

METHOD OF OPERATION
TEST CIRCUIT

Final Multiple Test Line, for Testing Incoming Selector Circuits - Having Four Party Semi-selective A.C. Ringing - 95 to 110 Volts - Automatic Routine Selector Test Frame - Power Driven Machine Switching System.

GENERAL DESCRIPTION

1. This circuit is used for making tests on machine switching incoming selector circuits. These incoming circuits are equipped with four party semi-selective ringing feature and use 24 volt talking battery. This circuit is used to test the ringing relays of the incoming selector circuit under test for premature tripping, false tripping, and timely tripping. The supervisory relay in the circuit under test is first given a soaking current, and then a releasing current, after which the relay is operated and released alternately until disconnection takes place.

2. These test lines are assigned special numbers and are cross connected to the final multiple, but not connected to either line switches, or line finders. Test calls are made by either a routine testing circuit, or a manual testing circuit at the originating end, which selects automatically a trunk for test.

DETAILED DESCRIPTION

3. When the test number designated by the telephone company is sent either by an automatic test circuit from the originating office, an incoming selector seizes a final selector, which in turn hunts for the first idle test line. When this circuit is seized by the final selector, battery over the S lead operates the CO relay which locks through its make contact, to battery on the S lead, when the test switch R-1, advances to position 2. The CO relay operated performs no useful function at this time. When the incoming selector circuit under test has advanced to its ringing position, the R relay operates on the first period of ringing current supplied by a two ring interrupter. The operation of the R relay closes a circuit from ground through its make contact, to battery through the winding of the R-1 relay, which operates. The operation of the R-1 relay closes circuits (a) from ground through the PU interrupter brush #1 (not shown) PU-1 lamp, contacts of cam I, make contacts of the R-1 relay, contacts of cam E, break contacts of the PU-1 and PU-2 relays, to battery through the winding of the PU-2 relay, and (b) from ground through the PU interrupter brush #2, (not shown), PU-2 lamp, contacts of cam H, make contacts of the R-1 relay, break contacts of the PU-2 and PU-1 relays, to battery through the winding of the PU-1 relay. If the ringing current operating the R relay is being received from the incoming circuit through ringing brush set #1, PU-2 relay operates, and locks through its make contact to ground on cam D. When the ringing current is connected to the test circuit through ringing brush set #2, the PU-1 relay operates and locks through its make contact to ground on cam D. The operation of either the PU-1 or PU-2 relays, opens the operating circuit to the other relay, preventing its subsequent operation. The operation of either the PU-1 or PU-2 relays closes a circuit from ground through its make contact, cam B, to battery through the R-1 magnet, advancing the switch to position 2. Should either set of interrupter brushes connect ground through the make or break contact of the PU-1 relay before the R-1 switch is moved out of position 3, the PU relay operates on its inner winding and locks on its outer winding and make contact to ground on cam C, preventing

further operation of the test circuit until disconnection takes place. With the switch in position 2, ringing current is disconnected from the test line circuit during the interval between the first and second rings, releasing the R relay, which in turn releases the R-1 relay. The release of the R-1 relay closes a circuit from ground on cam D, through the make contact of the CO relay, break contact of the R-1 relay, lower contacts of cam F, break contact of the PU relay to battery through the R-1 magnet, advancing the switch to position 3. When the next interval of two ring ringing current is connected to the test circuit, the R relay re-operates, in turn operating the R-1 relay. The operation of the R-1 relay connects ground through cam D, make contacts of the CO and R-1 relays, contacts of cam E, break contact of the PU relay, to battery through the R-2 magnet, advancing the switch to position 4. In position 4, either the PU interrupter brush set #1, or brush set #2 connects ground through cams I and H respectively, and contacts of the PU-1 relay, to battery through the PU relay, operating the relay. The operation of the PU relay, closes a circuit from ground on cam D, through the make contact of the CO relay, break contact of the R-1 relay, which released, during the interval between rings, contacts of cam F, make contacts of PU relay to battery through the R-1 magnet, advancing the switch to position 5. As the switch leaves position 4, the PU relay releases.

