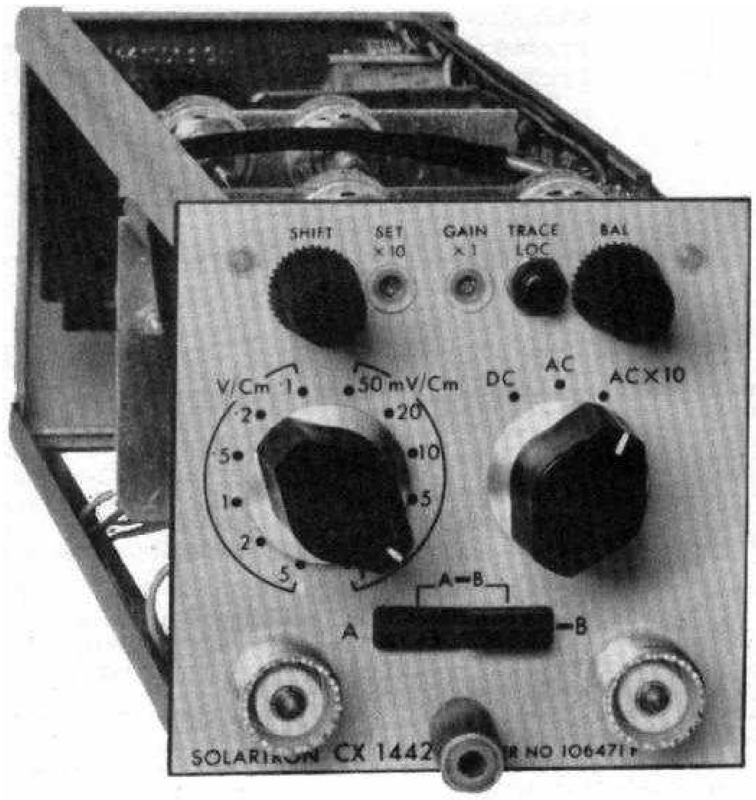
HIGH GAIN DIFFERENTIAL AMPLIFIER CX 1442



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SECTION 1
INTRODUCTION

1. The CX 1442 is a high-gain, differential Y amplifier for use with the CD 1400 oscilloscope main frame unit. It consists of a four-stage push-pull amplifier, and employs a balanced input attenuator ganged with the gain selector of the final amplifier for range setting. A high degree of in-phase rejection is obtained by operating the cathode-coupled input stage with a constant cathode current, and by stabilising certain critical electrode potentials.

SECTION 2
SPECIFICATION

2. **Bandwidth.** DC—75kc/s minimum (−3dB) on all calibrated ranges.
Sensitivity. 1mV/cm to 5V/cm covered in 12 calibrated ranges in 1, 2, 5, steps. Switched x10 gain available on all ranges giving a maximum sensitivity of 100μV/cm over the approximate bandwidth 3c/s—20kc/s minimum.
Input
Impedance. 1MΩ/35pF.
Condition. Switched choice of d.c. or a.c. (via 0·1μF) coupling.
Maximum Voltage. 150V peak.

Measuring Accuracy. ±5%.
Hum and Noise. <3mm at maximum sensitivity.
Common Mode Rejection. 60dB approximately.
Shift. Approximately 2 screen diameters.
Overall Dimensions and Weight

Height	3¼ in.	(8·2 cm)
Width	3¼ in.	(8·2 cm)
Depth	11½ in.	(28·3 cm)
Weight	1¾ lb	(0·79 kg)

SECTION 3
INSTALLATION AND OPERATING INSTRUCTIONS

INSTALLATION

INSERTION IN MAIN FRAME

3. Insert the CX 1442 sub-unit into either of the left-hand positions of the CD 1400 main frame unit. Engage thread of captive securing screw, and drive sub-unit fully-home by turning screw in a clockwise direction.

CAUTIONS

(1) Do not operate the instrument when it is standing on its back or on either side. However, short-term operation in these positions is permissible for servicing purposes.
(2) Always switch-off the instrument before removing any plug-in unit.
(3) Do not operate the instrument for long periods of time with any plug-in unit removed.
(4) Do not restrict the ventilation by placing other equipment or articles on top of the instrument.

OPERATING INSTRUCTIONS

PANEL CONTROLS

4. **Input Sockets (SKTA and SKTB)**
83 UHF coaxial sockets for signal inputs, connected to either side of the amplifier. The left-hand socket is designated 'A', and the right-hand socket '−B'.
Signal Selectors (SA1 and SA2)
Two single-pole, push-button switches, designated 'A' and −B', which when closed, apply the signal connected to the similarly designated socket to the appropriate side of the input amplifier to provide three modes of operation, *viz:*—

SWITCH CONDITION		DISPLAYED SIGNAL
'A'	'−B'	
"closed"	"open"	'A' only.
"open"	"closed"	Reverse phase display of '−B' relative to chassis.
"closed"	"closed"	Difference between 'A' and '−B'.

When both switches are "open", no input is applied to either side of the amplifier, the d.c. balance of which can then be set by adjustment of the BALance control. In this condition, the input grids are connected to chassis, and the input sockets are "floating".
Input Condition Selector (SB)
A three-position switch, in its first two positions giving choice of D.C. or A.C. signal coupling. In the third position, A.C. x10, the first cathode-follower stage is switched to operate as a conventional anode-loaded amplifier to provide a x10 gain increase. In both A.C. modes, d.c. negative feedback is employed to stabilise the operating point to ensure freedom from drift.
Range Selector (SC)
A 12-position switch giving calibrated control of the Y amplifier sensitivity between 1mV/cm and 5V/cm in 1, 2, 5, sequence.

SET GAIN Controls, x10 (RV3) and x1 (RV4)
Two preset, screwdriver adjusted, variable resistors providing control of amplifier gain for calibration purposes. Variable resistor RV4 sets the overall gain of the amplifier, whilst RV3 operates only on the A.C. x10 condition.

BALance Control (RV2)
A potentiometer for setting the d.c. balance condition.
TRACE LOCator (SE)
A push-button switch reducing the gain of the final amplifier to assist in trace location.
SHIFT Control (RV5)
A potentiometer controlling the trace position on the vertical axis.

OPERATION

General

5. The directions given in paragraphs 6 to 7 following assume that the CD 1400 main frame unit is fitted with a suitable X sub-unit, and that the CD 1400 controls have been adjusted to provide two satisfactory traces.

