[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R172	Resistor	1M	ELR25
R173	Resistor	100K	ELR25
R174	Resistor	1.8M	ELR25
R175	Resistor	1K	ELR25
R177	Resistor	470K	R25
R178	Resistor	470K	ELR25
R179	Resistor	3.3M	ELR25
R180	Trimmer	47K	H0651A
R181	Resistor	100	ELR25
R182	Resistor	220	ELR25
R183	Resistor	47	ELR25
R184	Resistor	100K	ELR25
R185	Resistor	1K	ELR25
R186	Resistor	10K	ELR25
R187	Resistor	470K	ELR25
R188	Resistor	3.3M	ELR25
R189	Resistor	22K	ELR25
R190	Resistor	22K	ELR25
R191	Trimmer	10K	H0651A
R192	Resistor	4.7K	ELR25
R193	Resistor	22K	ELR25
R194	Resistor	4.7K	ELR25
R195	Resistor	4.7K	ELR25
R196	Resistor	4.7K	R25
R197	Resistor	22K	ELR25
R198	Resistor	10K	ELR25
R199	Resistor	220	ELR25
R200	Resistor	220	ELR25
R201	Resistor	100	ELR25
R202	Resistor	47K	ELR25
R203	Resistor	47K	ELR25
R204	Trimmer	10K	H0651A
R205	Resistor	10K	ELR25
R206	Trimmer	10K	H0651A
R209	Trimmer	10K	H0651A
R210	Resistor	100K	ELR25
R211	Resistor	47K	R25
R212	Resistor	330	ELR25
R213	Resistor	47K	ELR25
R214	Resistor	10K	ELR25
R215	Resistor	10K	ELR25
R216	Resistor	1M	ELR25
R217	Resistor	1M	ELR25
R218	Resistor	220	ELR25
R219	Resistor	10K	ELR25
R220	Resistor	4.7K	ELR25
R221	Resistor	470K	ELR25
R222	Resistor	47K	ELR25
R223	Resistor	68K	ELR25
R224	Resistor	2.2K	ELR25
R225	Resistor	22	ELR25
R226	Resistor	3.3	ELR25
R227	Resistor	3.3K	ELR25
R228	Resistor	220	ELR25
R229	Resistor	4.7K	ELR25
R230	Resistor	4.7K	ELR25
R231	Resistor	100K	ELR25
R232	Resistor	33K	ELR25
R233	Resistor	4.7K	ELR25
R234	Resistor	2.2K	ELR25
R235	Resistor	47	ELR25
R236	Resistor	22K	ELR25
R237	Resistor	2.2	ELR25
R238	Resistor	10K	ELR25

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R239	Resistor	330	ELR25
R240	Resistor	6.8K	ELR25
C1	Barrier Lay	0.047	25V
C2	Barrier Lay	0.047	25V
C3	Barrier Lay	0.047	25V
C4	Barrier Lay	0.047	25V
C5	Barrier Lay	0.047	25V
C7	Barrier Lay	0.047	25V
C8	Ceramic	33P	50V
C9	Barrier Lay	0.047	25V
C10	Ceramic	0.0047	50V
C11	Ceramic	0.0047	50V
C12	Barrier Lay	0.047	25V
C13	Electrolytic	10	16V
C14	Barrier Lay	0.047	25V
C15	Ceramic	0.0047	50V
C16	Electrolytic	1	50V
C17	Barrier Lay	0.047	25V
C18	Electrolytic	47	10V
C19	Barrier Lay	0.047	25V
C20	Barrier Lay	0.1	25V
C21	Barrier Lay	0.047	25V
C22	Barrier Lay	0.047	25V
C23	Electrolytic	10	25V
C24	Barrier Lay	0.047	25V
C25	Barrier Lay	0.1	25V
C26	Barrier Lay	0.047	25V
C27	Barrier Lay	0.047	25V
C28	Barrier Lay	0.047	25V
C29	Barrier Lay	0.047	25V
C30	Ceramic	0.0047	50V
C31	Ceramic	0.0047	50V
C32	Barrier Lay	0.047	25V
C33	Electrolytic	33	10V
C34	Ceramic	0.0047	50V
C35	Ceramic	0.0047	50V
C36	Ceramic	0.0047	50V
C37	Trimmer	CV05E3001	
C38	Ceramic	82P	50V
C39	Ceramic	0.0047	50V
C40	Dip Mica	150P	50V
C41	Dip Mica	150P	50V
C42	Ceramic	0.0047	50V
C43	Ceramic	0.0047	50V
C44	Ceramic	0.0047	50V
C45	Trimmer	CV05E3001	
C46	Ceramic	47P	50V
C47	Ceramic	0.0047	50V
C48	Trimmer	CV05E3001	
C49	Ceramic	47P	50V
C50	Ceramic	0.0047	50V
C51	Barrier Lay	0.047	25V
C52	Barrier Lay	0.047	25V
C53	Ceramic	470P	50V
C54	Electrolytic	2.2	50V
C55	Electrolytic	1 B.P.	50V
C56	Electrolytic	100	16V
C57	Electrolytic	33	10V
C58	Barrier Lay	0.047	25V
C59	Electrolytic	10	25V
C60	Barrier Lay	0.047	25V
C61	Electrolytic	10	25V
C62	Electrolytic	47	10V

