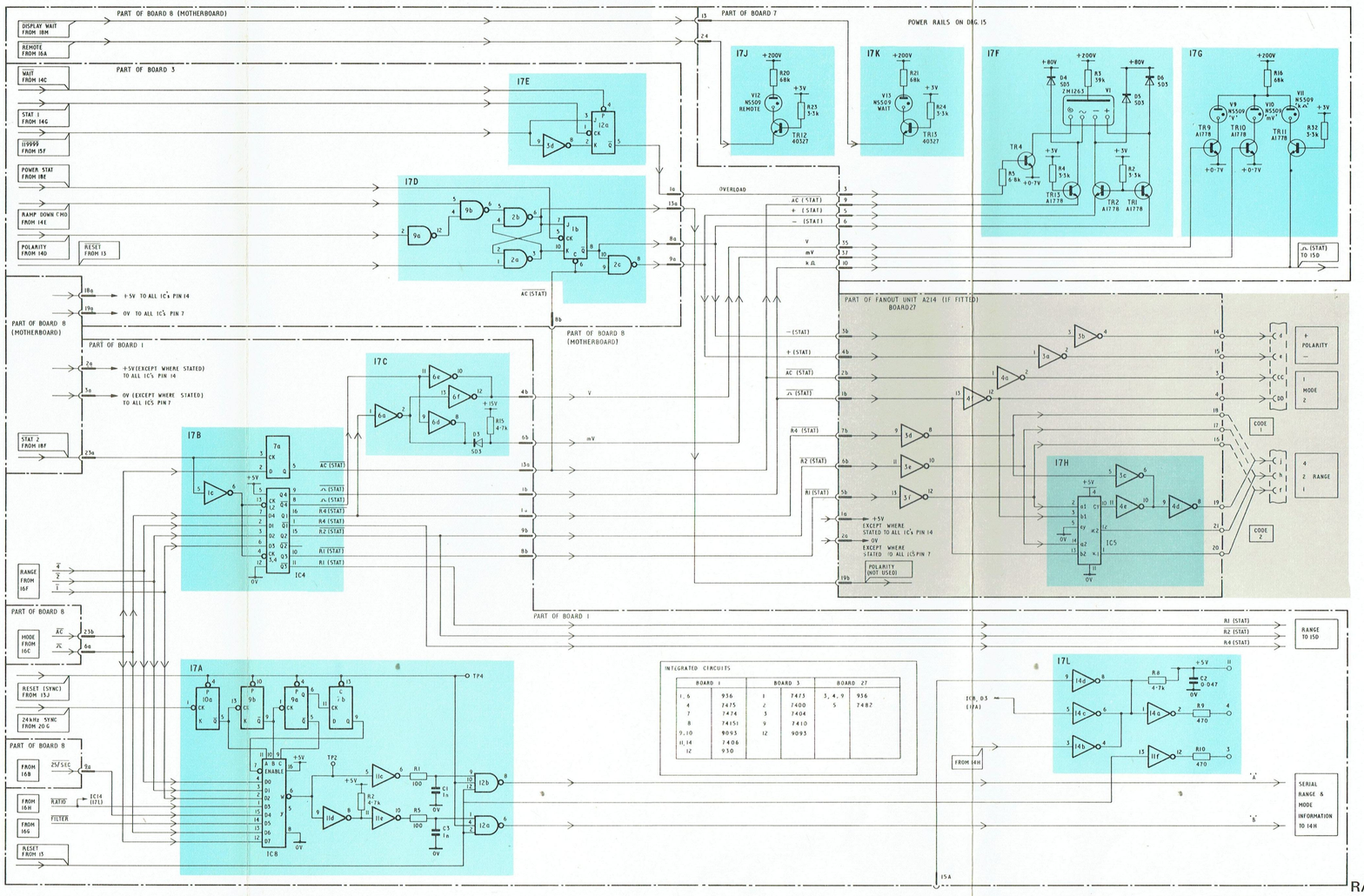


RANGE & MODE SERIALISER, STORE & DISPLAY (NIXIE TYPE)

A2107017 02

17a

17JK ANNUNCIATOR DRIVER (Fig. 17b)

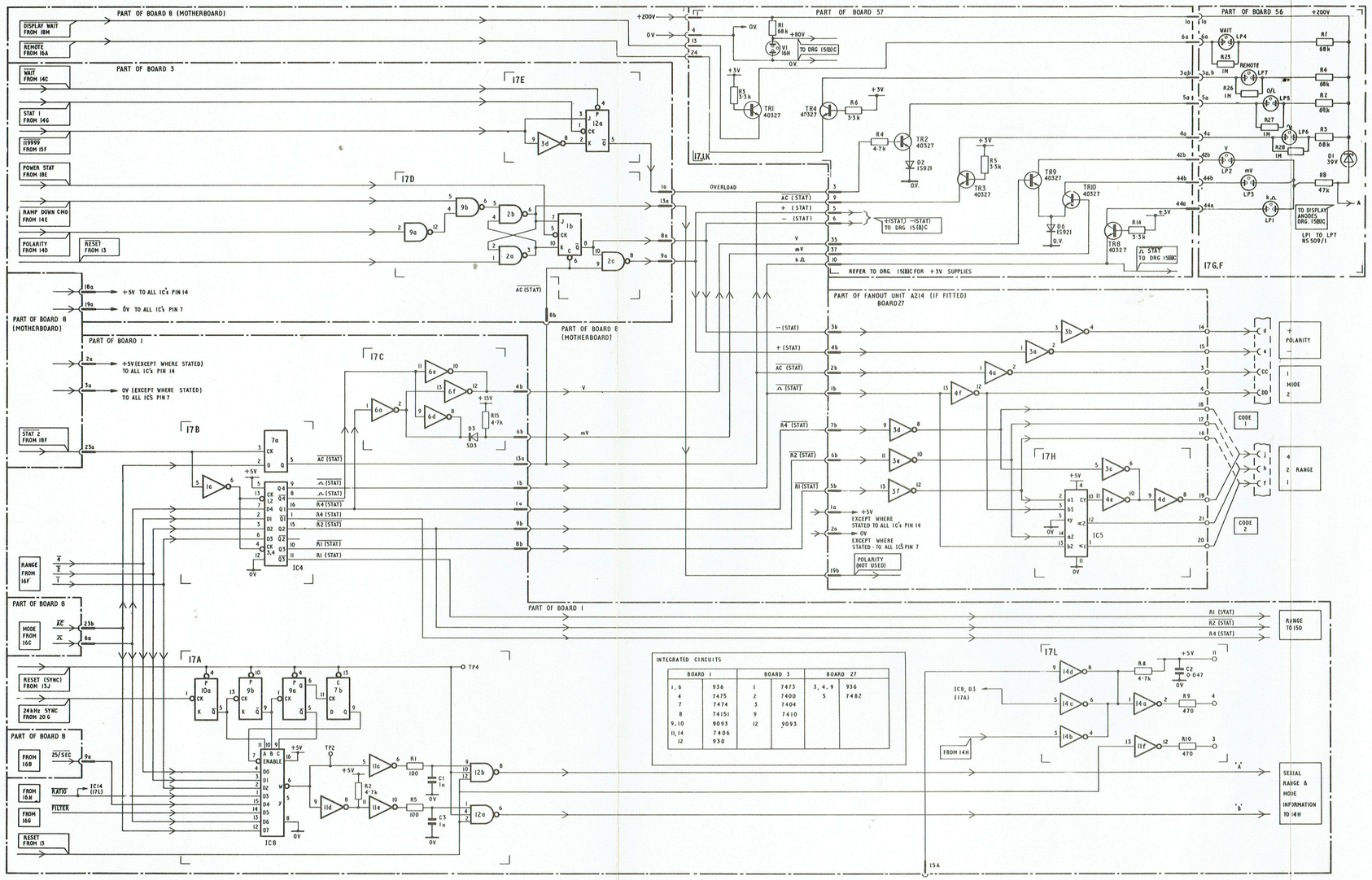
This converts the TTL level (+5V and 0V approx) inputs to the high voltages necessary to operate the 'annunciator lamps in 17G'.

The lines from 17G are low (+2.5V approx) when lamps are on, and high (> + 60V) when off.

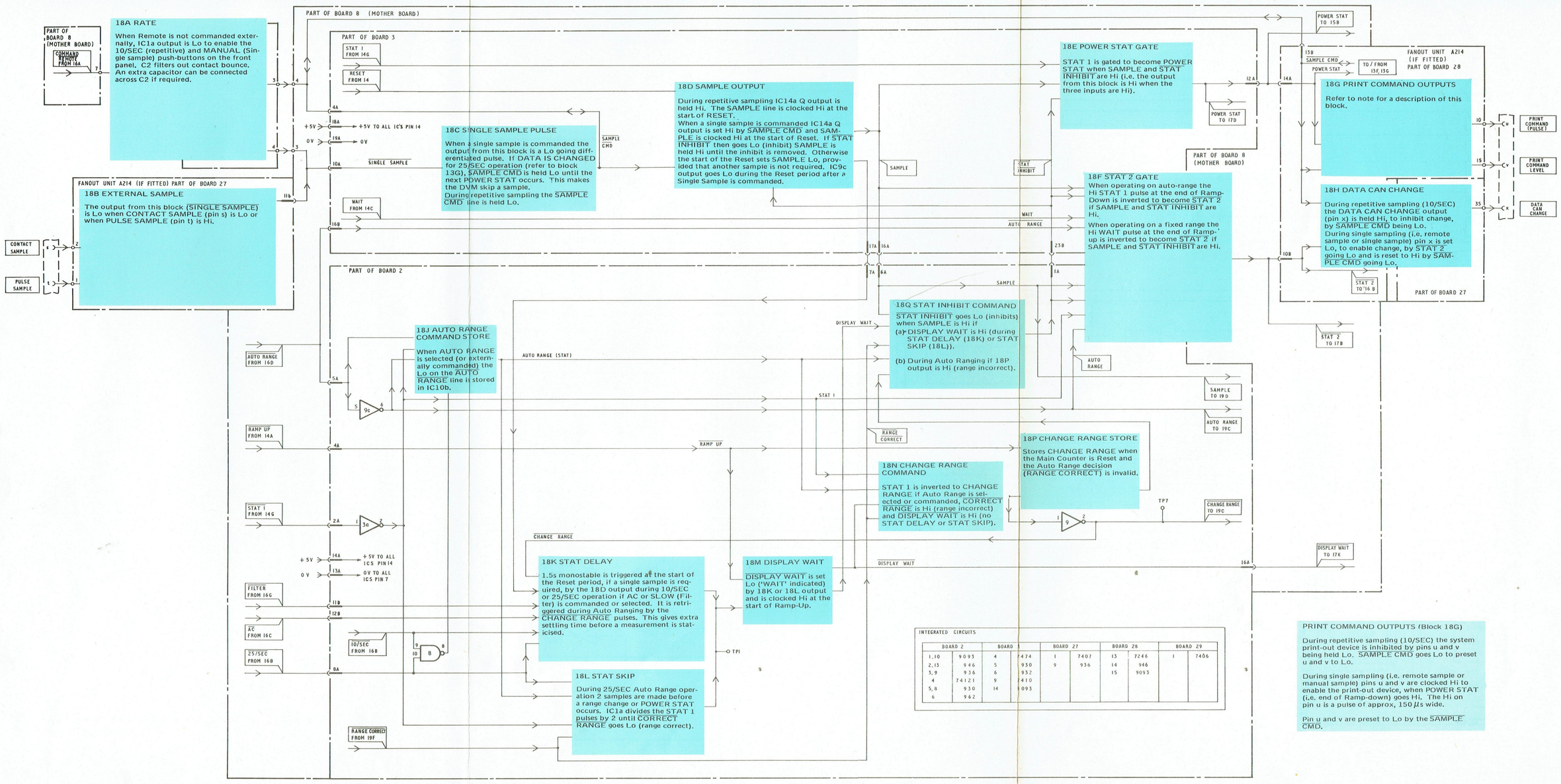
17GF ANNUNCIATORS

The voltages on the lines from 17F are low when the lamps are on and high (> 60V) when off.

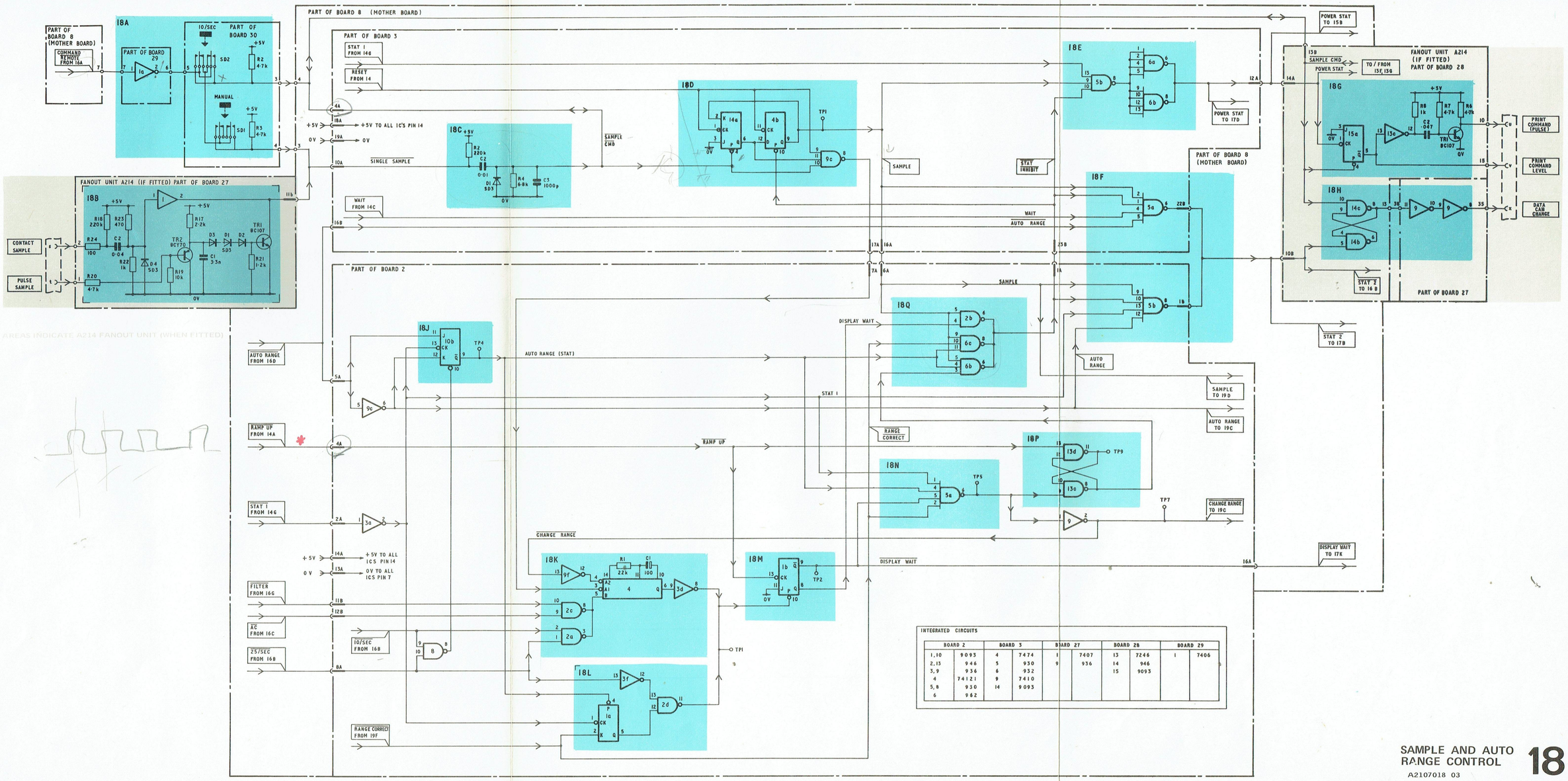
All other parts of this circuit are identical to 17a.



RANGE & MODE SERIALISER STORE & DISPLAY (7 SEGMENT TYPE) **17b**



BOARD 2		BOARD 3		BOARD 27		BOARD 28		BOARD 29	
1, 10	9093	4	7474	1	7407	13	7246	1	7406
2, 13	946	5	930	9	936	14	946		
3, 9	936	6	932			15	9093		
4	74121	9	7410						
5, 8	930	14	9093						
6	962								



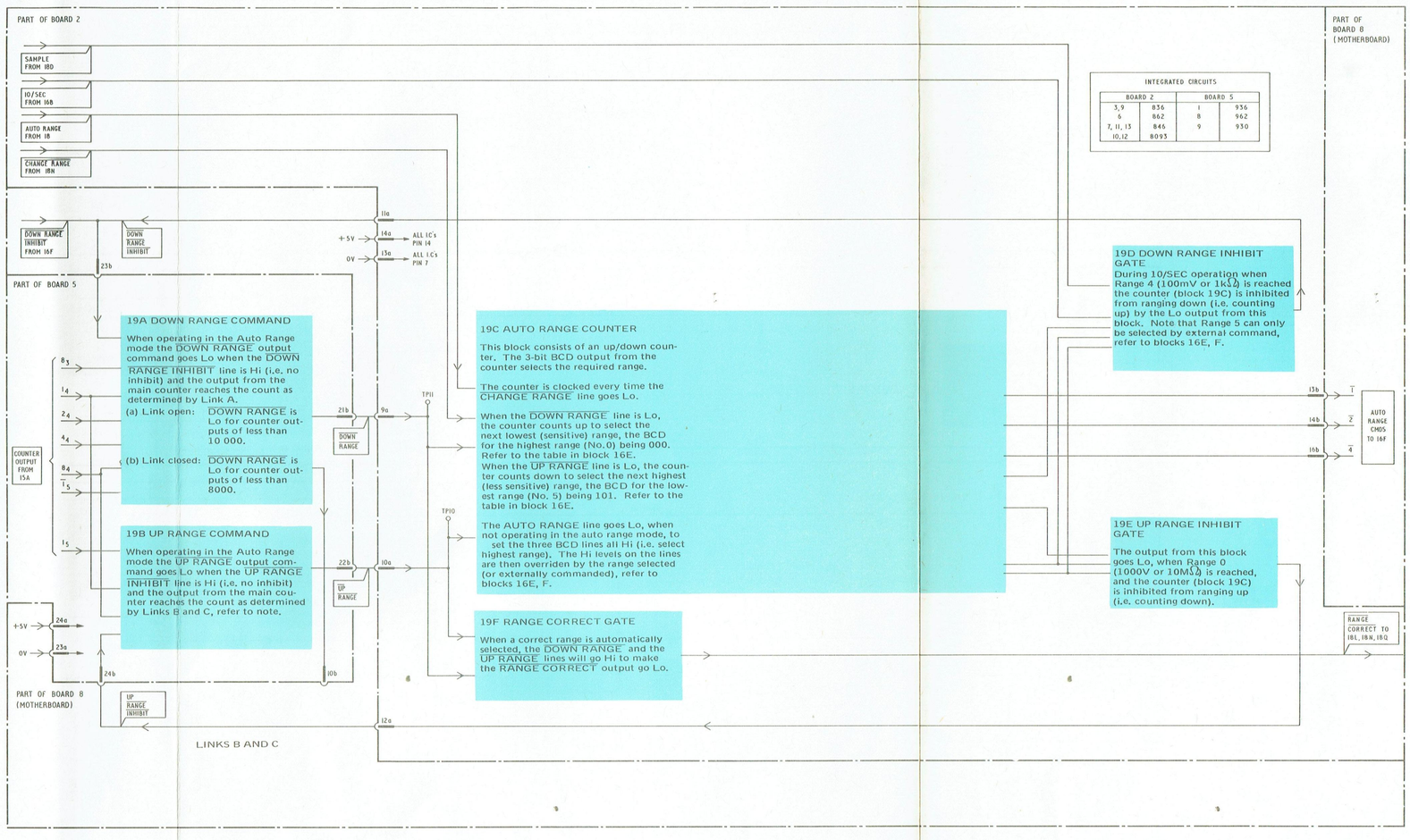
SAMPLE AND AUTO RANGE CONTROL

A2107018 03

18

JR/A210/2

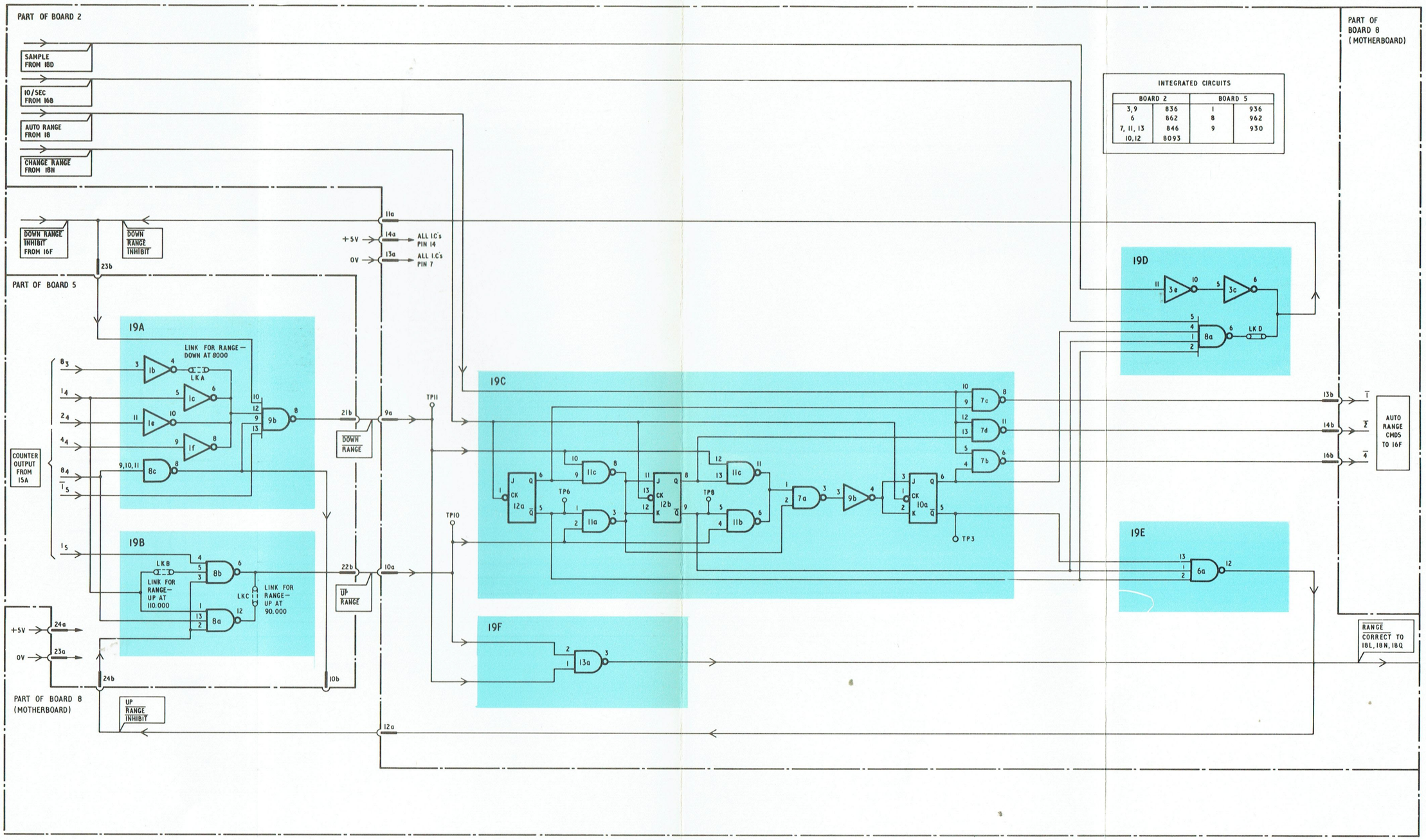
7.3.41



LINKS B AND C (Block 19B)

Links B closed, C open: $\overline{\text{UP RANGE}}$ is Lo for Counter outputs of greater than 109999.

Link B open, C closed: $\overline{\text{UP RANGE}}$ is Lo for Counter outputs of greater than 89999.

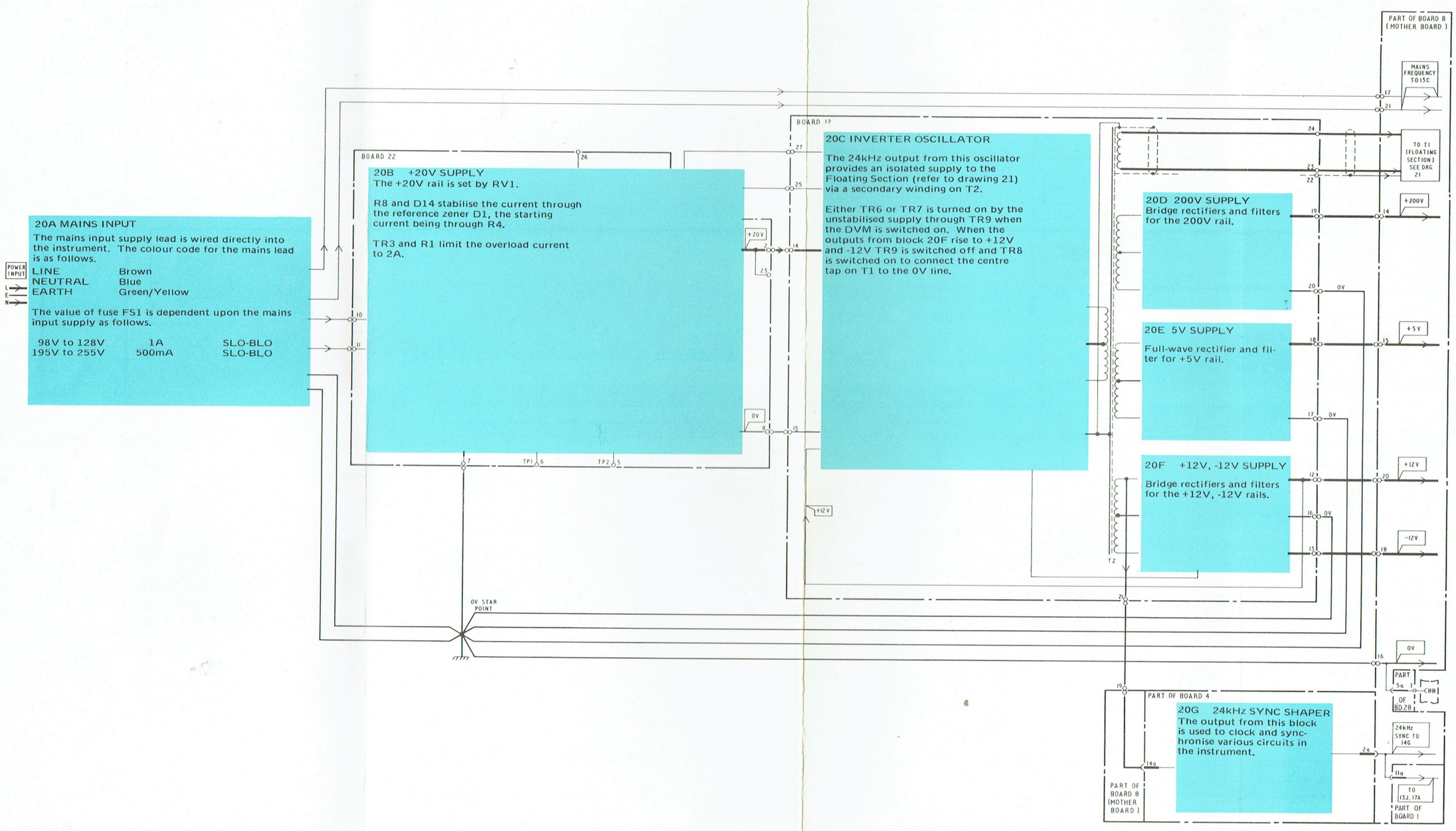


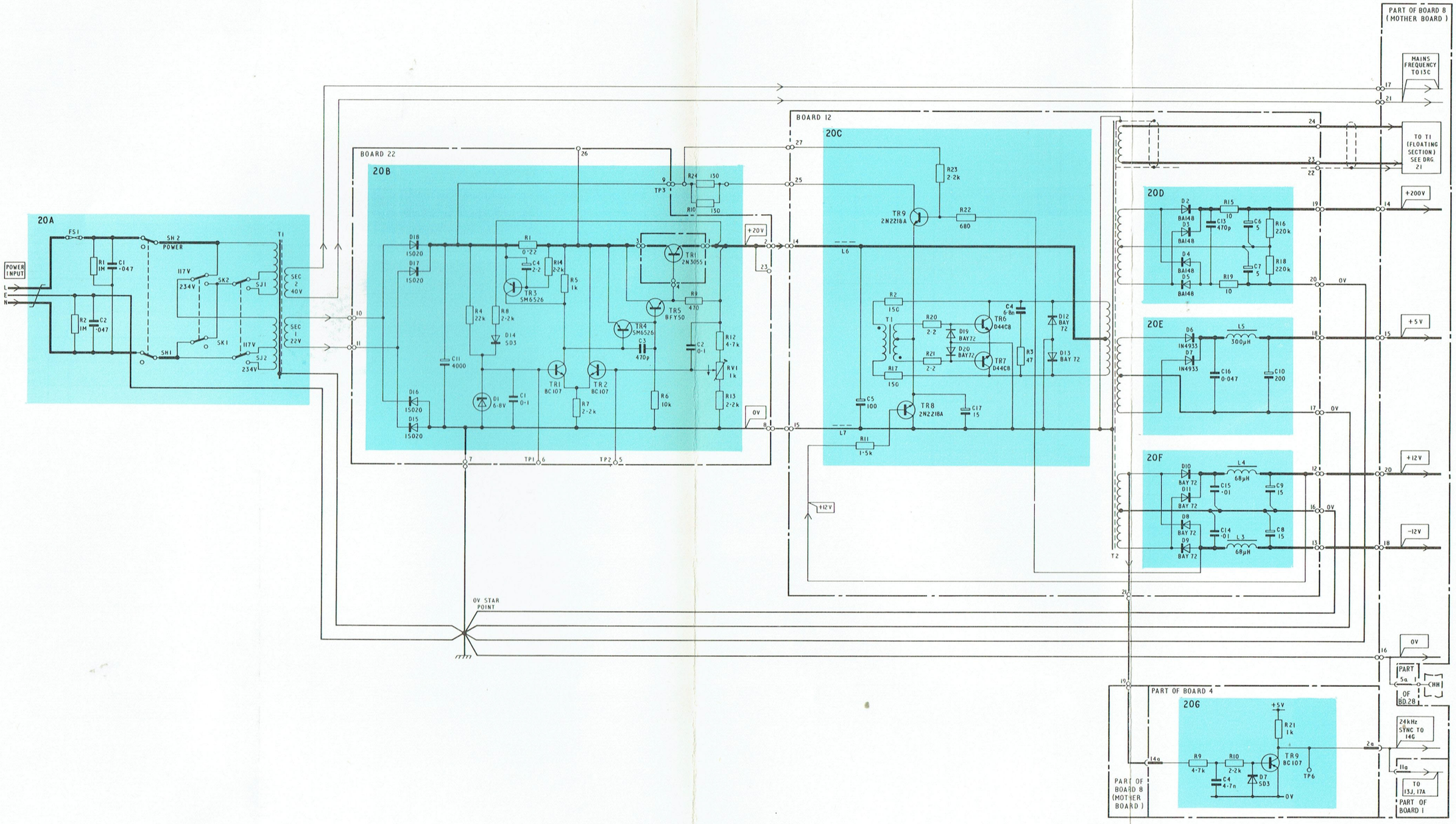
AUTO RANGING 19

A2107019 03

JR/A210/2

7.3.43

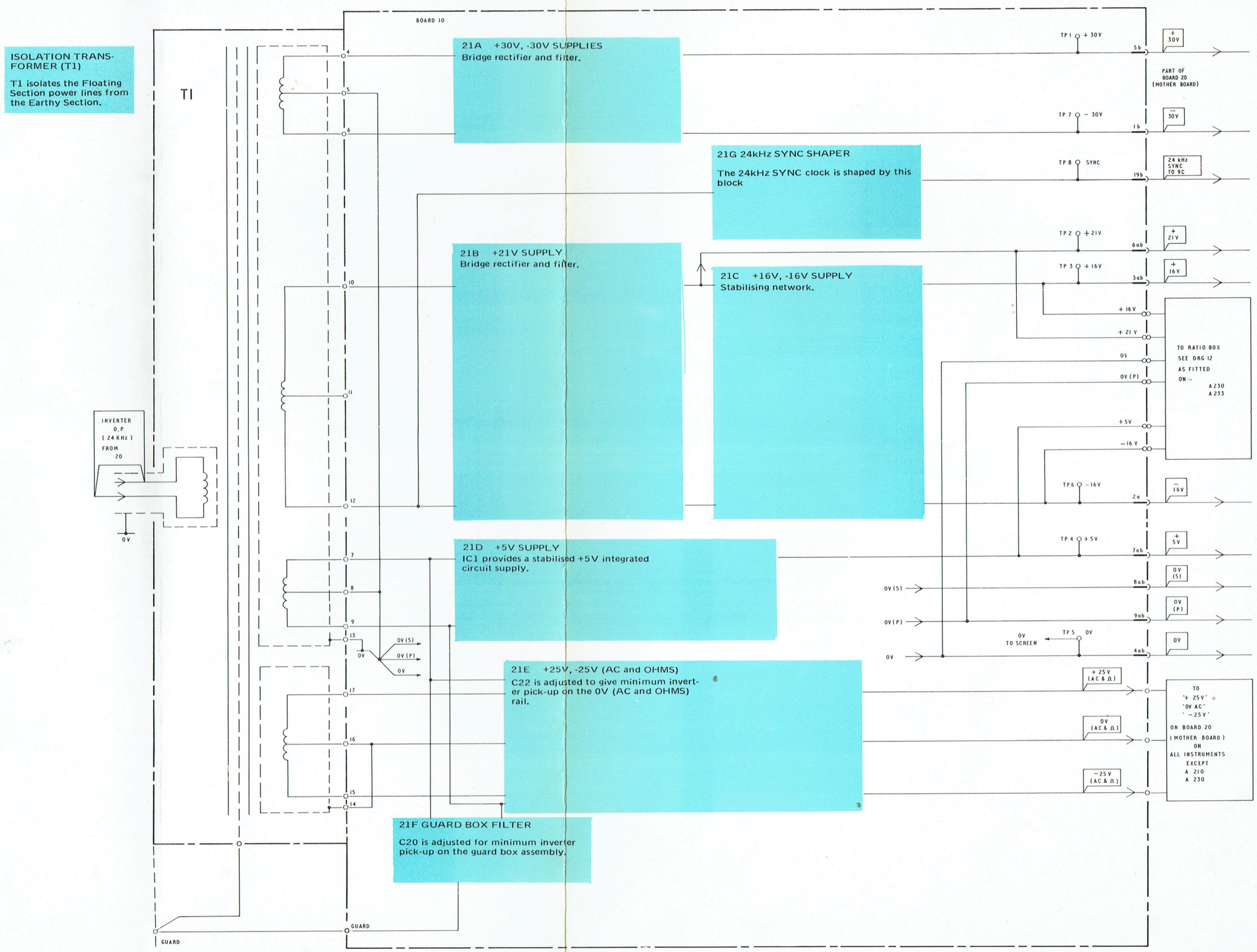

20A MAINS INPUT
The mains input supply lead is wired directly into the instrument. The colour code for the mains lead is as follows.
LINE Brown
NEUTRAL Blue
EARTH Green/Yellow
The value of fuse FS1 is dependent upon the mains input supply as follows.
98V to 128V 1A SLO-BLO
195V to 255V 500mA SLO-BLO
POWER INPUT
L
E
N
BOARD 22
20B +20V SUPPLY
The +20V rail is set by RV1.
R8 and D14 stabilise the current through the reference zener D1, the starting current being through R4.
TR3 and R1 limit the overload current to 2A.
TP1
TP2
+20V
0V
+12V
BOARD 12
20C INVERTER OSCILLATOR
The 24kHz output from this oscillator provides an isolated supply to the Floating Section (refer to drawing 21) via a secondary winding on T2.
Either TR6 or TR7 is turned on by the unstabilised supply through TR9 when the DVM is switched on. When the outputs from block 20F rise to +12V and -12V TR9 is switched off and TR8 is switched on to connect the centre tap on T1 to the 0V line.
T2
20D 200V SUPPLY
Bridge rectifiers and filters for the 200V rail.
20E 5V SUPPLY
Full-wave rectifier and filter for +5V rail.
20F +12V, -12V SUPPLY
Bridge rectifiers and filters for the +12V, -12V rails.
PART OF BOARD 8 (MOTHER BOARD)
MAINS FREQUENCY TO 13C
TO T1 (FLOATING SECTION) SEE DRG. 21
+200V
+5V
+12V
-12V
0V
0V STAR POINT
PART OF BOARD 4
20G 24kHz SYNC SHAPER
The output from this block is used to clock and synchronise various circuits in the instrument.
PART OF BOARD 8 (MOTHER BOARD)
PART 5a OF BD.28
24kHz SYNC TO 14G
TO 13J, 17A
PART OF BOARD 1



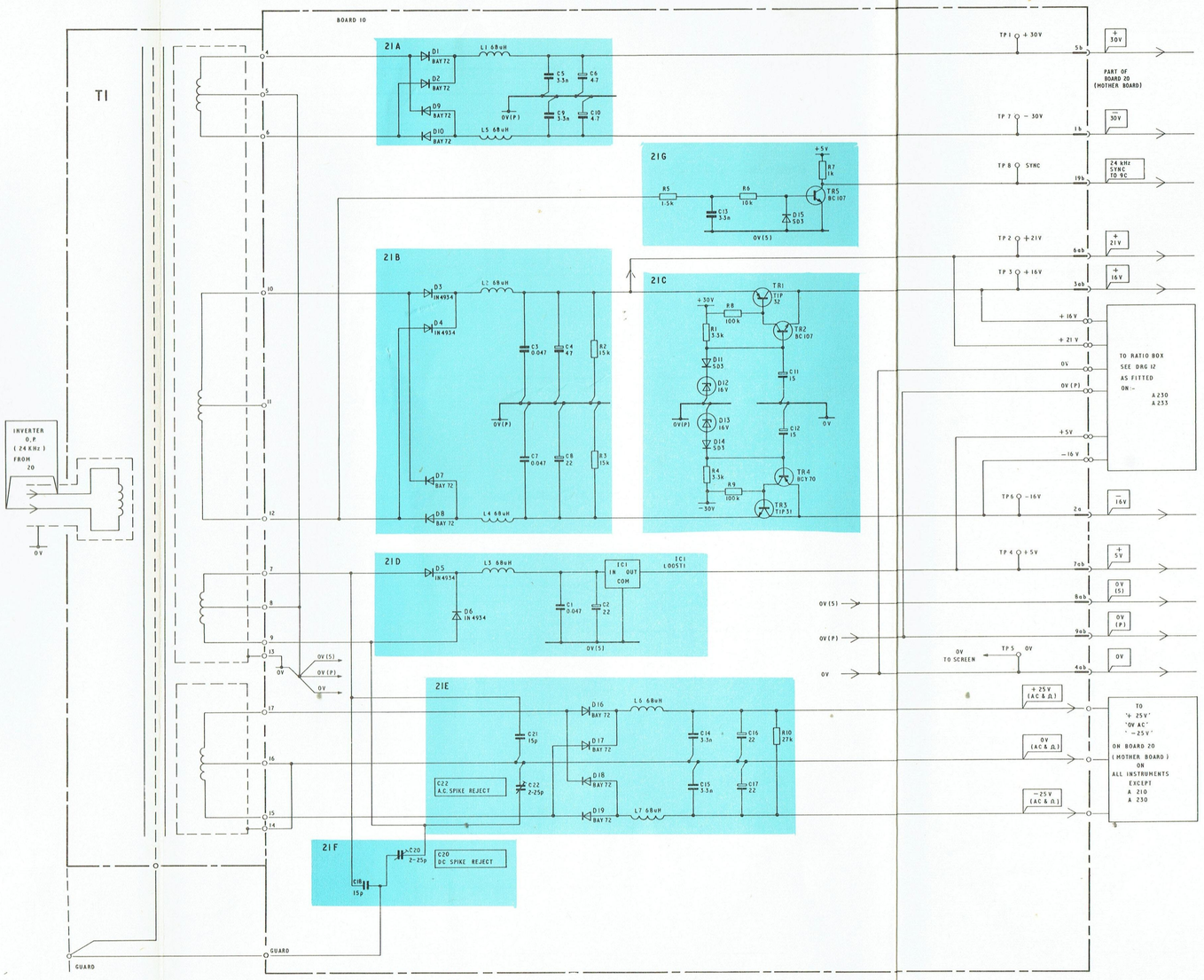
MAIN POWER SUPPLIES **20**

A2107020 02

PART OF FLOATING SECTION

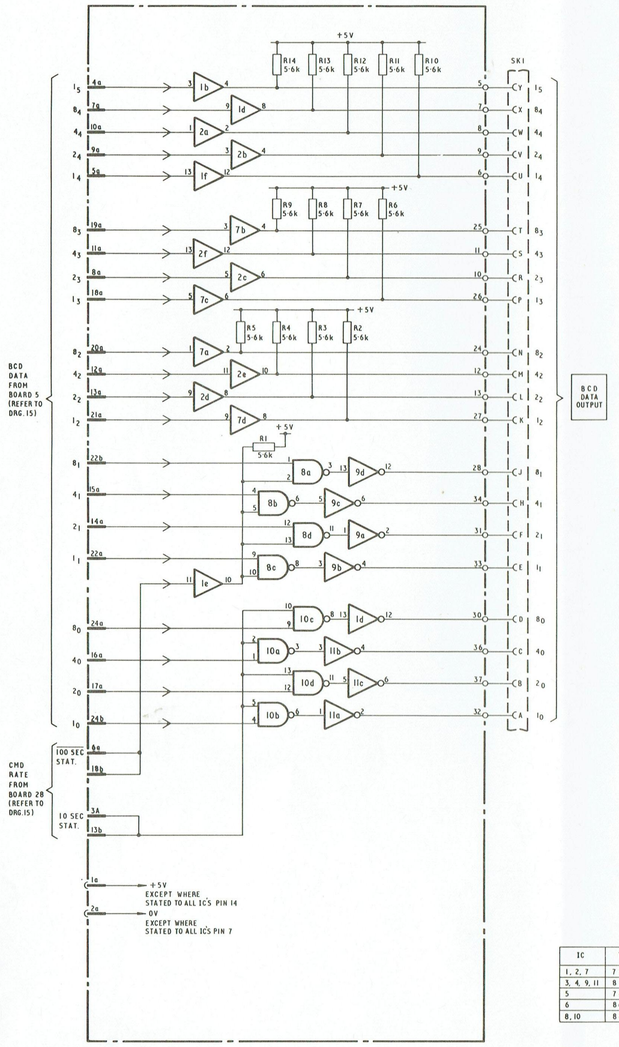


PART OF FLOATING SECTION

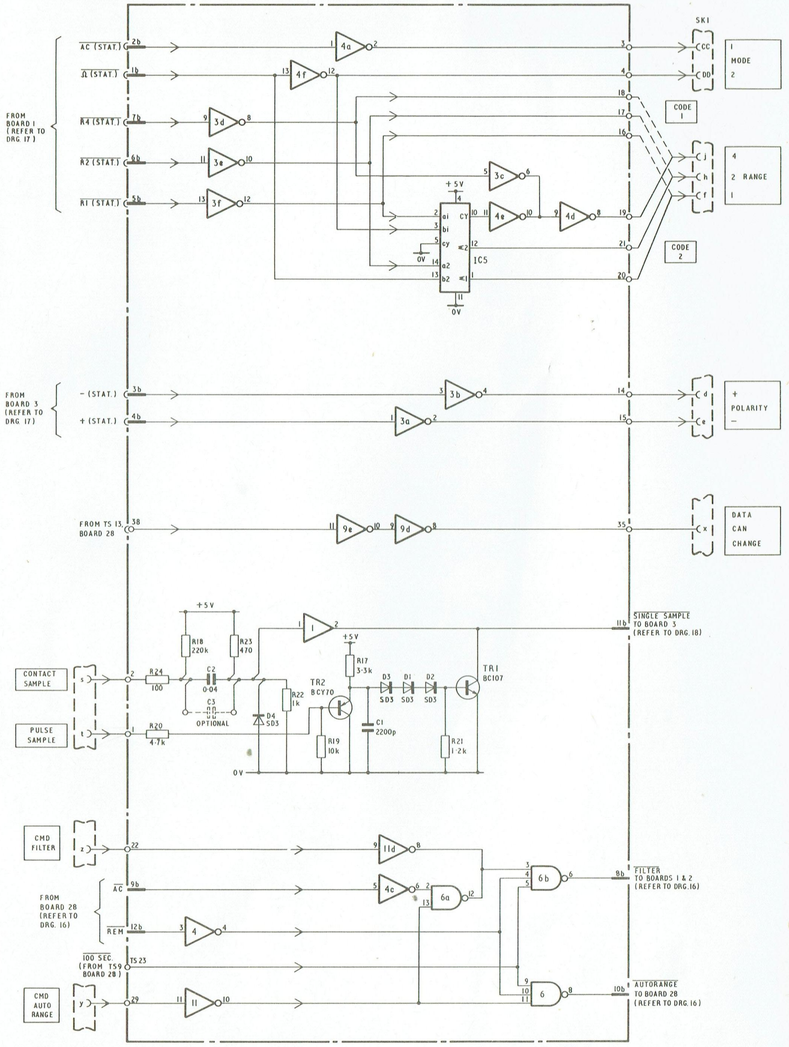


FLOATING POWER SUPPLIES **21**

A2107021 02



IC	TYPE
1, 2, 7	7 407
3, 4, 9, 11	8 36
5	7 482
6	8 62
8, 10	8 46



A214 FANOUT (SYSTEM INTERFACE) UNIT

GENERAL

The Fanout Unit is an optional unit which (when fitted) interfaces the DVM with a system. The unit consists of two printed circuit boards, PCB 27 and PCB 28, and a connector.

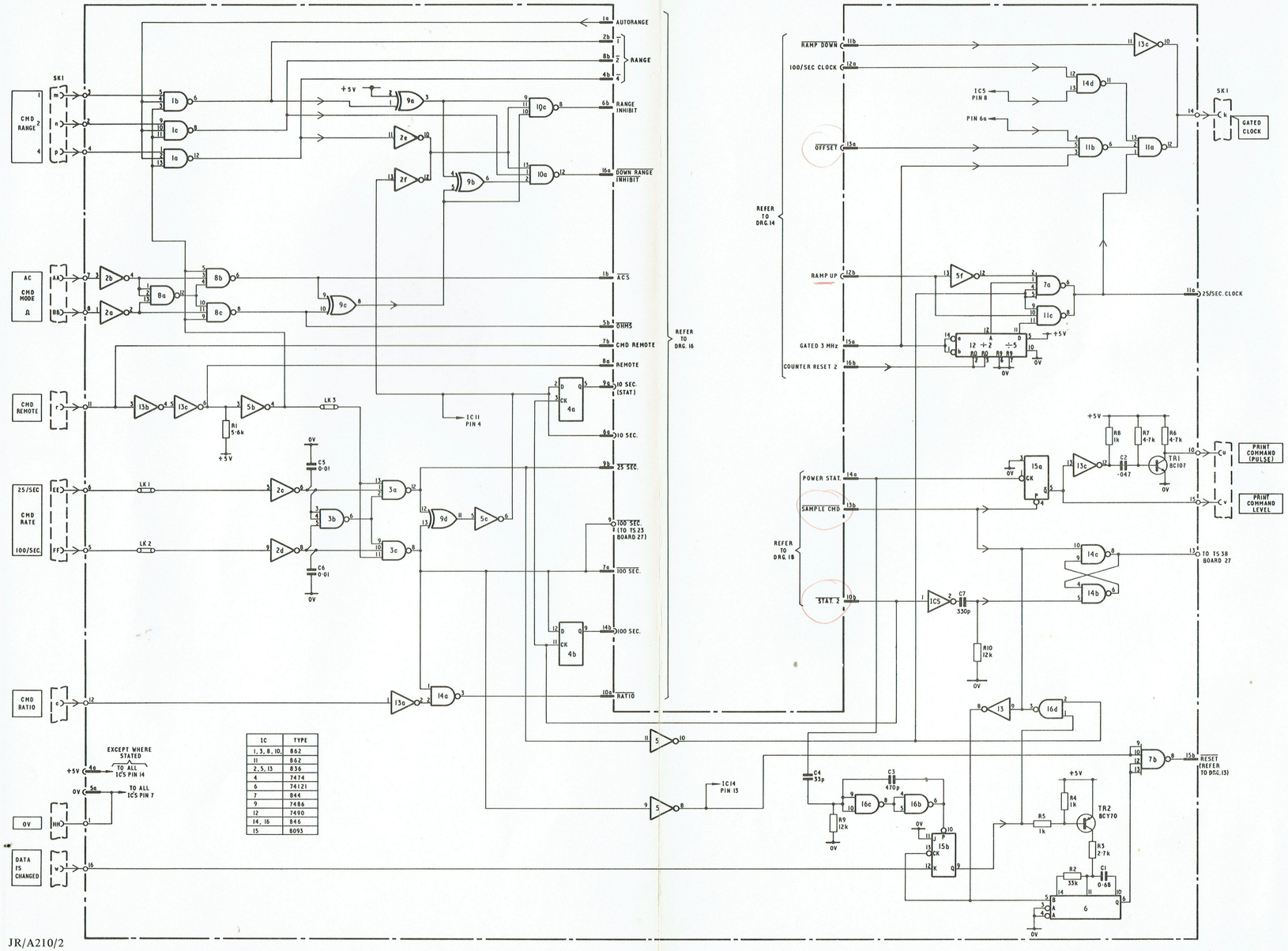
Provision is made in the Earthy Section mother board for boards 27 and 28 to be directly plugged-in. The connector is fitted to the rear panel after the removal of a blanking plate.