D.C. Balancing Procedure

6. **Note**: This procedure must be carried out prior to operation in any mode.
   (1) Apply power to the CD 1400 main frame unit, and allow a three minute warming-up period.
   (2) Set range selector (SC) to '50mV/cm', input condition selector (SB) to D.C., and both signal selector switches (SA1, SA2) to the 'open' (out) positions.
   Note: Switches SA1 and SA2 are 'closed' when the push-buttons lock-in after depression. They are returned to the 'open' position by further pressure followed by release.
   (3) Centre trace in the vertical direction by adjustment of the appropriate SHIFT control (RV5).
   (4) Set range selector (SC) to '·1V/cm' position, and re-centre trace by adjustment of BALance control (RV2).
   Note: Depress TRACE LOCator button if trace disappears when SC is set to the '·1V/cm' position.
   (5) Return range selector to '50mV/cm' position, and re-centre trace with appropriate SHIFT control.
   (6) Return range selector to '·1V/cm' position, and re-centre trace with BALance control.
   (7) Allow a further warm-up period of 15 minutes.
   (8) Repeat the procedure described in sub-paragraphs (4) to (7) inclusive.
   (9) Finally, check that no appreciable vertical trace movement occurs as the range selector is turned through the six positions from '1mV/cm' to '50mV/cm'.

Calibration

7. (1) Set appropriate range selector to the '1mV/cm' position, and apply the '5mV' calibrating voltage from SKTG on the CD 1400 to the 'A' input socket on the CX1442, via a screened cable.
   (2) Set the 'A' signal selector (SA1) to the 'closed' (in) position, and the '−B' signal selector to the 'open' (out) position.
   (3) Using a screwdriver, adjust the x1 SET GAIN control (RV4) for an exact peak-to-peak trace height of 5cm.
   (4) The CX 1442 is now calibrated on all 12 ranges for x1 and x10 gain operation.

CAUTION
The calibration of any CX 1442 sub-unit is valid only so long as the module is operated in the same position in the identical CD 1400 main frame unit in which the calibration was performed. If the CX 1442 sub-unit is transferred to another CD 1400 frame unit, or inter-changed between the upper and lower positions in the original CD 1400 frame unit, the sub-unit must be re-calibrated following the directions given in sub-paragraphs (1) to (4) preceding.

Probe Adjustment

8. (1) Connect probe lead to the required input socket ('A' or '−B') on the CX 1442 sub-unit, and depress the appropriate switch ('A' or '−B') to complete the input circuit.
   (2) Set the range selector (SC) to '2V/cm', and the input condition selector (SB) to A.C.
   (3) On the X sub-unit set the TIME/CM control to '500μsec'.
   (4) Insert probe tip into PROBE TEST socket, mounted in lower left-hand corner of the X sub-unit (CX 1443) front panel.
   (5) Adjust pre-set variable capacitor in probe for optimum square-wave response of the trace displayed.

Note: Since the 'A' and '−B' input capacitances are equalised, once the probe has been set up on one input, it can be transferred to the other without readjustment.

SECTION 4
PHYSICAL DESCRIPTION

MECHANICAL

9. The CX 1442 sub-unit is constructed on a rigidly braced framework and provided with locating slots to ensure accurate alignment of the connecting plug with the mating socket mounted on the CD 1400 main frame unit. The circuitry is built round two flow-soldered printed boards, Nos. 14429401 and 14429402. The main board (No. 14429401) is mounted in the vertical plane to promote efficient convection cooling. The control panel is faced with Melamine laminate material, and the sub-unit captive securing screw is drilled to accept a 4mm banana plug for the purpose of earth connection.

ELECTRICAL

10. The power and signal connections to the sub-unit are applied via an 18-way plug PLA. The pin assignments for this connector are listed in Table 1, and a sketch showing the position of the pins on the plug is given in the circuit diagram.

TABLE 1
PIN ASSIGNMENTS CX 1442 CONNECTOR PLA

PLA PIN NO.	FUNCTION
1	No connection.
2	No connection.
3	−50 volts rail, decoupled.
* 4	+360 volts rail, direct off reservoir capacitor
* 5	−56 volts rail, direct off reservoir capacitor
6	+320 volts rail, decoupled.
7	Chassis, zero volts.
* 8	+7·5 volts rail.
* 9	−7·5 volts rail.
10	−16 volts d.c. heater supply.
*11, *12	6·3 volts, 3·5 amperes, a.c. heater supply.
13, 14	6·3 volts, 2·5 amperes, a.c. heater supply, floating at 200 volts above earth.
15, 16	Trigger signal to X sub-unit.
17, 18	Balanced drive to c.r.t. Y plates.

NOTE. The supplies appearing at pins marked with an asterisk (*) are not used on the CX 1442 sub-unit.

SECTION 5
CIRCUIT DESCRIPTION

INPUT ATTENUATORS

11. The input signals are applied at sockets SKTA and SKTB, designated "A" and "−B" on the panel. Push-button switches SA1 ("A") and SA2 ("−B") when closed apply the signal connected to the similarly designated socket to the appropriate side of the input amplifier to provide three modes of operation, viz:—

SWITCH CONDITION		DISPLAYED SIGNAL
"A"	"−B"	
closed	open	"A" only.
open	closed	Reverse-phase display of "−B" relative to chassis.
closed	closed	Difference between "A" and "−B".

When both switches are open, no input is applied to either side of the amplifier, the input grids are earthed, and the d.c. balance can then be set by adjustment of the BALance control. Switchbanks SB1R and SB2R provide choice of D.C. or A.C. signal coupling. Identical resistive, capacitance-compensated attenuators are included in both "A" and "−B" input circuits, only one of which ("A") is described here.

In positions 7-12 of switchbank SC1F (the mV/cm ranges), the signal is applied unattenuated to the control grid of valve V2, the input capacitance then being adjusted by variable capacitor C3. In positions 1-6 of SC1F (the V/cm ranges), the signal is divided down by the 100:1 attenuator formed by resistors R1 and R2 prior to application to the input stage V2. Input capacitance adjustment is now effected by variable capacitor C5, which is switched in parallel with C3 by switchbank SC1R. The basic sensitivities of 0·1V/cm and 1mV/cm provided by the input attenuator are reduced to 2, 5, 10, 20, 50, V or mV/cm by stepped control of the gain of a later stage of the amplifier. (Refer paragraph 14.) Frequency compensation is effected by capacitors C4 and C6. Preset potentiometer RV1 permits equalisation of the attenuation of the two voltage dividers R1, R2, and R3, R4, which form the balanced attenuator.

