POWER LEAD

5.4 Fit a suitable plug to the power lead in accordance with the standard colour code:-

	European	American
LINE	Brown	Black
NEUTRAL	Blue	White
EARTH (GROUND)	Green/Yellow	Green

A.C POWER SUPPLIES CHECK

Resistance Check

5.5 With the power lead disconnected check the resistance of the transformer primary circuit (including FS50) using the multimeter (Table 5, item 1). The resistance should be as shown in Table 6.

TABLE 6

Power Supply Resistance Measurement

Voltage Selected	S52 Position	
	LO	HI
94-106/106-119	35Ω ± 6Ω	39Ω ± 7Ω
106-119/118-132	39Ω ± 7Ω	44Ω ± 7Ω
188-212/200-225	122Ω ± 18Ω	130Ω ± 20Ω
200-225/212-238	130Ω ± 20Ω	138Ω ± 20Ω
212-238/224-251	138Ω ± 20Ω	145Ω ± 22Ω
224-251/235-265	145Ω ± 22Ω	153Ω ± 22Ω

Supply Rail Voltages

5.6 (1) Remove the covers and prepare the power supply as described in the preceding paragraphs. Check that the a.c. supply voltage is correct.

(2) Set the power source selector switch on the rear panel to LINE POWER.

(3) With power supply connected, switch POWER to ON.

(4) Using the multimeter (Table 5, item 1) check the d.c. voltages at the following points on the main p.c.b. (Fig. 3 at the back of the book shows the component layout).

Test Point	Measurement	Remarks
TP 13	+5.0V ± 0.1V)	Relative to chassis (TP12)
TP 14	-5.1V ± 0.2V)	

NOTE: The supply rails can be adjusted simultaneously by means of R159. If the limits given above cannot be achieved check that the transformer primary connections and position of S52 agree with the local supply voltage. If these are correct the zener diode D21 should be checked.

Ripple Level

5.7 Connect the variac (Table 5, item 9) to the local a.c. supply, and power the unit under test (UUT) from the variac. Monitor the variac output with the multimeter (Table 5, item 1), and adjust to give the minimum voltage of the range which suits the local supply.

5.8 Using the oscilloscope (Table 5, item 2) monitor TP13 and TP14, using a.c. coupling. The power supply 100Hz ripple should be less than 150mV peak to peak.

BATTERY POWER SUPPLIES CHECK

Charging Rate Checks

5.9 The charging rate can be checked only when the battery pack is fitted. It can be checked by inserting a multimeter, set to an appropriate current range, in series with the battery lead, or by measuring the volt drop across a charge path resistor and calculating the current. The latter method is recommended. Measurement is made with a.c. supplies connected and the POWER switch ON.

LETHAL VOLTAGES ARE EXPOSED.

5.10 For the A Battery, (+5 volts), voltage measurement should be made across the 3.9Ω resistor R145. This is accessible from the top of the main p.c.b. The more negative end is towards the rear panel.

5.11 For the B Battery, (-5 volts), voltage measurement should be made across the 39Ω resistor R146. This is mounted on the top of the main p.c.b., but because of the proximity of other components measurement can be made more easily from the underside. The more positive end is that closest to the LINE POWER/CHARGE/BATTERY POWER switch.

5.12 Measurements should be made across both resistors with the rear panel switch in both the LINE POWER and CHARGE positions to allow calculation of the trickle charge and full charge rates respectively. The charging current varies considerably according to the state of charge. Nominal values during the middle of the charge period are:

		Current	Voltage across R145
Battery A	Trickle charge	85 mA	0.33V
	Full charge	630 mA	2.46V
		Current	Voltage across R146
Battery B	Trickle charge	6 mA	0.23V
	Full charge	60 mA	2.3V

Battery Economy Check

5.13 This check can be carried out without the battery pack fitted. Set the UUT controls as follows:

(1) Power source selector on the rear panel to LINE POWER

(2) NORMAL/STANDBY switch to STANDBY

(3) POWER switch to ON. After approximately a minute the display should blank out and the OVERFLOW/STANDBY indicator should light.

5.14 Press and release the RESET button. The display should indicate all zeros and the OVERFLOW/STANDBY indicator should be extinguished. After approximately one minute the display should again blank out and the OVERFLOW/STANDBY indicator should light.

PERFORMANCE TESTS AND CALIBRATION

NOTE: The procedures detailed in the following paragraphs may be carried out using line or battery supplies (provided the battery pack option is fitted). If battery supplies are to be used for performance testing it is desirable that the batteries be in the fully charged state at the commencement of testing. No test result obtained when the Battery Low indicator is lit should be considered valid.

Segment, Decimal Point and Self Check

5.15 (1) Set the POWER switch to ON and the STANDBY/NORMAL switch to NORMAL.

(2) Set the CHECK/OPERATE/HOLD switch to CHECK.

(3) Depress the FREQ.A button and verify that the GATE/CHARGING indicator lights.

(4) Select Time Base (n) = 1.

(5) The instrument should now read 0001000.kHz/ms. Refer to Table 7 and check the display and decimal points (Frequency column) for each time base button.

(6) Depress the PERIOD 'A' button and verify the readout and decimal points according to the Period column of Table 7.

(7) Briefly hold in the RESET button and check that the display reads 'all eights' (segment check).

TABLE 7

Self Check Readout

Range 'n' Selected	Gate Time	Display ± 1 count	
		Frequency	Period
1	1ms	0001000. kHz/μs	0000001.kHs/μs
10^1	10ms	001000.0 kHz/μs	000001.0 kHz/μs
10^2	100ms	01000.00 kHz/μs	00001.00 kHs/μs
10^3	1sec	1000.000 kHz/μs	0001.000 kHz/μs
10^4	10sec	* 000.0000 kHz/μs	001.0000 kHz/μs
10^5	100sec	* 00.00000 kHz/μs	01.00000 kHz/μs
		* Overflow lamp will light after 10 seconds on 10^4 Time Base and 100 seconds on 10^5 Time Base.	

A.C. Sensitivity Check: Input A

5.16 Equipment required:

Item	Table 5 Item No.
Signal Generator	4
Coaxial lead	8
T piece	6
BNC terminating pad	7

5.17 Connect the T piece to the Input 'A' socket of the UUT. Using the coaxial lead connect the signal generator to the T piece. Terminate the open end of the T piece with the 50Ω pad.

5.18 Set the controls on the UUT as follows:

(1) 'A' Channel AC/DC switch to AC.

(2) CHECK/OPERATE/HOLD switch to OPERATE.

(3) SENSITIVITY control to the 10 mV click position.

(4) Time base (n) 1 selected.

(5) FREQ. A selected.

5.19 Apply a frequency of 55 MHz at a level of 20 mV r.m.s. to the UUT. Adjust R44 to the mid point of the range over which counting is steady. Apply the frequencies shown in Table 8 at a level of 8 mV r.m.s., changing the time base selection as indicated. Verify that the display reads correctly and is stable.

TABLE 8

Input 'A' Sensitivity Check

Frequency	Time Base	Display
55 MHz	1	0055000. kHz/μs
13 MHz	1	0013000. kHz/μs
100 kHz	10^2	00100.00 kHz/μs
1 kHz	10^2	00001.00 kHz/μs
10 Hz	10^3	0000.010 kHz/μs

NOTE: If repairs involving the stage containing IC32 have been made and the above specification cannot be achieved a 33pF capacitor, Racal-Dana part number 21-1514, should be fitted in position C7 and the test repeated.

5.20 Select Time Base (n) 1 and apply 13 MHz at a level of 10 mV r.m.s. With the SENSITIVITY control in the 10 mV position ensure the display is stable. Increase the signal generator output to 500 mV r.m.s. and rotate the SENSITIVITY control clockwise. Check that counting ceases before the fully clockwise position is reached.

Totalize Check

5.21 Equipment required:

Item	Table 5 Item No.
Signal Generator	4
Coaxial leads	8
T piece	6
BNC terminating pad	7

5.22 Connect the T piece to the 'A' Channel input of the UUT. Connect the signal generator to the T piece and terminate the open end of the T piece with the 50Ω pad.

5.23 Set the controls of the UUT as follows:

(1) AC/DC switch to AC.

(2) CHECK/OPERATE/HOLD switch to OPERATE.

(3) SENSITIVITY control fully anti clockwise (to click position).

(4) Time Base (n) 10^5 selected.

(5) Total $\frac{A}{n}$ selected.

5.24 Apply a frequency of 100 kHz at a level of 10 mV r.m.s. from the signal generator. Press and release the START/STOP button and check that the least significant digit counts from 0 to 9 in approximately 10 seconds. Increase the frequency to 1 MHz to check the second digit, and select Time Base (n) 10^4 to 1 in turn to check the more significant digits.

5.25 Check that when the display has counted to all nines the OVERFLOW indicator lights, but counting continues. Press and release the START/STOP button, and check that counting stops and that the display is held for approximately 1.5 seconds before resetting automatically.

5.26 Set the CHECK/OPERATE/HOLD switch to HOLD. Start and stop a new measurement cycle using the START/STOP button, and ensure that the display does not automatically reset after 1.5 seconds, but is held until the RESET button is pressed and released.

DC Amplifier and Attenuator Checks

5.27 Equipment required:

Item	Table 5 Item No.
Signal Generator	4
Coaxial leads (1x 1 metre, 1 x 15cm)	8
T piece (2)	6
BNC terminating pad	7
Oscilloscope	2

5.28 Connect a T piece to both the 'A' and 'B' Channel inputs. Connect the T pieces together with the short coaxial lead and connect the signal generator and the 50Ω pad to the T pieces. Connect the oscilloscope to monitor the output at the Marker Output pins on the rear panel (1 MHz at approximately 3 volts peak to peak).

5.29 Set the UUT controls as follows:

(1) AC/DC switch to DC.

(2) Both TRIGGER LEVEL controls fully anticlockwise (to click position).

(3) Both attenuators to X1.

(4) FREQ.A selected.

5.30 Apply 1 MHz at a level of 10 mV r.m.s. Increase the input level slowly, noting the level at which each Trigger indicator commences to flash. This should be less than 80 mV r.m.s. in both cases. Check that the marker outputs are present when the indicators flash.

5.31 Put the attenuator switches to X10, and repeat the test. The Trigger indicators should flash with an input level less than 800 mV r.m.s.

5.32 Calculate the true attenuation for each channel. This should be 20 dB ± 3 dB.

Ratio Check

5.33 Equipment required:

Item	Table 5 Item No.
Signal Generator	4
Coaxial leads (1 x 1 metre, 1 x 15 cm)	8
T piece (2)	6
BNC terminating pad	7

5.34 Connect a T piece to both 'A' and 'B' Channel inputs. Connect the T pieces together with the short coaxial lead, and connect the signal generator and the 50Ω pad to the T pieces.

5.35 Set the UUT controls as follows:

(1) AC/DC switch to DC.

(2) Both attenuators to X1.

(3) Both TRIGGER LEVEL controls fully anticlockwise (to click position).

(4) CHECK/OPERATE/HOLD switch to OPERATE.

(5) Ratio $n\frac{A}{B}$ selected.

(6) Time Base (n) 1 selected.

5.36 Apply a 10 MHz signal at 80 mV r.m.s. Check that the display reads 0000001 and that no decimal points or units indicators are on.

5.37 Select Time Base (n) 10^1 to 10^5 in turn and check that the display increases by a factor of 10 for each change.

Time Interval, Single Line Check

5.38 Equipment required:

Item	Table 5 Item No.
Pulse Generator	5
Coaxial lead (1 x 1 metre)	8
T piece	6
BNC terminating pad	7

5.39 Connect the T piece to the 'B' Channel input of the UUT. Connect the pulse generator to the T piece and terminate the open end of the T piece with the 50Ω pad.

5.40 Set the controls of the UUT as follows:

(1) CHECK/OPERATE/HOLD switch to OPERATE.

(2) HOLD OFF control fully anticlockwise (to OFF position).

(3) 'B' Channel attenuator to X1.

(4) Stop Channel selection switch to B.

(5) Start and Stop slope selection switches to ⌐

(6) Time Base (n) 1 selected.

(7) T.I. selected.

(8) 'B' Channel TRIGGER LEVEL control fully anticlockwise (to click position).

5.41 Set the pulse generator to 1 kHz p.r.f., 4:1 mark/space ratio and +1.25 volts peak amplitude. Select Time Base (n) 1 to 10^5 in turn and verify that the display reads as shown in Table 9.

TABLE 9

Time Interval Decimal Point Check

Time Base (n)	Display
1	001.0000 ms
10^1	0001.000 ms
10^2	00001.00 ms
10^3	000.0010 sec
10^4	0000.001 sec
10^5	00000.00 sec

NOTE: (1) The final digits of the display will depend on the accuracy of the pulse being measured. It is proof of the UUT function if the display is stable and the digits move to the right by one place for each change of n.