CIRCUIT DIAGRAMS

Complete circuit diagrams for boards 27 and 28 are shown in drawings 22 and 23 respectively. These circuit diagrams are repeated in sections in the functional diagrams, Drg. 13 to 18, to show the functional operation of each section. Information about the logic levels of the input and output lines between the Fanout Unit and a system is given in Section 5, Data Systems Use.

◄ BOARD 27
A214 FANOUT UNIT **22**

A2107022 02



IC	TYPE
1, 3, 8, 10,	862
11	862
2, 5, 13	836
4	7474
6	74121
7	844
9	7486
12	7490
14, 16	846
15	8093

◄ BOARD 28
A214 FANOUT UNIT **23**

A2107023 03

SUB-SECTION 7.4 Printed Circuit Board References & Component Layouts

GENERAL

As previously explained in Sub-section 1 a full circuit diagram for each board is not given, (exceptions being boards 27 and 28 of the Fanout Unit and the Ratio Unit boards). Various parts of each board diagram are incorporated into the functional diagrams in Sub-section 7.3.

Note that the number and type of boards fitted to a DVM is dependent upon the DVM Type No.

BOARD INDEX

The board index lists each board and gives the functional diagram number on which part of a board or a complete board is shown. Board numbers are abbreviated to the least one or two significant numbers e.g. board A2109011 is abbreviated to Board 11.

FUNCTIONAL DIAGRAM INDEX

The diagram index lists each functional diagram and gives the board, or parts of boards, shown in each particular diagram. Board numbers are abbreviated as described in the previous paragraph.

MOTHER BOARDS CONNECTION DIAGRAMS

A mother board is a printed circuit board fitted with connector sockets into which the separate boards are inserted. Two mother boards are used in the instrument, one for the Floating Section and one for the Earthy Section.

The major functions on the connector sockets of the mother boards are shown in Figs. 7.4.1 and 7.4.2. A connection on a mother board connector pin may be used for convenience as a through connection only and need not necessarily be functionally used by the appropriate board.

The Ratio Unit A228 (when fitted) also contains a mother board which is not shown in this diagram.

BOARD COMPONENT LAYOUT AND COPPER TRACK ILLUSTRATIONS

Most boards have double-sided copper tracks but components are only mounted on one side. On the following component layout illustrations, blue indicates the component side copper and grey the opposite side.

The illustrations are shown in board numerical order and include all of the optional units (Fanout Unit, Ratio Unit etc.). Information on the location of the boards within the instrument is given in Sub-section 7.6, Spatial Description.

PRINTED CIRCUIT BOARD INDEX

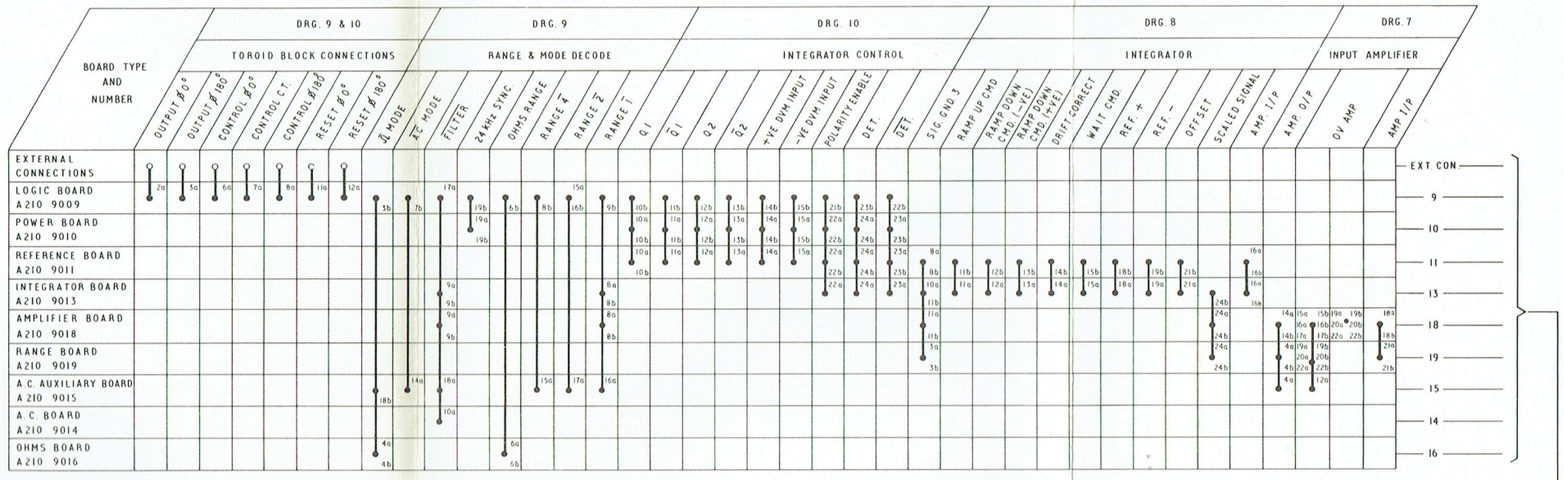
Board No.	Board Title	Functional Diagrams which show part of the board circuit diagram, (or complete board diagram).	DVM Type No. containing board
	EARTHY SECTION		
1	Ranging	13, 14, 15, 16, 17	All DVM Types
2	Auto-range	16, 18, 19	All DVM Types
3	Control	13, 14, 15, 17, 18	All DVM Types
4	Oscillator	13, 14, 20	All DVM Types
5	Counter	15, 19	All DVM Types
7	Readout Display (Nixie Type)	15, 17	All DVM Types
8	Earthy Section Mother Board	13 to 20	All DVM Types
	FLOATING SECTION		
9	Floating Section Logic	9, 10	All DVM Types
10	Floating Section Power Supply	21 (complete)	All DVM Types
11	Internal Reference	8, 9, 10, 11	All DVM Types
12	Inverter Oscillator	20 (complete)	All DVM Types
13	Integrator	8 (complete)	All DVM Types
14	AC Converter (Mean Sensing)	3 (complete)	A211, A213, A233
41	AC Converter (True RMS)	4 (complete)	A215, A235
15	AC Auxiliary (Mean Sensing and True RMS)	2 (complete)	All ac models
16	Ohms	5 (complete)	All ohms models
18	Input Amplifier	7 (complete)	All DVM Types
19	Ranging (Floating Section)	6 (complete)	All DVM Types
20	Floating Section Mother Board	1 to 11	All DVM Types
22	Power Supply Stabiliser	20 (complete)	All DVM Types
	A214 FANOUT UNIT		
27	A214, Fanout Unit, Board 27	22 (complete)	Optional Unit that can be fitted to all DVM Types.
28	A214 Fanout Unit, Board 28	23 (complete)	

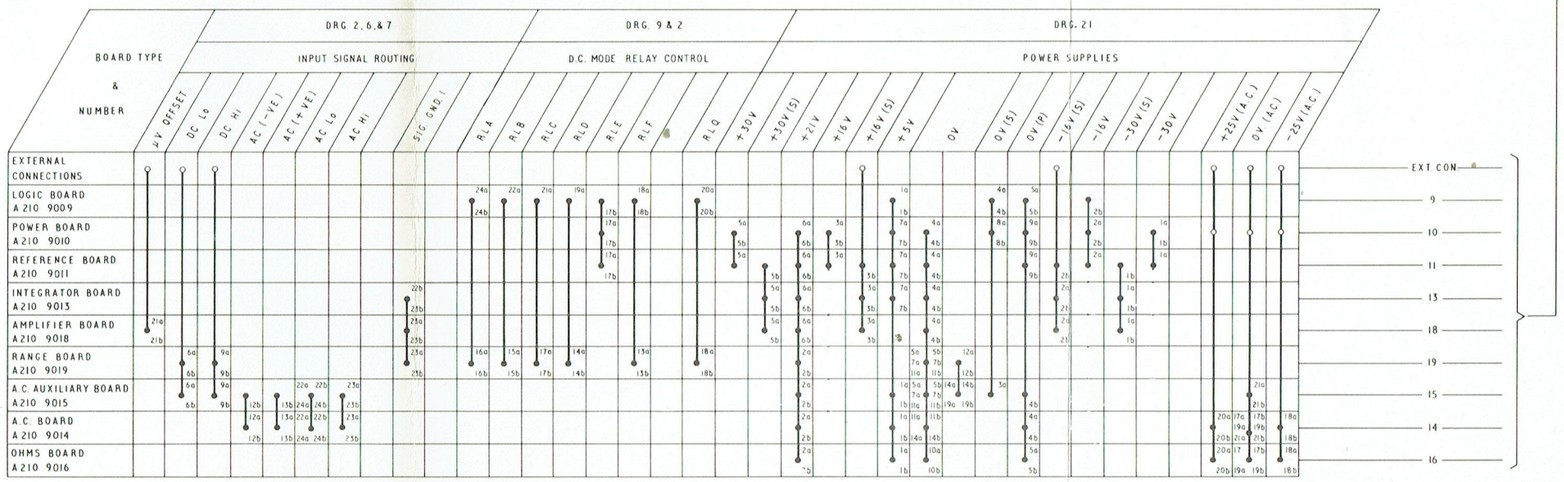
PRINTED CIRCUIT BOARD INDEX (Continued)

Board No.	Board Title	Functional Diagrams which show part of the board circuit diagram, (or complete board diagram).	DVM Type No. containing board
	FRONT PANEL		
29	Switch Board (Mode and Range)	16, 18	All DVM Types
30	Switch Board (Control, Rate and Response)	16, 18	All DVM Types
	A228 RATIO UNIT		
32	A228 Ratio Unit, Mother Board	12A, 12B	A230, A233, A235
33	A228 Ratio Unit, Amplifier	12B (complete)	A230, A233, A235
35	A228 Ratio Unit, Logic	12A (complete)	A230, A233, A235
36	A228 Ratio Unit, Attenuator	12A (complete)	A230, A233, A235
	MISCELLANEOUS		
41	Is shown following board 14		
56	Readout Display (Sperry Type)	15B, 17B	All DVM Types
57	Display Driver (Sperry Type)	15B, 17B	All DVM Types

FUNCTIONAL DIAGRAM INDEX

Drg. No.	Title	Part of board circuit diagram (or complete board diagram) shown.
1	DC Input	16, 15, 20
2	AC Input (Mean Sensing and True RMS)	15 (complete), 20
3	AC Converter (Mean Sensing)	14 (complete), 20
4	AC Converter (True RMS)	41 (complete), 20
5	Ohms Input	16 (complete), 20
6	Range and DC Filter	19 (complete), 20
7	Input Amplifier	18 (complete), 20
8	Integrator	11, 13 (complete), 20
9	Control Receiver, Range and Mode Decode	9, 11, 15, 16, 19, 20
10	Integrator Control Logic	9, 11, 20
11	Internal Reference	11, 20
12A	A228 Ratio Unit	32, 33, 35 (complete), 36 (complete)
12B	Ratio Unit Amplifier	32, 33 (complete)
13	Clock Oscillator and Reset	1, 3, 4, 8, 28
14	Ramp-Up/Ramp-Down Control	1, 3, 4, 8, 28
15A	Counter and Readout Display (Nixie Type)	1, 3, 5, 7, 8, 27
15B	Counter and Readout Display (7 Bar Type)	1, 3, 5, 8, 27, 56, 57
16	Range, Mode, Response and Rate Commands	1, 2, 8, 27, 28, 29, 30
17A	Range and Mode Serialiser Store and Display (Nixie Type)	1, 3, 7, 8, 27
17B	Range and Mode Serialiser Store and Display (7 Bar Type)	1, 3, 8, 27, 56, 57
18	Sample and Auto Range Control	2, 3, 8, 27, 28, 29, 30
19	Auto-Ranging	2, 5, 8
20	Main Power Supplies	4, 8, 12 (complete), 22 (complete)
21	Floating Power Supplies	10 (complete)
22	A214, Board 27	27 (complete)
23	A214, Board 28	28 (complete)

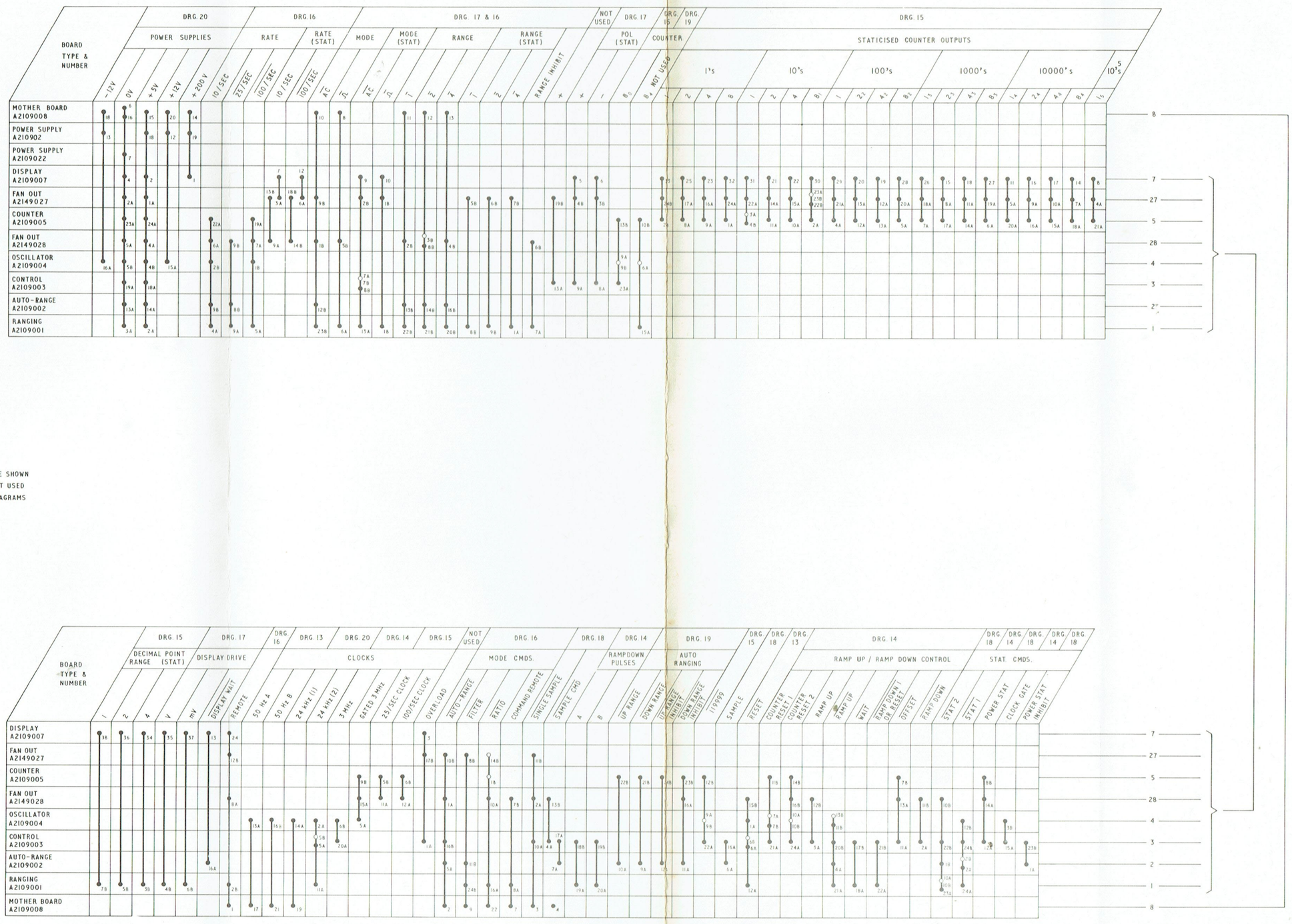




NOTES :-

1. ONLY MAJOR FUNCTIONS ARE SHOWN.
2. DRG. No. CROSS REFER TO DIAGRAMS SHOWING FUNCTIONS.
3. SOME CONNECTIONS ARE USED ONLY AS LEAD-THROUGH CONNECTIONS

Fig. 7.4.1 Floating Section Mother Board Connections Diagram.

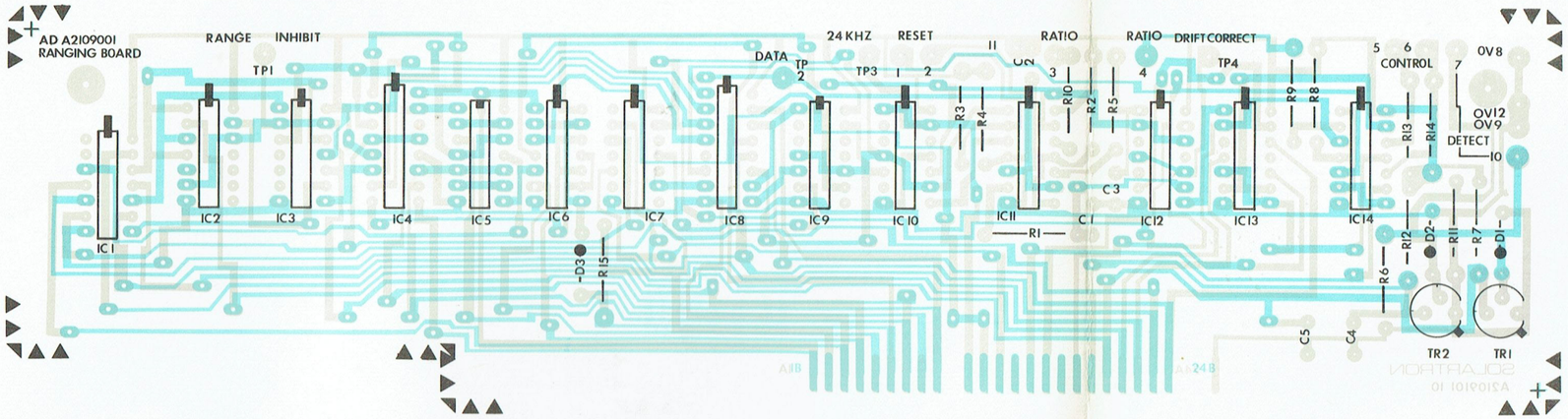


NOTES

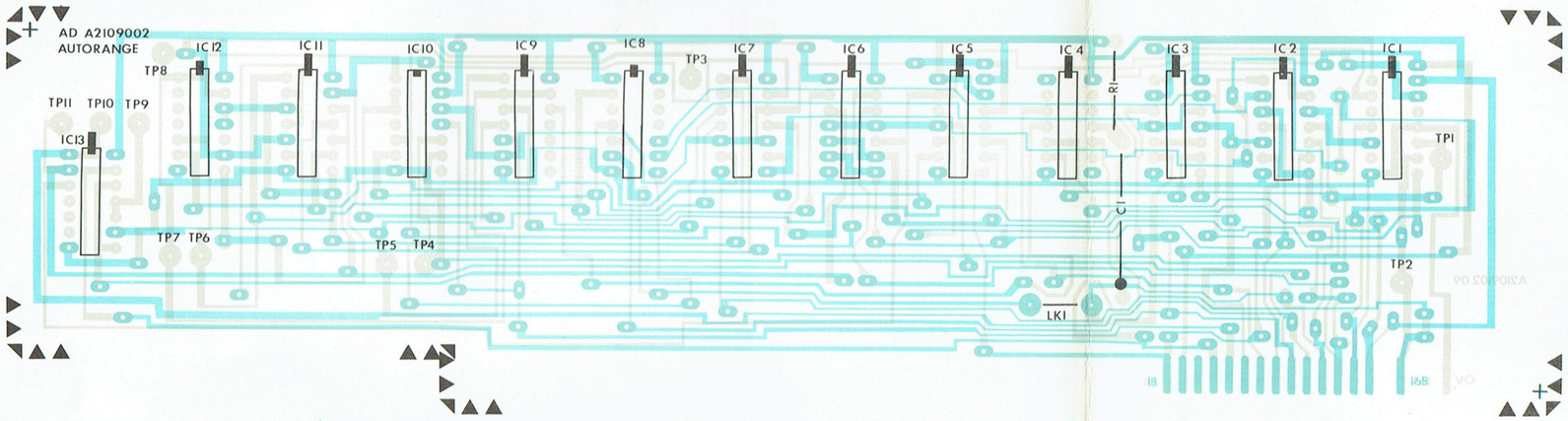
1. ONLY MAJOR FUNCTIONS ARE SHOWN
2. ○ PIN CONNECTIONS ARE NOT USED
3. DRG. No. CROSS-REFER TO DIAGRAMS SHOWING FUNCTIONS.

Fig. 7.4.2 Earthy Section Mother Board Connections Diagram.

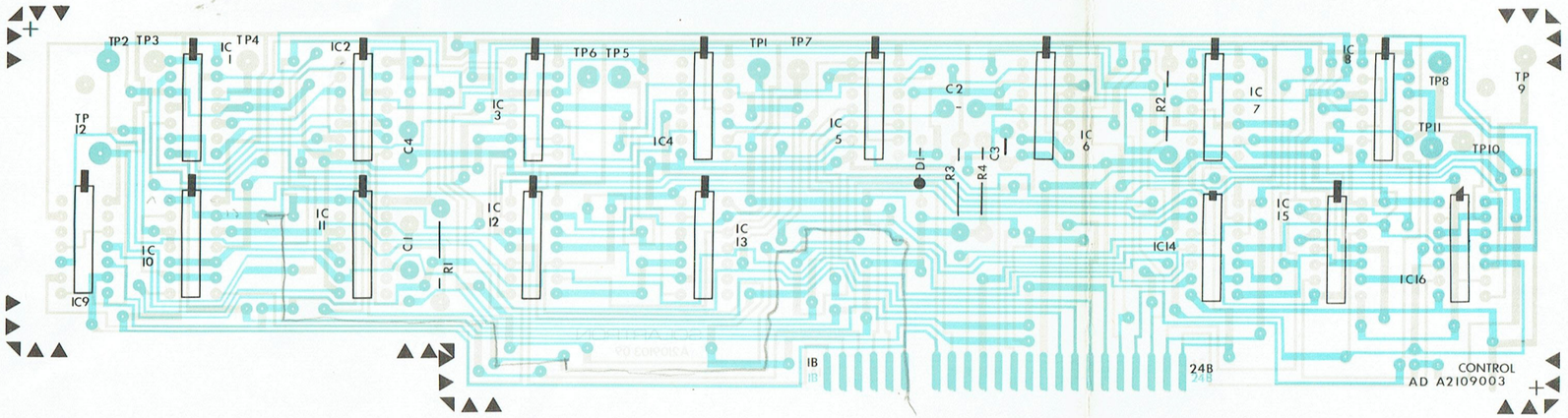
BOARD COMPONENT LAYOUT AND COPPER TRACK ILLUSTRATIONS



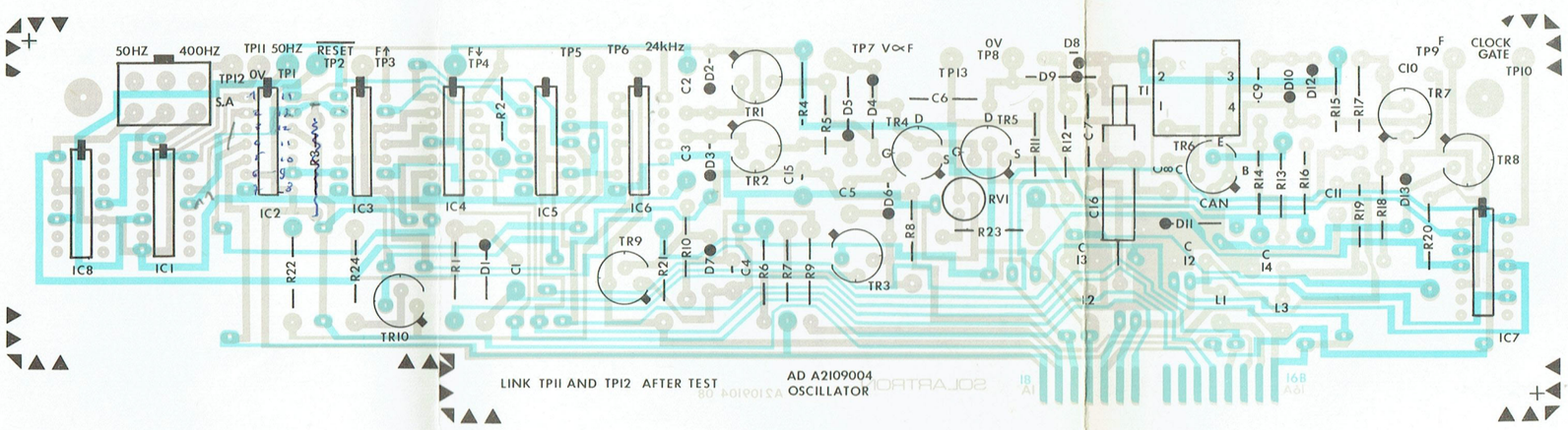
Pcb No. 1 (A2109001) Ranging



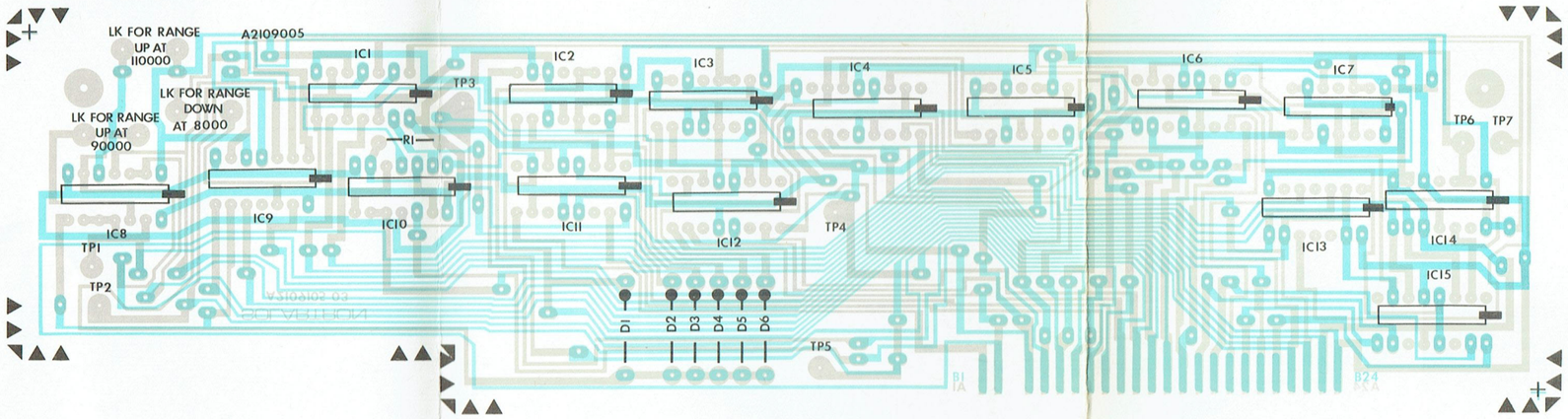
Pcb No. 2 (A2109002) Auto-range



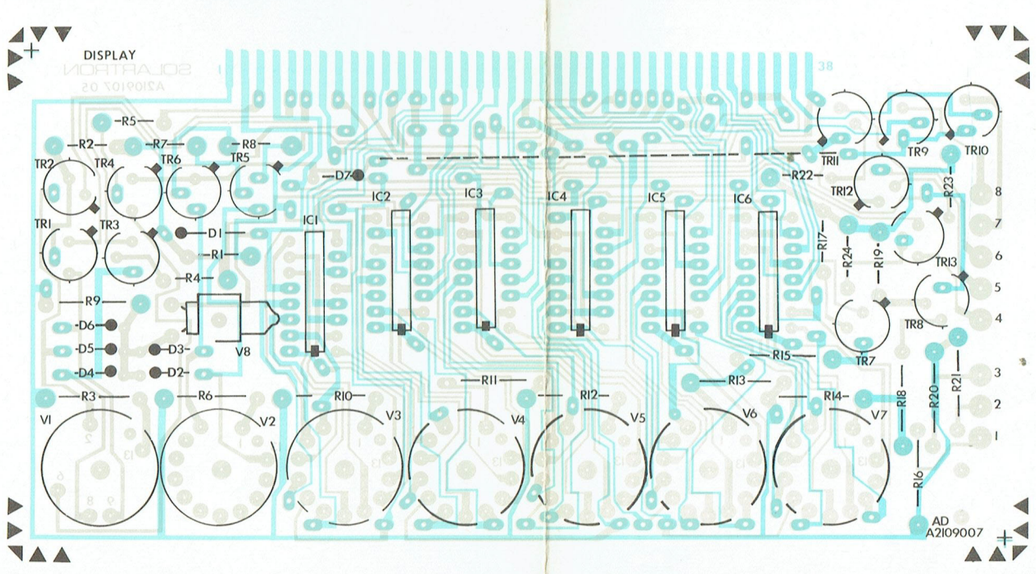
Pcb No. 3 (A2109003) Control



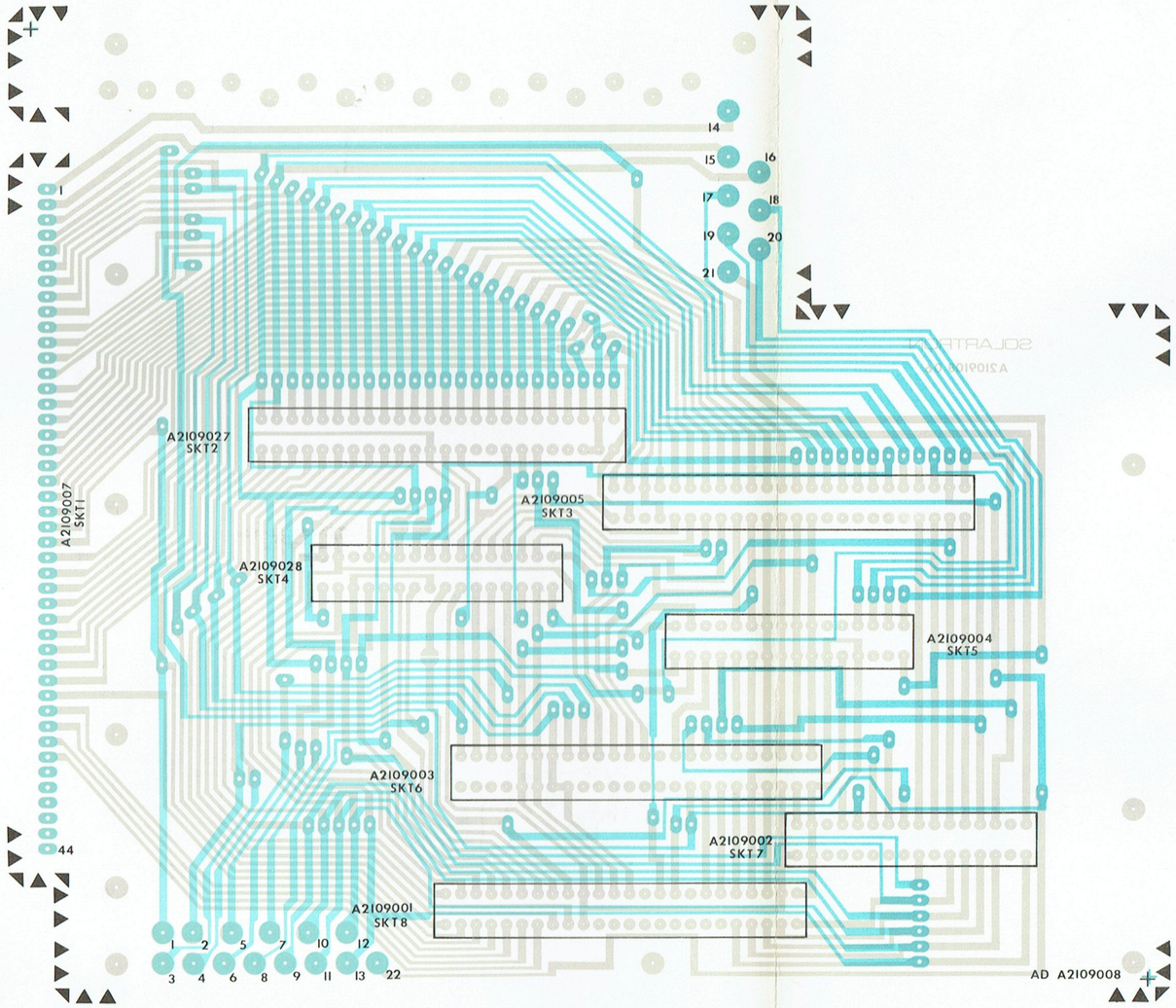
Pcb No. 4 (A2109004) Oscillator



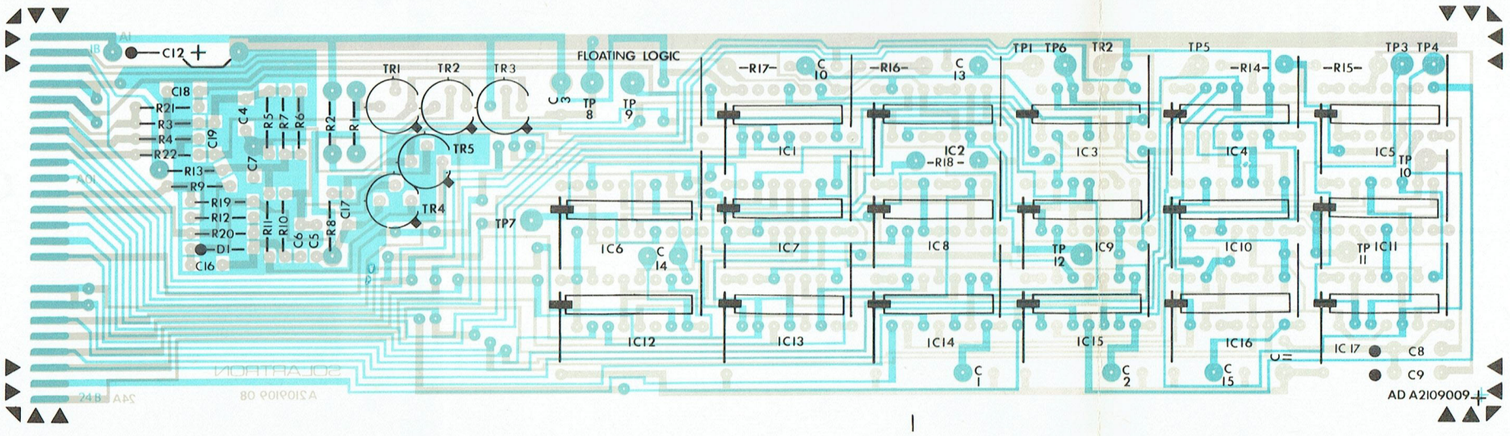
Pcb No. 5 (A2109005) Counter



Pcb No. 7 (A2109007) Readout Display (Nixie Type)

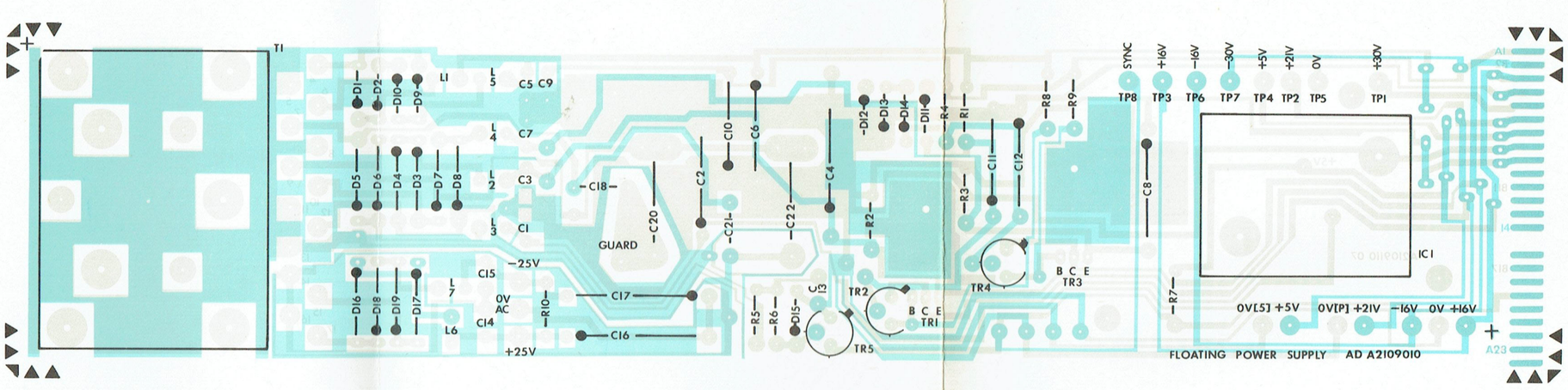


Pcb No. 8 (A2109008)
Earthy Section Mother Board



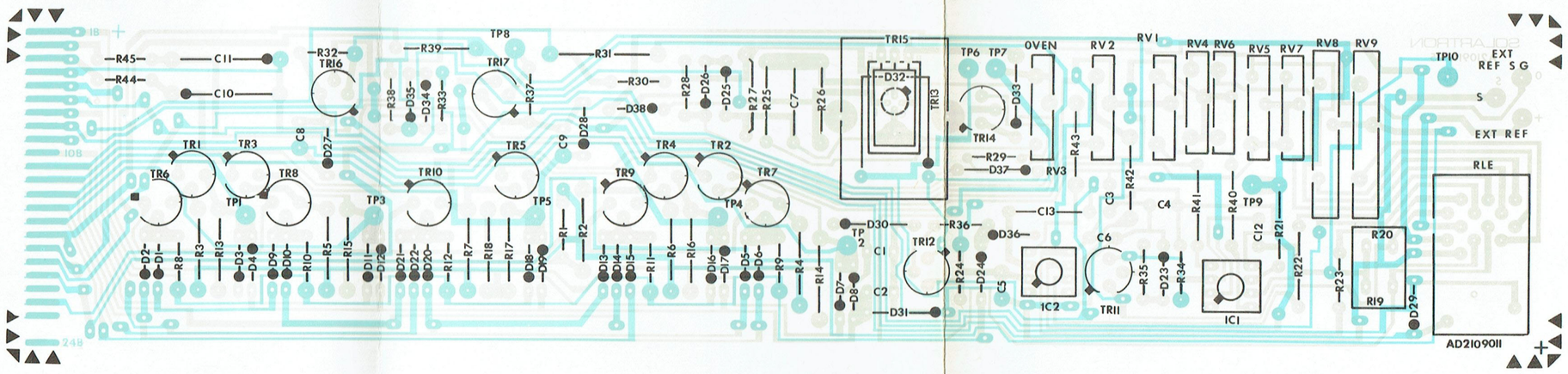
7 Blu
8 Marr Mauve
10 Gris

Pcb No. 9 (A2109009)
Floating Section Logic



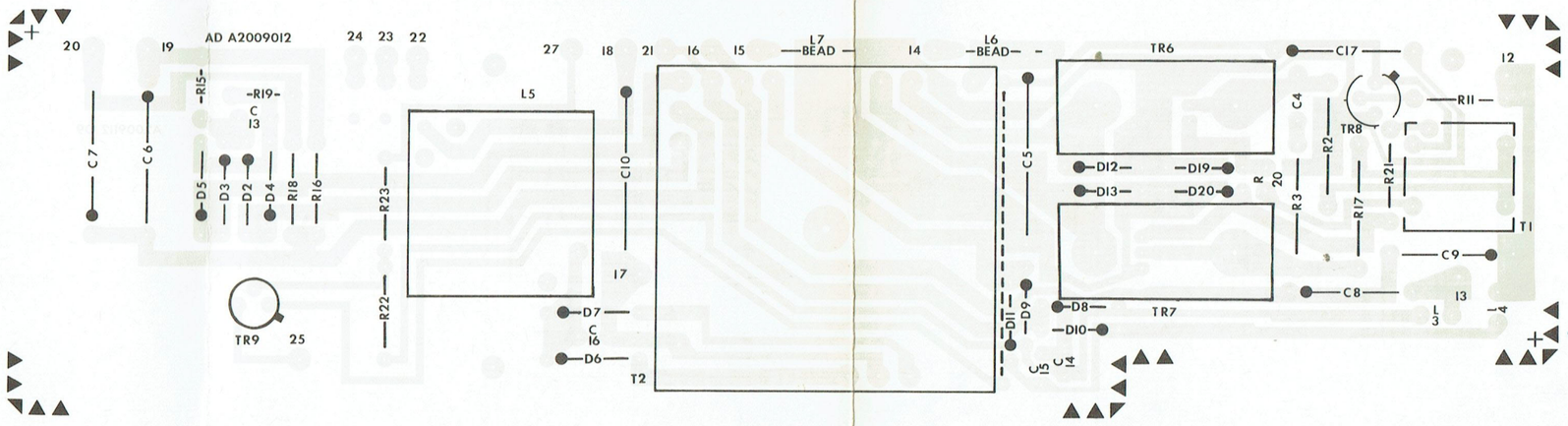
Pcb No. 10 (A2109010)

Floating Section Power Supply



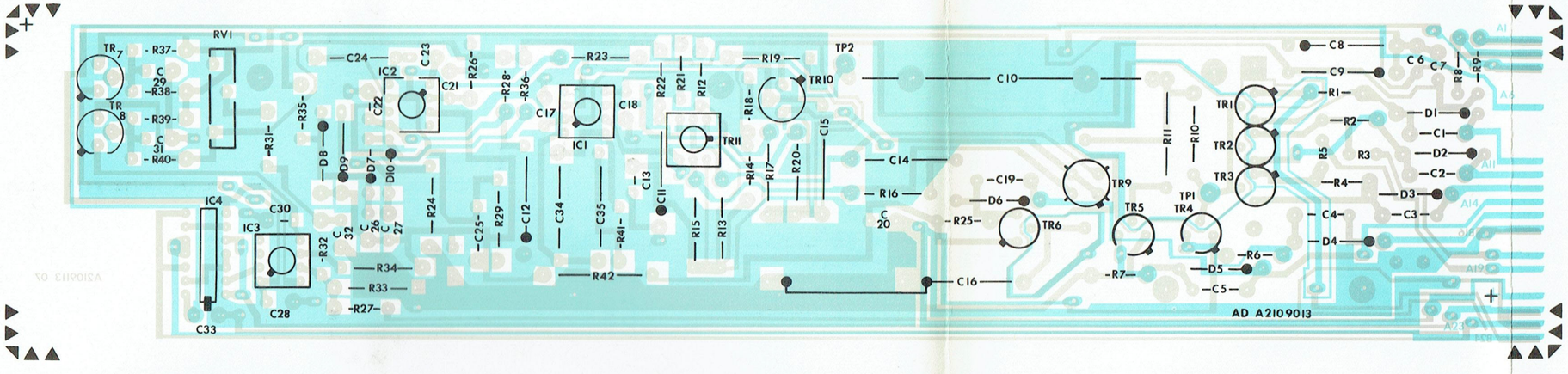
Pcb No. 11 (A2109011)

Internal Reference

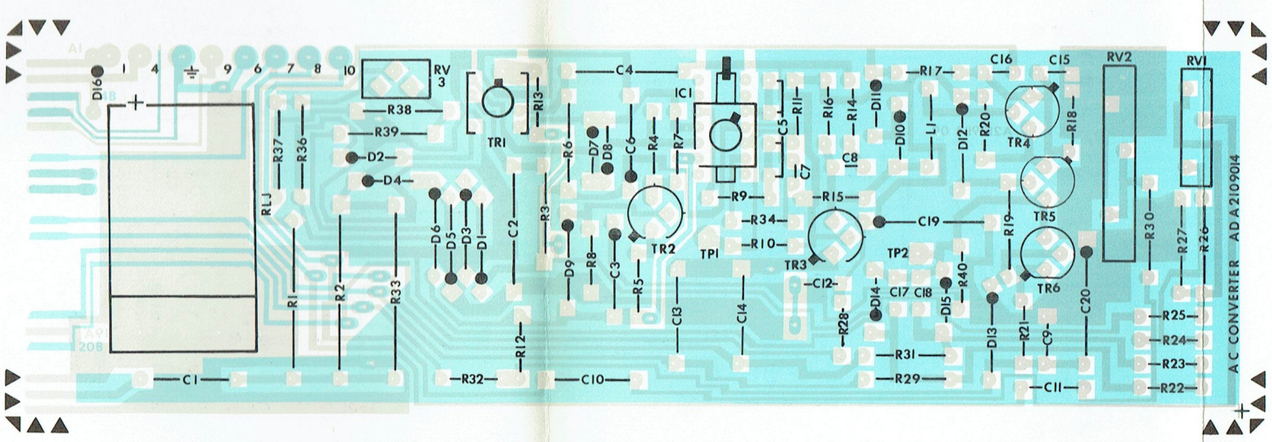


Pcb No. 12 (A2009012)

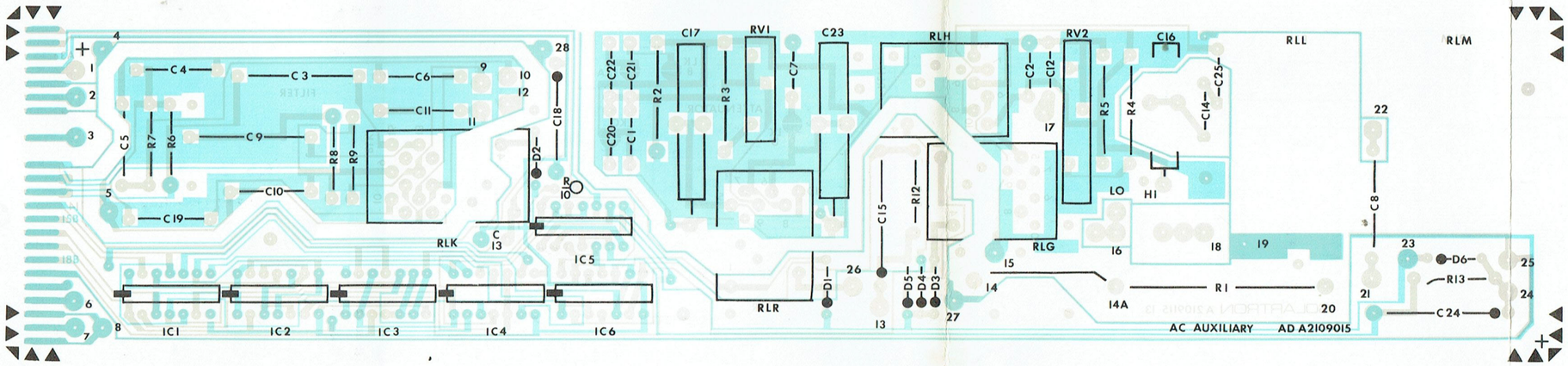
Inverter Oscillator



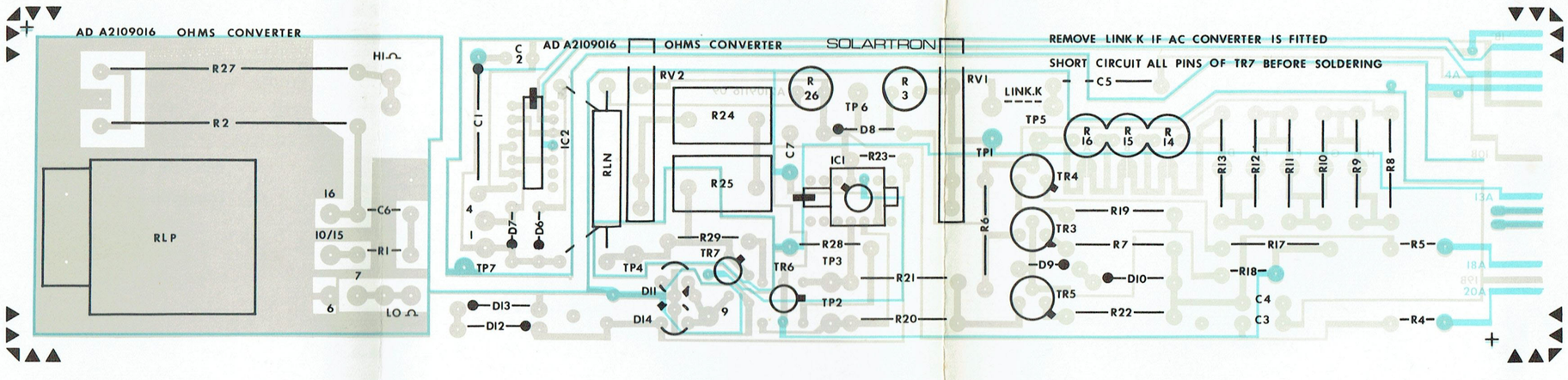
Pcb No. 13 (A2109013)
Integrator



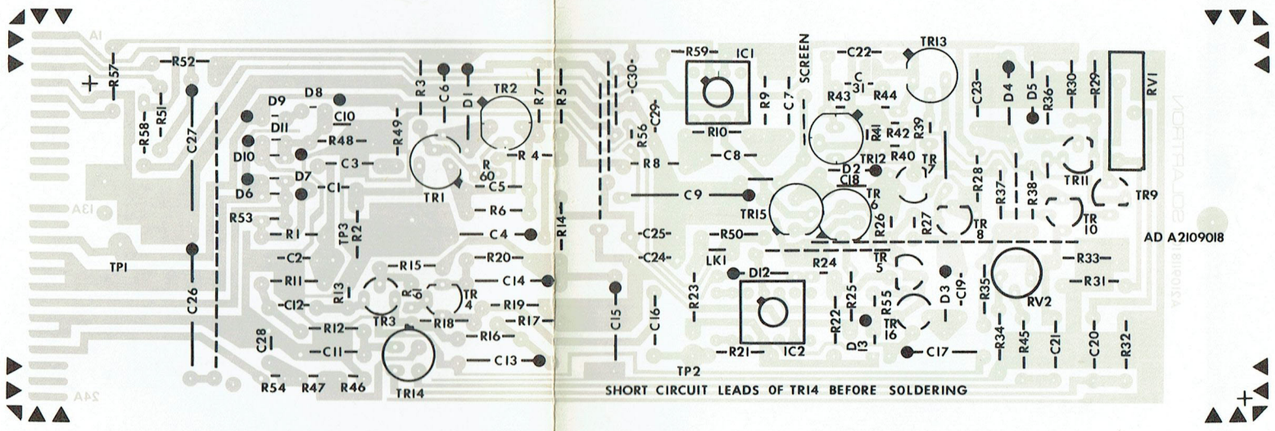
Pcb No. 14 (A2109014)
AC Converter (Mean Sensing)



