

Totalize Check

- 5.16
- (1) Set the CHECK/OPERATE switch to CHECK.
 - (2) Depress the TOTAL and $n = 10^5$ buttons. (To increase the counting rate a smaller 'n' factor may be selected).
 - (3) Press and release the START/STOP button and check that each display indicator counts through 0 to 9 and that the OVERFLOW indicator illuminates. Decimal points are not displayed.
 - (4) Press and release the START/STOP button to stop the count.
 - (5) Select:-
 - (a) CHECK/OPERATE to OPERATE.
 - (b) HOLD/NORMAL to HOLD.
 - (c) AC/DC switch to AC.
 - (d) SENSITIVITY control fully anticlockwise (10 mV).
 - (6) Set the signal generator to 10 MHz at 10 mV r.m.s. and connect to the terminated 'A' input socket.
 - (7) Depress the $n = 1$ Range button. Press and release the START/STOP button and note that:-
 - (a) The GATE indicator illuminates.
 - (b) The OVERFLOW indicator illuminates after one second.
 - (c) That counting continues.
 - (8) Press and release the START/STOP button and note that the GATE indicator extinguishes and the display is held.
 - (9) Set the NORMAL/HOLD switch to NORMAL. Repeat operations (7) and (8) and check that the display automatically resets, two seconds after the GATE indicator has extinguished.
 - (10) Disconnect all test equipment.

Frequency Standard Calibration

5.17 The 'cycle drift' method of frequency calibration, described below, is suitable for oscillators which have temperature stability characteristics of up to 1 part in 10^7 . The higher stability oscillators, such as the Racal 9421 and 9442, require specialised equipment such as the Tracor Frequency Difference Meter Type 527A, if the optimum calibration is to be achieved.

5.18 Equipment Required

Oscilloscope.

1 MHz external frequency standard, with accuracy better than one part in 10^7 .

5.19 Procedure

- (1) Allow a suitable warm-up period (not less than one hour for a temperature controlled oscillator).
- (2) Set the oscilloscope time base to $1 \mu\text{s}/\text{cm}$.
- (3) Connect the 1 MHz external standard to the 'External Trigger' input of the oscilloscope.
- (4) Connect the oscilloscope lead to the inner pin of the '1 MHz OUTPUT' socket on the rear panel (Screen to chassis).
- (5) Observe the oscilloscope display and check that in a period of 10 seconds not more than one cycle of displayed waveform moves past a fixed point on the oscilloscope face.
- (6) If necessary, adjust the oscillator trimmer to obtain a stationary trace. The trimmer is accessible via an aperture in the rear panel, except for a few early models in which the standard oscillator is mounted on the main p.c.b.

DISMANTLING

Removal of Display PCB

- 5.20 To change a component such as an LED indicator it is necessary to detach the Display Assembly from the front panel, but complete removal should be avoided if possible because of the numerous connections to the main p.c.b.
- (1) Disconnect power. Remove covers (para. 5.1).
 - (2) Remove the carrying handle as follows:-
 - (a) Insert a suitable tool such as a flat bladed screwdriver into the slot in the boss of each carrying handle and prise off the cap, thus exposing the retaining screws.
 - (b) Extract the screws which hold the carrying handle to the main frame, and remove the handle.
 - (3) With the handle removed slide back the short length of coloured metal strip into the space normally occupied by the handle boss. This will allow access to the screws which secure the front panel to the main frame. Remove these screws.
 - (4) The front panel assembly can now be carefully withdrawn as far as the wiring permits. Take care not to damage the flexible wiring connector to the main p.c.b. when withdrawing and re-fitting.
 - (5) To detach the Display Assembly:-
 - (a) Remove the knob from the SENSITIVITY control.
 - (b) Unsolder the earth connection and input capacitor connection at the 'B' input socket, and the START/STOP switch connection.
 - (c) Remove the four Pozidriv screws which secure the p.c.b. to the front panel. The p.c.b. can now be detached from the panel.
 - (d) For complete removal, unsolder the connections to the main p.c.b., noting the colour coding.

Removal of Main PCB

5.21 Due to excellent accessibility for servicing, removal of the main p.c.b., will rarely be necessary. It can be withdrawn either from the front or the rear. The rear panel method is described below.

- (1) Completely remove the two screws which are referred to in cover removal (paragraph 5.1).
- (2) Remove the covers and withdraw the rear panel as far as the wiring permits.
- (3) Unsolder the wiring between rear panel items and main p.c.b.
- (4) Unsolder the connections between the main p.c.b. and the regulator transistor on the side frame, and the rectifier on the rear panel.

NOTE: If preferred the transistor and rectifier can remain connected to the p.c.b. and be unscrewed from their mountings, but these items are not supplied with a replacement p.c.b.

- (5) Carefully unsolder the 33-way flexible wiring. If this needs to be renewed the Part No. is 25-6027.
- (6) Remove the three Pozidriv screws which secure the p.c.b. to the main frame, and slide out the p.c.b. towards the rear.

Replacement of Main PCB

- 5.22
- (1) Fit and secure the main p.c.b.
 - (2) Refit the rear panel. Solder the connections, and secure the transistor Q50 the side frame and rectifier D50 to the rear panel.
 - (3) Refit the two screws in the side members.
 - (4) Refit the covers when tests are completed. Replace the rubber plugs over the side panel screws.

FITTING OPTIONAL FREQUENCY STANDARD UNIT

- NOTES:
1. Operation (1) applies only to early models. In later models the oscillator is on a separate p.c.b. attached to the inner face of the rear panel.
 2. The black plate referred to below is not fitted on early models.

Procedure

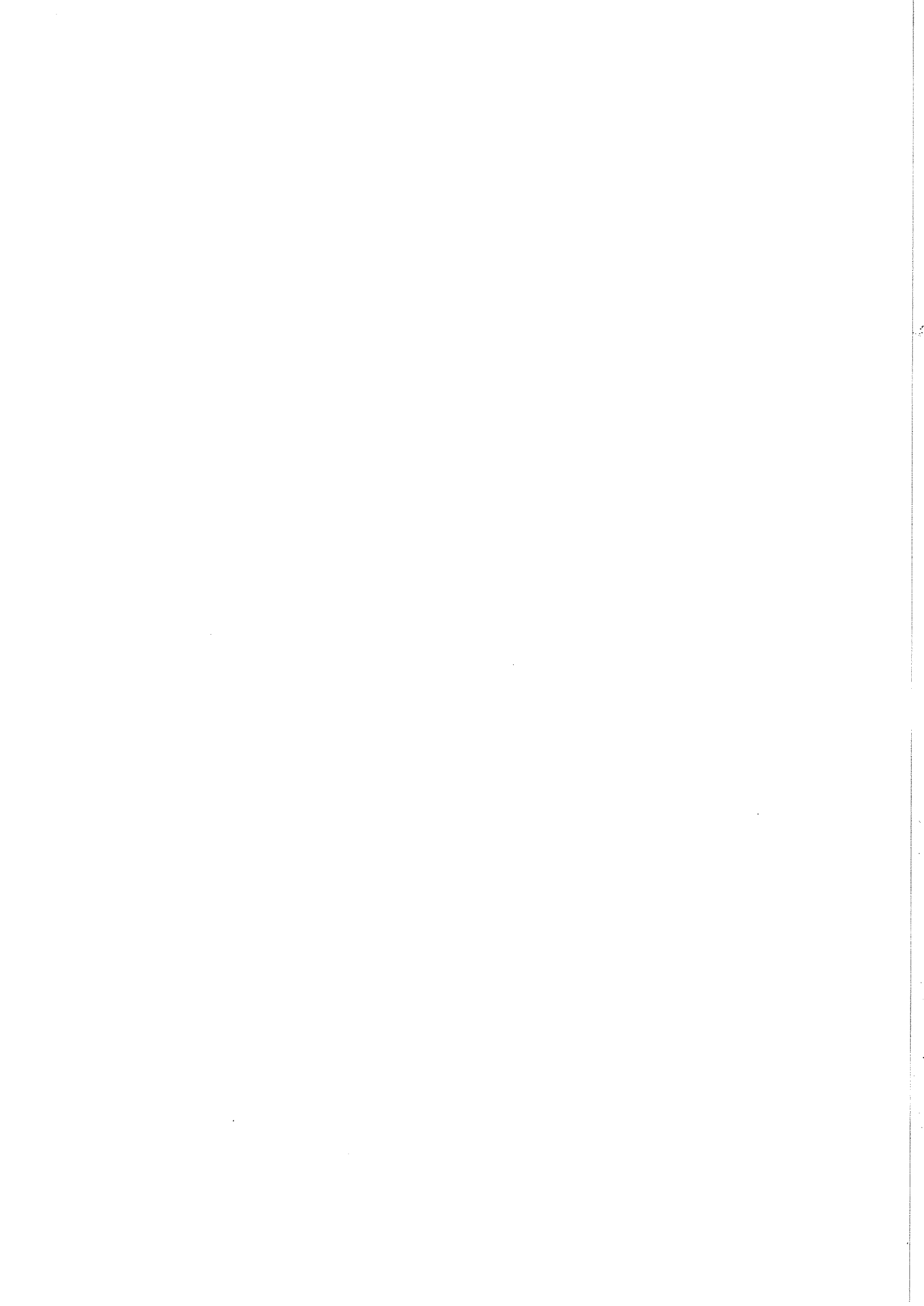
- 5.23
- (1) If the discrete component oscillator is mounted on the main p.c.b. (early models) remove link LK1 and crystal XL1 from the p.c.b.
 - (2) Unsolder the leads from pins 1, 2 and 3 of the discrete component oscillator p.c.b. (later models). Extract the two retaining screws (and spacers) from the rear panel and remove the p.c.b.
 - (3) Remove the black plate (if fitted) from the rear panel trimming aperture, and retain the screws.
 - (4) Attach the optional frequency standard unit to the inner face of the rear panel, align the fixing holes in the top of the unit with the rear panel holes and make secure with two M3, 6 mm, screws. (The screws removed with the black plate can be used).
 - (5) Solder the connecting leads to pins 1, 4 and 7 of the frequency standard base, as shown in the circuit diagram.
 - (6) If frequency standard Type 9421 is being fitted check that pins 5 and 6 on the base are linked.
 - (7) Carry out the instrument CHECK procedure to verify satisfactory functioning.
 - (8) Calibration of the frequency standard must be carried out before operational use. Refer to para. 5.17.
 - (9) Replace the instrument cover.

