TELEPHONIC INDICATOR PANELS TIP/2 SERIES

General Description

The TIP/2 Series of Telephonic Indicator Panels are designed for connection to a P.O. telephone circuit at an unattended station so that an indication of the state of the equipment at the station can be obtained remotely. When the station number is rung the unit sends to line groups of tone pulses which are coded to give the information required. All the pulses are of the same pitch, and fault conditions are indicated by increasing the duration of pulses so that they are changed from dots to dashes. Up to 22 pulses are available and may be used as necessary to provide the required information.

The TIP/2B, a modified TIP/2, is installed at stations which use a 23-kHz tone monitoring system. The circuit is arranged so that the unit can be started not only by ringing tone but, in the event of a fault, by the application of a suitable earth connection. The relays in the panel are used indirectly to key the output of an oscillator[1] the output of which is used to signal the fault condition to a parent station by injection into the programme chain.

The TIP/2 and TIP/2B operate from a 50-volt supply. Either the positive or the negative rail of the supply may be earthed provided that a six-way plug, mounted on the rear of the chassis, is positioned correctly. The TIP/2A is an earlier version of the TIP/2 and can operate only from a 50-volt supply with a positive earth.

The power supply requirements are less than 250 mA at 200-250 volts a.c. and up to 350 mA at 50 volts d.c.

Each unit is constructed on a 19 in. by $8\frac{3}{4}$ in. panel.

Operational Instructions

Information about the state of equipment supervised by a TIP can be obtained from any exchange telephone instrument. When a call is made over a manual exchange the caller should warn the operator that only a tone signal, instead of speech, is expected in the reply, and should also ask to be left connected while the call is being set up. This is necessary to deduce whether there is a mains failure at the station called. If that has occurred, the TIP will not function and only the ringing tone will be heard. Such unanswered ringing tone might also result from the setting up of a call to a wrong number. The call should therefore be made again after an appreciable interval and if the ringing tone is once more heard to continue for more than half a minute, then it may reasonably be assumed that the correct number has been called and that the lack of response from the TIP is due to a mains failure.

The TIP is normally connected to the P.O. exchange telephone line through the station telephone instrument which is a special type, see Fig. 1. When the station telephone number is called the ringing signal passes in series through the TIP and the local telephone bell, which then rings.

If the telephone is not answered, about a quarter of a minute after the commencement of the ringing signal the TIP will apply a loop to the line thus causing cessation of the ringing signal. The TIP then originates a starting signal of tone sustained for five seconds and followed by the informative dots or dashes. The complete train of starting signal followed by informative signals continues to be repeated for about two minutes, after which the unit is automatically switched off and reverts to its normal condition for receiving further incoming calls.

If staff are on duty at the station the call can be answered in the normal way, but the TIP should be disconnected by pressing the key on the telephone instrument. In addition to breaking the circuit from the line to the TIP, operation of this key interrupts the supply to the TIP, which is then restored to its quiescent condition. The key is automatically released when the hand set is replaced on its cradle.

Circuit Description

General

The circuit is divided into four main sections as shown in Fig. 2 which is applicable particularly to the TIP/2 and TIP/2A. A TIP/2B is a TIP/2 which has the mains-and-start circuit modified as shown in Fig. 3.