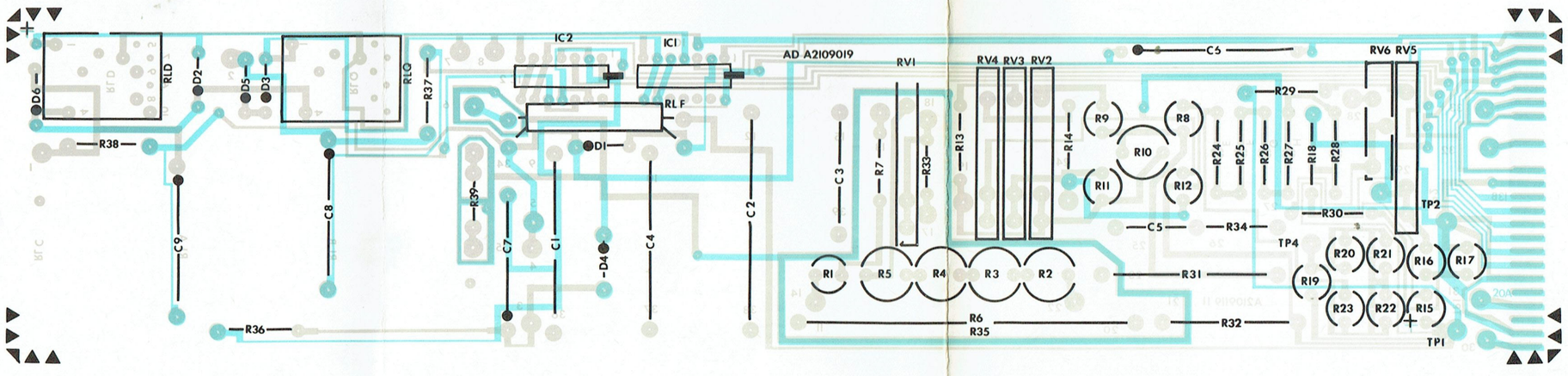
Pcb No. 15 (A2109015)
AC Auxiliary (Mean Sensing)



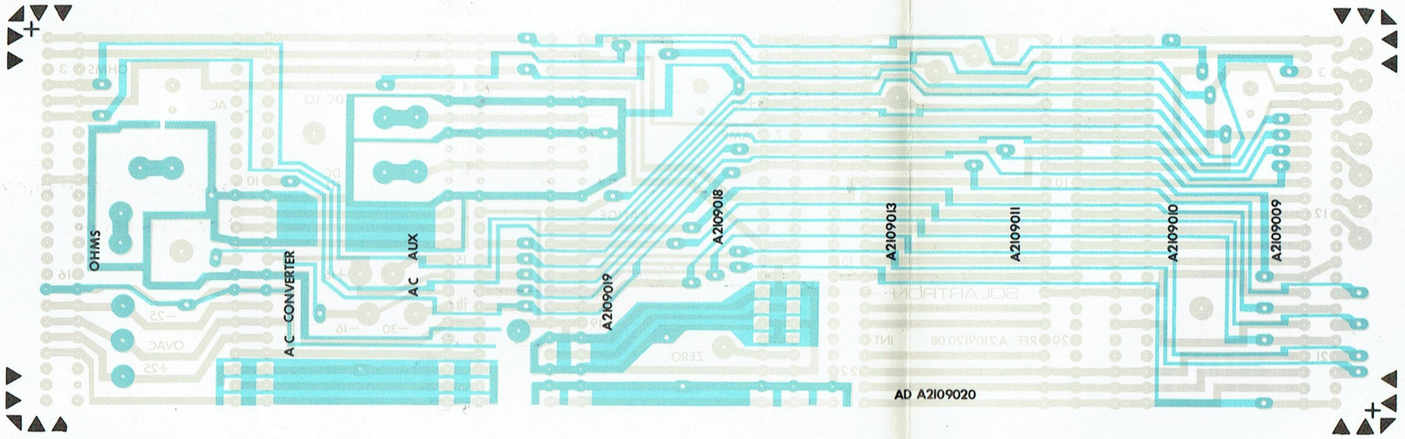
Pcb No. 16 (A2109016) Ohms



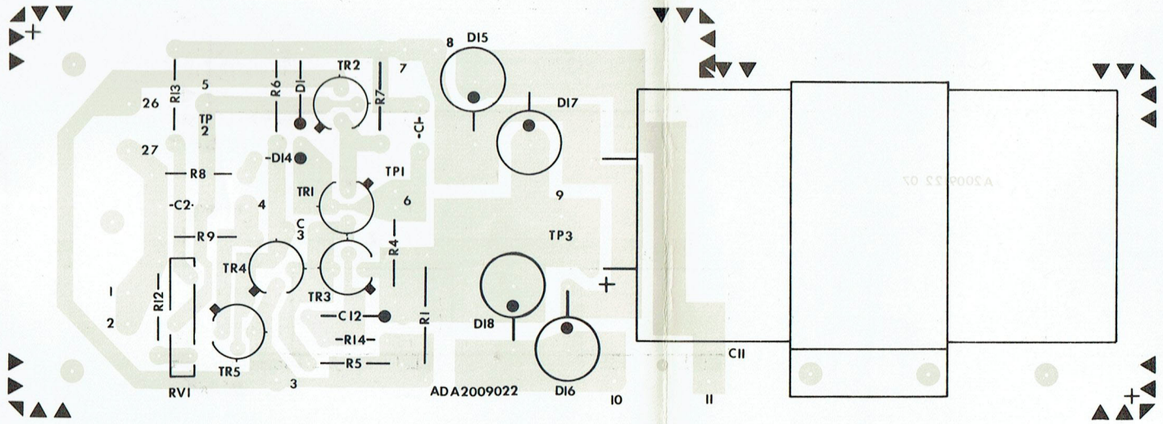
Pcb No. 18 (A2109018)
Input Amplifier



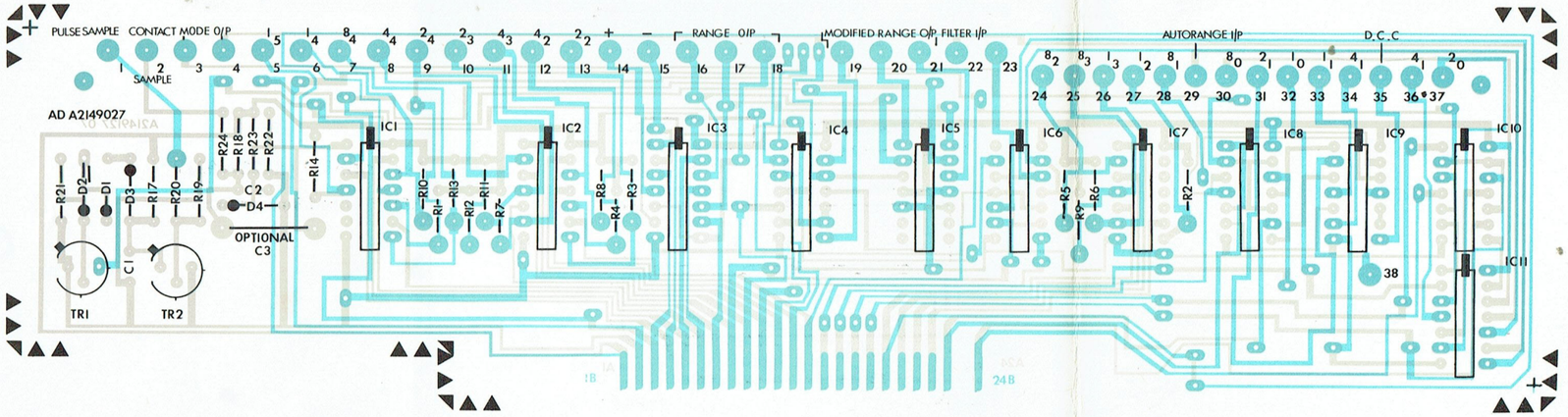
Pcb No. 19 (A2109019)
Ranging (Floating Section)



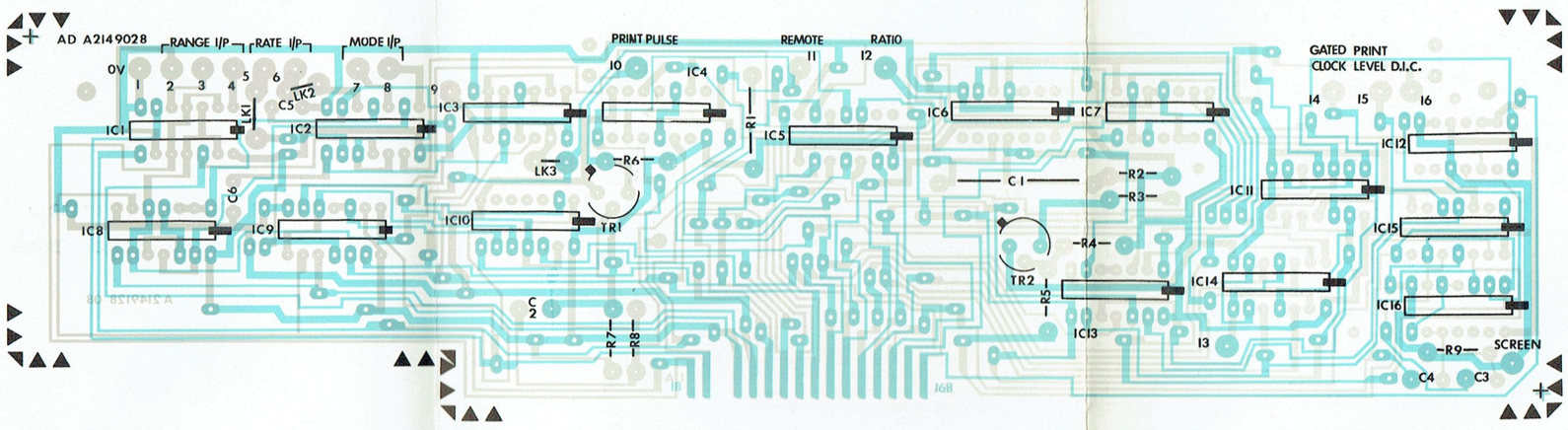
Pcb No. 20 (A2109020)
Floating Section Mother Board



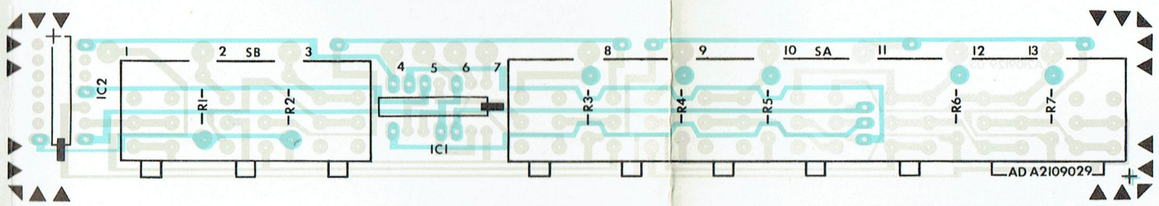
Pcb No. 22 (A2009022)
Power Supply Stabiliser



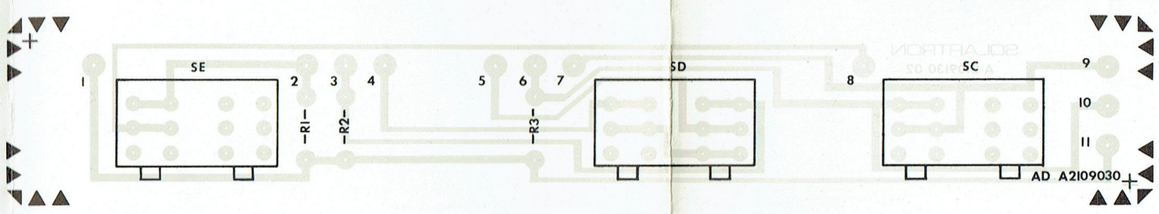
Pcb No. 27 (A2149027)
Part of Fanout Unit



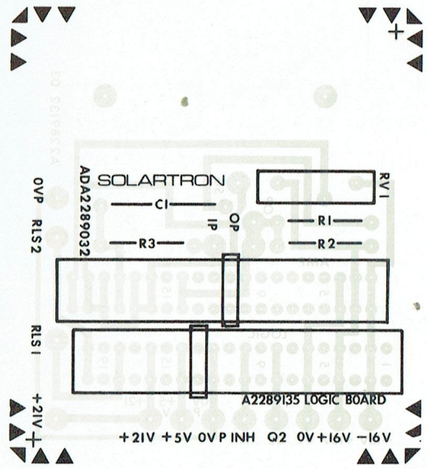
Pcb No. 28 (A2149028)
Part of Fanout Unit



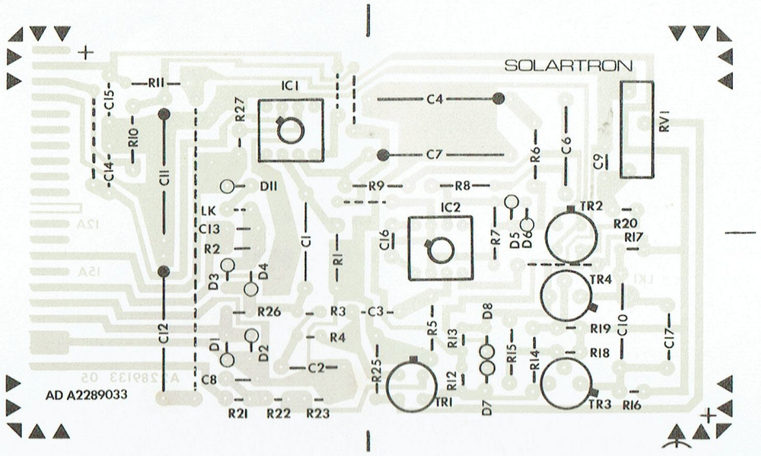
Pcb No. 29 (A2109029)
Switch Board (Mode and Range)

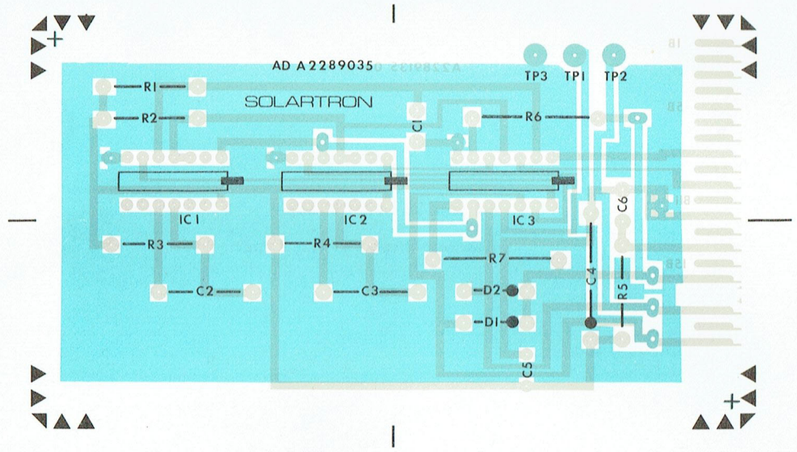


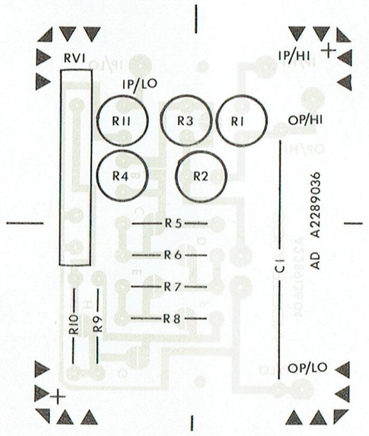
Pcb No. 30 (A2109030)
Switch Board (Control, Rate and Response)



Pcb No. 32 (A2289032)
Ratio Unit : Mother Board







Pcb No. 33 (A2289033)

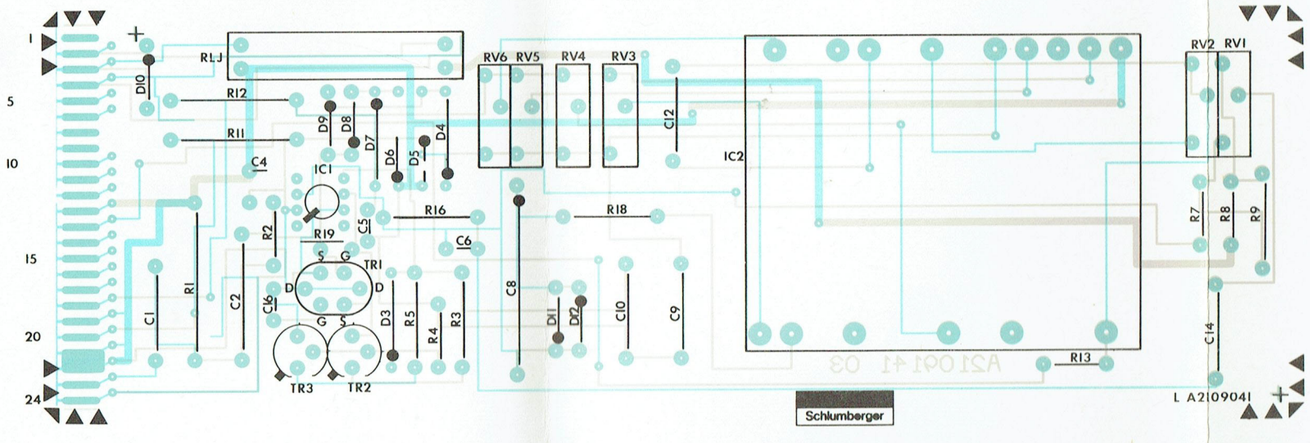
Ratio Unit : Amplifier

Pcb No. 35 (A2289035)

Ratio Unit : Logic

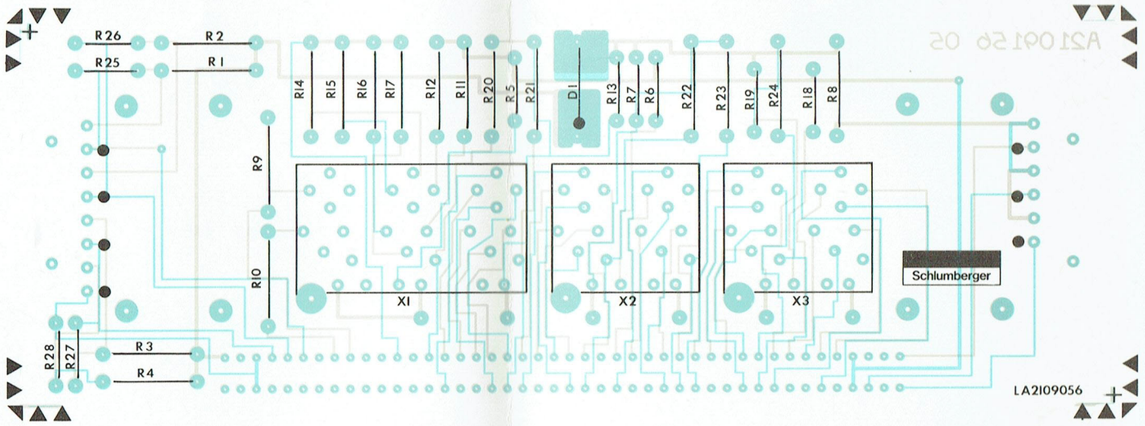
Pcb No. 36 (A2289036)

Ratio Unit : Attenuator



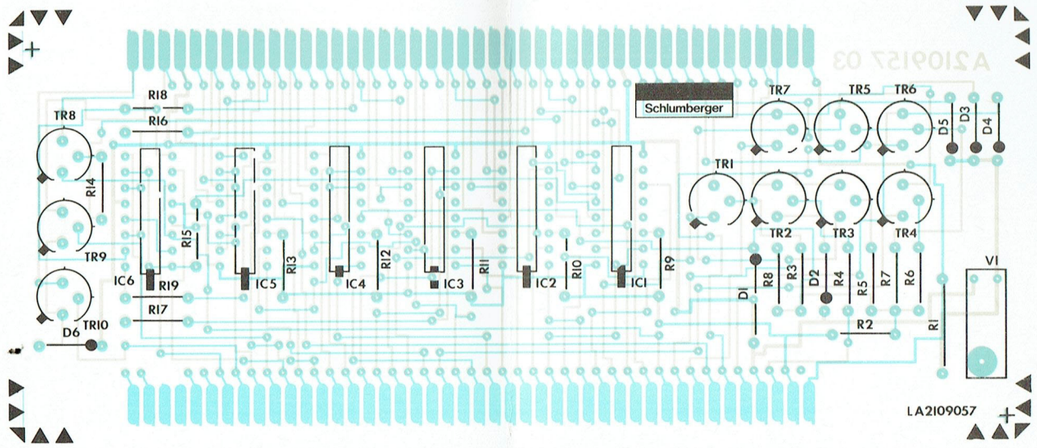
Pcb No. 41 (A2109041)

AC Converter (True RMS)



Pcb No. 56 (A2109056)

Readout Display (7 Bar Type)



Pcb No. 57 (A2109057)

Display Driver (7 Bar Type)

SUB-SECTION 7.5 Servicing Information

GENERAL

This sub-section contains information on servicing procedures and fault-finding waveforms.

ACCESS TO BOARDS AND SUB-UNITS

Refer to Fig. 7.5.1. To gain access to the boards and other sub-units,

(a) Release the side panel bracket screws located on the left and right of the rear panel.

(b) Withdraw the side panels from the rear of the instrument.

(c) Slide the top and bottom panels back to clear the rear panel.

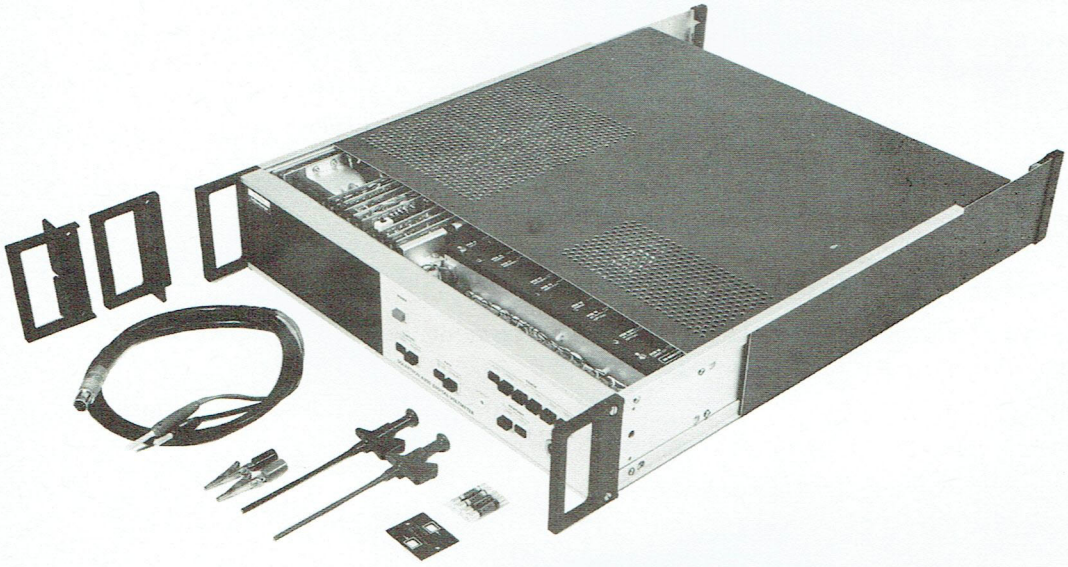


Fig. 7.5.1 Removal of Top and Side Panels

FRONT PANEL AND DISPLAY SCREEN REMOVAL

To remove the front panel and display screen.

(a) Remove top, bottom and side panels as instructed in previous paragraph.

(b) Remove the two screws from each handle and remove handles.

(c) Slacken off the screw on the bottom front cross-bar.

(d) Remove the screw from the top front cross-bar and remove cross-bar being prepared to collect the display screen and front panel.

Note that in some DVM types the removal of the front panel exposes redundant switches as shown in Fig. 7.6.8 of Sub-section 7.6. Where applicable ensure that these switches are properly set before fitting the front panel. In DVM type A210 the DC mode switch is to be depressed and where a ratio unit is not fitted, the RATIO switch is to be released.

BOARD AND SUB-UNIT LOCATION

Refer to Sub-section 7.6, Spatial Description for information on board and sub-unit location.

BOARD REPLACEMENT

CAUTION. The instrument must always be switched off when removing or inserting a board.

Boards should be removed (or inserted) evenly from the edge connector and NOT by pivoting about one corner.

Note that when Board 11 is removed, power supply lines to some other boards in the Floating Section are disconnected.

CLEANING SOLVENT

Excessive use of a cleaning solvent on the sub-assemblies and boards of the Floating Section could impair the performance characteristics of the instrument.

The cleaning solvent should always be very carefully applied in minimum quantities.

Note that some boards are protected by a sealant to which a cleaning solvent should NOT be applied. Board pins can be cleaned by rubbing with a soft pencil eraser.

INTEGRATED CIRCUIT TEST CLIP

The use of a dual-in-line IC test clip as shown in Fig. 7.5.2 is recommended for checking IC pin parameters. The type of clip recommended is supplied by:-

Electronic Component Supplies Ltd.,
Thames Avenue,
Windsor,
Berkshire,
England.

EXTENSION BOARD KIT

An extension board kit can be purchased from Solartron by quoting Extension Kit No. 3189.

This kit consists of 16 extension boards and these are derived from two basic boards (38 and 39) that have had the locating keyway cut to fit the DVM board being extended.

Each extension board is listed as follows along with the DVM board that is extended.

Ext. Board No.	for	DVM Board No.
A2109139/1		1
A2109139/2		2
A2109139/3		3
A2109139/4		4
A2109139/5		5
A2109139/6		27
A2109139/7		28
A2109138/1		9
A2109138/2		10
A2109138/3		11
A2109138/4		13
A2109138/5		14
A2109138/6		15
A2109138/7		16
A2109138/8		18
A2109138/9		19

COMPONENT REPLACEMENT

A soldering iron with a good earth connection must be used when replacing semiconductor devices. FET leads should be shorted together before handling.

CAUTION. Care must be taken to prevent damage to the copper track when removing multi- connection components from boards. It is recommended that a solder sucking type of tool be used when removing multi-connection components.

RELAY REPLACEMENT

All relays are soldered into circuit. Carefully note the pin connection of relays that are connected by wire links, before removing.

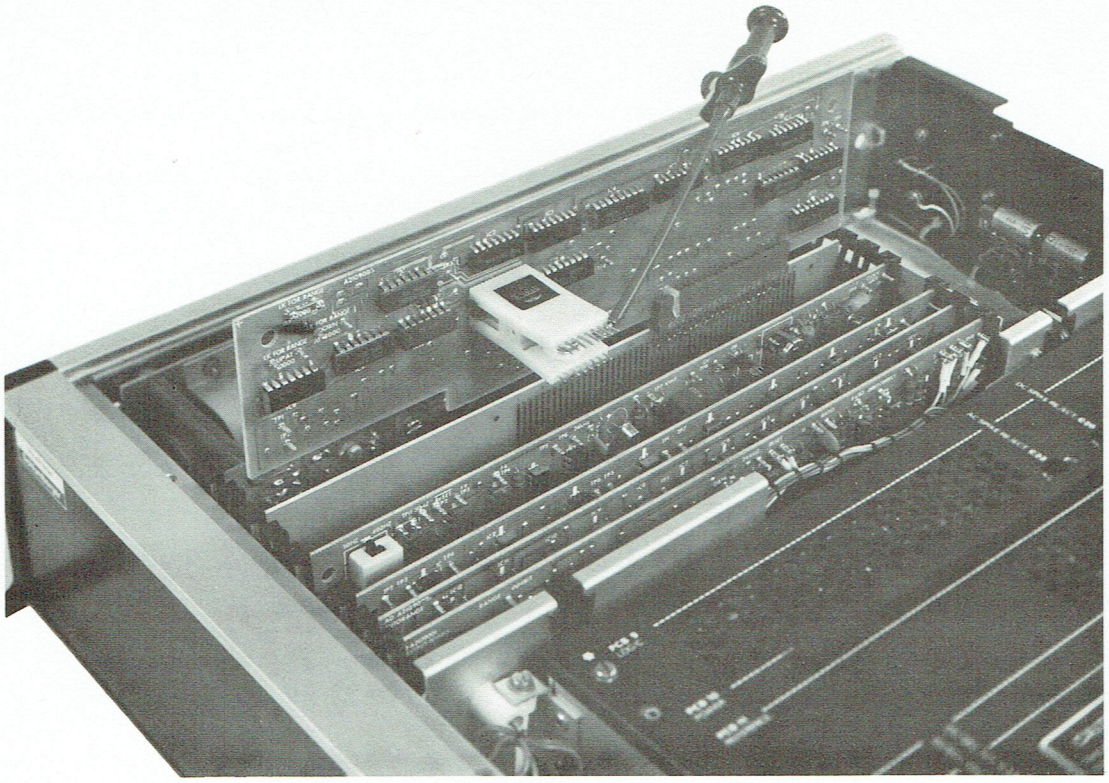


Fig. 7.5.2 Use of IC Clip and Extension Board

DISPLAY TUBE REPLACEMENT

The instrument is supplied with one of two types of display tubes, either **Nixie discharge type** or **Sperry neon type.**

NIXIE TUBE REPLACEMENT (If Fitted)

Remove the display screen as previously instructed then place the instrument on one side and carefully remove the Nixie display board by withdrawing it evenly from the edge connector. Do NOT remove the board by pivoting it about one corner as this could damage the edge connector. Unsolder the faulty Nixie tube from the board.

SPERRY NEON DISPLAY REPLACEMENT (If Fitted)

Remove the display screen as previously instructed then place the instrument on one side and remove the dual-board assembly by withdrawing it evenly from the edge connector. Do NOT remove the dual-board assembly by pivoting it about one corner as this could damage the edge connector. Separate the display board from the decoding board.

The neon displays are removed from their retaining socket by carefully levering them out. When replacing a neon assembly ensure that the pins are straight and correctly aligned before inserting.

CALIBRATION

Data on the short term accuracy (24hr) and the long term accuracy (90 days) of the instrument is given in Section 2, Technical Specification. Calibration information is given in Section 8, Test and Calibration Procedures.

FAULT-FINDING WAVEFORMS

GENERAL

The waveforms shown in Figs. 7.5.3 to 7.5.5 indicate the correct operation of the major functions of the instrument. The waveforms are divided into three groups, Earthy Section, Floating Section and an example of the sequence of operation when mode and range are selected.

Each waveform is functionally identified and the monitoring point given e.g. test point (TP), IC pin number or board pin number. Also a cross-reference to the functional drawing (Sub-section 7.3) and block is given for each waveform and information on the function of a particular waveform can be gained by referring to the appropriate functional block.

The top of all the waveforms represent a Hi in logic levels and the bottom a Lo.

EARTHY SECTION WAVEFORMS (FIG. 7.5.3)

The waveforms shown in Fig. 7.5.3 are that obtained when operating at the 10/SEC sampling rate. Note that the reset period, ramp-up time and maximum ramp-down time vary for each of the three possible sampling rates, refer to functional drawings (Sub-section 7.3) 8 and 13.

The following basic waveforms in the Earthy Section are derived from the 6MHz clock and are independent of the sequence of operations in the Floating Section and thus provide a starting point for fault-finding.

Clock outputs

Reset pulse

Ramp-up

Start of integrator ramp-down

FLOATING SECTION (FIG. 7.5.4)

The end of Ramp-down and Polarity are the only major waveforms that are initiated in the Floating Section all other major waveforms being initiated in the Earthy Section. For example if the reset pulse is not present on TP6 (Q1) of board 9 in the Floating Section it can be traced back to its source in the Earthy Section.

MODE AND RANGE WAVEFORMS (FIG. 7.5.5)

An example of the sequence of operation between the Floating Section and the Earthy Section, when mode and range are selected, is shown in the waveform diagram.

The example given is the DC mode, 1V range of operation with slow response.

EARTHY SECTION

10/SEC SAMPLING RATE
(NOT TO SCALE)

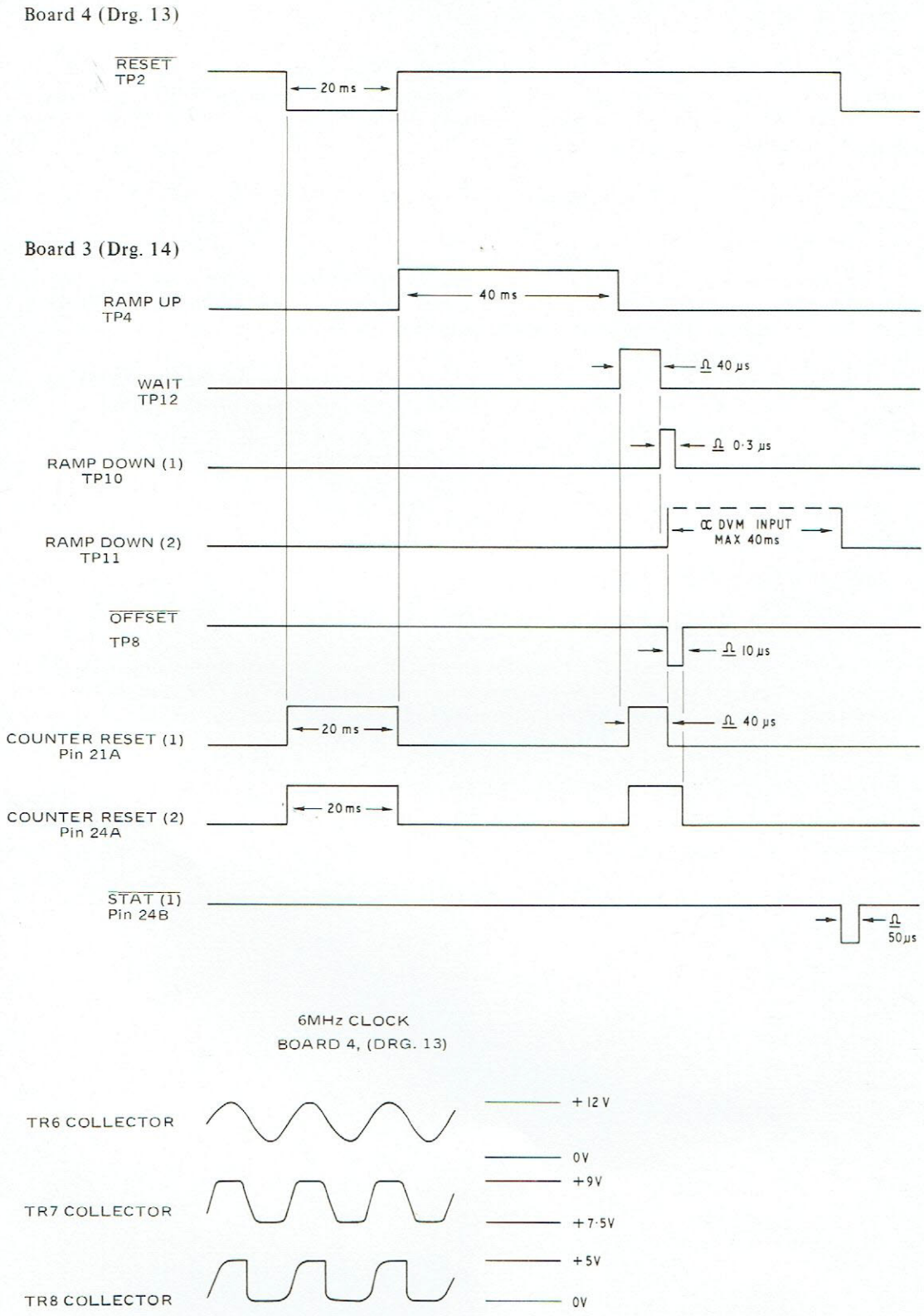


Fig. 7.5.3 Earthy Section Waveforms

FLOATING SECTION

10/SEC SAMPLING RATE
(NOT TO SCALE)

Board 9 (Drg. 10)

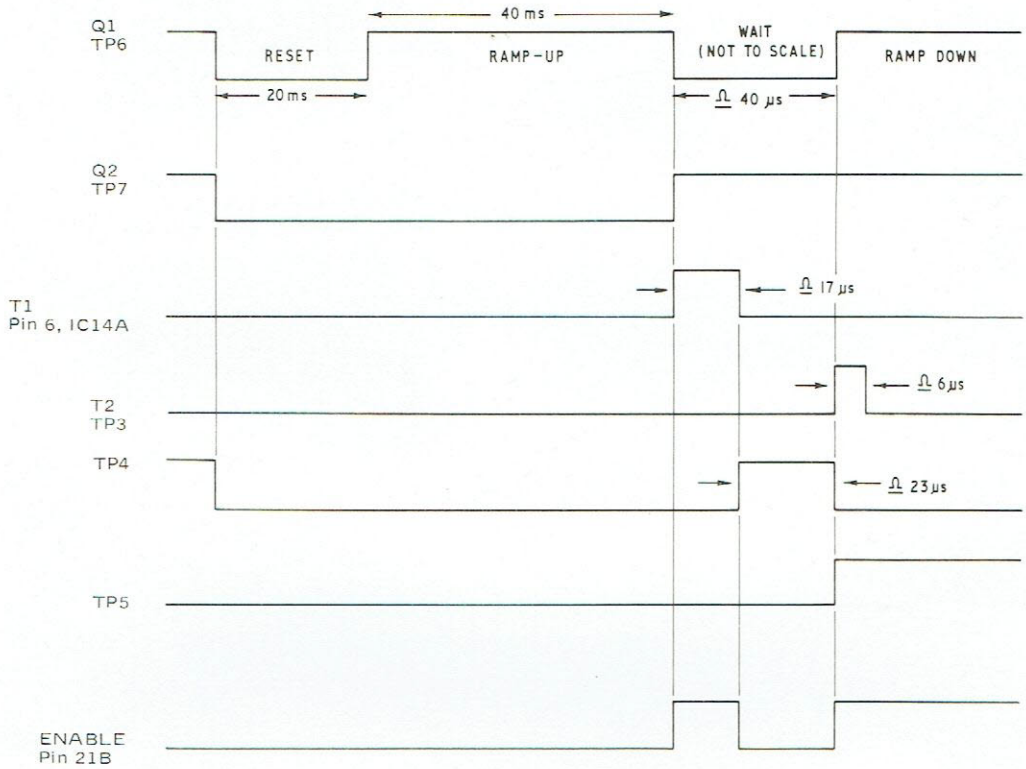


Fig. 7.5.4 Floating Section Waveforms

MODE AND RANGE WAVEFORMS

(NOT TO SCALE)

EXAMPLE : DC Mode, 1V Range, Slow Response.

Logic lines into the register, IC8 of Board 1 (Drg. 17) will be at the following levels (Refer to Drg. 16).

$\overline{4}$	$\overline{2}$	$\overline{1}$	$\overline{RATIO}$	$\overline{25}$	$\overline{F}$	$\overline{\Omega}$	$\overline{AC}$
Hi	Lo	Lo	Hi	Hi	Lo	Hi	Hi

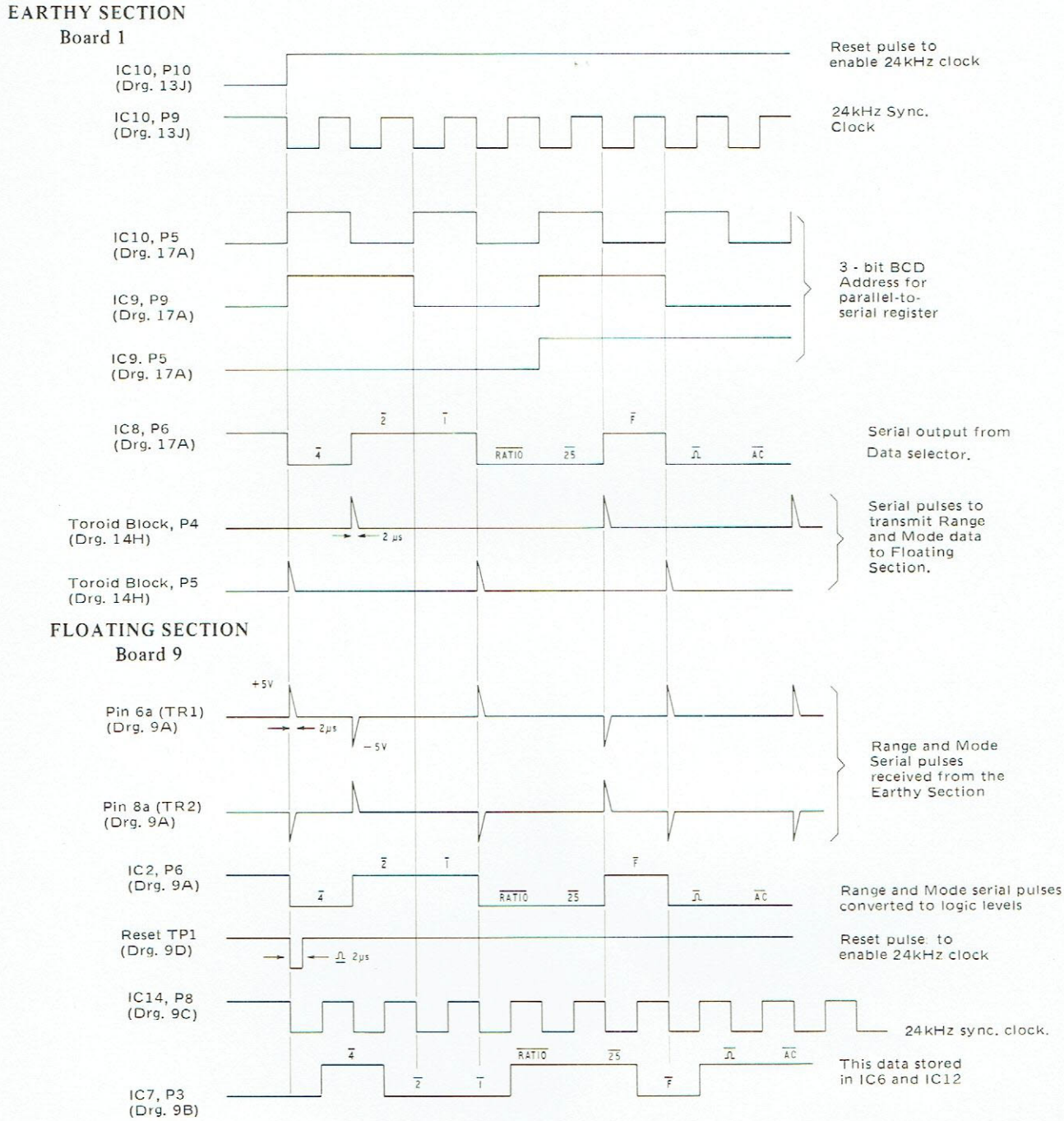


Fig. 7.5.5 Mode and Range Waveforms

SUB-SECTION 7.6 Spatial Description

GENERAL

The physical location of all boards and sub-assemblies is shown in this sub-section.

Note that the optional units (with the exception of the Ratio Unit) consist of one or more boards that are plugged into vacant connectors that have been provisioned on the mother boards. The Ratio Unit boards are contained in a separate chassis that is wired into the instrument.

