AUTOMATIC FAULT REPORTER PA2M/7A

Introduction

The PA2M/7A is designed for monitoring up to 30 points on equipment at unattended transmitting stations. The measurement points must provide a simple 'clear' or 'fault' indication. An earth connection is the normal condition and an open-circuit or +12 volts connection is the fault condition. If a change of state occurs at any of these points, the reporter can make a telephone call to a prearranged number and give coded information about the state of the equipment.

The reporter can also be interrogated by telephone, and a suitable signal from a remote telephone initiates signals in the reporter which can carry out switching on the equipment monitored.

The PA2M/7A comprises the following coded units contained in two PN2/23 chassis mounted one above the other:

motor supply generator GE1/4
power supplier PS1/33
power supplier PS2/105A
power supplier PS2/105B
tape reproducer RP4/3
up to 5 scan units UN1/98
a.f.r. service unit UN1/127
central control unit UN3/12A
peripheral control unit UN3/13A
scan control unit UN3/16
reset control unit UN3/28
telephone unit UN10/11
input logic delay unit UN14/4
up to 5 input logic units UN20/5

Signal interconnections are shown in Fig. 1 and power interconnections are shown in Fig. 2.

Operating Sequence

When the unit initiates a telephone call, after the call is answered the normal sequence is as follows:

1. A tape recorded voice announcement is sent to line, saying 'This is an automatic device on (exchange and number), calling (exchange and number). The message is *fault condition*, repeat, *fault condition*. This is an automatic device. Acknowledge please.'
2. The called subscriber replies with 1·5-kHz acknowledgement tone[1, 2].
3. Five seconds of 1·2-kHz reference tone are then sent by the fault reporter, followed by a two-second gap.
4. A serial readout of the states of the monitored points is given. A short pulse of tone indicates *clear*, and a longer burst of tone indicates *fault*. An acknowledgement gap is provided after the completion of the readout. This sequence is repeated for up to four minutes.
5. If an acknowledgement is sent, the serial readout stops, and a five-second period of frequency-modulated tone is sent from the fault reporter to line.
6. If a further acknowledgement tone is now sent to the fault reporter, switching of the monitored equipment is carried out. The audible response to the acknowledgement tone is a five second period of pulsed tone, after which the PA2M7/A reverts to standby.

A similar sequence is followed if the reporter is called from any P.O. telephone.