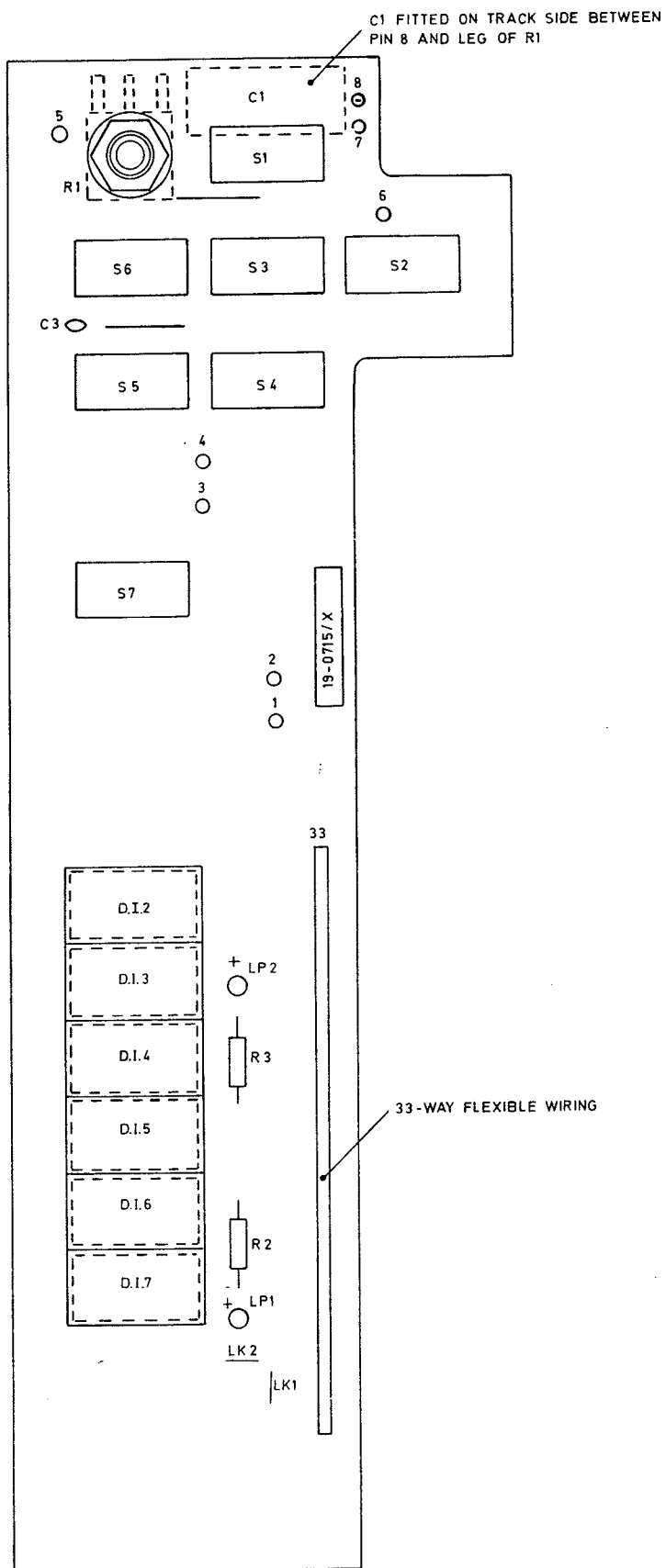
SECTION 3
PARTS LISTS
CIRCUIT DIAGRAMS
AND
COMPONENT LAYOUTS

ORDERING OF SPARE PARTS

1. 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 Part number and circuit reference of each item being ordered.

It should be noted that a minimum charge of £5 sterling is applicable to all U.K. orders.





Component Layout:
Display Assembly 19-0715

Fig. 1

PARTS LIST

DISPLAY ASSEMBLY 19-0715

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

Part No.	Description	Rat	Tol %	Value	Component Reference
	<u>Resistors</u>	<u>W</u>		<u>Ω</u>	
20-6627	Variable, log.		20	1M	R1
20-2331	Carbon Film	$\frac{1}{4}$	5	330	R2, R3
	<u>Capacitors</u>	<u>V</u>		<u>F</u>	
21-4528	Polyester	400	10	47n	C1
21-1708	Ceramic	50	20	100n	C3
	<u>Switches</u>				
23-4081	Slide switches: -				
	AC/DC				1S1
	B-B/B-A				1S2
	Stop Slope				1S3
	Start Slope				1S4
	Check/Operate				1S5
	Pulse/Contact				1S6
	Normal/Hold				1S7
	<u>Indicators</u>				
26-1505*	Numerical display, LED				D.1.2 to D.1.7
26-5004	Indicators LED: -				LP.1
	Overflow				LP.2
	Gate				
	<u>Miscellaneous</u>				
25-6027	Flexible wiring, 33 way				

*NOTE: Later Display Assemblies are fitted with LED numerical indicators Part No. 26-1505. These Display Assemblies are not interchangeable with earlier versions. The later versions can be identified by links LK1 and LK2. These links are not fitted to the earlier versions which use indicators 26-1504. See NOTE 2 on Fig. 4.

PARTS LIST

CHASSIS, FRONT AND REAR PANELS (Fig. 4)

Part No.	Description	Rat	Tol %	Value	Component Reference
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CHASSIS ASSEMBLY COMPONENTS (11-1059)

Transistor

22-6081	(MJE 520)				Q50
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FRONT PANEL COMPONENTS (11-1081)

Switches and Sockets

23-4013	Switch, push-button, START/STOP				S50
23-4065	Switch, toggle, POWER				S51
23-4013	Switch, push-button, RESET				S52
23-3005	Sockets, BNC, Inputs 'A' and 'B'				

For other switches refer to Display Assembly and Main PCB Assembly parts lists.

REAR PANEL ASSEMBLY COMPONENTS (11-1089)

17-4057	Transformer, mains				T50
19-0834	Oscillator PCB (refer to Parts List 19-0834)				
22-1650	Bridge rectifier, 200V, 2A (VS 248)				D50
23-0033	Fuselink (188V/265V) 100 mA antisurge			}	FS50
23-0027	Fuselink (94V/132V) 200 mA antisurge				
23-0044	Fuseholder for FS50				
23-3005	Socket BNC STD input and output				
23-3194	Power Input (Mains) plug, panel mounted				

PARTS LIST

MAIN PCB ASSEMBLY 19-0707 (Fig. 4)