DIFFERENTIAL AMPLIFIER

12. A four-stage, direct-coupled, balanced amplifier is employed to apply a push-pull drive to the Y plates. For the purpose of the following description it is assumed that the amplifier is being operated in the differential mode, i.e., with switches SA1 and SA2 both closed to display the difference ("A" "−B") signal. The "A" and "−B" signals are applied respectively to the control grids of pentodes V2 and V1, which are connected as a cathode-coupled differential amplifier. A high degree of in-phase rejection is ensured by operating the stage with a constant current through a common cathode load of high dynamic resistance. This condition is established by two means. Firstly, by replacing the conventional cathode-coupling resistor with a pentode valve V3A, the grid/cathode potential of which is held constant at approximately 9 volts by the zener voltage developed across MR1. Secondly, by tying the potential of the screen grids to that of the cathodes via the cathode-follower V3B and neon tube V5. The actual potential then applied to the screen grids of V2 and V1 will consist of the stabilised potential developed across the neon reference tube V5, plus the grid/cathode voltage of V3B.

Low drift is ensured by operating V1, V2, and V4 heaters from a transistor-stabilised d.c. heater supply. The anode potentials of V2 and V1 can be equalised by adjustment of the BALance control RV2. Push-pull output is taken from the anodes of V2 and V1, and is direct-coupled to the grids of the succeeding stage V4.

13. The second stage, employing the double-triode V4, is switched by the input condition selector SB between two different modes of operation. On D.C. and A.C. working (positions 1 and 2 of SB), valve sections V4B and V4A are connected as two independent cathode-followers. In this condition, the anode resistors R8 and R12 are parallelled by switchbank SB3R, and unity gain output is developed across the cathode load resistors R10 and R9. On A.C. X10 operation (position 3 of SB), the stage is switched to operate as a gainful cathode-coupled differential amplifier, in which condition the parallel connection is removed from R8 and R12, and a cathode-coupling mesh network (R10, RV3, R9) is introduced by switchbank SB3F. Variable resistor RV3 controls the degree of coupling between V4B and V4A to enable the gain of the stage to be set to exactly 10. Due to the 180° phase-shift produced by the common-cathode amplifier, the outputs are applied via capacitors C13 and C14 to the opposite sides of the succeeding stage (V7, V6, pentode sections) to that receiving the signal on cathode-follower operation. The original d.c. levels are maintained by resistors R7 and R11. Capacitors C11 and C12 are bootstrap capacitances improving the h.f. response of the input stage V2, V1.

14. The third stage consists of a cathode-coupled differential amplifier employing the pentode sections of valves V7 and V6. The basic sensitivities of 1mV/cm and 0·1V/cm provided by the input attenuator are reduced in the ratio 2, 5, 10, 20, 50, mV or V/cm by variation of the degree of cathode-coupling. This variation is effected by switchbank SC3R of the range selector which introduces resistor R46, R47, R48, R49, or R50 to incrementally reduce the stage gain by the appropriate ratio. When operating on the basic sensitivity ranges (1mV and 0·1V/cm), the coupling resistance consists solely of RV6, a preset variable which is adjusted for correct tracking between ranges. In both a.c. modes of operation, capacitor C17 is introduced into the coupling network by switchbank SB3F of the input condition selector to provide d.c. degeneration, thus stabilising the operating point to ensure freedom from drift. Zener diodes MR2 and MR3 ensure that the potential applied across capacitor C17 does not exceed its rated voltage. The anode loads for the stage consist of a mesh network R33, RV5, R38, R31, RV4 and R29. Variable resistor RV4 enables the effective anode load resistances to be adjusted to those values required to give X1 gain. Potentiometer RV5 effects differential adjustment of the anode loads of the two halves of the stage, thereby unbalancing the outputs from the anodes to provide shift facility. The TRACE LOCate push-button switch SE, when operated, opens to introduce resistor R51 into the common cathode circuit to reduce the stage gain and thereby facilitate trace location. Signal output from the anode is direct-coupled to the grids of the plate-drive stage.

15. The final output stage employs the triode sections of V7 and V6 connected as two independent cathode-followers. Bootstrap capacitors C22 and C19 are included to provide improved h.f. response. Trigger signal output to the X sub-unit is taken via resistors R40 and R39.

STABILISED D.C. HEATER SUPPLY

16. A stabilised heater supply at −12·6 volts d.c. is derived from the −16 volts d.c. rail by a transistor series-regulator circuit. The sample signal taken off the divider chain R42, RV7, RV3, is applied to the base of transistor VT1, which in turn drives the series control element VT2. The reference potential for the emitter of VT1 is provided by the zener diode MR4, the temperature coefficient of which is chosen to offset that of the driver transistor VT1. The supply is set to −12·6 volts by adjustment of RV7.

SECTION 6
MAINTENANCE

BREAKDOWN AND REPAIR DIRECTIONS

Removal of CX 1442 Sub-Unit

17. (1) Turn captive securing screw in a counter-clockwise direction until screw thread is completely disengaged.
(2) Withdraw sub-unit from main frame by a direct pull on the captive screw.

Improved Access for Servicing Purposes

18. The CX 1442 sub-unit may be operated outside the CD 1400 Main Frame Unit to give improved access for maintenance. For this purpose, the sub-unit and main frame are coupled via an 18-way cable-form connected pin-for-pin between an 18-way free plug at one end, and an 18-way free socket at the other. (McMurdo types XP18 and XS18.) A ready-made cableform is available as an optional extra.

Removal of Board-Mounted Components

19. Defective wire-ended, board-mounted components must not be unsoldered from the printed-circuit. Instead, the defective component must be detached from the board by severing the connecting wires at those points where they enter the body of the component. The replacement component is then soldered to the residual wire stubs, and the original soldered joint to the printed-circuit is thus left intact. This method of replacement cannot be applied to tag-mounting capacitors, which must be unsoldered from the printed-circuit to enable the fixing tag to be straightened-out prior to capacitor removal.

SETTING-UP AND TEST PROCEDURE

General

20. The following procedure is basically the production test to which all CX 1442 Sub-Units are subjected prior to despatch. It is given to enable the user to confirm the performance of the sub-unit should this at any time become suspect, and to make any adjustments that may be necessary.

Test Equipment Required

21. The following items of test equipment will be required if the procedure is to be carried-out in its entirety. The type numbers of suitable Solartron instruments are given in brackets.
(1) Square-wave (1kc/s) generator, 0-100 volts amplitude. (CD 1012, 1212, or 1220 Calibrator.)
(2) Capacitance meter or bridge to read 20-50pF.
(3) Avometer Model 8.