(2) All measurements are made to an accuracy of ±1 count, so a 1 in the right hand position for n = 10^5 should not be taken as evidence of UUT malfunction.

5.42 Select Time Base (n) 1. Set the Start and Stop slope switches as shown in Table 10 and verify the display obtained.

TABLE 10

Slope Selection Switch Check

Switch Setting		Display
Start	Stop	
⌐	¬	000.8000
¬	⌐	000.2000

NOTE: The final digits of the display will depend on the accuracy of the pulse being measured. The sum of the readings obtained should equal the reading obtained for n = 1 in paragraph 5.41.

5.43 Short the Start Inhibit pin on the rear panel to chassis and check that the Gate indicator goes off and the display reads all zeros. Remove the short circuit.

Time Interval, Double Line Check

5.44 Equipment required:

Item	Table 5 Item No.
Pulse Generator	5
Coaxial leads (1x1 metre and 1x15 cm)	8
T piece (2)	6
BNC terminating pad	7

5.45 Connect a T piece to both the 'A' and 'B' Channel inputs. Connect the T pieces together with the short coaxial lead. Connect the pulse generator to one T piece with the longer coaxial lead and terminate the open end of the other T piece with the 50Ω pad.

5.46 Set the controls of the UUT as follows:

(1) CHECK/OPERATE/HOLD switch to OPERATE.

(2) AC/DC switch to DC.

(3) Both channel attenuators to X1.

(4) Both TRIGGER LEVEL controls fully anticlockwise (to click position).

(5) Stop Channel selection switch to A.

(6) T.I. selected.

(7) Time Base (n) 1 selected.

(8) HOLD OFF Control fully anticlockwise (to OFF position).

5.47 Set the pulse generator as detailed in paragraph 5.41 and carry out the test detailed in paragraph 5.42.

5.48 Put the CHECK/OPERATE/HOLD switch to CHECK. Turn the HOLD OFF control away from the OFF position but at the anticlockwise end of its travel. Verify that the indicator lights, and that the display reads less than 0.1 ms. Turn the control fully clockwise and verify that the display reads at least 100 ms.

Time Interval (Average) Check

5.49 Equipment required:

Item	Table 5 Item No.
Pulse Generator	5
Coaxial leads (1 x 1 metre)	8
T piece	6
BNC terminating pad	7

5.50 Connect the T piece to the 'B' Channel inputs of the UUT. Connect the pulse generator to the T piece and terminate the open end of the T piece with the 50Ω pad.

5.51 Set the controls of the UUT as follows:

(1) CHECK/OPERATE/HOLD switch to OPERATE.

(2) HOLD OFF control fully anticlockwise (to OFF position).

(3) 'B' Channel attenuator to X1.

(4) 'B' Channel TRIGGER LEVEL control fully anticlockwise (to click position).

(5) Stop Channel selection switch to B.

(6) Time Base (n) 1 selected.

(7) T.I. (AVG) selected.

(8) Start slope selection switch to 

(9) Stop slope selection switch to 

5.52 Set the pulse generator to give a pulse width of 200 ns at a p.r.f. of approximately 950 kHz. (The actual p.r.f. must give a minimum interval between pulses of 150 ns and must not be harmonically related to 1 MHz). Select Time Base (n) 1 to 10^5 in turn and verify that the display reads as in Table 11.

TABLE 11

Time Interval (Average) Check

Time Base (n)	Display
1	000000.2 μs
10^1	00000.20 μs
10^2	0000.200 μs
10^3	000200.0 μs
10^4	00200.00 μs
10^5	0200.000 μs

NOTE: The final digits will depend upon the accuracy of the pulse being measured. It is proof of the UUT function if the display is stable and the digits move to the left by one place for each change of n.

DC Offset Check

5.53 Equipment required:

Item	Table 5 Item No.
D.C. Supply	10

5.54 Connect the d.c. supply to the 'A' Channel BNC input with the negative to the centre connection.

5.55 Set the controls on the UUT as follows:

(1) CHECK/OPERATE/HOLD switch to OPERATE.

(2) AC/DC switch to DC.

(3) Both attenuators to X1.

(4) Both TRIGGER LEVEL controls at mid travel.

5.56 Turn the 'A' Channel TRIGGER LEVEL control anticlockwise. The trigger l.e.d. should light when the indicator on the control is approximately in line with the - sign on the panel. Return the control to the mid position.

5.57 Reverse the d.c. supply and check that the trigger l.e.d. lights. Turn the 'A' Channel TRIGGER LEVEL control clockwise. The trigger l.e.d. should be extinguished when the indicator on the control is approximately in line with the + sign on the panel. Turn the control fully anticlockwise to the click position.

5.58 Repeat paragraphs 5.56 and 5.57 with the d.c. supply connected to the 'B' Channel BNC input and using the 'B' Channel TRIGGER LEVEL control.

External Frequency Standard Check

5.59 Equipment required:

Item	Table 5 Item No.
Oscilloscope	2
Frequency standard	3
Coaxial leads	8
T piece	6

5.60 Connect the oscilloscope Y input to the 1 MHz OUTPUT socket on the rear panel of the UUT. Connect the frequency standard to both the external trigger input of the oscilloscope and the 'B' Channel input of the UUT.

5.61 Set the oscilloscope to External Trigger, and to a time base of 1 μs/cm.

5.62 Set the controls of the UUT as follows:

(1) CHECK/OPERATE/HOLD switch to OPERATE.

(2) 'B' Channel attenuator to X1.

(3) 'B' Channel TRIGGER LEVEL fully anticlockwise (to click position).

5.63 Select each function in turn. Check that for FREQUENCY A and PERIOD A the waveform is a stationary 1 MHz, with a mark/space ratio of approximately 4:1. For all other functions the waveform should be of approximately 1:1 mark/space ratio and may drift slowly across the oscilloscope screen. The displayed waveform should be not less than 3 volts peak to peak. The EXTERNAL STANDARD indicator should light only when the FREQUENCY and PERIOD functions are selected.

Internal Frequency Standard Calibration

5.64 Equipment required:

Item	Table 5 Item No.
Oscilloscope	2
Frequency standard	3
Coaxial leads	8

5.65 Connect the oscilloscope to the 1 MHz OUTPUT socket on the rear panel of the UUT. Connect the frequency standard to the external trigger input of the oscilloscope. Set the oscilloscope to External Trigger and a time base of 1 μs/cm.

5.66 When the internal time base has been on for at least one hour check that the drift of one cycle of the waveform past a fixed point on the oscilloscope screen is within the following limits:

(1) For oscillator 11 - 1254, not less than 10 seconds (1 part in 10^7).

(2) For oscillators 9421 and 9442, not less than 100 seconds (1 part in 10^8).

5.67 The oscillator trimmer can be adjusted via a hole in the rear panel of the UUT.

DISMANTLING AND REASSEMBLY

Removal of Display P.C.B.

5.68 To change a component on the display board it is necessary to separate the display p.c.b. from the front panel. Complete removal of the p.c.b. from the instrument should be avoided if possible.

(1) Disconnect power and remove the upper and lower covers (see paragraph 5.1).

(2) With a flat screwdriver prise off the cap on each carrying handle boss. Remove the screws now exposed and remove the handle.

(3) Slide back the short length of metal trim at each side of the instrument into the space normally occupied by the handle boss. This will expose the two screws which secure the front panel.

(4) Unsolder two earth braids and two screened connections between the display p.c.b. and the main p.c.b. on the underside. Unsolder the R202/C103 combination on the upper side.

(5) Remove the screws securing the front panel and withdraw it as far as the wiring permits. Take care not to damage the flexible wiring connector.

(6) Remove the knobs of the 'A' and 'B' Channel DC OFFSET potentiometers and of the HOLD OFF control.

(7) Unsolder the START/STOP switch connections, the RESET switch connections and the connections to the 'A' and 'B' channel BNC sockets.

(8) Remove the lower screw of the POWER and NORMAL/STANDBY switch holder and the four other screws which secure the p.c.b. to the front panel. The p.c.b. can now be separated from the front panel.

5.69 If the p.c.b. is to be removed completely, remove the second screw in the POWER and NORMAL/STANDBY switch holder. Unsolder three wires to the 'A' Channel DC OFFSET, three wires to the 'B' Channel DC OFFSET and one wire to the HOLD OFF potentiometers. Unsolder the 40 way connector.

5.70 Replacement is carried out in the reverse order to dismantling. Care must be taken in lining up the l.e.d. indicators and switch knobs when attaching the p.c.b. to the front panel. Care must be taken in aligning S1 and S2 with the holes in the front panel when this is replaced on the instrument.

Removal of Main P.C.B.

5.71 With the top and bottom instrument covers and the battery pack removed all the main p.c.b. components are accessible for servicing, so the need for complete removal will be rare.

5.72 (1) Remove the upper and lower instrument covers as described in paragraph 5.1.

(2) Unsolder the wiring between the rear panel items and the main p.c.b. Remove the rear panel.

(3) Remove the battery pack, if fitted, (see paragraphs 5.80 and 5.81).

(4) Unsolder the connections to the three power transistors on the side frame.

(5) Disconnect the reservoir capacitors C100 and C101, noting the polarity of the leads. Withdraw the capacitors until the lugs are clear of the holes in the main p.c.b.

(6) Unsolder the R202/C103 combination on the upper side of the board and the two braids and two screened connections on the lower side of the board. Unsolder the braid from the main p.c.b. to the earthing tag under the main p.c.b. securing screw at the side of the main p.c.b.

(7) Unsolder three wires to the 'A' Channel DC OFFSET, three wires to the 'B' Channel DC OFFSET and one wire to the HOLD OFF potentiometers. Unsolder the 40 way connector.

(8) Unsolder 2 wires to the POWER switch and 2 wires to the NORMAL/STANDBY switch.

(9) Remove the 4 screws securing the main p.c.b. and withdraw it to the rear.

5.73 Replacement is carried out in the reverse order. Care must be taken to align S1 and S2 with the holes in the front panel during replacement. If the 40 way connector is damaged replace with Racal-Dana part number 25-6032. If the capacitor tie has to be cut, replace with Racal-Dana part number 24-0155.

FITTING FREQUENCY STANDARD 9421 or 9442

5.74 It should be noted that the frequency standard model 9421 cannot be fitted if the battery pack is fitted.

5.75 Remove the top cover of the instrument (see paragraph 5.1). Unsolder the three leads from the fitted frequency standard. Remove the retaining screws (and spacers in the case of the discrete component oscillator) and the black plate (if fitted). Remove the frequency standard.

5.76 Attach the replacement frequency standard to the inner face of the rear panel using the retaining screws removed in paragraph 5.75.

5.77 Solder the leads from the main p.c.b. pins 41, 39 and 40 to the frequency standard base pins 7, 1 and 4 respectively. If model 9421 has been fitted ensure pins 5 and 6 on its base are linked.

5.78 Carry out the instrument check procedure to verify satisfactory functioning, and calibrate the frequency standard as detailed in paragraphs 5.64 to 5.67.

5.79 Replace the instrument cover.

FITTING BATTERY PACK 11-1289

5.80 The battery pack option consists of the following items:-

Item	Racal-Dana Part Number	Quantity
Battery Pack Assembly, complete with batteries and connecting lead.	11-1274	1
Mounting bracket	11-1239	1
Locating pegs	14-1486	2
Screws M4	24-7729	4
Washers, plain, M4	24-2705	2
Washers, crinkle, M4	24-2802	4

Fitting Procedure

5.81 (1) Disconnect the a.c. supply and remove the top cover (see paragraph 5.1).

(2) Screw the two locator pegs into the threaded holes in the inner face of the right hand side member, as seen from the front of the instrument.

(3) Place the mounting bracket against the inside of the left hand side member with the large hole over the carrying handle nut. Secure it to the side member with two M4 screws and crinkle washers.

(4) Take the battery pack, with the batteries uppermost and the connecting lead to the left, and carefully place the holes in the right hand end over the locator pegs. Lower the left hand end onto the bracket, and secure it with two M4 screws fitted with both plain and crinkle washers. The crinkle washers should be immediately below the screw heads.

(5) Plug the connecting lead onto pins 48 to 51 on the main p.c.b. just to the right of the power transformer. The pins are polarized to prevent incorrect connection.

(6) Replace the top cover. Set the rear panel switch to CHARGE, connect the instrument to suitable a.c. supplies and set the POWER switch to ON.

(7) When the batteries are fully charged check the operation of the instrument on battery power.