Part No.	Description	Rat	Tol %	Value	Component Reference	Part No.	Description	Rat	Tol %	Value	Component Reference
<u>Resistors</u> <u>W</u>						<u>Resistor Arrays</u>					
20-4658	Metal Oxide	1	5	100k	R1	20-5503	D. I. L. Array 13 x 10k				R63
20-2106	Carbon Film	$\frac{1}{4}$	10	10M	R2	20-5502	D. I. L. Array 13 x 1k				R76
20-2120	Carbon Film	$\frac{1}{4}$	10	12	R3	20-5501	D. I. L. Array 8 x 220				R77
20-1532	Carbon Film	10	5	470	R41	20-5500	D. I. L. Array 7 x 56				R83
20-1538	Carbon Film	10	5	10k	R84						
20-2100	Carbon Film	$\frac{1}{4}$	5	10	R96						
20-2101	Carbon Film	$\frac{1}{4}$	5	100	R7, 86, 89, 100						
20-2102	Carbon Film	$\frac{1}{4}$	5	1k	R5, 6, 9, 14, 58, 65, 66, 68, 103, 109						
20-2103	Carbon Film	$\frac{1}{4}$	5	10k	R10, 20, 22, 27 to 30 32, 43, 54, 55, 61, 64, 90, 94, 97, 113, 114, 115, R26*	21-0566	Electrolytic	25		1000 μ	C54
20-2181	Carbon Film	$\frac{1}{4}$	5	180		21-0575	Electrolytic	16		4700 μ	C53
* R26 is 'select on test', in the range 150 to 270 Ω .						21-1000	Tantalum	35	20	3.3 μ	C16, 21, 23, 44, 46
20-2121	Carbon Film	$\frac{1}{4}$	5	120	R15, 62	21-1038	Tantalum	6	20	47 μ	C3, 8, 26, 48 to 52, 58, 59, 60
20-2122	Carbon Film	$\frac{1}{4}$	5	1.2k	R116	21-1039	Tantalum	16	20	22 μ	C4, 55
20-2124	Carbon Film	$\frac{1}{4}$	5	120k	R93	21-1048	Tantalum	35	20	2.2 μ	C56
20-2150	Carbon Film	$\frac{1}{4}$	5	15	R59, 60	21-1512	Ceramic	500	10	22p	C13
20-2152	Carbon Film	$\frac{1}{4}$	5	1.5k	R78, 110	21-1514	Ceramic	500	10	33p	C14
20-2182	Carbon Film	$\frac{1}{4}$	5	1.8k	R107	21-1516	Ceramic	500	10	47p	C19, 22
20-2220	Carbon Film	$\frac{1}{4}$	5	22	R119, 120	21-1524	Ceramic	500	10	220p	C9
20-2221	Carbon Film	$\frac{1}{4}$	5	220	R21, 25,	21-1525	Ceramic	500	10	270p	C1
20-2222	Carbon Film	$\frac{1}{4}$	5	2.2k	R4, 101, 118	21-1532	Ceramic	500	20	1n	C27, 32, 45
20-2223	Carbon Film	$\frac{1}{4}$	5	22k	R34, 45, 85	21-1538	Ceramic	500	20	3.3n	C42
20-2272	Carbon Film	$\frac{1}{4}$	5	2.7k	R91	21-1589	Ceramic	10	+50	220n	C28
20-2331	Carbon Film	$\frac{1}{4}$	5	330	R23, 37, 48, 56				-20		
20-2332	Carbon Film	$\frac{1}{4}$	5	3.3k	R12, 102	21-1616	Ceramic	12	-20	100n	C2, 5, 6, 10, 11, 12, 17, 18, 25, 29, 38, 41, 43, 47
20-2392	Carbon Film	$\frac{1}{4}$	5	3.9k	R98, 99				+80		
20-2470	Carbon Film	$\frac{1}{4}$	5	47	R8, 13						
20-2471	Carbon Film	$\frac{1}{4}$	5	470	R51, 53, 112						
20-2472	Carbon Film	$\frac{1}{4}$	5	4.7k	R17, 24, 40, 50, 87, 121						
20-2560	Carbon Film	$\frac{1}{4}$	5	56	R52						
20-2561	Carbon Film	$\frac{1}{4}$	5	560	R16, 18, 35, 46						
20-2562	Carbon Film	$\frac{1}{4}$	5	5.6k	R38, 44, 57, 88, 95						
20-2564	Carbon Film	$\frac{1}{4}$	5	560k	R92						
20-2681	Carbon Film	$\frac{1}{4}$	5	680	R19						
20-2682	Carbon Film	$\frac{1}{4}$	5	6.8k	R39, 49						
20-2820	Carbon Film	$\frac{1}{4}$	5	82	R80						
20-2821	Carbon Film	$\frac{1}{4}$	5	820	R36, 47, 117						
20-3820	Metal Oxide	$\frac{1}{2}$	5	82	R108						
20-4094	Metal Oxide	$\frac{1}{4}$	1	6.8k	R106						
20-4103	Metal Oxide	$\frac{1}{4}$	1	1.2k	R104						
20-4107	Metal Oxide	$\frac{1}{4}$	1	5.6k	R105						
20-4668	Metal Oxide	1	5	33	R111						
20-5064	Wirewound	$2\frac{1}{2}$	5	680	R31, 42						
20-6544	Variable, linear	$\frac{1}{4}$ W	20	3.3k	R11						
						<u>Diodes</u>					
						22-1029	Silicon, general purpose (1N4149)				D1, 3, 4, 5, 6, 7, 8, 15, 16, 17, 18
						22-1602	Rectifier, 100V. 5A (1N4002)				D11, 12, 13, 14
						22-1805	Voltage reg. 3.9V	5%			D9
						22-1808	Voltage reg. 5.1V	5%			D2, 10

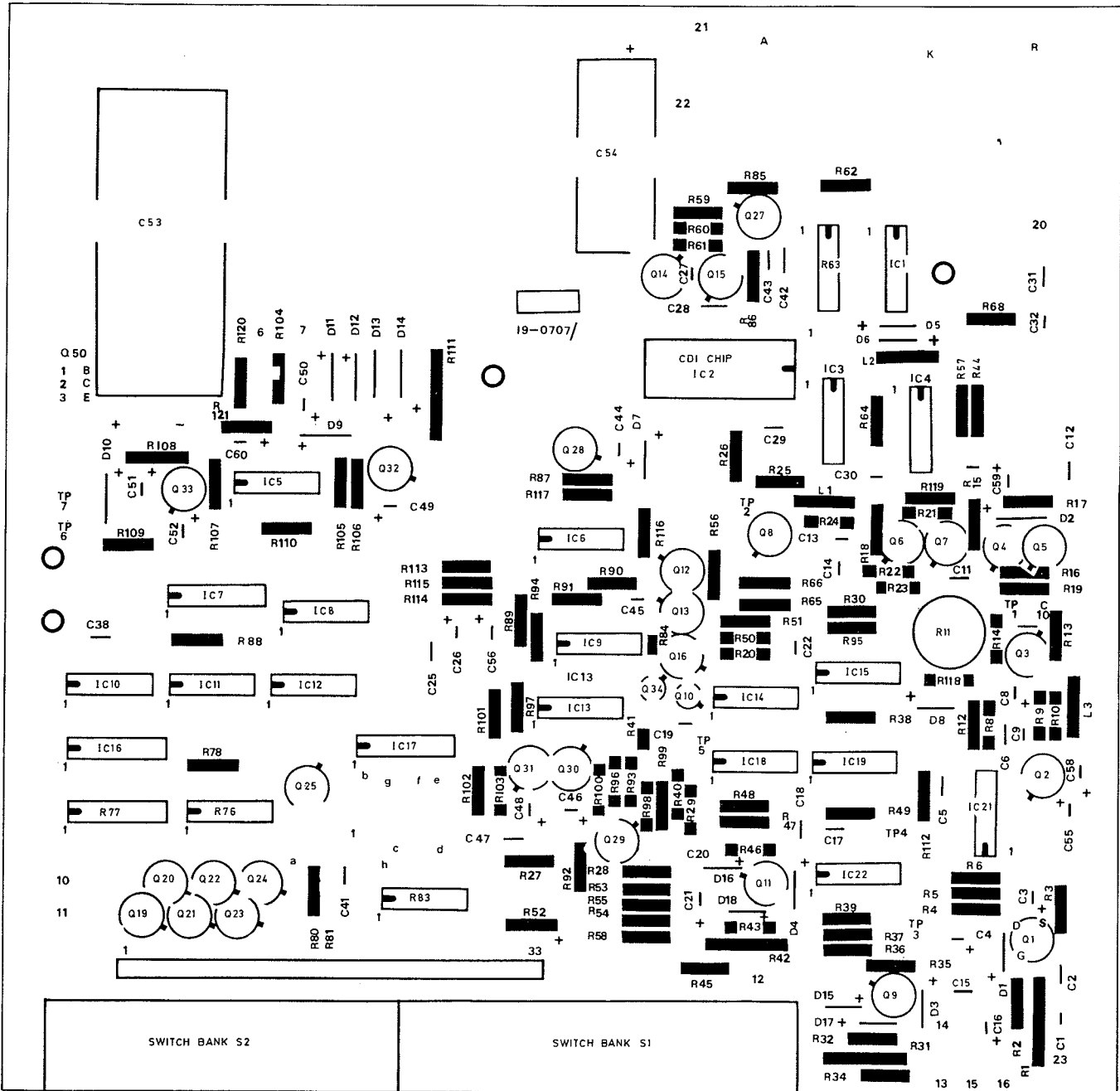
MAIN PCB ASSEMBLY 19-0707 (Continued)

