

DIAGRAM NOTES

for

U.A.X. N.Z. 13

LINE TESTING CIRCUIT

GBW.13870/13871

GENERAL

The diagram shows the circuit arrangement of the equipment to be used for the testing of subscribers' lines and associated equipment at a U.A.X. N.Z. 13.

FACILITY SCHEDULE

Provision is made for:-

- (1) Monitoring on a circuit under test.
- (2) Testing into the exchange or out to line.
- (3) Testing with an associated Voltmeter (Detector No. 4).
- (4) Dial Speed Testing.
- (5) Indicating by means of a test Bell, that a lineman required attention.
- (6) Loop dialling.
- (7) Ringing either normal or shared service subscribers.
- (8) A transmission bridge feed.
- (9) Holding calls on the service line or calls made via the testing circuit.
- (10) Testing Rural Lines.

## CIRCUIT DESCRIPTION

### OUTLINE

Speaking, monitoring and dialling are carried out by using the service telephone connected to terminals L1 and L2, or the rural Auto telephone connected to terminals R1 and R2.

Voltmeter tests are carried out by using a Detector No. 4 connected to the appropriate terminals.

Dial Speed tests are carried out in conjunction with a Tester No. 43 connected to the Dial Speed Tester terminals.

Access to the circuit required to be tested is provided by the insertion of two plugs, connected to the testing circuit by cords, into the Main Frame test springs.

Note While the keys on the testing circuit are normal the insertion of the plugs into the test springs does not interrupt a call which might be in progress.

### DETAIL

#### INDIVIDUAL OR MULTI-PARTY LINES

##### (a) Monitoring Individual or Multi-party Lines

Before testing commences the testing officer should ascertain that a call is not in progress on the circuit required for test.

The Test Circuit Speaking key KS is operated.

The Test Circuit Speaking Key KS operating,

KS1) } disconnect the service line from, and connect the  
KS2) } circuit required for test to, the service telephone  
via capacitor C4.

KS3 connects the magneto bell (in series with capacitor C3) across the service line to receive an incoming call while the service telephone is in use for monitoring or speaking.

Using the service telephone the testing officer monitors on the circuit required for test.

Note The transmitter of the service telephone is ineffective as the transmission bridge is not in circuit at this stage, and capacitor C4 prevents it being energised from the circuit under test.

##### (b) Testing out to line

The Test Out Key KTO is operated when tests are required on the line side of a circuit.

The Test Out Key KTO operating,

KT01 disconnects the A wire, on the exchange side of the circuit, from the testing circuit.

KT02 disconnects the B wire, on the exchange side of the circuit, from the testing circuit.

KTO3 short circuits capacitor C4 to connect the testing keys to the B wire.

The testing keys are now extended to the line side of the circuit required for testing.

(c) Testing into the exchange

The Test In Key KTI is operated (in place of the Test Out Key KTO as in (b) above) when tests are required on the exchange side of a circuit.

The Test In Key KTI operating,

KTI1 disconnects the A wire, on the line side of the circuit, from the testing circuit.

KTI2 disconnects the B wire, on the line side of the circuit, from the testing circuit.

KTI3 short-circuits the capacitor C4 to connect the testing keys to the B wire.

The testing keys are now extended to the exchange side of the circuit required for testing.

The following descriptions of tests assume that the line side of a circuit is being tested and that the Test Out Key KTO is operated in all cases in addition to those key or keys required for each individual test. The same tests, however, can be made on the exchange side of a circuit by operation of the Test In Key KTI in place of the Test Out Key KTO.

(d) Tests with the Voltmeter

Testing with a Voltmeter

(i) Testing for earth on the B wire

The Voltmeter Key KV is operated for this test.

The Voltmeter Key KV operating,

KV2 Connects the B wire to terminal + (voltmeter positive terminal).

The negative terminal of the Voltmeter is connected via KVR2 and KN2 and the testing circuit to the earthed exchange battery.

A positive deflection on the Voltmeter indicates that an earth potential exists on the B wire.

(ii) Testing for negative battery potential on the B wire

The Voltmeter Key KV is operated as for (d) (i) above and in addition the Voltmeter Battery Cut-Off and Receive Negative Key KN is operated.

The Voltmeter Battery Cut-Off and Receive Negative Key KN operating,

KN1 disconnects the B wire from, and connects earth to, terminal + of the voltmeter.

KN2 disconnects battery from, and connects the B wire to, terminal - of the voltmeter.

A positive deflection on the Voltmeter indicates that a negative battery potential exists on the B wire.

(iii) Testing for positive battery potential on the B wire

The Voltmeter Key KV and Receive Negative Key KN are operated as in (d) (ii) and in addition the Voltmeter Reversing Key KVR is operated.

The Voltmeter Reversing Key KVR operating,

KVR1 disconnects earth from, and connects the B wire to, terminal + of the voltmeter.