SECTION 3

PARTS LISTS

CIRCUIT DIAGRAMS

AND

COMPONENT LAYOUTS

ORDERING OF SPARE PARTS

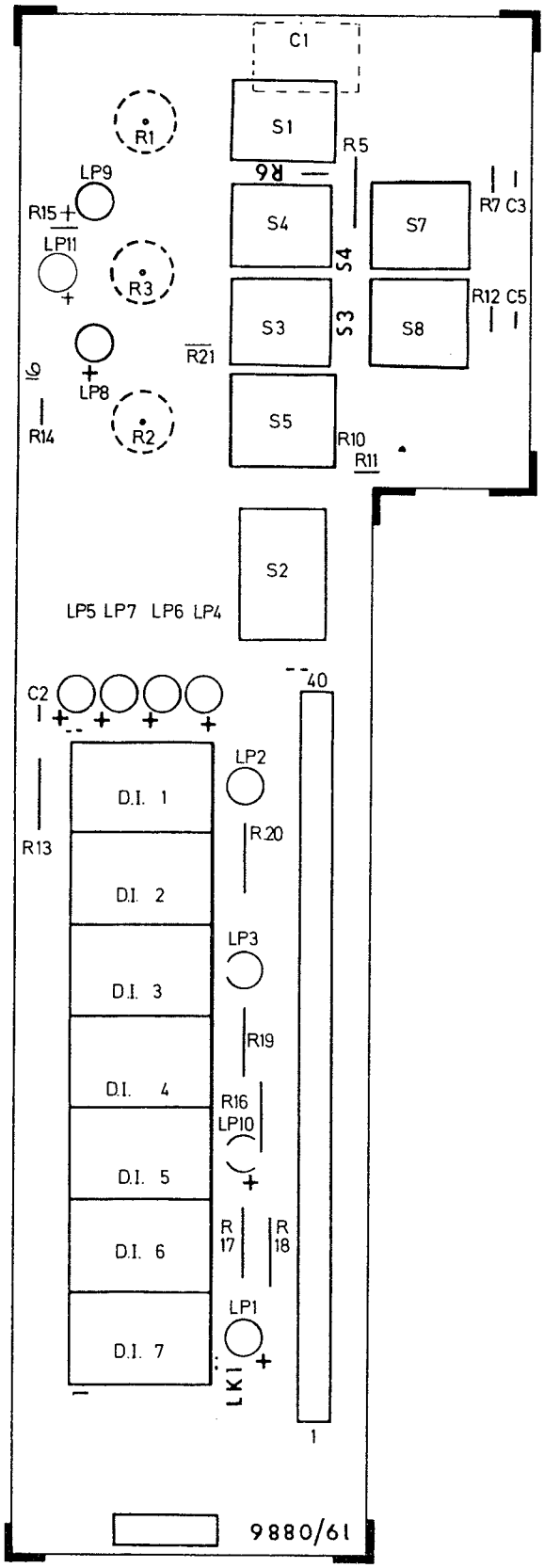
To be assured of satisfactory service when ordering replacement parts, the customer is requested to include the following information :

(a) Instrument type and serial number.

(b) The type reference of the Assembly in which the particular item is located (for example, '19-0834').

(c) The Racal-Dana Part number and circuit reference of each item being ordered.

It should be noted that a minimum charge of £10 sterling is applicable to all UK orders.



RACAL

WOH8155	19-0886
1	

Component Layout:
Display Assembly 19-0886

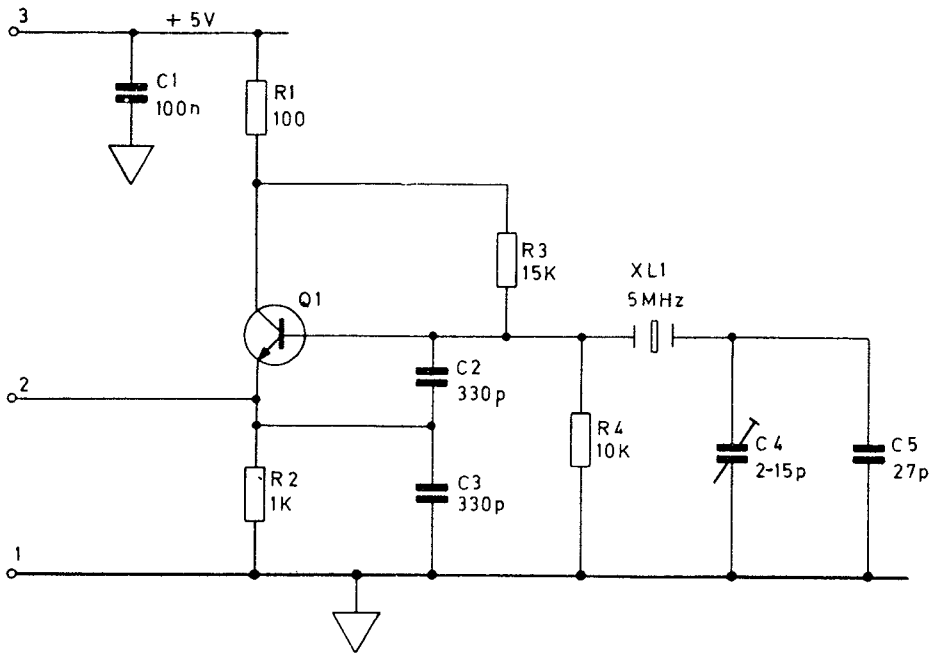
Fig. 1

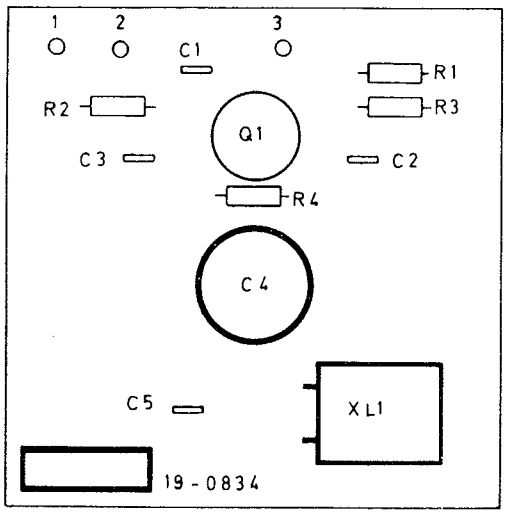
PARTS LIST

DISPLAY ASSEMBLY 19-0886

NOTE: Components are prefixed '1' on the circuit diagram (Fig. 4).

Part No.	Description	Rat	Tol %	Value	Component Reference
	Resistors	W		Ω	
20-1516	Carbon Film	0.1	5	220	R14,15
20-1517	Carbon Film	0.1	5	330	R21
20-1551	Carbon Film	0.1	5	100k	R7,12
20-1564	Carbon Film	0.1	5	120k	R6,11
20-2221	Carbon Film	¼	5	220	R20
20-2331	Carbon Film	¼	5	330	R13,16,18,19
20-2471	Carbon Film	¼	5	470	R17
20-2914	Carbon Film	¼	5	910k	R5,10
20-6625	Variable 1M log + 10k lin				R1
20-6626	Variable 1M log with switch				R3
20-6628	Variable 10k lin with switch				R2
	Capacitors	V		F	
21-1500	Ceramic	500	½p	2.2p	C7,8
21-1521	Ceramic	500	10	120p	C3, 5
21-1616	Ceramic	12	+80 -20	100n	C2
21-1683	Ceramic	63	2	18p	C9,10
21-4528	Polyester	400	10	47n	C1
	Switches				
23-4099	Slide switch 2 position				S1,3,4,5,7, 8
23-4100	Slide switch 3 position				S2
	Indicators				
26-1508	Numerical display, l.e.d.				D.1.1. to D.1.7
26-5004	Indicator l.e.d.				LP1,2,3,4, 5,6,7, 10,11
26-5011	Indicator l.e.d.				LP8,9
	Miscellaneous				
25-6032	Flexible Wiring, 40 way				





WOH	19-0834
1	

Circuit And Layout
5MHz Oscillator PCB 19-0834

Fig. 2

PARTS LIST

5 MHz CRYSTAL OSCILLATOR ASSEMBLY (19-0834)

Part No.	Description	Rat	Tol %	Value	Component Reference
	Resistors	W		Ω	
20-2101	Carbon Film	$\frac{1}{4}$	5	100	R1
20-2102	Carbon Film	$\frac{1}{4}$	5	1k	R2
20-2103	Carbon Film	$\frac{1}{4}$	5	10k	R4
20-2153	Carbon Film	$\frac{1}{4}$	5	15k	R3
	Capacitors	V		F	
21-1616	Ceramic	12	20	100n	C1
21-2621	Silver Mica	125	5	27p	C5
21-2631	Silver Mica	125	5	330p	C2,3
21-6030	Trimmer			2-15p	C4
	Transistors				
22-6017	Silicon NPN (2N2369)				Q1
	Crystal				
17-2087	Crystal Assembly, 5 MHz				XL1

PARTS LIST

CHASSIS, FRONT AND REAR PANELS

Part No.	Description	Rat.	Tol %	Value	Component Reference
CHASSIS ASSEMBLY 11-1297					
21-0575	Capacitor, Electrolytic	16V		4700µF	C100
21-0576	Capacitor, Electrolytic	25V		2200µF	C101
22-6081	Transistor, npn (MJE 520)				Q51, 52
22-6139	Transistor, pnp (MJE 371)				Q50
FRONT PANEL ASSEMBLY 11-1301					
20-4658	Resistor, Metal Oxide	1W	5	100kΩ	R202
21-1520	Capacitor, Ceramic	500V	10	100pF	C103
23-3030	Socket, BNC				SK50, 51
17-0113	Switch				S53, S52
23-4013	Switch				S50, 51
REAR PANEL ASSEMBLY 11-1302					
11-1254	Oscillator Assembly (refer to Parts List 2)				
17-4056	Transformer				T50
22-1650	Bridge Rectifier (VS 248) 200V, 2A				D50
23-0031	Fuselink (94V to 132V) 250mA anti-surge				FS50
23-0043	Fuselink (188V to 265V) 125mA anti-surge				
23-0044	Fuse Holder for FS50				
23-3005	Socket, BNC				SK52
23-3222 / 23-3253	Power Input Filter/Connector				
23-4091	Switch				S54
24-3515	Barb, Feedthrough				