The following list refers to the appropriate illustration for

(a) Pcb location

(b) Sub-assembly location

(c) Optional units

ILLUSTRATION LIST

PCB LOCATIONS	Fig. No.	OPTIONAL UNITS	Fig. No.
A210	7.6.1	Ohms Unit	7.6.12
A211	7.6.2	AC Unit	7.6.13
A212	7.6.3	A214 Fanout Unit	7.6.14
A213, A215	7.6.4	Fanout Unit Location	7.6.15
A230	7.6.5	A228 Ratio Unit	7.6.16
A233, A235	7.6.6		

SUB-ASSEMBLY LOCATION	
Main sub-assemblies	7.6.7
Front panel removed	7.6.8
Bottom view of instrument	7.6.9
Rear panel components	7.6.10
Earthy Section Power Supply	7.6.11

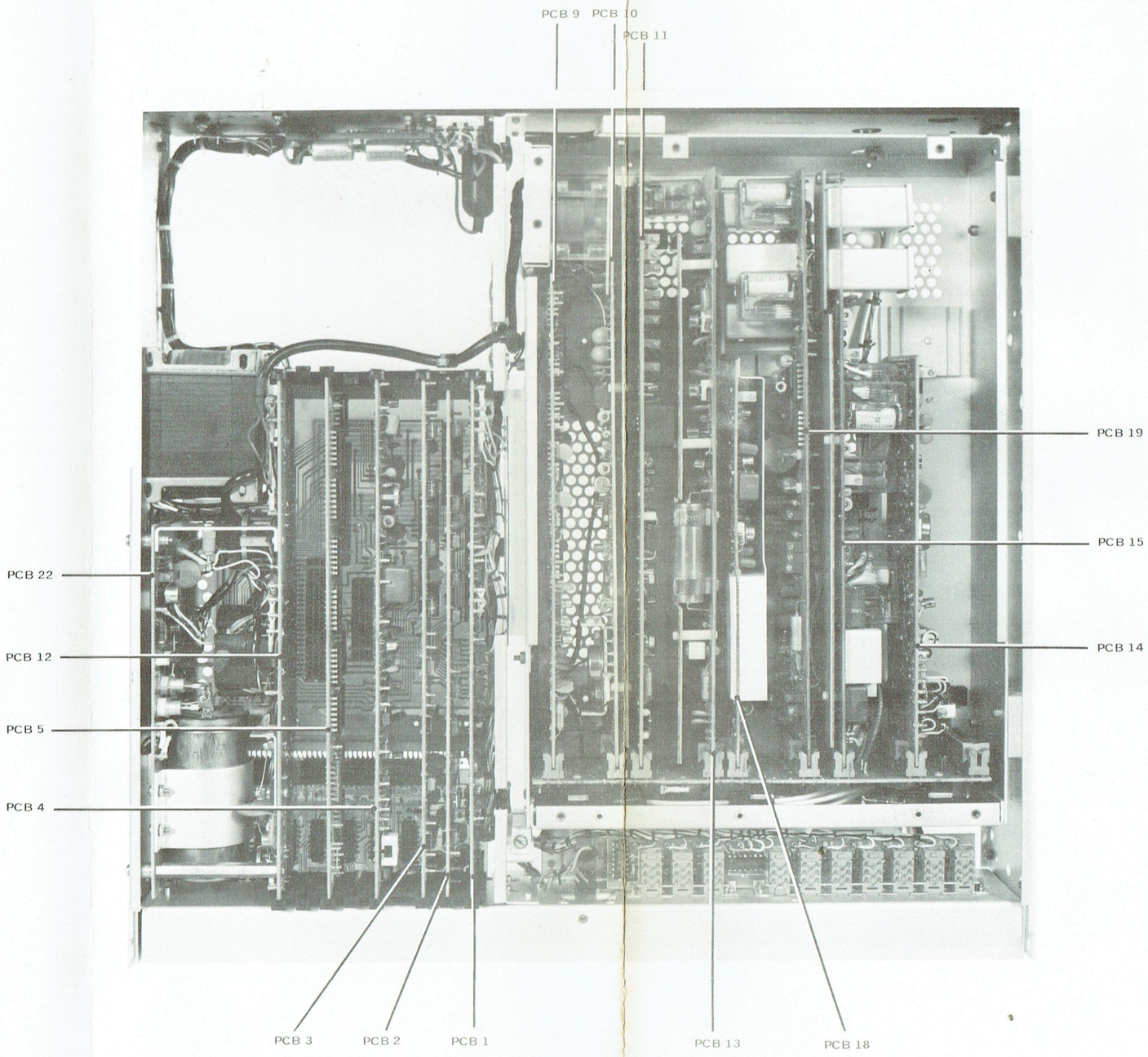


Fig. 7.6.2 A211 PCB Location

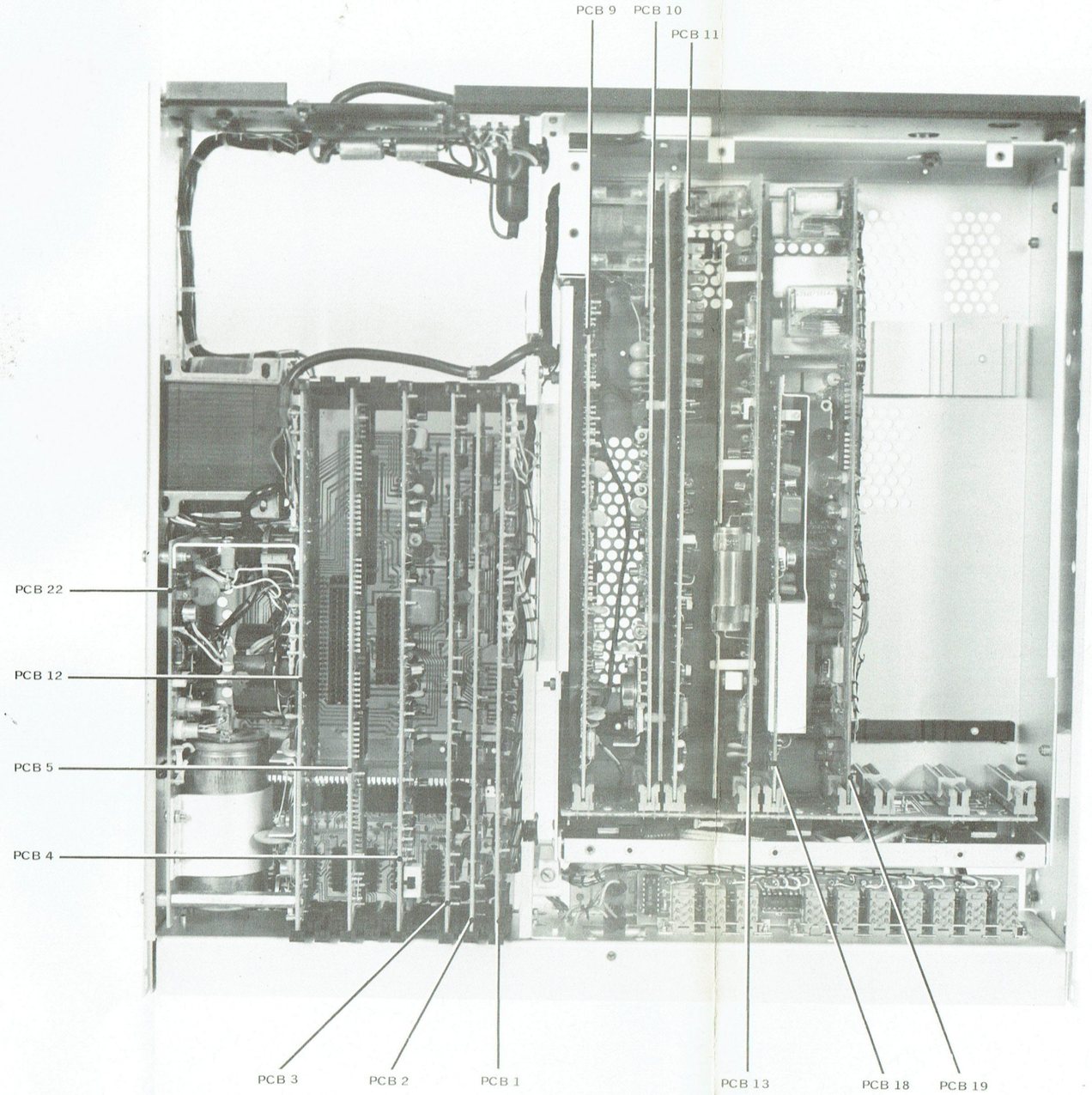


Fig. 7.6.1 A210 PCB Location

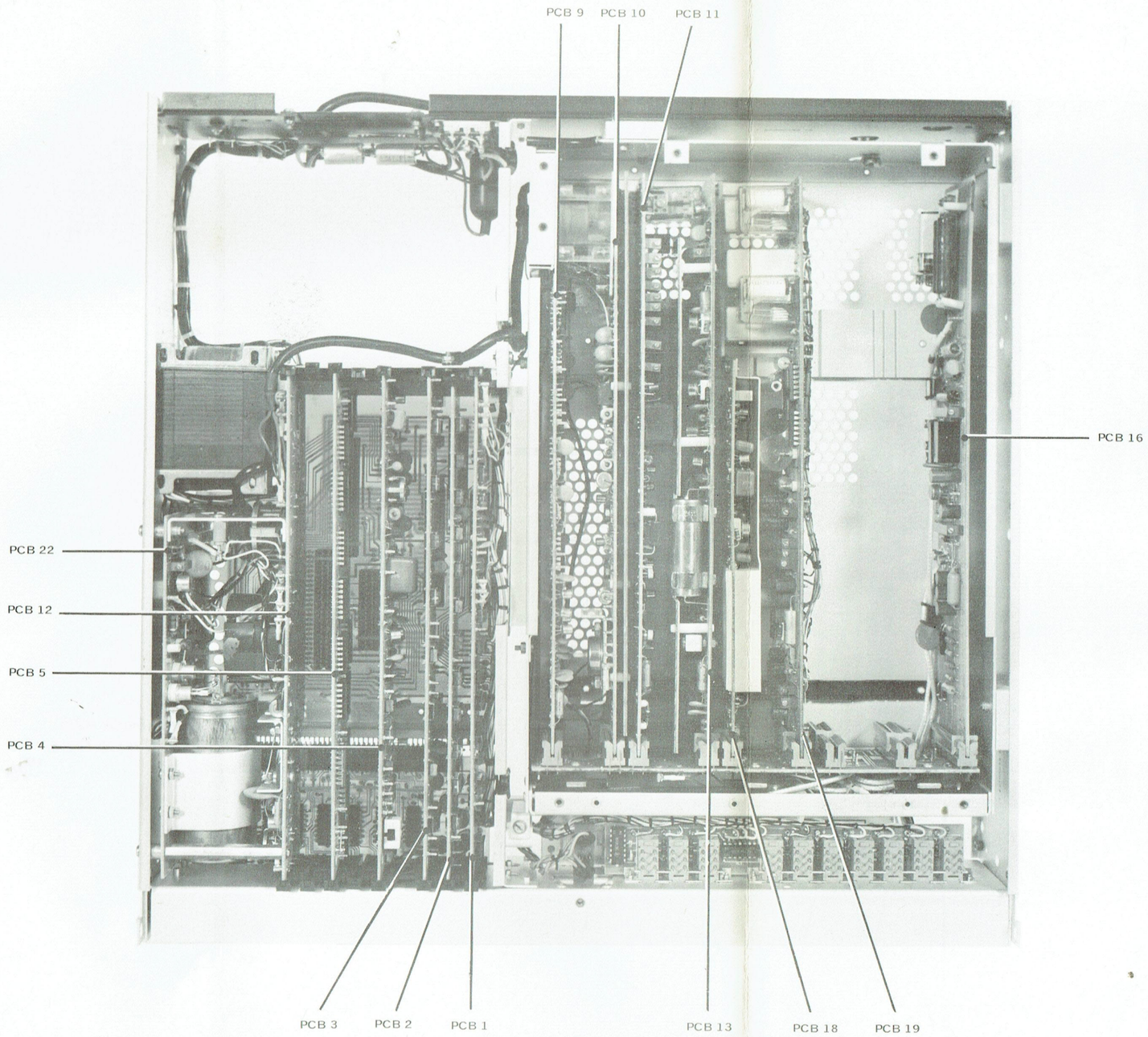
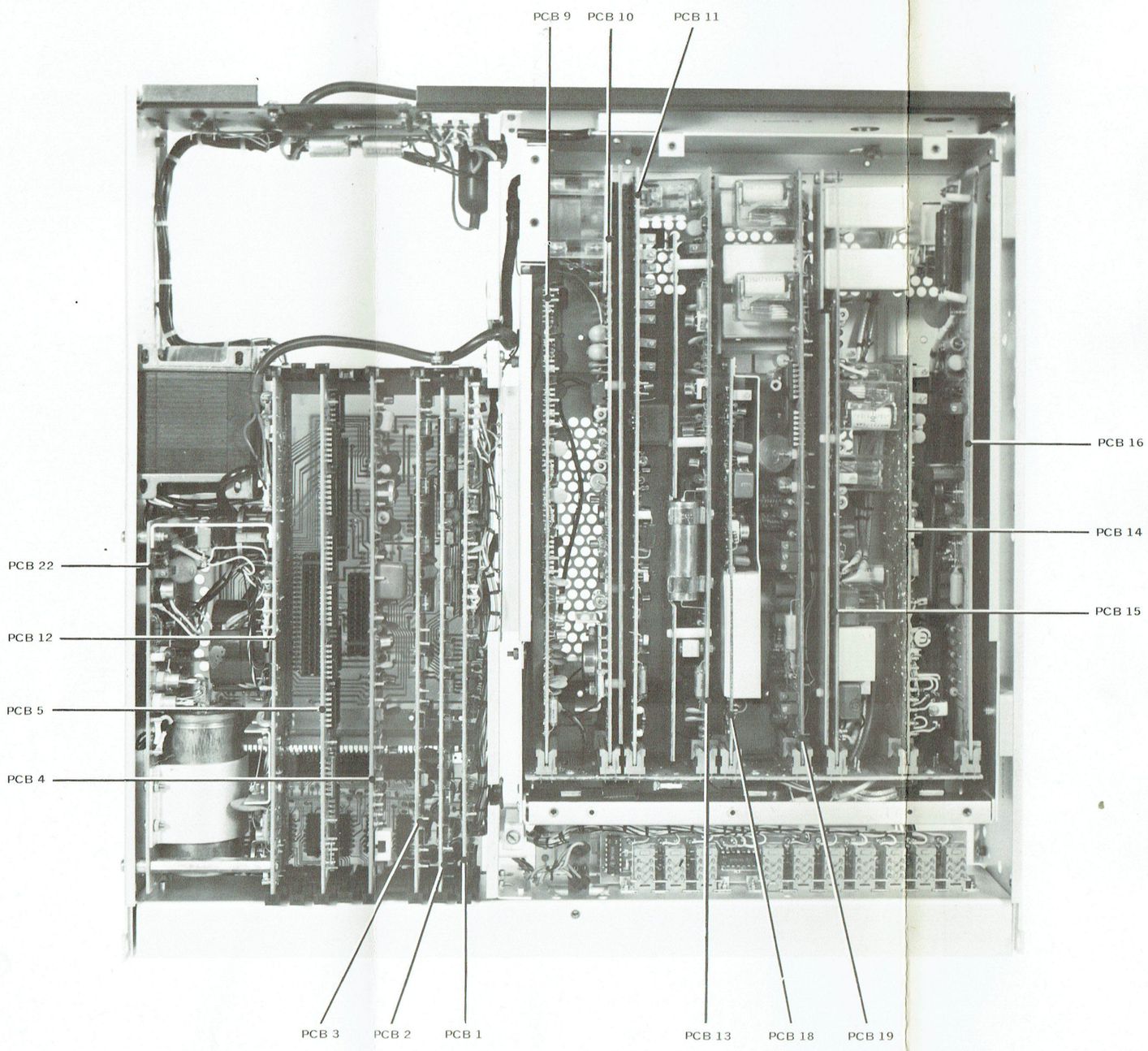
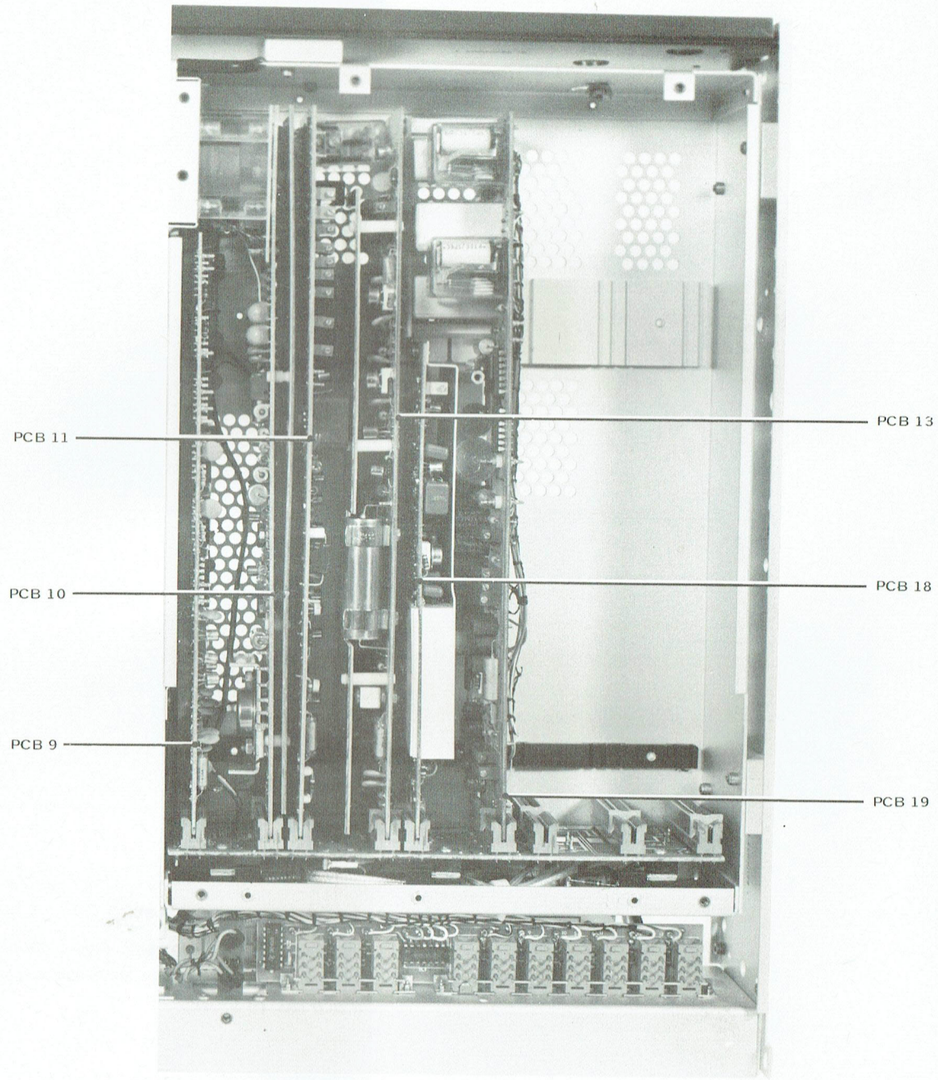


Fig. 7.6.3 A212 PCB Location



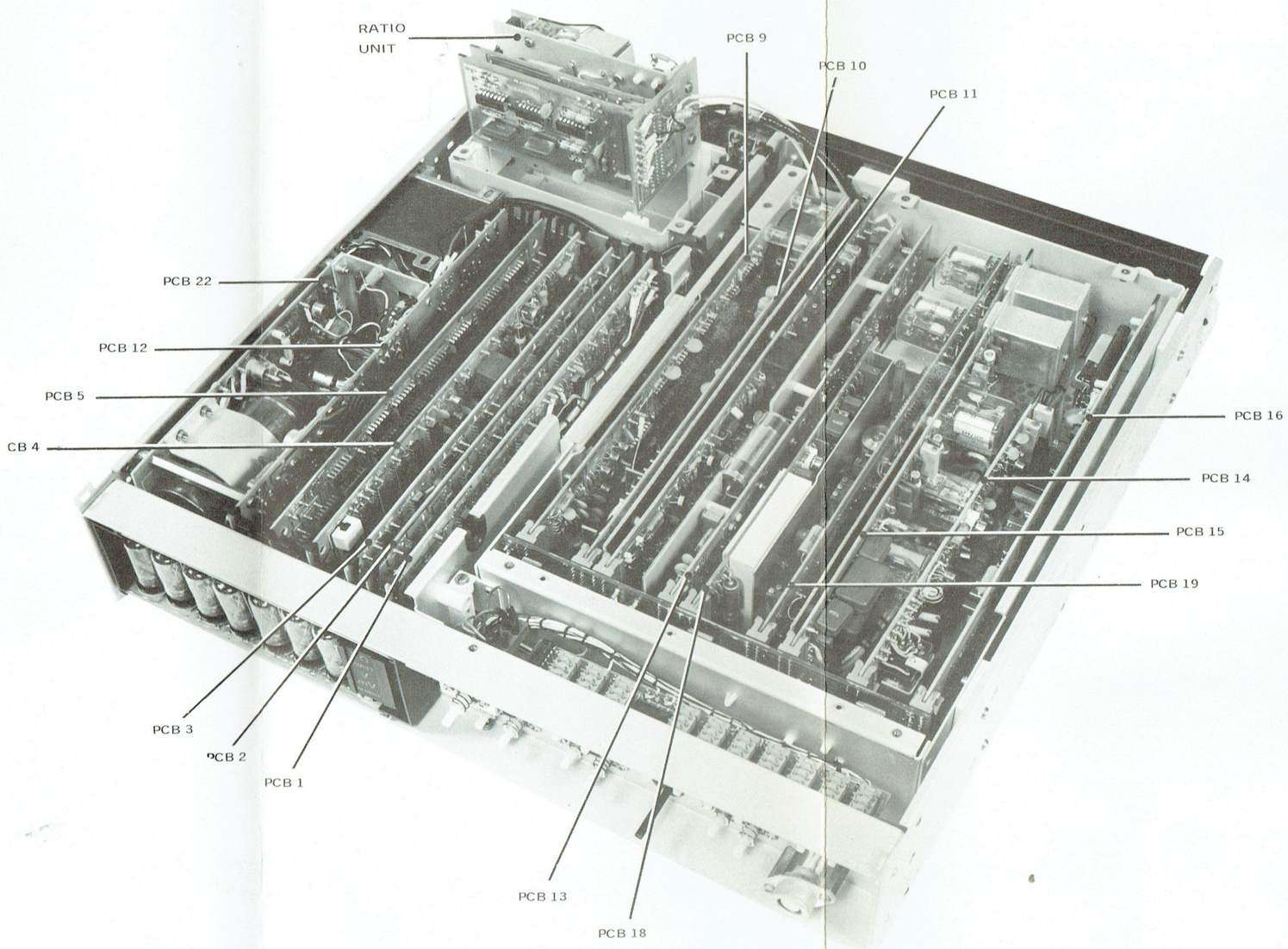
Model A213 is illustrated. Model A215 differs only in that pcb No. 41 is substituted for pcb No. 14 shown.

Fig. 7.6.4 A213 and A215 PCB Location



The pcb location for the A230 is similar to the A233 the difference being that pcb's 14, 15 and 16 are not fitted to the A230.

Fig. 7.6.5 A230 PCB Location



Model A233 is illustrated. Model A235 differs only in that pcb No. 41 is substituted for pcb No. 14 shown.

Fig. 7.6.6 A233 and A235 PCB Location

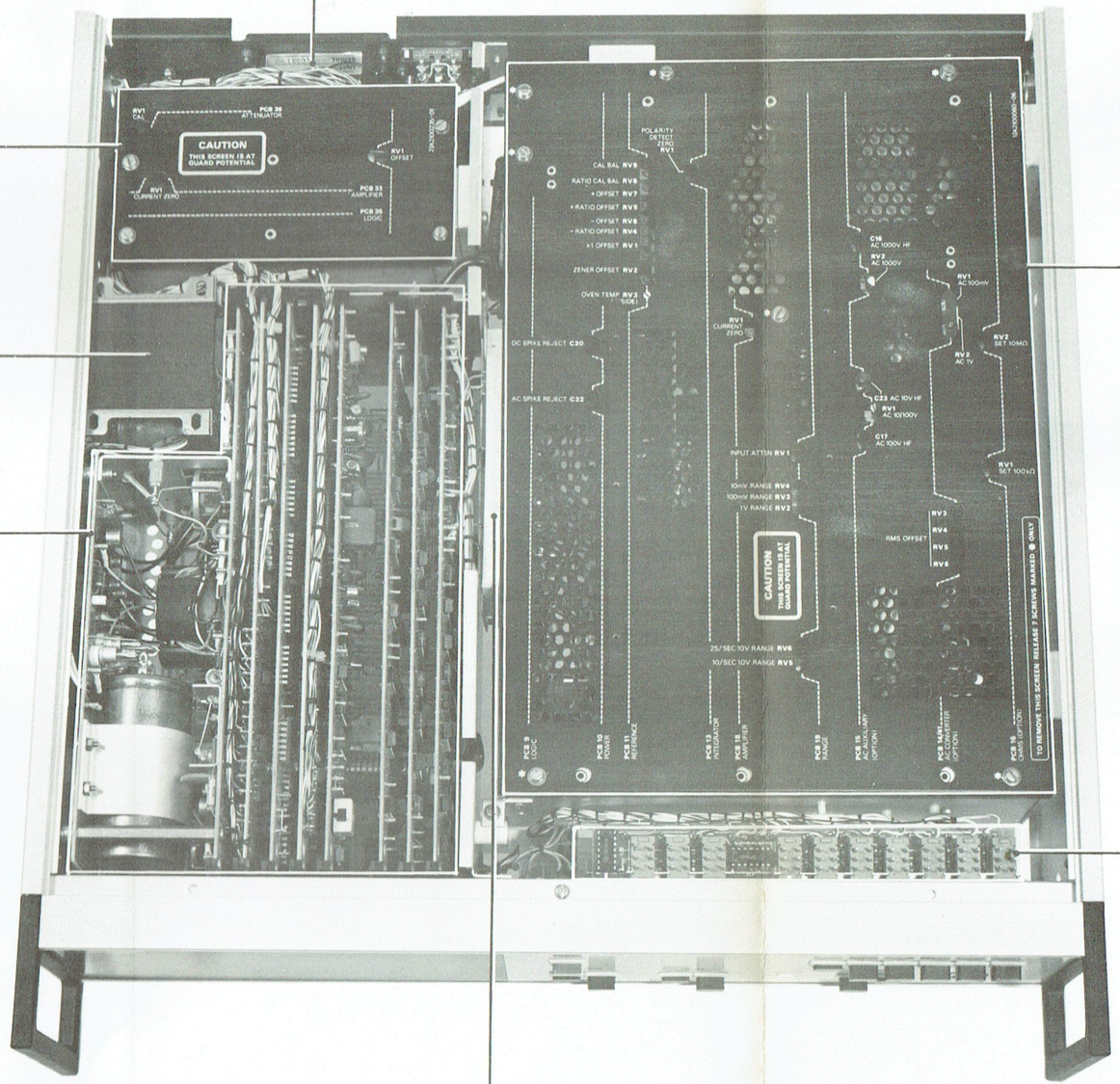
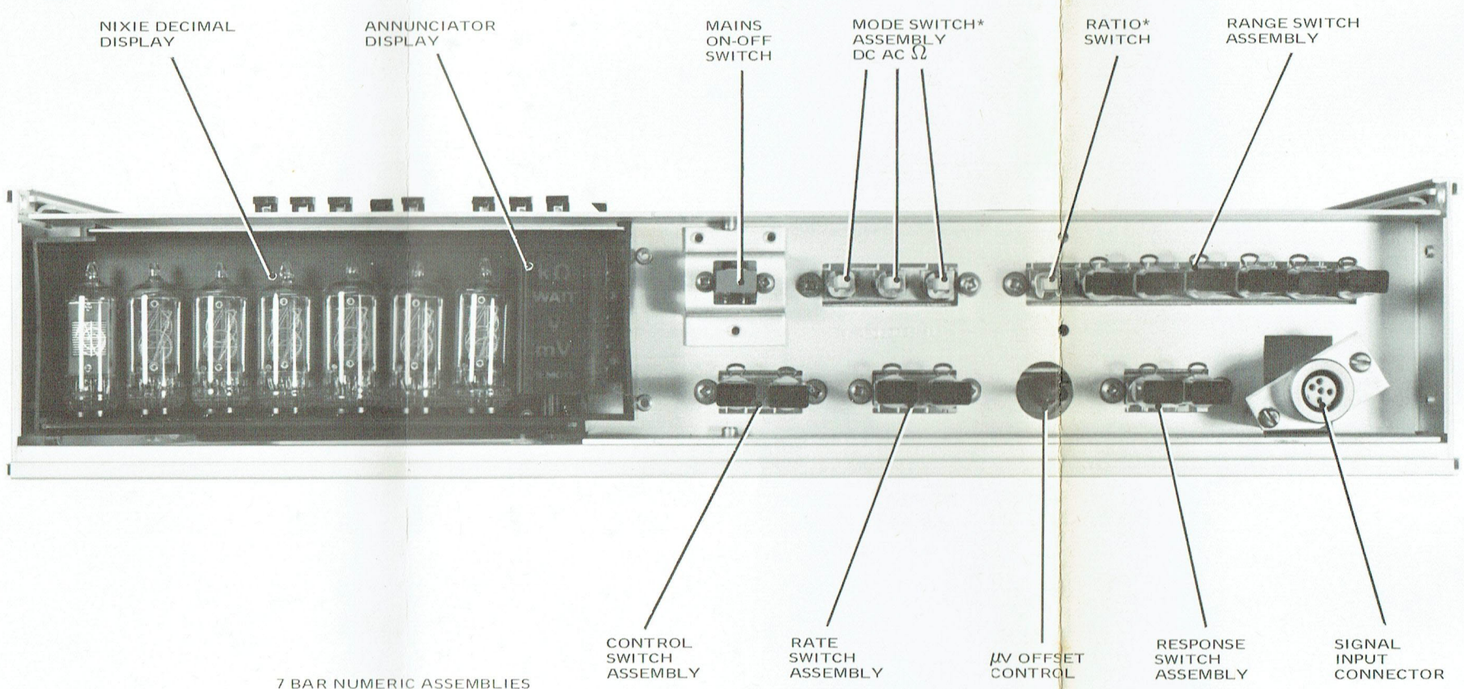
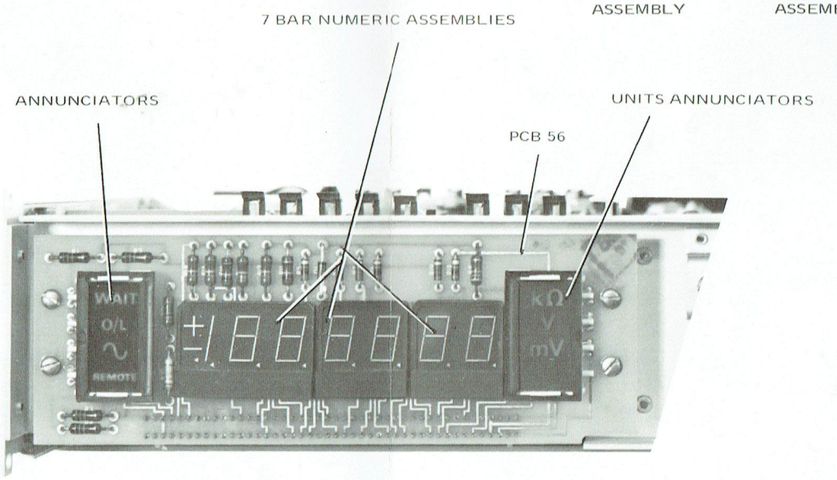


Fig. 7.6.7 Main Sub-assemblies

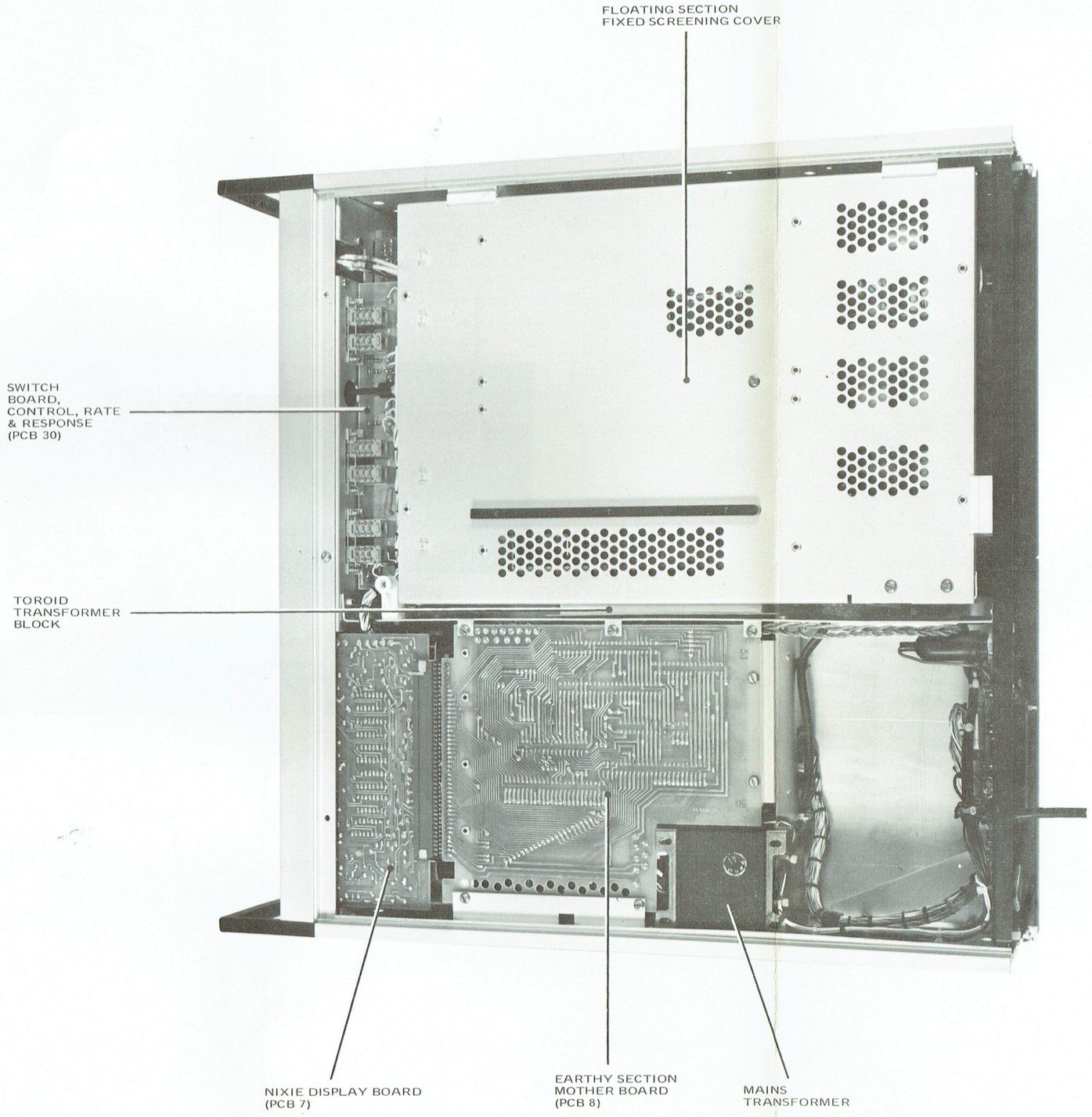




7 BAR DISPLAY

Note that all DVM types are fitted with complete switch assemblies as shown in this Fig. Front panels and knobs vary according to the DVM Type No.

Fig. 7.6.8 Front Panel Removed



Models with 7 bar displays use pcb No. 57 in place of No. 7 shown in this illustration.

Fig. 7.6.9 Bottom View of Instrument

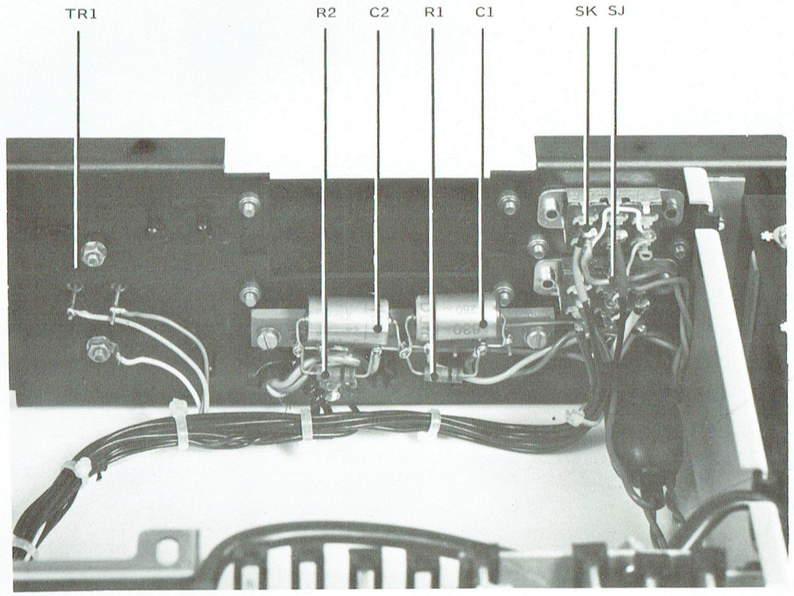
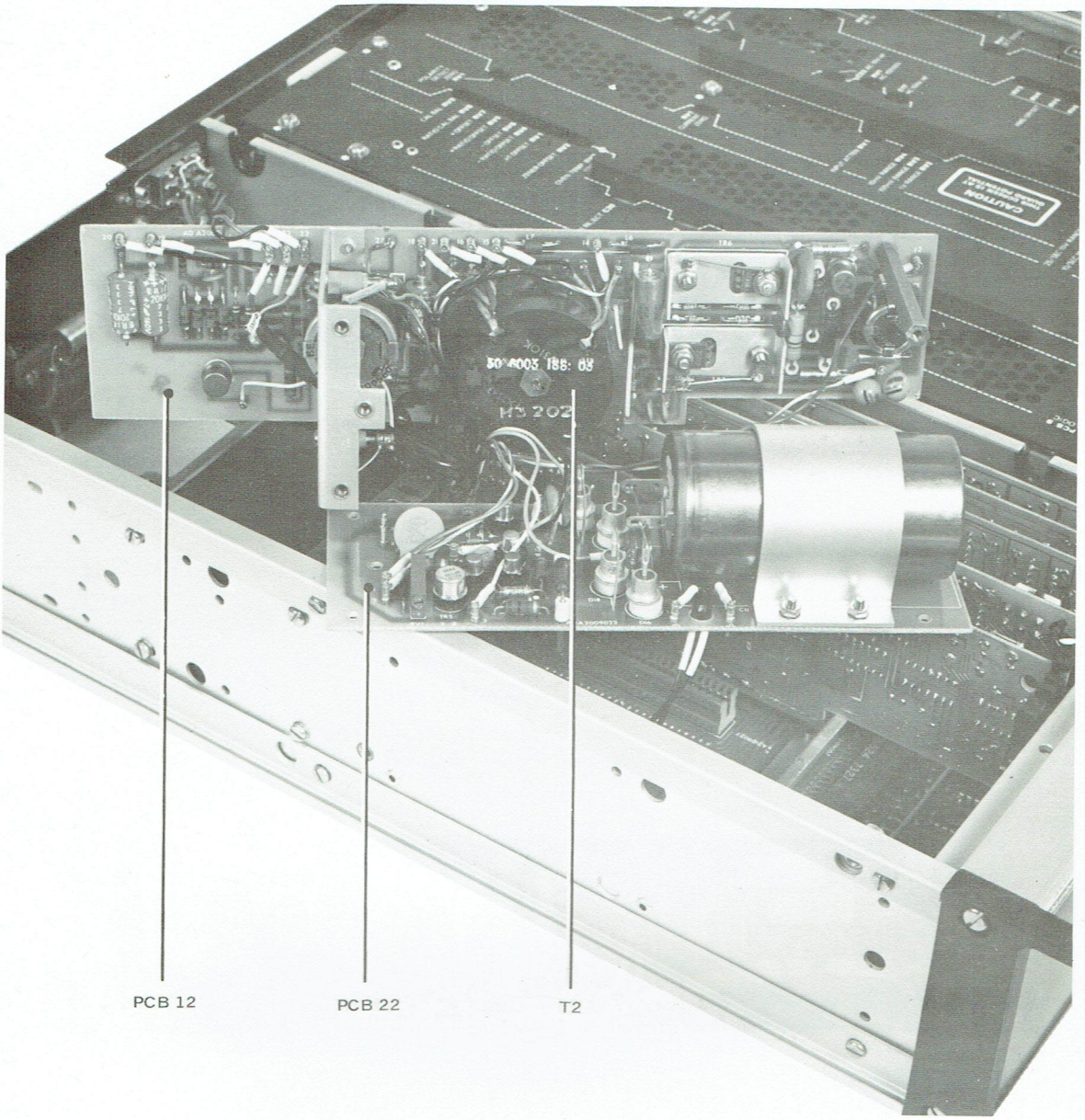


Fig. 7.6.10 Rear Panel Components



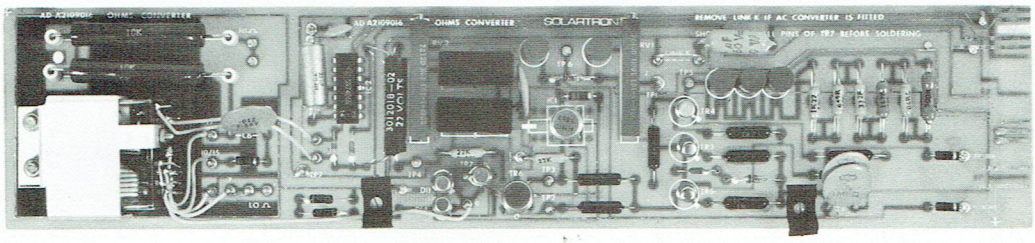
Removal of Earthy Section Power Supply

(a) Remove the 3 screws on the side of the chassis retaining boards 12 and 22.

(b) Withdraw and separate boarcs.

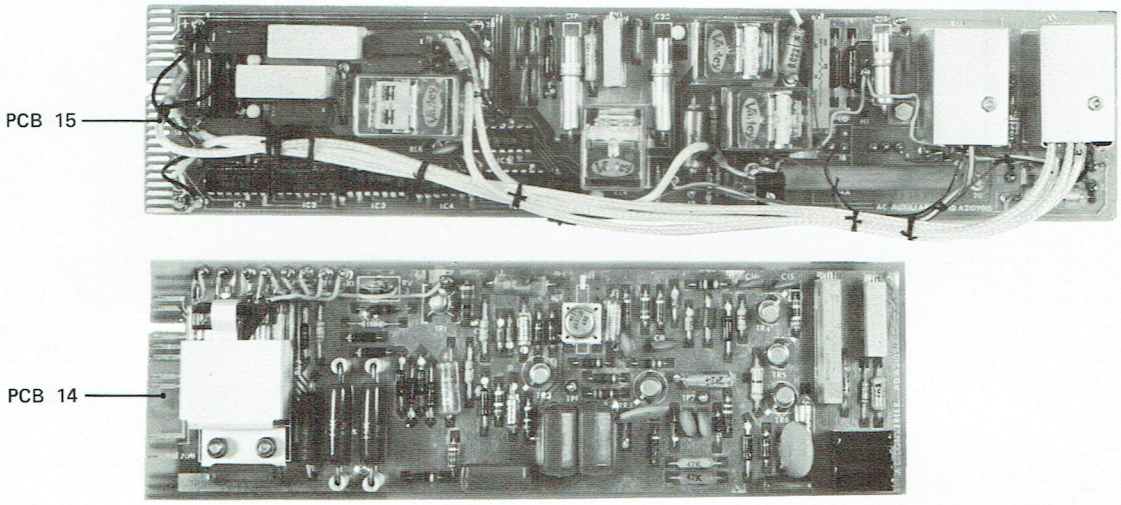
Fig. 7.6.11 Earthy Section Power Supply

OPTIONAL UNITS



The Ohms Unit consists of pcb 16 that is fitted to DVM types A212, A213 and A233.

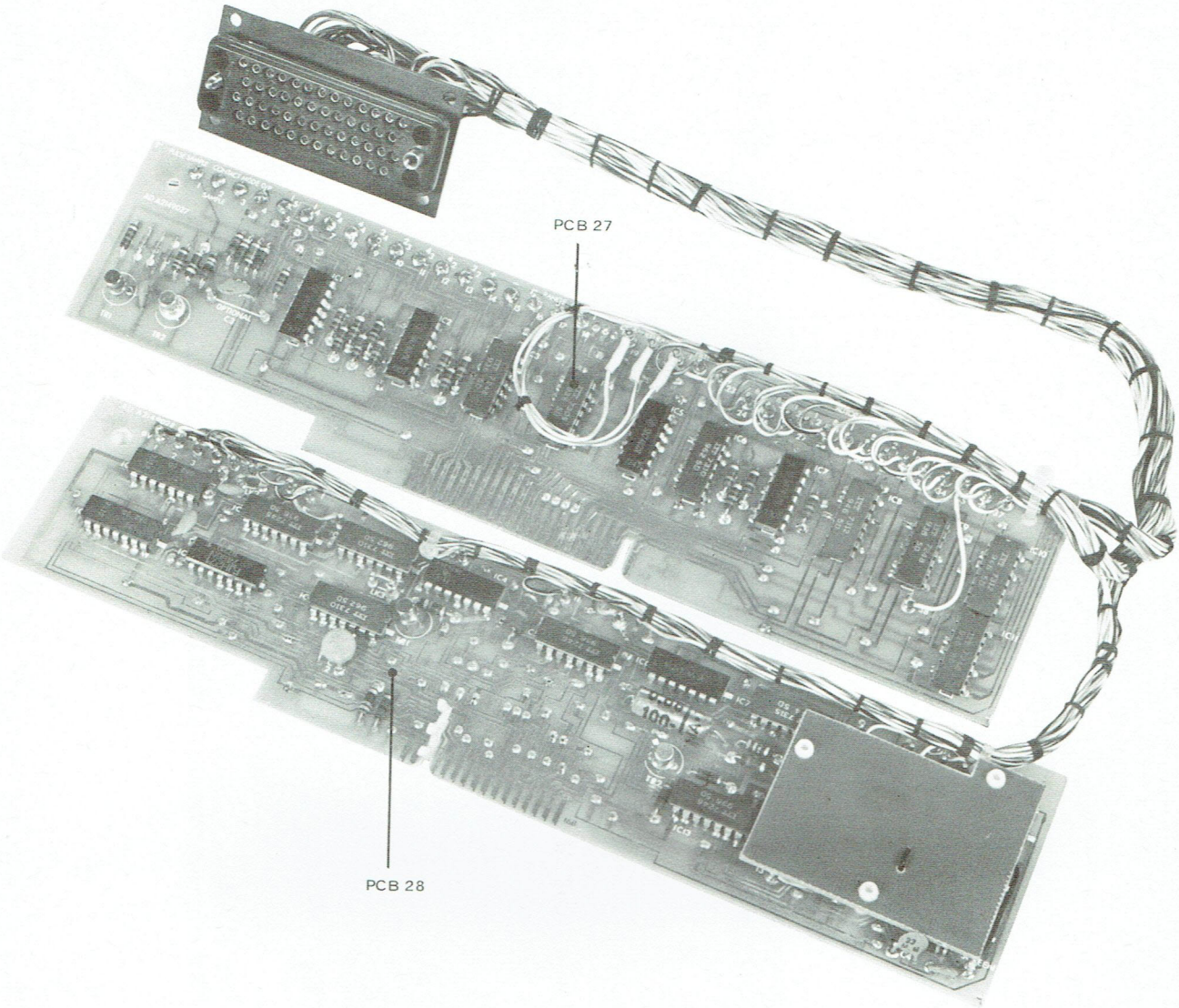
Fig. 7.6.12 Ohms Unit



This illustration shows the two boards that comprise the mean sensing unit as fitted to models A211, A213 and A233.

The true rms unit as fitted to models A215 and A235 use pcb No. 15 as shown, but pcb No. 14 is replaced by pcb No. 41, a layout diagram of which is shown on page 7.4.16.

Fig. 7.6.13 AC Unit



The A214 Fanout (Systems Interface) Unit consists of boards 27, 28 and a connector that can be fitted to all DVM types as shown in Fig. 7.6.15.

Fig. 7.6.14 A214 Fanout Unit.

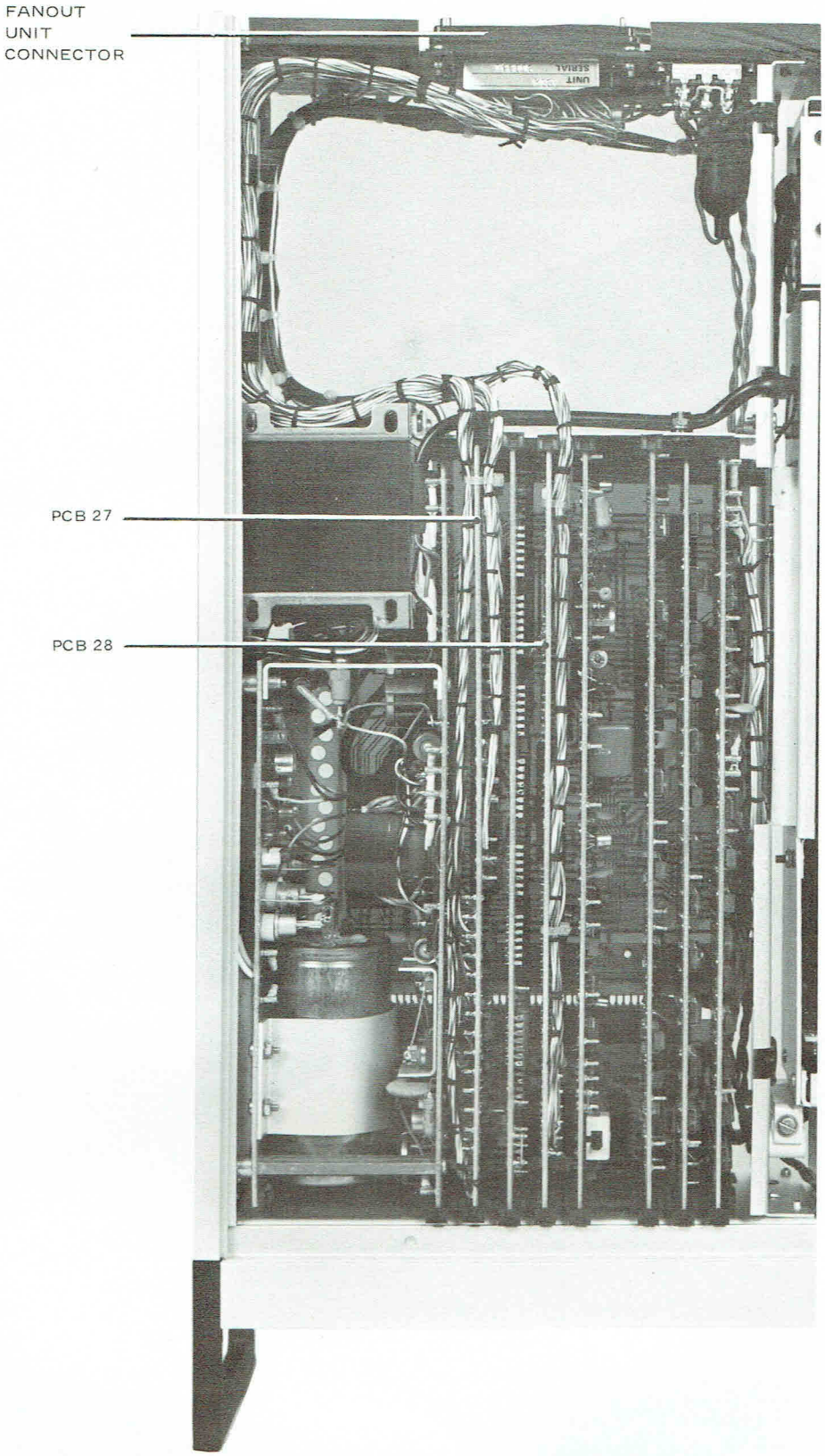
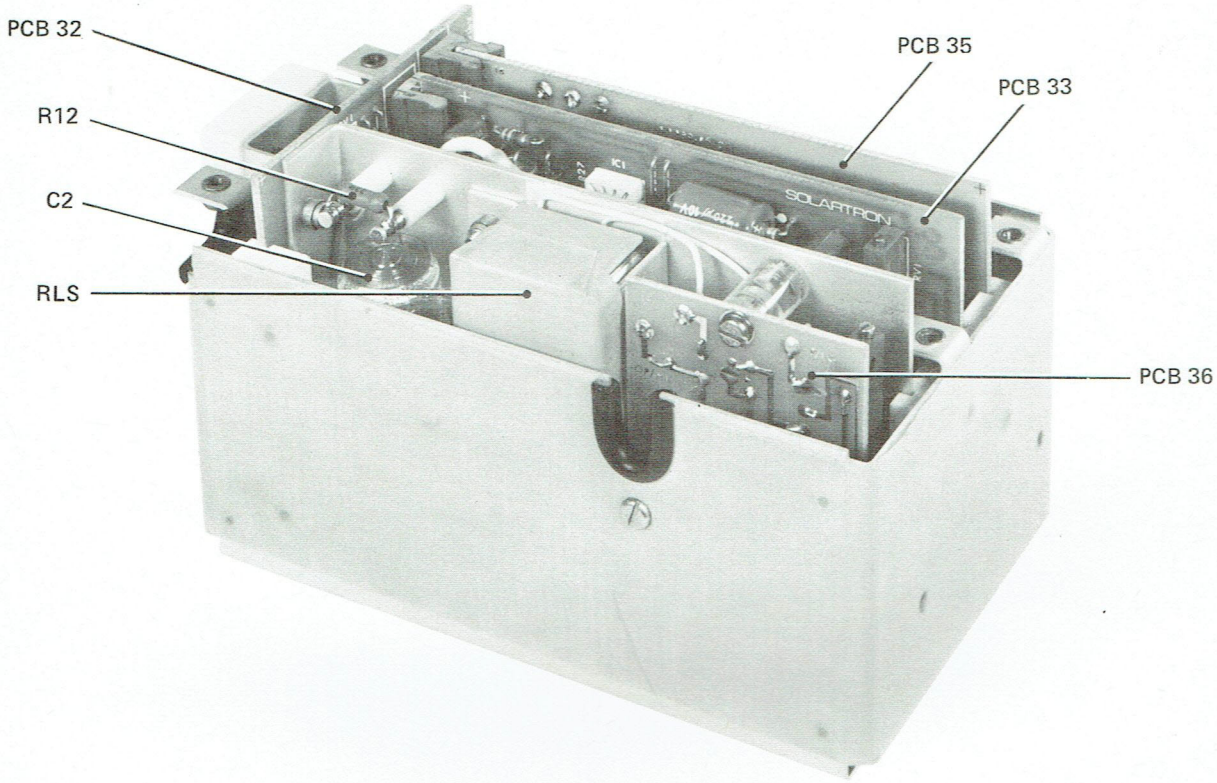


Fig. 7.6.15 Fanout Unit Location



The Ratio Unit consists of a separate chassis assembly that is fitted to DVM Types A230 and A233.

