first time (A) operates and (Z) will operate the first time (A) releases: (W) is slow release because of its short-circuited secondary winding and will start to release when (A) operates the second time. (Z) will remain operated under control of relay (ST). Relay (W) released and (Z) operated lights the (AL) lamp on the unit and operates relays (TR) and (AL). Relay (TR) operated transfers all pulsing requests to the other circuit on the unit, provides a path for locking relay (Z) operated under control of keys (AR) and (TR) and locks under control of relay (AL). Relay (AL) also gives the alarm condition and locks operated under control of the (AR) key.

On a normal condition, (EP) will operate and (ST) will release to release relay (A) and (Z). Relay (Z) releases (W). Since (Z) releases in this situation before (W), no alarm will be given.

In the event that both circuits on a unit become disabled, both alarm relays and both transfer relays will be operated and the alarm condition will continue until both circuits are restored to normal. The circuits may be restored to normal by momentarily operating the (AR) key.

4.4 False Ground Alarm

In the event of a false ground on either the "ST" lead or the "PU" lead, this circuit will act to give an alarm indication but will not necessarily disrupt service. A false ground on lead "PU" is recognized if a ground is present on that lead after relay (ST) operates at the start of a cycle. A false ground on lead "ST" is recognized if a ground is present on that lead after approximately 30 milliseconds after relay (EP) operates at the end of a cycle. This length of time is required to allow the associated trunk circuits that received pulses during the cycle to remove their source of ground from lead "ST". In either case, relay (AL) will operate to light the (FG) lamp on the unit, give the alarm indication, and lock to ground under control of the (AR) key. When the source of trouble is corrected the circuit may be restored to normal by operation of the (AR) key for a sufficient length of time to permit relay (AL) to release.

5. MISCELLANEOUS

Should a maintenance man desire to perform work on this circuit, he will operate the transfer key which will light the (AL) lamp and operate the transfer relay only if this circuit is idle. Should this circuit be in use at the time the key is operated, nothing will happen until the start relay releases at which time relay (TR) will immediately operate and lock under control of the other circuit on the unit if that circuit is in use. Relay (TR) will remain locked operated under control of the other circuit until the other circuit releases to insure completion of a pulse cycle to associated trunks whose requests were transferred to the other circuit on the unit.

Jack (PG) is provided to facilitate adjusting per cent break and PPS of the pulse generator. If the test man fails to remove the plug from jack (PG) at the end of the test, both lamps (AL) and (FG) will remain lit as a warning indication.

BELL TELEPHONE LABORATORIES, INCORPORATED

DEPT. 2335-MKD-FBB-ME