MAIN PCB ASSEMBLY 19-0885

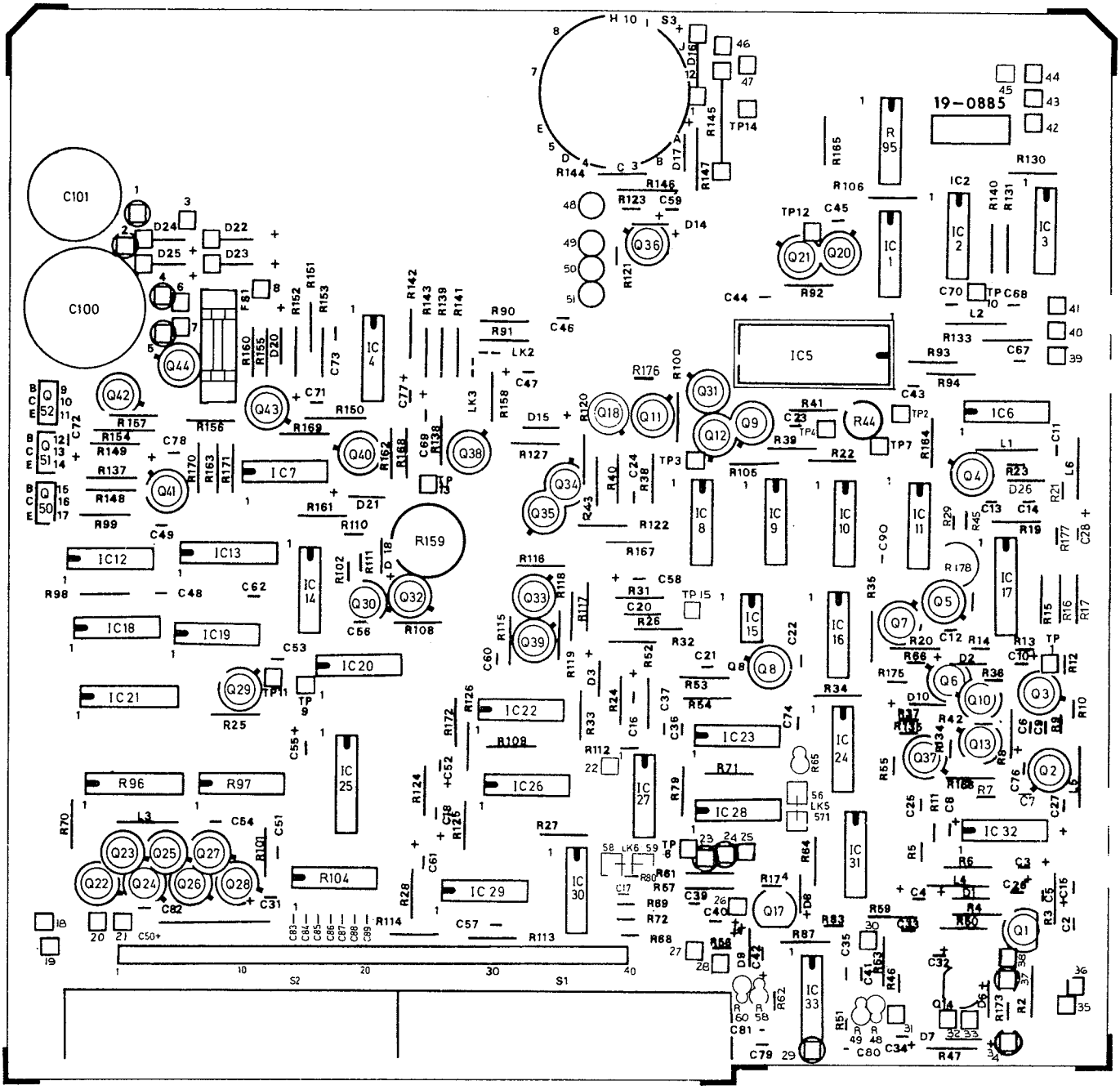
Part No.	Description	Rat	Tol %	Value	Component Reference
	Resistors	W		Ω	
20-1514	Carbon Film	0.1	5	100	R7
20-1516	Carbon Film	0.1	5	220	R23
20-1520	Carbon Film	0.1	5	10	R83
20-1521	Carbon Film	0.1	5	1k	R5,9,11,13,18,176
20-1528	Carbon Film	0.1	5	2.2k	R14
20-1532	Carbon Film	0.1	5	470	R12
20-1533	Carbon Film	0.1	5	5.6k	R55
20-1537	Carbon Film	0.1	5	3.3k	R37,66,121
20-1538	Carbon Film	0.1	5	10k	R10,29,36,42 45,68, 69,72,102,111, 112,134,135,175
20-1542	Carbon Film	0.1	5	4.7k	R21,123
20-1546	Carbon Film	0.1	5	56	R173,174
20-1563	Carbon Film	0.1	5	22k	R110
20-1565	Carbon Film	0.1	5	560k	R46,56
20-2006	Carbon Film	¼	5	3.3	R157
20-2100	Carbon Film	¼	5	10	R59,63,87,119
20-2101	Carbon Film	¼	5	100	R22,106,120,137, 172
20-2102	Carbon Film	¼	5	1k	R6,17,27,33,35, 41,108,124,133,138, 155
20-2103	Carbon Film	¼	5	10k	R20,25,26,28,34 70,71,92,93,105, 109,113,114,126, 131,139,156,160, 164,167
20-2104	Carbon Film	¼	5	100k	R54
20-2105	Carbon Film	¼	5	1M	R50,61
20-2106	Carbon Film	¼	10	10M	R2
20-2120	Carbon Film	¼	5	12	R3
20-2121	Carbon Film	¼	5	120	R165
20-2150	Carbon Film	¼	5	15	R90,91
20-2151	Carbon Film	¼	5	150	R98,99
20-2152	Carbon Film	¼	5	1.5k	R161
20-2155	Carbon Film	¼	10	1.5M	R141
20-2182	Carbon Film	¼	5	1.8k	R162
20-2220	Carbon Film	¼	5	22	R168,170
20-2222	Carbon Film	¼	5	2.2k	R4,171
20-2272	Carbon Film	¼	5	2.7k	R127
20-2274	Carbon Film	¼	5	270k	R53
20-2331	Carbon Film	¼	5	330	R31, 32, 100
20-2332	Carbon Film	¼	5	3.3k	R122,125,142
20-2333	Carbon Film	¼	5	33k	R158
20-2391	Carbon Film	¼	5	390	R144
20-2392	Carbon Film	¼	5	3.9k	R115,116
20-2393	Carbon Film	¼	5	39k	R118
20-2394	Carbon Film	¼	5	390k	R117
20-2470	Carbon Film	¼	5	47	R8
20-2471	Carbon Film	¼	5	470	R38,43,94,163,166
20-2472	Carbon Film	¼	5	4.7k	R39,40,64,169
20-2473	Carbon Film	¼	5	47k	R151
20-2474	Carbon Film	¼	5	470k	R52
20-2560	Carbon Film	¼	5	56	R24
20-2561	Carbon Film	¼	5	560	R19
20-2562	Carbon Film	¼	5	5.6k	R65,79,130, 140,153
20-2681	Carbon Film	¼	5	680	R152
20-2682	Carbon Film	¼	5	6.8k	R143
20-2820	Carbon Film	¼	5	82	R101
20-2821	Carbon Film	¼	5	820	R15,16
20-2914	Carbon Film	¼	5	910k	R47,57
20-3151	Metal Oxide	½	5	150	R154
20-3270	Metal Oxide	½	5	27	R147
20-1529	Carbon Film	0.1	5	33	R177
20-1575	Carbon Film	0.1	5	18k	R51,62

Part No.	Description	Rat	Tol %	Value	Component Reference
		W		Ω	
20-3390	Metal Oxide	½	5	39	R146
20-3820	Metal Oxide	½	5	82	R150
20-4033	Metal Oxide	¼	1	10k	R148,149
20-4037	Metal Oxide	¼	1	1.8k	R48,49,58,60
20-5055	Wirewound	2.5		3.9	R145
20-5500	D.I.L. Array 7 x 56				R104
20-5501	D.I.L. Array 8 x 220				R96
20-5502	D.I.L. Array 13 x 1k				R97
20-5503	D.I.L. Array 13 x 10k				R95
20-6546	Variable, linear ¼		20	10k	R159
20-7025	Variable			200	R44,178
	Capacitors	V		F	
21-0609	Electrolytic	6.3	-10+50	470µ	C50
21-1000	Tantalum	35	20	3.3µ	C16,58,59
21-1038	Tantalum	6.3	20	47µ	C3,8,15,18,26, 27,28,31,32,34 40,42,47,55,61, 69,71,72,77,78
21-1039	Tantalum	16	20	22µ	C4,10,76
21-1048	Tantalum	35	20	2.2µ	C52
21-1513	Ceramic	500	10	27p	C70
21-1514	Ceramic	500	10	33p	C7, 13
21-1516	Ceramic	500	10	47p	C24
21-1518	Ceramic	500	10	68p	C23
21-1520	Ceramic	500	10	100p	C14
21-1524	Ceramic	500	10	220p	C9
21-1532	Ceramic	500	20	1n	C36,45,48,49, 57,67
21-1534	Ceramic	500	20	1.5n	C21
21-1537	Ceramic	500	20	2.7n	C53
21-1545	Ceramic	25	+80-20	10n	C22
21-1589	Ceramic	10	+80-20	220n	C44
21-1616	Ceramic	12	+80-20	100n	C2,5,6,11,12, 17,25,33,35,37, 39,41,43,46,51, 54,56,60, 62,68, 73,74,79,82
21-1671	Ceramic	63	0.25p	1.8p	C80,81
21-4507	Polyester	100	20	150n	C20
21-1610	Ceramic	100	+80-20	10n	C83,84,85,86, 87,88,89
21-1688	Ceramic	63	2	47p	C90
	Diodes				
22-1029	Silicon, general purpose (1N4149)				D1,3,6,7,8, 9,14,15,17,18,
22-1602	Silicon (1N4002)				D16,22,23,24,25
22-1807	Voltage reg. (BZY88C4V7)				D20
22-1810	Voltage reg. (BZY88C6V2)				D10,21
22-1811	Voltage reg. (BZY88C6V8)				D2
22-1033	Hot Carrier (5082.2811)				D26

MAIN PCB ASSEMBLY 19-0885

Part No.	Description	Rat	Tol %	Value	Component Reference
	Integrated Circuits				
22-4044	Quad 2-Input Pos. NAND Gate (7400)				IC2
22-4053	Triple 3 Input Pos. NAND Gate (7410)				IC26
22-4061	Hex. Inverter Open Collector O/P (7405)				IC8
22-4128	BCD to 7-Segment Decoder (74247)				IC25
22-4202	Dual Freq. Compensated Op. Amp. (747)				IC4, 7
22-4206	Precision Timer (72555P)				IC15
22-4221	Differential Video Amp. (Selected 733)				IC32
22-4228	Dual Voltage Comparator (NE521)				IC33
22-4505	Schottky Quad 2-Input NAND Gate (74SN00N)				IC28
22-4516	Schottky Dual D-Type Bistable (74S74N)				IC31
22-4528	Triple Line Receiver (MC10116P)				IC17
22-4531	Schottky Quad 2 Input NAND Gate (74LS00N)				IC11,30
22-4532	Schottky Quad 2 Input NOR Gate (74LS02N)				IC12
22-4533	Schottky Hex. Inverter (74LS04N)				IC1,16
22-4534	Schottky Dual D Type Bistable (74LS74)				IC29
22-4536	Schottky Decade Counter (74LS90)				IC18
22-4537	Dual Retriggerable Monostable (74123N)				IC3
22-4546	Schottky Quad 2 Input NAND Gate (74LS03N)				IC24,27
22-4553	Schottky Hex. Inverter (74LS05N)				IC14,22
22-4556	Schottky BCD to Decimal Decoder Driver (74LS145N)				IC21
22-4124	Schottky Triple 3 Input NAND Gate (74S10)				IC10
22-4563	Schottky Quad Latch (74LS75)				IC13
22-4566	Schottky Quad 2 Input Exclusive OR Gate (74LS86)				IC9,19
22-4568	Schottky Quad 2 Input AND Gate (74LS08)				IC6
22-4601	CDI LSI (Racal-Dana)				IC5
22-4715	Hex. Inverter (CD4069)				IC23
22-4551	Hex. Schmitt Inverter (7414)				IC20

Part No.	Description	Rat	Tol %	Value	Component Reference
	Transistors				
22-6010	Silicon, pnp (2N4126)				Q3
22-6041	Silicon, npn (BC109)				Q10,13,32,44
22-6079	Silicon, npn (ZTX313L)				Q2,4,5,7,8,9,11 12,18,29,30,35, 36,37,38,39,42,
22-6101	FET, N Channel (W300A)				Q1
22-6112	Silicon, npn (ZTX450)				Q6
22-6113	Silicon, pnp (ZTX550)				Q20,22,23,24, 25,26,27,28, 31,33,34,40,41,43
22-6132	Dual N-Channel FET				Q14,17,
	Inductors				
23-7007	Inductor			0.68µH	L1
23-7014	Inductor			10µH	L6
23-7016	Inductor			22µH	L3
23-7055	Inductor			68µH	L5
23-7056	Inductor			100µH	L2,4
	Switches				
23-4078	Switch bank				S1,2
17-0084	3-Position rotary, edge				S3
	Miscellaneous				
23-0006	Fuselink, 1A				FS1
23-0034	Fuseholder (p.c.b.) for FS1				
23-3213	IC Holder for IC5				



