

POST OFFICE ENGINEERING DEPARTMENT

DIAGRAM NOTES AT 5422CSPECIFICATION T 4300

TESTER AT 5422

CASE TEST LINE

GENERAL

1.

This diagram shows the connexions of a line testing circuit fitted at exchanges which are not large enough to have a test desk or test rack or at large exchanges when required to supplement the test desk. It supersedes diagram AT 5000. The service telephone associated with this circuit includes a dial in exchanges of all types.

The moving coil instrument incorporated in this tester is calibrated 0-50 volts. It may be used, also, as an ohmmeter when associated with the appropriate resistors. In this instance, if the low resistance key is operated another scale gives a direct reading in ohms. If, however, the Low Resistance key is normal the reading on the ohms scale should be multiplied by 100 to obtain the true value.

The following diagrams or equivalents should be considered in conjunction with this diagram:-

AT 1886	P.A.B.X. CONNEXIONS FOR ENGINEERING OFFICER'S TELEPHONE CIRCUIT, BATTERY JACK, TEST LINE MULTIPLE JACK AND JACK FOR TEST CASE
AT 4100/1	INCOMING JUNCTION FROM U.A.Xs. 12, 13 & 14
AT 4208	GRADUATED HOWLER. 2000 TYPE
AT 60576	COMMON SERVICES JACK FOR TESTER AT 5422
CB 1001	CB EXCHANGES TEST DESK TESTING CIRCUIT FOR LINES CONNECTED VIA TEST JACKS
CB 2065	CB EXCHANGE 22 OR 40V. INCOMING JUNCTION RELAY SET FROM U.A.X's NOS. 12, 13 AND 14.

2.

FACILITY SCHEDULE

Provision is made for:-

- 2.1 Monitoring on a line under test
- 2.2 Testing into exchange equipment and out to subscriber's lines
- 2.3 Testing with a voltmeter
- 2.4 Measurement of resistances
- 2.5 Testing with a megger
- 2.6 Dial speed testing
- 2.7 Continuity testing by means of a test bell
- 2.8 Applying howler to the line under test

- 2.9 Loop and battery dialling
- 2.10 Ringing ordinary and shared service subscribers
- 2.11 Speaking on the line under test
- 2.12 Holding calls on the service line or via the tester
- 2.13 Simulation of U.A.X. calls to parent exchange (C.C.B. or Ordinary Calls)
- 2.14 Simulation of normal or emergency calls from C.C.B. lines at CB exchanges
- 2.15 Connecting the tester to a common services supply jack by means of a plug and cord.

3.

CIRCUIT DESCRIPTION

3.1 Outline

Speaking, monitoring and dialling are carried out by using the service telephone. A telephone No. 80 may, however, be used for speaking and monitoring if more convenient.

Access to a line may be obtained by:-

- (1) two plugs, connected to the tester by a 4 way cord, inserted in the main frame test springs.
- (2) a switchboard type of plug and cord (hereinafter referred to as the Test Plug) and a Test Extension Circuit such as CB 1001.

Common services to the tester may be by permanent wiring or by means of a cord and a multi-way plug.

In large exchanges where the Line Test Case supplements the Test Desk, calls can be extended via a double ended cord to the Line or Exchange jacks of this circuit. In these circumstances it is necessary to connect a battery via resistor R1 to the sleeves of the Line and Exchange jacks to operate the sleeve relays of the associated circuits e.g. Faultsmen's Test Circuit (AT 4589).

A Tester No. 43 should be used for dial speed testing, if required, or a tester No. 43A in a 22 volt exchange.

3.2 Detail

3.2.1 When using the two plugs inserted in the Main Frame Test Springs

With all keys normal the line to be tested should be seized by inserting the plugs into the test springs on the M.D.F. This should not interrupt any call which may be in progress.

3.2.1.1 Monitoring

The Monitor Key (KM) when operated connects the Service Telephone via transformer T1 and capacitor C8 to the line under test. The test clerk may then monitor to ascertain that the line is not 'engaged speaking' before making a test.

3.2.1.2 Testing into exchange or out to line

The operation of the Test Exchange Key (KTE) disconnects the exchange equipment from the subscriber's line and short circuits the blocking capacitors C1 and C2. The testing keys are then in contact with the exchange equipment.