KVR2 disconnects the B wire from, and connects earth to, terminal - of the voltmeter.

A positive deflection on the voltmeter indicates that a positive battery potential exists on the B wire.

(iv) Testing on the A wire

The tests (i), (ii) and (iii) can be repeated for the A wire by operating the Reversing Key KR in addition to those keys described above for each test.

The Reversing Key KR operating,

KR1 )  
KR2 ) reverse the connexions of the A and B wires.

The references previously made to the B wire now apply to the A wire.

(v) Testing for a Loop between the A and B wires.

The Voltmeter Key KV is operated and connects the positive terminal of the voltmeter to the B wire as described in (d) (i) above.

The Earthing Key KE is now operated.

The Earthing Key KE operating,

KE1 connects earth to the A wire.

KE2 is spare.

A positive deflection on the voltmeter (when the Earthing Key KE is operated) indicates a loop between the A and B wires.

(vi) Testing for Capacitance between the A and B wires.

The Voltmeter Key KV and the Earthing Key KE are operated as in (d) (v) above.

Under these conditions the A wire is earthed and the B wire is connected to battery potential via the voltmeter. The line is therefore charged.

The Reversing Key KR is now operated and the connexions to the A and B wires are reversed thus discharging the line (via the voltmeter) and charging it in the reverse direction.

During the discharge-charging process there is a momentary deflection on the voltmeter, the amount depending on the length of line and the capacitance of any equipment connected to the line (e.g. a subscriber's bell set).

(e) Dial Speed Testing

The Speaking Battery Key KB operating,

- KB1) connect relay DS to the line under test. Relay DS operates to the loop on the A and B wires
- KB2) formed by the dial which it is required to test.
- KB3) perform no useful function at this stage.
- KB4)

Relay DS operating.

DS1 is ineffective at this stage.

The Dial Test Key KD operating

- KD1 disconnects capacitor C2 and the earthed winding of retard I from the A wire to prevent interference during the subsequent impulsing of relay DS.
- KD2 disconnects capacitor C1 and the battery connected winding of retard I from the B wire to prevent interference during subsequent impulsing.
- KD3 prepares the circuit of the Dial Speed Tester (Tester No. 43).

The testing officer now sets the Tester No. 43 in the start position and when the dial to be tested is operated loop-disconnect impulses are received over the A and B wires.

Relay DS responds to the impulses which are dialled.

Relay DS impulsing

DS1 connects an earth to the Tester No. 43 on each break of the contact.

When the train of impulses have been completed relay DS remains operated, to the loop formed by the dial, and the reading on the Tester No. 43 will indicate the speed of the dial.

(f) Test Bell Facility

When the testing circuit is connected to a line on which a lineman is working, it may be necessary to leave the line connected to the testing circuit and for the lineman to call the testing officer periodically in order to test the line. For this purpose the Speaking Battery Key KB is operated and connects relay DS to the line as described in (e) above.

The Test Bell Key KTB is also operated.

The Test Bell Key KTB operating,

KTB1 prepares an operating circuit for the Test Bell.

KTB2 is spare.

When the lineman wishes to call the testing officer, he connects his telephone across the line. Relay DS operates to the loop from the telephone.

Relay DS operating,

DS1 completes the circuit of the Test Bell which provides an audible signal to attract the attention of the testing officer.

Similarly, when the testing officer is testing on the exchange side of a subscriber's circuit, the operation of the Test In Key connects the testing keys to the line side of the circuit (see (c)). If, therefore, the Test Bell Key (KTB) is also operated and the subscriber or a lineman attempts to make a call, an audible indication is given to the testing officer. It is important to ensure, when using this facility on a shared service line, that the test plugs are not inadvertently reversed.

(g) Loop Dialling.

In order to dial over a circuit under test the Test Circuit Speaking Key KS is operated and connects the service telephone to the A and B wires as in (a).

Using the dial on the service telephone the testing officer is able to loop dial on a circuit providing dialling facilities.

(h) Ringling Individual or 2 Party

Ringling is provided from a hand generator or from the exchange ringling supply if available.

The Ring Individual or 2 Party Key (KX) is operated to provide ringling current to the B wire to ring ordinary or 'X' shared service subscribers.

The Ring Individual or 2 Party Key KX operating,

KX1 connects earth to the A wire as a ringling return circuit.

KX2 connects the earthed hand generator or earthed ringling supply to the B wire.

KX3 operates the ringling start relay.

Should ringling be required on the A wire (to ring 'Y' shared service subscribers) the Reversing Key KR is operated in addition to the Ring Key KX.

The Reversing Key KR operating,

KR1 } reverse the connexions of the A and B wires, so that  
KR2 } ringling current is transmitted over the A wire and  
the B wire is earthed.

(i) Ringling Multi-Party

The Ringling Multi-Party Key KMP is operated (using a suitable ringling code to call the required subscriber) to provide ringling current to A and B wires to ring the particular multi-party subscriber.