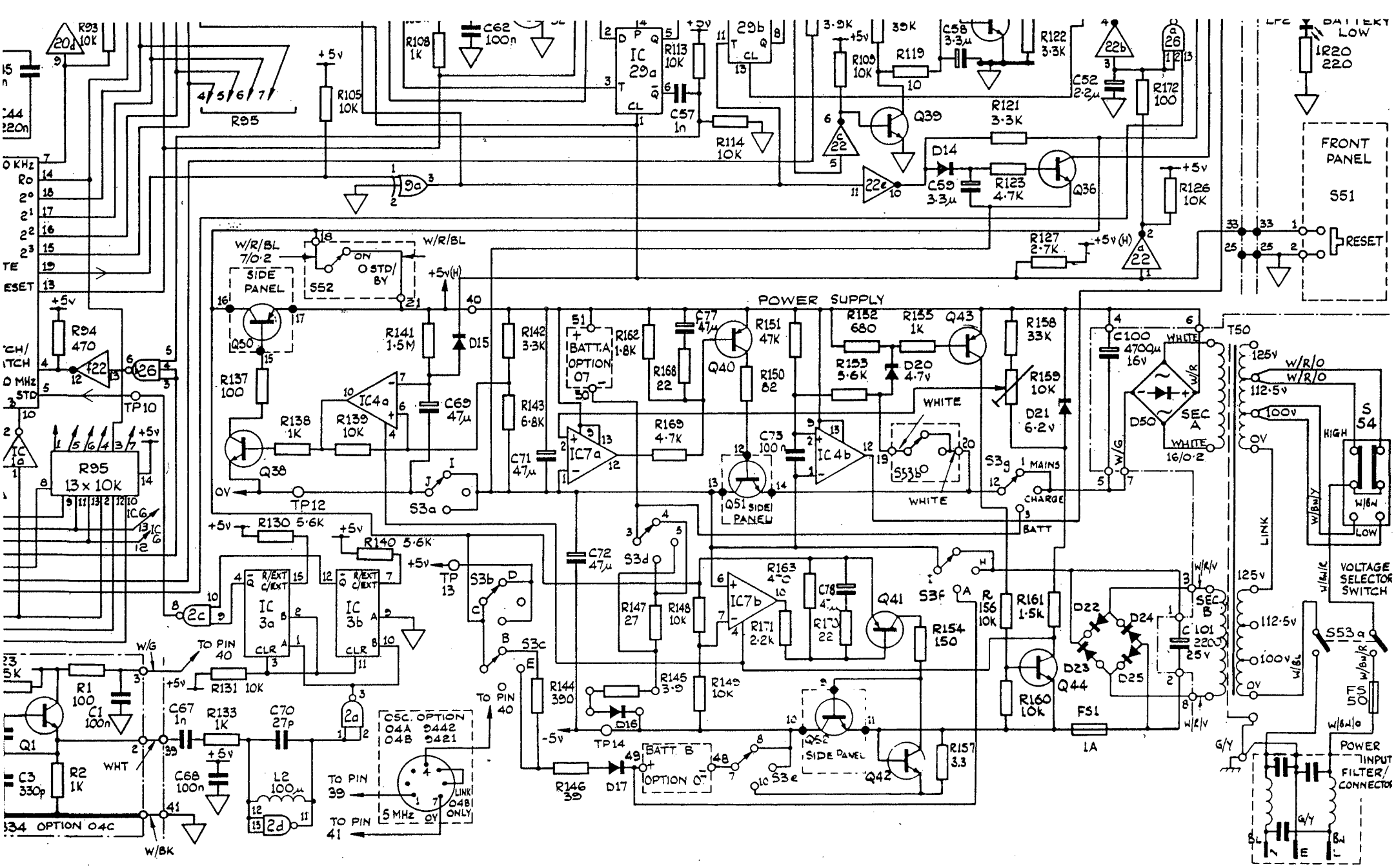
Component Layout:

