DIAGRAM NOTES

RELATING TO

GBW 17410 ISSUE 1

TELEPRINTER AUTOMATIC SWITCHING SYSTEM

TESTER FOR RELAYS POLARISED

NOS. 2B, 3B & 4B

TITLE PAGE	TEXT PAGES
Issue 1	All pages Issue1

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TESTER FOR RELAYS POLARISED
NOS. 2B, 3B & 4B

1. GENERAL

The diagram shows the circuit of a tester designed to test Relays Polarised Nos. 2B/..... 3B/..... and 4B/..... at teleprinter automatic switching centres.

2. FACILITY SCHEDULE

Provision is made for:-

(1) Plugging the polarised relays Nos. 2B/..... and 4B/..... into a jack.

(2) To connect polarised relay No. 3B/..... to a terminal block by means of flexible leads and clips.

(3) Connecting the mains supply to the tester with lamp indication when the supply is switched on.

(4) Recording test conditions applied to the polarised relay a centre zero milliammeter (35-0-35) is used.

(5) Indicating when the polarised relay tongue is resting on the mark contact by the deflection of a centre zero milliammeter (35-0-35) needle to the right.

(6) Indicating when the polarised relay tongue is resting on the space contact by the deflection of a centre zero milliammeter (35-0-35) needle to the left.

(7) Disconnecting the meter shunt by operating a non-locking key with lamp indication.

(8) Connecting the test battery to the mark and space contacts of the relay under test by operation of locking key.

(9) The insertion of resistance in series with each coil winding by appropriate key operation in order that each coil is energised with 6.5 - 8.0 ampere turns under D.C. tests and 20 ampere turns under A.C. tests.

(10) Selecting any one of the relay coils for test by operation of the appropriate locking key.

(11) Determine whether the relay is in neutral adjustment by connecting a 50 cycle A.C. supply to any one relay coil.

(12) Determine the transit time of the relay tongue by the operation of a locking key.

(13) Checking the sensitivity of the polarised relay by operation of the mark and space keys.

(14) Checking the current in the relay coil under test by inserting a plug into a break jack and thereby connecting a meter in series with the relay coil.

3. CIRCUIT DESCRIPTION

3.1 OUTLINE

The tester is designed for checking the performance of a relay polarised No. 2B/..... 3B/..... and 4B/..... and is operated in accordance with Engineering Instructions Telegraphs General T.1001, Testers TG.1149 and GBW 17410 are identical testers. The relay is tested for neutrality, transit time, sensitivity, and side stability of the relay tongue to both mark and space contacts. A centre zero milliammeter (35-0-35) is provided to record these conditions, and in order to obtain greater accuracy in reading the meter, a meter shunt control key is provided for disconnecting the meter shunt on lower readings.

The transit time of the relay tongue from mark to space may be calculated from meter readings taken in accordance with Maintenance Routine Instruction No.74 (Teles. Auto, B.5174) paragraph 7, sub-paragraphs f-g, the result of which should fall within the limits of 1-2 to 1-8 milliseconds.

Each relay winding is tested in turn for neutrality, transit time sensitivity and side stability, the operate current is applied to each coil in turn by the operation of the applicable coil key and one or more of a group of keys according to the number of turns in the relay coil under test. The operate current under D.C. tests will produce the equivalent of between 6.5 to 8.0 ampere turns. The current in the relay winding operate circuit may be ascertained by the insertion of a milliammeter in series with the winding, for this purpose a break jack is provided. The current in the relay coil when A.C. tests are applied produces an equivalent of 20 ampere turns. The power supply for the tester is from the 50 cycle public mains supply via a tapped mains transformer, lamps are lit from a 10 volt tap and the test side from a 140 volt tap on the secondary. The 140 volts is rectified and smoothed for D.C. tests and connected raw for neutrality and transit time tests.

4. DETAIL

The mains supply is connected to the tester and the operation of switch SWC which extends the 50 cycles A.C. supply to the primary winding of transformer (TRA). A "MAINS ON" lamp is lit off the secondary winding of transformer (TRA).

The correct connections to the relay are established by operating key KTB to test 2B/..... and 4B/..... or key KTA for 3B/.....

When testing a Relay Polarised No. 2B/..... or No. 4B/..... one coil of the relay is selected for test by operating the appropriate TEST COIL key 1, 2, 3 or 4, (KCA, KCB, KCC, KCD). For Relay Polarised No. 3B/..... the TEST COIL keys are ineffective and the coil for test is selected by direct connection to the coil tags from the rear terminal block.