Fig. 7.6.16 A228 Ratio Unit.

SECTION 8 Test & Calibration Procedures

GENERAL

The following comprehensive test and calibration procedures are based on the factory production test specification and as such some of the instructions given in the initial calibration procedures (Sub-sections B to E) need not apply to instruments already in service. Also note that in the final calibration procedures (Sub-sections F to J) some of the result figure tolerances (e.g. ± 2 bits) given are more accurate than that required to meet the technical specifications given in Section 2.

The location of the calibration preset controls are shown on the Floating Section cover plate. These preset controls are identified in the appropriate functional drawings (Sub-section 7.3) to indicate the calibration adjustment required, if any, when an associated component is renewed.

CAUTION HIGH VOLTAGE STEP FUNCTIONS

If a high voltage step function, greater than 1000V dc or 800V ac, rms, is applied to the instrument a current surge occurs as the capacitance of the input lead is charged. The resultant transient voltage could exceed the overload rating of the instrument resulting in component failure.

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8.9	Fanout Unit, Reset Waveforms

SUB-SECTION 8A

TEST EQUIPMENT

1. DC CALIBRATION (ALL DVM TYPES)

Variac auto transformer

Mains isolation transformer

AC voltmeter e.g. AVO 8

Oscilloscope with a Y amplifier bandwidth of approximately 20kHz.

e.g. Tektronix 545A with 1A7A Module,

or Solartron CD1400 with CX1441, CX1442 and CX1443 Modules.

Thermocouple Thermometer, e.g. Comark Thermometer.

DC Calibrator, e.g. COHU 351, DC Voltage Standard.

DC Digital Voltmeter of at least 0.05% accuracy, and 10μV resolution, e.g. Solartron A220.

Kelvin Varley Divider, e.g. ES1 Dekavider RV622A (10kΩ).

10MΩ resistor

2. AC (MEAN SENSING) CALIBRATION (DVM TYPES A211, A213 AND A233) AC (TRUE RMS) CALIBRATION (DVM A215, A235)

AC Calibrator e.g. Hewlett Packard AC Calibrator 745A with a Hewlett Packard 1000V Amplifier 746A.

3. OHMS CALIBRATION (DVM TYPES A212, A213, A233)

Multimeter e.g. AVO 8

Decade Resistance Standard (to 1.11MΩ) e.g. ES1 RS624.

Resistance Standard, 10MΩ, of known value to an uncertainty of 0.005%.

Resistance Standard, 5MΩ, of known value to an uncertainty of 0.005%.

Resistance Standard, 1MΩ, of known value to an uncertainty of 0.005%.

Resistance Standard, 100kΩ of known value to an uncertainty of 0.003%.

Resistance Standard, 10kΩ of known value to an uncertainty of 0.01%.

Resistance Standard, 1kΩ of known value to an uncertainty of 0.03%.

4. RATIO CALIBRATION (DVM TYPES A230 AND A233)

10V dc supply

DC Voltage Standard and Kelvin Varley Divider as detailed in para. 1.

5. FANOUT UNIT (OPTIONAL UNIT APPLICABLE TO ALL DVM TYPES)

0 to 5V variable dc supply

Oscilloscope, as detailed in para. 1.

Voltmeter e.g. AVO 8

SUB-SECTION B

EARTHY SECTION INITIAL CALIBRATION

The tests detailed in paragraphs 1 and 2 are applicable to instruments that have had major power supply repairs.

1. PRECAUTIONS

(a) Check for short circuits on all power rails.

(b) Check that the wiring from the Inverter (pcb 12) to the Earthy Section Mother Board (pcb 8) is correct as shown in Drg. 20 of Sub-section 7-3.

2. MAINS REGULATION

(a) Switch OFF. Set the Mains Selector to 230V and check that a 500mA fuse is fitted. Connect the instrument to the mains supply via a Variac.

(b) Set the Variac to 0V and switch ON the variac and the instrument.

(c) Connect the test equipment DVM to pin 2 of pcb 22 and increase the Variac setting to 240V.

(d) Adjust RV1, pcb 22, for a reading of +20V ± 0.1V. Set the Variac to 0V.

(e) Use the two mains selector plates to check out the four mains settings as shown in the following table. Check that the +20V rail remains stabilised over the mains variation given in the table. Fit a 500mA fuse for 200 to 250V and 1A fuse for 98V to 130V.

Mains Selector Plate	Mains Supply
195V to 230V	200V to 230V
220V to 255V	220V to 250V
98V to 115V	98V to 115V
110V to 128V	110V to 130V

Reset the mains selector plate and insert the correct fuse to suit supply.

3. SUPPLY RAILS

(a) Connect the test equipment DVM to pin 2 of pcb 22 and adjust RV1, pcb 22, for a reading of +20V ± 0.1V.

(b) Check the rails for voltage and ripple limits as given in the following table:

Rail	Pin No. (pcb 22)	Voltage Limits	Ripple Limits
+5V	18	5V ± 0.5V	≯ 150mV p-p
+12V	13	12.5V ± 0.5V	≯ 150mV p-p
-12V	12	12.5V ± 0.5V	≯ 350mV p-p
+200V	19	210V ± 20V	≯ 2V p-p

4. CLOCK OSCILLATOR

(a) Measure the voltage between TP13 and TP8, pcb 4, and adjust C16 for a minimum reading, less than ± 0.2V.

(b) When a Fanout Unit is fitted command 100/sec rate remotely by connecting pin EE and pin r to pin HH on the fanout socket. Adjust RV1, pcb 4 for a minimum reading not less than 0.2V.

(c) Remove the connections from the connector and monitor the RESET waveform at TP2 pcb 4. Set the switch on pcb 4 to the 400Hz position and check the duration between successive -ve going edges of the waveform is approximately 800ms. Return the switch to the 50Hz position.

SUB-SECTION 8C

FLOATING SECTION INITIAL CALIBRATION

1. POWER SUPPLIES (FLOATING)

(a) Check the following rails for voltage and ripple:

Rail	PCB	Pin	With Reference to	Voltage	Ripple
+5V	10	TP4	TP5 (0V)	5V ± 0.25V	≯ 10mV p-p
+16V	10	TP3	TP5 (0V)	16.5V ± 2V	≯ 10mV p-p
-16V	10	TP6	TP5 (0V)	16.5V ± 2V	≯ 10mV p-p
+21V	10	TP2	TP5 (0V)	20V ± 1V	≯ 250mV p-p
+30V	10	TP1	TP5 (0V)	29V ± 2V	≯ 150mV p-p
-30V	10	TP7	TP5 (0V)	29V ± 2V	≯ 150mV p-p
+25V (AC&Ω)	20	+25V	0V AC	25V ± 2V	Not applicable to A210
-25V (AC&Ω)	20	-25V	0V AC	25V ± 2V	

2. INPUT AMPLIFIER

All Adjustments and test points are on pcb 18.

(a) Select LOCAL, DC, 10/SEC, 10V Range, SLOW, and fit an input lead to the DVM.

(b) Apply approximately +100mV from the COHU 351 (or other low impedance source) to TP3, adjusting RV2, for maximum amplitude waveform at TP2. This should be approximately 2V p-p. Remove the applied voltage.

(c) Check the spike amplitude at TP1 and adjust RV1 for an amplitude not greater than 2mV p-p.

(d) Check the voltage across C9. If greater than 1.8V, remove the link across R50.

3. INVERTER CHECKS

(a) Select DC, 10V range, FAST.

(b) Monitor the waveform on the 0V AC line (junction of C16, C17 pcb 10) with the oscilloscope earth lead on the 0V dc line (TP5 pcb 10) and adjust C22 pcb 10 for a minimum amplitude of inverter frequency.

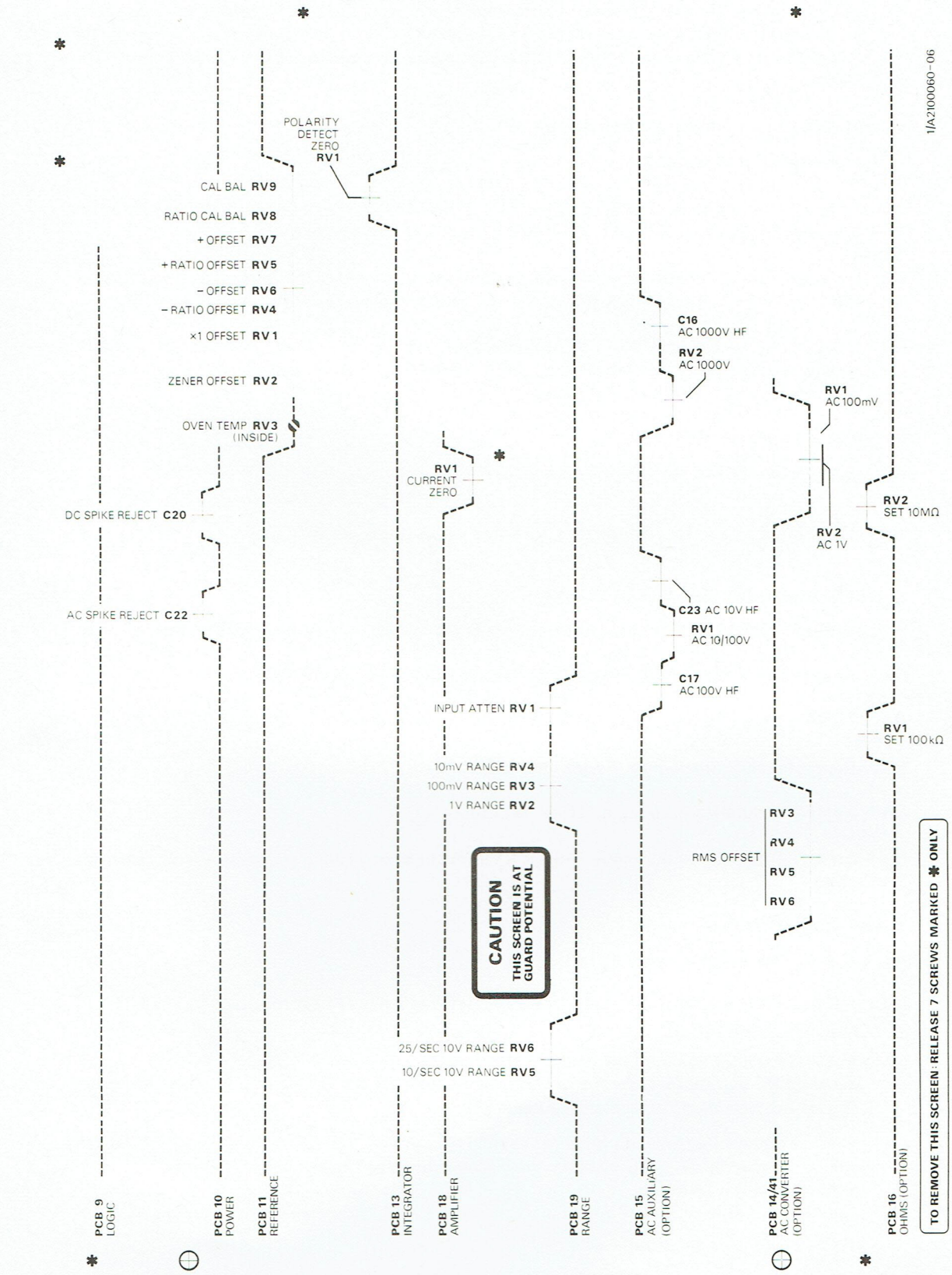

Fig. 8.1 Floating Section Cover.

(c) Transfer the oscilloscope input to TP1 pcb 18 and adjust C20 (pcb 10) for a minimum amplitude of inverter frequency.

(d) Using a double beam oscilloscope monitor the waveform at TP3 pcb 1 and the sync. waveform at TP8 pcb 10. The waveforms should be approx. in phase. It may be necessary to reverse the connections of the primary winding of the floating transformer to achieve the "in phase" condition.

4. OVEN AND REFERENCE AMPLIFIER

All functions are on pcb 11.

(a) If pcb 11 has not been pre-tested, RV4, RV5, RV6 and RV7 should be set fully anticlockwise. Check the oven space around D32 is filled with heatsink compound.

(b) Measure the oven temperature with the thermocouple probe (test equipment thermometer) in the oven test aperture. Adjust RV3 to set the oven temperature to $80^{\circ}C \pm 1^{\circ}C$.

(c) Using the test equipment dvm on $10\mu V$ resolution, measure the voltage between TP6 and TP9 (0V) and adjust RV2 for a minimum reading. Measure the voltage between TP10 and TP9, adjusting RV1 for a minimum reading.

5. INTEGRATOR OFFSET

(a) Select LOCAL, DC, 10/SEC, 10V RANGE, FAST.

(b) Short input Hi and Lo. Adjust RV1 for + and - signs displayed alternately.

6. OFFSET AND REFERENCE SUPPLIES

Using the COHU 351, DC Voltage Standard, carry out the following adjustment on pcb 11.

(a) Apply +1mV to the Input. Adjust RV7 for a reading of +10 bits.

(b) Apply -1mV to the Input. Adjust RV6 for a reading of -10 bits.

(c) Repeat (a) and (b) and para. 5 tests until all points are correct.

(d) Apply - 10.0000V to the Input. Note the reading.

(e) Apply + 10.0000V to the Input. Adjust RV9 for the same reading as obtained with negative input.

7. 10V RANGE CALIBRATION

(a) Select:- DC, 10/SEC., 10V Range, FAST.

(b) Adjust RV5 pcb 19 to its fully clockwise position and connect a shorting link between TP3 and TP4 of pcb 19.

(c) Apply -10.0000V and note the reading. By using the tables provided in Appendix 8.1 ascertain the pattern for links A to J and then set them up appropriately. Note that this test applies to a new board or to a repaired board.

(d) Remove the shorting link and bring the reading to exactly -10.0000V by adjustment of RV5, pcb 19. It may be necessary to make some slight adjustment to the links if the range of RV5 is not quite adequate.

(e) When a Fanout Unit is fitted command 25/SEC remotely by connecting pin EE on the fanout socket to pin HH. Command the 10V range by connecting pin p and m to pin HH. Select REMOTE on the front panel. Adjust RV6, pcb 19, for a reading of -10.000V. Remove connections from socket.

8. INPUT CURRENT AND ZERO CHECKS

(a) Select LOCAL, DC, 10/SEC, 100mV RANGE, SLOW.

(b) Ensure the Floating Box screen is fitted.

(c) Connect a 1MΩ resistor across Input Hi and Lo. Adjust RV1 pcb 18 for a minimum reading on the display.

(d) Connect the input lead. Short Input Hi to Lo. Select FAST and adjust "μV OFFSET" (RV1, front panel) for a reading of about +5μV. Check the noise on the display. The scatter should be not greater than 4 bits. Check that a swing of at least ± 10μV can be obtained by adjusting the μV OFFSET. Adjust the "μV OFFSET" for a zero reading.

(e) Recheck para. 6 OFFSET AND REFERENCE SUPPLIES making final adjustments where necessary. Recheck (c) above and reset RV1 if necessary to give a zero reading or 0 to 1 flicker on the 100mV range.

(f) Short circuit Input Hi to Lo and check the reading on 1V to 1000V Ranges is zero ± 1 bit.

(g) Select SLOW and check the reading on all ranges is zero ± 1 bit.

9. LINEARITY

(a) Repeat test 7 (d).

(b) Select LOCAL, DC, 10/SEC, 10V RANGE, FAST.

(c) Apply the voltage increments as shown in the table, on both polarities, checking the readings are within the limits given. Use a divider box type RV622A in conjunction with the voltage standard to obtain the necessary division accurately.

Input Positive and Negative	Limits
100μV to 1mV in 100μV steps	± 1 bit
100mV to 900mV in 100mV steps	± 1 bit
1V to 11V in 1V steps	± 1 bit
Check with 11.9000V	± 2 bits

10. RANGE CALIBRATION

CAUTION: **Observe the overload limits. Refer to the caution given at the front of this section.**

(a) Select SLOW.

(b) Apply the voltages shown in the following tables, using the COHU 351, and the RV622A for voltages below 10V, adjusting the potentiometers appropriate to each range for the correct reading. Check zero setting on the 100mV range with SLOW filter selected before making adjustments. Check that correct polarity, mV, V and decimal point are displayed.

Rate	Range	Input	Adjustment pcb 19	Reading
10/SEC	1V	+1.00000V	RV2	+1.00000V
10/SEC	100mV	+100.000mV	RV3	+100.000mV

(c) If a Fanout Unit is fitted select REMOTE on the front panel and command the 25/SEC rate by connecting pin EE to pin HH on the Fanout socket. Command the 10mV range by connecting pin n to pin HH and adjust RV4 as follows.

Rate	Range	Input	Adjustment pcb 19	Reading
25/SEC	10mV	+10.0000mV	RV4	+10.000mV

Note that the last decade is not displayed.

(d) Repeat the adjustments given in the table in (b) and (c) until all three readings are correct.

(e) Select 10/SEC rate (If Fanout Unit is fitted disconnect connections from pin HH) and complete the flowing checks.

Rate	Range	Input	Adjustment pcb 19	Reading
10/SEC	100V	+100.000V	RV1	+100.000V
10/SEC	1000V	+1000.00V		+1000.00V ± 10 bits

(f) Check all ranges on the negative polarity using the voltages indicated in the tables (b), (c) and (e), checking the difference in readings on the two polarities does not exceed 2 bits.

(g) Select FAST. Using a negative input voltage check the readings on ranges 100mV to 1000V at Full Scale are within ± 3 bits of the readings with Filter Slow.

11. If the instrument under test is fitted with Ohms and/or AC optional units carry out the initial Ohms and/or the initial AC calibration given in Sub-section 8D, 8E and 8L before proceeding to para. 12.

When both Ohms and AC options are fitted complete the Ohms tests before proceeding to the AC tests.

12. FUNCTIONAL CHECKS

(a) Select manual mode. Check the display reading does not change, with change of input voltage, until the manual button is pressed. Select 10/SEC mode.

(b) Check the correct decimal point and mV, V indications are obtained on all dc ranges.

(c) On DVM Types A211, A213, A215, A233, A235 select AC mode and check the correct decimal point, mV, and ~ indications are obtained on all ac ranges.

(d) On DVM Types A212, A213, A215, A233, A235 select Ω and check the correct decimal point and kΩ indications are obtained on all ohms ranges. The mV, V and ~ signs should all be extinguished. Select DC Mode. Select manual mode and filter slow.

(e) Check the WAIT sign is indicated when the instrument is sampled. Select 10/SEC.

(f) Check the overload indicator is illuminated when the display reading reaches 11.9999.

(g) Check the REMOTE sign is indicated when the remote button is selected.

(h) Check the correct polarity sign is indicated for the applied input polarity to the instrument.

13 AUTO RANGE CHECKS

(a) Select DC, AUTO, 10/SEC, FAST.

(b) Using a variable voltage supply check the instrument changes to a higher range when the reading exceeds 110,000 bits and to a lower range when the reading falls below 10,000 bits.

(c) Check the instrument finds the correct range when applying the voltages shown in the table below.

Input Voltage	90mV	900mV	9V	90V	500V
DVM Range	100mV	1V	10V	100V	1,000V

(d) On DVM Types A211, A213 and A233 select AC and AUTO and apply voltages as shown in the table (c) at 400Hz checking that the instrument finds the correct range. Perform the same test for DVM's Type A215 and A235 at 1kHz.

(e) On DVM Types A212, A213 and A233 check that the instrument finds the correct ohms range as shown in the following table.

Input Resistance	900Ω	9kΩ	90kΩ	900kΩ	9MΩ
DVM Range	1kΩ	10kΩ	100kΩ	1000kΩ	10000kΩ

(f) Select DC manual mode. Apply 500V and then press the sample button when the reading should be updated to 500V. N.B. The ranging relays should be heard to operate as soon as the 500V is applied and should not operate after the manual button is pressed.

Reduce the input to zero and then press the sample button. The instrument should now be on the 100mV range and the reading should be zero ± 20μV.

Note that in this case the ranging relays should not operate until after the manual button is pressed.

(g) Select Filter Slow and repeat check (f) above. The reading on the 100mV range should be zero ± 20μV.

(h) If a fanout unit is fitted select REMOTE on the front panel and command the 25/SEC rate by connecting pin EE to pin HH on the Fanout socket and repeat check (f) above. The reading on the 10mV range should be zero ± 20μV.

14. INPUT IMPEDANCE CHECKS

(a) Select:- DC, 10/SEC, SLOW.

(b) Check out the input impedance on the ranges given in the table, on both polarities. Use a 1MΩ resistor between the input voltage and input high lead and take the difference between the readings with and without the network.

DC Range	Input Voltage	Change In Reading
10V	10.0000V	± 10 bits
1V	1.00000V	± 10 bits
100mV	100.000mV	± 100 bits

15. SERIES MODE REJECTION

(a) Select LOCAL, DC, 10/SEC, SLOW.

(b) Connect the test equipment as shown in Fig. 8.2 and set the test switch to SERIES MODE.

(c) Apply the series mode mains frequency inputs to the DVM on the ranges shown in the following table; check the change in reading is not greater than ± 1 bit.

Mode	Range	Series Mode Input
10/SEC	10V	7V rms
10/SEC	1V	700mV rms
10/SEC	100mV	70mV rms

16. AC COMMON MODE REJECTION

(a) Select 100mV, DC, 10/SEC, FAST.

(b) Connect the test equipment as shown in Fig. 8.2 and set the test switch to COMMON MODE.

(c) Apply 7V rms at mains frequency to the DVM, checking that the change in reading is not greater than ± 1 bit.

(d) Select SLOW. Apply 230V at mains frequency to the DVM, checking that the change in reading is not greater than ± 1 bit.

17. DC COMMON MODE REJECTION

(a) Select 100mV DC, 10/SEC, SLOW.

(b) Connect the test equipment as shown in Fig. 8.3.

(c) Apply the 500V dc common mode voltage when the reading should be not greater than 10mV.

18. TEMPERATURE EFFECTS TESTS

(a) Select LOCAL, DC, 10/SEC, SLOW.

(b) Switch on and allow the DVM to stabilise for 2 hours at room ambient temperature.

(c) Using the appropriate test equipment apply the inputs as detailed in the following table and carry out the range and mode tests as specified. Use a frequency of 400Hz for the ac inputs.

Note the readings obtained at ambient temperature (column a).

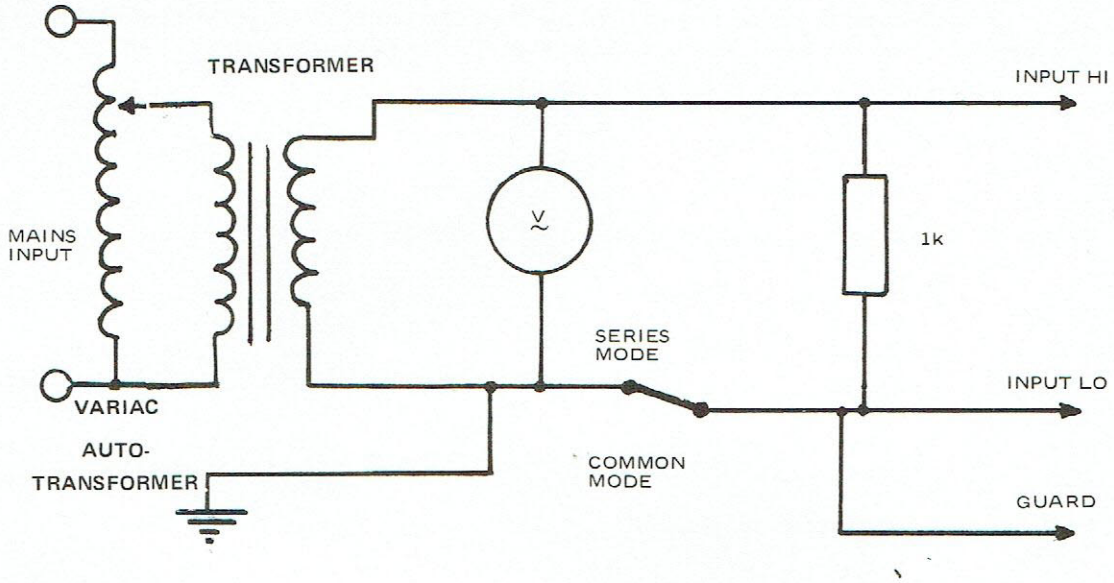

Fig. 8.2 AC Series and Common Mode Rejection

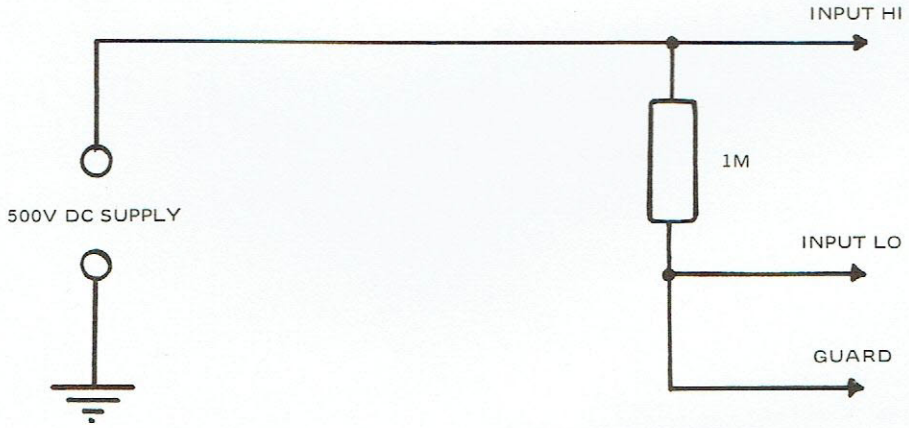

Fig. 8.3 DC Common Mode Rejection

(d) Insert the instrument into an oven at 45°C and allow it to stabilise for a period of two hours. Apply the same inputs again and note the readings taken at 45°C (column b).

(e) Take the difference between each set of readings. The diffference is to be not greater than that given in column c.

DVM Mode	Range	Input Conditions	(a) Ambient Check	(b) Oven Check	(c) Reading Change
DC (All DVM Types)	100mV	S/C Input			± 0.3μV/°C
	100mV	1MΩ			100μV total
	10V	Input ± 1mV			± 0.1 bit/°C
	100mV	-100.000mV			± 1 bit/°C
	1V	-1.00000V			± 1 bit/°C
	10V	± 10.0000V			± 1 bit/°C
	100V	-100.000V			± 1.5 bits/°C
	1000V	-1000.00V			± 1.5 bits/°C
AC at 400Hz (DVM Types A211, A213, A233)	100mV	100.000mV			± 5 bits/°C
	1V	1.00000V			± 5 bits/°C
	100V	100.000V			± 15 bits/°C
	1000V	750.00V			± 11 bits/°C
AC at 400Hz (DVM Types A215 and A235)	100mV	100.000mV			± 12.5 bits/°C
	1V	1.00000V			± 12.5 bits/°C
	100V	100.000V			± 17.5 bits/°C
	1000V	750.00V			± 13.5 bits/°C
OHMS (DVM Types A212, A213 A233)	10kΩ	10kΩ			± 2 bits/°C
	1000kΩ	1000kΩ			± 3 bits/°C

SUB-SECTION 8D

OHMS INITIAL CALIBRATION

(APPLICABLE TO DVM TYPES A212, A213, A215, A233 AND A235)

GENERAL

The instrument should be tested to Sub-section B and to para. 10 of Sub-section C before commencing these tests.

1. BOARD 16

(a) Remove the top screening cover of the floating box assembly and check that pcb 16 is fitted and correctly wired to the input socket as shown in Drg. 5, Functional Drgs, Section 7.3.

It will be necessary to use the standard 4 terminal lead for the ohms tests in order to minimise the effect of lead termination resistance, as the sensitivity on the 1kΩ range is 0.01Ω/bit.

2. INVERTER REJECTION

(a) Monitor TP1, pcb 18, with an oscilloscope and adjust C20, pcb 10, for minimum amplitude of inverter frequency.

3. REFERENCE VOLTAGE ADJUSTMENT

(a) Select OHMS, 10kΩ, 10/SEC, LOCAL, FAST.

(b) Link TP1 to TP5 on pcb 16. Connect a resistance of 10kΩ ± 0.01% across the DVM signal input and note the reading on the display. The polarity indicator should be positive. Refer to the table given in Appendix 8.2 and set up the link pattern on links A to H for the particular reading obtained and then remove the link between TP1 and TP5. Note that this test only applies to new boards or boards that have been repaired.

4. ZENER STABILITY

(a) With the 10kΩ resistance still connected note the reading on the display. Adjust slightly RV1 on pcb 22 to change the +20V rail by ± 0.5V checking the reading on the display does not change by more than ± 10 bits. Reset the +20V rail with RV1 pcb 22.

5. CURRENT ADJUSTMENTS

(a) Select the 100kΩ range. Change the external resistance to one of known value to within ± 0.003% and near to 100kΩ and adjust RV1 pcb 16 until the display indicates the value of the resistance. It may be necessary to slightly modify the link pattern if the range of RV1 is inadequate.

(b) Select the 1,000kΩ range and Filter SLOW. Change the external resistance to one of known value to within ± 0.003% and near to 1MΩ and adjust RV2 pcb 16 until the display indicates the value of the resistance.

(c) Repeat (a) and (b) above until both the ranges are correct.

6. ZERO CHECK

(a) Select LOCAL, DC, 10/SEC, 100mV, SLOW.

(b) Short input Hi to Lo and set the μV OFFSET control for zero reading.

(c) Check that the reading on all of the OHMS ranges is zero ± 1 bit.

7. OVERLOAD CHECKS

(a) Select OHMS, 10/SEC, LOCAL, 1,000kΩ, FAST.

(b) Using an Avometer or other isolated voltmeter monitor the voltage across D11 pcb 16. Apply an input of 200V to the input leads with the Hi lead to the positive side of the supply and check the voltage across D11 is approximately 16V. Reverse the polarity of the 200V supply when the voltage across D11 should be approximately 1V.

8. RANGE ACCURACY AND LINEARITY

(a) For this test use a resistance decade box type ES1 RS624 or one of similar accuracy. Select the resistance values as shown in the table, checking the readings are within the limits given. For the 1,000kΩ range, use precision resistance of known value to within ± 0.005% and near to the value indicated. Select filter slow for 100kΩ and 1,000kΩ range.

DVM Range	Resistance Standard	Limits
1k	1k	± 10 bits
	0.8k	± 8 bits
	0.6k	± 6 bits
	0.4k	± 4 bits
	0.2k	± 2 bits
10k	10k	± 10 bits
	8k	± 8 bits
	6k	± 6 bits
	4k	± 4 bits
	2k	± 2 bits

DVM Range	Resistance Standard	Limits
100k	100k	± 10 bits
	80k	± 8 bits
	60k	± 6 bits
	40k	± 4 bits
	20k	± 2 bits
1000k	1000k	± 10 bits
	800k	± 8 bits
	600k	± 6 bits
	400k	± 4 bits
	200k	± 2 bits

SUB-SECTION 8E

AC (MEAN SENSING) INITIAL CALIBRATION
(APPLICABLE TO DVM TYPES A211, A213 AND A233)

The instrument should be tested to Sub-section B and to para. 10 of Sub-section C before commencing these tests.

Remove the top screening cover from the Floating Box assembly and check the two pcbs 14 and 15 are fitted and correctly wired to the input socket. Set RV3 pcb 14 to its mid position.

A voltage standard HP745A/746A should be used for all calibration checks. The 745A voltage standard and instrument should have been switched on for a period of at least 1 hour.

1. INVERTER REJECTION

(a) Select AC, LOCAL, 100mV RANGE, FAST.

(b) Monitor TP1, pcb 18 with an oscilloscope and adjust C20 pcb 10, for minimum amplitude of inverter frequency.

2. LINEARITY

(a) Select AC, 1V RANGE, FAST.

(b) Apply 1V at 400Hz and adjust RV2, pcb 14, for a reading of 1.00000V ± 10 bits.

(c) Reduce the input to 0.1V and adjust RV3 pcb 14 for a reading of 0.10000 ± 2 bits.

(d) Repeat (b) and (c) above until both readings are correct. Refit the top cover to the floating box.

3. ZERO CHECKS

Connect input Hi to Lo and check the readings on the 1V, 100V and 1000V ranges do not exceed 5 bits. Check the readings on the 100mV and 10V ranges do not exceed 15 bits.

In all cases allow some short time for the reading to run down to its final minimum value.

4. BASIC RANGE CALIBRATION AND FREQUENCY CHECK

(a) Feed in 0.1V at 400Hz on the 100mV range and adjust RV1 pcb 14 for a reading of 100.000mV ± 10 bits.

(b) Change the frequency to 20kHz when the reading should be 100.000mV ± 50 bits.

(c) Change the frequency to 100kHz when the reading should be 100.000mV ± 300 bits.

(d) Select SLOW. Change the frequency to 40Hz when the reading should be 100.000mV ± 60 bits.

5. 100V RANGE CALIBRATION

(a) Select SLOW.

(b) Feed in 100V at 400Hz on the 100V range and adjust RV1 pcb 15 for a reading of 100.000V ± 10 bits.

(c) Change the frequency to 20kHz and adjust C17 pcb 15 for a reading of 100.000V ± 10 bits. Note it may be necessary to short links A, B or C to bring this range into calibration if the initial range of C17 is inadequate.

(d) Repeat (b) and (c) above until both readings are correct.

6. 10V RANGE CALIBRATION

(a) Select SLOW.

(b) Apply 10V at 400Hz on the 10V range when the reading should be 10.000V ± 15 bits.

(c) Change the frequency to 20kHz and adjust C23 pcb 15 for a reading of 10.0000V ± 10 bits. It may be necessary to modify link D to obtain the correct range of C23.

(d) Change the frequency to 10kHz when the reading should be 10.0000V ± 60 bits.

7. 1000V RANGE CALIBRATION

(a) Select SLOW.

(b) Apply 500V at 400Hz on the 1000V range and adjust RV2 pcb 15 for a reading of 500.00V ± 20 bits.

(c) Change the frequency to 20kHz and adjust C16 pcb 15 for a reading of 500.00V ± 20 bits.

(d) Repeat (b) and (c) until both readings are correct.

(e) Apply 100V at 40Hz when the reading should be 100.00V ± 16 bits.

SUB-SECTION 8F

DC FINAL CALIBRATION

1. TEST EQUIPMENT

DC Bridge Potentiometer 0.001%	e.g. Cambridge Type 44248
Temperature Controlled Standard Cell Bank	e.g. Guildline 9152T/4
Volts Ratio Box	e.g. Sullivan T2100
DC Voltage Standard, 0.003%	e.g. COHU 351

The test equipment interconnection is shown in Fig. 8.4.

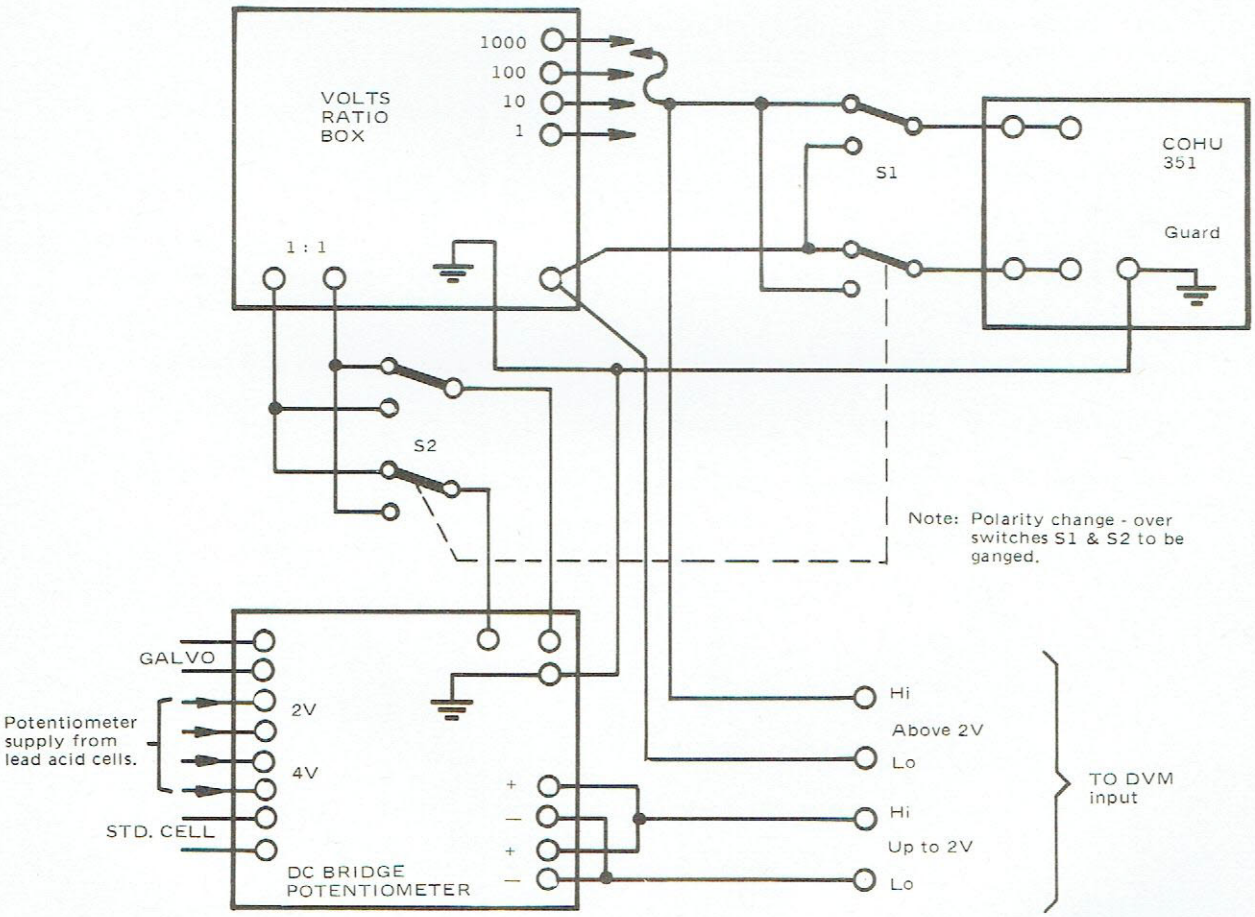

Fig. 8.4 DC Final Calibration Test Circuit

The equipment must be thoroughly stabilised at 20°C ± 1°C and must be operated, maintained and records kept in accordance with Standards Room Procedures.

The Volts Ratio Box and Standard Cell Bank should have valid certificates of calibration and values traceable to a National Calibration Authority.

The instrument should have been switched on for at least two hours in a 20°C (± 1°C) ambient, stable to 0.5°C.

2. FINAL DC CALIBRATION AT 20°C

(a) Select DC, 10/SEC, 100mV, LOCAL, SLOW.

(b) Connect a 1MΩ resistance across the input Hi and Lo and adjust RV1 pcb 18 for minimum reading.

(c) Connect input Hi to Lo. Adjust the μV offset control on the front panel to give a zero reading or 0 to 1 flicker.

(d) Select the 10V range. Adjust RV1 pcb 13 if necessary to provide the point where the positive and negative signs are being alternatively displayed.

(e) Apply +1mV and adjust RV7 pcb 11 for a reading of +10 bits.

(f) Change the input to -1mV and adjust RV6 pcb 11 for a reading of -10 bits.

(g) Apply -10.0000V and adjust RV5 pcb 19 for a reading of -10.0000V.

(h) Apply +10.0000V and adjust RV9 pcb 11 for a reading of +10.0000V.

(j) Apply +1.00000V on the 1V range and adjust RV2 pcb 19 for a reading of +1.00000V.

(k) Select the 100mV range. Check the reading is zero with zero input applied. Feed in +100.000mV and adjust RV3 pcb 19 for a reading of +100.000mV.

(l) Repeat sections (j) and (k) until all ranges are correct, there is some interaction between the range potentiometers.

(m) Select the 100V range and apply +100.000V. Adjust RV1 pcb 19 for a reading of +100.000V.

(n) Apply the voltages on the appropriate ranges as shown in the following table checking that the readings lie within the specified limits.

Response	DC Range	Input	Reading Limits
		+10.0000V	± 2 bits
		+5.0000V	± 2 bits
FAST	10V	-5.0000V	± 2 bits
		-10.0000V	± 2 bits

Response	DC Range	Input	Reading Limits
		+1.00000V	± 2 bits
		+0.50000V	± 2 bits
FAST	1V	-0.50000V	± 2 bits
		-1.00000V	± 2 bits
		+100.000mV	± 2 bits
		+50.000mV	± 2 bits
SLOW	100mV	-50.000mV	± 2 bits
		-100.000mV	± 2 bits
		+100.000V	± 2 bits
		+50.000V	± 2 bits
FAST	100V	-50.000V	± 2 bits
		-100.000V	± 2 bits
		+1000.00V	± 2 bits
		+500.00V	± 2 bits
FAST	1000V	-500.00V	± 2 bits
		-1000.00V	± 2 bits

SUB-SECTION 8G

OHMS FINAL CALIBRATION

(APPLICABLE TO DVM TYPES A212, A213, A215, A233 AND A235)

1. TEST EQUIPMENT

The resistance standards detailed must be thoroughly stabilised at 20°C ± 1°C. The DVM should have been switched on for at least 2 hours in a 20°C (± 1°C) ambient and the DC FINAL CALIBRATION (Sub-section 8F) completed.

2. FINAL OHMS CALIBRATION PROCEDURE AT 20°C

(a) Connect the input Hi to Lo. Adjust the μV offset control on the front panel to give a zero reading or 0 to 1 flicker on the 100mV dc range.

(b) Select OHMS, 10/SEC, LOCAL, 100kΩ, FILTER SLOW.

The resistances required for the following checks need to be known to an accuracy of ± 0.003% at 20°C. For the 10,000kΩ range use precision resistances of known values to within ± 0.005%.

(c) Connect a resistance of 100kΩ between input Hi and Lo and adjust RV1 pcb 16 until the display indicates the value of the resistance.

(d) Select the 1,000kΩ range. Change the resistance to 1MΩ and adjust RV2 pcb 16 until the display indicates the value of the resistance.

(e) Repeat (c) and (d) above until both readings are correct.

Using the resistance decade box ESI RS624 select the resistance values shown in the table, checking the readings are within the limits given. For the 10,000kΩ range use precision resistances of known values to within ± 0.005%.

Range	Ext. Resistance	Limits
	1kΩ	± 8 bits
1kΩ	0.5kΩ	± 4 bits
	0.1kΩ	± 1 bit

Range	Ext. Resistance	Limits
	10kΩ	± 8 bits
10kΩ	5kΩ	± 4 bits
	1kΩ	± 1 bit
	100kΩ	± 8 bits
100kΩ	50kΩ	± 4 bits
	10kΩ	± 1 bit
	1MΩ	± 8 bits
1,000kΩ	500kΩ	± 4 bits
	100kΩ	± 1 bit
	10MΩ	± 30 bits
10,000kΩ	5MΩ	± 15 bits
	1MΩ	± 3 bits

SUB-SECTION 8H

AC (MEAN SENSING) FINAL CALIBRATION
(APPLICABLE TO DVM TYPES A211, A213 AND A233)

Carry out the following tests at 20°C after completion of the DC calibration (Sub-section 8F) of the instrument.

1. ZERO SETTING

(a) Connect the input Hi to Lo. Adjust the μV offset control on the front panel to give a zero reading or 0 to 1 flicker on the 100mV dc range.

2. VOLTAGE LINEARITY CHECK

(a) Select AC, SLOW, 1V RANGE.

(b) Apply 1V at 400Hz and adjust RV2 pcb 14 for a reading of 1.00000V ± 5 bits.

(c) Reduce the input to 0.1V and adjust RV3 pcb 14 for a reading of 0.10005V ± 2 bits.

(d) Repeat (b) and (c) above until both readings are correct.

(e) Check out the linearity on the 1V range as indicated in the table below.

AC Input	0.80000V	0.60000V	0.40000V	0.20000V
Reading Limits	0.80000V ± 5 bits	0.60000V ± 5 bits	0.40000V ± 5 bits	0.20002V ± 4 bits

3. FINAL ADJUSTMENTS ON ALL RANGES

(a) Select AC, SLOW.

(b) Carry out the adjustments in the following table in sequence. Note the application of 500V on the 1000V range results in a power dissipation in the 1MΩ input attenuator of 0.25W. The temperature coefficient of the resistor is such that the heating effect of the input power will result in the instrument calibration changing slightly as the resistor temperature increases.

Thus after applying the 500V input allow about 5 minutes for the instrument reading to stabilise at a final value.

Similarly when returning to the 10V or 100V ranges it will be necessary to allow a similar resettling time.

Sequence	Range	Input	Frequency	Adjustment	Limits
(a)	100mV	0.10000V	400Hz	RV1 pcb 14	± 5 bits
(b)	100V	100.000V	400Hz	RV1 pcb 15	± 10 bits
(c)	100V	100.000V	20kHz	C17 pcb 15	± 10 bits
(d)	Repeat (b) and (c)				
(e)	10V	10.0000V	400Hz		± 15 bits
(f)	10V	10.0000V	20kHz	C23 pcb 15	± 10 bits
(g)	Repeat (c) and (f)				
(h)	1000V	500.00V	400Hz	RV2 pcb 15	± 20 bits
(j)	1000V	500.00V	20kHz	C16 pcb 15	± 20 bits
(k)	Repeat (e) and (f)				

4. FREQUENCY RESPONSE CHECKS ON ALL RANGES

(a) Select SLOW.

(b) Apply the following voltages at the frequency indicated checking the readings are within the limits shown.

AC Range	AC Input	Frequency	Limits
	0.1V	40Hz	± 70 bits
	0.1V	2.5kHz	± 20 bits
	0.1V	10kHz	± 30 bits
100mV	0.1V	20kHz	± 60 bits
	0.1V	50kHz	± 200 bits
	0.1V	100kHz	± 400 bits
	0.01V	100kHz	± 100 bits
	0.01V	20kHz	± 12 bits
	1V	40Hz	± 60 bits
	1V	2.5kHz	± 20 bits
	1V	5kHz	± 30 bits
1V	1V	20kHz	± 60 bits
	1V	50kHz	± 200 bits
	1V	100kHz	± 400 bits
	0.1V	100kHz	± 100 bits
	0.1V	20kHz	± 12 bits

AC Range	AC Input	Frequency	Limits
	10V	40Hz	± 70 bits
	10V	2.5kHz	± 50 bits
	10V	5kHz	± 50 bits
10V	10V	20kHz	± 60 bits
	10V	50kHz	± 200 bits
	10V	100kHz	± 400 bits
	1V	100kHz	± 100 bits
	1V	20kHz	± 12 bits
	100V	2.5kHz	± 50 bits
	100V	10kHz	± 80 bits
	100V	20kHz	± 60 bits
100V	100V	50kHz	± 200 bits
	100V	100kHz	± 400 bits
	10V	100kHz	± 100 bits
	10V	20kHz	± 15 bits
	100V	40kHz	± 16 bits
	100V	20kHz	± 12 bits
	100V	100kHz	± 110 bits
	500V	50kHz	± 150 bits
1000V	500V	40kHz	± 100 bits
	500V	20kHz	± 30 bits
	500V	10kHz	± 40 bits
	500V	2.5kHz	± 20 bits

SUB-SECTION 8J

A228 RATIO UNIT (APPLICABLE TO DVM TYPES A230, A233 AND A235)

These tests are to be carried out after the completion of the DC Final Calibration (Sub-section 8F).

INITIAL CALIBRATION

1. RELAY DRIVE WAVEFORMS

(a) Select RATIO, 10/SEC, LOCAL, DC.

(b) Using a double beam oscilloscope monitor the STAT 1 signal at TP7, pcb 3, on one trace and trigger from the +ve edge of this waveform. Using the second trace monitor in turn the waveforms at TP1 and TP2 on pcb 35 checking they are approximately as shown in Fig. 8.6. Connect the oscilloscope earth to TP3 pcb 35.

(c) Release the RATIO button when TP1 and TP2 should be at approximately +20V.

2. INPUT CURRENT

(a) Link the red and black reference terminals together and select the RATIO mode. Monitor the voltage level at the output of the ratio amplifier, between the two pins in the middle of the mother pcb 36, with a dvm of sensitivity 100μV/bit.

(b) Release the RATIO button when the reading will be seen to increase or decrease about the previous value.

(c) Adjust RV1 pcb 33 until the rate of change in this voltage is at a minimum.

(d) If the amplifier output level should go outside the range of ± 0.1V whilst making the adjustment press the RATIO button, release it again and then readjust with RV1, pcb 33.