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C63	Electrolytic	4.7	50V
C64	Electrolytic	0.47	50V
C65	Electrolytic	4.7	50V
C66	Mylar	0.01	50V
C67	Electrolytic	47	10V
C68	Mylar	0.022	50V
C69	Mylar	0.022	50V
C70	Mylar	0.022	50V
C71	Barrier Lay	0.047	25V
C72	Electrolytic	22	16V
C73	Mylar	0.033	50V
C74	Electrolytic	100	10V
C75	Electrolytic	22	16V
C76	Mylar	0.022	50V
C77	Barrier Lay	0.047	25V
C78	Barrier Lay	0.047	25V
C79	Barrier Lay	0.1	25V
C80	Electrolytic	220	10V
C81	Electrolytic	47	10V
C82	Electrolytic	47	16V
C83	Electrolytic	470 MS9	16V
C84	Electrolytic	47	10V
C85	Ceramic	0.0047	50V
C86	Barrier Lay	0.1	25V
C87	Tantalum	10	16V
C88	Electrolytic	47	10V
C89	Mylar	0.022	50V
C90	Mylar	0.022	50V
C91	Mylar	0.022	50V
C92	Ceramic	0.001	50V
C93	Electrolytic	470	10V
C94	Barrier Lay	0.1	25V
C95	Electrolytic	4.7	50V
C96	Electrolytic	4.7	50V
C97	Barrier Lay	0.1	25V
C100	Ceramic	0.0047	50V
C101	Electrolytic	470	10V
C102	Electrolytic	1	50V
C103	Ceramic	0.0047	50V
C104	Ceramic	0.0047	50V
C106	Ceramic	0.0047	50V
C112	Barrier Lay	0.047	50V
C113	Electrolytic	47	10V
C114	Electrolytic	47	10V
C115	Electrolytic	1	50V
C116	Electrolytic	0.47 BO	50V
C117	Ceramic	0.0047	50V
C118	Barrier Lay	0.047	25V
C119	Electrolytic	33	10V
C120	Electrolytic	47	10V
C121	Electrolytic	10	50V
C122	Mylar	0.1	50V
C123	Barrier Lay	0.047	25V
C124	Ceramic	0.0047	50V
C125	Electrolytic	47	10V
C126	Electrolytic	47	10V
C127	Barrier Lay	0.1	16V
C128	Electrolytic	47	10V
B1	MAIN P.C.B	B-578C	
S1	Switch	SSS012	
S2	Switch	SSS012	
J1	Connector	TL-25P-05-V1	
J3	Connector	TL-25P-02-V1	

[MAIN UNIT]

REF. NO.	DESCRIPTION	PART NO.
J4	Connector	TL-25P-06-V1
J5	Connector	TL-25P-04-V1
J6	Connector	TL-25P-05-V1
J7	Connector	TL-25P-03-V1
J8	Connector	TL-25P-08-V1
J9	Connector	TL-25P-04-V1
J10	Connector	TL-25P-02-V1
J11	Connector	TL-25P-02-V1
J12	Connector	TL-25P-06-V1
J13	Connector	TL-25P-02-V1
J14	Connector	TL-25P-02-V1
J15	Connector	TL-25P-09-V1
J16	Connector	TL-25P-04-V1
J17	Connector	TL-25P-09-V1
J18	Connector	TL-25P-02-V1
J19	Connector	TL-25P-05-V1
J20	Connector	TL-25P-05-V1
J21	Connector	TL-25P-08-V1
J22	Connector	TL-25P-09-V1
J24	Connector	TL-25P-04-V1
J25	Connector	TL-25P-02-V1
J26	Connector	TL-25P-05-V1
J27	Connector	TL-25P-04-V1
J28	Connector	TL-25P-06-V1
J29	Connector	TL-25P-04-V1
J30	Connector	TL-25P-06-V1
J31	Connector	TL-25P-03-V1