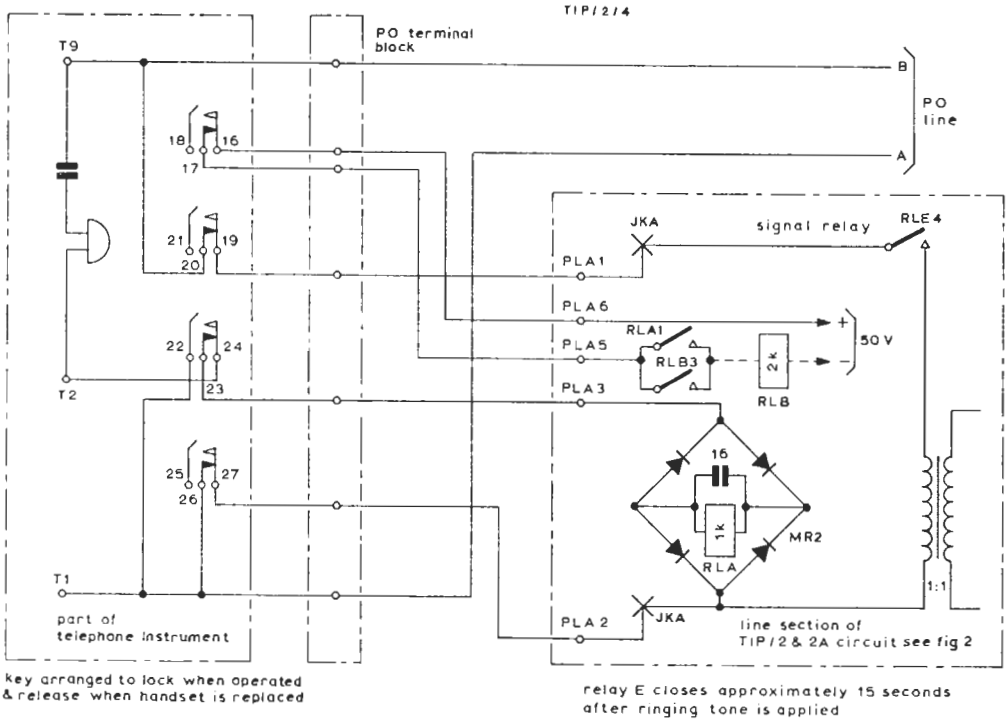


Fig. 1 Input Circuit and Connection to P.O. Telephone of TIP/2 Series

The mains-and-start circuit is switched on by an incoming ringing signal and starts the timing circuit. The gas-filled valve V1 is arranged to strike 11 seconds after the unit is switched on, and thereafter the striking intervals are controlled by the sequence relay circuit and sequence circuit. Each time valve V1 strikes it interrupts tone which is being fed to the line. This tone, which contains predominantly higher audible harmonics of 50 Hz, is obtained from the tuned 6·3-volt output circuit of the mains transformer. When the relays in the sequence relay circuit operate they sample in sequence the 24 tags (of which numbers 2 to 23 inclusive are available for supervisory circuits) of the sequence circuit, and control the action of valve V1.

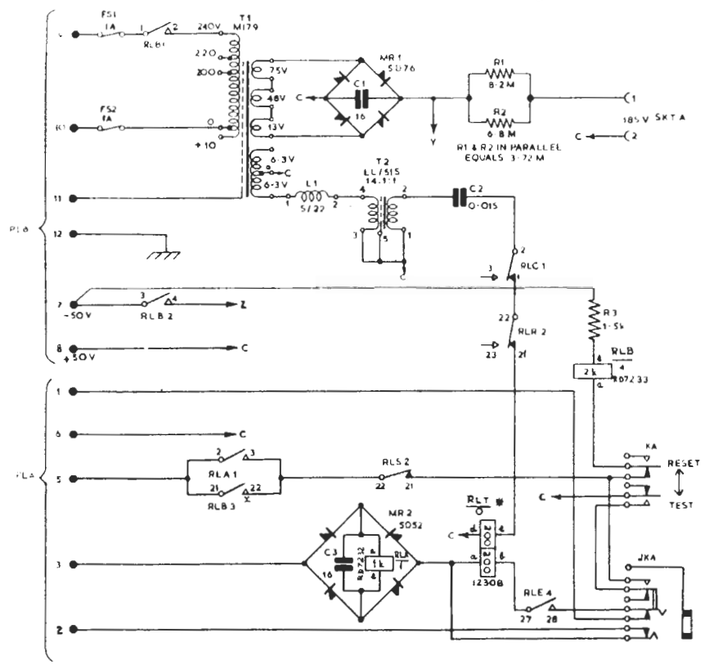
By connecting the last tag (No. 24: sequence stop) to any input tag from No. 2 to No. 23, the sampling sequence repeats up to that tag. By these means the number of tone pulses in the sequence can be varied. By connecting the first tag (No. 1: group gap) to other input tags the tone pulses, corresponding to the signals from these other tags, are muted. This enables the sequence of pulses to be separated into groups, each group being separated by a silent period.

Two minutes after the unit is switched on, the gas-filled valve V2 strikes, to switch the unit off and prepare the whole circuit for further incoming telephone calls.