Main P.C.B. Assembly 19-0885

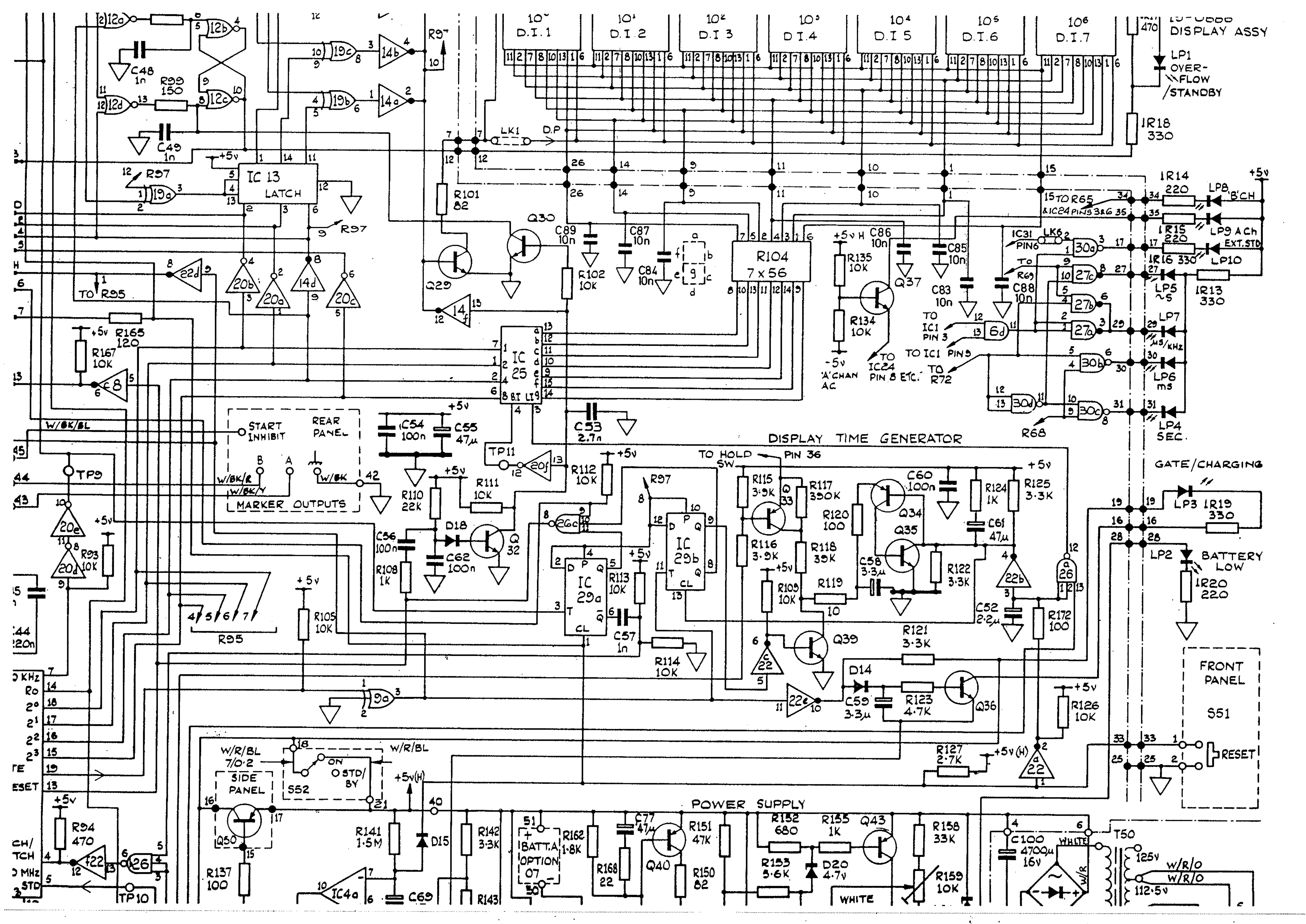
Fig. 3

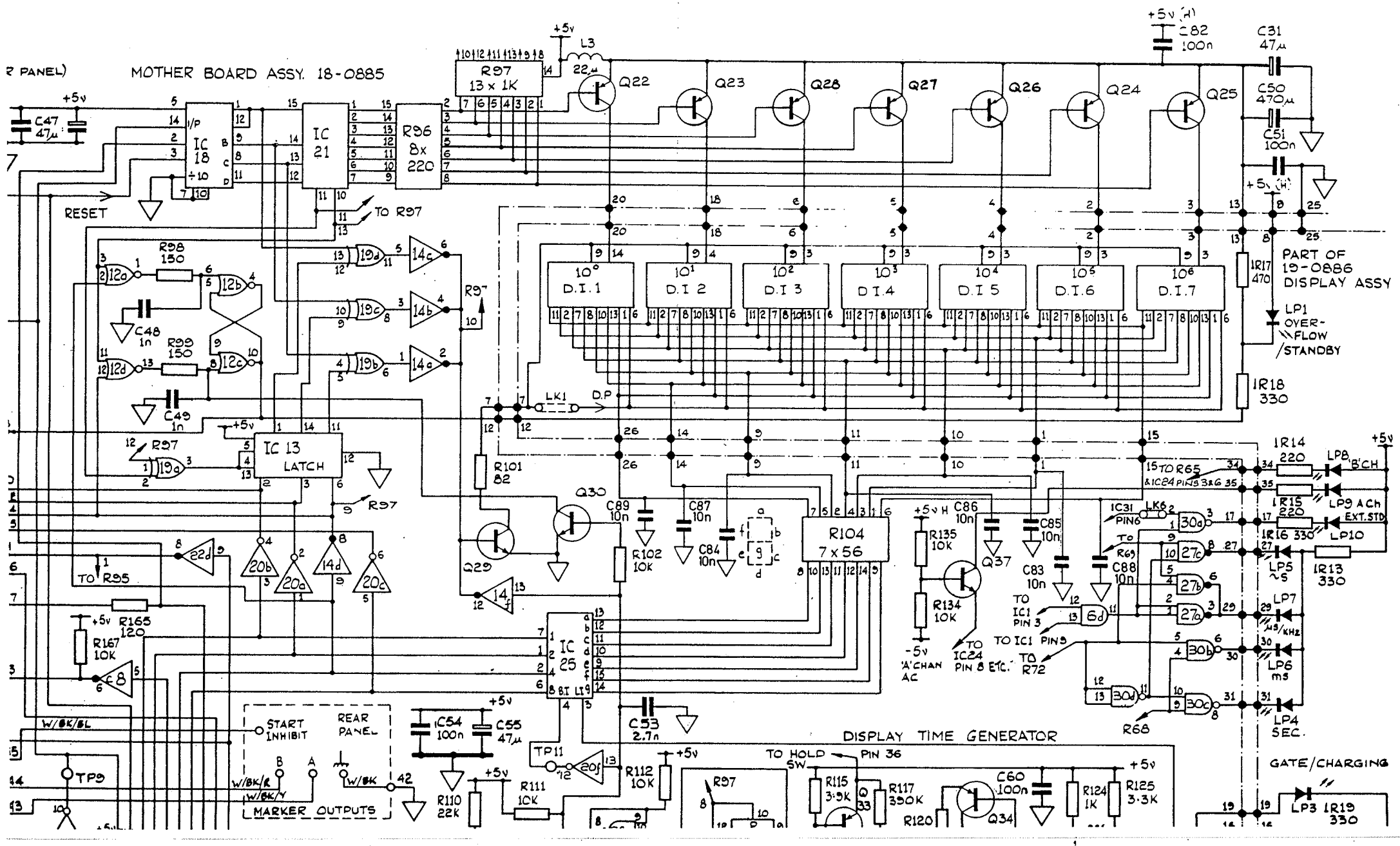
RACAL

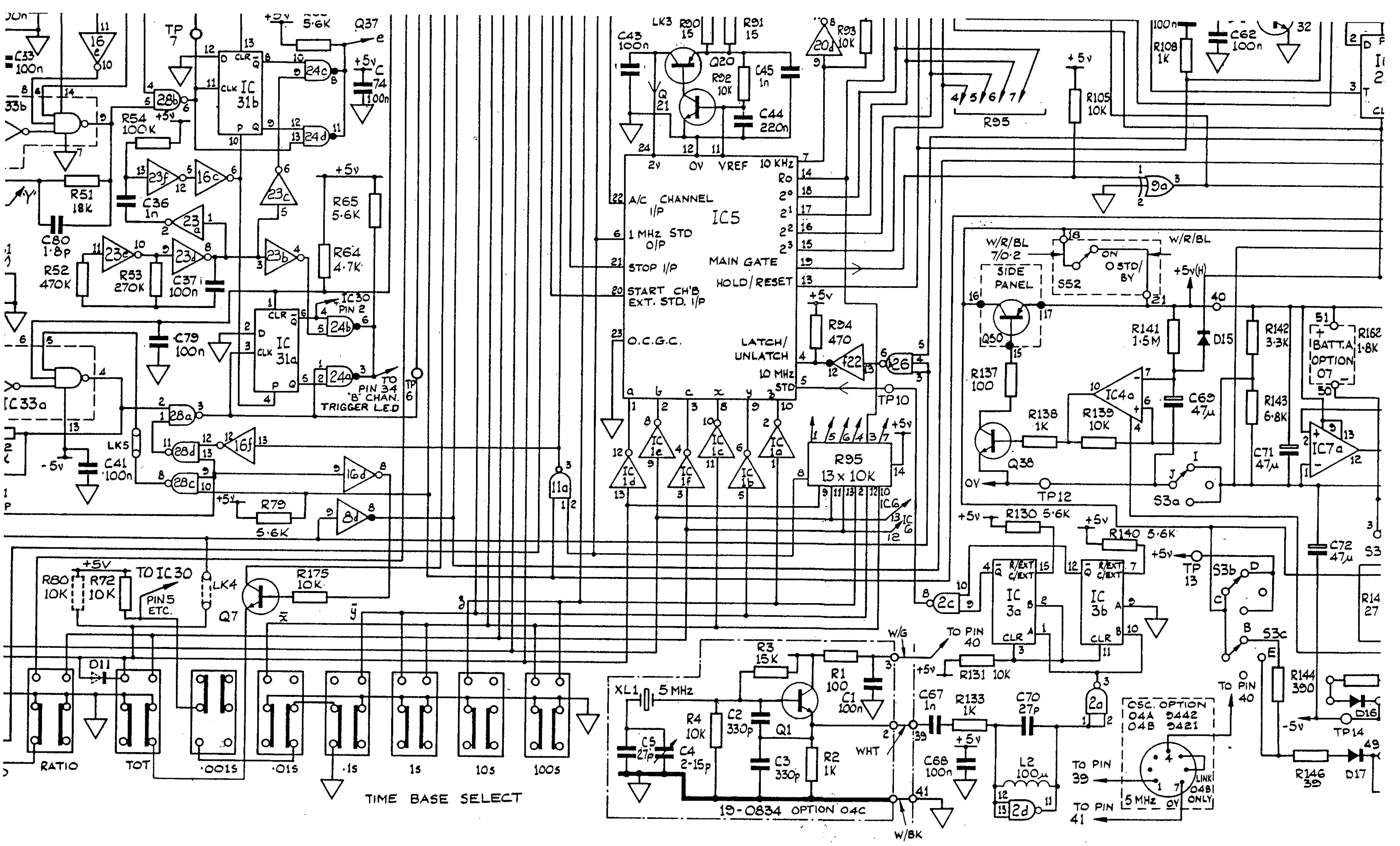
WOH8155	19-0885
1	5 | 6



Overall Circuit : 9904 Fig. 4

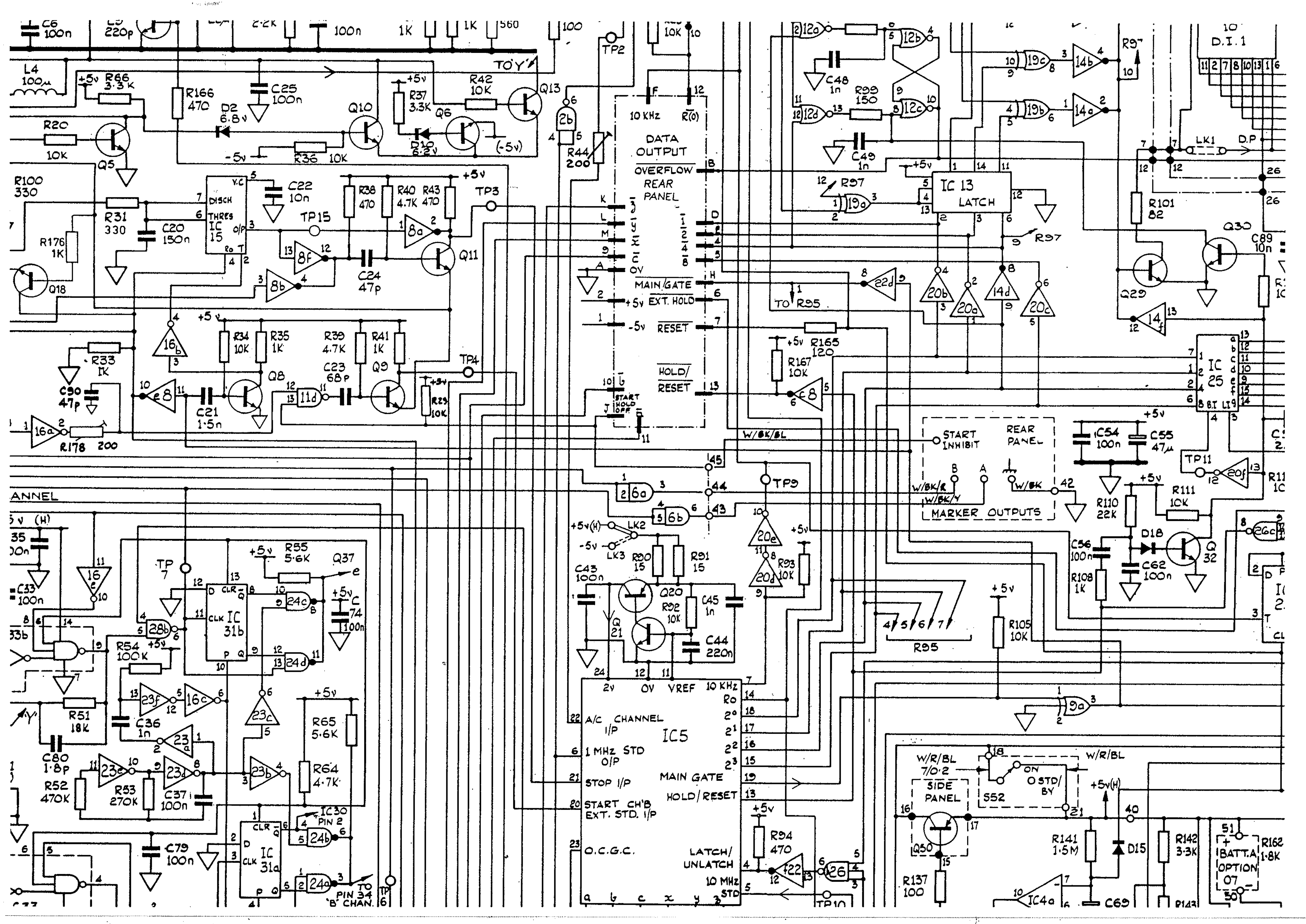

DISPLAY ASSY
D.I.1
D.I.2
D.I 3
D.I.4
D.I 5
D.I.6
D.I.7
LP1 OVER-FLOW /STANDBY
1R18 330
IC 13 LATCH
R104 7 x 56
IC 25
START INHIBIT
REAR PANEL
MARKER OUTPUTS
DISPLAY TIME GENERATOR
TO HOLD SW
PIN 36
IC 29a
IC 29b
GATE/CHARGING
BATTERY LOW
FRONT PANEL
S51
RESET
POWER SUPPLY
SIDE PANEL
S52
ON
STD/ BY
BATT.A OPTION 07
T50
LP8 B'CH
LP9 A Ch
LP10 EXT.STD
LP5 ~S
LP7 μS/KHz
LP6 mS
LP4 SEC.
LP3
LP2
R95
R97
TP9
TP10
TP11

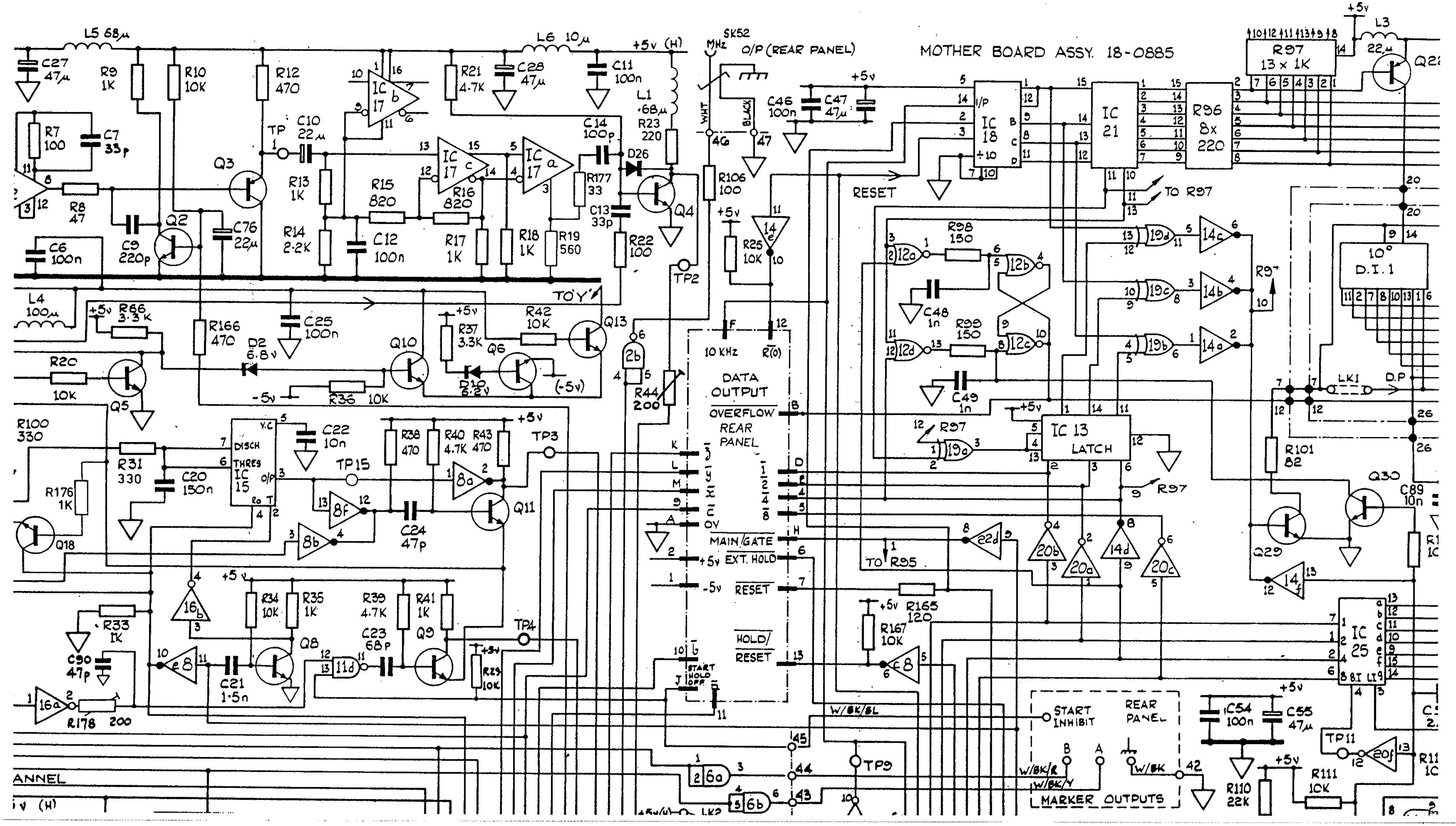

R PANEL)
MOTHER BOARD ASSY. 18-0885
+5v
C47 47µ
IC 18 ÷10
IC 21
R96 8x 220
R97 13 x 1K
L3 22µ
Q22
Q23
Q28
Q27
Q26
Q24
Q25
C82 100n
C31 47µ
C50 470µ
C51 100n
+5v (H)
RESET
TO R97
R98 150
R99 150
C48 1n
C49 1n
IC 13 LATCH
D.I.1
D.I.2
D.I.3
D.I.4
D.I.5
D.I.6
D.I.7
PART OF 19-0886 DISPLAY ASSY
1R17 470
LP1 OVER-FLOW /STANDBY
1R18 330
LK1
D.P
R101 82
Q30
Q29
C89 10n
C87 10n
C84 10n
R102 10K
R104 7x56
C86 10n
C85 10n
C83 10n
C88 10n
R135 10K
R134 10K
Q37
-5v 'A' CHAN AC
TO IC24 PIN 8 ETC.
TO R72
TO IC1 PIN 3
TO R95
R165 120
R167 10K
IC 25
C53 2.7n
C54 100n
C55 47µ
R110 22K
R111 10K
R112 10K
TP11
TP9
START INHIBIT
REAR PANEL
MARKER OUTPUTS
W/BK/BL
W/BK/R
W/BK/Y
W/BK
42
DISPLAY TIME GENERATOR
TO HOLD SW
PIN 36
R115 3.9K
R117 350K
R120
Q34
C60 100n
R124 1K
R125 3.3K
1R14 220
1R15 220
1R16 330
1R13 330
LP8 B'CH
LP9 A Ch EXT. STD
LP10
LP5 ~S
LP7 µS/kHz
LP6 mS
LP4 SEC.
GATE/CHARGING
LP3 1R19 330
R68
IC31 PIN6
LK6
15 TO R65 & IC24 PINS 33 & 35



TIME BASE SELECT
100s
10s
1s
.1s
.01s
.001s
TOT
RATIO
IC5
MAIN GATE
HOLD/RESET
LATCH/UNLATCH
A/C CHANNEL I/P
1 MHz STD O/P
STOP I/P
START CH'B EXT. STD. I/P
O.C.G.C.
10 KHz
10 MHz STD
VREF
19-0834 OPTION 04C
5 MHz
SIDE PANEL
BATT.A OPTION 07
OSC. OPTION 04A 9442 04B 9421
TO PIN 40
TO PIN 39
TO PIN 41
TO IC30 PIN5 ETC.
TO PIN 34 'B' CHAN. TRIGGER LED
R95 13 x 10K