PREMATURE TRIPPING TEST

4. With the R-1 switch in position 5, a circuit is closed from either ringing interrupter brush set #1, or brush set #2, depending upon the position of the PU-2 relay, contacts of cam O, 1 M.F. condenser, R relay to generator ground on cam N, operating the R relay on the first ringing period of the two ring current. Ringing current is also being supplied from the incoming under test, but this current performs no useful function in the test circuit. The R relay operated, in turn operates the R-1 relay, which closes a circuit from ground on cam D, through the make contacts of the CO and R-1 relays, inner contacts of cam E (R-1), cam B on R-2, to battery through the R-2 magnet, advancing the timing switch from position 1 the A cam carrying it to position 9. As the R-2 switch is advancing through position 2 to 7-3/4, the T and R sides of the test circuit are closed through cam E on R-2, cam J, on R-1, E, D, C, B and A resistances for 1/2 second, testing for premature tripping of the ringing relays in the incoming selector circuit under test. At the end of the first ringing period, the R and R-1 relays release, closing a circuit from ground on cam D, through the make contact of the CO relay, break contact of the R-1 relay, cams F and G in position 5, upper inner contact of cam B on R-2, to battery through the R-2 magnet, advancing the switch to position 10. With the R-1 switch in position 5, and the R-2 switch in position 10, the R and R-1 relays re-operate on a second period of ringing current closing a circuit from ground on cam D and make contact of the CO relay, make contact of R-1 relay cam E, cam B on R-2, to battery through the R-2 magnet, advancing the switch out of position 10, the A cam carrying it to position 18.

5. As the R-2 switch is moving through position 11 to 16-3/4. the ringing relays in the incoming selector circuit under test, are again tested for premature tripping, by connecting the A,B,C, D and E resistances across the tip and ring side of the test and through cams J and E. When the R relay releases at the end of the second ringing period the R-1 relay releases, and closes a circuit from ground through its break contact, cams F and upper outer contact of G on R-1, cam C on R-2, which is in position 18, to battery through the R-1 magnet, advancing the switch to position 6. When the R relay releases a circuit is also closed through its break

contact, cams F and G on R-1, cam B on R-2, to battery through the R-2 magnet, advancing the timing switch to position 1. On the next ringing interval the R and R-1 relays again operate and move the R-2 switch out of position 1 through cam B advancing the switch to position 9. As the R-2 switch is passing through positions 2 to 7-1/4 on its second revolution, the premature tripping of the ringing relays is tested a third time. In the silent period between the two rings, the R relay releases, in turn releasing the R-1 relay, which connects ground through its break contact, cams F and G, cam B, to battery through the R-2 magnet, advancing the timing switch to position 10. With the R-2 switch in position 10, the same ground through cam C on R-2, advances the R-1 switch to position 7. In position 7 of R-1, the R relay is connected across the T and R sides of the test circuit awaiting the second interval of ringing current.

TRIPPING TEST

6. If the ringing relays in the incoming selector circuit under test have not tripped prematurely, and the R relay operates on the second ringing interval, in turn operating the R-1 relay, which closes a circuit from ground through its make contact, upper outer contact of cam E, break contact of the PU relay to battery through the R-1 magnet, advancing the switch to position 8. However, should the ringing relays in the incoming selector circuit trip prematurely, the R relay does not operate, and the test circuit is held up until cleared from the originating end. In position 8 of R-1, the silent interval between the two rings and one ring periods occurs, releasing the R relay, which in turn releases the R-1 relay. The release of the R-1 relay closes ground through its break contact, and inner contacts of cam F, to battery through the R-1 magnet, advancing the sequence switch to position 9. In position 9 of R-1, the R relay is connected in a circuit from generator ground on cam N, winding of the R relay, cam O, contact of the PU-2 relay to either brush set #1 or brush set #2, of the ringing interrupter, operating the R relay. The R relay re-operates the R-1 relay, which connects ground through its make contact, and cam E to cam B on R-2, advancing the R-2 switch out of position 10 of its second revolution. The R-2 switch is carried to position 18, by means of the A cam, and as it passes through positions 11 to 16-3/4, the ringing relays in the selector circuit are tested for timely tripping, by connecting the A and B resistances across the T and R side of the test line. During the silent period, after the second two ring interval, the R and R-1 relays release which advances the R-2 switch to position 1 in a circuit through the lower inner contacts of cams F and G, and cam B on R-2. With the R-2 switch in position 1, the same ground through the break contact of the R-1 relay, cams F and G on R-1, cam C on R-2, to battery through the R-1 magnet, advances the testing switch to position 10.