Mains and Start Circuit

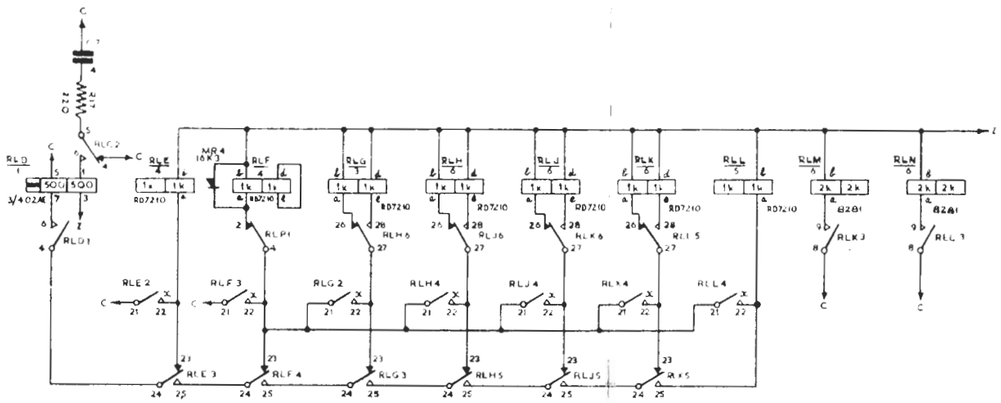
The incoming ringing-tone is applied to tags 2 and 3 of plug PLA, see Fig. 2. The tone is rectified by MR2 and energises relay RLA. As tags 5 and 6 of PLA are connected together via the telephone instrument, relay RLB is energised by relay contact RLA1 and remains energised over contact RLB3 when ringing tone ceases.

Operation of RLB connects the mains supply to transformer T1 through contact RLB1; contact RLB2 extends the 50-volt supply negative to the sequence relay circuit. The timing circuit, which includes valves V1 and V2, is therefore powered via the connections Y and C. Because of the operation

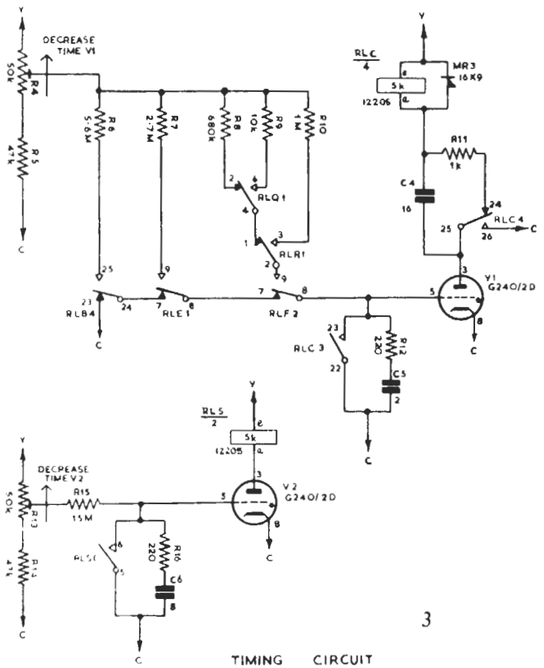


MAINS & START CIRCUIT

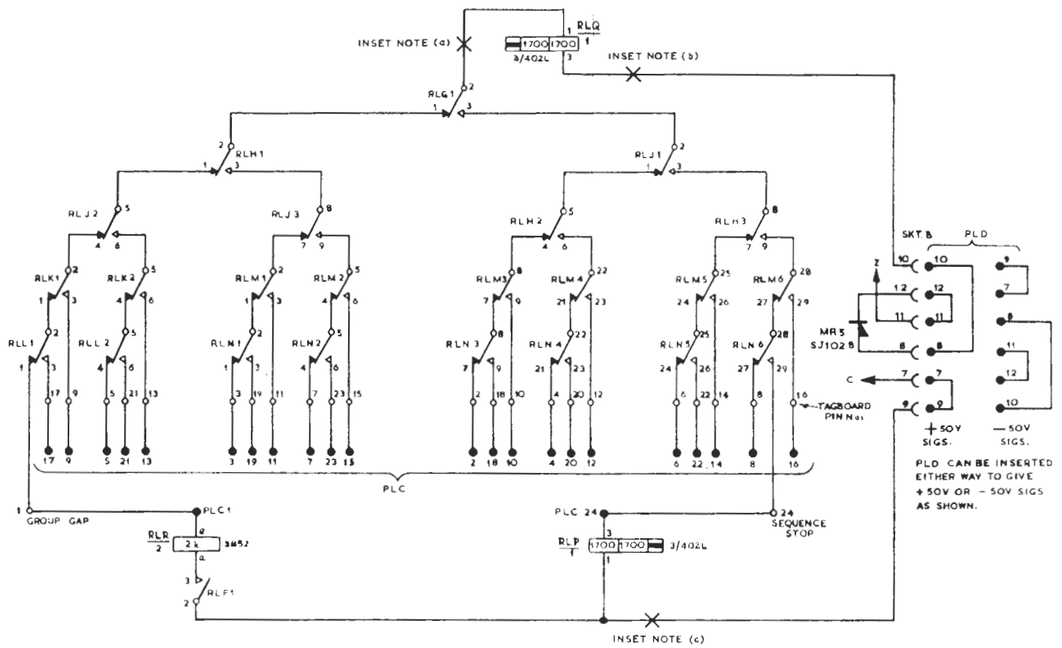
NOTE.
a RELAY 'F' WITHOUT ARMATURE & COVER USED AS A TRANSFORMER.