0


D.I.1
IC 13 LATCH
DATA OUTPUT
10 KHz
R(0)
OVERFLOW
REAR PANEL
MAIN/GATE
EXT. HOLD
RESET
HOLD/RESET
START HOLD OFF
IC 25
IC 15
IC 31b
IC 31a
IC5
A/C CHANNEL I/P
1 MHz STD O/P
STOP I/P
START CH'B EXT. STD. I/P
O.C.G.C.
MAIN GATE
HOLD/RESET
LATCH/UNLATCH
10 MHz STD
VREF
START INHIBIT
MARKER OUTPUTS
SIDE PANEL
S52
ON
O STD/BY
BATT.A OPTION 07
W/R/BL
W/R/BL 7/0·2
W/BK/BL
W/BK/R
W/BK/Y
W/BK
TO R95
R95
TO PIN 34 'B' CHAN.
'TOY'
TP2
TP3
TP4
TP7
TP9
TP10
TP11
TP15
LK1
LK2
LK3
IC4a
IC30 PIN 2
Q5
Q6
Q8
Q9
Q10
Q11
Q13
Q18
Q20
Q21
Q29
Q30
Q32
Q37
Q50
D2 6.8v
D10 6.2v
D15
D18
L4 100µ
R20 10K
R31 330
R33 1K
R34 10K
R35 1K
R36 10K
R37 3.3K
R38 470
R39 4.7K
R40 4.7K
R41 1K
R42 10K
R43 470
R44 200
R51 18K
R52 470K
R53 270K
R54 100K
R55 5.6K
R64 4.7K
R65 5.6K
R66 3.3K
R90 15
R91 15
R92 10K
R93 10K
R94 470
R97
R99 150
R100 330
R101 82
R105 10K
R108 1K
R110 22K
R111 10K
R137 100
R141 1.5M
R142 3.3K
R162 1.8K
R165 120
R166 470
R167 10K
R176 1K
R178 200
C20 150n
C21 1.5n
C22 10n
C23 68p
C24 47p
C25 100n
C36 1n
C37 100n
C43 100n
C44 220n
C45 1n
C48 1n
C49 1n
C54 100n
C55 47µ
C56 100n
C62 100n
C79 100n
C80 1.8p
C89 10n
C90 47p
+5v
-5v
+5v(H)



MOTHER BOARD ASSY. 18-0885
O/P (REAR PANEL)
SK52
MHz
DATA OUTPUT
OVERFLOW REAR PANEL
10 KHz
MAIN/GATE
EXT. HOLD
RESET
HOLD/ RESET
START HOLD OFF
REAR PANEL
START INHIBIT
MARKER OUTPUTS
IC 13 LATCH
IC 25
IC 21
IC 18
IC 15
IC 17
10° D.I.1
R97 13 x 1K
R96 8x 220
TO R97
TO R95
'TOY'

SECTION 4

APPENDICES

AND

CHANGE INFORMATION

OPTION 01

SERIAL TO PARALLEL INTERFACE UNIT

CONTENTS

TABLES

SERIAL TO PARALLEL INTERFACE UNIT

OPTION 01

INTRODUCTION

1. The interface comprises a metal box, measuring approximately 132 x 95 x 36mm containing the p.c.b assembly 19-0851. Connections are made to printer or data display via a 50-way fixed socket and to the '99' instrument via a flying lead fitted with a 28-way edge connector. The unit is designed to operate with the following Racal counters, referred to in this description as the '99' series'

Frequency Meters		Universal Counter Timers (UCT)	
9910	9911	9900	9901
9912	9913	9902	9903
9914	9915	9904	9905
9916	9917	9906	
9917A	9919	9908	

2. Definition of Terms

(1) Hold Signal : a signal returned by the users equipment to the interface for control purposes.

(2) Print Command : a signal output by the interface to indicate that new measurement information is available.

(3) Print Hold input : An input which allows the user's Hold Signal to prevent the parallel information from changing.

(4) Hold/Reset input : An input which allows the user's signal to prevent the parallel information from changing and which resets the instrument when the Hold Signal returns to its normal state, thus starting a new measurement.

(5) Hold Control : An input to the interface which determines the mode of operation.

FUNCTION

3. The function of the Interface Unit is to convert the serial b.c.d. data output from a '99 series' counter to a static parallel form, suitable for driving a printer, data display or processing equipment.

4. The parallel output data is updated at the end of each gate time unless the printer (or other data processing equipment) is applying a Hold Signal. In addition to measurement data the interface also transfers information on decimal point position, selected range (gate time) and the 'overflow' state of the counter display. Information supplied is for 8 digits (excluding decimal point data) on all units except the 9917 and 1197A which supply information for 9 digits.

5. Fig. A1. shows the sequence of events which occurs at the end of the gate time. Note that when using counters 9910, 9911, 9912 and 9919, and when using counter 9908 on 'A' channel with AC coupling, all timings are doubled, except the print command pulse width.

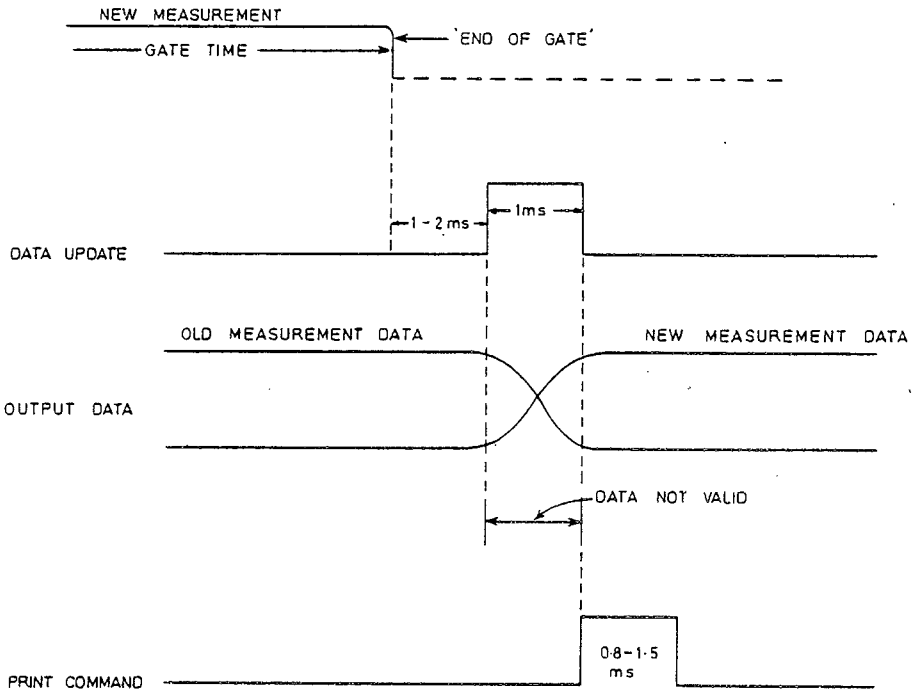


Fig. A1

CONNECTION

6. Before connecting the Interface Unit to the counter refer to the modes of operation in paras 8 to 18 and make the necessary changes to the 50-way connection or 28-way flying lead, according to the type of counter in use and the required function. All changes on the 50-way connection should be made at the customers connector.

7. Having checked the appropriate connection changes in paras 8 to 18, the interface should be connected up as follows:-

(1) Remove the black plate which covers the DATA OUTPUT aperture on the rear panel of the counter. Retain the two screws.

(2) Slacken off the cable clamp on the metal cover on the cable of the flying lead, and push the cover away from the connector.

(3) Plug the flying lead connector into the Data Output edge connector in the counter, noting the keyway which ensures correct orientation.

(4) To minimise r.f. radiation interference, the metal cover on the cables

(4) should be placed over the edge connector and held into place by the two screws which originally secured the cover plate removed in (1). The cable clamp should then be tightened.

(5) Connect the interface unit to the data processing equipment via the fixed 50-way socket.

MODES OF OPERATION

REMOTE DISPLAYS

Connections

8. If the interface is required to drive a remote display, or such other equipment that does not require the data to be held for a period longer than the gate time, check the following pin conditions on the 50-way connector:-

Pin No.	Required Connection
19	Must be either open circuit
24	or connected to OV.
49	

Latched Operation

9. The display is latched and is updated at the end of each gate time, irrespective of the counter function.

Unlatched Operation

10. (1) If the interface Unit is connected to a genuine remote display the subjective result is that the display will appear to follow the counter , for both latched and unlatched counter modes.

(2) The data outputs will be updated every 3 to 4 ms.

(3) The blue wire 'H' on the 28-way flying lead connector should be disconnected and reconnected to 'F' together with the violet wire. For other applications refer to paras 16 to 18.

USING EQUIPMENT WHICH PROVIDES HOLD SIGNALS

11. Differing instructions apply, depending on whether the counter is a frequency meter or universal counter timer (UCT) as described in paras 12 to 15.

Frequency Meters - Normal Use

12. (1) Check the following pin connections on the 50 way connector:-

Pin No.	Required Connection
19 and 24	Open Circuit, or connected to OV
49	Connected to the Hold signal

(2) The Hold signal (logic level '1' to hold) should be applied to the interface after receiving the Print Command signal, but before the end of the next gate time (ie 7 ms for 10 ms gate time), and should remain at logic level '1' for the period that the information on the data output is required to remain unchanged. Although the outputs from the interface will remain unchanged whilst a Hold is applied, the counter continues its normal measurement sequence, i.e. 'free run'. This has the advantage that the next Print Command will be given at the end of the gate time immediately following the release of the Print Hold. This result in a more rapid measurement sequence. From Fig. A2. it can be seen that a Print Command signal occurs 3 to 4 ms after an end of gate, by which time the gate time for a new measurement will have commenced.

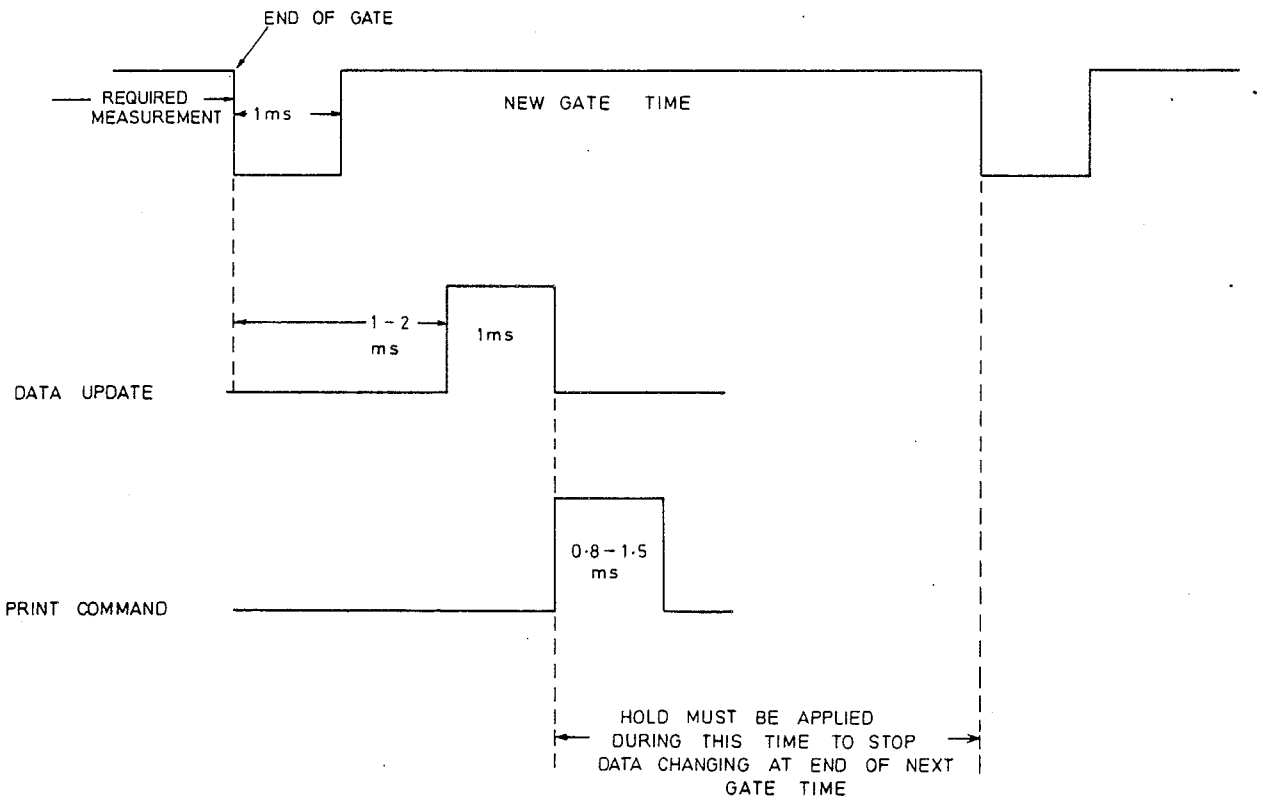


Fig. A2

Universal Counter Timers (UCT's) - Basic Hold Requirements

13. The measurement cycle of the 99 series of UCT's has two distinct phases; the Gate Time during which the measurement is made, and the Display Time during which the results are displayed. If the hold time required by the equipment to which the interface is connected is less than the display time, the remainder of the display time is effectively wasted. The interface can be used to shorten the display time, but in so doing the counter display is reset, which may not be convenient. For this reason the interface can be used with UCT's in two modes, the Print Hold and the Hold/Reset modes, as described in paras 14 and 15. It should be noted that, with UCT's, the interface will not produce a data change or Print Command signal from the operation of a front panel RESET control.