The Ringing Multi-Party Key KMP operating,

KMP1 connects earthed ringing supply to the 'B' wire.

KMP2 connects R.R. ETH. to the 'A' wire.

KMP3 operates the ringing start relay.

(j) Transmission Bridge

A transmission bridge consisting of relay DS, retard I and capacitors C1 and C2 is provided in the testing circuit to enable speech to take place over the line under test using the service telephone.

The Speaking Battery Key KB and the Test Circuit Speaking Key KS are operated.

The Speaking Battery Key KB operating,

KB1 connects earth via relay DS (winding a-b) to the A wire on the line side of the testing circuit.

KB2 connects battery via relay DS (winding d-e) to the B wire on the line side of the testing circuit.

KB3 connects earth via retard I (winding a-b) to the A wire on the service telephone side of the testing circuit.

KB4 connects battery via retard I (winding d-e) to the B wire on the service telephone side of the testing circuit.

The Test Circuit Speaking Key KS operating,

KS1 } disconnect the service line from, and connect  
KS2 } retard I to, the service telephone.

KS3 connects the magneto bell (in series with capacitor C3) across the service line to receive an incoming call while the service telephone is in use for testing purposes.

Using the service telephone the testing officer is able to speak over the line under test.

While the line is looped relay DS operates but contact DS1 is ineffective unless the Test Bell Key KTB is operating (see (f) above).

(k) Holding Calls

With the testing circuit keys normal the service telephone is connected to the service line over which the testing officer may make or receive calls.

If the testing officer operates the Test Circuit Speaking Key KS to make a test call on a line, and a call is received over the service line the Hold Tester Key KHT is operated.

The Hold Tester Key KHT operating,

- KHT1) connect a 600 ohm resistor YA across the line under
- KHT2) test to hold the test call.
- KHT3 completes a circuit to light the Hold Guard Lamp.

The Test Circuit Speaking Key KS is now restored to connect the service telephone to the service line in order to answer the call.

Similarly if the testing officer makes an outgoing call over the service line and then requires to use the service telephone to speak over a line under test, the Hold Service Line Key KHL is operated.

The Hold Service Line Key KHL operating,

- KHL1) connect a 600 ohm resistor YA across the service
- KHL2) line to hold the outgoing call.
- KHL3 completes a circuit to light the Hold Guard Lamp.

The Test Circuit Speaking Key KS may then be operated to disconnect the service telephone from the service line and connect it to the testing circuit.

#### TESTING RURAL LINES

##### (1) Monitoring Rural Lines.

Before testing commences the testing officer should ascertain that a call is not in progress on the circuit required for test.

The Speak Rural Line Key KSR is operated.

The Speak Rural Line Key KSR operating.

- KSR1) disconnect the transmission bridge and the service
- KSR2) line from, and connect the circuit required for test to, the rural auto telephone via capacitor C4.

Using the rural auto telephone the testing officer monitors on the circuit required for test.

(m) The tests described in (a), (b), (c) and (d).

##### (n) Dial Speed Testing

The Speak Rural Line Key KSR operating,

- KSR1) disconnect transmission bridge and service line as
- KSR2) described in (1).

The testing officer makes arrangements, for dialling to take place, with the dial which it is required to test, sets the tester No. 43 in the start position and operates the Dial Test Rural Line Key KDR.



The Dial Test Rural Line Key KDR operating,

KDR1) disconnect the rural auto telephone from, and  
KDR2) connect the A and B wires to relay DR. Relay  
DR operates.  
KDR3 prepares the circuit of the dial speed tester  
(Tester No. 43).

DR operating

DR1 connects earth to relay B. Relay B operates.  
DR2 spare.

B operating

B1 prepares circuit for Dial Speed Tester (Tester  
No. 43).

When dial to be tested is operated earth disconnect  
impulses are received over the A and B wires.

Relay DR responds to impulses which are dialled.

Relay DR impulsing

DR1 disconnects relay B and connects earth via B1 and  
KDR3 to the tester No. 43 on each break of the  
contact.

Relay B remains operated during impulsing.

When the train of impulses has been completed, relays DR  
and B remain operated, to the earth via the dial, and the  
reading on the Tester No. 43 will indicate the speed of the dial.

(O) Simplex Dialling (Rural Party).

The Speak Rural Line key KSR operating

KSR1) disconnect the A and B lines required for  
KSR2) dialling from the transmission bridge and  
service line, and extend them via the R1 and  
R2 wires to the special rural auto telephone.

The testing officer using the dial on the special rural  
party telephone is able to dial on a rural party line circuit.

(P) Ring Rural Party Lines

The Speak Rural Line key KSR operating

KSR1) disconnect transmission bridge and service line  
KSR2) as described in (O).

The testing officer using the hand generator on the  
rural auto telephone, and a suitable code, calls the required  
subscriber.