SEQUENCE RELAY CIRCUIT



TIMING CIRCUIT



SEQUENCE CIRCUIT

from SH 2048

DIAGRAM REFERS TO TIP/2
DIFFERENCES IN TIP/2A ARE :-
SKT B AND PLD OMITTED, AND ALSO
(a) MR 5 (TYPE 16X3) BETWEEN RLG 1 AND RLQ
(b) RLQ COIL CONNECTED DIRECTLY TO Z
(c) RLF 1 AND RLP COIL CONNECTED DIRECTLY TO C

Fig 2 Telephone Indicator Panels TIP/2 and TIP/2A Circuit

of contact RLB4, V1 strikes 11 seconds after the operation of relay B and momentarily energises relay C which supplies a pulse to the sequence relay circuit through contact RLC2. This pulse energises relay D.

Relay E, which is initially energised through one winding of relay D and the contact RLD1, remains operated by contact RLE2 until the 50-volt supply is switched off. The closing of contact RLE4 connects one of the low-impedance windings of relay T across the line thus causing removal of the ringing tone.

Relay T has its armature removed and is used, in conjunction with T2, L1 and C2, as a transformer to transmit to line the tone pulses generated in its second winding. The supply for these pulses is obtained from the 6·3-volt winding of mains transformer T1, stepped down by transformer T2 and, except in the TIP/2B, fed through relay contacts RLC1 and RLR2 to the second winding of relay T. Contact RLC1 switches the pulses fed to the line and contact RLR2 is arranged to open to give silent periods when these are required.

In the TIP/2B the tone pulses are passed from C2 via a relay contact, connected across pins 5 and 6 of SKTE, to a second winding of relay T, see Fig. 3. The coil of the relay controlling this contact is connected across pins 7 and 8 of SKTE and is energised via contacts RLC1 and RLR2.

The value of the capacitor C2 in the pulse supply circuit is arranged to give a pulse tone which consists mainly of ripple-frequency components introduced into the mains-transformer windings by rectifier MR1.