7. With the switch in position 10, the R relay is again connected across the tip and ring sides of the test line. If the ringing relays in the selector circuit under test have not tripped, the R and R-1 relays operate on the first period of ringing current, and the R-1 relay locks through cam J, and its own make contacts, make contact of the CO relay to ground on cam D, preventing further operation of the testing circuit until disconnection takes place. If the ringing relays in the incoming circuit are tripped, ringing current is not supplied to the test circuit, and the R and R-1 relays consequently do not operate. During the ringing interval, with the testing switch in position 10, ground is supplied wither through pick up interrupter brush set #1, or brush set #2 cam I or cam H, make or break contact of the PU-1 relay, depending upon whether the PU-2 or PU-1 relay is operated, to battery

through the inner winding of the PU relay, which operates. With the PU relay operated, and the R-1 relay non-operated, a circuit is closed from ground on cam D, through the make contact of the CO relay, break contact of the R-1 relay, cam F, make contacts of the PU relay to battery through the R-1 magnet, advancing the switch to position 11. As the test switch leaves position 10, the holding circuits for the PU-1, or PU-2 relays, and the PU relay are open, releasing the relays. In position 11 of the R-1 switch, the R-1 relay is placed under control of the 149 interrupter. When the contacts of the interrupter make, a circuit is closed from ground on cam K, through the contacts of the interrupter, upper contacts of cam J, to battery through the winding of the R-1 relay, which operates. The operation of the R-1 relay closes a circuit from ground on cam D, through the make contacts of the CO and R-1 relay, break contact of the PU relay to battery through the R-1 magnet, advancing the switch to position 12. With the switch in position 12, the R-1 relay releases, when the interrupter contacts break, and advances the testing switch to position 13, in a circuit from ground on cam D, through make contact of the CO relay, break contact of the R-1 relay, contacts of cam F to battery through the R-1 magnet. The testing switch remains in position 13, approximately 1/2 second until the brushes on the 149 interrupter make. During this interval of time, the A resistance (20 ohms) is connected across the tip and ring sides of the test line, through cam M, to give a soaking current to the supervisory relay under test, in the incoming selector circuit.

SUPERVISORY RELAY TEST

8. Upon the make of the contacts on the 149 interrupter, the R-1 relay re-operates and closes a circuit from ground through its make contact, contacts on cam E, break contacts of the PU relay to battery through the R-1 magnet, advancing the testing switch to position 14. When it leaves position 13, the short around the LO relay is open at cam M, allowing the LO relay to operate over the tip and ring sides of the test line, in series with the testing resistances to battery and ground in the incoming selector circuit under test. The operation of the LO relay connects ground through its make contact, and cam C, to battery through the outer winding of the PU relay, which locks through its make contact, to the same ground. In position 14, of the R-1 switch, the contacts of the 149 interrupter make, operating the R-1 relay, which prevents the moving of the R-1 switch out of position 14, through the break contact of the R-1 relay. During the interval the brushes on the 149 interrupter make, the A, B, C, D, E, and F resistances and the LO relay, are connected across the tip and ring sides of the test line, to release the supervisory relay in the incoming selector circuit. Upon the break of the interrupter brushes, the R-1 relay releases, connecting ground through its break contact and cam F, to battery through the R-1 magnet, advancing the testing switch to position 15. In position 15, of the switch, the A, B, and C, or the A, B, C and D resistances, depending upon the length of subscriber's loop the supervisory relay is adjusted to operate over, are connected across the tip and ring sides of the test circuit through the contacts of the 149 interrupter and the LO relay, cam J. When the contacts of the 149 interrupter alternately make and break, the supervisory relay in the incoming selector circuit under test, is alternately operated and released until the required number of pulses are sent back to satisfy the routine test circuit (not shown).