Part No.	Description	Rat	Tol %	Value	Component Reference	Part No.	Description	Rat	Tol %	Value	Component Reference
<u>Integrated Circuits</u>						<u>Transistors</u>					
22-4044	Quad 2-Input Pos. NAND Gate (7400)				IC3,15	22-6101	FET, N Channel (W300A)				Q1
22-4051	Quad latch (7475)				IC7	22-6009	Silicon, npn (2N4124)				Q3,27
22-4048	Dual-D Bistable (7474)				IC9	*22-6079	Silicon, npn (ZTX313L)				Q2,4,5,6,7,8,10,12,13,15,25,28,31,34
22-4049	Decade Counter				IC10	22-6010	Silicon, pnp (2N4126)				Q9,11
22-4053	Triple 3 Input Pos. NAND Gate (7410)				IC6,18	22-6113	Silicon, pnp (ZTX 550)				Q14,16,19,20,21,22,23,24,29,30,33
22-4058	BCD to 10 Line Decoder (7442)				IC16	22-6112	Silicon, npn (ZTX 450)				Q32
22-4059	Hex. Inverter (7404)				IC1,8,14	*Except for Q8, type 2N2369 (22-6017) is alternative					
22-4061	Hex. Inverter Open Collector O/P (7405)				IC12,13	<u>Inductors</u>					
22-4128	BCD to 7-Segment Decoder (74247)				IC17	23-7007	Inductor			0.68μH	L1
22-4202	Dual Freq. Comparator Op. Amp (747)				IC5	23-7056	Inductor			100 μH	L2
22-4207	Differential Video Amp. (72733)				IC21	23-7107	Inductor			470 μH	L3
22-4517	Quad I/P Exclusive OR Gate (7486)				IC11,19	<u>Switches</u>					
22-4527	Dual Line Receiver (75107A)				IC22	23-4077	Switch bank, Function				S1
22-4537	Retriggerable Monostable*				IC4	23-4078	Switch bank, Time Base				S2
22-4601	CDI LSI				IC2	<u>Miscellaneous</u>					
						23-3213	IC Holder for IC2				

* Only Texas Instruments 74123N to be used

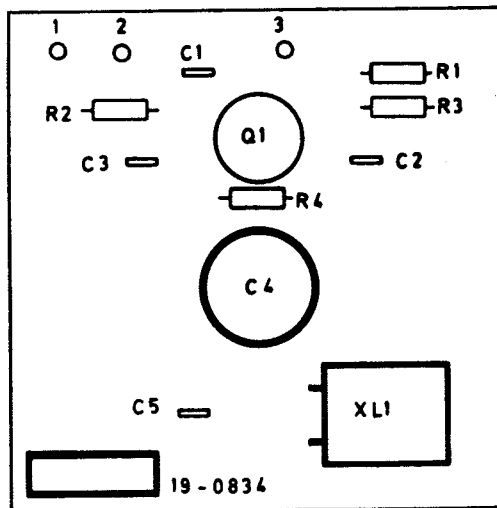
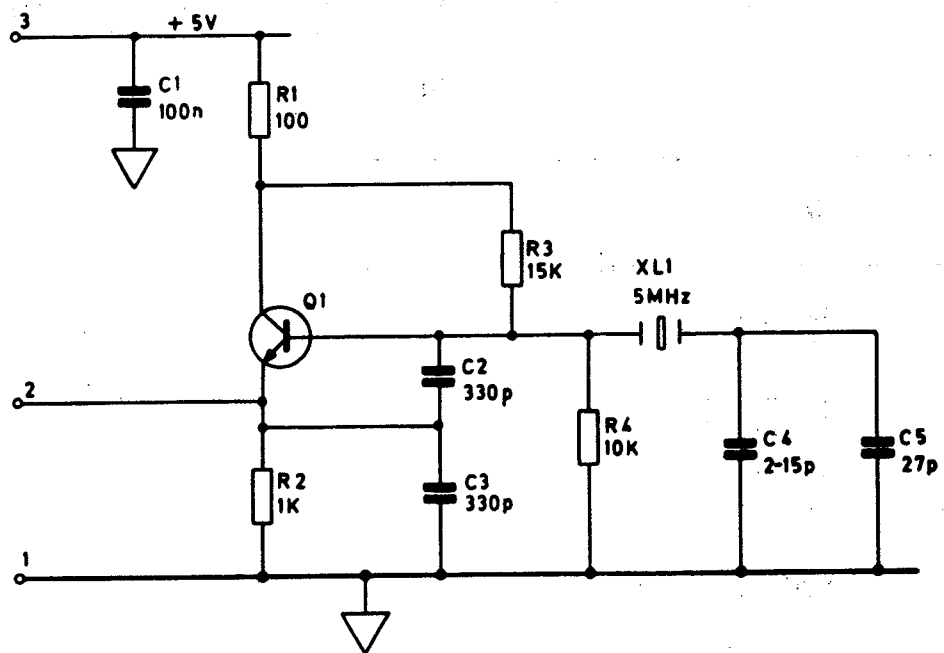
AMENDMENT INFORMATION

Check with Section 4 at the back of the book for change information.