Preparatory

22. (1) Insert the CX 1442 Sub-Unit under test into either of the left-hand compartments of a tested CD 1400 Main Frame Unit, fitted with an operationally sound time-base/X amplifier sub-unit. A serviceable Y amplifier must be inserted in the vacant left-hand compartment of the CD 1400.
(2) Set the listed controls in accordance with the directions given.
SHIFT (RV5) to mid-travel
BALance (RV2) to mid-travel
V/CM selector (SC) to "50mV/cm"
Input condition selector (SB) to D.C.
Push-buttons SA1, SA2, both "out"
SET GAIN, ×1 and ×10 (RV4, RV3) to mid-travel.
(3) Set Avometer to 25 volts range, and connect between test point (−ve) on VT2 heat sink and chassis (+ve).
(4) Apply power to the oscilloscope.
(5) Adjust potentiometer RV7 for a reading of −12·6 volts on the Avometer.
(6) Disconnect Avometer, and allow a five-minutes warm-up period before proceeding further.

Set D.C. Balance

23. (1) With the controls set to the positions given in paragraph 22 (2), centre the trace by adjustment of the Y SHIFT control on the CX 1442 Sub-Unit.
(2) Set V/CM selector to "0·1V/CM" position, hold-in TRACE LOCate button, and finely adjust BALance control to re-centre trace.
(3) Return V/CM selector to "50mV/CM" position, and re-centre trace by adjustment of SHIFT control.
(4) Set V/CM selector to "0·1V/CM" position, and if necessary, finely adjust BALance control to re-centre trace.
(5) Repeat the procedure detailed in sub-paragraphs (1) to (4) until no trace movement occurs as the V/CM selector is turned through all twelve positions.

Set Gain

24. (1) Apply a 1kc/s square-wave signal of 100mV amplitude to the "A" input socket.
(2) Depress the "A" push-button, set V/CM selector to "50mV/CM", and adjust the ×1, SET GAIN control (RV4) for a trace height of 2cm.
(3) Set V/CM selector to "0·1V/CM" position, increase amplitude of 1kc/s input to 200mV, and adjust preset variable resistor RV6 for a trace height of 2cm.
(4) Repeat the procedure detailed in sub-paragraphs (1) to (3) as necessary to track correctly the ranges of the V/CM selector.
(5) Set V/CM selector to "50mV/CM", and switch SB to "AC×10".
(6) Set 1kc/s input to 10mV amplitude, and adjust the ×10 SET GAIN control for a trace height of 2cm.

Set Attenuator Responses and Input Capacitances

25. (1) Set V/CM selector to "0·1V/CM", switch SB to D.C., and the "A" push-button to the "in" position, and the "−B" push-button to the "out" position.
(2) Apply a 1kc/s square-wave signal of approximately 200mV amplitude to the "A" input socket.
(3) Adjust variable capacitor C4 for optimum square-wave response.
(4) Disconnect 1kc/s input from "A" socket and apply to "−B" input socket.
(5) Set the "A" push-button to the "out" position, and the "−B" push-button to the "in" position.
(6) Adjust variable capacitor C8 for optimum square-wave response.
(7) Set both "A" and "−B" push-buttons to the "in" positions.
(8) Apply a 1kc/s square-wave signal, 100 volts amplitude to input sockets "A" and "−B".
(9) Adjust potentiometer RV1 for minimum l.f. component.
(10) Disconnect signal from input sockets, and connect capacitance meter to "A" input socket.
(11) Set V/CM selector to "50mV/CM", and adjust variable capacitor C3 for a reading of 37pF on the capacitance meter.
NOTE: If a reading of 37pF is not obtainable, adjust C3 for the nearest approximation to that value.
(12) Set V/CM selector to "0·1V/CM", and adjust variable capacitor C5 for a reading equal to that set in sub-paragraph (11).
(13) Disconnect capacitance meter from "A" input socket, and connect instead to "−B" input socket.
(14) Set V/CM selector to "50mV/CM", and adjust variable capacitor C7 for a reading equal to that set in sub-paragraph (11) on the capacitance meter.
(15) Set V/CM selector to "0·1V/CM", and adjust variable capacitor C9 for a reading equal to that set in sub-paragraph (11).

FAULT-FINDING

General

26. Typical d.c. potentials of supply rails and valve electrodes are given on the circuit diagram. These potentials were measured on an Avometer Model 8, with the CX 1442 sub-unit set to the

D.C. input condition, both input sockets earthed, and with the amplifier correctly balanced. A suggested procedure for identifying a defective stage is given in paragraph 27 following.

Fault-Finding Procedure

27. (1) Inspect sub-unit for obvious defects.
(2) Check that the potentials of the +320 volts and 50 volts rails are approximately correct.
(3) Check that the potential of the d.c. heater rail (test point on VT2 heat sink) is − 12·6 volts d.c.
(4) Check that the valve anode potentials approximate to the typical values given on the circuit diagram.
(5) Connect the Avometer successively between the listed circuit points, and check that the meter can be swung through the zero point by adjustment of the appropriate control. After the successful completion of each test, return the control to that setting giving zero meter deflection. Closely investigate any stage which cannot be swung through zero point.

METER CONNECTION POINTS	CONTROL
V1, V2, anodes (pins 6)	BALance (RV2)
V4 cathodes (pins 3 and 8)	BALance (RV2)
V6, V7, anodes (pins 6)	*SHIFT (RV5)
V6, V7, cathodes (pins 8)	*SHIFT (RV5)