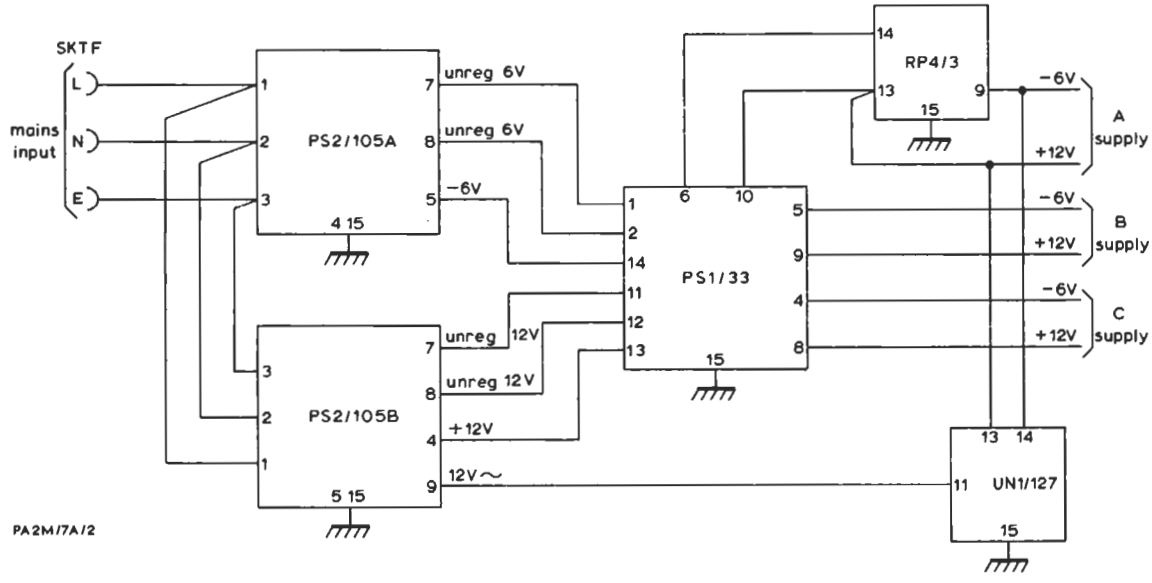


Fig. 2. PA2M/7A Mains and D.C. Connections

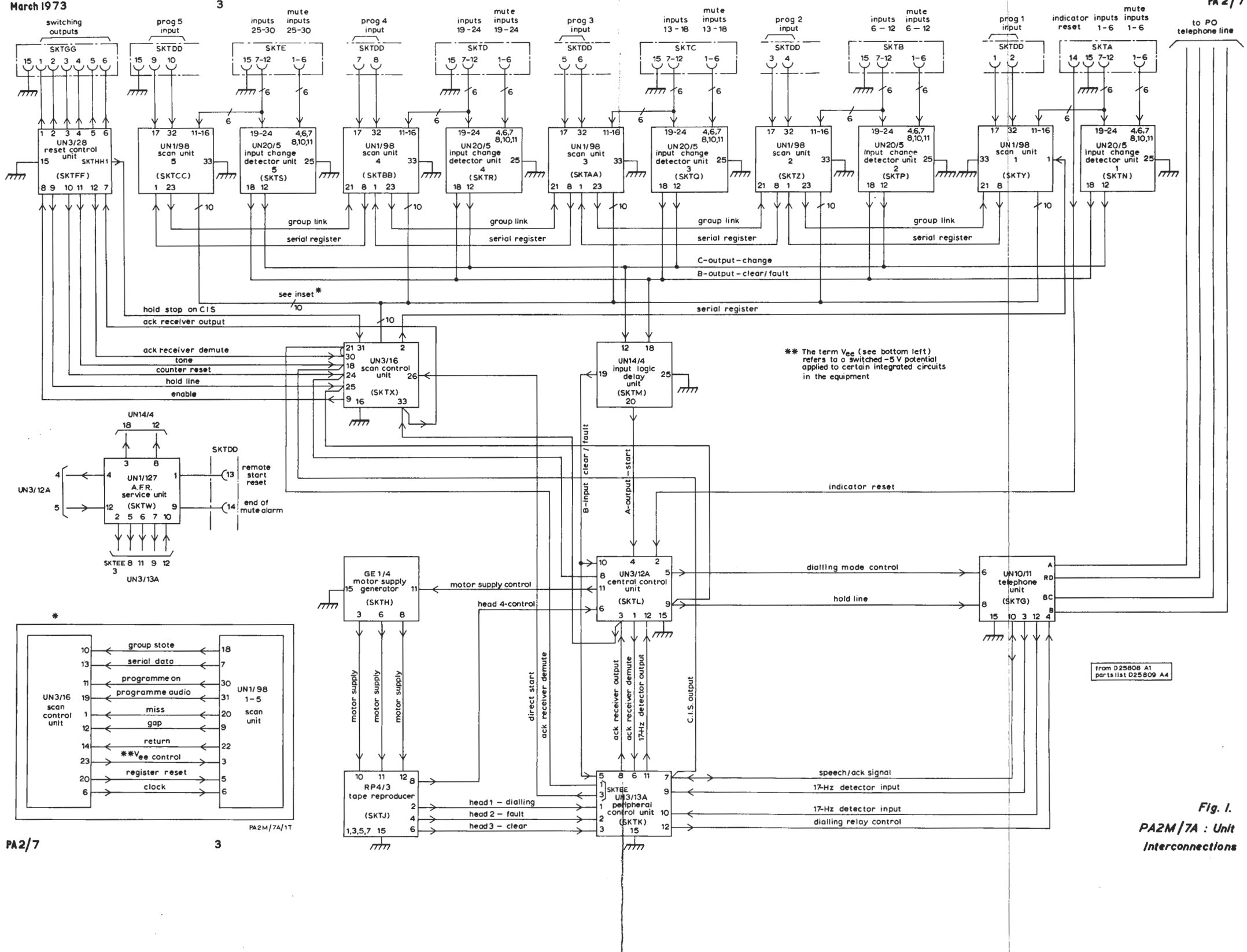


Fig. 1.
PA2M/7A : Unit Interconnections

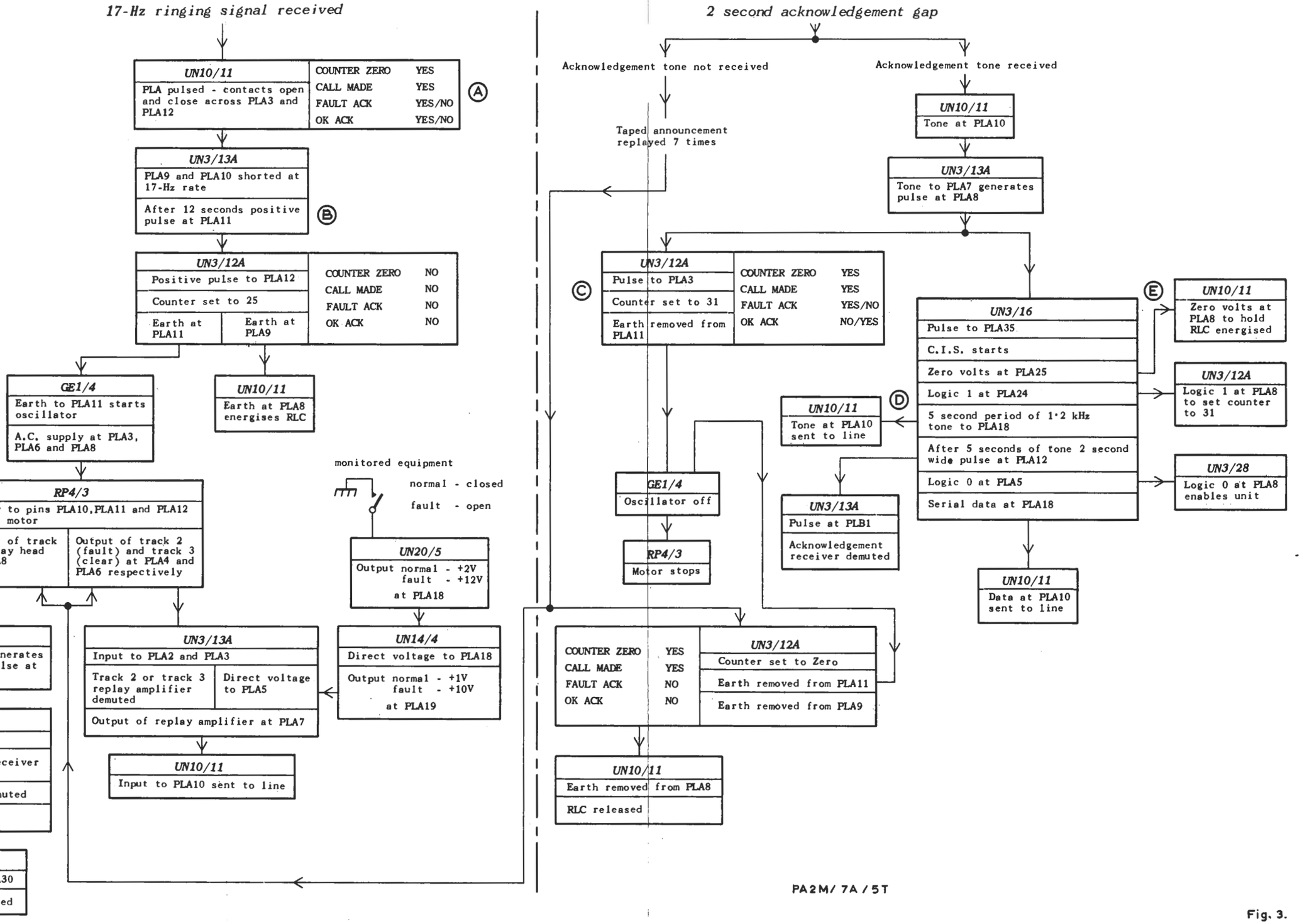


Fig. 3.

PA2M/ 7A Operating Sequence Chart: Incoming Ringing Signal

Operating Conditions

Monitor Inputs (pins 7-12 of SKTA to SKTE)

Clear	Earth
Fault	Open circuit or +12 volts

All unused inputs must be connected to earth.

Muting Inputs (pins 1-6 of SKTA to SKTE)

Mute	−6 volts
Demute	Open circuit

Audio Input (one input to SKTDD for each UN1/98)

Maximum level	2·2 volts p-p
Impedance	20 kilohms balanced

Indicator Reset

The indicators on the UN3/12A can be reset by applying an earth to pin 14 of socket SKTA.

Remote Start/Reset Mute Input

The timer in the UN1/127 can be reset and started remotely by applying an earth to pin 13 of socket SKTDD.

Reset Outputs (6 outputs on pins 1-6 of SKTGG)

Each output can supply up to 50 mA at +12 volts for switching associated equipment.

End-of-mute Alarm Output

At the end of the period timed by the UN1/127 an earth connection is made for 10 seconds at pin 14 of socket SKTDD.

Description of Operation

Figs. 3 to 6 are operating sequence charts for the fault reporter taking account of the various possible conditions. The following notes explain matters not covered in the sequence charts. The letters A, B, C and so on in the text refer to corresponding letters on the diagrams.

Static State (Figs. 3, 4 and 6)

UN10/11 All relays are de-energised.

RP4/3 Motor off; unless the cut-out is tripped both lamps are off.

UN3/12A Indicator lamps are as shown on Fig. 3, (A). If the fault reporter was acknowledged during its last operation, either the *Fault* or the *OK Acknowledge* lamp may indicate *Yes*, but not both at once. If the reporter was not acknowledged both lamps show *No*.