[MATRIX UNIT]

REF. NO.	DESCRIPTION	PART NO.	
IC1	Diode Array	DAN401	
IC2	Diode Array	DAN401	
IC3	Diode Array	DAN401	
IC4	Diode Array	DAN401	
IC5	Diode Array	DAN401	
IC6	Diode Array	DAN401	
D1	Diode	1SS53	
D2	Diode	1SS53	
D3	Diode	1SS53	
D4	Diode	1SS53	
D5	Diode	1SS53	
D6	Diode	1SS53	
D7	Diode	1SS53	
D8	Diode	1SS53	
D9	Diode	1SS53	
D10	Diode	1SS53	
D11	Diode	1SS53	
D12	Diode	1SS53	
D13	Diode	1SS53	
D14	Diode	1SS53	
D15	Diode	1SS53	
D16	Diode	1SS53	
D17	Diode	1SS53	
R1	Resistor	33	ELR25
R2	Resistor	1K	R25
R3	Resistor	1K	R25
R4	Resistor	1K	R25
R5	Resistor	1K	R25
R6	Resistor	1K	R25
R7	Resistor	1K	R25
R8	Resistor	1K	R25
R10	Resistor	750	CRB25FX
R11	Resistor	1.8K	CRB25FX
R12	Resistor	3.3K	CRB25FX
R13	Resistor	5.6K	CRB25FX
R14	Resistor	1K	CRB25FX
R15	Resistor	4.7K	CRB25FX
R16	Resistor	1K	ELR25
C1	Barrier Lay	0.047	25V
C2	Barrier Lay	0.047	25V
C3	Barrier Lay	0.047	25V
C4	Barrier Lay	0.047	25V
C5	Barrier Lay	0.047	25V
C6	Barrier Lay	0.047	25V
C7	Barrier Lay	0.047	25V
C8	Barrier Lay	0.047	25V
C9	Barrier Lay	0.047	25V
C10	Barrier Lay	0.1	25V
C11	Ceramic	0.0047	50V
C12	Barrier Lay	0.047	25V
C13	Barrier Lay	0.047	25V
C14	Electrolytic	100	10V
C15	Electrolytic	10	16V
J1	Connector	TL-25P-08-V1	
J3	Connector	TL-25P-04-V1	
J4	Connector	TL-25P-06-V1	
J5	Connector	TL-25P-06-V1	
J6	Connector	TL-25P-07-V1	
J7	Connector	TL-25P-09-V1	
J8	Connector	TL-25P-04-V1	

[MATRIX UNIT]

REF. NO.	DESCRIPTION	PART NO.
J9	Connector	TL-25P-08-V1
B1	MATRIX P.C.B	B-579C

[LOGIC UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC1	CPU	μPD650C-080
IC2	IC	μPD4071
IC3	IC	μPD4030
IC4	IC	μPD4013
IC5	IC	μPD4081
IC6	IC	TC4013
IC7	IC	TC4013
IC8	IC	μPD4066
IC9	IC	μPD4030
IC10	IC	μA78L05
IC11	IC	μPD4030
IC12	IC	μPD4081
IC13	IC	DAN401
Q1	Transistor	2SC945 ANY RANK
Q2	Transistor	2SA798
Q3	Transistor	2SC945 ANY RANK
D5	Diode	1SS53
D6	Diode	1SS53
D7	Diode	1SS53
D8	Diode	1SS53
D9	Diode	1SS53
D10	Diode	1SS53
D11	Diode	1SS53
D12	Diode	1SS53
D13	Diode	1SS53
D14	Diode	1SS53
D15	Diode	1SS53
D16	Diode	1SS53
D17	Diode	1SS53
D18	Diode	1SS53
D19	Diode	1SS53
D20	Diode	1SS53
D21	Diode	1N4002
D22	Diode	1SS53
D23	Diode	1SS53
X1	Ceramic Unit	CSB430A
R1	Resistor	100K R25
R2	Resistor	220K R25
R3	Resistor	1M R25
R4	Resistor	100K R25
R5	Resistor	220K R25
R6	Resistor	1M R25
R7	Resistor	47K ELR25
R8	Resistor	47K ELR25
R9	Resistor	47K ELR25
R10	Resistor	47K R25
R11	Resistor	100K R25
R12	Resistor	100K ELR25
R13	Resistor	2.7K ELR25
R14	Resistor	10K ELR25
R15	Resistor	10K ELR25
R16	Resistor	150K ELR25
R17	Resistor	100K R25
R18	Resistor	47K R25
R19	Resistor	47K R25
R20	Resistor	220K R25
R21	Resistor	100K R25
R22	Resistor	100K R25
R23	Resistor	22K R25
R24	Resistor	22K R25