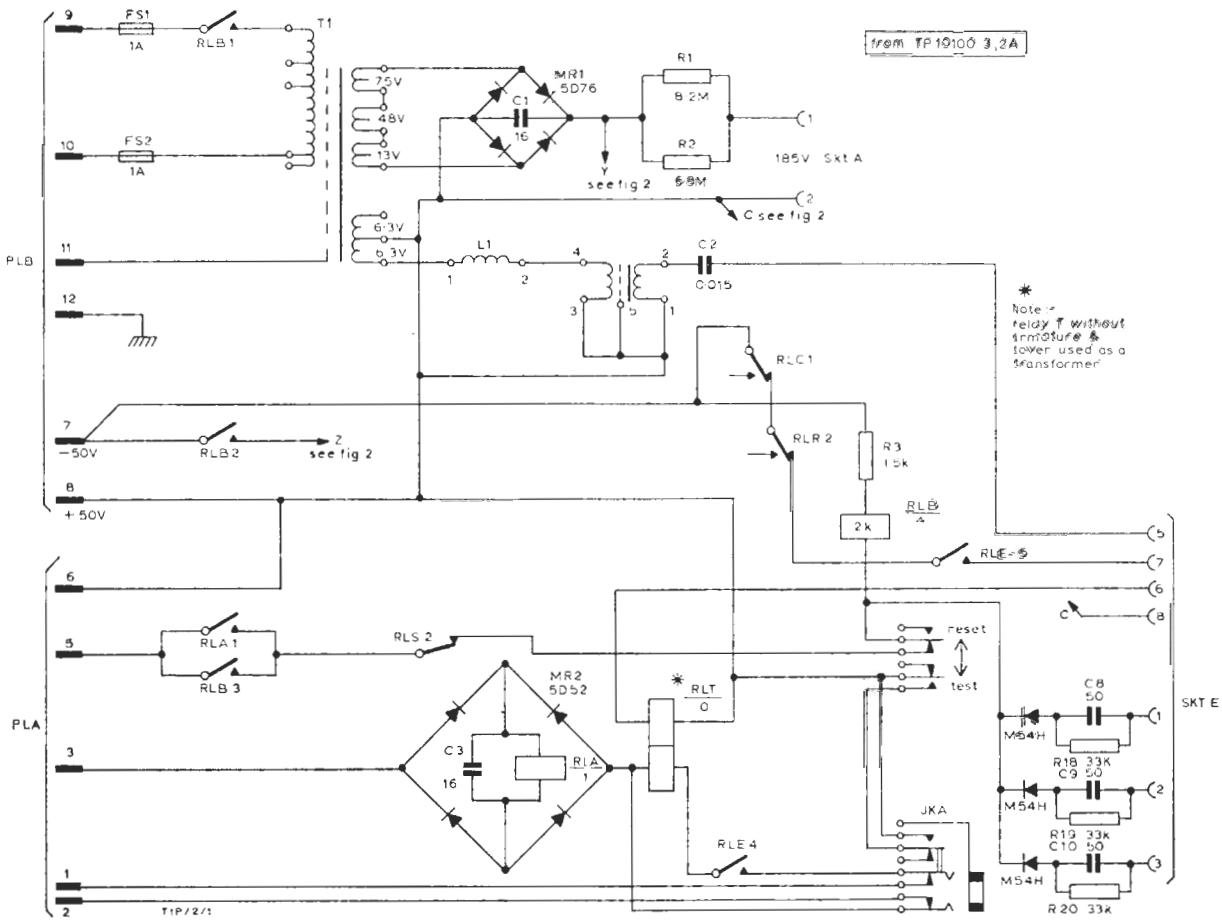


Fig. 3 Mains-and-Start Circuit of TIP/2B

Timing Circuit

Each time the valve V1 strikes, relay C in its anode circuit is energised. When this relay is energised, contact RLC3 causes discharge of capacitor C5 in the trigger circuit of valve V1. Contact RLC4 earths the anode of valve V1 and extinguishes the discharge between anode and cathode. When capacitor C4 has charged sufficiently, relay C releases. The operation of relay C also interrupts the tone being fed to line, (contact RLC1) and energises relay D via contact RLC2. The time interval between each operation of valve V1 is controlled by the relay contacts RLB4, RLE1, RLF2, RLR1 and RLQ1. These contacts determine the speed of charging of capacitor C5. When there is sufficient voltage across C5, the trigger electrode causes V1 to strike between its anode and cathode.

Two minutes after the unit is switched on valve V2 strikes and energises relay S. Contact RLS2 breaks the circuit to release relay B. The unit is therefore switched off and prepared for further incoming telephone calls.

Sequence Relay Circuit

Each time that relay C is energised, relay contact RLC2 energises relay D. Each operation of relay D causes one of the relays E—K to be energised and the selected relay, in turn, releases relay D.

The relays G—K are each wired so that energising of the second winding results in flux cancellation which causes release of the relay. The relays are energised or released according to Table 1, in which the notation x is used for an energised relay and the notation o for a de-energised or released relay. Relays M and N are controlled by relays K and L respectively.