Component Layout:
Main P.C.B. Assembly 19-0707

Fig. 3



WOH 6201	19-0834
1	

Circuit And Layout
5MHz Oscillator PCB 19-0834

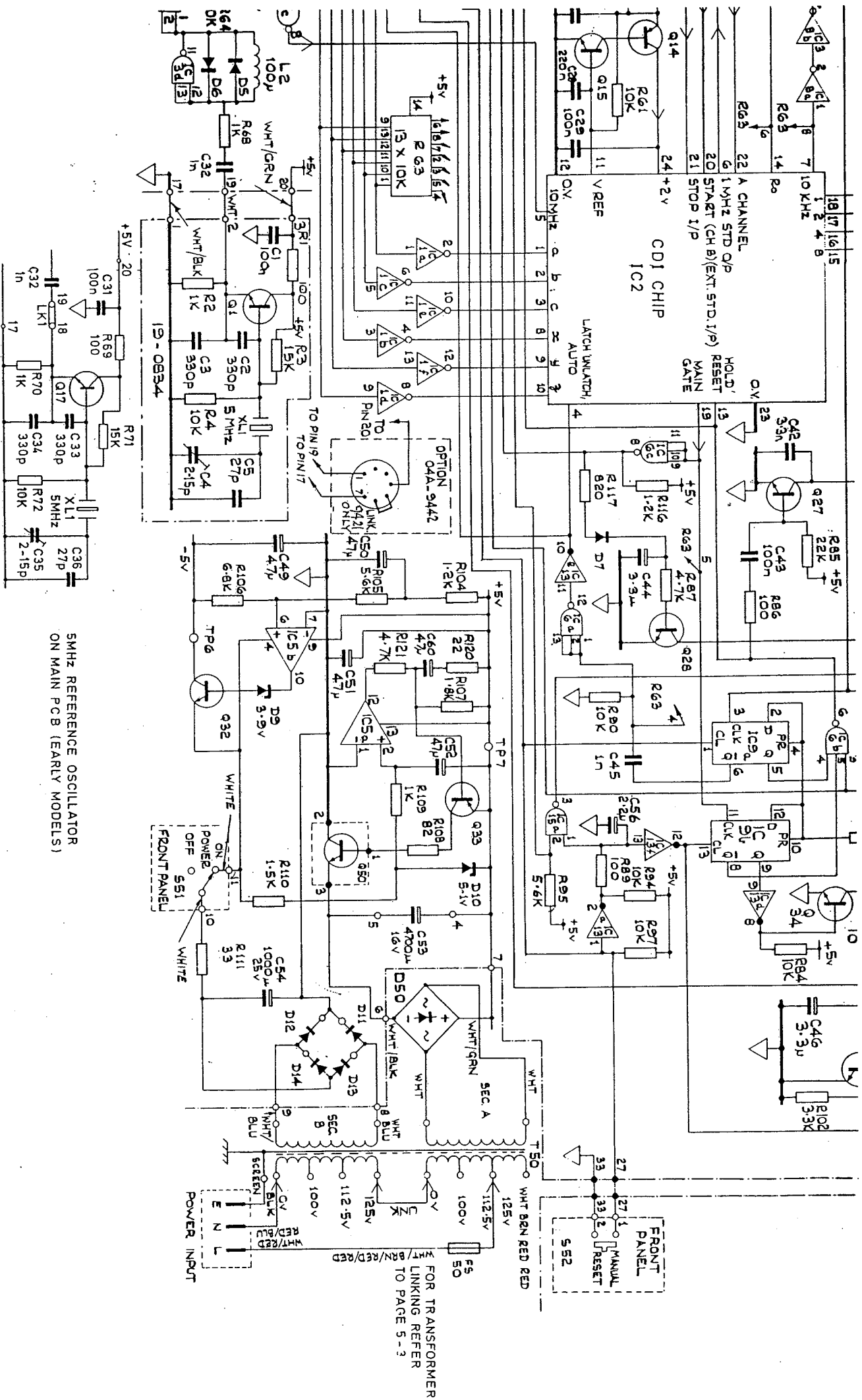
Fig.2

PARTS LIST

5 MHz CRYSTAL OSCILLATOR ASSEMBLY (19-0834)

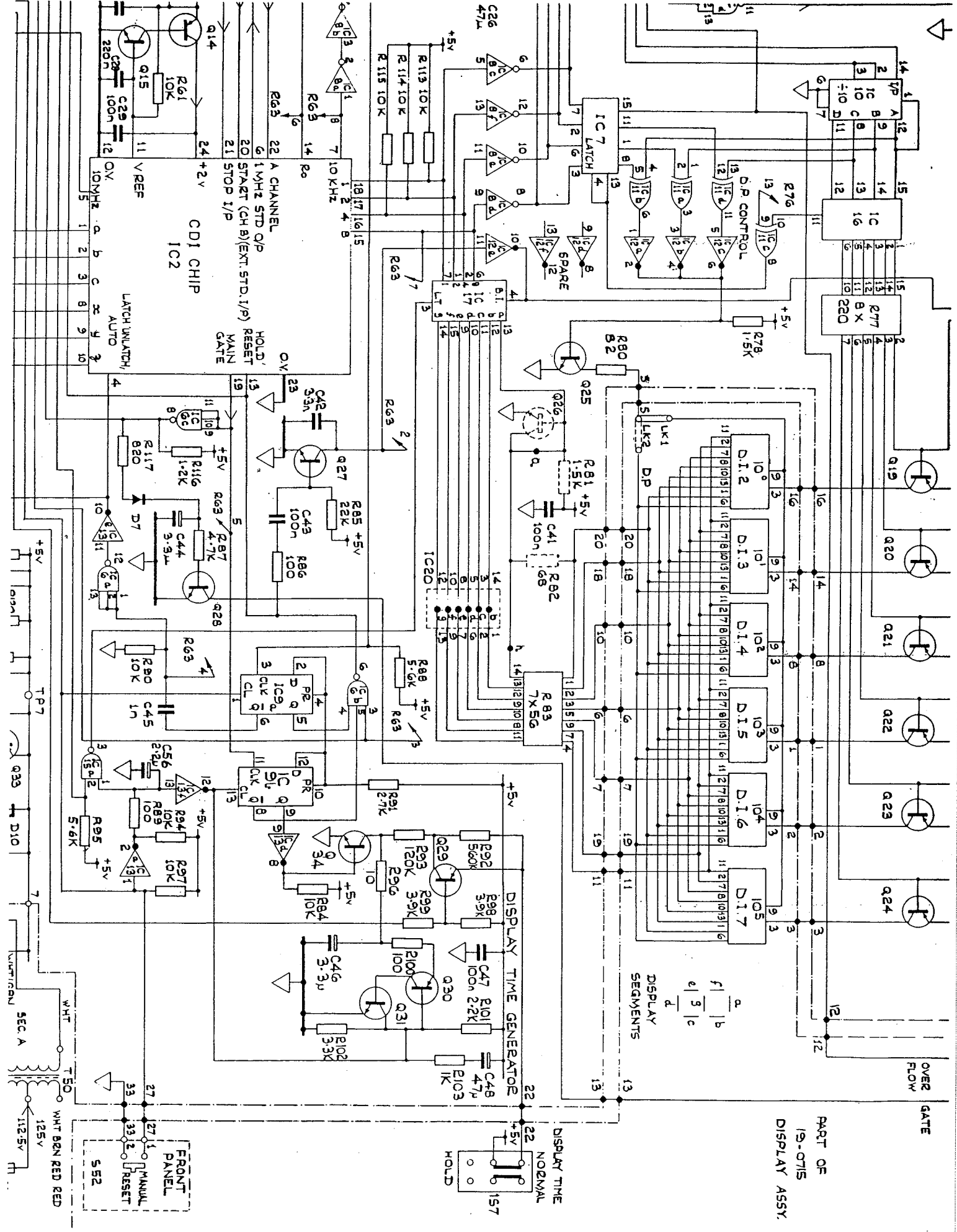
(Fig. 2)

Part No.	Description	Rat.	Tol %	Value	Component Reference
<u>Resistors</u>					
		<u>W</u>		<u>Ω</u>	
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
<u>Capacitors</u>					
		<u>V</u>		<u>F</u>	
21-1616	Ceramic	12	+80-20	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
<u>Transistors</u>					
22-6017	Silicon NPN (2N2369)				Q1
<u>Crystal</u>					
17-2087	Crystal Assembly, 5 MHz				XL1



SMHz REFERENCE OSCILLATOR
ON MAIN PCB (EARLY MODELS)