The operation of the Test Line Key (KTL) similarly connects the testing keys to the subscriber's line.

Note: KTE and KTL are combined in a three position key.

3.2.2 When using the test plug with a Test Extension Circuit (CB 1001 or similar circuit)

With all keys normal except the Monitor Key (KM) the Test Plug should be inserted into the "through" jack of the Test Extension Circuit. This enables the test clerk to ascertain whether the line is "engaged speaking", in a similar manner to that already described, without interrupting any call which may be in progress. The test Plug should then be removed from the "through" jack of the Test Extension Circuit and inserted into either the "line" or "exchange" jack thereof according to the tests to be made.

In the following tests, when access to the line under test is obtained via the MDF, either key KTL or KTE should be operated as indicated in the notes. If access to the line under test is obtained via a Test Extension Circuit where key KTL is stated to be operated, the Test Plug should be inserted into the "line" jack of the Test Extension Circuit and where key KTE is stated to be operated the Test Plug should be inserted into the "exchange" jack instead.

Thus in the following the testing keys are assumed to be connected to the line or to the exchange equipment whichever is appropriate to the test being described.

3.2.3 Testing with the Voltmeter

3.2.3.1 Normal Voltmeter Tests

The operation of the Voltmeter Key (KV) with key KTL operated connects the earthed 67.5V battery, via the voltmeter formed by resistors R5, 6, 8, 9 and 10 and the moving coil instrument, to the B wire. This provides an insulation test to earth of the B wire. It should be noted that the moving coil instrument is shunted by means of resistors R11 and RV1. If the latter is adjusted, with the Zero Check key (KZC) operated until the moving coil instrument reads zero ohms, the insulation resistance of the line is obtained by multiplying the ohms scale reading by 100.

Subsequent operation of the Line Reverse Key (KR) applies a similar test to the A wire.

The Earthing Key (KE) may be operated to apply earth to the wire opposite to the one to which the voltmeter is connected, thereby giving a test for loop, short circuit or low insulation between the A and B wires of a line. A capacitive loop will also be identified on this test by a momentary deflexion of the voltmeter owing to capacitor discharge each time the Line Reversing Key is operated or restored.

The capacitor on the B wire of a shared service line can however be detected by operating key KV (see above) and then operating and releasing the Test Shared Service Key (KTS). The operation of this key disconnects, at KTS1, earth from the positive terminal of the 67.5V. battery and connects earth via resistor R7 to the negative terminal of the battery. KTS2 disconnects the normal voltmeter circuit from and connects the positive terminal of the 67.5V. battery to the B wire of the circuit under test. The subsequent release of key KTS reconnects the normal voltmeter circuit (with 67.5V. negative earthed battery) to the B wire. This causes a characteristic momentary deflexion of the voltmeter needle if there is a capacitor connected between the B wire of the circuit under test and earth. The operation of the reversing key, KR will enable a similar test to be made on the A wire of the circuit.

Tests for negative battery conditions on the line may be made by disconnecting the 67.5V. battery from the voltmeter and substituting earth. The key which accomplishes this is the Receive Negative Key (KN) at contacts KN1 and KN2. In addition KN3 removes a short circuit from resistors R12 and R13; while KN4 disconnects the shunt provided by R11 and RV1 from the moving coil instrument. The meter accordingly enables a direct reading to be obtained of an earthed negative battery condition in the range 0-50V. To Test for positive battery it is necessary to operate, in addition, the Voltmeter Reversing Key (KVR). If during these tests, a reading of less than 5V. is obtained, the Low Volt Scale Key (KL) should be operated. At KL1, this reduces the resistance of the voltmeter circuit from 100,000 to 10,000 ohms so that any reading on the volts scale should now be divided by 10. KL2 is spare.

3.2.3.2 Direct Measurement of "High Resistance"

Keys KV and KTL should be operated as for normal voltmeter tests. The effective resistance of the meter circuit is approximately 50,000 ohms.