[LOGIC UNIT]

REF. NO.	DESCRIPTION	PART NO.
R25	Resistor	22K R25
R26	Resistor	22K R25
R27	Resistor	56K R25
R28	Resistor	47K R25
R29	Resistor	47K R25
R30	Resistor	470K R25
R31	Resistor	4.7K R25
R32	Resistor	47K R25
R33	Resistor	47K R25
R34	Resistor	47K R25
R35	Resistor	820K ELR25
R36	Resistor	4.7K ELR25
R37	Resistor	4.7K R25
R38	Resistor	1M ELR25
R39	Resistor	820K R25
R40	Resistor	3.3M R25
R41	Resistor	RM4-473K
R42	Resistor	RM8-222K
R43	Resistor	NETWORK-A1
R44	Resistor	47K R25
R45	Resistor	470K R25
R46	Resistor	47K R25
R47	Resistor	1.2K ELR25
R48	Resistor	3.3K ELR25
C1	Ceramic	0.001 50V
C2	Ceramic	0.001 50V
C3	Ceramic	0.001 50V
C4	Ceramic	0.001 50V
C5	Barrier Lay	0.1 25V
C6	Electrolytic	0.47 50V
C7	Electrolytic	0.47 50V
C8	Electrolytic	100 10V
C9	Electrolytic	4.7 10V
C10	Ceramic	0.001 50V
C11	Ceramic	0.0022 50V
C12	Barrier Lay	0.1 25V
C13	Ceramic	0.001 50V
C14	Ceramic	100P 50V
C15	Ceramic	100P 50V
C16	Barrier Lay	0.1 25V
C17	Barrier Lay	0.1 25V
C18	Barrier Lay	0.047 25V
C19	Barrier Lay	0.1 25V
C20	Barrier Lay	0.1 25V
C21	Barrier Lay	0.1 25V
C22	Ceramic	0.0047 50V
C23	Electrolytic	470 10V
C24	Electrolytic	220 10V
C25	Barrier Lay	0.1 25V
C26	Electrolytic	10 16V
J1	Connector	TL-25P-03-V1
J2	Connector	TL-25P-05-V1
J3	Connector	TL-25P-04-V1
J4	Connector	TL-25P-03-V1
J5	Connector	TL-25P-04-V1
J6	Connector	TL-25P-04-V1
J7	Connector	TL-25P-08-V1
J8	Connector	TL-25P-06-V1
J9	Connector	TL-25P-05-V1
J10	Connector	TL-25P-05-V1
B1	LOGIC P.C.B	B-608B

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	TC9125P
IC2	IC	HD10551
Q1	Transistor	2SC945P
Q2	Transistor	2SC763C
Q3	Transistor	2SC763C
Q4	Transistor	2SC763C
Q5	Transistor	2SC945P
Q6	FET	2SK125
Q7	Transistor	2SC763C
Q8	Transistor	2SC945P
D1	Varactor Diode	1SV50
D2	Varactor Diode	SVC201
D3	Diode	1SS53
X1	Crystal	9.000MHz HC-18/u
X2	Crystal	13.666MHz HC-18/u
L1	Coil	LS-191
L2	Coil	LS-191
L3	Coil	LS-3A
L4	Coil	LS-3A
L5	Choke Coil	LAL04SK100K
L6	Choke Coil	LAL04SK2R7M
L7	Choke Coil	LW-19
L8	Coil	LB-113
L9	Coil	LS-3A
L10	Choke Coil	LS-206
L11	Choke Coil	R70 (LB4)
R1	Resistor	630 ELR25
R2	Resistor	100K ELR25
R3	Resistor	47K ELR25
R4	Resistor	22K ELR25
R5	Resistor	10K ELR25
R6	Resistor	1K R25
R7	Resistor	2.2K R25
R8	Resistor	22K ELR25
R9	Resistor	4.7K ELR25
R10	Resistor	2.2K R25
R11	Resistor	22K R25
R12	Resistor	4.7K ELR25
R13	Resistor	1K R25
R14	Resistor	220 R25
R15	Resistor	100 ELR25
R16	Resistor	470 R25
R17	Resistor	22K R25
R18	Resistor	5.6K ELR25
R19	Resistor	22K ELR25
R20	Resistor	4.7K ELR25
R21	Resistor	100 ELR25
R22	Resistor	470 ELR25
R23	Resistor	47K ELR25
R24	Resistor	22K ELR25
R25	Resistor	680 ELR25
R26	Resistor	330 R25
R27	Resistor	100 R25
R28	Resistor	10K R25
R29	Resistor	47K ELR25
R30	Resistor	2.2K ELR25
R31	Resistor	100K ELR25
R32	Resistor	470 R25
R33	Resistor	10K ELR25