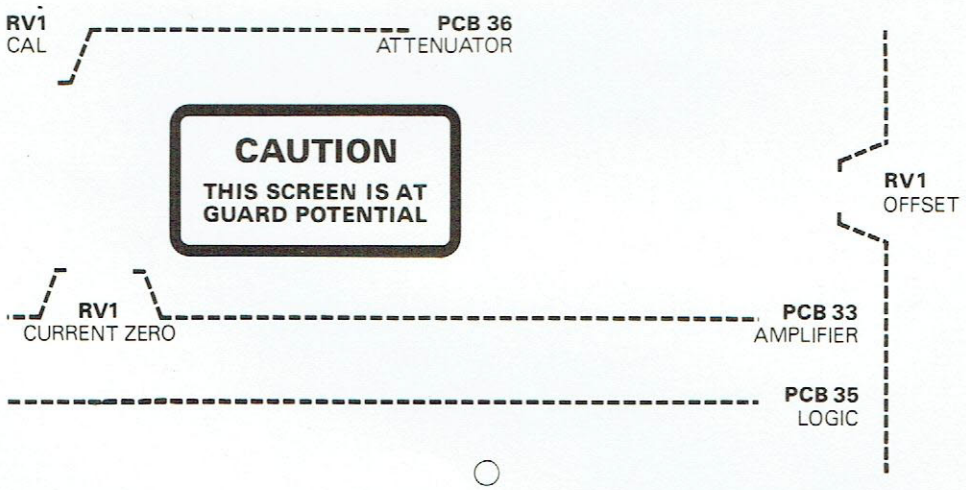

Fig. 8.5 Ratio Unit Cover

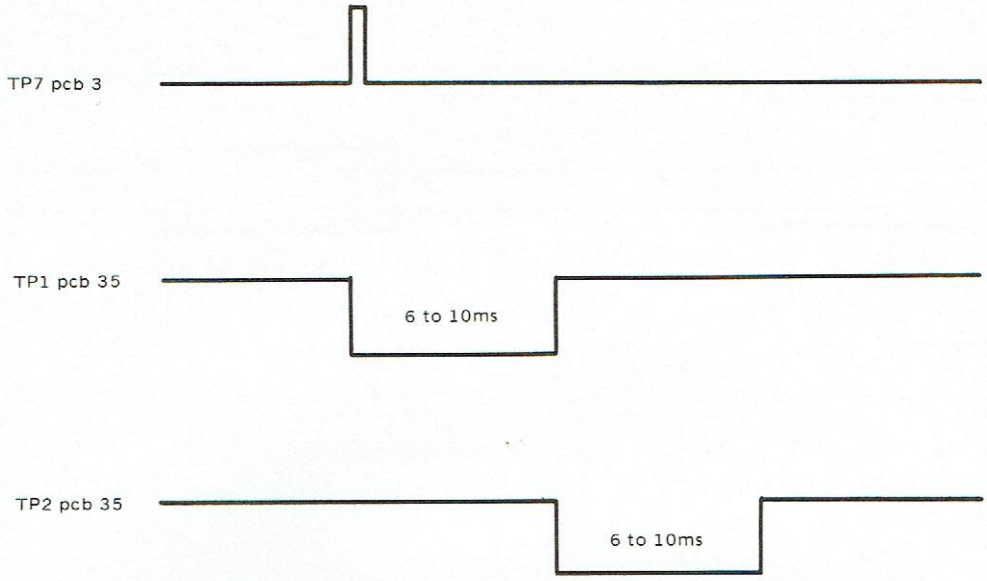

Fig. 8.6 Ratio Unit, Relay Drive Waveforms

3. RATIO CALIBRATION SUPPLY

(a) For the calibration in paragraphs 5, 6, 7 and 8 use a voltage standard type COHU 351 and Divider Box type RVB22A or similar, connected as shown in Fig. 8.7. Reversal of the dvm input voltage should be carried out by changing over the connections between the voltage standard and divider box.

4. OFFSET ADJUSTMENTS

(a) Select DC, RATIO, 10V RANGE.

(b) Connect +10.0000V to the remote reference terminals.

(c) Connect +1mV to the dvm input and adjust RV5 pcb 11 for a reading of +10 bits.

(d) Change the dvm input to -1mV and adjust RV4 pcb 11 for a reading of -10 bits.

(e) Repeat (c) and (d) until both are correct.

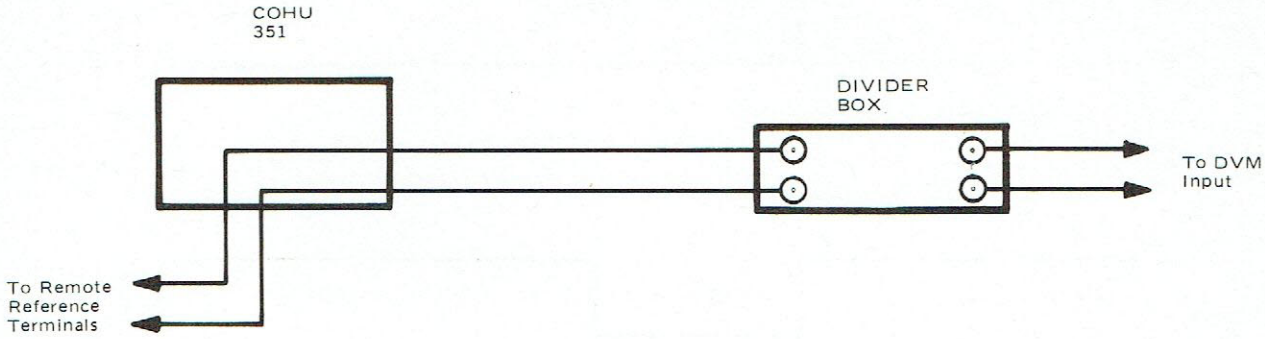

Fig. 8.7 Ratio Unit, Calibration Supply

5. SCALING ADJUSTMENTS

(a) Select DC, RATIO, 10V RANGE.

(b) Connect a link between TP1 (Junction RV1 and R10) and TP2 (Junction R2, R3) on pcb 36 and set RV1 pcb 36 fully clockwise.

(c) Feed in +10V to the remote reference terminals and -10V to the dvm input.

(d) From the reading obtained on the display refer to the table in Appendix 8.3 to ascertain the required link positions on the resistor chain on pcb 36. Remove the link between TP1 and TP2. Note that this test only applies to a new board or to a repaired board.

(e) Adjust RV1 pcb 36 for a reading of -10.0000V. It may be necessary to make a slight adjustment to link G or H if the range of adjustment on RV1 is inadequate. If the reading appears to be excessively noisy (i.e. greater than ± 1 bit) it may be necessary to increase the value of R3, pcb 35 to 12kΩ.

(f) Carry out the adjustments shown in the table below using the appropriate voltages to reference input and dvm.

Sequence	DVM Input	Reference Input	Adjustment	Reading	Noise Limits
(a)	-2V	+2V	RV1 pcb 32	-10.0000	± 4 bits
(b)	-10V	+10V	RV1 pcb 36	-10.0000	± 1 bit
(c)			Repeat (a) & (b)		
(d)	+10V	+10V	RV8 pcb 11	+10.0000	± 1 bit
(e)	+2V	+2V	RV1 pcb 11	+10.0000	± 4 bits
(f)			Repeat (d) & (e)		

6. LINEARITY CHECKS

(a) Select DC, RATIO, 10V RANGE.

(b) Feed in the voltages as shown in the following table checking that the linearity is within specification.

Reference Input	DVM Input	Reading	Limits
+10V	± 10V	± 10.0000	± 2 bits
+10V	± 5V	± 5.0000	± 2 bits
+10V	± 2V	± 2.0000	± 2 bits
+ 2V	± 2V	± 10.0000	± 4 bits
+ 2V	± 1V	± 5.0000	± 6 bits
+ 2V	± 0.4V	± 2.0000	± 10 bits

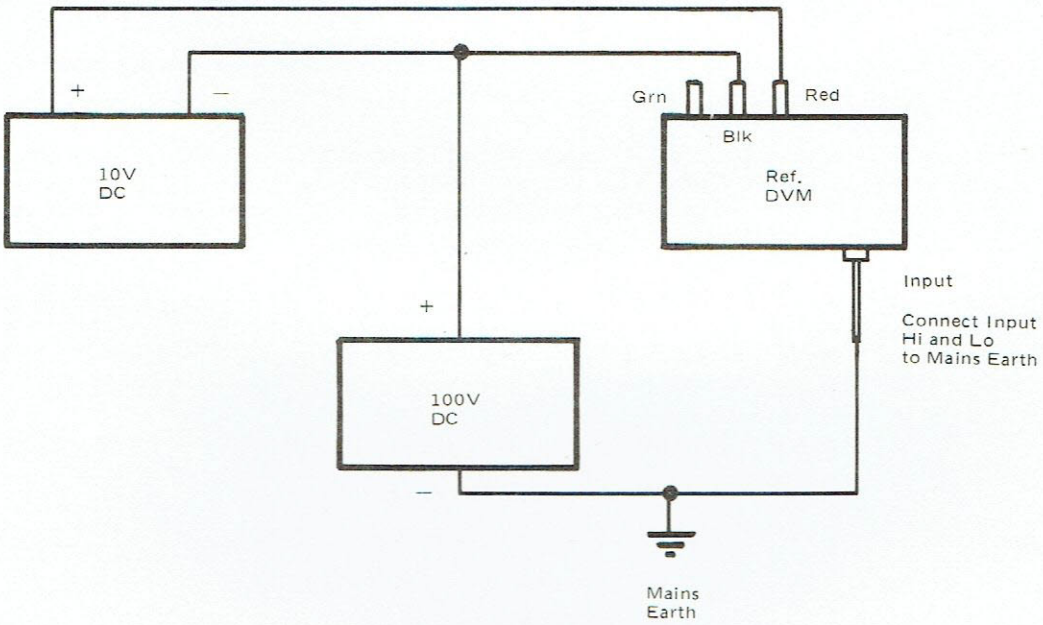

Fig. 8.8 Ratio Unit, Common Mode Rejection

7. DC COMMON MODE REJECTION

(a) Select DC, RATIO.

(b) Connect the reference source and common mode signal to the DVM as shown in Fig. 8.8. Check the readings obtained on ranges 100mV to 1,000V do not exceed those values shown in the following table.

Range	DVM Reading
100mV	± 50 bits
1V	± 50 bits
10V	± 15 bits
100V	± 50 bits
1000V	± 10 bits

FINAL CALIBRATION

8. FINAL RATIO UNIT CALIBRATION AT 20°C

(a) Select DC, RATIO, LOCAL 10/SEC, 10V RANGE.

(b) The following calibration should be carried out with the instrument in an ambient temperature of 20°C after it has received the final dc calibration.

(c) Carry out the adjustments in the following table in sequence checking that the readings are within the limits shown. Connect the dvm input leads directly in parallel with the reference lead termination at the supply source, for sequence (c) to (h). The supply source for this sequence should be stable but need not be accurately standardised.

(d) Allow some time for the dvm readings to stabilise when changing the reference voltage supply.

Sequence	DVM Input	Reference Input	Adjustment	Reading	Noise Limits
(a)	+1mV	+10V	RV5 pcb 11	+10 bits	± 1 bit
(b)	-1mV	+10V	RV4 pcb 11	-10 bits	± 1 bit
(c)	-10V	+10V	RV1 pcb 36 (Cal)	-10.0000	± 1 bit
(d)	- 2V	+ 2V	RV1 pcb 32 (Offset)	-10.0000	± 4 bits
(e)			Repeat (c) & (d)		
(f)	+10V	+10V	RV8 pcb 11	+10.0000	± 1 bit
(g)	+ 2V	+ 2V	RV1 pcb 11	+10.0000	± 4 bits
			Repeat (f) & (g)		

(e) Release the RATIO button and recheck the calibration with +10.0000V on the 10V range. Readjust RV9 pcb 11 if necessary to correct the calibration.

SUB-SECTION 8K

A214 FANOUT UNIT

(OPTIONAL UNIT APPLICABLE TO ALL DVM TYPES)

All of the following tests are made by applying inputs to and monitoring outputs on the socket fitted to the rear panel. Fit an extension lead between the socket and a connection board. A list of the socket pins with their function is given in Section 5.

The logic levels used in the tests are as follows.

Input (command) information

"1" = line open circuit

"0" = line connected to 0V

Output information

"1" = +5V ± 1V

"0" = 0V ± 0.5V

Note that pin HH is connected to the 0V line. Check that the Fanout Unit boards, 27 and 28, are correctly fitted to the instrument.

1. BCD OUTPUT DATA

(a) Select DC, 10V, LOCAL, 10/SEC.

(b) Apply a variable voltage supply to the DVM input to bring-up BCD weightings 1, 2, 4 and 8 in each readout display decade and monitor the BCD weightings on the socket pins. Check that the logic levels on the pins, as shown in the following table, change from 0V to +5V approximately with respect to pin HH.

BCD	DECADES					
	10^0	10^1	10^2	10^3	10^4	10^5
1	A	E	K	P	U	Y
2	B	F	L	R	V	–
4	C	H	M	S	W	–
8	D	J	N	T	X	–

2. MODE INFORMATION

(a) Select REMOTE.

(b) Apply the mode command information on pins AA and BB checking the correct mode information is present on pins CC and DD.

	Input Information				Output Information		
	DC	AC	Ohms		DC	AC	Ohms
AA	1	0	1	CC	0	1	0
BB	1	1	0	DD	0	0	1

3. RANGE INFORMATION

(a) Select REMOTE and command the DC range (refer to previous paragraph).

(b) Two range output codes are available, Code 1 or the preferred code, Code 2. Pins j, h and f on the socket are connected into different pins on board 27 for the code selected as follows.

Code 1			Code 2 Preferred Code		
BCD	Skt pins	Bd 27 pins	BCD	Skt pins	Bd 27 pins
4	j	18	4	j	19
2	h	17	2	h	21
1	f	16	1	f	20

(c) Command each range in turn as shown in the Input Information table and monitor at pins j, h and f for the correct range output as shown in the appropriate range table. For the 10mV range command the 25/SEC rate by connecting pin EE to HH.

Volts Range Input Table

BCD	Skt Pin	10mV	100mV	1V	10V	100V	1000V
1	m	1	0	1	0	1	0
2	n	0	0	1	1	0	0
4	p	1	1	0	0	0	0

Code 1 Output Table

BCD	Skt Pin	10mV	100mV	1V	10V	100V	1000V
1	f	1	0	1	0	1	0
2	h	0	0	1	1	0	0
4	j	1	1	0	0	0	0

Code 2 (Preferred) Output Table

BCD	Skt Pin	100mV	1V	10V	100V	1000V
1	f	0	1	0	1	0
2	h	1	0	0	1	1
4	j	1	1	1	0	0

(d) Command OHMS range by connecting pin BB to HH. Command each range in turn, using the Ohms Range Input table and monitor at pins j, h and f for the correct range output as shown in the Ohms preferred output table.

Ohms Range Input Table

BCD	Skt Pin	1kΩ	10kΩ	100kΩ	1000kΩ	10000kΩ
1	m	0	1	0	1	0
2	n	0	1	1	0	0
4	p	1	0	0	0	0

Ohms Range (Preferred) Output Table

BCD	Skt Pin	1kΩ	10kΩ	100kΩ	1000kΩ	10000kΩ
1	f	1	0	1	0	1
2	h	0	0	1	1	0
4	j	1	1	0	0	0

4. MISCELLANEOUS CHECKS

(a) Connect pin y to HH when autorange operation should be commanded.

(b) Connect pin z to HH when the filter should be commanded.

(c) Connect pin c to HH when ratio operation should be commanded. This is most easily checked by observing that relay E on pcb 11 of the instrument is energised.

(d) Apply a positive input voltage to the instrument and check pin e is at 0V and pin d at +5V. The positive sign should be displayed.

(e) Apply a negative input voltage and check pin e is at +5V and pin d at 0V. The negative sign should be displayed.

(f) Connect pin p to HH and apply about 2V to the instrument to provide a 11,9999 display. The level at pin 34 of pcb 27 should be at +5V and should go to 0V when the overload condition is removed.

(g) Select LOCAL on the instrument and connect pin r to HH when REMOTE sign should be indicated.

5. DIGITISE COMMAND CHECKS

(a) Select REMOTE, MANUAL SAMPLE.

(b) Check the instrument samples when pin s is connected to HH.

(c) Check the instrument samples when a +5V pulse is applied to pin t.

(d) Monitor with an oscilloscope the level at pin v and check it changes from +5V to 0V and back to +5V when the sample button is pressed.

(e) Monitor the level at pin x and check it changes from 0V to +5V and back to 0V when the sample button is pressed.

(f) Monitor pin u and check that a positive pulse of approximately 150μs duration is obtained when the sample button is pressed.

6. GATED CLOCK CHECKS

(a) Select REMOTE, 10/SEC.

(b) Connect pin p to HH to command the 1V dc range and connect in approximately 1.5V to the instrument input. Refer to Fig. 8.9 for the following tests.

(c) Using an oscilloscope triggered from the -ve edge of the reset waveform, TP2 pcb 4, monitor the waveform at k. It should be possible to see the gated clock pulses during the 40ms ramp down period and the display reading should be 119999.

(d) Connect pin EE to pin HH to command the 25/Sec rate when it should be possible to see the gated clock pulses during the 8ms ramp down period and the display reading should be 11999-. Check now on pins A, B, C and D that the levels are all 0V ± 0.5V. Remove EE from HH.

(e) Connect pin FF to HH, to command the 100/Sec rate when it should be possible to see the gated clock pulses during the 4ms ramp-down period. It will be necessary to operate the sample button to obtain a display at this rate of operation when the display reading should also change to 1199––.

Check now on pins E, F, H and J that the levels are all at 0V ± 0.5V. Monitor TP2 pcb 4 with the oscilloscope and check the reset period is of about 15ms duration when the sample button is operated.

(f) Connect pin w to HH with pin FF still connected to HH. The reset period should be reduced to about 1ms. Sample the instrument to obtain the display.

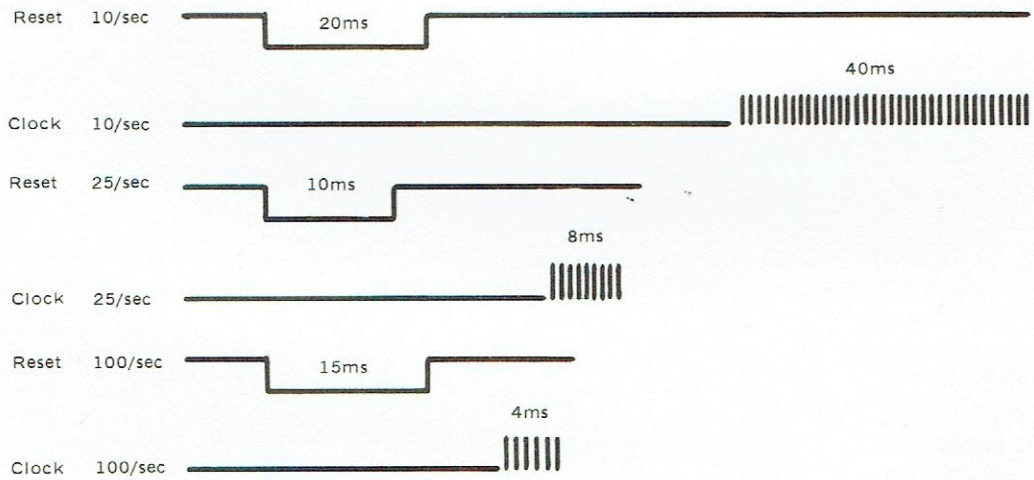

Fig. 8.9 Fanout Unit, Reset Waveforms

SUB-SECTION 8L

AC (TRUE RMS) INITIAL AND FINAL CALIBRATION (APPLICABLE TO DVM TYPES A215 AND A235)

INITIAL CALIBRATION

The instrument should be tested to the following Sub-sections before commencing with these tests.

(a) Sub-section 8B Earthy Section Initial Calibration

(b) To paragraph 10 of Sub-section 8C Floating Section Initial Calibration

(c) Sub-section 8D Ohms Initial Calibration

Remove the top screening cover from the Floating Box assembly and check that pcb's 15 and 41 are correctly fitted. Ensure that link K on pcb 16 (Ohms pcb) is removed. (This only applies to a repaired or new board).

A voltage standard, Hewlett Packard 745A should be used for all calibration checks. The 745A and the instrument should have been switched on for a period of at least one hour.

1. INVERTER REJECTION

(a) Select DC, LOCAL, 10V RANGE, FAST.

(b) Monitor TP1, pcb 18 with an oscilloscope and adjust C20, pcb 10, for minimum amplitude of inverter frequency.

2. INITIAL POTENTIOMETER SETTINGS

(a) Select LOCAL, AC, FILTER FAST, 1V range (with input short-circuited)

(b) Using a DVM monitor the pins on IC2 of pcb 41 as shown in the following table and set the appropriate potentiometer for minimal reading. Measurements are made with respect to pin 14 of IC2.

IC2 pin No.	PCB 41 potentiometer	Reading
25	RV6	Less than ± 30mV
17	RV5	Less than ± 30mV
4	RV3	Less than ± 50μV
9	RV4	+ 190mV, ± 10mV

(c) Recheck RV3 setting and fit floating box cover.

3. AMPLIFIER ADJUSTMENTS AND FREQUENCY RESPONSE CHECKS

(a) Select AC, LOCAL, FAST.

(b) Proceed with the following adjustments in sequence checking that the readings are within the limits shown.

Sequence	Range	Input	Frequency	Adjustment	Reading	Limits
(a)	1V	Short circuit	-	RV6, pcb 41	Zero	± 5 bits
(b)	1V	100.00mV	1kHz	RV5, pcb 41	0.1000V	± 5 bits
(c)	1V	1.00000V	1kHz	RV2, pcb 41	1.00000V	± 10 bits
(d) Repeat b & c						
(e)	1V	1.4mV	1kHz	RV4, pcb 41	See note	
(f) Repeat a to e						
(g)	1V	0.5000V	1kHz		0.5000V	± 20 bits
(h)	1V	0.0100V	1kHz		0.0100V	± 30 bits
(j)	100mV	100.000mV	1kHz	RV1, pcb 41	100.000mV	± 15 bits
(k)	100mV	100.000mV	5kHz		100.000mV	± 50 bits
(l)	100mV	100.000mV	100kHz		100.000mV	± 800 bits
(m)	100mV	10.000mV	100kHz		10.000mV	± 800 bits
(n)	100mV	10.000mV	30Hz		10.000mV	± 80 bits

NOTE. Adjust RV4 (sequence (e)) for an abrupt change of reading from approximately 2mV to 'near zero'. Leave the potentiometer setting at the 'near zero' reading.

4. 100V RANGE CALIBRATION

(a) Select AC, 100V RANGE, LOCAL, SLOW.

(b) Apply 100V at 1kHz on the 100V range and adjust RV1, pcb 15 for a reading of 100.000V ± 10 bits.

(c) Change the frequency to 20kHz and adjust C17, pcb 15 for reading of 100.000V ± 10 bits. Note it may be necessary to short links A, B or C on pcb 15 to bring this range into calibration if the initial range of C17 is inadequate.

(d) Repeat (b) and (c) above until both readings are correct.

5. 10V RANGE CALIBRATION

(a) Select AC, 10V RANGE, LOCAL, SLOW.

(b) Apply 10V at 1kHz on the 10V range when the readings should be 10.0000V ± 15 bits.

(c) Change the frequency to 20kHz and adjust C23, pcb 15 for a reading of 10.0000V ± 10 bits. It may be necessary to modify link D on pcb 15 to obtain the correct range of C23.

(d) Change the frequency to 10kHz when the reading should be 10.0000V ± 60 bits.

6. 1000V RANGE CALIBRATION

(a) Select AC, 1000V RANGE, LOCAL, SLOW.

(b) Apply 500V at 1kHz on the 1000V range and adjust RV2, pcb 15 for a reading of 500.00V ± 20 bits.

(c) Change the frequency to 20kHz and adjust C16, pcb 15 for a reading of 500.00V ± 20 bits.

(d) Repeat (b) and (c) above until both readings are correct.

Paragraph 7 not included.

FINAL CALIBRATION

Carry out the following tests at 20°C after completion of the final DC calibration (Sub-section 8F) of the instrument.

8. ZERO SETTING

(a) Connect the input Hi to Lo. Adjust the μV offset control on the front panel to give a zero reading or 0 to 1 flicker on the 100mV dc range.

9. FINAL CALIBRATION ON ALL RANGES

(a) Select AC, LOCAL, SLOW.

(b) Proceed with the adjustments, in sequence, given in the following table noting that the readings are within the limits shown.

NOTE. The application of 500V on the 1000V range results in a power dissipation in the 1MΩ input attenuator of 0.25W. The temperature coefficient of the resistor is such that the heating effect of the input power will result in the instrument calibration changing slightly as the resistor temperature increases.

Thus after applying the 500V input allow about 5 minutes for the instrument to stabilise to a final value.

Similarly when returning to the 10V or 100V ranges it will be necessary to allow a similar resettling time.

Sequence	Range	Input	Frequency	Adjustment	Reading	Limits
(a)	1V	Short circuit		RV6, pcb 41	Zero	± 5 bits
(b)	1V	100.000mV	1kHz	RV5, pcb 41	0.10000V	± 5 bits
(c)	1V	1.00000V	1kHz	RV2, pcb 41	1.00000V	± 10 bits
(d) Repeat b & c						
(e)	1V	1.4mV	1kHz	See note		
(f) Repeat a to e						
(g)	100mV	100.000mV	1kHz	RV1, pcb 41	100.000mV	± 15 bits
(h)	100mV	10.000mV	1kHz		10.000mV	± 20 bits
(j)	100V	100.000V	1kHz	RV1, pcb 15	100.000V	± 15 bits
(k)	100V	100.000V	20kHz	C17, pcb 15	100.000V	± 15 bits

Sequence	Range	Input	Frequency	Adjustment	Reading	Limits
(l) Repeat j & k						
(m)	10V	10.0000V	1kHz		10.0000V	± 20 bits
(n)	10V	10.0000V	20kHz	C23, pcb 15	10.0000V	± 15 bits
(p) Repeat m & n						
(q)	1,000V	500.00V	1kHz	RV2, pcb 15	500.00V	± 20 bits
(r)	1,000V	500.00V	20kHz	C16, pcb 15	500.00V	± 20 bits
(s) Repeat q & r						

NOTE. Adjust RV4 (sequence (e)) for an abrupt cnange of reading from approximately 2mV to 'near zero'. Leave the potentiometer setting at the 'near zero' reading.

10. FREQUENCY RESPONSE CHECKS ON ALL RANGES

(a) Select AC, LOCAL, SLOW.

(b) Apply the following voltages at the frequencies indicated and check that the readings are within the limits shown.

AC Range	AC Input	Frequency	Limit
	0.1V	10Hz	± 700 bits
	0.1V	100Hz	± 50 bits
	0.1V	5.0kHz	± 50 bits
	0.1V	10kHz	± 90 bits
100mV	0.1V	20kHz	± 200 bits
	0.1V	50kHz	± 600 bits
	0.1V	100kHz	± 800 bits
	0.01V	100kHz	± 800 bits
	0.01V	5.0kHz	± 50 bits
	1V	10Hz	± 700 bits
	1V	100Hz	± 50 bits
	1V	3.0kHz	± 50 bits
	1V	5kHz	± 50 bits
1V	1V	20kHz	± 200 bits
	1V	50kHz	± 600 bits
	1V	100kHz	± 800 bits
	0.1V	100kHz	± 800 bits
	0.1V	5.0kHz	± 50 bits

A228 RATIO UNIT (APPLICABLE TO DVM TYPE A235)

Refer to the test and calibration procedure given in Sub-section 8J.

AC Range	AC Input	Frequency	Limit
	10V	30Hz	± 100 bits
	10V	3.0kHz	± 50 bits
	10V	5kHz	± 50 bits
10V	10V	20kHz	± 200 bits
	10V	50kHz	± 600 bits
	10V	100kHz	± 800 bits
	1V	100kHz	± 800 bits
	1V	5kHz	± 50 bits
	100V	3.0kHz	± 50 bits
	100V	5kHz	± 50 bits
100V	100V	20kHz	± 200 bits
	100V	50kHz	± 600 bits
	100V	100kHz	± 800 bits
	10V	100kHz	± 800 bits
	10V	5kHz	± 50 bits
	100V	30Hz	± 70 bits
	100V	5kHz	± 50 bits
	100V	100kHz	± 800 bits
	800V	50kHz	± 600 bits
1000V	800V	20kHz	± 200 bits
	800V	10kHz	± 80 bits
	800V	5.0kHz	± 60 bits

APPENDIX 8.1 DC RANGE INITIAL CALIBRATION TABLE

This table is used to set up the resistor links, A to J, on board 19 as instructed in Sub-section 8C. A circuit diagram of the board is shown in Drg. 6 of Sub-section 7.3.

The links on the board are made by soldering across small pads on the copper track and are broken by removing the solder from the pads.

In the following table,

1 = broken link (i.e. remove solder from pad)

0 = made link (i.e. solder across pad)

DVM Reading		Board Links A	B	C	D	E	F	G	H	J
100000	100069	0	0	0	0	0	0	0	0	0
100091	100161	0	0	0	0	0	0	0	0	1
100177	100247	0	0	0	0	0	0	0	1	0
100266	100337	0	0	0	0	0	0	0	1	1
100344	100415	0	0	0	0	0	0	1	0	0
100432	100503	0	0	0	0	0	0	1	0	1
100515	100586	0	0	0	0	0	0	1	1	0
100601	100672	0	0	0	0	0	0	1	1	1
100661	100732	0	0	0	0	0	1	0	0	0
100745	100817	0	0	0	0	0	1	0	0	1
100825	100897	0	0	0	0	0	1	0	1	0
100908	100980	0	0	0	0	0	1	0	1	1
100980	101053	0	0	0	0	0	1	1	0	0
101061	101134	0	0	0	0	0	1	1	0	1
101138	101211	0	0	0	0	0	1	1	1	0
101216	101291	0	0	0	0	0	1	1	1	1
101248	101322	0	0	0	0	1	0	0	0	0
101327	101400	0	0	0	0	1	0	0	0	1
101401	101475	0	0	0	0	1	0	0	1	0
101478	101552	0	0	0	0	1	0	0	1	1
101546	101620	0	0	0	0	1	0	1	0	0
101622	101696	0	0	0	0	1	0	1	0	1
101693	101768	0	0	0	0	1	0	1	1	0
101768	101842	0	0	0	0	1	0	1	1	1
101820	101895	0	0	0	0	1	1	0	0	0
101893	101968	0	0	0	0	1	1	0	0	1
101962	102038	0	0	0	0	1	1	0	1	0
102034	102110	0	0	0	0	1	1	0	1	1
102097	102173	0	0	0	0	1	1	1	0	0
102168	102244	0	0	0	0	1	1	1	0	1
102235	102311	0	0	0	0	1	1	1	1	0
102304	102380	0	0	0	0	1	1	1	1	1
102249	102325	0	0	0	1	0	0	0	0	0
102318	102395	0	0	0	1	0	0	0	0	1
102384	102460	0	0	0	1	0	0	0	1	0
102452	102529	0	0	0	1	0	0	0	1	1
102511	102589	0	0	0	1	0	0	1	0	0
102578	102656	0	0	0	1	0	0	1	0	1
102642	102719	0	0	0	1	0	0	1	1	0
102707	102785	0	0	0	1	0	0	1	1	1
102754	102832	0	0	0	1	0	1	0	0	0
102819	102897	0	0	0	1	0	1	0	0	1
102880	102958	0	0	0	1	0	1	0	1	0
102943	103022	0	0	0	1	0	1	0	1	1
102999	103078	0	0	0	1	0	1	1	0	0
103062	103141	0	0	0	1	0	1	1	0	1
103121	103200	0	0	0	1	0	1	1	1	0
103183	103262	0	0	0	1	0	1	1	1	1
103206	103286	0	0	0	1	1	0	0	0	0
103267	103347	0	0	0	1	1	0	0	0	1
103325	103404	0	0	0	1	1	0	0	1	0
103385	103465	0	0	0	1	1	0	0	1	1

DVM Reading		Board Links A	B	C	D	E	F	G	H	J
103437	103517	0	0	0	1	1	0	1	0	0
103496	103576	0	0	0	1	1	0	1	0	1
103552	103632	0	0	0	1	1	0	1	1	0
103610	103690	0	0	0	1	1	0	1	1	1
103651	103731	0	0	0	1	1	1	0	0	0
103708	103789	0	0	0	1	1	1	0	0	1
103762	103843	0	0	0	1	1	1	0	1	0
103818	103899	0	0	0	1	1	1	0	1	1
103867	103949	0	0	0	1	1	1	1	0	0
103923	104004	0	0	0	1	1	1	1	0	1
103975	104057	0	0	0	1	1	1	1	1	0
104030	104112	0	0	0	1	1	1	1	1	1
103966	104048	0	0	1	0	0	0	0	0	0
104021	104103	0	0	1	0	0	0	0	0	1
104072	104155	0	0	1	0	0	0	0	1	0
104126	104209	0	0	1	0	0	0	0	1	1
104173	104256	0	0	1	0	0	0	1	0	0
104226	104309	0	0	1	0	0	0	1	0	1
104276	104359	0	0	1	0	0	0	1	1	0
104329	104412	0	0	1	0	0	0	1	1	1
104365	104448	0	0	1	0	0	1	0	0	0
104417	104500	0	0	1	0	0	1	0	0	1
104465	104549	0	0	1	0	0	1	0	1	0
104516	104600	0	0	1	0	0	1	0	1	1
104560	104644	0	0	1	0	0	1	1	0	0
104610	104694	0	0	1	0	0	1	1	0	1
104658	104742	0	0	1	0	0	1	1	1	0
104707	104791	0	0	1	0	0	1	1	1	1
104726	104810	0	0	1	0	1	0	0	0	0
104774	104859	0	0	1	0	1	0	0	0	1
104820	104905	0	0	1	0	1	0	0	1	0
104868	104953	0	0	1	0	1	0	0	1	1
104910	104995	0	0	1	0	1	0	1	0	0
104956	105043	0	0	1	0	1	0	1	0	1
105002	105088	0	0	1	0	1	0	1	1	0
105049	105134	0	0	1	0	1	0	1	1	1
105082	105167	0	0	1	0	1	1	0	0	0
105126	105214	0	0	1	0	1	1	0	0	1
105171	105257	0	0	1	0	1	1	0	1	0
105217	105303	0	0	1	0	1	1	0	1	1
105257	105343	0	0	1	0	1	1	1	0	0
105301	105388	0	0	1	0	1	1	1	0	1
105344	105430	0	0	1	0	1	1	1	1	0
105388	105474	0	0	1	0	1	1	1	1	1
105353	105439	0	0	1	1	0	0	0	0	0
105397	105483	0	0	1	1	0	0	0	0	1
105438	105525	0	0	1	1	0	0	0	1	0
105482	105569	0	0	1	1	0	0	0	1	1
105520	105607	0	0	1	1	0	0	1	0	0
105563	105650	0	0	1	1	0	0	1	0	1
105603	105691	0	0	1	1	0	0	1	1	0
105646	105733	0	0	1	1	0	0	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H	J
105675	105763	0	0	1	1	0	1	0	0	0
105717	105805	0	0	1	1	0	1	0	0	1
105757	105844	0	0	1	1	0	1	0	1	0
105798	105886	0	0	1	1	0	1	0	1	1
105834	105922	0	0	1	1	0	1	1	0	0
105874	105963	0	0	1	1	0	1	1	0	1
105913	106001	0	0	1	1	0	1	1	1	0
105953	106041	0	0	1	1	0	1	1	1	1
105968	106057	0	0	1	1	1	0	0	0	0
106008	106097	0	0	1	1	1	0	0	0	1
106046	106134	0	0	1	1	1	0	0	1	0
106085	106174	0	0	1	1	1	0	0	1	1
106119	106208	0	0	1	1	1	0	1	0	0
106158	106247	0	0	1	1	1	0	1	0	1
106194	106284	0	0	1	1	1	0	1	1	0
106233	106322	0	0	1	1	1	0	1	1	1
106260	106349	0	0	1	1	1	1	0	0	0
106297	106387	0	0	1	1	1	1	0	0	1
106333	106423	0	0	1	1	1	1	0	1	0
106370	106460	0	0	1	1	1	1	0	1	1
106403	106493	0	0	1	1	1	1	1	0	0
106440	106530	0	0	1	1	1	1	1	0	1
106474	106565	0	0	1	1	1	1	1	1	0
106511	106601	0	0	1	1	1	1	1	1	1
106442	106532	0	1	0	0	0	0	0	0	0
106478	106568	0	1	0	0	0	0	0	0	1
106513	106603	0	1	0	0	0	0	0	1	0
106549	106639	0	1	0	0	0	0	0	1	1
106580	106671	0	1	0	0	0	0	1	0	0
106616	106707	0	1	0	0	0	0	1	0	1
106650	106740	0	1	0	0	0	0	1	1	0
106685	106776	0	1	0	0	0	0	1	1	1
106710	106801	0	1	0	0	0	1	0	0	0
106744	106836	0	1	0	0	0	1	0	0	1
106777	106869	0	1	0	0	0	1	0	1	0
106812	106903	0	1	0	0	0	1	0	1	1
106842	106933	0	1	0	0	0	1	1	0	0
106876	106967	0	1	0	0	0	1	1	0	1
106908	107000	0	1	0	0	0	1	1	1	0
106941	107033	0	1	0	0	0	1	1	1	1
106954	107046	0	1	0	0	1	0	0	0	0
106988	107080	0	1	0	0	1	0	0	0	1
107019	107111	0	1	0	0	1	0	0	1	0
107052	107144	0	1	0	0	1	0	0	1	1
107081	107173	0	1	0	0	1	0	1	0	0
107113	107205	0	1	0	0	1	0	1	0	1
107144	107236	0	1	0	0	1	0	1	1	0
107176	107268	0	1	0	0	1	0	1	1	1
107198	107291	0	1	0	0	1	1	0	0	0
107230	107323	0	1	0	0	1	1	0	0	1
107260	107353	0	1	0	0	1	1	0	1	0
107291	107385	0	1	0	0	1	1	0	1	1
107319	107412	0	1	0	0	1	1	1	0	0
107350	107443	0	1	0	0	1	1	1	0	1
107379	107473	0	1	0	0	1	1	1	1	0
107410	107503	0	1	0	0	1	1	1	1	1
107386	107479	0	1	0	1	0	0	0	0	0
107416	107510	0	1	0	1	0	0	0	0	1
107445	107539	0	1	0	1	0	0	0	1	0
107475	107569	0	1	0	1	0	0	0	1	1
107502	107596	0	1	0	1	0	0	1	0	0
107532	107626	0	1	0	1	0	0	1	0	1
107560	107654	0	1	0	1	0	0	1	1	0
107590	107684	0	1	0	1	0	0	1	1	1
107610	107705	0	1	0	1	0	1	0	0	0
107640	107734	0	1	0	1	0	1	0	0	1
107667	107762	0	1	0	1	0	1	0	1	0
107696	107791	0	1	0	1	0	1	0	1	1
107722	107816	0	1	0	1	0	1	1	0	0
107750	107845	0	1	0	1	0	1	1	0	1
107777	107872	0	1	0	1	0	1	1	1	0
107806	107900	0	1	0	1	0	1	1	1	1
107816	107911	0	1	0	1	1	0	0	0	0
107845	107940	0	1	0	1	1	0	0	0	1
107871	107966	0	1	0	1	1	0	0	1	0
107899	107994	0	1	0	1	1	0	0	1	1
107923	108018	0	1	0	1	1	0	1	0	0
107951	108046	0	1	0	1	1	0	1	0	1
107977	108072	0	1	0	1	1	0	1	1	0
108004	108099	0	1	0	1	1	0	1	1	1
108023	108118	0	1	0	1	1	1	0	0	0
108050	108145	0	1	0	1	1	1	0	0	1
108075	108171	0	1	0	1	1	1	0	1	0
108102	108198	0	1	0	1	1	1	0	1	1
108125	108221	0	1	0	1	1	1	1	0	0
108151	108247	0	1	0	1	1	1	1	0	1
108176	108272	0	1	0	1	1	1	1	1	0
108202	108298	0	1	0	1	1	1	1	1	1
108172	108263	0	1	1	0	0	0	0	0	0
108198	108294	0	1	1	0	0	0	0	0	1
108223	108319	0	1	1	0	0	0	0	1	0
108248	108345	0	1	1	0	0	0	0	1	1
108271	108367	0	1	1	0	0	0	1	0	0
108296	108393	0	1	1	0	0	0	1	0	1
108321	108417	0	1	1	0	0	0	1	1	0
108346	108443	0	1	1	0	0	0	1	1	1
108364	108460	0	1	1	0	0	1	0	0	0
108389	108485	0	1	1	0	0	1	0	0	1
108412	108509	0	1	1	0	0	1	0	1	0
108437	108534	0	1	1	0	0	1	0	1	1
108459	108556	0	1	1	0	0	1	1	0	0
108483	108580	0	1	1	0	0	1	1	0	1
108506	108604	0	1	1	0	0	1	1	1	0
108530	108628	0	1	1	0	0	1	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H	J
108540	108637	0	1	1	0	1	0	0	0	0
108564	108661	0	1	1	0	1	0	0	0	1
108587	108684	0	1	1	0	1	0	0	1	0
108610	108708	0	1	1	0	1	0	0	1	1
108631	108729	0	1	1	0	1	0	1	0	0
108655	108753	0	1	1	0	1	0	1	0	1
108677	108775	0	1	1	0	1	0	1	1	0
108700	108798	0	1	1	0	1	0	1	1	1
108717	108815	0	1	1	0	1	1	0	0	0
108740	108838	0	1	1	0	1	1	0	0	1
108762	108860	0	1	1	0	1	1	0	1	0
108785	108883	0	1	1	0	1	1	0	1	1
108805	108903	0	1	1	0	1	1	1	0	0
108827	108926	0	1	1	0	1	1	1	0	1
108849	108947	0	1	1	0	1	1	1	1	0
108871	108970	0	1	1	0	1	1	1	1	1
108853	108952	0	1	1	1	0	0	0	0	0
108876	108974	0	1	1	1	0	0	0	0	1
108897	108996	0	1	1	1	0	0	0	1	0
108919	109018	0	1	1	1	0	0	0	1	1
108939	109037	0	1	1	1	0	0	1	0	0
108960	109059	0	1	1	1	0	0	1	0	1
108981	109080	0	1	1	1	0	0	1	1	0
109003	109102	0	1	1	1	0	0	1	1	1
109018	109117	0	1	1	1	0	1	0	0	0
109040	109139	0	1	1	1	0	1	0	0	1
109060	109160	0	1	1	1	0	1	0	1	0
109082	109181	0	1	1	1	0	1	0	1	1
109100	109200	0	1	1	1	0	1	1	0	0
109121	109221	0	1	1	1	0	1	1	0	1
109141	109241	0	1	1	1	0	1	1	1	0
109162	109262	0	1	1	1	0	1	1	1	1
109170	109270	0	1	1	1	1	0	0	0	0
109191	109291	0	1	1	1	1	0	0	0	1
109211	109311	0	1	1	1	1	0	0	1	0
109231	109331	0	1	1	1	1	0	0	1	1
109249	109350	0	1	1	1	1	0	1	0	0
109270	109370	0	1	1	1	1	0	1	0	1
109289	109389	0	1	1	1	1	0	1	1	0
109309	109410	0	1	1	1	1	0	1	1	1
109324	109424	0	1	1	1	1	1	0	0	0
109344	109444	0	1	1	1	1	1	0	0	1
109363	109463	0	1	1	1	1	1	0	1	0
109382	109483	0	1	1	1	1	1	0	1	1
109400	109500	0	1	1	1	1	1	1	0	0
109420	109520	0	1	1	1	1	1	1	0	1
109438	109539	0	1	1	1	1	1	1	1	0
109458	109558	0	1	1	1	1	1	1	1	1
109392	109493	1	0	0	0	0	0	0	0	0
109412	109513	1	0	0	0	0	0	0	0	1
109431	109531	1	0	0	0	0	0	0	1	0
109450	109551	1	0	0	0	0	0	0	1	1
109467	109568	1	0	0	0	0	0	1	0	0
109487	109588	1	0	0	0	0	0	1	0	1
109505	109606	1	0	0	0	0	0	1	1	0
109524	109625	1	0	0	0	0	0	1	1	1
109538	109639	1	0	0	0	0	1	0	0	0
109557	109658	1	0	0	0	0	1	0	0	1
109575	109676	1	0	0	0	0	1	0	1	0
109593	109695	1	0	0	0	0	1	0	1	1
109610	109711	1	0	0	0	0	1	1	0	0
109629	109730	1	0	0	0	0	1	1	0	1
109646	109748	1	0	0	0	0	1	1	1	0
109665	109766	1	0	0	0	0	1	1	1	1
109672	109773	1	0	0	0	1	0	0	0	0
109690	109792	1	0	0	0	1	0	0	0	1
109708	109809	1	0	0	0	1	0	0	1	0
109726	109828	1	0	0	0	1	0	0	1	1
109742	109844	1	0	0	0	1	0	1	0	0
109760	109862	1	0	0	0	1	0	1	0	1
109777	109879	1	0	0	0	1	0	1	1	0
109795	109897	1	0	0	0	1	0	1	1	1
109807	109909	1	0	0	0	1	1	0	0	0
109825	109927	1	0	0	0	1	1	0	0	1
109842	109944	1	0	0	0	1	1	0	1	0
109860	109962	1	0	0	0	1	1	0	1	1
109875	109977	1	0	0	0	1	1	1	0	0
109892	109995	1	0	0	0	1	1	1	0	1
109909	110011	1	0	0	0	1	1	1	1	0
109926	110029	1	0	0	0	1	1	1	1	1
109912	110015	1	0	0	1	0	0	0	0	0
109930	110032	1	0	0	1	0	0	0	0	1
109946	110049	1	0	0	1	0	0	0	1	0
109963	110066	1	0	0	1	0	0	0	1	1
109978	110081	1	0	0	1	0	0	1	0	0
109995	110098	1	0	0	1	0	0	1	0	1
110011	110114	1	0	0	1	0	0	1	1	0
110028	110131	1	0	0	1	0	0	1	1	1
110040	110143	1	0	0	1	0	1	0	0	0
110057	110160	1	0	0	1	0	1	0	0	1
110072	110175	1	0	0	1	0	1	0	1	0
110089	110192	1	0	0	1	0	1	0	1	1
110103	110207	1	0	0	1	0	1	1	0	0
110120	110223	1	0	0	1	0	1	1	0	1
110135	110239	1	0	0	1	0	1	1	1	0
110152	110255	1	0	0	1	0	1	1	1	1
110158	110261	1	0	0	1	1	0	0	0	0
110174	110277	1	0	0	1	1	0	0	0	1
110189	110293	1	0	0	1	1	0	0	1	0
110205	110309	1	0	0	1	1	0	0	1	1
110219	110323	1	0	0	1	1	0	1	0	0
110235	110339	1	0	0	1	1	0	1	0	1
110250	110354	1	0	0	1	1	0	1	1	0
110266	110370	1	0	0	1	1	0	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H	J
110277	110381	1	0	0	1	1	1	0	0	0
110293	110397	1	0	0	1	1	1	0	0	1
110308	110412	1	0	0	1	1	1	0	1	0
110323	110427	1	0	0	1	1	1	0	1	1
110337	110441	1	0	0	1	1	1	1	0	0
110352	110456	1	0	0	1	1	1	1	0	1
110367	110471	1	0	0	1	1	1	1	1	0
110382	110486	1	0	0	1	1	1	1	1	1
110364	110469	1	0	1	0	0	0	0	0	0
110380	110484	1	0	1	0	0	0	0	0	1
110394	110498	1	0	1	0	0	0	0	1	0
110409	110514	1	0	1	0	0	0	0	1	1
110423	110527	1	0	1	0	0	0	1	0	0
110438	110542	1	0	1	0	0	0	1	0	1
110452	110556	1	0	1	0	0	0	1	1	0
110467	110571	1	0	1	0	0	0	1	1	1
110477	110582	1	0	1	0	0	1	0	0	0
110492	110597	1	0	1	0	0	1	0	0	1
110506	110611	1	0	1	0	0	1	0	1	0
110521	110625	1	0	1	0	0	1	0	1	1
110534	110638	1	0	1	0	0	1	1	0	0
110548	110653	1	0	1	0	0	1	1	0	1
110562	110667	1	0	1	0	0	1	1	1	0
110576	110681	1	0	1	0	0	1	1	1	1
110582	110687	1	0	1	0	1	0	0	0	0
110596	110701	1	0	1	0	1	0	0	0	1
110610	110715	1	0	1	0	1	0	0	1	0
110624	110729	1	0	1	0	1	0	0	1	1
110637	110742	1	0	1	0	1	0	1	0	0
110651	110756	1	0	1	0	1	0	1	0	1
110664	110769	1	0	1	0	1	0	1	1	0
110678	110784	1	0	1	0	1	0	1	1	1
110688	110793	1	0	1	0	1	1	0	0	0
110702	110807	1	0	1	0	1	1	0	0	1
110715	110821	1	0	1	0	1	1	0	1	0
110729	110835	1	0	1	0	1	1	0	1	1
110741	110847	1	0	1	0	1	1	1	0	0
110755	110860	1	0	1	0	1	1	1	0	1
110768	110873	1	0	1	0	1	1	1	1	0
110782	110887	1	0	1	0	1	1	1	1	1
110771	110876	1	0	1	1	0	0	0	0	0
110784	110890	1	0	1	1	0	0	0	0	1
110797	110903	1	0	1	1	0	0	0	1	0
110811	110916	1	0	1	1	0	0	0	1	1
110823	110928	1	0	1	1	0	0	1	0	0
110836	110942	1	0	1	1	0	0	1	0	1
110849	110955	1	0	1	1	0	0	1	1	0
110862	110968	1	0	1	1	0	0	1	1	1
110871	110977	1	0	1	1	0	1	0	0	0
110884	110990	1	0	1	1	0	1	0	0	1
110897	111003	1	0	1	1	0	1	0	1	0
110910	111016	1	0	1	1	0	1	0	1	1
110922	111028	1	0	1	1	0	1	1	0	0
110935	111041	1	0	1	1	0	1	1	0	1
110947	111053	1	0	1	1	0	1	1	1	0
110960	111066	1	0	1	1	0	1	1	1	1
110965	111071	1	0	1	1	1	0	0	0	0
110977	111084	1	0	1	1	1	0	0	0	1
110990	111096	1	0	1	1	1	0	0	1	0
111002	111109	1	0	1	1	1	0	0	1	1
111014	111120	1	0	1	1	1	0	1	0	0
111026	111133	1	0	1	1	1	0	1	0	1
111038	111145	1	0	1	1	1	0	1	1	0
111051	111157	1	0	1	1	1	0	1	1	1
111060	111166	1	0	1	1	1	1	0	0	0
111072	111179	1	0	1	1	1	1	0	0	1
111084	111191	1	0	1	1	1	1	0	1	0
111096	111203	1	0	1	1	1	1	0	1	1
111107	111214	1	0	1	1	1	1	1	0	0
111119	111226	1	0	1	1	1	1	1	0	1
111131	111238	1	0	1	1	1	1	1	1	0
111143	111250	1	0	1	1	1	1	1	1	1
111120	111227	1	1	0	0	0	0	0	0	0
111132	111239	1	1	0	0	0	0	0	0	1
111144	111251	1	1	0	0	0	0	0	1	0
111156	111263	1	1	0	0	0	0	0	1	1
111167	111274	1	1	0	0	0	0	1	0	0
111179	111286	1	1	0	0	0	0	1	0	1
111190	111297	1	1	0	0	0	0	1	1	0
111202	111309	1	1	0	0	0	0	1	1	1
111210	111318	1	1	0	0	0	1	0	0	0
111222	111330	1	1	0	0	0	1	0	0	1
111234	111341	1	1	0	0	0	1	0	1	0
111245	111353	1	1	0	0	0	1	0	1	1
111256	111363	1	1	0	0	0	1	1	0	0
111267	111375	1	1	0	0	0	1	1	0	1
111278	111386	1	1	0	0	0	1	1	1	0
111290	111398	1	1	0	0	0	1	1	1	1
111295	111402	1	1	0	0	1	0	0	0	0
111306	111414	1	1	0	0	1	0	0	0	1
111317	111425	1	1	0	0	1	0	0	1	0
111329	111436	1	1	0	0	1	0	0	1	1
111339	111446	1	1	0	0	1	0	1	0	0
111350	111458	1	1	0	0	1	0	1	0	1
111361	111469	1	1	0	0	1	0	1	1	0
111372	111480	1	1	0	0	1	0	1	1	1
111380	111488	1	1	0	0	1	1	0	0	0
111391	111499	1	1	0	0	1	1	0	0	1
111402	111510	1	1	0	0	1	1	0	1	0
111413	111521	1	1	0	0	1	1	0	1	1
111423	111531	1	1	0	0	1	1	1	0	0
111434	111542	1	1	0	0	1	1	1	0	1
111445	111553	1	1	0	0	1	1	1	1	0
111456	111564	1	1	0	0	1	1	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H	J
111447	111555	1	1	0	1	0	0	0	0	0
111458	111566	1	1	0	1	0	0	0	0	1
111468	111577	1	1	0	1	0	0	0	1	0
111479	111588	1	1	0	1	0	0	0	1	1
111489	111597	1	1	0	1	0	0	1	0	0
111500	111608	1	1	0	1	0	0	1	0	1
111510	111618	1	1	0	1	0	0	1	1	0
111521	111629	1	1	0	1	0	0	1	1	1
111528	111637	1	1	0	1	0	1	0	0	0
111539	111648	1	1	0	1	0	1	0	0	1
111549	111658	1	1	0	1	0	1	0	1	0
111560	111669	1	1	0	1	0	1	0	1	1
111569	111678	1	1	0	1	0	1	1	0	0
111580	111689	1	1	0	1	0	1	1	0	1
111590	111699	1	1	0	1	0	1	1	1	0
111600	111709	1	1	0	1	0	1	1	1	1
111604	111713	1	1	0	1	1	0	0	0	0
111615	111724	1	1	0	1	1	0	0	0	1
111625	111734	1	1	0	1	1	0	0	1	0
111635	111744	1	1	0	1	1	0	0	1	1
111644	111753	1	1	0	1	1	0	1	0	0
111655	111763	1	1	0	1	1	0	1	0	1
111664	111773	1	1	0	1	1	0	1	1	0
111675	111784	1	1	0	1	1	0	1	1	1
111682	111791	1	1	0	1	1	1	0	0	0
111692	111801	1	1	0	1	1	1	0	0	1
111702	111811	1	1	0	1	1	1	0	1	0
111712	111821	1	1	0	1	1	1	0	1	1
111721	111830	1	1	0	1	1	1	1	0	0
111731	111840	1	1	0	1	1	1	1	0	1
111740	111849	1	1	0	1	1	1	1	1	0
111750	111859	1	1	0	1	1	1	1	1	1
111739	111848	1	1	1	0	0	0	0	0	0
111749	111858	1	1	1	0	0	0	0	0	1
111758	111867	1	1	1	0	0	0	0	1	0
111768	111877	1	1	1	0	0	0	0	1	1
111777	111886	1	1	1	0	0	0	1	0	0
111786	111896	1	1	1	0	0	0	1	0	1
111796	111905	1	1	1	0	0	0	1	1	0
111806	111915	1	1	1	0	0	0	1	1	1
111812	111922	1	1	1	0	0	1	0	0	0
111822	111932	1	1	1	0	0	1	0	0	1
111831	111941	1	1	1	0	0	1	0	1	0
111841	111951	1	1	1	0	0	1	0	1	1
111850	111959	1	1	1	0	0	1	1	0	0
111859	111969	1	1	1	0	0	1	1	0	1
111868	111978	1	1	1	0	0	1	1	1	0
111878	111988	1	1	1	0	0	1	1	1	1
111881	111991	1	1	1	0	1	0	0	0	0
111891	112001	1	1	1	0	1	0	0	0	1
111900	112010	1	1	1	0	1	0	0	1	0
111909	112019	1	1	1	0	1	0	0	1	1
111918	112028	1	1	1	0	1	0	1	0	0
111927	112037	1	1	1	0	1	0	1	0	1
111936	112046	1	1	1	0	1	0	1	1	0
111945	112055	1	1	1	0	1	0	1	1	1
111952	112062	1	1	1	0	1	1	0	0	0
111961	112071	1	1	1	0	1	1	0	0	1
111970	112080	1	1	1	0	1	1	0	1	0
111979	112089	1	1	1	0	1	1	0	1	1
111987	112097	1	1	1	0	1	1	1	0	0
111996	112106	1	1	1	0	1	1	1	0	1
112005	112115	1	1	1	0	1	1	1	1	0
112014	112124	1	1	1	0	1	1	1	1	1
112007	112117	1	1	1	1	0	0	0	0	0
112016	112126	1	1	1	1	0	0	0	0	1
112025	112135	1	1	1	1	0	0	0	1	0
112034	112144	1	1	1	1	0	0	0	1	1
112041	112152	1	1	1	1	0	0	1	0	0
112050	112161	1	1	1	1	0	0	1	0	1
112059	112169	1	1	1	1	0	0	1	1	0
112068	112178	1	1	1	1	0	0	1	1	1
112074	112185	1	1	1	1	0	1	0	0	0
112083	112193	1	1	1	1	0	1	0	0	1
112091	112202	1	1	1	1	0	1	0	1	0
112100	112211	1	1	1	1	0	1	0	1	1
112108	112218	1	1	1	1	0	1	1	0	0
112117	112227	1	1	1	1	0	1	1	0	1
112125	112236	1	1	1	1	0	1	1	1	0
112134	112244	1	1	1	1	0	1	1	1	1
112137	112248	1	1	1	1	1	0	0	0	0
112146	112256	1	1	1	1	1	0	0	0	1
112154	112265	1	1	1	1	1	0	0	1	0
112162	112273	1	1	1	1	1	0	0	1	1
112170	112281	1	1	1	1	1	0	1	0	0
112179	112289	1	1	1	1	1	0	1	0	1
112187	112298	1	1	1	1	1	0	1	1	0
112195	112306	1	1	1	1	1	0	1	1	1
112201	112312	1	1	1	1	1	1	0	0	0
112210	112321	1	1	1	1	1	1	0	0	1
112218	112329	1	1	1	1	1	1	0	1	0
112226	112337	1	1	1	1	1	1	0	1	1
112233	112344	1	1	1	1	1	1	1	0	0
112242	112353	1	1	1	1	1	1	1	0	1
112250	112361	1	1	1	1	1	1	1	1	0
112258	112369	1	1	1	1	1	1	1	1	1