For the purpose of circuit details a relay polarised No. 2B/103 is plugged into the jack No. 72 in order to carry out the following tests:-

4.1 Checking the relay sensitivity when operated to mark with side stability.

4.2 Checking the relay sensitivity when operated to space with side stability.

4.3 Neutrality.

4.4 Transit time of relay tongue.

For the purpose of these notes a polarised No. 2B/103 is being placed on test, the turns per coil are as follows:-

Coil No. 1	4000 Turns
Coil No. 2	4000 Turns
Coil No. 3	4000 Turns
Coil No. 4	4000 Turns

5. PROCEDURE

To carry out tests on relay coil No. 1, Test Coil 1 (KCA) key is operated.

5.1 Test Coil 1

Key KCA operating,
KCA1 prepares to extend the D.C. power supply to coil No. 1.
KCA2 prevents Coil No. 3 being energised.
KCA3 prevents Coil No. 4 being energised.

So that the right amount of current may be applied to the coil when operated, the key or combination of keys are operated comparable to the number of turns on the coil, in this case there are 4000 turns, 4000 T key (KD) is operated.

4000 T

Key KD operating,
KD1 inserts 25K ohms (YN and YP) in series with the relay coil.

The D.C. supply which is obtained by rectifying, and smooth the 140 volt obtained from the secondary of transformer TR1 is connected to the space and mark contact as positive and negative battery respectively by operating DC key (KDC).

Key DC

Key KDC operating,
KDC1 connects negative battery to mark contact of polarised relay and to key contacts KM1 and KS2.
KDC2 connects positive battety to space contact of polarised relay and to key contacts KM2 and KS1.
KDC3 maintains the shunt resistance (ZC) across the milliammeter MA.

To test that the relay tongue makes contact with mark and that the tongue is side stable with the mark contact when operated to make the Mark Key (KM) is operated.
KDC4 spare.

Mark Key

Key KM operating,
KM1) connects the battery across relay coil 1 (tags 3-1) in such a manner that
KM2) the lower numbered coil tag is made more positive with respect to the higher under such conditions the tongue of the relay will come to rest on the mark contact. The milliammeter (MA) is connected in the tongue circuit such that the needle moves over to the right.

The Mark Key (KM) is now returned to normal in order to check whether the tongue of the relay is side stable in respect to mark contact.

Mark Key

Key KM restoring,
KM1)
KM2) disconnects the polarising battery from relay coil 1.

If the relay tongue is side stable in respect to mark contact the needle of the milliammeter (MA) will remain deflected to the right.

5.2 To ascertain whether the relay tongue makes on the space contact and the tongue is side stable when operated to space contact, the Space Key (KS) is operated.

Space Key

Key KS operating,
KS1 connects the battery across relay coil 1 (tags 3-1) in such a manner that the higher numbered coil tag is made more positive with respect to the lower under such conditions the tongue of the relay will come to rest on the space contact. The milliammeter (MA) is connected in the tongue circuit such that the needle moves to the left.

The Space Key (KS) is now returned to normal in order to check whether the tongue of the relay is side stable in respect to space contact.

Key KS restoring,
KS1)
KS2) disconnects the polarising battery from relay coil 1.

If the relay tongue is side stable in respect to space contact the needle of the milliammeter (MA) will remain deflected to the left.

5.3 To test whether the relay tongue is neutrally adjusted 4000 T (KD) and Test Coil 1 (KCA) keys remain operated as in para. 5.1. A fifty cycle 140V A.C. supply is connected to relay coil 1, by operating the Vibrate Key (KV).

Vibrate Key

Key KV operating,
KV1)
KV2) connects 50 cycle 140V A.C. supply to relay Coil No.1 (tags 3-1).
KV3 connects negative battery to relay mark contact.
KV4 connects positive battery to relay space contact.

The relay tongue will oscillate to the fifty cycles, and if the tongue is neutrally adjusted, the mean value of the time that the tongue is resting on either the mark or space contacts is indicated on the milliammeter (MA) as a zero reading. In order to obtain a more accurate recording of the Meter Shunt Control (KSC) key is operated.

Meter Shunt Control Key

Key KSC operating,
KSC2 lights the "Meter Shunt Disconnect" lamp.
KSC1 disconnects the meter shunt ZC.

The mean value of the meter needle vibration to the right indicates a marking bias and to the left a spacing bias.

5.4 The transit time of the relay tongue from mark to space contacts is obtained in the following manner, Keys 4000 T (KD), Test Coil 1 (KCA) and D.C. (KDC) are operated as in para. 5.1 Space Key (KS) is operated.

Space Key

Key KS operating,
KS1) connects the battery across relay coil 1 (tags 3-1) the tongue of the
KS2) relay comes to rest on the space contact.