Overall Circuit 9901 Fig. 4

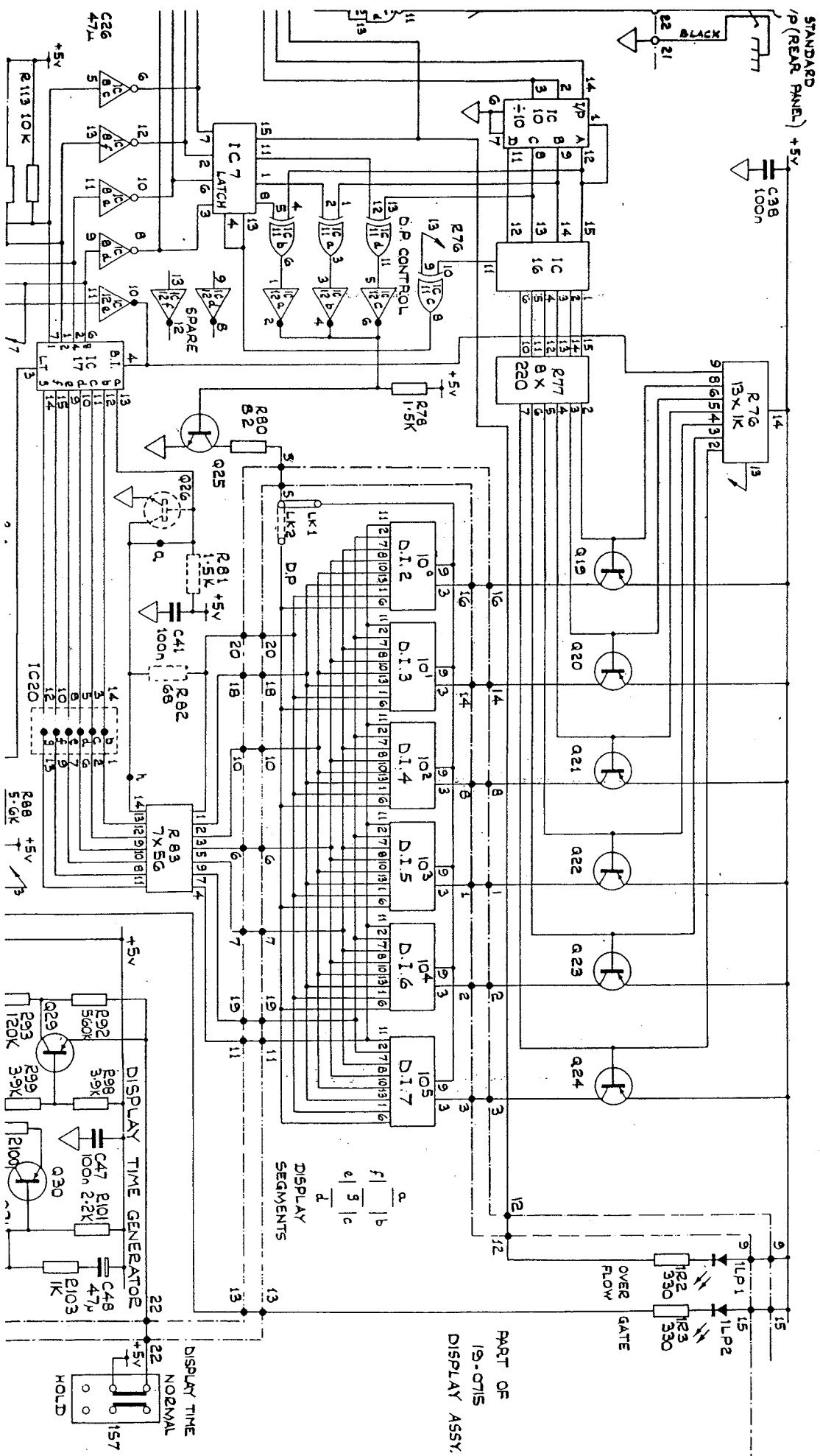


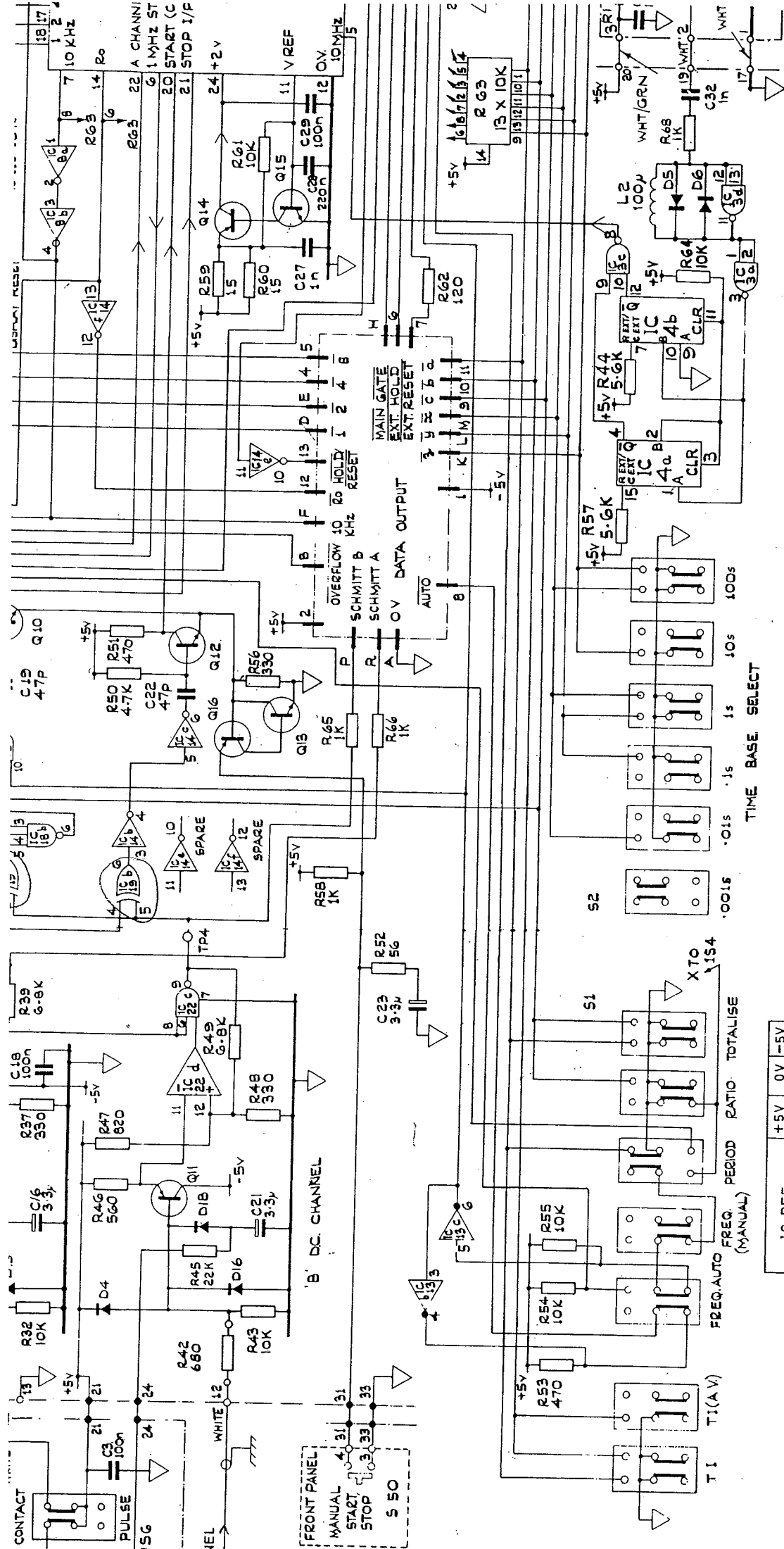
PART OF
 19-0715
 DISPLAY ASSY.

OVER GATE

DISPLAY TIME
 NORMAL
 HOLD

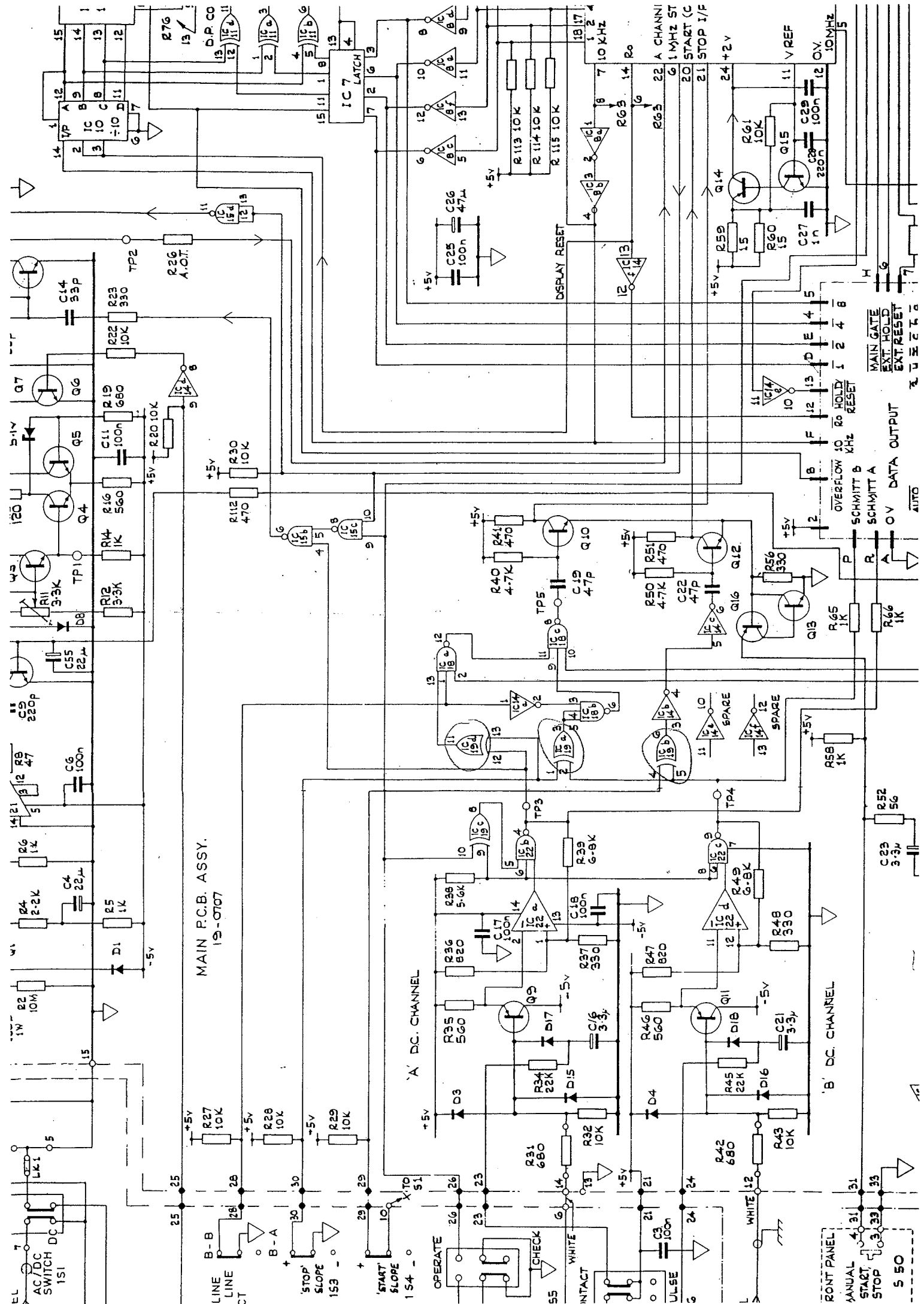
DISPLAY
 SEGMENTS
 a
 b
 c
 d
 e
 f
 g





- NOTES:
1. C7, R81, R82, Q26, IC20 NOT NORMALLY FITTED.
 2. LINKS LK1 AND LK2 IN DISPLAY ASSEMBLY:
 - (a) LK1 FITTED WITH INDICATORS 26-1505 (LATER MODELS)
 - (b) LK2 FITTED WITH INDICATORS 26-1504 (EARLIER MODELS)

IC REF	+5V PIN	0V PIN	-5V PIN
IC1, 3, 6, 8,	14	7	
9, 11, 12, 13, 14,			
15, 16, 19	9, 13	-	-
IC5	5	12	
IC7	5	10	
IC10	5	10	
IC16, 17, IC4	16	8	
IC21	10		5
IC22	14	7	13