DISCONNECTION

9. When the routine test circuit is satisfied, disconnection takes place, opening the tip and ring sides of the test circuit in the incoming selector circuit,

releasing the LO relay. The release of the LO relay opens the circuit of the PU relay, which releases. The release of the PU relay closes a circuit of the PU relay, which releases. The release of the PU relay closes a circuit from ground on cam D, through the make contact of the CO relay, break contact of the R-1 relay, cam F, break contact of the PU relay, to battery through the R-1 magnet, advancing the switch to position 16, the A cam carrying it to position 18. The switch remains in position 18 until the release of the final selector circuit. When the final selector circuit releases, the S terminal of the test circuit opens and the CO relay releases, closing a circuit from battery through a resistance, break contact of the CO relay, cam P, to the S terminal, holding this circuit busy to other hunting finals until restored to normal. The release of the CO relay also closes a circuit from ground on cam D to the break contact of the relay, to battery through the winding of the MR register, which operates and records the number of tests made with this circuit. The operation of the MR register closes a circuit from ground through its make contact, cam D or R-2 to battery through the R-2 magnet, advancing the switch to position 1 provided it has not already advanced to position 1. With the R-2 switch in position 1, the same ground is connected through the lower contacts of cam D on R-2, cam B or R-1 to battery through the R-1 magnet advancing the test switch to position 1. In position 1 of R-1, the MR register releases, restoring the circuit to normal.

10. In case of premature disconnection due to fault either in the incoming circuit under test or the test circuit itself, the test line circuit awaits in the position in which the trouble occurred until the release of the final. From this point the circuit is restored to normal as described above.

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY

| | <u>OPERATE</u> | <u>NON-OPERATE</u> | <u>RELEASE</u> |
|---|--|-------------------------------------|--------------------------------------|
| B263 (LO) | Special requirements to insure fast operation. Readj. .0033 amp. Test .0035 amp. W.C.C. .0035 amp. | | Readj. .0008 amp. Test .0007 amp. |
| E572 (R-1) | Special requirements to insure A.C. control Readj. .012 amp. Test .013 amp. W.C.C. .021 amp. | Readj. .007 amp. Test .0066 amp. | |
| E720 (OU) Inner Wdg. (1500 ohms) | Test requirement of outer winding is proportional to test requirement of inner winding. Readj. .018 amp. Test .019 amp. W.C.C. .020 amp. | Readj. .011 amp. Test .010 amp. | |
| Outer Wdg. (1500 ohms) | Test .021 amp. W.C.C. .028 amp. | | |
| E866 (PU-1 & PU-2) | Readj. .021 amp. Test .023 amp. W.C.C. .025 amp. | | Readj. .004 amp. Test .0038 amp. |

NOTE:- When necessary to readjust this relay adjust straight outside spring of make break combination to give a least 20 grams contact pressure against the bent spring.

| | | | |
|---|---|------------------------------------|--|
| E1328 (CO) Wdgs. in series aiding | Test requirement of inner winding is proportional to test requirement of windings in series. Readj. .018 amp. Test .033 amp. W.C.C. .048 amp. | Readj. .012 amp. Test .011 amp. | |
| Inner Wdg. 100 ohms | Test .066 amp. W.C.C. .134 amp. | | |

CIRCUIT REQUIREMENTS

THE READJUST REQUIREMENTS SHOWN BELOW ARE FOR MAINTENANCE USE ONLY

OPERATE

NON-OPERATE

RELEASE

J-4
R

Special requirements to insure A.C. operation.
Armature air gap - minimum .023 inch.
Contact follow - minimum .003 inch.
Test in series with 1 M.F. condenser and 7300 ohm resistance at exchange
ringing voltage.