UCT's Using Print Hold Mode

14. In the Hold/Reset mode the Hold signal extends the display time indefinitely the next gate time commencing when the Hold is released or when the normal display period has ended, whichever period is the longer. The Hold signal must be applied within the display time period in order to halt the measurement cycle. The required pin connections on the 50 way connector are as follows:-

Pin No.	Required Connection
Pin 19	Connected to Pin 50 (or to 5V via 180Ω)
Pin 49	Connected to the Hold signal source
Pin 24	To be open circuit or connected to OV

UCT's Using Hold/Reset Mode

15. In the Hold/Reset mode the Hold signal (minimum width 5 ms) extends the display time indefinitely, but when it is released the counter display resets and a new measurement commences. This result in a more rapid measurement sequence, again the Hold signal must be applied within the display time period in order to halt the measurement cycle. The required pin connections on the 50-way connector are as follows:-

Pin No.	Required Connection
Pin 19	Connected to pin 50 (or to 5V via 180Ω)
Pin 24	Connected to the Hold signal source
Pin 49	To be open circuit or connected to OV

SPECIAL APPLICATIONS

Remote Display-Special Applications

16. When used in the unlatched mode with certain types of equipment other than remote displays (for example a digital comparator) there is a limit to the maximum possible counting rate. Therefore the reading for which the comparator is looking could be missed, i.e. there is a maximum update rate for the option of 3-4 ms. This corresponds to an input frequency of 200 Hz (N=1) on Totalize mode and a maximum resolution of 10ms on Time Interval mode. The counting rate can be increased if a degree of overshoot can be tolerated.

The maximum overshoot that will occur is given by:-

$$\text{Counting Rate} \times 4 \times 10^{-3} \text{ counts.}$$

It is advisable to use the Print Command as a 'data valid' signal in such systems.

Frequency Meters - Special Applications

17. In some applications it is not possible to use the interface in the manner described in Para 12. For example, in control systems, where the output of the interface is used as feedback to the device on the input of the counter, problems arise because the next gate time has already started before the information becomes available from the previous one. Therefore, even if the feedback correction is made almost instantly, the reading at the end of the next gate time will be incorrect. Alternatively, if the correction process takes more than one gate time, the end of gate time immediately following the process will also give incorrect results. These problems may be overcome by applying a Hold signal to the Print Hold input (pin 49) for the length of time that the correction takes, plus an additional time to ensure that the gate time from which the next data is to be taken cannot start until the correction process has been completed, as shown in Fig. A3.

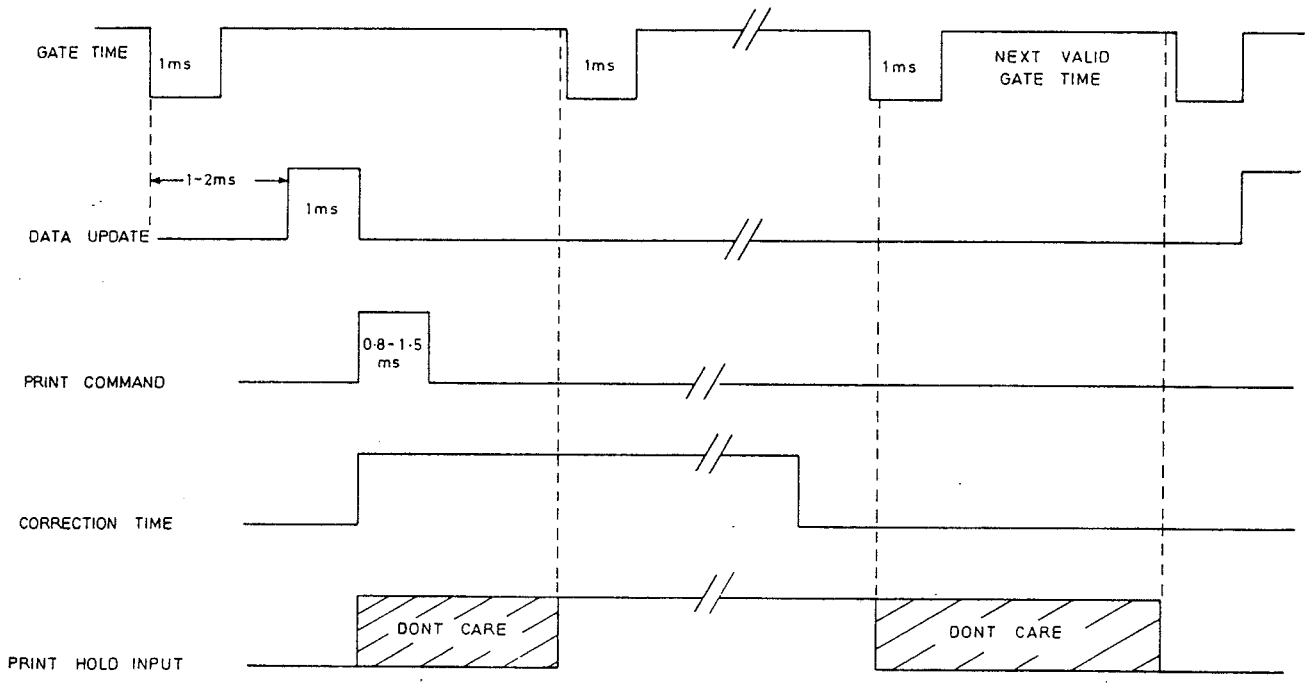


Fig. A3

18. An alternative to para 17, particularly when fast cycle times are desired, is to connect the Hold signal to the Hold/Reset input. If this is done, a stretched version must additionally be applied to the print Hold input (pin 49). The Hold signal should be at least as long as the correction process, and the signal applied to the Print Hold input should be approximately 200μs longer than that applied to the Hold/Reset input. This is to prevent the interface responding to the end of gate time produced by the reset. For cases where the correction time is short (less than the Print Command pulse width) this may be implemented by linking the Print Command output (pin 48) to the Hold/Reset input (pin 24) and by applying a stretched version of the Print Command to the Print Command to the Print Hold input (pin 49). In this way cycle times as short as 'Gate Time + 5ms' can be achieved. This is illustrated in Fig. A4.

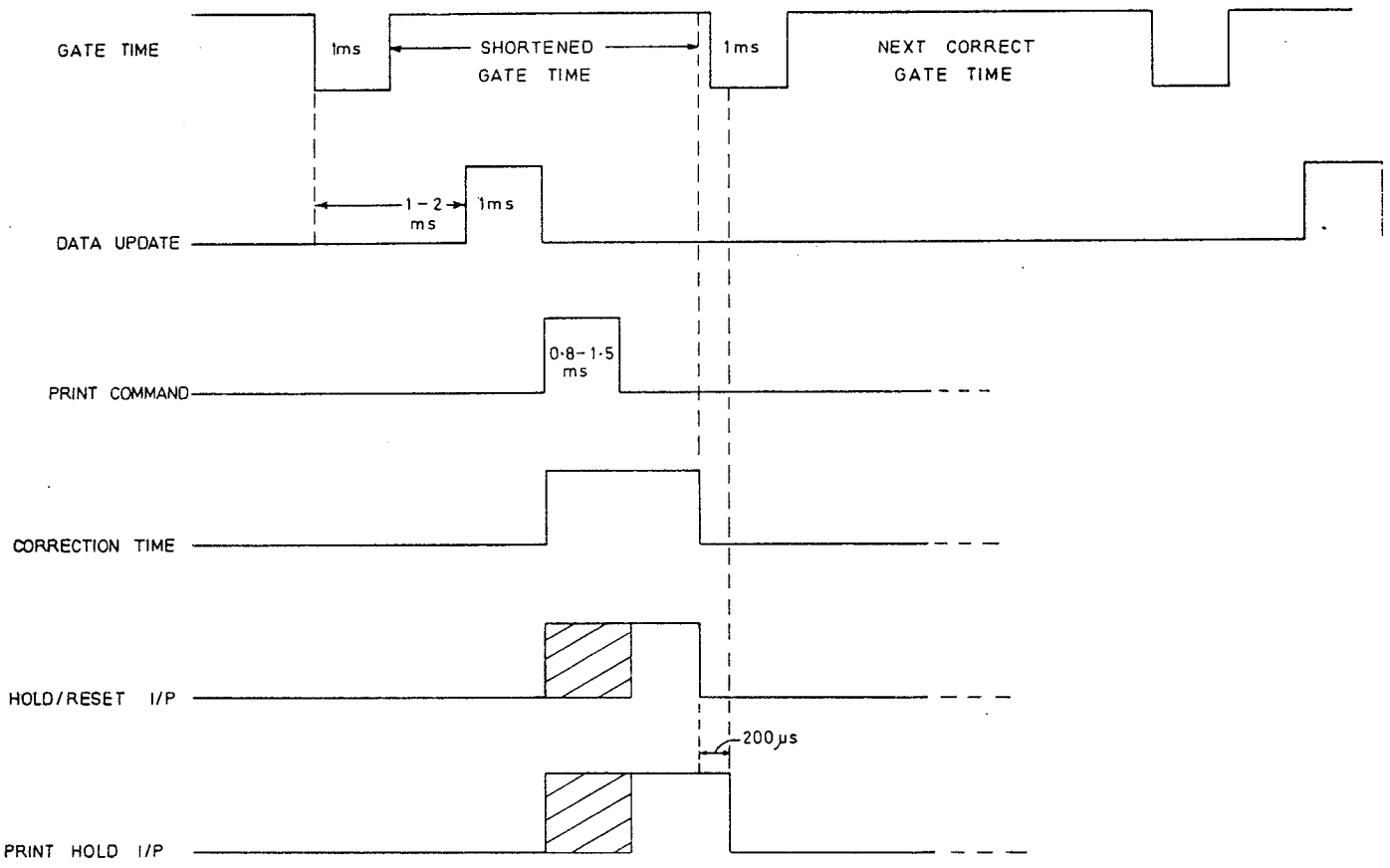


Fig. A4

TABLE 1.

FLYING LEAD CONNECTIONS

Pin No.		Pin No.	
1.	Not Connected	A	0V
2.	+ 5V (nominal)	B	$\overline{\text{OVERFLOW}}$
3.	KEYWAY	C	KEYWAY
4.	$\overline{4}$ BCD DATA	D	$\overline{1}$ BCD DATA
5.	$\overline{8}$	E	$\overline{2}$
6.	$\overline{\text{COUNTER HOLD}}$	F	Multiplex Sync (Note 2)
7.	$\overline{\text{COUNTER RESET}}$	H	$\overline{\text{MAIN GATE}}$
8.	DIGIT 10^8 SELECT	J	Not Connected
9.	Not Connected	K	$\overline{Z}$)
10.	Not Connected	L	$\overline{Y}$) TIME BASE
11.	Not Connected	M	$\overline{X}$)
12.	$\overline{Ro}$	N	Not Connected
13.	$\overline{\text{HOLD/RESET}}$	P	Not Connected
14.	See NOTE 1	R	Not Connected

NOTE 1. In option 01 units with serial numbers after 1389, pin 14 of the flying lead connection is connected within the interface unit to pin 43 of the 50 way connector. This permits a remote indication when instruments are in the divide by ten prescale mode.

NOTE 2. The multiplex sync. signal on pin F is 10 KHz, except with 9911 and 9919 instruments when it is 5 KHz.

TABLE 2.

50-WAY CONNECTOR

Pin No.	Facility		Pin No.	Facility	
1.	1	10^0 DIGIT	26.	1	10^1 DIGIT
2.	2		27.	2	
3.	4.		28.	4	
4.	8		29.	8	
5.	1	10^2 DIGIT	30.	1	10^3 DIGIT
6.	2		31.	2	
7.	4		32.	4	
8.	8		33.	8	
9.	1	10^4 DIGIT	34.	1	10^5 DIGIT
10.	2		35.	2	
11.	4		36.	4	
12.	8		37.	8	
13.	1	10^6 DIGIT	38.	1	10^7 DIGIT
14.	2		39.	2	
15.	4		40.	4	
16.	8		41.	8	
17.	OVERFLOW		42.	4	10^8 DIGIT
18.	1	10^8 DIGIT	43.	See table 1 NOTE 1.	
19.	HOLD CONTROL I/P		44.	8	10^8 DIGIT
20.	2	10^8 DIGIT	45.	1	DECIMAL POINT
21.	$\overline{X}$	TIME BASE	46.	2	
22.	$\overline{Y}$		47.	4	
23.	$\overline{Z}$		48.	PRINT COMMAND O/P	
24.	HOLD/RESET I/P		49.	PRINT HOLD I/P	
25.	0V		50.	+ 5V (VIA 180Ω)	