APPENDIX 8.2 OHMS RANGE INITIAL CALIBRATION TABLE

This table is used to set up the resistor links, A to H, on board 16 as instructed in Sub-section 8D. A circuit diagram of the board is shown in Drg. 5 of Sub-section 7.3.

The links on the board are made by soldering across small pads on the copper track and are broken by removing the solder from the pads.

In the following table,

1 = broken link (i.e. remove solder from pad)

0 = made link (i.e. solder across pad)

Board Links

DVM Reading		A	B	C	D	E	F	G	H
100250	100333	0	0	0	0	0	0	0	0
100322	100406	0	0	0	0	0	0	0	1
100391	100474	0	0	0	0	0	0	1	0
100463	100546	0	0	0	0	0	0	1	1
100527	100610	0	0	0	0	0	1	0	0
100599	100682	0	0	0	0	0	1	0	1
100668	100751	0	0	0	0	0	1	1	0
100740	100823	0	0	0	0	0	1	1	1
100791	100874	0	0	0	0	1	0	0	0
100863	100946	0	0	0	0	1	0	0	1
100932	101015	0	0	0	0	1	0	1	0
101004	101087	0	0	0	0	1	0	1	1
101068	101151	0	0	0	0	1	1	0	0
101140	101223	0	0	0	0	1	1	0	1
101208	101292	0	0	0	0	1	1	1	0
101281	101364	0	0	0	0	1	1	1	1
101308	101392	0	0	0	1	0	0	0	0
101380	101464	0	0	0	1	0	0	0	1
101449	101533	0	0	0	1	0	0	1	0
101521	101605	0	0	0	1	0	0	1	1
101585	101668	0	0	0	1	0	1	0	0
101657	101741	0	0	0	1	0	1	0	1
101726	101809	0	0	0	1	0	1	1	0
101798	101881	0	0	0	1	0	1	1	1
101849	101933	0	0	0	1	1	0	0	0
101921	102005	0	0	0	1	1	0	0	1
101990	102073	0	0	0	1	1	0	1	0
102062	102146	0	0	0	1	1	0	1	1
102126	102209	0	0	0	1	1	1	0	0
102198	102281	0	0	0	1	1	1	0	1
102267	102350	0	0	0	1	1	1	1	0
102339	102422	0	0	0	1	1	1	1	1
102282	102365	0	0	1	0	0	0	0	0
102354	102437	0	0	1	0	0	0	0	1
102423	102506	0	0	1	0	0	0	1	0
102495	102578	0	0	1	0	0	0	1	1
102558	102642	0	0	1	0	0	1	0	0
102631	102714	0	0	1	0	0	1	0	1
102699	102783	0	0	1	0	0	1	1	0
102771	102855	0	0	1	0	0	1	1	1
102823	102906	0	0	1	0	1	0	0	0
102895	102978	0	0	1	0	1	0	0	1
102963	103047	0	0	1	0	1	0	1	0
103036	103119	0	0	1	0	1	0	1	1
103099	103183	0	0	1	0	1	1	0	0
103171	103255	0	0	1	0	1	1	0	1
103240	103323	0	0	1	0	1	1	1	0
103312	103396	0	0	1	0	1	1	1	1
103340	103423	0	0	1	1	0	0	0	0
103412	103496	0	0	1	1	0	0	0	1
103481	103564	0	0	1	1	0	0	1	0
103553	103636	0	0	1	1	0	0	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
103617	103700	0	0	1	1	0	1	0	0
103689	103772	0	0	1	1	0	1	0	1
103758	103841	0	0	1	1	0	1	1	0
103830	103913	0	0	1	1	0	1	1	1
103881	103964	0	0	1	1	1	0	0	0
103953	104036	0	0	1	1	1	0	0	1
104022	104105	0	0	1	1	1	0	1	0
104094	104177	0	0	1	1	1	0	1	1
104158	104241	0	0	1	1	1	1	0	0
104230	104313	0	0	1	1	1	1	0	1
104298	104382	0	0	1	1	1	1	1	0
104371	104454	0	0	1	1	1	1	1	1
104287	104370	0	1	0	0	0	0	0	0
104359	104442	0	1	0	0	0	0	0	1
104428	104511	0	1	0	0	0	0	1	0
104500	104583	0	1	0	0	0	0	1	1
104563	104647	0	1	0	0	0	1	0	0
104636	104719	0	1	0	0	0	1	0	1
104704	104788	0	1	0	0	0	1	1	0
104776	104860	0	1	0	0	0	1	1	1
104828	104911	0	1	0	0	1	0	0	0
104900	104983	0	1	0	0	1	0	0	1
104968	105052	0	1	0	0	1	0	1	0
105041	105124	0	1	0	0	1	0	1	1
105104	105188	0	1	0	0	1	1	0	0
105176	105260	0	1	0	0	1	1	0	1
105245	105328	0	1	0	0	1	1	1	0
105317	105400	0	1	0	0	1	1	1	1
105345	105428	0	1	0	1	0	0	0	0
105417	105501	0	1	0	1	0	0	0	1
105486	105569	0	1	0	1	0	0	1	0
105558	105641	0	1	0	1	0	0	1	1
105622	105705	0	1	0	1	0	1	0	0
105694	105777	0	1	0	1	0	1	0	1
105763	105846	0	1	0	1	0	1	1	0
105835	105918	0	1	0	1	0	1	1	1
105886	105969	0	1	0	1	1	0	0	0
105958	106041	0	1	0	1	1	0	0	1
106027	106110	0	1	0	1	1	0	1	0
106099	106182	0	1	0	1	1	0	1	1
106163	106246	0	1	0	1	1	1	0	0
106235	106318	0	1	0	1	1	1	0	1
106303	106387	0	1	0	1	1	1	1	0
106376	106459	0	1	0	1	1	1	1	1
106318	106402	0	1	1	0	0	0	0	0
106391	106474	0	1	1	0	0	0	0	1
106459	106542	0	1	1	0	0	0	1	0
106531	106615	0	1	1	0	0	0	1	1
106595	106678	0	1	1	0	0	1	0	0
106667	106750	0	1	1	0	0	1	0	1
106736	106819	0	1	1	0	0	1	1	0
106808	106891	0	1	1	0	0	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
106859	106943	0	1	1	0	1	0	0	0
106931	107015	0	1	1	0	1	0	0	1
107000	107083	0	1	1	0	1	0	1	0
107072	107155	0	1	1	0	1	0	1	1
107136	107219	0	1	1	0	1	1	0	0
107208	107291	0	1	1	0	1	1	0	1
107277	107360	0	1	1	0	1	1	1	0
107349	107432	0	1	1	0	1	1	1	1
107377	107460	0	1	1	1	0	0	0	0
107449	107532	0	1	1	1	0	0	0	1
107518	107601	0	1	1	1	0	0	1	0
107590	107673	0	1	1	1	0	0	1	1
107653	107737	0	1	1	1	0	1	0	0
107726	107809	0	1	1	1	0	1	0	1
107794	107878	0	1	1	1	0	1	1	0
107866	107950	0	1	1	1	0	1	1	1
107918	108001	0	1	1	1	1	0	0	0
107990	108073	0	1	1	1	1	0	0	1
108058	108142	0	1	1	1	1	0	1	0
108131	108214	0	1	1	1	1	0	1	1
108194	108277	0	1	1	1	1	1	0	0
108266	108350	0	1	1	1	1	1	0	1
108335	108418	0	1	1	1	1	1	1	0
108407	108490	0	1	1	1	1	1	1	1
108270	108353	1	0	0	0	0	0	0	0
108342	108426	1	0	0	0	0	0	0	1
108411	108494	1	0	0	0	0	0	1	0
108483	108566	1	0	0	0	0	0	1	1
108547	108630	1	0	0	0	0	1	0	0
108619	108702	1	0	0	0	0	1	0	1
108688	108771	1	0	0	0	0	1	1	0
108760	108843	1	0	0	0	0	1	1	1
108811	108894	1	0	0	0	1	0	0	0
108883	108966	1	0	0	0	1	0	0	1
108952	109035	1	0	0	0	1	0	1	0
109024	109107	1	0	0	0	1	0	1	1
109087	109171	1	0	0	0	1	1	0	0
109160	109243	1	0	0	0	1	1	0	1
109228	109312	1	0	0	0	1	1	1	0
109301	109384	1	0	0	0	1	1	1	1
109328	109412	1	0	0	1	0	0	0	0
109400	109484	1	0	0	1	0	0	0	1
109469	109553	1	0	0	1	0	0	1	0
109541	109625	1	0	0	1	0	0	1	1
109605	109688	1	0	0	1	0	1	0	0
109677	109761	1	0	0	1	0	1	0	1
109746	109829	1	0	0	1	0	1	1	0
109818	109901	1	0	0	1	0	1	1	1
109869	109953	1	0	0	1	1	0	0	0
109941	110025	1	0	0	1	1	0	0	1
110010	110093	1	0	0	1	1	0	1	0
110082	110166	1	0	0	1	1	0	1	1
110146	110229	1	0	0	1	1	1	0	0
110218	110301	1	0	0	1	1	1	0	1
110287	110370	1	0	0	1	1	1	1	0
110359	110442	1	0	0	1	1	1	1	1
110302	110385	1	0	1	0	0	0	0	0
110374	110457	1	0	1	0	0	0	0	1
110443	110526	1	0	1	0	0	0	1	0
110515	110598	1	0	1	0	0	0	1	1
110578	110662	1	0	1	0	0	1	0	0
110650	110734	1	0	1	0	0	1	0	1
110719	110803	1	0	1	0	0	1	1	0
110791	110875	1	0	1	0	0	1	1	1
110842	110926	1	0	1	0	1	0	0	0
110915	110998	1	0	1	0	1	0	0	1
110983	111067	1	0	1	0	1	0	1	0
111056	111139	1	0	1	0	1	0	1	1
111119	111203	1	0	1	0	1	1	0	0
111191	111275	1	0	1	0	1	1	0	1
111260	111343	1	0	1	0	1	1	1	0
111332	111416	1	0	1	0	1	1	1	1
111360	111443	1	0	1	1	0	0	0	0
111432	111516	1	0	1	1	0	0	0	1
111501	111584	1	0	1	1	0	0	1	0
111573	111656	1	0	1	1	0	0	1	1
111637	111720	1	0	1	1	0	1	0	0
111709	111792	1	0	1	1	0	1	0	1
111778	111861	1	0	1	1	0	1	1	0
111850	111933	1	0	1	1	0	1	1	1
111901	111984	1	0	1	1	1	0	0	0
111973	112056	1	0	1	1	1	0	0	1
112042	112125	1	0	1	1	1	0	1	0
112114	112197	1	0	1	1	1	0	1	1
112177	112261	1	0	1	1	1	1	0	0
112250	112333	1	0	1	1	1	1	0	1
112318	112402	1	0	1	1	1	1	1	0
112391	112474	1	0	1	1	1	1	1	1
112307	112390	1	1	0	0	0	0	0	0
112379	112462	1	1	0	0	0	0	0	1
112448	112531	1	1	0	0	0	0	1	0
112520	112603	1	1	0	0	0	0	1	1
112583	112667	1	1	0	0	0	1	0	0
112656	112739	1	1	0	0	0	1	0	1
112724	112808	1	1	0	0	0	1	1	0
112796	112880	1	1	0	0	0	1	1	1
112848	112931	1	1	0	0	1	0	0	0
112920	113003	1	1	0	0	1	0	0	1
112988	113072	1	1	0	0	1	0	1	0
113061	113144	1	1	0	0	1	0	1	1
113124	113208	1	1	0	0	1	1	0	0
113196	113280	1	1	0	0	1	1	0	1
113265	113348	1	1	0	0	1	1	1	0
113337	113421	1	1	0	0	1	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
113365	113448	1	1	0	1	0	0	0	0
113437	113521	1	1	0	1	0	0	0	1
113506	113589	1	1	0	1	0	0	1	0
113578	113661	1	1	0	1	0	0	1	1
113642	113725	1	1	0	1	0	1	0	0
113714	113797	1	1	0	1	0	1	0	1
113783	113866	1	1	0	1	0	1	1	0
113855	113938	1	1	0	1	0	1	1	1
113906	113989	1	1	0	1	1	0	0	0
113978	114061	1	1	0	1	1	0	0	1
114047	114130	1	1	0	1	1	0	1	0
114119	114202	1	1	0	1	1	0	1	1
114183	114266	1	1	0	1	1	1	0	0
114255	114338	1	1	0	1	1	1	0	1
114323	114407	1	1	0	1	1	1	1	0
114396	114479	1	1	0	1	1	1	1	1
114338	114422	1	1	1	0	0	0	0	0
114411	114494	1	1	1	0	0	0	0	1
114479	114563	1	1	1	0	0	0	1	0
114551	114635	1	1	1	0	0	0	1	1
114615	114698	1	1	1	0	0	1	0	0
114687	114771	1	1	1	0	0	1	0	1
114756	114839	1	1	1	0	0	1	1	0
114828	114911	1	1	1	0	0	1	1	1
114879	114963	1	1	1	0	1	0	0	0
114951	115035	1	1	1	0	1	0	0	1
115020	115103	1	1	1	0	1	0	1	0
115092	115176	1	1	1	0	1	0	1	1
115156	115239	1	1	1	0	1	1	0	0
115228	115311	1	1	1	0	1	1	0	1
115297	115380	1	1	1	0	1	1	1	0
115369	115452	1	1	1	0	1	1	1	1
115397	115480	1	1	1	1	0	0	0	0
115469	115552	1	1	1	1	0	0	0	1
115538	115621	1	1	1	1	0	0	1	0
115610	115693	1	1	1	1	0	0	1	1
115673	115757	1	1	1	1	0	1	0	0
115746	115829	1	1	1	1	0	1	0	1
115814	115898	1	1	1	1	0	1	1	0
115886	115970	1	1	1	1	0	1	1	1
115938	116021	1	1	1	1	1	0	0	0
116010	116093	1	1	1	1	1	0	0	1
116078	116162	1	1	1	1	1	0	1	0
116151	116234	1	1	1	1	1	0	1	1
116214	116298	1	1	1	1	1	1	0	0
116286	116370	1	1	1	1	1	1	0	1
116355	116438	1	1	1	1	1	1	1	0
116427	116511	1	1	1	1	1	1	1	1

APPENDIX 8.3 RATIO UNIT SCALING CALIBRATION TABLE

This table is used to set up the resistor links, A to H, on board 36 of the Ratio Unit as instructed in Sub-section 8J. A circuit diagram of the board is shown in Drg. 12A of Sub-section 7.3.

The links on the board are made by soldering across small pads on the copper track and are broken by removing the solder from the pads.

In the following table,

1 = broken link (i.e. remove solder from pad)

0 = made link (i.e. solder across pad)

Board Links

DVM Reading		A	B	C	D	E	F	G	H
100000	100076	0	0	0	0	0	0	0	0
100057	100133	0	0	0	0	0	0	0	1
100112	100188	0	0	0	0	0	0	1	0
100169	100245	0	0	0	0	0	0	1	1
100218	100294	0	0	0	0	0	1	0	0
100275	100350	0	0	0	0	0	1	0	1
100329	100405	0	0	0	0	0	1	1	0
100386	100461	0	0	0	0	0	1	1	1
100424	100500	0	0	0	0	1	0	0	0
100481	100556	0	0	0	0	1	0	0	1
100535	100610	0	0	0	0	1	0	1	0
100591	100666	0	0	0	0	1	0	1	1
100640	100715	0	0	0	0	1	1	0	0
100696	100771	0	0	0	0	1	1	0	1
100750	100824	0	0	0	0	1	1	1	0
100806	100880	0	0	0	0	1	1	1	1
100829	100903	0	0	0	1	0	0	0	0
100864	100959	0	0	0	1	0	0	0	1
100938	101012	0	0	0	1	0	0	1	0
100994	101068	0	0	0	1	0	0	1	1
101042	101116	0	0	0	1	0	1	0	0
101097	101171	0	0	0	1	0	1	0	1
101150	101224	0	0	0	1	0	1	1	0
101205	101279	0	0	0	1	0	1	1	1
101243	101317	0	0	0	1	1	0	0	0
101298	101372	0	0	0	1	1	0	0	1
101351	101424	0	0	0	1	1	0	1	0
101406	101479	0	0	0	1	1	0	1	1
101454	101527	0	0	0	1	1	1	0	0
101508	101581	0	0	0	1	1	1	0	1
101561	101634	0	0	0	1	1	1	1	0
101615	101688	0	0	0	1	1	1	1	1
101602	101674	0	0	1	0	0	0	0	0
101656	101729	0	0	1	0	0	0	0	1
101708	101781	0	0	1	0	0	0	1	0
101763	101835	0	0	1	0	0	0	1	1
101810	101882	0	0	1	0	0	1	0	0
101864	101936	0	0	1	0	0	1	0	1
101916	101988	0	0	1	0	0	1	1	0
101970	102042	0	0	1	0	0	1	1	1
102007	102079	0	0	1	0	1	0	0	0
102061	102132	0	0	1	0	1	0	0	1
102112	102184	0	0	1	0	1	0	1	0
102166	102238	0	0	1	0	1	0	1	1
102213	102284	0	0	1	0	1	1	0	0
102266	102337	0	0	1	0	1	1	0	1
102318	102389	0	0	1	0	1	1	1	0
102371	102442	0	0	1	0	1	1	1	1
102393	102464	0	0	1	1	0	0	0	0
102446	102517	0	0	1	1	0	0	0	1
102497	102568	0	0	1	1	0	0	1	0
102551	102621	0	0	1	1	0	0	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
102596	102667	0	0	1	1	0	1	0	0
102649	102720	0	0	1	1	0	1	0	1
102700	102771	0	0	1	1	0	1	1	0
102753	102823	0	0	1	1	0	1	1	1
102789	102859	0	0	1	1	1	0	0	0
102842	102912	0	0	1	1	1	0	0	1
102892	102962	0	0	1	1	1	0	1	0
102945	103014	0	0	1	1	1	0	1	1
102990	103060	0	0	1	1	1	1	0	0
103042	103112	0	0	1	1	1	1	0	1
103093	103162	0	0	1	1	1	1	1	0
103145	103214	0	0	1	1	1	1	1	1
103103	103173	0	1	0	0	0	0	0	0
103155	103225	0	1	0	0	0	0	0	1
103205	103275	0	1	0	0	0	0	1	0
103257	103326	0	1	0	0	0	0	1	1
103302	103371	0	1	0	0	0	1	0	0
103354	103423	0	1	0	0	0	1	0	1
103404	103473	0	1	0	0	0	1	1	0
103456	103524	0	1	0	0	0	1	1	1
103491	103559	0	1	0	0	1	0	0	0
103542	103611	0	1	0	0	1	0	0	1
103592	103660	0	1	0	0	1	0	1	0
103643	103712	0	1	0	0	1	0	1	1
103688	103756	0	1	0	0	1	1	0	0
103739	103807	0	1	0	0	1	1	0	1
103788	103856	0	1	0	0	1	1	1	0
103839	103907	0	1	0	0	1	1	1	1
103860	103928	0	1	0	1	0	0	0	0
103911	103979	0	1	0	1	0	0	0	1
103960	104028	0	1	0	1	0	0	1	0
104011	104079	0	1	0	1	0	0	1	1
104055	104123	0	1	0	1	0	1	0	0
104106	104173	0	1	0	1	0	1	0	1
104154	104222	0	1	0	1	0	1	1	0
104205	104272	0	1	0	1	0	1	1	1
104239	104306	0	1	0	1	1	0	0	0
104290	104357	0	1	0	1	1	0	0	1
104338	104405	0	1	0	1	1	0	1	0
104388	104455	0	1	0	1	1	0	1	1
104432	104499	0	1	0	1	1	1	0	0
104482	104549	0	1	0	1	1	1	0	1
104530	104597	0	1	0	1	1	1	1	0
104580	104647	0	1	0	1	1	1	1	1
104567	104634	0	1	1	0	0	0	0	0
104617	104684	0	1	1	0	0	0	0	1
104665	104731	0	1	1	0	0	0	1	0
104715	104781	0	1	1	0	0	0	1	1
104758	104824	0	1	1	0	0	1	0	0
104808	104874	0	1	1	0	0	1	0	1
104855	104921	0	1	1	0	0	1	1	0
104905	104971	0	1	1	0	0	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
104938	105004	0	1	1	0	1	0	0	0
104988	105053	0	1	1	0	1	0	0	1
105035	105101	0	1	1	0	1	0	1	0
105084	105150	0	1	1	0	1	0	1	1
105127	105192	0	1	1	0	1	1	0	0
105176	105241	0	1	1	0	1	1	0	1
105223	105288	0	1	1	0	1	1	1	0
105272	105337	0	1	1	0	1	1	1	1
105292	105357	0	1	1	1	0	0	0	0
105341	105406	0	1	1	1	0	0	0	1
105388	105453	0	1	1	1	0	0	1	0
105436	105501	0	1	1	1	0	0	1	1
105478	105543	0	1	1	1	0	1	0	0
105527	105592	0	1	1	1	0	1	0	1
105574	105638	0	1	1	1	0	1	1	0
105622	105686	0	1	1	1	0	1	1	1
105655	105719	0	1	1	1	1	0	0	0
105703	105767	0	1	1	1	1	0	0	1
105749	105814	0	1	1	1	1	0	1	0
105798	105862	0	1	1	1	1	0	1	1
105839	105903	0	1	1	1	1	1	0	0
105887	105951	0	1	1	1	1	1	0	1
105933	105997	0	1	1	1	1	1	1	0
105981	106045	0	1	1	1	1	1	1	1
105931	105995	1	0	0	0	0	0	0	0
105979	106043	1	0	0	0	0	0	0	1
106025	106089	1	0	0	0	0	0	1	0
106073	106136	1	0	0	0	0	0	1	1
106114	106178	1	0	0	0	0	1	0	0
106162	106225	1	0	0	0	0	1	0	1
106207	106271	1	0	0	0	0	1	1	0
106255	106318	1	0	0	0	0	1	1	1
106287	106350	1	0	0	0	1	0	0	0
106334	106397	1	0	0	0	1	0	0	1
106380	106443	1	0	0	0	1	0	1	0
106427	106490	1	0	0	0	1	0	1	1
106468	106531	1	0	0	0	1	1	0	0
106515	106577	1	0	0	0	1	1	0	1
106560	106623	1	0	0	0	1	1	1	0
106607	106669	1	0	0	0	1	1	1	1
106626	106689	1	0	0	1	0	0	0	0
106673	106735	1	0	0	1	0	0	0	1
106718	106780	1	0	0	1	0	0	1	0
106765	106827	1	0	0	1	0	0	1	1
106805	106867	1	0	0	1	0	1	0	0
106852	106914	1	0	0	1	0	1	0	1
106896	106958	1	0	0	1	0	1	1	0
106943	107005	1	0	0	1	0	1	1	1
106974	107036	1	0	0	1	1	0	0	0
107021	107082	1	0	0	1	1	0	0	1
107065	107127	1	0	0	1	1	0	1	0
107111	107173	1	0	0	1	1	0	1	1
107151	107213	1	0	0	1	1	1	0	0
107197	107259	1	0	0	1	1	1	0	1
107241	107303	1	0	0	1	1	1	1	0
107287	107349	1	0	0	1	1	1	1	1
107276	107337	1	0	1	0	0	0	0	0
107322	107383	1	0	1	0	0	0	0	1
107366	107427	1	0	1	0	0	0	1	0
107411	107472	1	0	1	0	0	0	1	1
107451	107512	1	0	1	0	0	1	0	0
107497	107557	1	0	1	0	0	1	0	1
107540	107601	1	0	1	0	0	1	1	0
107586	107646	1	0	1	0	0	1	1	1
107617	107677	1	0	1	0	1	0	0	0
107662	107723	1	0	1	0	1	0	0	1
107706	107766	1	0	1	0	1	0	1	0
107751	107811	1	0	1	0	1	0	1	1
107790	107850	1	0	1	0	1	1	0	0
107835	107895	1	0	1	0	1	1	0	1
107879	107939	1	0	1	0	1	1	1	0
107924	107983	1	0	1	0	1	1	1	1
107942	108002	1	0	1	1	0	0	0	0
107987	108047	1	0	1	1	0	0	0	1
108030	108090	1	0	1	1	0	0	1	0
108075	108134	1	0	1	1	0	0	1	1
108114	108173	1	0	1	1	0	1	0	0
108158	108218	1	0	1	1	0	1	0	1
108201	108260	1	0	1	1	0	1	1	0
108246	108305	1	0	1	1	0	1	1	1
108276	108335	1	0	1	1	1	0	0	0
108320	108379	1	0	1	1	1	0	0	1
108363	108422	1	0	1	1	1	0	1	0
108407	108466	1	0	1	1	1	0	1	1
108446	108504	1	0	1	1	1	1	0	0
108490	108549	1	0	1	1	1	1	0	1
108532	108591	1	0	1	1	1	1	1	0
108576	108635	1	0	1	1	1	1	1	1
108541	108600	1	1	0	0	0	0	0	0
108585	108644	1	1	0	0	0	0	0	1
108627	108686	1	1	0	0	0	0	1	0
108671	108730	1	1	0	0	0	0	1	1
108709	108768	1	1	0	0	0	1	0	0
108753	108811	1	1	0	0	0	1	0	1
108795	108853	1	1	0	0	0	1	1	0
108839	108897	1	1	0	0	0	1	1	1
108868	108926	1	1	0	0	1	0	0	0
108912	108970	1	1	0	0	1	0	0	1
108954	109012	1	1	0	0	1	0	1	0
108997	109055	1	1	0	0	1	0	1	1
109035	109093	1	1	0	0	1	1	0	0
109078	109136	1	1	0	0	1	1	0	1
109120	109177	1	1	0	0	1	1	1	0
109163	109221	1	1	0	0	1	1	1	1

Board Links

DVM Reading		A	B	C	D	E	F	G	H
109181	109238	1	1	0	1	0	0	0	0
109224	109281	1	1	0	1	0	0	0	1
109265	109323	1	1	0	1	0	0	1	0
109308	109366	1	1	0	1	0	0	1	1
109346	109403	1	1	0	1	0	1	0	0
109388	109446	1	1	0	1	0	1	0	1
109430	109487	1	1	0	1	0	1	1	0
109472	109529	1	1	0	1	0	1	1	1
109501	109558	1	1	0	1	1	0	0	0
109544	109601	1	1	0	1	1	0	0	1
109585	109642	1	1	0	1	1	0	1	0
109628	109684	1	1	0	1	1	0	1	1
109664	109721	1	1	0	1	1	1	0	0
109707	109763	1	1	0	1	1	1	0	1
109748	109804	1	1	0	1	1	1	1	0
109790	109846	1	1	0	1	1	1	1	1
109779	109836	1	1	1	0	0	0	0	0
109822	109878	1	1	1	0	0	0	0	1
109862	109918	1	1	1	0	0	0	1	0
109904	109960	1	1	1	0	0	0	1	1
109941	109997	1	1	1	0	0	1	0	0
109963	110039	1	1	1	0	0	1	0	1
110023	110079	1	1	1	0	0	1	1	0
110065	110121	1	1	1	0	0	1	1	1
110094	110149	1	1	1	0	1	0	0	0
110136	110191	1	1	1	0	1	0	0	1
110176	110231	1	1	1	0	1	0	1	0
110217	110273	1	1	1	0	1	0	1	1
110254	110309	1	1	1	0	1	1	0	0
110295	110351	1	1	1	0	1	1	0	1
110335	110390	1	1	1	0	1	1	1	0
110377	110432	1	1	1	0	1	1	1	1
110394	110449	1	1	1	1	0	0	0	0
110435	110490	1	1	1	1	0	0	0	1
110475	110530	1	1	1	1	0	0	1	0
110516	110571	1	1	1	1	0	0	1	1
110552	110607	1	1	1	1	0	1	0	0
110593	110648	1	1	1	1	0	1	0	1
110633	110688	1	1	1	1	0	1	1	0
110674	110729	1	1	1	1	0	1	1	1
110702	110756	1	1	1	1	1	0	0	0
110743	110797	1	1	1	1	1	0	0	1
110782	110837	1	1	1	1	1	0	1	0
110823	110878	1	1	1	1	1	0	1	1
110858	110913	1	1	1	1	1	1	0	0
110899	110954	1	1	1	1	1	1	0	1
110938	110993	1	1	1	1	1	1	1	0
110979	111033	1	1	1	1	1	1	1	1

SECTION 9 Component Parts List

COMPONENT PARTS LIST

ABBREVIATIONS

Circuit References

B	Battery
C	Capacitor (μF)
CSR	Thyristor
D	Diode
FS	Fuse
IC	Integrated Circuit
L	Inductor
LP	Lamp (including Neon)
LK	Link
M	Meter
MSP	Mains Selector Panel
PL	Plug
R	Resistor (Ω)
RL	Relay
S	Switch
SK	Socket
T	Transformer
TP	Terminal Post (or Test Point)
TR	Transistor
V	Valve
X	Other Components

Also Used:-

RNL	Non Linear Resistor (Ω)
RV	Variable Resistor (Ω)

Component Composition

FIXED RESISTORS

Carbon Composition	CACP
Carbon Film	CAFM
Cracked Carbon	CKCA
Metal Film	MEFM
Metal Oxide	MEOX
Power Wirewound	POWW
Precision Wirewound	PRWW
Temperature Sensitive	TEMP
Thick Film	TKFM
Thin Film	TNFM
Voltage Sensitive	VOLT

Component Composition (Cont'd)

VARIABLE RESISTORS

Wirewound Preset Single Turn	WWPS
Wirewound Preset Multiturn	WWPM
Wirewound Front Panel Single Turn	WWFS
Wirewound Front Panel Multiturn	WWFM
Carbon Preset Single Turn	CAPS
Carbon Preset Multiturn	CAPM
Carbon Front Panel Single Turn	CAFS
Carbon Front Panel Multiturn	CAFM
Cermet Preset Single Turn	CMPS
Cermet Preset Multiturn	CMPM
Cermet Front Panel Single Turn	CMFS
Cermet Front Panel Multiturn	CMFM

CAPACITORS

Air	AIR
Aluminium Electrolytic	ALME
Aluminium Solid	ALMS
Polycarbonate	CARB
Ceramic	CERM
Polyester Foil	ESTF
Polyester Metallised	ESTM
Glass	GLAS
Mica	MICA
Metallised Lacquer	MLAC
Paper Foil	PAPF
Paper Metallised	PAPM
PTFE	PTFE
Polystyrene	STYR
Tantalum Dry	TAND
Tantalum Foil	TANF
Tantalum Wet	TANW

Component Parts List

for

Printed Circuit Board A2109001

(Ranging)

Cct Ref.	General description				Solartron Part No.
R1	CACP	100	1/4W	10%	172321000
R2	CACP	4.7k	1/4W	10%	172334700
R3	CACP	470	1/4W	10%	172324700
R4	CACP	470	1/4W	10%	172324700
R5	CACP	100	1/4W	10%	172321000
R6	CACP	1k	1/4W	10%	172331000
R7	CACP	1k	1/4W	10%	172331000
R8	CACP	4.7k	1/4W	10%	172334700
R9	CACP	470	1/4W	10%	172324700
R10	CACP	470	1/4W	10%	172324700
R11	CACP	1k	1/4W	10%	172331000
R12	CACP	1k	1/4W	10%	172331000

Cct. Ref.	General Description				Solartron Part No.
R13	CACP	1000	1/4W	10%	172331000
R14	CACP	1000	1/4W	10%	172331000
R15	CACP	4.7k	1/4W	10%	172334700
C1	CERM	1000p	500V	20%	241331000
C2	CERM	0.047	25V	+50% -25%	241944700
C3	CERM	1000p	500V	20%	241331000
C4	CERM	1000p	500V	20%	241331000
C5	CERM	1000p	500V	20%	241331000

Cct. Ref.	General Description	Solartron Part No.
D3	SD3	300522160
TR1	2N2369	300552390
TR2	2N2369	300552390
IC1	936	510000290
IC2	962	510000200
IC3	946	510000160
IC4	7475	510000350
IC5	946	510000160
IC6	936	510000290
IC7	7474	510000490
IC8	74151	510000850
IC9	9093	510000300
IC10	9093	510000300
IC11	7406	510000760
IC12	930	510000100
IC13	930	510000100
IC14	7406	510000760

Component Parts List for Printed Circuit Board A 2109002 (Auto Range)

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	22k	1/4W	10%	172342200
C1	TAND	100	10V	20%	265481000
IC1	8093				510000300
IC2	846				510000160
IC3	836				510000290
IC4	74121				510000530
IC5	830				510000100
IC6	862				510000200
IC7	846				510000160
IC8	830				510000100
IC9	836				510000290
IC10	8093				510000300
IC11	846				510000160
IC12	8093				510000300
IC13	846				510000160

Component Parts List for Printed Circuit Board A2109003 (Control)

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	4.7k	1/4W	10%	172334700
R2	CACP	220k	1/4W	10%	172352200
R4	CACP	6.8k	1/4W	10%	172336800
C1	ESTM	0.01	100V	10%	225441000
C2	CERM	0.01	25V	+50% -25%	241941000
C3	CERM	1000p	500V	20%	241331000
C4	CERM	1000p	500V	20%	241331000
D1	SD3				300522160
IC1	7473				510000570
IC2	7400				510000340
IC3	7404				510000410
IC4	7474				510000490
IC5	930				510000100
IC6	932				510000120
IC7	9093				510000300
IC8	946				510000160
IC9	7410				510000420
IC10	7400				510000340
IC11	74121				510000530
IC12	9093				510000300
IC13	946				510000160
IC14	9093				510000300
IC15	7473				510000570
IC16	962				510000200

Component Parts List for Printed Circuit Board A2109004 (Oscillator)

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	10k	1/4W	10%	172341000
R2	CACP	470	1/4W	10%	172324700
R3	CACP	4.7k	1/4W	10%	172334700
R4	CACP	1M	1/4W	10%	172361000
R5	CACP	1M	1/4W	10%	172361000
R6	CACP	1k	1/4W	10%	172331000
R7	CACP	2.2k	1/4W	10%	172332200
R8	CACP	10k	1/4W	10%	172341000
R9	CACP	4.7k	1/4W	10%	172334700
R10	CACP	2.2k	1/4W	10%	172332200
R11	CACP	10k	1/4W	10%	172341000
R12	CACP	100k	1/4W	10%	172351000
R13	CACP	1k	1/4W	10%	172331000
R14	CACP	4.7k	1/4W	10%	172334700
R15	CACP	470	1/4W	10%	172324700
R16	CACP	470	1/4W	10%	172324700
R17	CACP	1k	1/4W	10%	172331000
R18	CACP	150	1/4W	10%	172321500
R19	CACP	1.8k	1/4W	10%	172331800
R20	CACP	1k	1/4W	10%	172331000
R21	CACP	1k	1/4W	10%	172331000
R22	CACP	1k	1/4W	10%	172331000
R23	CACP	3.3k	1/4W	10%	172333300
R24	CACP	470	1/4W	10%	172324700
RV1	CMPS	5k	3/4W	10%	130435000
C1	CERM	0.047	25V	+50% -20%	241944700
C2	CERM	1000p	500V	20%	241331000
C3	CERM	1000p	500V	20%	241331000
C4	CERM	4700p	350V	25%	208400059
C5	CERM	47p	500V	20%	241314700
C6	ESTM	1	100V	10%	225461000
C7	STYR	4.7p	125V	0.5%	208100100
C8	CERM	0.01	25V	+50% -20%	241941000
C9	CERM	680p	500V	10%	208400097
C10	CERM	4700p	350V	25%	208400059
C11 to C15	CERM	0.047	25V	+50% -20%	241944700
C16	PTFE	1.5 to 12p			290060030

Cct. Ref.	General Description	Solartron Part No.
D1	Zener 4.7V	300521470
D2	SD3	300522160
D3	SD3	300522160
D4	IN3595	300523590
D5	IN3595	300523590
D6	SD3	300522160
D7	SD3	300522160
D8	MV2109 33p 30V 10%	300525010
D9	Zener 9.1V	300521340
D10	SD3	300522160
D11	Zener 9.1V	300521340
D12	SD3	300522160
D13	SD3	300522160
TR1	BCY70	300553590
TR2	BC107A	300553320
TR3	BCY70	300553590
TR4	F.E.T N-Channel U1899	300554320
TR5	N-Channel U1899	300554320
TR6	BF115	300554170
TR7	BC107A	300553320
TR8	2N2369	300552390
TR9	BC107A	300553320
TR10	BCY70	300553590
IC1	7490	510000280
IC2	944	510000140
IC3	946	510000160
IC4	936	510000290
IC5	7474	510000490
IC6	7413	510000710
IC7	7473	510000570
IC8	7493	510000310
L1	Inductor Choke	
SA	Slide Switch Siemens C42315-A60-A2	375000510
L1	Choke 68	305020370
L2	Choke 68	305020370
L3	Choke 68	305020370
T1	Transformer	309601801

Component Parts List

for

Printed Circuit Board A2109005

(Counter)

Cct REF.	General Description	Solartron Part No.
R1	CACP 1k 1/8W 10%	172031000
R2	CACP 100 1/8W 10%	172021000
C1	CERM 100p 500V 20%	241321000
D1 to D6	SD3	300522160
IC1	936	510000290
IC2	7490	510000280
IC3	7490	510000280
IC4	7475	510000350
IC5	7490	510000280
IC6	7475	510000350
IC7	7490	510000280
IC8	962	510000200
IC9	930	510000100
IC10	946	510000160
IC11	7475	510000350
IC12	7475	510000350
IC13	9093	510000300
IC14	7490	510000280
IC15	7475	510000350

Component Parts List

for

Printed Circuit Board A2109007

(Readout Display : Nixie Type)

Cct Ref.	General Description	Solartron Part No.
R1	CACP 220 1/8W 10%	172022200
R2	CACP 3.3k 1/8W 10%	172033300
R3	CACP 39k 1/4W 10%	172343900
R4	CACP 3.3k 1/8W 10%	172033300
R5	CACP 6.8k 1/8W 10%	172036800
R6	CACP 22k 1/4W 10%	172342200
R7	CACP 3.3k 1/8W 10%	172033300
R8	CACP 4.7k 1/8W 10%	172034700
R9	CACP 100k 1/4W 10%	172351000
R10	CACP 22k 1/4W 10%	172342200
R11	CACP 22k 1/4W 10%	172342200
R12	CACP 22k 1/4W 10%	172342200
R13	MEOX 22k 1/4W 5%	193542200
R14	MEOX 22k 1/4W 5%	193542200
R15	MEOX 22k 1/4W 5%	193542200
R16	MEOX 68k 1/2W 5%	193546800
R17	CACP 3.3k 1/8W 10%	172033300
R18	MEOX 22k 1/4W 5%	193542200
R19	CACP 3.3k 1/8W 10%	172033300
R20	MEOX 68k 1/2W 5%	193546800
R21	MEOX 68k 1/2W 5%	193546800
R22	CACP 3.3k 1/8W 10%	172033300
R23	CACP 3.3k 1/8W 10%	172033300
R24	CACP 3.3k 1/8W 10%	172033300
D1	Zener 3V	300523880
D2 to D7	SD3	300522160
TR1 to TR6	A1778	300551430
TR7	40327	300552890
TR8	40327	300552890
TR9 to TR11	A1778	300551430
TR12	40327	300552890
TR13	40327	300552890
IC1 to IC6	SN74141N	510000471
V1	Numicator ZM1263	300011411
V2 to V7	Numicator ZM1175	
V8	Indicator Lamp Neon 16H	300720300
V9 to V13	Indicator Lamp Neon	300720450
	Numicator Support Moulding	B16200006

Component Parts List

for

Printed Circuit Board A2109009

(Floating Section Logic)