If the *Reset* button on the UN3/12A is operated the *Counter Zero* lamp shows *Yes* and the other three lamps *No*. This facility is used to determine whether the reporter has functioned since the *Reset* button was last operated. Immediately prior to a call-out the lamps are reset automatically.

Incoming Ring

On receipt of an incoming ringing signal the sequence is as shown in Figs. 3 and 4.

A positive pulse generated at PLA11 of the UN3/13A, (B), makes the indicators on the UN3/12A all show *No*.

The tape recorded *clear* or *fault* message is replayed seven times before the fault reporter closes down and releases the line. Each time the tape is replayed the acknowledgement receiver is demuted for two seconds and the counter in the UN3/12A is advanced one. If an acknowledgement tone is received the counter is set to 31, (C), so that after the acknowledgement period the RP4/3 motor stops and the counter is at zero.

When the code indicator section (C.I.S.) starts, a five-second period of 1·2-kHz reference tone is sent to line, (D).

Relay RLC in the UN10/11 is kept energised by a potential at pin PLA25 of the UN3/16, (E), to prevent release of the line when the counter returns to zero.

The C.I.S. then transmits the coded information, and a two-second acknowledgement gap is subsequently provided. If the C.I.S. is not acknowledged, it repeats for four minutes, then closes down and releases the line, (F). If the C.I.S. is acknowledged, it closes down, (G). The acknowledgement pulse, at pin PLA3 of the UN3/12A, would reset the last two stages of the counter and two minutes later the reporter would dial-out, if resetting during C.I.S. operation were not prevented by a voltage* applied to pin PLA8 of the UN3/12A, (H).