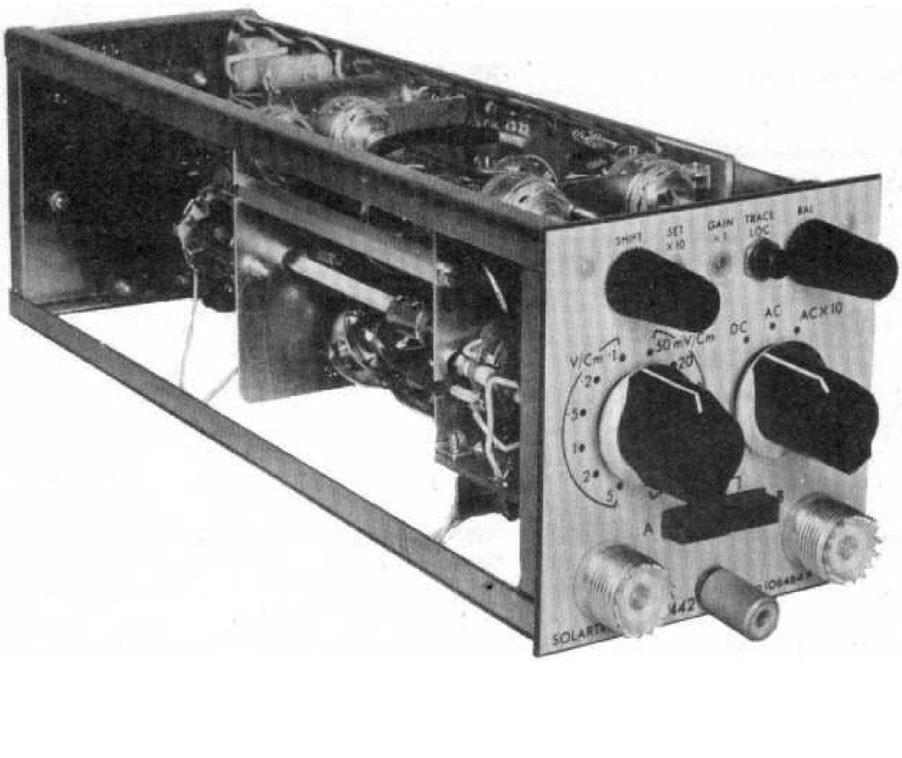
*BALance control set for zero output from V4 cathodes.

Components Affecting Calibration

28. The renewal of certain components may invalidate the calibration of the sub-unit. When any of the listed valves and/or semi-conductors, or component associated with that valve or semi-conductor, is changed, then the appropriate part of the setting-up procedure as listed in Table 2 must be carried out. With regard to V1 and V2, due to the high-valued anode load resistors employed, slight discrepancies in the characteristics of these valves can cause large trace deflections. It may therefore be necessary to select a matched pair when replacing one or other of the original factory—aged valves. However, any valve that permits the amplifier to be balanced, should enable the specified performance figures to be realised.

TABLE 2
CRITICAL COMPONENTS

COMPONENT	ACTION NECESSARY
V1 or V2	Set Attenuator Responses and Input Capacitances (refer para. 25). Set Gain, ×1 (refer para. 24).
V4	Set Gain, ×1, ×10 (refer para. 24).
V5	Set Gain, ×1, and 1, 2, 5, gain tracking by RV6 (refer para. 24).
MR1	Set Gain, ×1 (refer para. 24).
MR4 VT1 VT2	Set Potential of D.C. Heater Rail (refer para. 22).



COMPONENTS LIST

for

HIGH GAIN DIFFERENTIAL AMPLIFIER CX1442

MAIN UNIT

PRINTED CIRCUIT BOARDS

Board No.	Type No.
1	B1442 9001
2	B1442 9002

NOTE:

The components in the following lists are distributed between the main unit and the two printed circuit boards. Because of this distribution, the location of each component is detailed below:-

	Main Unit	P.C.B. No. 1.	P.C.B. No. 2.
Resistors	R6, R44 to R51	R5, R7 to R43	R1 to R4
Resistors, Variable.	RV2 to RV5	RV6, RV7	RV1
Capacitors	C1, C2	C11 to C23	C3 to C10
Valves	V1 to V7		
Semi-conductors	VT2	MR1 to MR4 VT1	
Miscell-aneous	SB, SC, SE, SKTA, SKTB, PLA		SA

CX1442 MAIN UNIT/Cont'd

RESISTORS

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
R6	220k	5	1/4	1705 52200	Dubilier	SP 310 HS
R44	39k	5	2	1930 43900	Electrosil	CJ42 F
R45	39k	5	2	1930 43900	Electrosil	CJ42 F
R46	1k	1	1/4	1704 31000	Dubilier	SP 310 HS
R47	4.15k	1	1/4	1704 34150	Dubilier	SP 310 HS
R48	10.1k	1	1/4	1704 41010	Dubilier	SP 310 HS
R49	25k	1	1/4	1704 42500	Dubilier	SP 310 HS
R50	130k	1	1/4	1704 51300	Dubilier	SP 310 HS
R51	100k	10	1/4	1723 51000	Dubilier	BTT Carbon

RESISTORS, VARIABLE

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
RV2	500k	20	1/4	1100 12610	Morganite	U
RV3	5k	20	1/4	1100 12820	Morganite	U
RV4	2.5M	20	1/8	1100 12620	Morganite	U
RV5	25k	20	1/4	1100 12600	Morganite	U

CAPACITORS

Circuit Ref.	Value μF	Tol. %	Rating Volts	Solartron Part No.	Manufacturer & Type	
C1	0.1	1	400	2208 51000	Wima	M Tropyfol
C2	0.1	1	400	2208 51000	Wima	M Tropyfol

VALVES

Circuit Ref.	Description	Solartron Part No.	Manufacturer & Type	
V1	Pentode	3000 05151	Mullard	EF86
V2	Pentode	3000 05151	Mullard	EF86
V3	Triode Pentode	3000 35010	Mullard	ECF82
V4	Double Triode	3000 33020	Mullard	ECC81
V5	Gas Filled	3000 11100	Hivac	XC12
V6	Triode Pentode	3000 35040	Brimar	ECF804
V7	Triode Pentode	3000 35040	Brimar	ECF804