Table 1

Pulse No.	*Relay(s)*							*Sequence Circuit Contact Selected*
	E	*F*	*G*	*H*	*J*	*K and M*	*L and N*	
1	x	o	o	o	o	o	o	PLC1
2	x	x	o	o	o	o	o	PLC1
3	x	x	x	o	o	o	o	PLC2
4	x	x	o	x	o	o	o	PLC3
5	x	x	x	x	o	o	o	PLC4
6	x	x	o	o	x	o	o	PLC5
7	x	x	x	o	x	o	o	PLC6
8	x	x	o	x	x	o	o	PLC7
9	x	x	x	x	x	o	o	PLC8
10	x	x	o	o	o	x	o	PLC9
11	x	x	x	o	o	x	o	PLC10
12	x	x	o	x	o	x	o	PLC11
13	x	x	x	x	o	x	o	PLC12
14	x	x	o	o	x	x	o	PLC13
15	x	x	x	o	x	x	o	PLC14
16	x	x	o	x	x	x	o	PLC15
17	x	x	x	x	x	x	o	PLC16
18	x	x	o	o	o	o	x	PLC17
19	x	x	x	o	o	o	x	PLC18
20	x	x	o	x	o	o	x	PLC19
21	x	x	x	x	o	o	x	PLC20
22	x	x	o	o	x	o	x	PLC21
23	x	x	x	o	x	o	x	PLC22
24	x	x	o	x	x	o	x	PLC23
25	x	x	x	x	x	o	x	PLC24

Operation of relays in accordance with the table, when the circuit contacts 2 to 23 inclusive on plug PLC are earthed, results in the following sequence of tone pulses being sent to line after the original 11 second silence:—

5 seconds start tone, 2 seconds silence followed by 22 short pulses of the same tone, each pulse of approximately 0·1-sec duration. After this the start tone is heard again and the sequence repeated until power supplies are switched off.

When PLC24 is selected, relay P is energised and restores the sequence relays to the condition shown against pulse No. 1. The sequence then repeats, as above, until the power supplies are switched off.

When PLC1 is selected, relay R is energised provided that relay F is also energised. The operation of relay R introduces the 2-second silent period mentioned above. This silent period is known as a group gap.

The relays in the sequence relay circuit operate to select in turn each contact on plug PLC in the sequence circuit.

When the contacts 2 to 23 inclusive are earthed relay Q is energised each time a contact on plug PLC is selected. The closing of contact RLQ1, in the timing circuit of valve V1, shortens the time interval between successive operations of this valve. This causes the unit to send short pulses to line. Should any contact on plug PLC not be earthed, relay Q does not become energised when the contact is selected and the pulses are made longer in duration. Thus, if a particular fault on the supervised equipment is arranged to disconnect the earth from a given tap on plug PLC, the corresponding pulse becomes lengthened into a dash.

The operation of relay R by relay F at the start of the sequence of pulses introduces a group gap, about 2 seconds of silence. If pin 1 on plug PLC is joined to other pins on this plug in place of the equipment connections, then the sequence of pulses is divided into groups. At the end of the pulse sequence, relay P operates and stops the sequence by releasing relay F. This restores the sequence to the condition corresponding to pulse 1 in the table, with only relay E energised. The number of pulses in a sequence can be altered where desired, by joining pin 24 on plug PLC to the appropriate pin of the same plug.

TIP/2B: Automatic Operation

Relay RLB, see Fig. 3, can be energised by making an earth connection to pins 1, 2 or 3 of SKTE. Connections are made from the other pins of SKTE to an oscillator keying unit[2]. Relays RLC, RLE and RLR are switched as described previously and complete a circuit, via pins 7 and 8 of SKTE, to energise relays in the keying unit.

Suppose, for example, that a fault has occurred and pin 1 of SKTE is earthed. The charging current of C8 is sufficient to energise relay RLB which locks on through its own contact RLB3, C8 then discharges through R18. At the end of the two minutes timed sequence contact RLS2 opens, the charging current through C8 is sufficient to keep relay RLB energised. As C8 charges the current falls and when relay RLB is de-energised contact RLB3 opens. This occurs before contact RLS2 has reclosed and thus the sequence circuit operates once only. If the fault clears the earth is removed from SKTE. If the original fault is still present and a second fault occurs the earth is removed for a sufficient time to allow C8 to discharge through R18. When the earth connection is remade the sequence circuit operates once more.

Testing Facilities

A test key KA, a jack, JKA and a metering socket SKTA are provided so that the operation of the unit can be checked locally.

Test Procedure

This procedure, which applies to the TIP/2A or TIP/2B with an earthed-positive 50-volt supply, may be used for either fault location or performance testing after repair. Appropriate modifications should be made in other circumstances.