When the C.I.S. is acknowledged, the UN3/28 is started, and a five-second period of frequency-modulated tone is sent to line, (I).

Relay RLC in the UN10/11 is kept energised through pin PLA9 of the UN3/28, (J).

If a switching operation is required, acknowledgement tone must be sent to line immediately after the frequency modulated tone has stopped, and switching takes place while a five-second period of pulsed tone is sent to line (K).

The final acknowledgement tone would initiate dialling as described previously and also restart the C.I.S. but is prevented by the application of logic level 1 to pin PLA8 of the UN3/12A, (L), and of logic level 0 to pin PLA31 of the UN3/16, (M), when the UN3/28 is operating.

When the pulsed tone stops the UN3/28 closes down and relay RLC in the UN10/11 is de-energised thus releasing the line and returning the equipment to its static state.

* This voltage corresponds to logic level 1 in the UN3/12A.

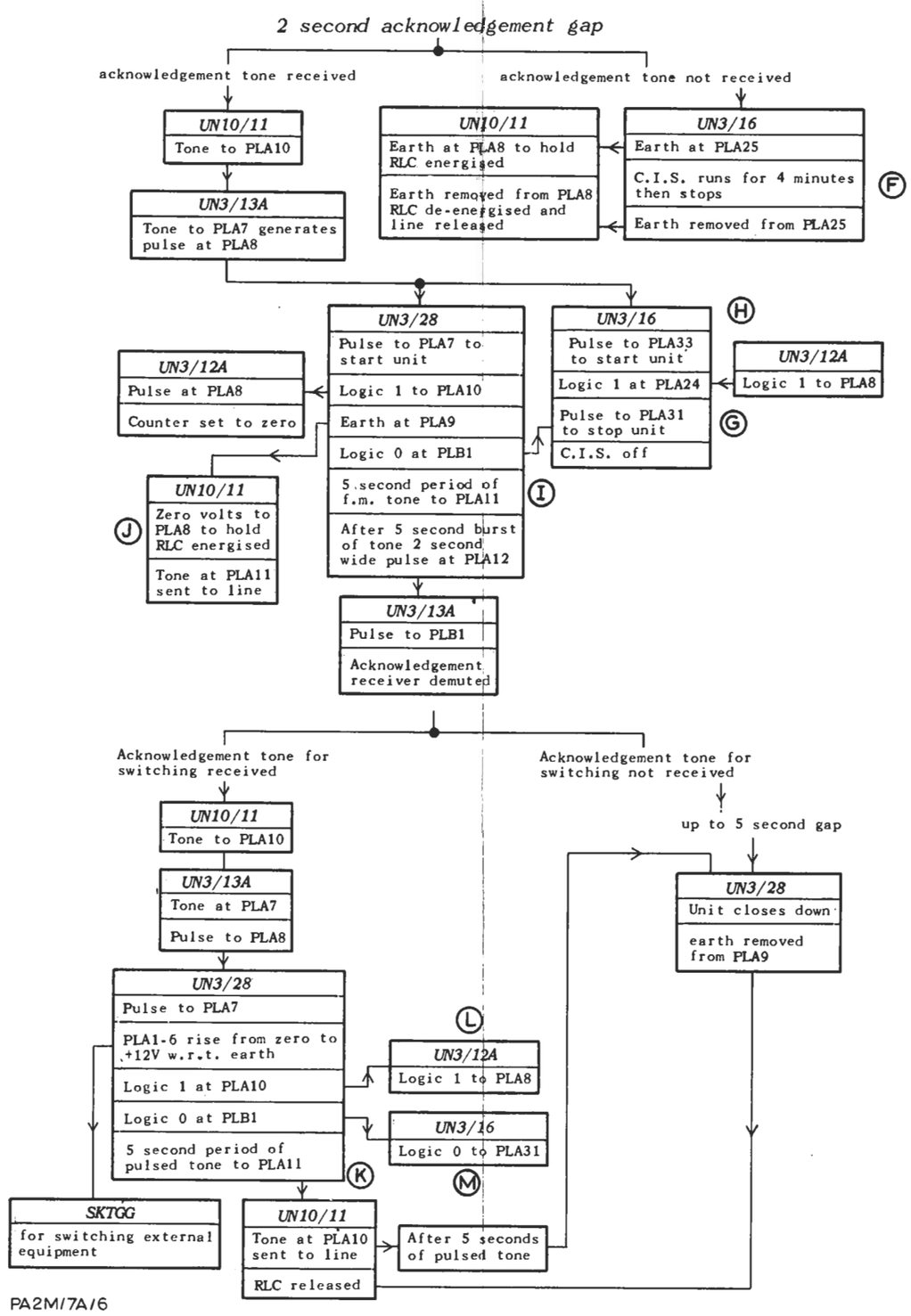


Fig. 4. PA2M/7A Operating Sequence Chart: Acknowledgement and Switching Signal

Detected Fault

Fig. 5 is the sequence chart for this mode of operation.

When a change of state of the monitored equipment occurs a positive 12-volt signal is applied to pin PLA12 of the UN14/4, (A). After a preset delay of up to 19 minutes a positive pulse is generated within the UN14/4, (B). The indicator lamps on the UN3/12A are as shown at (C).

The required number is dialled and the recorded fault message is replayed up to seven times. If the message is acknowledged the sequence is the same as that for an incoming ringing signal.