The Space Key (KS) is restored.

Key KS restoring,
KS1)
KS2) disconnects the polarising battery from relay coil 1 (tags 3-1).

The scale reading in divisions is recorded on the left-hand side of the 35-0-35 millia mmeter (MA) and is set against term D1. This reading is checked on each test and should be constant if the mains supply is constant.

The D.C. Key (KDC) is restored.

D.C. Key

Key KDC restoring,
KDC1) disconnects the negative and positive battery from mark and space
KDC2) contacts respectively.

The Transit Time Key (KTT) is now operated.

Transit Time Key

Key KTT operating,
KTT1) connect the mark and space contacts and extends them to positive terminal
KTT3) of milliammeter (MA).
KTT2 connects the relay tongue and negative terminal of milliammeter (MA) to positive battery.

The Vibrate Key (KV) is operated.

Vibrate Key

Key KV operating,
KV1)
KV2) connects 50 cycles 140V A.C. supply to relay coil 1 (tags 3-1).
KV3 extends negative battery to the balanced resistors ZAA and ZAB.
KV4 extends positive battery to the balanced resistors ZBA and ZBB.

The Meter Shunt Control Key (KSC) is operated.

Meter Shunt Control Key

Key KSC operating,
KSC1 removes the shunt (ZC) from milliammeter (MA).
KSC2 lights "Meter Shunt Discon ect" lamp.

The number of divisions the meter deflected is recorded and is set against term D2. In order to calculate the transit time the values obtained are submitted in the following formula:-

$$\text{Transit time} = \frac{D2}{D1} \times 1.83 \text{ milliseconds.}$$

Test 5.1 - 5.2 and 5.3 are repeated with coils No. 2 - 3 and 4.

Test with Coil No. 2. Test Coil 2 (KCB) key is operated.

Test Coil 2

Key KCB operating,
KCB1 prepares to extend the D.C. supply to Coil No. 2. (tags 4-6).
KCB2 prevents Coil No. 3 being energised.
KCB3 prevents Coil No. 4 being energised.

From the table of turns per coil, Coil No. 2 has 4000 turns the 4000T Key (KD) is operated.

4000T Keys

Key KD operating,
KD1)
KD2) function as in para. 5.1.

Tests are now carried out as detailed in paras. 5.1 - 5.2 and 5.3.

Test with Coil No. 3. Test Coil 3 (KCC) Key is operated.

Test Coil 3

Key KCC operating,
KCC1 prepares to extend the D.C. supply to Coil No. 3 (tags 9-7).
KCC2 prevents coil No. 1 being energised.
KCC3 prevents coil No. 2 being energised.

From the table of turns per Coil No. 3 has 4000T turns the 4000T Key (KD) is operated.

4000T Key

Key KD operating,
KD1)
KD2) function as in para. 5.1.

Tests are now carried out as detailed in paras. 5.1 - 5.2 and 5.3.

Test with Coil No. 4. Test Coil 4 (KCD) key is operated.

Test Coil 4

Key KCD operating,
KCD1 prepares to extend D.C. supply to Coil No. 4. (tags 5-2).
KCD2 prevents Coil No. 1 being energised.
KCD3 prevents Coil No. 2 being energised.

From the table of turns per coil, Coil No. 4 has 4000 turns, the 4000T (KD) Key is operated.

4000T Key

Key KD operating,

KD1) KD2) functions as in para. 5.1.

Tests are now carried out as detailed in paras. 5.1 - 5.2 and 5.3.

Further keys are available other than has been mentioned, e.g. 4000T (KD) in connection with the number of turns in a coil under test, used whether singly or in combination to meet the requirements of any relay in the table they are:-

Key 500T (KA), Key 1000T (KB), Key 2000T (KC), Key 8000T (KE) and Key 16000T (KF). The contacts of which function in a similar manner to Key 4000T (KD) as detailed in para. 5.1.

6. DESIGN DETAILS

Reasons for Resistors

YA-YU controls the value of current in the relay coils according to the number of turns of wire in the relay coil.

ZAA, ZAB, ZBA, ZBB forms two arms of a potentiometer the centre point of which is connected to milliammeter (MA) positive terminal at zero potential.

ZC employed as a shunt across milliammeter (MA).

YQB together with capacitor QB as a spark quench to the polarised relay under test space contact.

YQC together with capacitor QC acts as a spark quench to the polarised relay under test mark contact.

YZ control the current in LPA circuit.

YY Control the current in LPB circuit.

Reasons for Capacitors

QAA) QZB) Smoothing capacitors across the rectified output from MRA.

QB see resistor YQB.

QC see resistor YQC.

END OF DIAGRAM NOTES