When testing a TIP/2B, a PA6/59 should be connected to socket SKTE. If one of these units is not available the device shown in Fig. 4 should be made up and connected; pins 1 or 2 or 3 can be

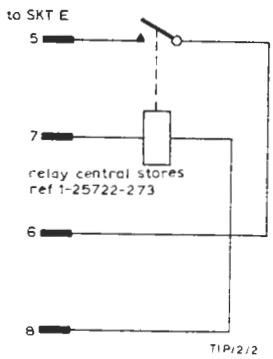


Fig. 4 Circuit of Device for Testing TIP/2B

earthed as required to energise relay RLB and initiate the timed sequence. The test apparatus required comprises:—

Avometer
Peak Programme Meter (PPM/6)
Portable Test Meter PTM/6

Tag numbers prefixed by the letters PLA refer to the Painton 6-way connector, those prefixed by PLB refer to the F. and E. 6-way connector, and those prefixed by PLC to the Painton 24-way connector. Socket SKTE is an 8-way Jones socket fitted on the TIP/2B only. Other tag numbers refer to the 24-way tag strip.

1. Plug a PTM/6 into the h.t. metering socket SKTA (185V). Insert a plug into the test jack JKA and connect tag PLA5 to tag PLA6. Turn variable resistors R4 and R13 fully counter-clockwise.
2. Momentarily throw the test key to Test position to energise relay B. Meter M3 of the PTM/6 should read 50 μA ±10%.
3. Throw the key to Reset position to switch off the power supplies. Turn R4 (Decrease Time V1) clockwise for about two-thirds of its travel. Place a temporary short-circuit across C6 to prevent relay S from being energised.
4. Throw key to Test position and note the time lapse before relay C is energised. This time should be adjusted to 11 seconds by means of R4, the unit being reset by means of the key before commencing any timing run.
5. Reset the unit to cut off power supplies, and remove the short-circuit across C6. Turn R13 (Decrease Time V2) clockwise for about two-thirds of its travel.
6. Start the unit by means of the test key and check the time that relay B remains energised. Adjust this period to be two minutes (±15 sec.) by means of R13.
7. Throw the key to Reset position and remove the plug from the test jack. Momentarily connect a 17-Hz input between tags PLA2 and PLA3.
8. Connect a pair of headphones to the test jack and temporarily short-circuit C6.
9. Throw the key to the Reset position to ensure that C5 is discharged. Throw the key to the Test position and note that the following sequence of events takes place in the approximate times given:

   11 seconds silence, 5 seconds tone (start tone), 2 seconds silence followed by 22 long pulses of the same tone, each pulse of approximately 1·5-sec. duration. After this the start tone should be heard again and the sequence repeated until power supplies are switched off.
10. Unplug the headphones from the test jack and plug in a 600-ohm peak programme meter previously lined up to read 4 with a tone input level of +4 dB. The pulses from the TIP/2A should peak between 5 and 6. Disconnect the programme meter and reconnect the headphones.
11. Connect tags 2 to 23 inclusive on the tag strip to earth. This results in the operation of relay Q whenever any of these tags is selected by the sequence circuit. The 22 signals following the start tone should then be short pulses of approximately 0·1-sec. duration. The sequence is repeated again from the commencement of the start tone until power supplies are switched off.

Note: If a fault occurs in the sequence relay circuit and/or the sequence circuit, any desired condition in these circuits can be achieved by removing V1 and pulsing relay D by momentarily manual operation of relay C. If it is desired to select the conditions shown against pulse 25 in Table 1 relay P can be short-circuited to cancel its action on the sequence relay circuit; this must be done before relay D receives pulse number 25. Relay P will reset the sequence relay circuit when the short-circuit is removed provided that no more pulses have been sent to relay D in the meantime. If further pulses have been sent to relay D the sequence relay circuit can only be reset by breaking the power supplies in order to start again.

Routine Maintenance

Routine maintenance should be carried out at regular intervals. A pair of headphones should be inserted into the test jack after ensuring that the unit is not in use. Throw the test key to Reset and then to Test, then plug a PTM/6 into the h.t. socket. Check that the meter reads 50 μA ±10% and that the TIP goes through its correct sequence of relay operations as previously listed.

Remove the PTM/6 and the headphones and check the line circuit by ringing the station from an external telephone.

References to Typical Associated Equipment

1. Oscillator OS2/31
2. Automatic Control Panel PA6/59

WG 3/62
LPB 11/69