If the message is not acknowledged the RP4/3 motor stops when the counter registers eight, one dialling message and seven fault messages, the line is released and all the indicators on the UN3/12A show *No.*

After a delay of two minutes the dialling sequence is repeated. A total of four attempts, at two-minute intervals, is made to obtain the desired number after which the reporter closes down and waits for the next initiating signal, either an incoming ring or another change of state. In this state the indicators in the UN3/12A are as shown at (D).

RP4/3 Motor Cut-out

If the motor cut-out in the RP4/3 has tripped, the fault reporter is unable to initiate a call. Upon receipt of an incoming ringing signal, the C.I.S. is started directly, and the equipment can be operated from that point.

Test Procedure

1. Switch on the UN1/127. Remove the handset of the associated telephone instrument. Remove the UN14/4 and connect a 10-megohm resistor between nodes 29 and 30 (as numbered on the printed wiring board) across D1. This has the effect of reducing the preset delay time to a few seconds.
2. Operate the *Start A.F.R.* button of the UN/127. Check that the equipment has gone into the dialling mode by noting that the level of dialling tone in the telephone handset has dropped. The indicator lamps on the UN3/12A should be:

Counter Zero	*Yes*
Call Made	*No*
Fault Ack.	*No*
O.K. Ack.	*No*

3. Check that after about 12 seconds the RP4/3 motor starts. The digital counter on the UN1/127 registers the number of digits dialled. It is necessary to operate the *Reset* button after each digit has been dialled.
4. When the dialling is complete the *Counter Zero* lamp should show *No.*
5. Check that the tape recorded message is replayed seven times after which the fault reporter closes down and the telephone line is released.
6. Check that after about two minutes the reporter repeats the dialling and message sequence as before. After this has occurred four times check that the fault reporter closes down and releases the telephone line. The UN3/12A indicators should show:

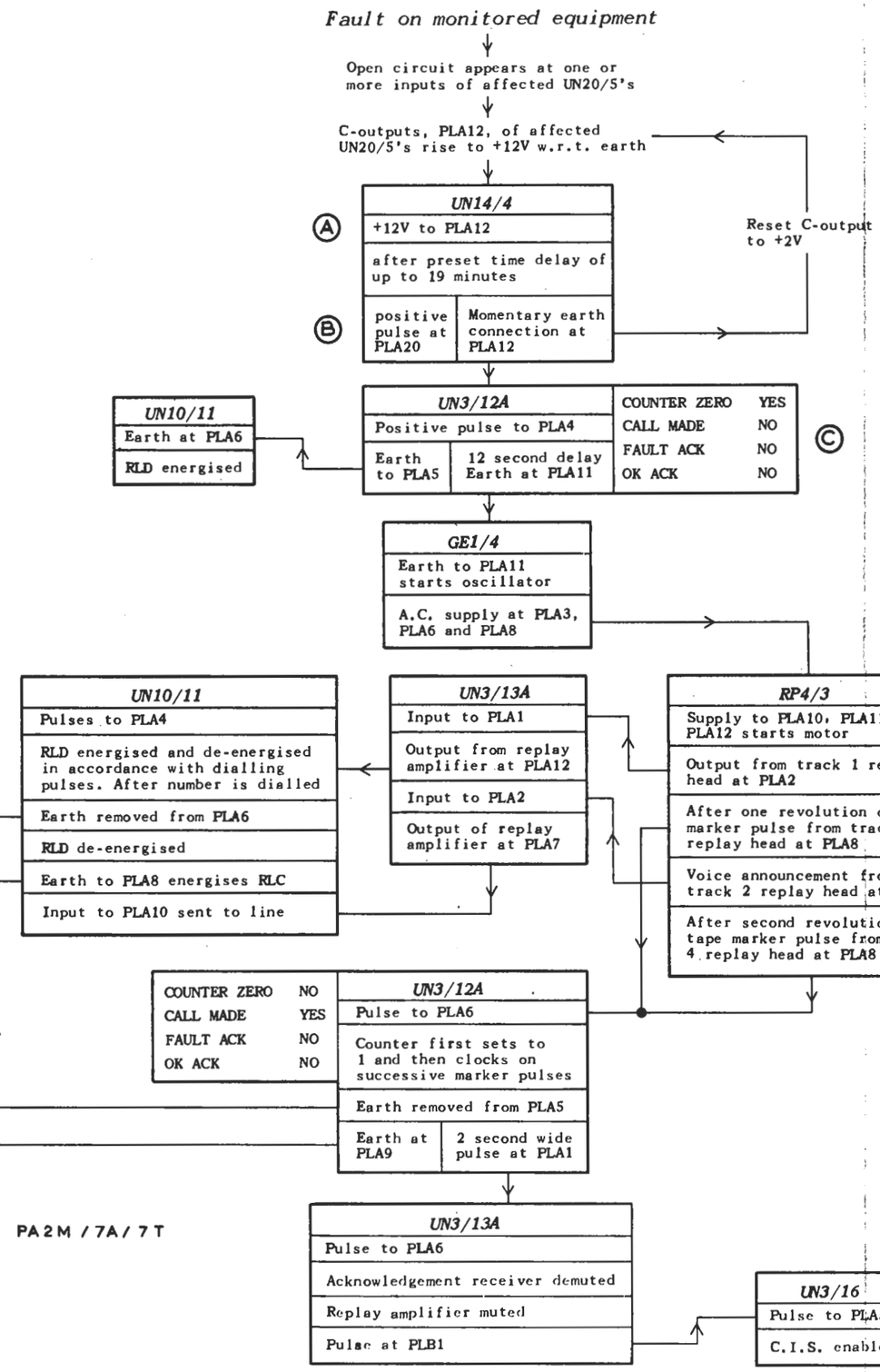
Counter Zero	*Yes*
Call Made	*Yes*
Fault Ack.	*No*
O.K. Ack.	*No*