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.
R34	Resistor	27K R25
R35	Resistor	10K ELR25
R36	Resistor	330 ELR25
R37	Resistor	1K R25
R38	Resistor	100 ELR25
R39	Resistor	100 ELR25
R40	Resistor	100 ELR25
R41	Resistor	82 ELR25
R42	Resistor	100 R25
R43	Resistor	68 ELR25
R44	Resistor	330 ELR25
R45	Resistor	330 ELR25
R46	Resistor	330 ELR25
R47	Resistor	330 ELR25
R48	Resistor	330 ELR25
C1	Ceramic	0.0047 50V
C2	Ceramic	0.0047 50V
C3	Electrolytic	47 10V
C4	Ceramic	0.0047 50V
C5	Ceramic	220P 50V
C6	Ceramic	220P 50V
C7	Ceramic	220P 50V
C8	Ceramic	0.0047 50V
C9	Ceramic	20P 50V
C10	Ceramic	1P 50V
C11	Ceramic	22P 50V
C12	Ceramic	10P 50V
C13	Ceramic	10P 50V
C14	Ceramic	0.0047 50V
C15	Ceramic	0.35P 50V
C16	Ceramic	10P 50V
C17	Ceramic	0.0047 50V
C18	Ceramic	220P 50V
C19	Ceramic	0.0047 50V
C20	Ceramic	4P 50V
C21	Ceramic	0.047 50V
C22	Ceramic	0.0047 50V
C23	Ceramic	33P 50V
C24	Ceramic	33P 50V
C25	Ceramic	0.001 50V
C26	Ceramic	0.0047 50V
C27	Ceramic	0.0047 50V
C28	Ceramic	0.0047 50V
C29	Electrolytic	47 10V
C30	Ceramic	0.0047 50V
C31	Trimmer	CV05D2001
C32	Ceramic	18P 50V
C33	Ceramic	20P 50V
C34	Ceramic	470P 50V
C35	Ceramic	470P 50V
C36	Electrolytic	1 50V
C37	Ceramic	0.0047 50V
C38	Electrolytic	47 10V
C39	Ceramic	15P 50V
C40	Ceramic	3P 50V
C41	Ceramic	3P 50V
C42	Ceramic	0.0047 50V
C44	Ceramic	1P 50V
C45	Ceramic	0.0047 50V
C46	Ceramic	10P 50V
C47	Cylinder	0.001 50V
C48	Electrolytic	470 10V
C49	Ceramic	0.0047 50V

[FRONT UNIT]

REF. NO.	DESCRIPTION	PART NO.
J28	Connector	TL-25P-04-V1
J29	Connector	TL-25P-04-V1
J30	Connector	RT-01T-1.3B
J31	Connector	RT-01T-1.3B
J32	Connector	TL-25P-06-V1
J33	Connector	TLB-P04H-B1
J36	Connector	TL-25P-03-L1
J37	Connector	TL-25P-06-V1
J38	Connector	TL-25P-03-V1
J39	Connector	TL-25P-03-V1
P1	Connector	TL-25H-03-A1
P2	Connector	TL-25H-04-A1
P3	Connector	TL-25H-04-A1
P4	Connector	TL-25H-06-A1
P5	Connector	TL-25H-07-A1
P6	Connector	TL-25H-04-A1
P7	Connector	TL-25H-06-A1
P8	Connector	TL-25H-04-A1
P9	Connector	TL-25H-05-A1
P10	Connector	TL-25H-04-A1
P11	Connector	TL-25H-03-A1
P12	Connector	TL-25H-03-A1
P13	Connector	TL-25H-06-A1
P14	Connector	TL-25H-03-A1
P15	Connector	TL-25H-07-A1
P16	Connector	TL-25H-05-A1
P17	Connector	TL-25H-03-A1
P18	Connector	TL-25H-05-A1
P19	Connector	TL-25H-05-A1
P20	Connector	TL-25H-04-A1
P21	Connector	TL-25H-06-A1
P22	Connector	1545P-1
P23	Connector	TL-25H-03-A1
DS1	Display Tube	9-BT-12
B1	DISP P.C.B	B-581B
B2	DC-DC P.C.B	B-585B
B3	VR (A) P.C.B	B-586A
B4	VR (B) P.C.B	B-587A
B5	VR (C) P.C.B	B-588A
B6	SW (A) P.C.B	B-589B
B7	SW (B) P.C.B	B-590A
B8	SW (C) P.C.B	B-591B
B9	SW (D) P.C.B	B-592C
B10	SW (E) P.C.B	B-593B
B11	MIC P.C.B	B-594A
B12	LED (A) P.C.B	B-595
B13	LED (B) P.C.B	B-596
B14	SW (F) P.C.B	B-606B