The Zero Check Key (KZC) should be operated and Resistor RV1 adjusted until the moving coil instrument reads zero ohms. When key KZC is released the instrument will enable a measurement to be made of resistance in the range 5000 to 500,000 ohms between the B wire and earth (see Design Details). The scale reading should be multiplied by 100 during this test. The operation of key KR will enable a similar test to be made between the A wire and earth.

3.2.3.3 Direct Measurement of "Low" Resistance

The Low Resistance Key (KLR) should be operated in addition to keys KV and KTL.

KLR1 connects the 1.5V. battery to resistor R4,
KLR2 disconnects resistor R5 from R6 and connects it to R4.

The effective resistance of the meter circuit is now approximately 500 ohms.

The Zero Check Key (KZC) should be operated and resistor RV1 adjusted until the moving coil instrument reads zero ohms.

When Key KZC is released, the instrument will enable a measurement to be made of resistance in the range 50-5000 ohms between the B wire and earth (see Design Details). The operation of key KR will enable a similar test to be made between the A wire and earth.

The moving coil instrument is calibrated as an ohmmeter suitable for direct reading of resistance in this test.

Loop resistance may be measured by earthing one wire, using key KE, and measuring the resistance to earth of the other wire.

3.2.4 Megger Tests

A portable megger should be connected to the megger terminals and the Megger Key (KG) operated in addition to key KTL. This connects the line to the Megger to enable megger tests to be made.

3.2.5 Dial Speed Tests

Dial speed tests may be made by operating the Battery Feed Key (KBF) the Dial Speed Key (KDS) and key KTL.

Key KBF should be operated before key KDS to prevent flicks and false pulses from reaching the dial speed tester.

The operation of key KBF connects relay DS to the line and lights the supervisory lamp.

KDS1) disconnect the rest of the transmission bridge from the line
KDS2) and Relay DS.
KDS3 connects the contact of relay DS to the dial speed tester.
KDS4 short circuits relay LC.

The supervisory lamp will glow while key KBF is operated.

Relay DS operates to a loop from the line.
DS1 repeats the dial pulses to the dial speed tester.

3.2.6 Test Bell Facility

The Test Bell Key (KTB) should be operated, in addition to keys KBF and KTL. Key KBF connects relay DS to the line, as above. Key KTB connects contact DS1 to the Test Bell.

Application of earth to the B wire, battery to the A wire, or a short circuit across A and B wires operates relay DS. If in addition, Key KR is operated, relay DS will be operated by an earth on the A wire, battery on the B wire, or a short circuit.

Relay DS operated,
DS1 actuates the Test Bell.

3.2.7 Howler Connexions

The operation of the Howler Key (KH) short circuits the Howler Start terminals and connects the line under test to the output terminals of the howler circuit via the capacitors C3 and C4.

3.2.8 Loop and battery dialling

3.2.8.1 Loop Dialling

The operation of the Speak Key (KS), connects the service telephone to the line under test for monitoring purposes. When key KTE is also operated, speaking and dialling can take place from the service telephone to the exchange equipment. With keys KS and KTL operated, speaking and dialling could take place over a junction.

3.2.8.2 Battery Dialling

Battery dialling is achieved by proceeding as for loop dialling with the Battery Dial Key (KBD) also operated.

3.2.9 Ringling

Operation of the Ringling Key (KX), with key KTL operated, connects ringing supply (or hand generator) to the B wire and earth to the A wire.

It is necessary to operate the Line Reverse Key (KR) in addition to keys KX and KTL in order to ring on the A wire.

3.2.10 Speaking

Operation of the Battery Feed Key (KBF), the Speak Key (KS) and (KTL) connects the service telephone and line under test to opposite sides of the transmission bridge formed by retard I, relay DS and capacitors C6 and C7, thus allowing speech between the service telephone and the subscriber. For speaking to exchange see Loop Dialling above (Para. 3.2.8.1).

3.2.11 Holding Calls

Operation of the Hold Service Line Key (KHL) connects the 600 ohm resistor R15 across the service line so that a call may be held on the service line whilst another call may be made via the tester.

Similarly operation of the Hold Tester Key (KHT) enables a call made via the tester to be held whilst another call is made (or answered) on the service line. Operation of either key causes the Hold Guard Lamp to glow.

Note: KHT and KHL are combined in a three position key.