MAIN P.C.B. ASSY.
19-0707

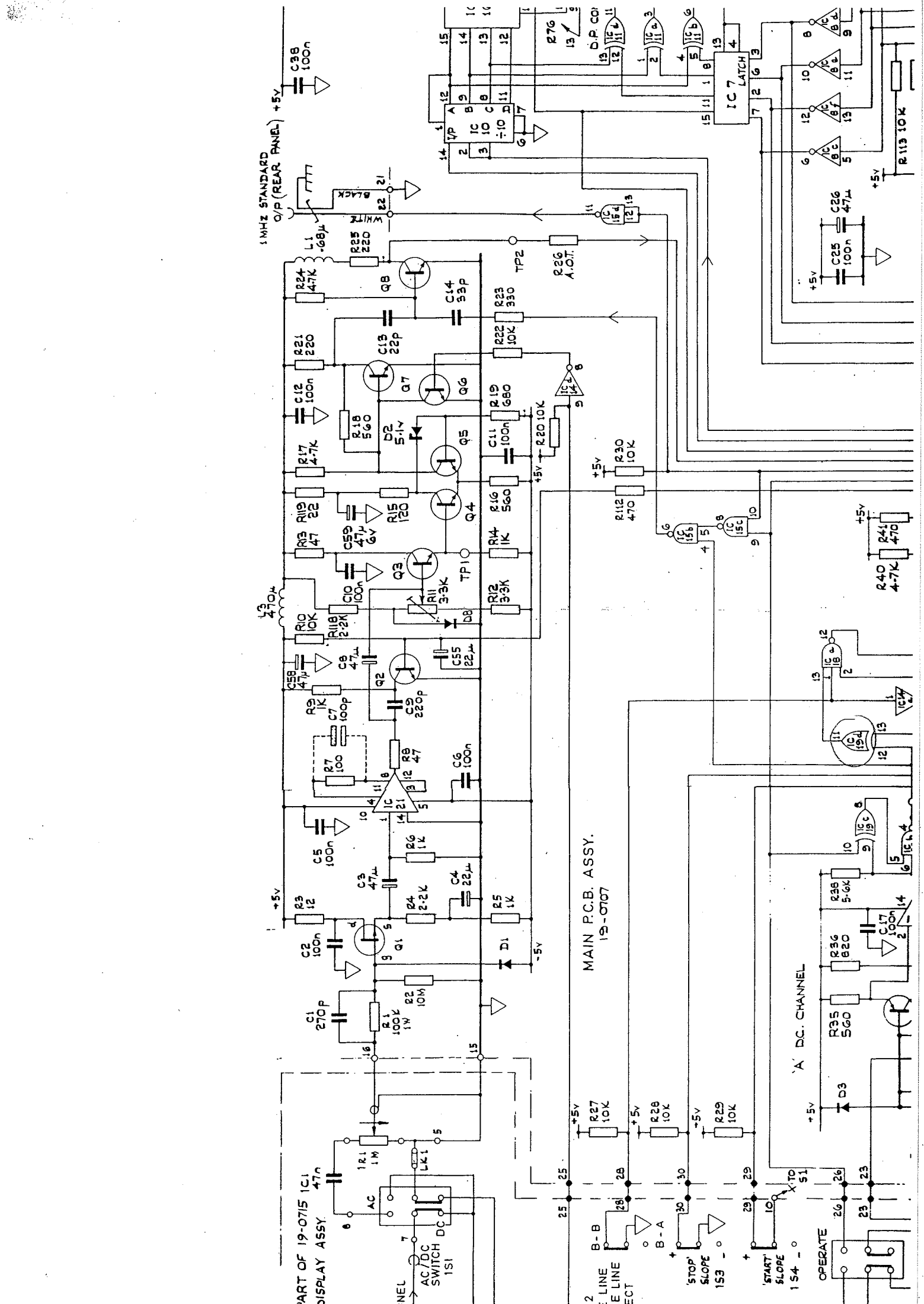
'A' DC. CHANNEL

'B' DC. CHANNEL

MAIN GATE
EXT. HOLD
EXT. RESET

OVERFLOW 10 KHz
SCHMITT B
SCHMITT A
OV DATA OUTPUT
AUTO

5.50



1MHZ STANDARD
O/P (REAR PANEL) +5V

PART OF 19-0715 IC1
DISPLAY ASSY.