7. Operate the *Simulate Ring* button on the UN1/127. Check that the RP4/3 motor starts and that the recorded message is replayed seven times before the reporter closes down and releases the telephone line.
8. Operate the *Simulate Ring* button on the UN1/127.
9. During an acknowledgement period briefly operate the *Simulate Ack.* button on the UN1/127. Check that the RP4/3 motor stops and the C.I.S. starts. The UN3/12A lamps should show:

Counter Zero	*Yes*
Call Made	*Yes*
Fault Ack.	*No/Yes*
O.K. Ack.	*Yes/No*

10. Operate the *Simulate Ack.* button on the UN1/127 after the five-second period of reference tone. Check that the C.I.S. stops and the UN3/28 starts.
11. Operate the *Simulate Ack.* button after the period of frequency-modulated tone. Check that the voltage measured between pin 1 on socket SKTGG and earth is 12 volts positive for a period of about five seconds. Check that after this the fault reporter closes down.
12. Operate the *Simulate Ring* button on the UN1/127 and acknowledge the reporter. This is done by holding the transmitter in the telephone handset close to the earpiece in the UN1/127, and operating the tone button on the UN1/127 during an acknowledgement gap.
13. Check the ring detector in the UN10/11 by arranging for a call to be made to the number.
14. To check the input logic circuits in the UN20/5 arrange that one of the monitored inputs changes state and, after the fault reporter has started, operate the *Simulate Ack.* button on the UN1/127. Check that the RP4/3 motor stops within 20 seconds.

Text continued on page 11.



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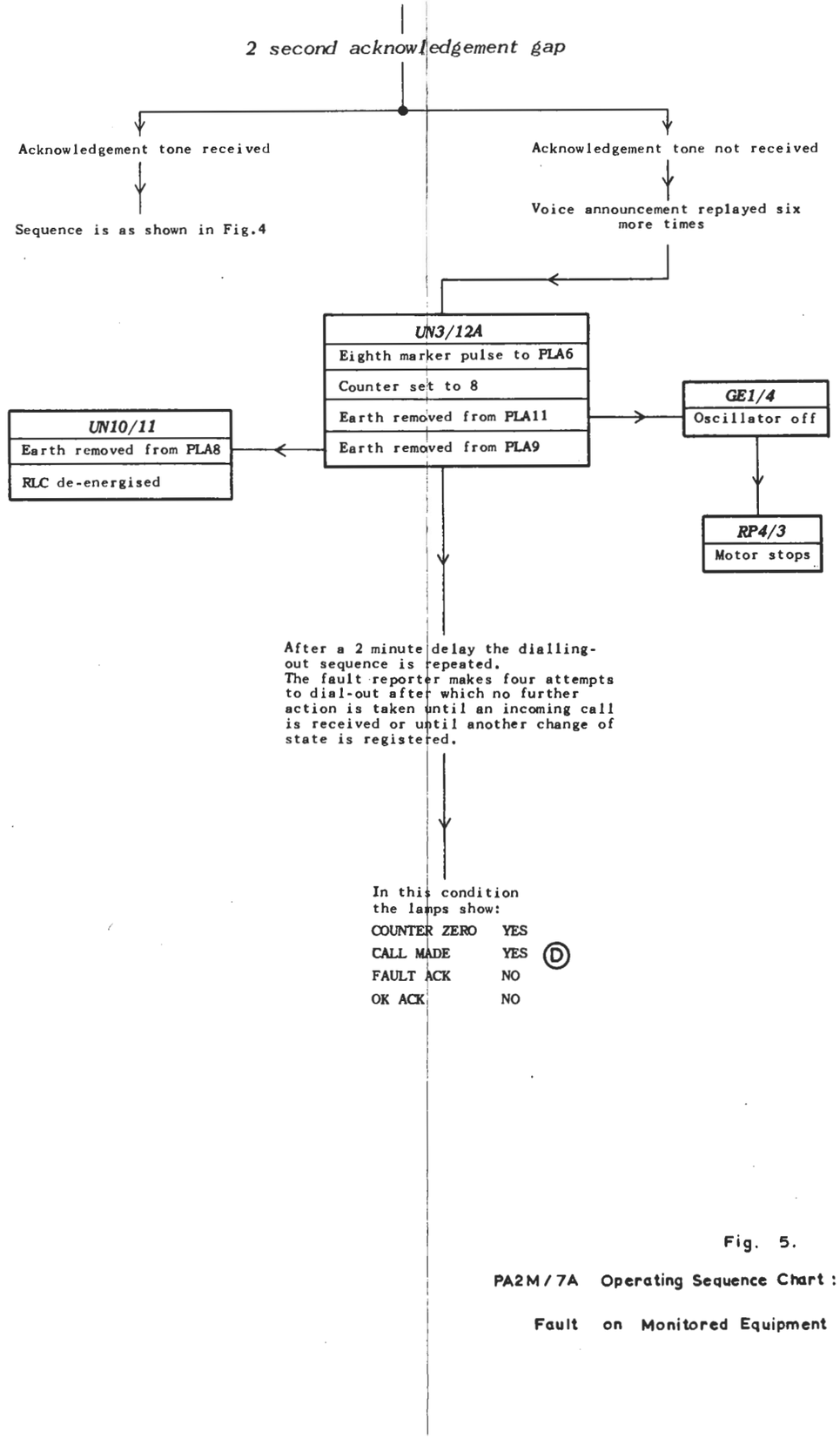