Cct Ref.	General Description				Solartron Part No.
R1	CACP	2.2k	1/8W	10%	172032200
R2	CACP	2.2k	1/8W	10%	172032200
R3	CACP	1k	1/8W	10%	172031000
R4	CACP	1k	1/8W	10%	172031000
R5	CACP	560	1/8W	10%	172025600
R6	MECX	1.8k	1/8W	10%	195631800
R7	CACP	8.2k	1/8W	10%	172038200
R8	CACP	2.2k	1/8W	10%	172032200
R9	CACP	2.2k	1/8W	10%	172032200
R10	CACP	1.5k	1/8W	10%	172031500
R11	CACP	2.7k	1/8W	10%	172032700
R12	CACP	8.2k	1/8W	10%	172038200
R13	CACP	82	1/8W	10%	172018200
R14	MEOX	390	1/4W	1%	195623900
R15	MEOX	390	1/4W	1%	195623900
R16	MEOX	1k	1/4W	1%	195631000
R17	MEOX	1k	1/4W	1%	195631000
R18	CACP	33	1/8W	10%	172013300
R19	CACP	22	1/8W	10%	172012200
R20	CACP	22	1/8W	10%	172012200
R21	CACP	47	1/8W	10%	172014700
R22	CACP	47	1/8W	10%	172014700
C1 to C7	CERM	.047	25V	+50% -25%	241944700
C8	ESTM	.01	100V	10%	225441000
C9	ESTM	.022	100V	10%	225442200
C10	CERM	.047	25V	+50% -25%	241944700
C11	CERM	.047	25V	+50% -25%	241944700
C12	TAND	33	10V	20%	265473300
C13	CERM	.047	25V	+50% -25%	241944700
C14	CERM	3300p	500V	20%	241333300
C15	CERM	.047	25V	+50% -20%	241944700
C16	CERM	2200	500V	25%	208450065
C17	CERM	100	500V	20%	241321000
C18	CERM	220	500V	20%	241322200
C19	CERM	220	500	20%	241322200
C20	CERM	100p	500	20%	241321000
C21	CERM	100p	500	20%	241321000
D1	SD3				300522160
TR1 to TR5	2N 2369				300552390
IC1	7406				510000760
IC2	7400				510000340
IC3	7473				510000570
IC4	7404				510000410
IC5	7413				510000710
IC6	74175				510001310
IC7	74164				510001150
IC8	7400				510000340
IC9	7474				510000490
IC10	7410				510000420
IC11	7420				510000380
IC12	74175				510001310
IC13	7400				510000340
IC14	7404				510000410
IC15 to IC17	7400				510000340

Component Parts List

for

Printed Circuit Board A2109010

(Floating Section, Power Supply)

Cct Ref.	General Description				Solartron Part No.
R1	CACP	3.3k	1/8W	10%	172033300
R2	CACP	15k	1/8W	10%	172041500
R3	CACP	15k	1/8W	10%	172041500
R4	CACP	3.3k	1/8W	10%	172033300
R5	CACP	1.5k	1/8W	10%	172031500
R6	CACP	10k	1/8W	10%	172041000
R7	CACP	1k	1/8W	10%	172031000
R8	CACP	100k	1/8W	10%	172051000
R9	CACP	100k	1/8W	10%	172051000
R10	CACP	27k	1/8W	10%	172042700
C1	CERM	.047	25V	+50% -25%	241944700
C2	TAND	22	15V	20%	265672200
C3	CERM	.047	25V	+50% -25%	241944700
C4	TAND	47	35V	20%	266074700
C5	CERM	3300p	500V	20%	241333300
C6	TAND	4.7	35V	20%	266064700
C7	CERM	.047	25V	+50% -25%	241944700
C8	TAND	22	35V	20%	266072200
C9	CERM	3300p	500V	20%	241333300
C10	TAND	4.7	35V	20%	266064700
C11	TAND	15	20V	20%	265871500
C12	TAND	15	20V	20%	265871500
C13	CERM	3300p	500V	20%	241333300
C14	CERM	3300p	500V	20%	241333300
C15	CERM	3300p	500V	20%	241333300
C16	TAND	22	35V	20%	266072200
C17	TAND	22	35V	20%	266072200
C18	MICA	15	350V	5%	250311500
C20	PTFE	2 to 25p	2kV		290060020
C21	MICA	15	350		250311500
C22		2 to 25p	2kV		290060020
D1	Bay 72				300524530
D2	Bay 72				300524530
D3 to D6	IN4934				300524960
D7 to D10	Bay 72				300524530
D11	SD3				300522160
D12	Zener	16V	0.4W	5%	300521320
D13	Zener	16V	0.4W	5%	300521320
D14	SD3				300522160
D15	SD3				300522160
D16	Bay 72				300524530
D17 to D19	Bay 72				300524530
TR1	T.I.P.32				300554240
TR2	BC107				300553320
TR3	T.I.P.31				300554010
TR4	BCY70				300553590
TR5	BC107				300553320
IC1	Voltage Regulator		5V		510090110
L1 to L7	Choke	68			305020370

Component Parts List

for

Printed Circuit Board A2109011

(Internal Reference)

Cct Ref.	General Description				Solartron Part No.
R1	MEOX	1.5k	1/4W	5%	195631500
R2 to R7	MEOX	1k	1/2W	5%	193531000
R8 to R12	CACP	4.7k	1/8W	10%	172034700
R13 to R17	MEOX	5.6k	1/2W	5%	193535600
R18	MEOX	8.2k	1/2W	5%	193538200
R19	Set	940	Special		169603202
R20	Set	940	Special		169603202
R21	MEFM	470	1/8W	0.5%	192724702
R22	MEFM	820	1/4W	0.5%	192728202
R23	CACP	1.5k	1/8W	10%	172031500
R24	CACP	330	1/8W	10%	172023300
R25	MEFM	3.9k	1/8W	0.5%	192733902
R26	MEFM	470	1/8W	0.5%	192724702
R27	MEFM	18k	1/8W	0.5%	192741802
R28	CACP	4.7k	1/8W	10%	172034700
R29	CACP	1k	1/8W	10%	172031000
R30	CACP	1k	1/8W	10%	172031000
R31	POWW	22	1.5W	5%	173412200
R32	CACP	1M	1/8W	10%	172061000
R33	MEOX	8.2k	1/4W	5%	195638200
R34	CACP	330	1/8W	10%	172023300
R35	CACP	470	1/8W	10%	172024700
R36	CACP	470	1/8W	10%	172024700
R37	CACP	1M	1/8W	10%	172061000
R38	CACP	10k	1/8W	10%	172041000
R39	MEFM	47	1/8W	0.5%	192714702
R40	MEFM	4.7k	1/8W	0.5%	192734702
R41	MEFM	4.7k	1/8W	0.5%	192734702
R42	MEFM	1.8k	1/8W	0.5%	192731802
R43	MEFM	1.8k	1/8W	0.5%	192731802
R44	CACP	10	1/8W	10%	172011000
R45	CACP	10	1/8W	10%	172011000
RV1	WWPM	20k	1/2W	10%	121242000
RV2	WWPM	20k	1/2W	10%	121242000
RV3	WWPM	2k	1/2W	10%	121242000
RV4 to RV7	WWPM	10k	1/2W	10%	121241000
RV8	CMPM	100	3/4W	20%	124021000
RV9	CMPM	100	3/4W	20%	124021000
C1 to C6	CERM	.047	25V	+50% -25%	251944700
C7	ESTF	47p	400V	10%	222314700
C8	CERM	33p	500V	20%	241313300
C9	CERM	33p	500V	20%	241313300
C10	TAND	15	20V	20%	265871500
C11	TAND	15	20V	20%	265871500
C12	CERM	3300	500V	20%	241333300
C13	ESTM	0.47	100V	10%	225454700
D1 to D29	SD3				300522160
D30	Zener 12V			5%	300521480
D31	Zener 22V			5%	300523680
D32	Reference Zener 6.2V			5%	300524950
D33	Zener 5.1V			5%	300521310
D34	SD3				300522160
D35	SD3				300522160
D36	SD3				300522160
D37	Zener 3.9V				300521420
D38	SD3				300522160

Cct. Ref.	General Description	Solartron Part No.
TR1 to TR5	2N 2906A	300554500
TR6 to TR10	BC107	300553320
TR11	BCY70	300553590
TR12	BC107	300553320
TR13	BF115	300554170
TR14	BC107	300553320
TR15	TIP31	300554010
TR16	F.E.T. U 1897 E	300553800
TR17	F.E.T. U 1897 E	300553800
IC1	AD 741L	510090090
IC2	AD 741K	510090100
RLE	4 Pole c/o	300651890

Component Parts List

for

Printed Circuit Board A2009012

(Inverter Oscillator)

Cct Ref.	General Description				Solartron Part No.
R2	MEOX	150	1W	5%	193421500
R3	MEOX	47	1W	5%	193414700
R11	CACP	1.5k	1/4W	10%	172331500
R15	CACP	10	1/8W	10%	172011000
R16	CACP	220k	1/8W	10%	172052200
R17	MEOX	150	1W	5%	193421500
R18	CACP	220k	1/8W	10%	172052200
R19	CACP	10	1/8W	10%	172011000
R20	CACP	2.2	1/4W	10%	172302200
R21	CACP	2.2	1/4W	10%	172302200
R22	CACP	680	1/4W	10%	172326800
R23	CACP	2.2k	1/4W	10%	172332200
C4	CERM	6800p	500V		241036800
C5	TAND	47	35V	20%	266074700
C6	ALME	5	150V	+50% -10%	271665000
C7	ALME	5	150V	+50% -10%	271665000
C8	TAND	15	20V	20%	265871500
C9	TAND	15	20V	20%	265871500
C10	ALME	200	10V	+50% -20%	273182200
C13	CERM	470p	500V	20%	241324700
C14	CERM	0.01	25V		241941000
C15	CERM	0.01	25V	+50% -20%	241941000
C16	CERM	0.047	25V	+50% -20%	241944700
C17	TAND	15	20V	20%	265871500
D2 to D5	BA148				300525070
D6	IN4933				300524830
D7	IN4933				300524830
D8 to D13	BAY 72				300524530
D19	BAY 72				300524530
D20	BAY 72				300524530
TR6	BDX 35				300555230
TR7	BDX 35				300555230

Cct. Ref.	General Description			Solartron Part No.
TR8	2N 2218A			300552000
TR9	2N 3053			300551800
L3	Choke	68	10%	305020370
L4	Choke	68	10%	305020370
L5	Choke	300		309500101
L6	FX1115			309010060
L7	FX1115			309010060
T1	Timing			309600501
T2	Inverter			309600303

Component Parts List for Printed Circuit Board A2109013 (Integrator)

Cct Ref.	General Description					Solartron Part No.
R1	CACP	1M	1/8W	10%		172061000
R2	CACP	1M	1/8W	10%		172061000
R3	Special	1.9k	1/4W	0.1%		169602601
R4	CACP	1M	1/8W	10%		172061000
R5	Special	1.9k	1/4W	0.1%		169602601
R6	CACP	1M	1/8W	10%		172061000
R7	CACP	1M	1/8W	10%		172061000
R8	CACP	10	1/8W	10%		172011000
R9	CACP	10	1/8W	10%		172011000
R10	MEFM	110k	1/8W	0.5%		192751101
R11	MEFM	3.6k	1/4W	1%		198333602
R12	CACP	820	1/8W	10%		172028200
R13	MEFM	22k	1/8W	0.5%		192742202
R14	MEOX	27k	1/4W	5%		195642700
R15	MEFM	22k	1/8W	0.5%		192742202
R16	MEFM	3.9k	1/8W	0.5%		192733902
R17	MEFM	470k	1/8W	0.5%		192754702
R18	MEOX	10k	1/4W	5%		195641000
R19	MEFM	18k	1/8W	0.5%		192741802
R20	MEFM	470k	1/8W	0.5%		192754702
R21	CACP	22	1/8W	10%		172012200
R22	CACP	22	1/8W	10%		172012200
R23	MEFM	4.7k	1/8W	0.5%		192734702
R24	MEFM	4.7k	1/8W	0.5%		192734702
R25	CACP	1M	1/8W	10%		172061000
R26	CACP	22	1/8W	10%		172012200
R27	MEOX	22k	1/4W	5%		195642200
R28	CACP	22	1/8W	10%		172012200
R29	MEFM	47k	1/8W	0.5%		192744702
R31	MEOX	27k	1/4W	5%		195642700
R32	MEOX	22k	1/4W	5%		195642200
R33	MEFM	100	1/8W	0.5%		192721002
R34	MEFM	100	1/8W	0.5%		192721002
R35	CACP	10k	1/8W	10%		172041000
R36	CACP	10k	1/8W	10%		172041000
R37	MEOX	3.3k	1/4W	5%		195633300
R38	MEOX	12k	1/4W	5%		195641200
R39	MEOX	12k	1/4W	5%		195641200
R40	MEOX	3.3k	1/4W	5%		195633300
R41	MEOX	100k	1/4W	5%		195651000
R42	MEFM	56	1/4W	1%		198315602
RV1	WWPM	20k	1/2W	10%		121242000
C1 to C5	MICA	39p	350V	5%		250313900
C6	CERM	.047	25V	+50% -25%		241944700
C7	CERM	.047	25V	+50% -25%		241944700
C8	TAND	15	20V	20%		265871500
C9	TAND	15	20V	20%		265871500
C10	STYR	.22	100V	5%		208100170
C11	TAND	15	20V	20%		265871500
C12	TAND	15	20V	20%		265871500
C13	CERM	.047	25V	50% 25%		241944700
C14	ESTF	1500p	400V	10%		222331500
C15	ESTF	1000p	400V	10%		222331000
C16	ESTM	10	100V	10%		219971000
C17	ESTF	.047	25V	50%		241944700
C18	ESTM	.047	25V	+50% -25%		241944700
C19	MICA	39p	350V	5%		250313900
C20	CERM	2200p	500V	-25%		208450065
C21	CERM	.047	25V	+50% -25%		241944700
C22	CERM	.047	25V	+50% -25%		241944700
C23	CERM	3.3p	200	0.5%		208400125
C24	ESTF	150p	400V	10%		222321500
C25	MICA	56p	350V	5%		208500045
C26	CERM	.047	25V	+50% -25%		241944700
C27	CERM	.047	25V	+50% -25%		241944700
C28	CERM	.047	25V	+50% -25%		241944700
C29	CERM	.047	25V	+50% -25%		241944700
C30	CERM	.047	25V	+50% -25%		241944700
C31	CERM	.047	25V	+50% -25%		241944700
C32	CERM	.047	25V	+50% -25%		241944700
C33	ESTF	.047	25V	+50% -25%		241944700
C34	ESTF	47p	400V	10%		222314700
C35	ESTF	470p	400V	10%		222324700
D1 to D6	IN3595					300523590
D7	SD3					300522160
D8	Zener 3.9V					300521420
D9	Diode 3.9V		4W	5%		300521420
D10	SD3					300522160
TR1 to TR3	Selected F.E.T. Set Containing 3 Transistors					300400203
TR4 to TR6	F.E.T. U1897 E					300553800
TR7	BC 107					300553320
TR8	BCY 70					300553590
TR9	Selected F.E.T.					300400301
TR10	BC 107					300553320
TR11	2N 2913					300554510
IC1	LM301A					510000620
IC2	LM. 301A					510000620
IC3	LM 306					510090120
IC4	7400					510000340

Component Parts List for Printed Circuit Board A2109014 (AC Converter : Mean Sensing)

Cct Ref.	General Description				Solartron Part No.
R1	CKCA	10M	1/2W	5%	170871000
R2	POWW	15k	3W	5%	173741500
R3	MEOX	3.9k	1/4W	5%	195633900
R4	MEOX	1k	1/4W	5%	195631000

Cct. Ref.	General Description				Solartron Part No.
R5	CACP	3.9k	1/8W	10%	172033900
R6	CKCA	3.9k	1/4W	5%	195633900
R7	CKCA	1k	1/4W	5%	195631000
R8	CACP	3.9k	1/8W	10%	172033900
R9	CACP	1.5k	1/8W	10%	172031500
R10	CACP	3.3k	1/8W	10%	172033300
R11	CACP	1k	1/8W	10%	172031000
R12	CACP	820	1/8W	10%	172028200
R13	CACP	10M	1/8W	10%	172071000
R14	CACP	1k	1/8W	10%	172031000
R15	CACP	10k	1/8W	10%	172041000
R16	CACP	4.7k	1/8W	10%	172034700
R17	CACP	39	1/8W	10%	172013900
R18	CACP	390	1/8W	10%	172023900
R19	MEOX	3.9k	1/2W	5%	193533900
R20	MEOX	470	1/4W	5%	195624700
R21	MEOX	1k	1/4W	5%	195631000
R22	1.206k	Matched			169601201
R23	1.206k	Set			
R24	1.179k	of			
R25	131	four Resistors			
R26	MEFM	1.5	1/8W	1%	191201502
R27	MEOX	24k	1/4W	5%	195642400
R28	CACP	10	1/8W	10%	172011000
R29	MEFM	47k	1/8W	0.5%	192744702
R30	MEFM	10k	1/8W	0.5%	192741002
R31	MEFM	47k	1/8W	0.5%	192744702
R32	CACP	10	1/8W	10%	192011000
R33	POWW	15k	3W	5%	173741500
R34	CACP	1k	1/8W	10%	172031000
R36	MEOX	120k	1/4W	5%	195651200
R37	MEOX	1k	1/4W	5%	195631000
R38	MEOX	1k	1/4W	5%	195631000
R39	MEOX	120k	1/4W	5%	195651200
R40	CACP	100k	1/8W	10%	172051000
RV1	CMFS	100	1/8W	10%	110016040
RV2	CMPM	1k	1/4W	10%	124031000
RV3	CAPS	2.2k	1/2W	10%	137332200
C1	ESTM	0.033	630V	20%	226443300
C2	ESTF	4700p	160V	10%	221334700
C3	TAND	2.2	20V	20%	265862200
C4	ESTF	4700p	160V	10%	221334700
C5	ESTF	2200p	160V	10%	221332200
C6	TAND	2.2	20V	20%	265862200
C7	CERM	68p	500V	20%	241316800
C8	CERM	22p	500V	20%	241312200
C9	CERM	0.1	30V	-25% +50%	242051000
C10	ESTM	0.68	100V	10%	225456800
C11	ESTM	0.1	100V	10%	225451000
C12	CERM	0.1	30V	-25% +50%	242051000
C13	ESTM	1.0	100V	10%	225461000
C14	ESTM	1.0	100V	10%	225461000
C15	CERM	33p	500V	20%	241313300
C16	CERM	330p	500V	20%	241323300
C17	CERM	4.7p	500V	20%	241304700
C18	CERM	4.7p	500V	20%	241304700
D1	Zener 7.5V				300521460
D2	IN3595				300523590
D3	Zener 5.6V				300521450
D4	IN3595				300523590
D5	Zener 5.6V				300521460
D6	Zener 7.5V				300521460
D7	SD3				300522160
D8	SD3				300522160
D9	Zener 6.2V				300521240
D10	SD3				300522160
D11	SD3				300522160
D12	Zener 10V				300522760
D13	Zener 10V				300522760
D14	Hot Carrier H.P.5082-2800				300524910
D15	Hot Carrier H.P.5082-2800				300524910
D16	SD3				300522160
TR1	Dual Fet, 2N 3958				300553810

Cct. Ref.	General Description	Solartron Part No.
TR2 to TR4	BC107s	300553320
TR5	BCY70	300553590
TR6	BC107s	300553320
IC1	SN 72 709 N	510000250
RLJ	Varley PCB Type Silenced	301200202
L1	Mullard FX1115	309010060

Component Parts List

for

Printed Circuit Board A2109015

(A.C. Auxiliary : Mean Sensing)

Cct Ref.	General Description				Solartron Part No.
R1	Met. Film (Spec)	990k	2W	0.1%	169600501
R2	TKFM	10.68k	1/4W	0.1%	160400526
R3	MEFM	150k	1/4W	1%	198351504
R4	TKFM	14.77k	1/4W	1%	160400528
R5	TKFM	1.058k	1/4W	0.1%	160400527
R6 to R9	MEFM	47k	1/8W	0.5%	192744702
R10	CACP	4.7k	1/8W	10%	172034700
R12	MEOX	82	1/2W	5%	193518200
R13	MEOX	82	1/2W	5%	193518200
RV1	CMPM	20k	1/2W	10%	130642000
RV2	CMPM	2k	1/2W	10%	124032000
C1	MICA	1000p	350V	5%	250331000
C2	MICA	6800p	200V	5%	250336800
C3	ESTM	3.3	100	10%	225463300
C4	ESTM	0.68	100	10%	225463300
C5	ESTM	0.33	100	10%	225453300
C6	ESTM	0.47	100	10%	225454700
C7	MICA	22p	350	5%	250312200
C8	ESTM	0.022	160V	10%	220342200
C9	ESTM	3.3	100V	10%	225463300
C10	ESTM	0.68	100V	10%	225456800
C11	ESTM	0.33	100V	10%	225441000
C12	ESTM	0.01	100V	10%	225441000
C13	CERM	0.047	25V	-20% +10%	241944700
C15	TAND	22	35	20%	266072200
C16	PTFE	0.2 - 5p	2kV		290060020
C17	PTFE	2 - 24p	2kV		290060020
C18	TAND	6.8	35V	20%	266066800
C19	ESTM	0.68	100V	5%	225456800
C20	MICA	22p	350V	5%	250312200
C21	MICA	39p	350V	5%	250313900
C22	MICA	82p	350V	5%	250313900
C23	PTFE	2 - 24p	2kV		290060020
C24	TAND	22	35	20%	266072200
C26	PTFE	0.2 - 5p	2kV		290060060
D1 to D6	SD3				300522160
IC1	936				510000290
IC2	946				510000160
IC3	7406				510000760
IC4	962				510000200
IC5	7407				510000750
IC6	7406				510000760

Cct. Ref.	General Description	Solartron Part No.
RLG	Relay 2P. C.O. (Spec)	301201302
RLH	Relay 2P. C.O. / M & B	301201701
RLK	Relay 4P. C.O	300651890
RLL	Relay 4P. C.O. (Spec)	301201203
RLM	Relay 4P. C.O. (Spec)	301201203
RLR	Relay 2P. C.O.	301201701

Cct. Ref.	General Description	Solartron Part No.
TR3	BC107	300553320
TR4	BCY70	300553590
TR5	BC107	300553320
TR6	Dual Fet, U251	300554230
TR7	M.O.S. F.E.T., Plessey MT101B	300554220
IC1	741	510000591
IC2	7406	510000760
RLN	Relay Sp.St Reed	301201802
RLP	Relay 4.P. C.O. (Spec)	301200502
	Yarley PTFE P.C.B. MTG	

Component Parts List

for

Printed Circuit Board A2109016

(OHMS Unit)

Cct Ref.	General Description					Solartron Part No.
R1	CACP	1k	1/8W	10%		172031000
R2	POWW	10k	9W	5%		174041000
R3	PREC'	120k	1/4W	0.1%		169603501
R4	CACP	10	1/8W	10%		172011000
R5	CACP	10	1/8W	10%		172011000
R6	MEFM	2.7k	1/4W	1%		198332702
R7	MEFM	820	1/4W	1%		198328202
R8	MEFM	300	1/4W	1%		198323004
R9	TKFM	86.6	1/4W	1%		160400417
R10	TKFM	169	1/4W	1%		160400418
R11	TKFM	332	1/4W	1%		160400419
R12	TKFM	649	1/4W	1%		160400420
R13	TKFM	1270	1/4W	1%		160400430
R14	Prec. W.W. (Spec)	2.438k	1/4W	0.1%		169603101
R15	Prec. W.W. (Spec)	4.844k	1/4W	0.1%		169603001
R16	Prec. W.W. (Spec)	9.624k	1/4W	0.1%		169602901
R17	MEFM	1.1k	1/4W	1%		198331103
R18	CACP	2.2M	1/8W	10%		172062200
R19	MEFM	2.7k	1/4W	1%		198332702
R20	MEFM	330k	1/4W	1%		198353302
R21	MEFM	330k	1/4W	1%		198353302
R22	MEFM	100k	1/4W	1%		198351002
R23	CACP	1.5k	1/4W	10%		172031500
R24	Prec	3.6M	Set			169603603
R25	Prec	4.59M	Set			169603603
R26	Prec. W.W. (Spec)	8282k			0.005%	169603701
R27	POWW	10k	9W	5%		174041000
R28	MEFM	22k	1/8W	0.5%		192742202
R29	MEFM	22k	1/8W	0.5%		192742202
RV1	WWPM	100		10%		122021000
RV2	WWPM	20k		10%		122042000
C1	TAND	22	35V	20%		266072200
C2	CERM	0.047	25V	-20% +10%		241944700
C3	CERM	0.1	30V	+50% -20		242051000
C4	CERM	0.1	30V	-25% +50%		242051000
C5	ESTF	0.01	160V	10%		221341000
C6	CERM	0.01	3kV	20%		288450085
C7	CERM	0.1	30	+50% -25%		242051000
D6	SD3					300522160
D7	SD3					300522160
D8	Zener Ref. IN938					300524290
D9	SD3					300522160
D10	REF. IN823					300521270
D11	PAD10/BAV 48					300525340
D12	Zener 7.5V					300521460
D13	Zener 7.5V					300521460
D14	PAD10/BAV 48					300525340

Component Parts List

for

Printed Circuit Board A2109018

(Input Amplifier)

Cct Ref.	General Description				Solartron Part No.
R1	MEFM	10k	1/16W	1%	192641002
R2	CACP	1M	1/8W	10%	172061000
R3	MEFM	10k	1/16W	1%	192641002
R4	MEFM	220	1/16W	1%	192622202
R5	CACP	56k	1/8W	10%	172045600
R6	MEFM	2.2k	1/16W	1%	192632202
R7	CACP	10k	1/8W	10%	172041000
R8	MEFM	2.2	1/16W	1%	192632202
R9	CACP	470k	1/8W	10%	172054700
R10	MEFM	2.2k	1/16W	1%	192632202
R11	MEFM	10k	1/16W	1%	192641002
R12	MEFM	1.2k	1/16W	1%	192631202
R13	CACP	1M	1/8W	10%	172061000
R14	CACP	1k	1/8W	10%	172031000
R15	MEFM	15k	1/16W	1%	192641502
R16	MEFM	220	1/16W	1%	192622202
R17	CACP	56k	1/8W	10%	172045600
R18	MEFM	10k	1/16W	1%	192641002
R19	CACP	33k	1/8W	10%	172043300
R20	CACP	6.8k	1/8W	10%	172036800
R21	CACP	10k	1/8W	10%	172041000
R22	CACP	220k	1/8W	10%	172052200
R23	CACP	33k	1/8W	10%	172043300
R24	CACP	150	1/8W	10%	172021500
R25	CACP	1.8k	1/8W	10%	172031800
R26	CACP	22k	1/8W	10%	172042200
R27	CACP	22k	1/8W	10%	172042200
R28	CACP	3.3k	1/8W	10%	172033300
R29	CACP	27k	1/8W	10%	172042700
R30	CACP	1k	1/8W	10%	172031000
R31	MEFM	47	1/16W	1%	192614702
R32	CACP	100k	1/8W	10%	172051000
R33	MEFM	470	1/16W	1%	192624702
R34	MEFM	2.2k	1/16W	1%	192632202
R35	MEFM	10k	1/16W	1%	192641002
R36	CACP	6.8k	1/8W	10%	172036800
R37 to R42	CACP	1k	1/8W	10%	172031000
R43	CACP	470	1/8W	10%	172024700
R44	CACP	470	1/8W	10%	172024700
R45	CACP	100k	1/8W	10%	172051000
R46	MEFM	10	1/16W	1%	192611002
R47	CACP	3.3M	1/8W	10%	172063300
R48	MEFM	470	1/16W	1%	192624702
R49	CACP	390k	1/8W	10%	172053900
R50	CACP	33k	1/8W	10%	172043300
R51	CACP	68	1/8W	10%	172016800
R52	CACP	39	1/8W	10%	172013900
R53	MEFM	470	1/16W	1%	192624702
R54	CACP	3.3M	1/8W	10%	172063300

Cct. Ref.	General Description				Solartron Part No.
R55	CACP	22k	1/8W	10%	172042200
R57	CACP	68	1/8W	10%	172016800
R58	CACP	68	1/8W	10%	172016800
R59	CACP	470	1/8W	10%	172024700
R60	CACP	10k	1/8W	10%	172041000
R61	CACP	10k	1/8W	10%	172041000
R63	MEFM	47	1/16W	1%	192614702
RV1	CMFS	100			110016040
RV2	WWPS	10k			130541000
C1	ESTM	0.047	100V	10%	225444700
C2	ESTM	0.047	100V	10%	225444700
C3	MICA	22p	350V	5%	250312200
C4	TAND	22	15V	20%	265672200
C5	MICA	1000p	350V	5%	250333100
C6	TAND	15	20V	5%	265871500
C7	MICA	1000p	350V	5%	250331000
C8	MICA	100p	350V	5%	250321000
C9	TAND	47	20V	20%	265874700
C10	CERM	1000p	500V	20%	241331000
C11	MICA	470p	350V	5%	250324700
C12	ESTM	0.01	100V	10%	225441000
C13	TAND	22	15V	20%	265672200
C14	TAND	15	20V	20%	265871500
C15	TAND	15	20V	20%	265871500
C16	ESTM	0.22	100V	10%	225452200
C17	TAND	22	15V	20%	265672200
C18	CERM	33p	200V	10%	240713300
C19	CERM	33p	200V	10%	240713300
C20 to C23	ESTM	0.22	100V	10%	225452200
C24	ESTM	0.047	100V	20%	225444700
C25	ESTM	0.047	100V	20%	225444700
C26	ALME	47	40V	+100% -20%	273774700
C27	ALME	47	40V	+100% -20%	273774700
C28	CERM	0.047	25V	+50% -20%	241944700
C29	ESTM	0.047	100V	20%	225444700
C30	ESTM	0.047	100V	20%	225444700
C31	ESTM	0.022	100V	10%	225442200
D1	Zener C4V7				300521470
D2	SD3				300522160
D3	SD3				300522160
D4	Zener C6 V2				300521240
D5	Zener C3 V3				300521860
D6	IN3595				300523590
D7	IN3595				300523590
D8	Zener C18				300521300
D9	Zener C18				300521300
D10	IN3595				300523590
D11	IN3595				300523590
D12	Zener C4 V7				300521470
D13	SD3				300522160
TR1	2N4303				300553160
TR2	BFX37				300553030
TR3	2N4303				300553160
TR4	BFX37				300553030
TR5	BFX37				300553030
TR6 to TR8	BC107S				300553320
TR9 to TR13	2N2369				300552390
TR14	40673				300555210
TR15	U1897E				300553800
TR16	U1897E				300553800
IC1	MC1436G				510090030
IC2	741C				510000591

Component Parts List

for

Printed Circuit Board A2109019

(Floating Section Ranging)

Cct. Ref.	General Description				Solartron Part No.
R1	Matched	99.95K			169602401
R2 to R5	Set of Prec W.W.	2.475M			
R6	MEFM	47k	2W	1%	199344702
R7	MEFM	100	1/8W	0.5%	192721002
R8	Matched Set : Prec. W.W.	90k			169602302
R9	Matched Set : Prec. W.W.	270k			
R10	Matched Set : Prec. W.W.	9.3k			
R11	Matched Set : Prec. W.W.	909			
R12	Matched Set : Prec. W.W.	100.84			
R13	MEFM	82k	1/8W	0.5%	192748202
R14	MEFM	10k	1/8W	0.5%	192741002
R15	Matched Set : Prec. W.W.	4.648k			169602501
R16	Matched Set. Prec. W.W.	2.4k			
R17	Matched Set : Prec. W.W.	1.6k			
R18	MEFM	18	1/8W	0.5%	192711802
R19	Prec. W.W.	12k	1/4W	0.1%	169602701
R20	Prec. W.W.	19.124k	1/4W	0.1%	169602801
R21	Prec. W.W.	9.624k	1/4W	0.1%	169602901
R22	Prec. W.W.	4.844k	1/4W	0.1%	169603001
R23	Prec. W.W.	2.438k	1/4W	0.1%	169603101
R24	MEFM	1.27k	1/8W	1%	160400430
R25	MEFM	649	1/8W	1%	160400420
R26	MEFM	332	1/8W	1%	160400419
R27	MEFM	169	1/8W	1%	160400418
R28	MEFM	86.6	1/8W	1%	160400417
R29	MEFM	200k	1/8W	0.5%	192752002
R30	MEFM	470	1/8W	0.5%	192724702
R31	MEFM	68k	1/2W	1%	198646803
R32	MEFM	180k	1/2W	1%	198651803
R33	CACP	470	1/8W	10%	172024700
R34	CACP	470	1/8W	10%	172024700
R35	MEFM	47	2W	1%	199344702
R36	MEOX	150	1/2W	5%	193521500
R37	MEOX	150	1/2W	5%	193521500
R38	MEOX	150	1/2W	5%	193521500
R39	CACP	10	1/8W	10%	172011000
RV1	WWPM	10k	1W	5%	122041000
RV2	WWPM	20k	1W	5%	122042000
RV3	WWPM	20k	1W	5%	122042000
RV4	WWPM	5k	1W	5%	122035000
RV5	WWPM	20k	1W	5%	122042000
RV6	WWPM	500	1/2W	10%	121225000
C1	STYR	0.1	63V	10%	209951000
C2	STYR	0.47	63V	10%	209954700
C3	STYR	4700	25V	10%	210234700
C4	STYR	0.047	25V	10%	210244700
C5	CERM	0.01	3kV	20%	208450085
C6 to C9	TAND	22	35V	20%	266072200
D1 to D6	SD3				300522160
IC1	SN7407N				510000750
IC2	SN7407B				510000750

Cct. Ref.	General Description	Solartron Part No.
RLA	4 Pole	301200805
RLB	2 Pole C/O	301200903
RLC	2 Pole C/O	301200903
RLD	2 Pole C/O	300651880
RLF	Reed N/O	301201802
RLQ	2 Pole C/O	301200202

Component Parts List

for

Printed Circuit Board A2009022

(Power Supply Stabiliser)

Cct. Ref.	General Description					Solartron Part No.
R1	POWW	0.22	2.6W	10%		173500220
R4	CACP	22k	1/4W	10%		172342200
R5	CACP	1k	1/4W	10%		172331000
R6	CACP	10k	1/4W	10%		172341000
R7	CACP	2.2k	1/4W	10%		172332200
R8	CACP	2.2k	1/4W	10%		172332200
R9	CACP	470	1/4W	10%		172324700
R12	MEFM	4.7k	1/8W	0.5%		192734702
R13	MEFM	2.2k	1/8W	0.5%		192732202
R14	CACP	2.2k	1/8W	10%		172032200
RV1	WWPM	1k	1/2W	10%		121231000
C1	CERM	0.1	30V	+50% -25%		242051000
C2	CERM	0.1	30V	+50% -25%		242051000
C3	CERM	470	500V	20%		241324700
C11	ALME	4000	40V			208600155
C12	TAND	2.2	20V	20%		265862200
D1	Zener C6V8					300522540
D14	SD3					300522160
D15 to D18	1S020					300520670
TR1	BC107s					300553320
TR2	BC107s					300553320
TR3	SM6526					300552990
TR4	SM6526					300552990
TR5	BFY50					300553610

Component Parts List

for

Printed Circuit Board A2149027

Cct. Ref.	General Description					Solartron Part No.
R1 to R14	CACP	5.6k	1/8W	10%		172035600
R17	CACP	2.2k	1/8W	10%		172032200
R18	CACP	220k	1/8W	10%		172052200
R19	CACP	10k	1/8W	10%		172041000
R20	CACP	4.7k	1/8W	10%		172034700
R21	CACP	1.2k	1/8W	10%		172031200
R22	CACP	1k	1/8W	10%		172031000
R23	CACP	470	1/8W	10%		172024700
R24	CACP	100	1/8W	10%		172021000
C1	CERM	3300p	500V	25%		241333300
C2	CERM	.047	25V	+50% -25%		241944700
D1 to D4	SD3					300522160
TR1	BC107A					300553320
TR2	BCY70					300553590
IC1	7407					510000750
IC2	7407					510000750
IC3	836					510000290
IC4	836					510000290
IC5	7482					510000510
IC6	862					510000200
IC7	7407					510000750
IC8	846					510000160
IC9	836					510000200
IC10	846					510000160

Component Parts List

for

Printed Circuit Board A2149028

Cct. Ref.	General Description					Solartron Part No.
R1	CACP	5.6k	1/4W	10%		172335600
R2	CACP	33k	1/8W	10%		172043300
R3	CACP	2.7k	1/8W	10%		172032700
R4	CACP	1k	1/8W	10%		172031000
R5	CACP	1k	1/8W	10%		172031000
R6	CACP	4.7k	1/8W	10%		172034700
R7	CACP	4.7k	1/8W	10%		172034700
R8	CACP	1k	1/8W	10%		172031000
R9	CACP	12k	1/8W	10%		172041200
C1	ESTM	0.68	100V	10%		219856800
C2	CERM	0.047	25V	50% -25%		241944700
C3	CERM	470p	500V	20%		241324700
C4	CERM	33p	500V	20%		241313300
C5	CERM	0.01	25V	+50% -20%		241941000
C6	CERM	0.01	25V	+50% -20%		241941000
TR1	BC107A					300553320
TR2	BCY70					300553590
IC1	862					510000200
IC2	836					510000290
IC3	862					510000200
IC4	7474					510000490
IC5	836					510000290
IC6	74121					510000530
IC7	844					510000140
IC8	862					510000200
IC9	7486					510000650
IC10	862					510000200
IC11	862					510000200
IC12	7490					510000280
IC13	836					510000290
IC14	846					510000160
IC15	8093					510000300
IC16	846					510000160

Component Parts List

for

Printed Circuit Board A2109029

(Switch Board : Mode & Range)

Cct. Ref.	General Description				Solartron Part No.
R1 to R7	CACP	4.7k	1/8W	10%	172034700
IC1	7406				510000760
IC2	7406				510000760
S.A.	Push Button : (7/ Way)				379602901
S.B.	Push Button : (3/Way)				379600201

Component Parts List

for

Printed Circuit Board A2109030

(Switch Board : Control, Rate & Response)

Cct. Ref.	General Description				Solartron Part No.
R1 to R3	CACP	4.7k	1/8W	10%	172034700
S.C.	Push Button (2-Way)				379600101
S.D.	Push Button (2-Way)				379600402
S.E.	Push Button (2-Way)				379600101

Component Parts List

for

Printed Circuit Board A2289032

(A228 Ratio Unit : Mother Board)

Cct. Ref.	General Description				Solartron Part No.
R1	MEFM	39k	1/8W	1%	192743902
R2	CACP	4.7k	1/8W	10%	172034700
R3	MEFM	2.2k	1/8W	1%	192732202
RV1	WWPM	20k	1/2W	10%	222334700
C1	ESTF	4700	400V	10%	222334700

Component Parts List

for

Printed Circuit Board A2289033

(A228 Ratio Unit : Amplifier Board)

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	220k	1/8W	10%	172052200
R2	CACP	470	1/4W	10%	172024700
R3	CACP	10k	1/4W	10%	172041000
R4	CACP	100k	1/4W	10%	172051000
R5	CACP	220k	1/4W	10%	172052200
R6	CACP	39	1/4W	10%	172013900
R7	CACP	220k	1/4W	10%	172052200
R8	CACP	10k	1/4W	10%	172041000
R9	CACP	68k	1/4W	10%	172046800
R10	CACP	330	1/4W	10%	172023300
R11	CACP	330	1/4W	10%	172023300
R12	CACP	10k	1/4W	10%	172041000
R13	CACP	10k	1/4W	10%	172041000
R14	CACP	22k	1/4W	10%	172042200
R15	CACP	22k	1/4W	10%	172042200
R16	CACP	3.3k	1/4W	10%	172033300
R17	CACP	3.3k	1/4W	10%	172033300
R18	CACP	10k	1/4W	10%	172041000
R19	CACP	10k	1/4W	10%	172041000
R20	CACP	33k	1/4W	10%	172043300
R21	CACP	100k	1/4W	10%	172051000
R22	CACP	100k	1/4W	10%	172051000
R23	MEFM	10	1/16W	1%	192611002
R25	CACP	220k	1/8W	10%	172052200
R26	CACP	470	1/8W	10%	172024700
R27	CACP	100	1/8W	10%	172021000

Cct. Ref.	General Description				Solartron Part No.
RV1	WWPM	20k			121242000
C1	ESTM	0.47	100V	10%	225454700
C2	ESTM	0.047	100V	10%	225444700
C3	ESTM	.047	100V	10%	225444700
C4	ALME	200	10V	20%	273182200
C6	ESTM	0.47	100V	10%	225454700
C7	TAND	47	20V	20%	265874700
C8	CERM	.047	25V	20%	241944700
C9	CERM	100p	500V	+50% -20%	241321000
C10	ESTM	1.0	100V	10%	225461000
C11	ALME	47	40V	+50% -10%	273774700
C12	ALME	47	40V	+50% -10%	273774700
C13	CERM	1000p	500V	20%	241331000
C14	ESTM	.047	100V	10%	225444700
C15	ESTM	.047	100V	10%	225444700
C16	CERM	2.2p	500V	20%	208450094
C17	ESTM	0.1	100V	10%	225451000
D1 to D4	IN3595				300523590
D5	SD3				300522160
D6	SD3				300522160
D7	Zener	3.9V	400mW	5%	300521420
D8	Zener	3.9V	400mW	5%	300521420
D11	Zener	8.2V			300521330
TR1	40673				300554210
TR2	40673				300554210
TR3	BC107				300553320
TR4	BC107				300553320
IC1	A741				510000591
IC2	LM301A				510000620

Component Parts List

for

Printed Circuit Board A2289035

(A228 Ratio Unit : Logic Board)

Cct. Ref.	General Description				Solartron Part No.
R1	CACP	4.7k	1/8W	10%	172034700
R2	CACP	4.7k	1/8W	10%	172034700
R3	MEFM	10k	1/8W	1%	192741002
R4	MEFM	10k	1/8W	1%	192741002
R5	MEFM	5.6	1/8W	1%	191205602
R6	MEOX	680	1W	5%	193426800
R7	MEOX	680	1W	5%	193426800
C1	CERM	0.047	25V	50%	241944700
C2	ESTM	1.0	63V	10%	225161000
C3	ESTM	1.0	63V	10%	225161000
C4	TAND	33	10V	20%	265473300
C5	CERM	0.047	25V	50%	241944700
C6	CERM	0.047	25V	50%	241944700
D1	SD3				300522160
D2	SD3				300522160
IC1	74121				510000530
IC2	74121				510000530
IC3	7406				510000760

Component Parts List

for

Printed Circuit Board A2289036

(Ratio Unit : Attenuator)

Cct. Ref.	General Description				Solartron Part No.
R1	Set of 3	1893k	1/4W	0.1%	169695701
R2	PREC.	540.4k	1/4W	0.1%	169695701
R3		850.0k	1/4W	0.1%	169605801
R4		42.59k	1/4W	0.1%	169605901
R5	MEFM	21.5k	1/8W	1%	192742152
R6	MEFM	11.0k	1/8W	1%	192741102
R7	MEFM	5.6k	1/8W	0.5%	192735602
R8	MEFM	2.87k	1/8W	1%	192732872
R9	MEFM	1.47k	1/8W	1%	192727502
R10	MEFM	750	1/8W	1%	192727502
R11	W.W.	189.3k	1/4W	0.1%	169695701
RV1	WWPM	1k	1W	5%	122031000
C1	ESTM	1.5	63V	20%	219961500

Component Parts List

for

Printed Circuit Board A2109041

(A.C. Converter, True R.M.S.)

Cct Ref.	General Description				Solartron Part No.
R1	CKCA	10M	1/2W	5%	170871000
R2	CACP	100k	1/8W	10%	172051000
R3	MEFM	10k	1/8W	1%	191241002
R4	CACP	10k	1/8W	10%	172041000
R5	MEFM	10k	1/8W	1%	191241002
R7	4804	1.179k	0.1W	0.1%	169607101
R8	4804	131	0.1W	0.1%	169607101
R9	MEFM	4.7	1/8W	1%	191204702
R11	MEOX	120	1W	5%	193421500
R12	MEOX	120	1W	5%	193421500
R13	4804	50k	0.1W	0.1%	169607101
R16	CACP	10M	1/2W	10%	172371000
R18	MEFM	4.7	1/8W	10%	191204702
R19	CACP	10k	1/8W	10%	172041000
C1	ESTM	0.033	630V	10%	226343300
C2	ESTF	0.01	400V	10%	222341000
C4	CERM	3300	500V	+50% -25%	241333300
C5	CERM	3300	500V	+50% -25%	241333300
C6	CERM	22	500V	+50% -25%	241333300
C8	TAND	330	6V		265283300
C9	ESTM	0.47	100V	10%	225454700
C10	ESTM	0.47	100V	10%	225454700
C12	ESTM	2.2	63V	10%	225162200
C14	ESTM	1	100V	10%	225461000
C16	CERM	100	500V	+50% -25%	241321000

Cct. Ref.	General Description				Solartron Part No.
D3	BZY88	3.3	0.4W	5%	300521860
D4	BZY88	5.6	0.4W	5%	300521450
D5	IN4739A	9.1	1W	5%	300525410
D6	IN4739A	9.1	1W	5%	300525410
D7	BZY88	5.6	0.4W	5%	300521450
D8	IN3595				300523590
D9	IN3595				300523590
D10	SD3				300523590
D11	IN3595				300523590
D12	IN3595				300523590
TR1	Dual F.E.T. U235				300553810
TR2	BC107				300553320
TR3	BC107				300553320
IC1	OP. AMP., I.C. LM318H				510090210
IC2	RMS Module, Intronics R310				510090220
RV1	CMPM	1k	3/4W	20%	130631000
RV2	CMPM	500	3/4W	20%	130625000
RV3 to RV6	CMPM	20k	3/4W	20%	130642000
RLJ	REED RELAY				300651870

Component Parts List

for

Printed Circuit Board A2109056

(Display)

Cct Ref.	General Description				Solartron Part No.
R1 to R4	MEOX	68k	1/2W	5%	193546800
R5	CACP	1	1/8W	10%	172061000
R6	CACP	1	1/8W	10%	172061000
R7	CACP	2.2k	1/8W	10%	172032200
R8	MEOX	47k	1/2W	5%	193544700
R9	MEOX	48k	1/2W	5%	193546800
R10	MEOX	150k	1/2W	5%	193551500
R11	MEOX	100k	1/2W	5%	193551000
R12	MEOX	120k	1/2W	5%	193551200
R13	CACP	2.2k	1/8W	10%	172032200
R14	MEOX	120k	1/2W	5%	193551200
R15	MEOX	120k	1/2W	5%	193551200
R16	MEOX	100k	1/2W	5%	193551000
R17	MEOX	120k	1/2W	5%	193551200
R18	CACP	1	1/8W	10%	172061000
R19	CACP	2.2k	1/8W	10%	172032200
R20 to R24	CACP	5.6M	10%	1/8W	172365600
R25 to R28	CACP	1M	1/8W	10%	172061000
D1	Zener	39v	1W		300525480
X1	Display Sperry SP354				300730290
X2	Display Sperry SP352				300730270
X3	Display Sperry SP352				300730270
LP1 to LP7	Neon NS 509/1				300720450

Component Parts List

for

Printed Circuit Board A2109057

(Display Driver)

Cct Ref.	General Description				Solartron Part No.
R1	MEOX	68k	0.5W	5%	193546800
R2	CACP	220	1/8W	10%	172022200
R3	CACP	3.3k	1/8W	10%	172033300
R4	CACP	4.7k	1/8W	10%	172034700
R5	CACP	3.3k	1/8W	10%	172033300
R6	CACP	3.3k	1/8W	10%	172033300
R7	CACP	3.3k	1/8W	10%	172033300
R8	CACP	3.3k	1/8W	10%	172033300
R9 to R13	MEOX	12k	1/4W	5%	195641200
R14	CACP	3.3k	1/8W	10%	172033300
R15 to R19	CACP	270k	1/8W	10%	172052700
D1	Zener C3VO				300523880
D2 to D6	IS 921				300522620
TR1 to TR4	40327				300552890
TR5 to TR7	A1778				300551430
TR8 to TR10	40327				300552890
IC1 to IC5	Decoder/Driver Sperry				510001600
IC6	BCD-DEC. Decoder/Driver				510000471
V1	Neon Lamp				300720220

Component Parts List

for

Main Frame

(Earthy Section)

Cct Ref.	General Description				Solartron Part No.
R1	CACP	1M	1/4W	10%	172361000
R2	CACP	1M	1/4W	10%	172361000
R10	POWW	130	3W	5%	173721300
R24	POWW	130	3W	5%	173721300
C1	PAPF	0.047	630V		208300059
C2	PAPF	0.047	630V		208300059
TR1	2N3055				300552340
FS1	Fuse Link 500MA				360103060
SJ	Slider D.P.D.T.				375000100
SK	Slider D.P.D.T.				375000100
	Mica Washer				300584050
	Insulator Bush				300584040
	Transformer : Mains				309600205

Component Parts List

for

Floating Box Assembly

Cct Ref.	General Description				Solartron Part No.
RV1	CAFS	4.7	1/4W	20%	136834700
T1	Toroid Transformer Block				309601408
R1	CACP	220	1/8W	10%	172022200
C1	ESTF	0.01	400V	10%	222341000

Parts List

for

Mother Boards

(No Components Fitted)

Earthy Section Mother Board A2109008

Floating Section Mother Board A2109020

Component Parts List

for Accessories

General Description	Solartron Part No.
Accessories Kit comprising the following items	A2100006
Input Lead Assy.	A2000168
Clip: Alligator (Red)	355900670
Clip: Alligator (Black)	355900660
Prod. Test (Black)	351901010
Prod. Test (Red)	351901020
Fuse: 500MA	360103060
Fuse: 1 AMP	360103080
Lock Plate Fabrication	A2100265
Handle (Rack Mounting)	429700101