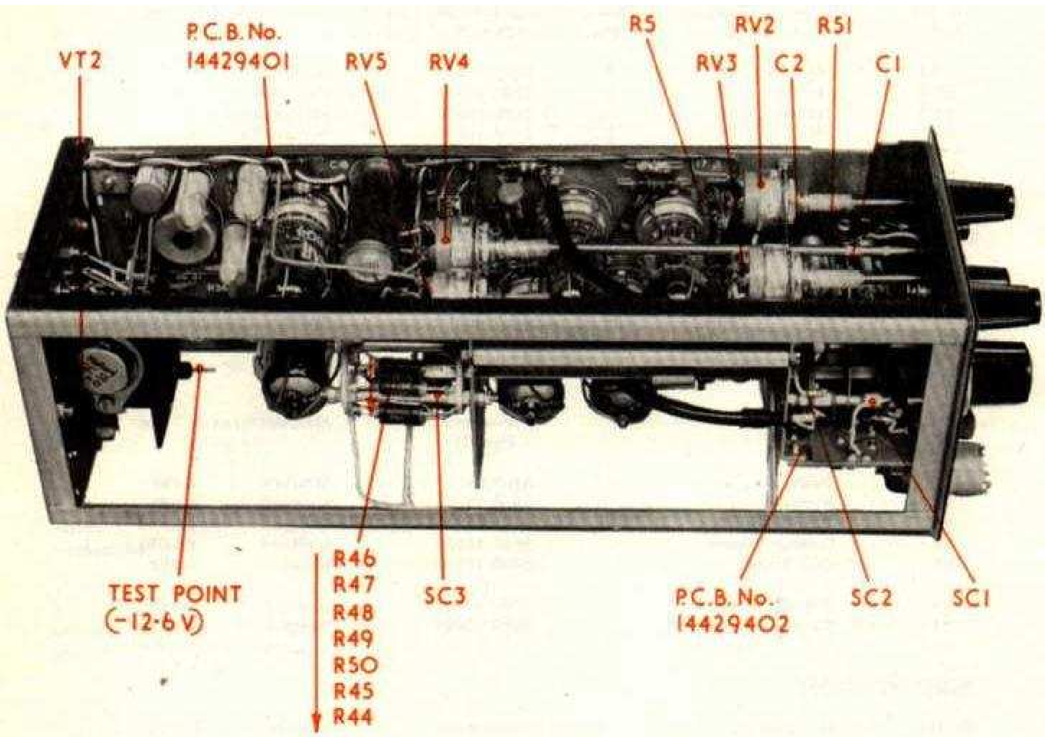
SEMICONDUCTORS

Circuit Ref.	Description	Solartron Part No.	Manufacturer & Type	
VT2	Transistor	3005 50170	Mullard	OC35

CX1442 MAIN UNIT/Cont'd

MISCELLANEOUS

Circuit Ref.	Description	Solartron Part No.	Manufacturer & Type	
SB	Switch, Wafer	3701 00540	N.S.F.	A
SC	Switch, Wafer	3701 00530	N.S.F.	A
SE	Switch, Push Button	3770 00010	Rendar	PBS/1/B
SKTA	Connector socket	3521 01170	Greenpar	GE40010
SKTB	Connector socket	3521 01170	Greenpar	GE40010
PLA	Connector Plug	3523 18030	McMurdo	XP18



COMPONENTS LIST

for

PRINTED CIRCUIT BOARD NO. 1.

B1442 9001

RESISTORS

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
R5	220k	5	¼	1705 52200	Dubilier	SP 310 HS
R7	1M	10	¼	1723 61000	Dubilier	BTT Carbon
R8	12k	5	2	1930 41200	Electrosil	CJ42 F
R9	22k	5	2	1930 42200	Electrosil	CJ42 F
R10	22k	5	2	1930 42200	Electrosil	CJ42 F
R11	1M	10	¼	1723 61000	Dubilier	BTT Carbon
R12	12k	5	2	1930 41200	Electrosil	CJ42 F
R13	100	10	¼	1723 21000	Dubilier	BTT Carbon
R14	150k	1	¼	1704 51500	Dubilier	SP 310 HS
R15	150k	1	¼	1704 51500	Dubilier	SP 310 HS
R16	100	10	¼	1723 21000	Dubilier	BTT Carbon
R17	10k	10	¼	1723 41000	Dubilier	BTT Carbon
R18	10k	5	¼	1705 41000	Dubilier	SP 310 HS
R19	22k	10	¼	1723 42200	Dubilier	BTT Carbon
R20	10k	10	¼	1723 41000	Dubilier	BTT Carbon
R21	100	10	¼	1723 21000	Dubilier	BTT Carbon
R22	270k	10	¼	1723 52700	Dubilier	BTT Carbon
R23	100k	10	¼	1723 51000	Dubilier	BTT Carbon
R24	10k	10	¼	1723 41000	Dubilier	BTT Carbon
R25	1k	10	¼	1723 31000	Dubilier	BTT Carbon
R26	100	10	¼	1723 21000	Dubilier	BTT Carbon
R27	56k	10	¼	1723 45600	Dubilier	BTT Carbon
R28	100	10	¼	1723 21000	Dubilier	BTT Carbon
R29	10k	10	¼	1723 41000	Dubilier	BTT Carbon
R30	10	10	¼	1723 11000	Dubilier	BTT Carbon
R31	10k	10	¼	1723 41000	Dubilier	BTT Carbon
R32	10	10	¼	1723 11000	Dubilier	BTT Carbon
R33	39k	5	2	1930 43900	Electrosil	CJ42 F
R34	100	10	¼	1723 21000	Dubilier	BTT Carbon
R35	47k	5	2	1930 44700	Electrosil	CJ42 F
R36	47k	5	2	1930 44700	Electrosil	CJ42 F
R37	100	10	¼	1723 21000	Dubilier	BTT Carbon
R38	39k	5	2	1930 43900	Electrosil	CJ42 F
R39	220k	10	¼	1723 52200	Dubilier	BTT Carbon
R40	220k	10	¼	1723 52200	Dubilier	BTT Carbon
R41	3.6k	5	2	1930 33600	Electrosil	CJ42 F
R42	220	10	¼	1723 22200	Dubilier	BTT Carbon
R43	220	10	¼	1723 22200	Dubilier	BTT Carbon

PCB No. 1/Cont'd

RESISTORS, VARIABLE

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
RV6	2k	20	½	1100 31250	Welwyn	P25 M
RV7	100	20	½	1100 31260	Welwyn	P25 M

CAPACITORS

Circuit Ref.	Value μF	Tol. %	Rating Volts	Solartron Part No.	Manufacturer & Type	
C11	15p	10	500	2105 11500	Suflex	HS 7/R
C12	15p	10	500	2105 11500	Suflex	HS 7/R
C13	0.1	10	400	2208 51000	Wima	M Tropyfol
C14	0.1	10	400	2208 51000	Wima	M Tropyfol
C15	0.01	-20 +80	100	2084 50015	Erie	K 800011/ 801
C16	0.1	10	400	2208 51000	Wima	M Tropyfol
C17	200	-20 +100	12	2086 90004	Plessey	CE 2018
C18	8	-20 +50	450	2086 00080	C.C.L.	V2 51S
C19	100p	10	500	2105 21000	Suflex	HS 7/S
C20	15p	10	500	2105 11500	Suflex	HS 7/R
C21	15p	10	500	2105 11500	Suflex	HS 7/R
C22	100p	10	500	2105 21000	Suflex	HS 7/S
C23	25	-20 +100	25	2086 00081	Plessey	PA 110

SEMICONDUCTORS

Circuit Ref.	Description	Solartron Part No.	Manufacturer & Type	
MR1	Diode	3005 20820	Mullard	OAZ 247
MR2	Diode	3005 22300	Mullard	OAZ 272
MR3	Diode	3005 22300	Mullard	OAZ 272
MR4	Diode	3005 20170	Mullard	OAZ 243
VT1	Transistor	3005 50630	Texas	2S 302

COMPONENTS LIST

for

PRINTED CIRCUIT BOARD NO. 2.