Fig. 5.

PA2M / 7A Operating Sequence Chart :

Fault on Monitored Equipment

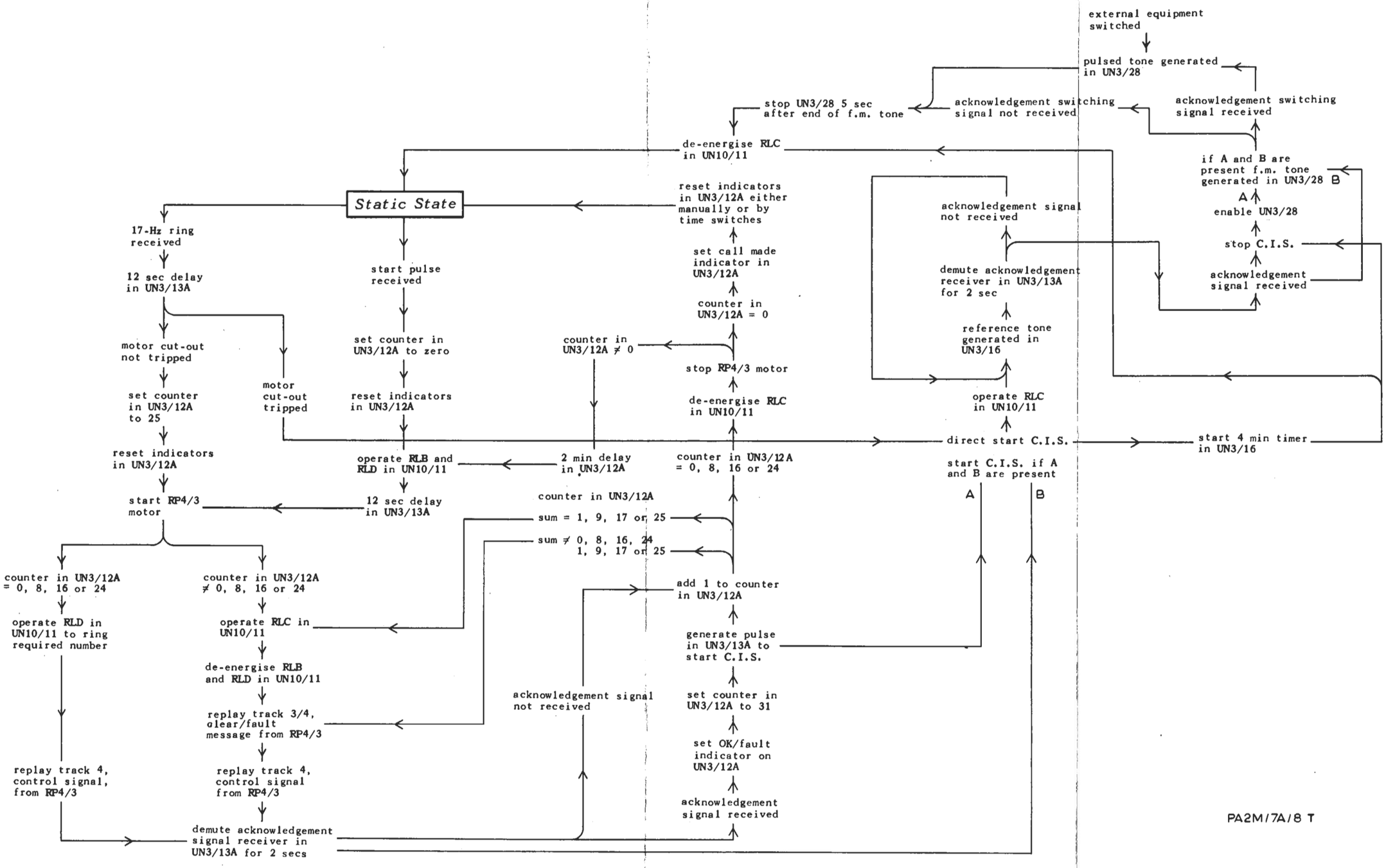

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Fig. 6.
PA 2M /7A Operating Sequence Chart : All Conditions

Fault Finding

Fig. 7 is a chart showing possible faults and the most likely causes.

Use of the TIP2/A in place of the C.I.S.

General

A suitably modified telephonic indicator panel TIP2/A can be used in place of the code indicator section, UN1/98 and UN3/16, of the fault reporter. In these circumstances a special trigger unit, Fig. 8, is used.

