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COMMON SYSTEMS 55-D TEST SET CIRCUIT FOR ADJUSTING RELAYS AND OTHER ELECTRO-MAGNETIC APPARATUS

CHANGES

B. CHANGES IN APPARATUS

B.1	Removed	Replaced by
	Spl.38-AR per D-96036 resistance	107A resistance 75,000 ohms ± 1%

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 The (T) resistance has been changed and the resistance shown as ± 1%.

All other headings, no change.

BELL TELEPHONE LABORATORIES, INC.

DEPT. 332

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COMMON SYSTEMS
35-D TEST SET CIRCUIT
FOR ADJUSTING RELAYS AND
OTHER ELECTRO-MAGNETIC APPARATUS

CHANGES

B. CHANGES IN APPARATUS

B.1	Removed	Replaced by
P3F	cord fig. 3	J99213A-L13 cord
P2P	" " 4	J99212A-L18 "
P3E	" " 5	J99213A-L6 "
P3C	" " 6	J99213A-L2 "
893	" " 7	J99211B-L9 "
W2W	" " 8	J99212B-L18 "
W3M	" " 9	J99213B-L4 "

D. DESCRIPTION OF CIRCUIT CHANGES

D.1 To omit the arrangement for negative grounded battery the leads between the (BAT & GRD CO) key and the (VM) key and the (A) fuse and resistance of the black rheostat and the (VM) key formerly shown as "X" wiring are shown continuous. "Y" wiring for reversing these pairs of leads is removed. Note 101 has been removed and was as follows: Use "X" wiring in offices having the positive side of battery grounded. In offices having the negative side of battery grounded use "Y" wiring.

D.2 Note 101 was formerly note 102.

All other headings under changes no change.

DEVELOPMENT

1. PURPOSE OF CIRCUIT

1.1 This circuit is used for testing relays and other electro-magnetic apparatus on a voltage or current flow basis.

1.2 The test set is arranged so that current to an external circuit can be measured and regulated for making electrical checks upon relays, clutches and other apparatus for which current flow requirements are specified.

2. WORKING LIMITS

2.1 None

OPERATION

3. FUNCTIONS

3.01 This test set is provided with a volt milliammeter and variable resistances for checking current flow requirements of relays and other electrical apparatus for which current values are specified.

3.02 The set is equipped with four telegraph keys and a black and red rheostat which permits setting up four different and independent current flow values at one time. The rheostat is constructed in two sections with four sliders on each and the sections are referred to as black and red. The resistance of the red rheostat is approximately 28000 ohms and is divided in steps of 1000 ohms each, while the resistance of the black rheostat is approximately 1150 ohms and is used for obtaining finer readings.

3.03 The meter is provided with four current ranges which give full scale readings of 3 milliamperes, 15 milliamperes 75 milliamperes and 750 milliamperes under control of non-locking keys designated (3MA), (15-3), (75) and (750). On the milliammeter side with all keys normal the 750 mil scale is connected to the test circuit.

3.04 On the volts side the designations of this key are 15, 300, 75 with the 300 normal scale. The four telegraph keys are each equipped with a short circuiting switch, so that a steady current will be maintained while adjusting the slides for the proper readings.

3.05 The telegraph keys (1) and (2) are connected directly to the red and black rheostats, while keys (3) and (4) each close a circuit through approximately 500,000 ohms and the inner contacts of a cutoff jack, thru which the test circuit may be connected to a remote control key or some other external circuit, such as an interrupter. Part or all of the high resistance can be cut out by means of the single pole double throw switches, three of which are associated with the (3) key and three with (4) key. With all switches operated to the zero position all resistances from (A) to (S) are short circuited.

3.06 The set is arranged to connect to the apparatus under test by means of jacks and/or binding posts. With the exception of the two jacks (4W) and (3R) the test and signal jacks are wired in duplicate to permit the use of cords with 109 or 110 plugs.

3.07 The set is arranged to make tests over the tip, ring and sleeve separately or over the tip and ring together.

3.08 A reverse key, (REV) is used to reverse the leads to the apparatus under test by reversing the tip and ring leads to the (T&R) jacks.

3.09 When the (VM) key is operated the 3 mil scale is connected in series with appropriate resistance to give full scale readings of 300 volts with 15 - 75 key at normal or full scale at 15 volts and 75 volts with respectively designated keys operated.

NONE OF THE NON-LOCKING KEYS SHOULD BE HELD IN AN OPERATED POSITION WHILE OPERATING OR RESTORING ANY OF THE LOCKING KEYS.