B1442 9002

RESISTORS

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
R1	990k	1	$\frac{1}{4}$	1704 59900	Dubilier	SP 310 HS
R2	9.9k	1	$\frac{1}{4}$	1704 39900	Dubilier	SP 310 HS
R3	990k	1	$\frac{1}{4}$	1704 59900	Dubilier	SP 310 HS
R4	9.9k	1	$\frac{1}{4}$	1704 39900	Dubilier	SP 310 HS

RESISTORS, VARIABLE

Circuit Ref.	Value Ohms	Tol. %	Rating Watts	Solartron Part No.	Manufacturer & Type	
RV1	250	20	$\frac{1}{4}$	1100 31210	Welwyn	P25 M

CAPACITORS

Circuit Ref.	Value μF	Tol. %	Rating Volts	Solartron Part No.	Manufacturer & Type	
C3	7/35p		160	2900 20270	Triko	N1500
C4	3.5-13p		160	2900 20250	Triko	N470
C5	7/35p		160	2900 20270	Triko	N1500
C6	820p	10	125	2102 28200	Suflex	HS 10/F
C7	7/35p		160	2900 20270	Triko	N1500
C8	3.5-13p		160	2900 20250	Triko	N470
C9	7/35		160	2900 20270	Triko	N1500
C10	820p	10	125	2102 28200	Suflex	HS 10/F

MISCELLANEOUS

Circuit Ref.	Description	Solartron Part No.	Manufacturer & Type	
SA	Switch, Push Button	3750 00310	A. B. Metals	500