[REG UNIT]

REF. NO.	DESCRIPTION	PART NO.	
IC1	IC	MB3756	
Q1	Transistor	2SD313	
D1	Diode	1N4002	
D2	Diode	1N4002	
R1	Resistor	4.7	ELR25
R2	Resistor	220	ELR25
C1	Electrolytic	1000	16V
C2	Electrolytic	4.7	10V
C3	Electrolytic	22	10V
C4	Electrolytic	47	10V
C5	Electrolytic	100	10V
B1	REG P.C.B	B-482A	

[KEY-JUMP UNIT]

REF. NO.	DESCRIPTION	PART NO.
P1	Connector	TL-25H-04-A1
P2	Connector	TL-25H-04-A1
P3	Connector	TL-25H-03-A1
J1	Connector	TL-25P-03-V1
J2	Connector	TL-25P-04-V1
B1	KEY-JUMP P.C.B	B-650

[PLL UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C50	Ceramic	0.001	50V
C51	Ceramic	220P	50V
C52	Electrolytic	22	10V
C53	Ceramic	220P	50V
C54	Ceramic	68P	50V
C55	Ceramic	0.0047	50V
C56	Ceramic	470P SL	50V
C57	Ceramic	470P SL	50V
C58	Electrolytic	47	10V
C59	Ceramic	0.0047	50V
C60	Ceramic	470P	50V
C61	Ceramic	470P	50V
C62	Ceramic	470P	50V
C63	Ceramic	470P	50V
C64	Ceramic	470P	50V
C65	Ceramic	0.0047	50V
J1	Connector	TL-25P-06-V1	
J2	Connector	TL-25P-04-V1	
J3	Connector	TL-25P-02-V1	
P1	Connector	TL-25H-02-A1	
B1	PLL P.C.B	B-582B	

For Service Manuals Contact
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Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

[VCO UNIT]

REF. NO.	DESCRIPTION	PART NO.	
IC1	IC	BA618	
Q1	FET	2SK19GR (2SK192AGR)	
Q2	FET	2SK19GR (2SK192AGR)	
Q3	FET	2SK19GR (2SK192AGR)	
Q4	FET	2SK19GR (2SK192AGR)	
Q5	Transistor	2SC763C	
Q6	Transistor	2SC2053	
Q7	Transistor	2SC945P	
D1	Varicap	SVC201	
D2	Diode	1SS53	
D3	Diode	1SS53	
D4	Diode	1SS53	
D5	Varicap	SVC201	
D6	Diode	1SS53	
D7	Varicap	SVC201	
D8	Diode	1SS53	
D9	Varicap	SVC201	
D10	Diode	1SS53	
L1	Choke Coil	LAL04NA820K	
L2	Coil	LB-137	
L3	Choke Coil	LAL04NA820K	
L4	Choke Coil	LAL04NA101K	
L5	Coil	LB-137	
L6	Choke Coil	LAL04NA101K	
L7	Coil	LB-138	
L8	Choke Coil	LAL04NA101K	
L9	Coil	LB-138	
L10	Coil	LR-87	
L11	Choke Coil	LAL04NA101K	
L12	Choke Coil	R36	LB-4
L13	Choke Coil	LA137A	
L14	Choke Coil	R12	LB-4
R1	Resistor	100	ELR25
R2	Resistor	100	ELR25
R3	Resistor	220K	ELR25
R4	Resistor	220K	ELR25
R5	Resistor	4.7K	ELR25
R7	Resistor	100	ELR25
R8	Resistor	100	ELR25
R9	Resistor	100	R25
R10	Resistor	4.7K	ELR25
R11	Resistor	1K	ELR25
R12	Resistor	220K	ELR25
R13	Resistor	220K	ELR25
R14	Resistor	100	R25
R15	Resistor	4.7K	ELR25
R16	Resistor	1K	ELR25
R17	Resistor	220K	ELR25
R18	Resistor	220K	ELR25
R19	Resistor	100	R25
R20	Resistor	4.7K	ELR25
R21	Resistor	47	ELR25
R22	Resistor	15K	ELR25
R23	Resistor	47K	ELR25
R24	Resistor	100	ELR25
R25	Resistor	1K	ELR25
R26	Resistor	22	ELR25
R27	Resistor	220	ELR25
R28	Resistor	5.6K	ELR25
R29	Resstor	15K	ELR25