3.2.12 U.A.X. Call to Parent Exchange

Keys KBF, KCM and KR or KCB with KTL are used to simulate U.A.X. Parent Manual Board calling conditions either "Ordinary" or "C.C.B." from the test position directly over the parent junction.

3.2.12.1 Ordinary Call

Keys KBF, KR and KCM are operated. This connects battery via resistor R17 and relay DS, to the positive wire of the junction. This causes the ordinary calling lamp at the Parent Manual Board to glow. The tester supervisory lamp will glow to earth at DS1 operated. When the operator answers the positive wire is disconnected. Relay DS releases and the tester supervisory lamp ceases to glow. Key KCM is then restored. This connects earth via LC and DS relays to the negative wire of the junction. When the operator operates the speak key the positive wire of the junction is reconnected. Relay LC then controls the tester supervisory lamp.

3.2.12.2 C.C.B. Call

Keys KBF, KCB and KCM are operated. This connects earth via DS relay, or battery via resistor R17 and relay DS if the parent exchange is a directly connected 22 or 40 volt exchange, to the negative wire of the junction. This causes the C.C.B. calling lamp at the Parent Manual Board to glow. The tester supervisory lamp will glow to earth at DS1 operated. When the operator answers, the negative wire of the junction is disconnected, DS relay releases and the tester supervisory lamp ceases to glow. Key KCM is then restored. This connects battery via R17 and relays LC and DS to the positive wire of the junction. When the operator operates her speak key the negative wire of the junction is reconnected. Relay LC then controls the tester supervisory lamp.

3.2.13 Simulating Normal and Emergency calls from C.C.B. lines at CB Exchanges

3.2.13.1 Normal Calls

The operation of the Coin Box Normal Call Key (KNC), with Key KTE operated, applies earth via R14 (at 22v exchanges) or via R14 and R15 in series (at 40v exchanges) to the B wire, and battery via resistor R17 and one winding of relay DS to the A wire. This establishes normal calling conditions at the exchange. When the operator answers relay DS operates to the earth condition returned on the A wire and at DS1 causes the tester supervisory lamp to glow.

3.2.13.2 Emergency Calls

The operation of the Coin Box Emergency Call Key (KEC) with Key KTE operated, connects earth via resistor R16 to the B wire, and battery via resistor R17 and one winding of relay DS to the A wire. This establishes emergency calling conditions at the exchange. When the operator answers, relay DS operates to the earth condition returned on the A wire and at DS1 causes the tester supervisory lamp to glow.

Note: Keys KNC and KEC are combined in a three position key.

DESIGN DETAILS

4.

The accuracy of the meter for resistance measurements is within $\pm 5\%$ for resistance values between one tenth and ten times the mid scale resistance values (i.e. 5000-500.000 ohms on the "high" scale and 50-5000 ohms on the "low" scale).

is a variable
be maintained within the normal limits of the reaction to
batteries. The resistor should be adjusted, with key ~~key~~
operated, immediately before each resistance measurement,
until 500 μ A (zero on the resistance scales) is flowing in
the meter.

5.

HISTORY

Issue A

The connexions to Keys KEC and KNC were amended so as to avoid the necessity of operating the Line Reverse Key when making Coin Box call tests in C.B. exchanges, to prevent a false clear condition being given to the operator during such tests and to give a supervisory lamp signal to the testing officer when the operator answers. Opportunity was taken to amend the title to agree with the revised designation of the item. The break springs of Key KBD were deleted as they are not provided on the key shown on the relative drawing.

Alternative connexions to Key KCB were shown to cater for U.A.X. parent manual board tests being correctly simulated even if the parent exchange is a directly connected 22 or 40V manual exchange.

Opportunity was taken to amend the value of resistor R5 to the nearest standard value.

Issue B

Certain resistors were changed to the preferred values and the ringing supply and howler connections were simplified. Note 12 was added.

Issue C

An alternative multiway plug was shown to enable the tester to be portable. The title was amended to line up with others published documents including the Rate Book.

Diagram Notes AT 5422C - Issue 1

Engineering Department, TPM 3/2/JJH/2463
October, 1964

END OF DIAGRAM NOTES