3.10 A switch (G) is used for connecting ground to one side of the milliammeter but it is effective only when the (BAT) & GRD CO) key is operated. If the (G) switch is operated to the position marked "GRD", ground is connected to one side of the milliammeter. If the (G) switch is open and the (BAT & GRD CO) key operated a metallic circuit is closed thru the milliammeter.

3.11 A switch (L) is provided to control the sleeve condition of the (T&R) jacks and is used principally in testing supervisory relays. With this switch normal, a 500 ohm resistance is in the sleeve circuit. When this switch is operated in the direction marked "10", a 10 ohm resistance is placed in parallel with the 500 ohms and when operated to the "500 & LAMP" position a local circuit is closed thru the signal lamp. A 12 volt, 24 volt or 48 volt lamp may be used as required to suit the test condition.

3.12 With battery and ground supplied to the test (BAT & GRD) jack and the (BAT & GRD CO) key normal, tests may be made thru the (T&R) jacks on apparatus connected to ground on the tip or ring, or on apparatus bridged across the tip and ring of the (T&R) jacks. With the (BAT & GRD CO) key operated, tests may be made on apparatus connected to battery on the tip or ring or on apparatus connected to battery on the ring and ground on the tip (Metallic Test). For any of the above conditions if the connections give a reversed reading, the (REV) key should be operated.

3.13 The connections to various apparatus and relays are made with the test set by the different patching cords shown, or by connecting leads to the binding posts, multiplied to the jacks.

3.14 Associated Cords

3.141 The Cord in Fig. 3 may be used as a battery supply cord when the jack supplying battery has ground on the tip and battery on the ring. It may also be used as a patching cord for extending the "T & R" or "S" jacks.

3.142 The cord in Fig. 4 is required for battery supply wherever the standard battery supply jack is provided.

3.143 The cord in Fig. 5 is required in place of the cord in Fig. 3 only when a jack requiring a 110 plug is patched to the 3R or 4W jacks.

3.144 The 32C Test Set Fig. 2 provides remote control for the #3 and 4 key circuits and may also be required for use with an associated relay timing test set. In either instance it provides manual remote control.

3.145 The cord in Fig. 6 is required only for step-by-step offices and provides for a direct connection to a test jack.

3.146 The cord in Fig. 8 is required wherever any standard tool is used for connecting to apparatus under test or for battery supply when no battery supply jacks are available.

3.147 The cord in Fig. 9 may be substituted for the cord in Fig. 8 when the sleeve is to be extended by means of connecting tools.

3.148 The above cords are supplemented by the use of the single jumper cord in Fig. 7 for use with tools also by the use of the 361, 364, 365 and 357 tools and by the 257A test plug (#10 office) also the 113A plug gauge.

4. CONNECTING CIRCUITS

4.1 Battery and Ground supply circuits.

4.2 Relay timing test set circuit.

DETAILED DESCRIPTION

5. CIRCUIT OPERATION

5.01 Testing Relays or Other Apparatus not Connected to Battery or Ground (B/G Test Set Preparation)

5.011 Preliminary Operation

Battery and ground may be supplied to the test set by patching from a battery supply jack with (a) a cord in figure 3, (b) a cord in figure 4, in offices where battery is connected to the tip and ground to the sleeve of battery supply jacks (c) a cord in figure 8 equipped with the proper connecting tools, (d) by inserting a regular working common battery switchboard cord directly in the test (BAT & GRD) jack or (e) by connecting ground and battery to the binding posts designated (GRD) and (BAT), respectively.

If the relay or apparatus to be tested is bridged by a jack, this jack may be patched with a cord in figure 3; if

it is a relay in the tip or ring of a cord circuit this cord may be inserted directly in the (T&R) jack. If connection is to be made to relay winding terminals or terminals of other apparatus, a cord in figure 8 equipped with the proper connecting tools may be used.

Before setting up any readings, all short-circuiting switches of the telegraph keys should be open and all rheostat slides should be in their extreme right position. If currents less than 1 milliampere at 24 V. or less than 2 milliamperes at 48 V. are to be read, the circuits thru keys (3) and (4) should be used to cut in additional resistances as required. These resistances are designated from (A) to (S). Under this condition all knife switches designated (3) and (4), controlling these resistances, should be open. The maximum resistance of the rheostat should be in the circuit before operating the knife switches to guard as much as possible against the injury to the meter. It is desirable to set up readings for "hold" and "release" values before "operate" in order to obtain more accurate readings for the "operate". With the MIL. AMPS. keys normal the 750 scale of the meter is in circuit so that the (3MA), (15/3) or (75) scale keys should not be operated until the readings of the milliammeter indicates that the current is less than the full scale reading of the range to which the transfer is to be made. The circuit is so arranged that the (3MA) and (15/3) keys must be operated (in opposite directions) before the 3MA winding is connected into circuit.