(d) Resistor R6 in the TIP/2A is changed to 10 kilohms.
(e) The connections shown in Fig. 9 are made.

Circuit Description of Trigger Unit

Normally, transistors TR1, TR2 and TR3 are cut off and relay RLX is de-energised. A positive-going acknowledgement signal at input A causes transistors TR1 and TR2 to saturate. TR2 remains saturated because of the positive bias developed across resistor R2. Relay RLX is energised. Capacitor C2 charges through resistor R4 until transistors TR1 and TR2 cut off; relay RLX is de-energised. The momentary operation of the relay starts the TIP/2A.

If the motor cut-out in the RP4/3 is tripped, transistor TR3 is saturated by a negative-going pulse from the ring detector which is applied to input B. A positive-going pulse is developed at its collector, input A. The subsequent operation of the circuit is as described previously.

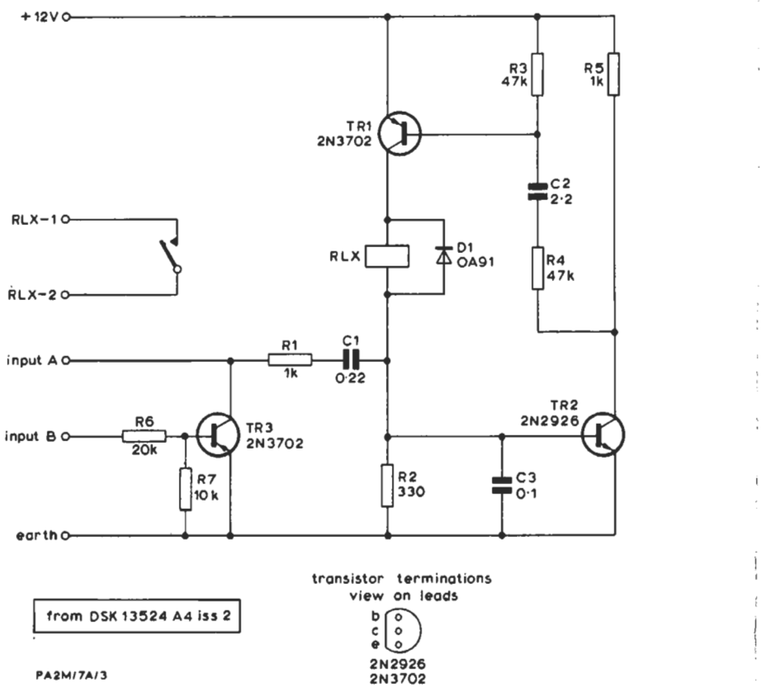

Fig. 8. Circuit of the T.I.P. Trigger Unit

The TIP/2A is required to be triggered either by a pulse from the acknowledgement signal detector or from the 17-Hz ring detector both of which are in the UN3/13A. The TIP/2A must also be able to hold the exchange line by keeping relay RLC in the UN10/11 energised.

The TIP/2A must be modified in accordance with the detailed instructions given in Designs Department Technical Memorandum 2.190 (70). Briefly it is necessary that:

(a) Plug PLD, on the TIP/2A, is in the *–50 V Sigs.* position.
(b) The associated 50-volt power supplier has the negative terminal earthed.
(c) Suppression diodes are fitted across relays B, G, H, J, K, L, M and N in the TIP/2A.

References to Typical Associated Equipment

1. Acknowledgement Signal Generator GE1/5 and 5A.
2. 1·5-kHz Audible Tone Generator GE1/6,

LPB 9/72

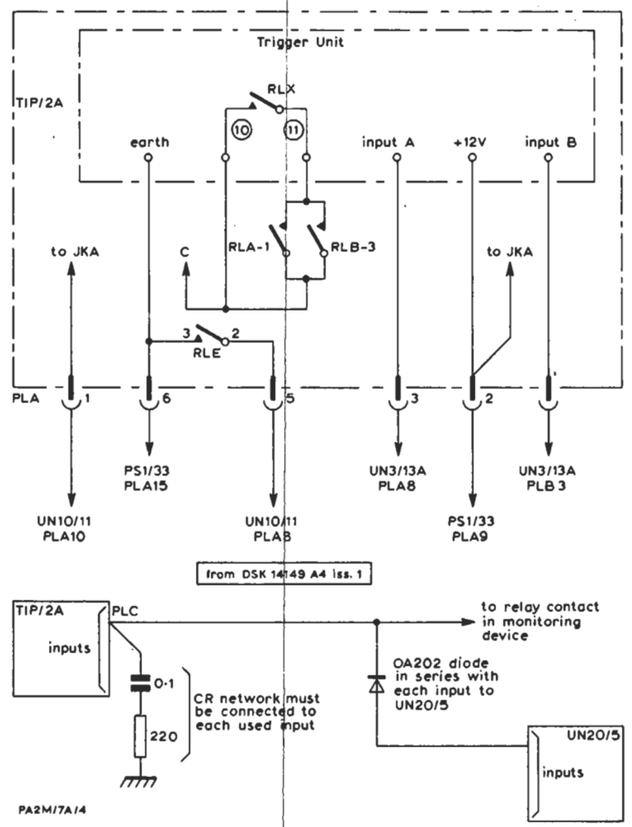

Fig. 9. Modifications Necessary to Use a TIP/2A with a PA2M/7A