[VCO UNIT]

REF. NO.	DESCRIPTION	PART NO.	
R31	Resistor	4.7K	ELR25
R32	Resistor	1.2K	R25
R33	Resistor	330	ELR25
R34	Resistor	100	ELR25
R35	Resistor	2.2K	ELR25
R36	Resistor	3.3K	R25
C1	Barrier Lay	0.047	25V
C2	Ceramic	68P	50V
C3	Ceramic	12P	50V
C4	Trimmer	CTZ51A	
C5	Ceramic	18P	50V
C6	Ceramic	47P	50V
C7	Ceramic	22P	50V
C8	Ceramic	39P	50V
C9	Electrolytic	47	10V
C10	Ceramic	0.0047	50V
C11	Electrolytic	47	10V
C12	Barrier Lay	0.047	25V
C13	Ceramic	68P	50V
C14	Ceramic	15P	50V
C15	Trimmer	CTZ51A	
C16	Ceramic	47P	50V
C17	Ceramic	10P	50V
C18	Ceramic	15P	50V
C19	Electrolytic	47	10V
C20	Ceramic	0.0047	50V
C22	Ceramic	47P	50V
C23	Ceramic	10P	50V
C24	Trimmer	CTZ51A	
C25	Ceramic	47P	50V
C26	Ceramic	27P	50V
C27	Ceramic	18P	50V
C28	Electrolytic	47	10V
C29	Ceramic	0.0047	50V
C30	Barrier Lay	0.047	25V
C31	Ceramic	47P	50V
C32	Ceramic	5P	50V
C33	Trimmer	CTZ51A	
C34	Ceramic	47P	50V
C35	Ceramic	10P	50V
C36	Ceramic	15P	50V
C37	Electrolytic	47	10V
C38	Ceramic	0.0047	50V
C39	Ceramic	0.0047	50V
C40	Electrolytic	47	10V
C41	Ceramic	5P	50V
C42	Ceramic	0.0047	50V
C43	Ceramic	0.0047	50V
C44	Electrolytic	47	16V
C45	Ceramic	0.0047	50V
C46	Ceramic	68P	50V
C47	Ceramic	100P	50V
C48	Ceramic	68P	50V
C49	Ceramic	56P	50V
C50	Ceramic	100P	50V
C51	Ceramic	120P	50V
C52	Ceramic	27P	50V
C53	Ceramic	0.0047	50V
C54	Electrolytic	100	10V
C55	Ceramic	0.0047	50V
C56	Barrier Lay	0.047	50V
C58	Ceramic	82P	50V

[VCO UNIT]

REF. NO.	DESCRIPTION	PART NO.
J1	Connector	TLB-P05H-B1
P1	Connector	TL-25H-02-A1
P2	Connector	TL-25H-02-A1
P3	Connector	TL-25H-02-A1
P4	Connector	TL-25H-06-A1
B1	VCO P.C.B	B-634A