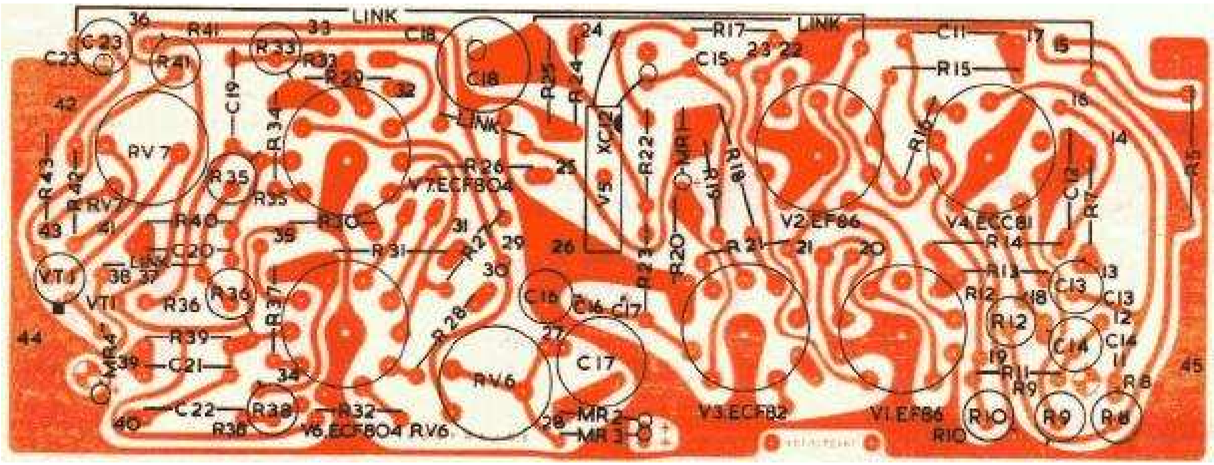


Fig. 2. Component Location - Printed Circuit Board 1

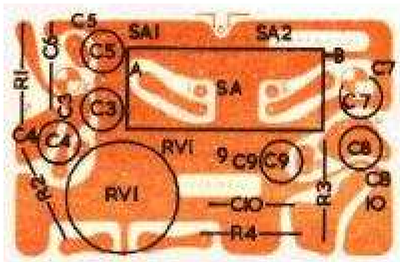
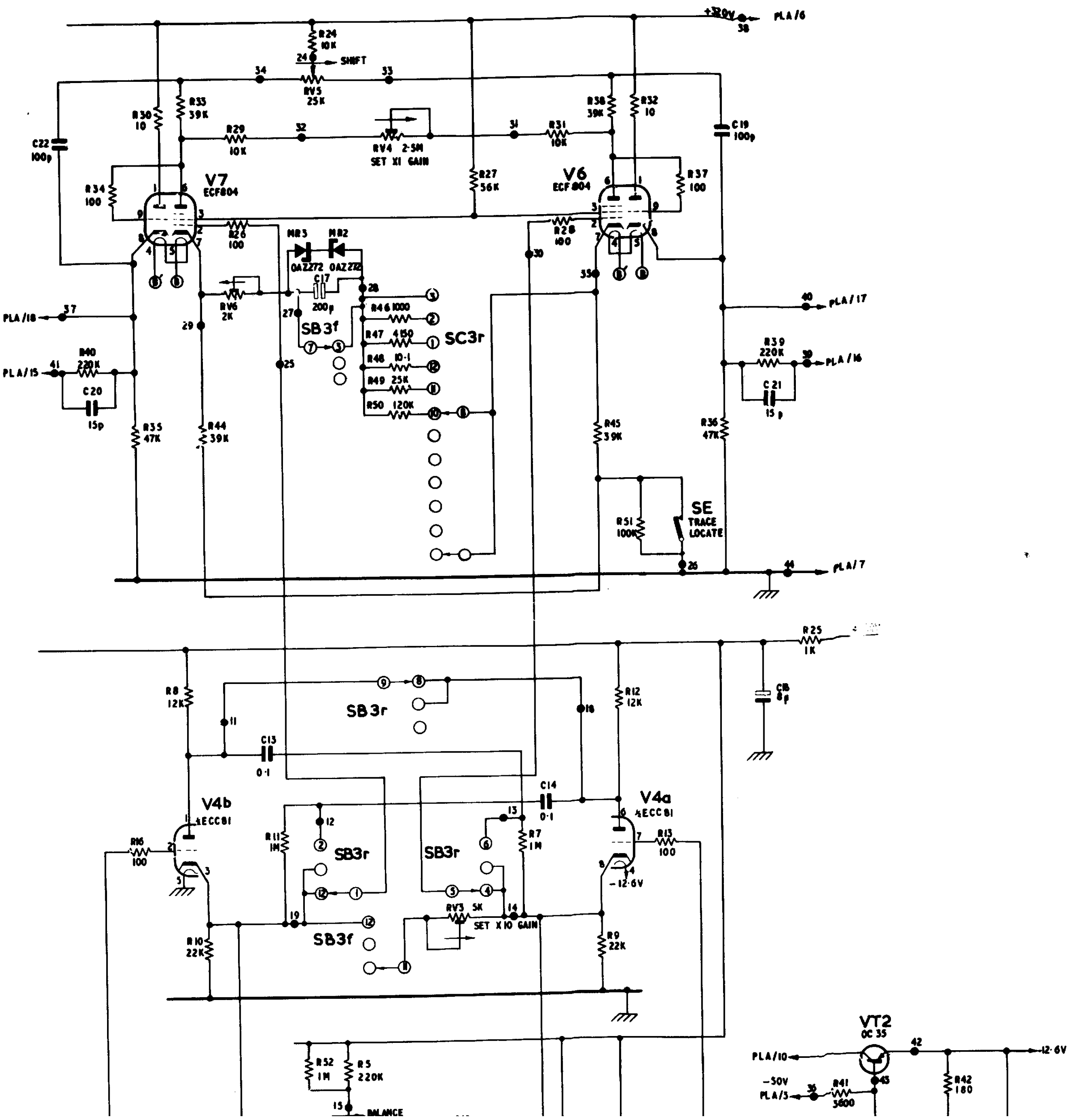
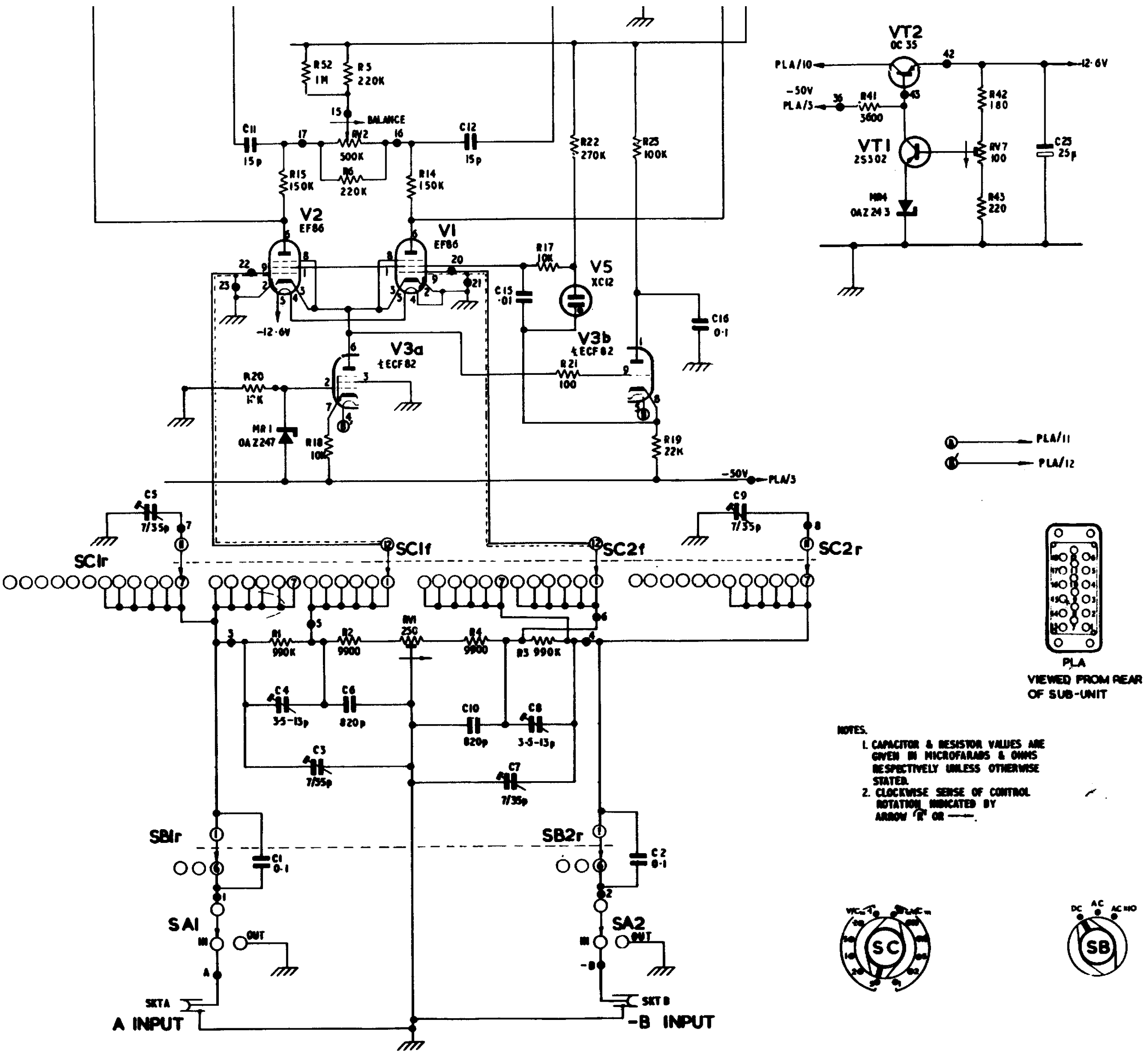


Fig. 3. Component location - Printed Circuit Board 2.




VT2
OC 35
VT1
2S302
V1
EF86
V2
EF86
V3a
½ECF82
V3b
½ECF82
V5
XC12
PLA
VIEWED FROM REAR
OF SUB-UNIT
NOTES.
1. CAPACITOR & RESISTOR VALUES ARE GIVEN IN MICROFARADS & OHMS RESPECTIVELY UNLESS OTHERWISE STATED.
2. CLOCKWISE SENSE OF CONTROL ROTATION INDICATED BY ARROW 'R' OR ——.
A INPUT
-B INPUT
SC1r
SC1f
SC2f
SC2r
SB1r
SB2r
SA1
SA2
SC
SB