NEL
AC/DC
SWITCH
1S1

MAIN P.C.B. ASSY.
19-0707

'A' DC. CHANNEL

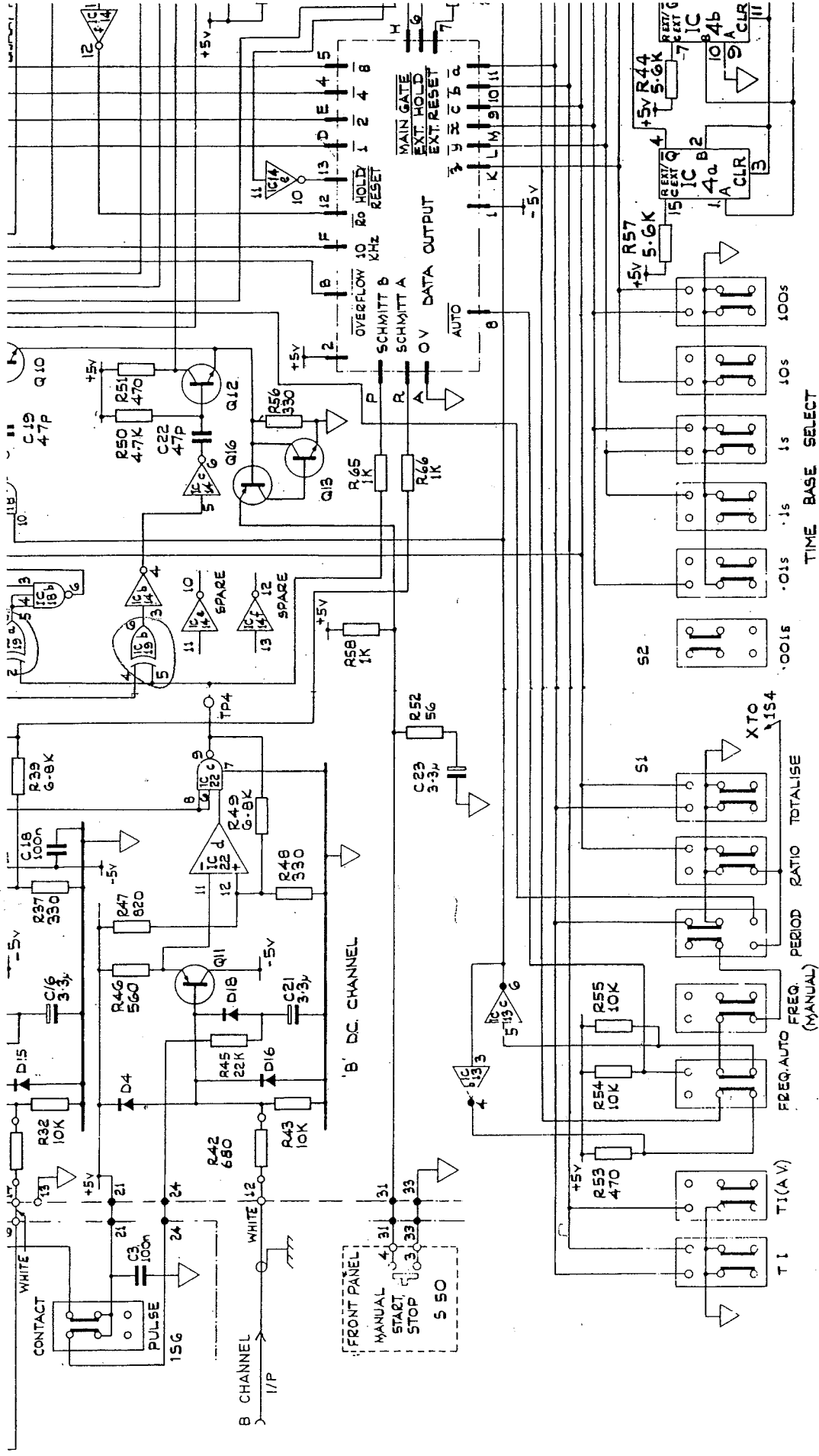
LINE
E LINE
ECT

'STOP'
SLOPE
1S3

'START'
SLOPE
1S4

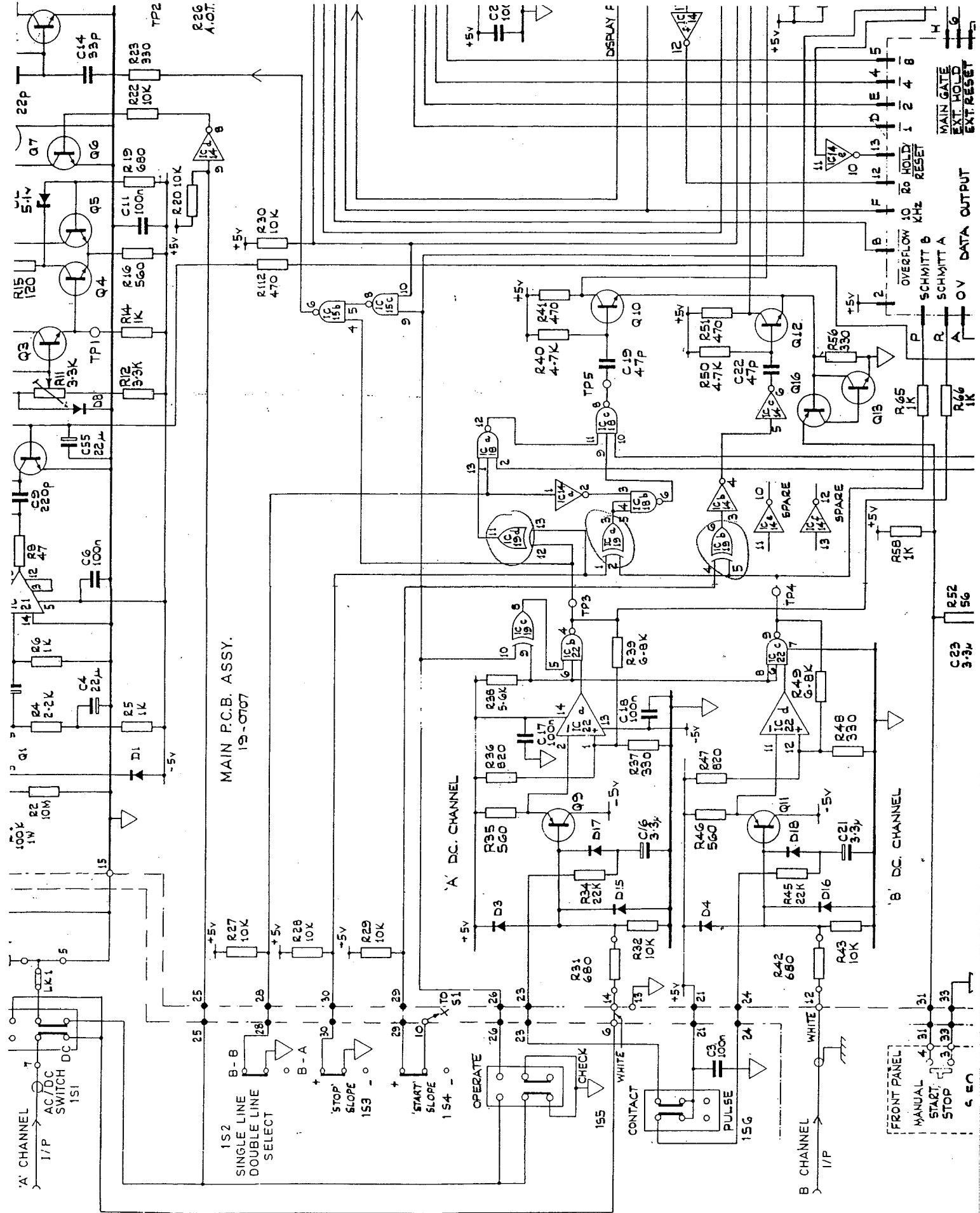
OPERATE

X TO
51



IC REF	+5V PIN	0V PIN	-5V PIN
IC1, 3, 6, 8,			
9, 11, 12, 13, 14,	14	7	
15, 18, 19			
IC5	9, 13	-	-
IC7	5	12	-
IC10	5	10	
IC16, 17, IC4	16	8	
IC21	10		5
IC22	14	7	13

- NOTES: 1. C7, R81, R82, Q26, IC20 NOT NORMALLY FITTED.
 2. LINKS LK1 AND LK2 IN DISPLAY ASSEMBLY:-
 (a) LK1 FITTED WITH INDICATORS 26-1505 (LATER MODELS)
 (b) LK2 FITTED WITH INDICATORS 26-1504 (EARLIER MODELS)



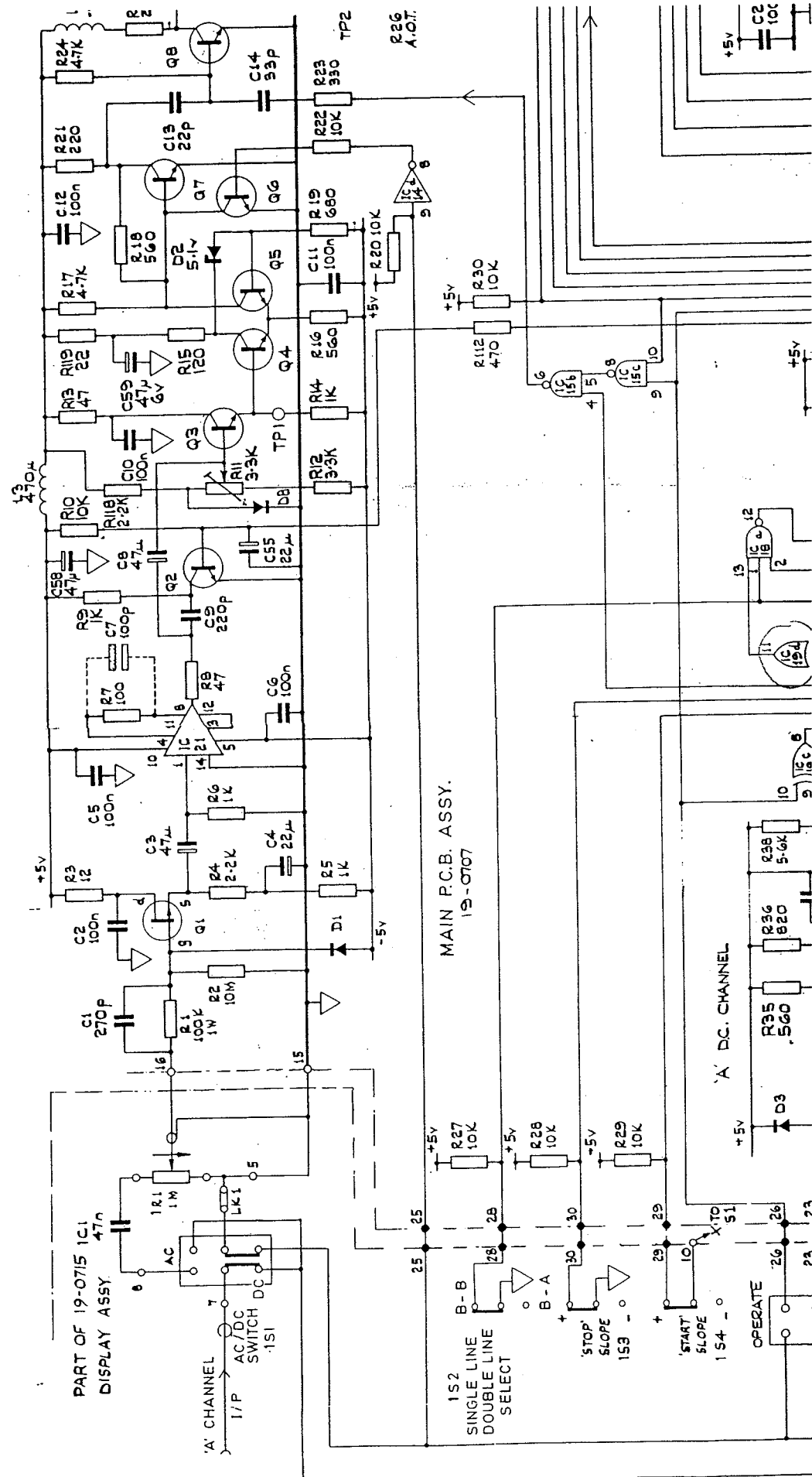
MAIN GATE
EXT HOLD
EXT RESET

OVERFLOW 10
RESET
SCHMITT B
SCHMITT A

OV DATA OUTPUT

SPARE
SPARE
R58 1K
R52 3.3K

FRONT PANEL
MANUAL
STOP
S 50





SECTION 4

APPENDICES

AND

CHANGE INFORMATION

UNIVERSAL COUNTER-TIMER 9901AMENDMENTSOverall Circuit Diagram Fig. 4

- (1) At the top left hand corner of Fig. 4 draw capacitor C15 (47 μ) in parallel with C2. This is a tantalum type with the positive side connected to the junction of C2/R3.
- (2) At the bottom right hand corner of Fig. 4 amend the colour code details of the a.c. supply input as follows:-

Line Input (L) to transformer T50	White/Brown
Neutral Input (N) to transformer T50	White/Blue
Earth line (E)	White/Black
From SEC. B to junction D11/D13	White/Green/Violet
From SEC. B to junction D12/D14	White/Green/Violet
From the positive (+) output of D50	White/Red

Component Layout: Main PCB 19-0707 Fig. 3

Insert new component symbol, C15, at the bottom right hand corner of the diagram, beside, and parallel to, C2. Insert '+' sign at upper end.

Parts List Page 4a

Add C15 to the list of tantalum capacitors opposite Part No. 21-1038.