5.012 Testing

With the (REV) and (BAT & GRD CO) keys normal and the (G) knife switch open, ground is connected thru these keys and the (S) jacks to the ring of the (T&R) jacks. Battery is connected thru the (BAT & GRD CO) key, the (A) fuse, (VM) and scale change keys to the meter, through the (VM) key, black rheostat, one of the telegraph keys, red rheostat, the (B) fuse, (REV) key and contacts of the (S) jacks to the tip of the (T&R) jack. The relay or apparatus under test may then be checked for the requirements specified. Current thru the relay or apparatus under test may be reversed by operating the (REV) key. This is necessary when testing polarized relays.

5.02 Testing Relays or Apparatus Having Ground Connected to One Side of the Winding (Bat Test Set Preparation)

The conditions for this test are the same as described in paragraph 5.011 and 5.012 except battery is connected to the ring of the test (BAT & GRD) jacks and no ground is required. If the tip clip of the patching test cord is connected to the relay or apparatus under test, the (REV) and (BAT & GRD CO) keys should be normal and the (G) switch open. If the ring conductor is used the (REV) key should be operated. The relay or apparatus under test may then be checked for the requirements specified.

5.03 Testing Relays or Apparatus Having Battery Connected to One Side of the Winding (GRD Test Set Preparation)

The conditions for this test are the same as described in paragraph 5.011 and 5.012 except ground is connected to the tip of the test (BAT & GRD) jack and no battery is required. If the ring clip of the patching test cord is connected to the relay or apparatus under test, the (REV) key should be normal and the (BAT & GRD CO) keys and the (G) switch operated. The relay or apparatus under test may then be checked for the requirements specified.

5.04 Testing Relays or Apparatus Having Battery and Ground on the Winding (Metallic Test Set Preparation)

The conditions for this test are the same as described for this test under 5.011 and 5.012 except no battery or ground supply are required. However if the cord supplying battery and ground is connected to the test (BAT & GRD) jack this battery and ground will be disconnected by operating the (BAT & GRD CO) key and opening the (G) switch. If ground is connected to the tip clip and battery to the ring clip of the patching test cord the (REV) key should be normal, but if this condition is reversed the (REV) key should be operated. The relay or apparatus under test may then be checked for the requirements specified.

5.05 Sleeve and Lamp Tests

The 10 ohm and 500 ohm resistances associated with the (L) switch are provided to approximate the sleeve condition of various cord circuits. When setting up a test for supervisory relays or checking contact closure, it is necessary to ground the sleeve thru 500 ohms or 34 ohms. The ground which is usually supplied thru the tip of another "A" cord and the (X) resistance is approximately 34 ohms. With the (L) switch operated to the "500 & LAMP" position, the lamp is connected across the tip and ring of the signal (BAT & GRD) jack in local circuit and may be used to check contact closure using a cord in figure 8. Binding posts (L1) and (L2) may also be connected to check contact closure in the same manner as when using the signal battery and ground supply jacks. Connecting ground to the (L1) binding post with the (L) switch normal, places a 500 ohm ground on the sleeve of the (T&R) jacks and with the (L) switch operated to the "10" position places approximately 10 ohm ground on the sleeve of the (T&R) jacks. The lamp may also be connected in series with 500 ohms or approximately 10 ohms by supplying battery or ground to the (L1) or (L2) binding post and operating the (L) switch to the "500 & LAMP" or "10" position as required, if it is desired to operate any apparatus over the sleeve of the (T&R) jack while making current flow adjustments over the tip and ring of this same jack.

5.06 The milliammeter is wired and connected in the circuit for use in offices having the positive side of the battery grounded.

5.07 When the (VM) key is operated the voltmeter is connected thru appropriate resistances also the REV key to the tip and ring of the (T&R) jack. The voltmeter may be used to check the voltage of external circuits or that of the battery supply jack by shorting all resistances.

With the voltmeter connected across the T & R leads to the apparatus under test and the battery or ground or both connected thru the test set, the voltage applied to the relay may be varied by adjustment of the set resistance. When battery or ground is connected to the apparatus under test, use of a short circuit plug in the Bat. & Grd. jack together with the operation of the Bat. & Grd. C. O. and GRD. switches will connect the voltmeter in multiple with the variable resistance and by closing the battery or grd. circuit externally any desired voltage may be obtained by resistance variations.

If a particular set resistance is desired, rather than a definite current flow the voltage of the battery supply may be determined by operating the VM key and closing a telegraph key with all resistance cut out. Restoring the VM key and using the milammeter the desired resistance may be provided by $I = \frac{E}{R}$. E being the previously determined voltage, R the desired resistance and I the readingfor the milammeter.

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