[HPL UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	SN76515
IC2	IC	SN76515
IC3	IC	μA78L05
IC4	IC	MB8718M
IC5	IC	M74LS161P
IC6	IC	DAN401
IC7	IC	DAN401
IC8	IC	DAN401
IC9	IC	SAN401
IC10	IC	SAN401
IC11	IC	μA78L82
Q1	Transistor	2SC945
Q2	Transistor	2SC763C
Q3	Transistor	2SC1571G
Q4	Transistor	2SC1571G
Q5	Transistor	2SC763C
Q6	Transistor	2SC763C
Q7	Transistor	2SC763C
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1SS53
D7	Diode	1SS53
D8	Diode	1SS53
D9	Diode	1SS53
D10	Diode	1SS53
D11	Diode	1SS53
D12	Diode	1SS53
D13	Diode	1SS53
D14	Diode	1SS53
D15	Diode	1SS53
D16	Diode	1SS53
D17	Diode	1SS53
D18	Diode	1SS53
D19	Diode	1SS53
D20	Diode	1S953
X1	Crystal	34.9315MHz HC-18/u
L1	Coil	LS193
L2	Coil	LR116
L3	Coil	LS191
L4	Coil	LS191
L5	Choke Coil	101 (LB-4)
L6	Coil	LR116
L7	Choke Coil	101 (L-4)
L8	Choke Coil	1R0 (LB4)
L9	Choke Coil	R70 (LB4)
R1	Resistor	4.7K ELR25
R2	Resistor	560 ELR25
R3	Resistor	22K ELR25
R4	Resistor	150 ELR25
R5	Resistor	3.3K ELR25
R6	Resistor	10 ELR25
R7	Resistor	47K ELR25
R8	Resistor	470 ELR25
R9	Resistor	100K R25
R10	Resistor	3.3K ELR25
R11	Resistor	10 ELR25

[HPL UNIT]

REF. NO.	DESCRIPTION	PART NO.
R12	Resistor	47 ELR25
R13	Trimmer	1K H0651A
R15	Resistor	15K ELR25
R16	Resistor	4.7K ELR25
R17	Resistor	100 ELR25
R18	Resistor	15K ELR25
R19	Resistor	5.6K ELR25
R20	Resistor	330 ELR25
R21	Array	RM8-473K
R22	Resistor	68K R25
R23	Resistor	68K R25
R24	Resistor	68K R25
R25	Resistor	68K R25
R26	Resistor	68K ELR25
R27	Resistor	68K ELR25
R28	Resistor	68K ELR25
R29	Resistor	1.5K ELR25
R30	Resistor	1K R25
R31	Resistor	15K ELR25
R32	Resistor	1K ELR25
R33	Resistor	150 ELR25
R34	Resistor	39K ELR25
R35	Resistor	10K ELR25
R36	Resistor	22K ELR25
R37	Resistor	22K ELR25
R38	Resistor	22K ELR25
R39	Resistor	22K ELR25
R40	Resistor	22K ELR25
R41	Array	RM6-104K
R42	Resistor	27K ELR25
R43	Resistor	15K ELR25
R44	Resistor	10K ELR25
R45	Resistor	12K ELR25
C1	Ceramic	470P 50V
C2	Ceramic	0.0047 50V
C3	Ceramic	82P 50V
C4	Ceramic	0.001 50V
C5	Ceramic	0.001 50V
C6	Ceramic	0.0047 50V
C7	Ceramic	0.0047 50V
C8	Ceramic	0.0047 50V
C10	Ceramic	0.0047 50V
C11	Ceramic	0.001 50V
C12	Ceramic	0.0047 50V
C13	Electrolytic	47 16V
C14	Ceramic	27P 50V
C15	Ceramic	2P 50V
C16	Ceramic	27P 50V
C17	Ceramic	15P 50V
C18	Ceramic	470P 50V
C19	Ceramic	0.001 50V
C20	Ceramic	0.0047 50V
C21	Ceramic	0.0047 50V
C22	Ceramic	0.0047 50V
C23	Ceramic	0.0047 50V
C25	Ceramic	0.0047 50V
C26	Ceramic	0.001 50V
C27	Tantal	0.47 35V
C28	Ceramic	0.0047 50V
C29	Electrolytic	47 16V
C30	Ceramic	0.0047 50V
C31	Electrolytic	10 16V
C32	Electrolytic	47 10V

[HPL UNIT]

REF. NO.	DESCRIPTION	PART NO.	
C33	Ceramic	0.0047	50V
C34	Ceramic	0.0047	50V
C35	Ceramic	0.001	50V
C36	Ceramic	0.0047	50V
C37	Ceramic	180P	50V
C38	Ceramic	82P	50V
C39	Ceramic	10P	50V
C40	Ceramic	120P	50V
C41	Ceramic	30P	50V
C42	Ceramic	62P	50V
C43	Ceramic	0.0047	50V
C44	Ceramic	0.0047	50V
C45	Ceramic	0.0047	50V
C46	Ceramic	0.001	50V
C47	Ceramic	0.0047	50V
C48	Ceramic	0.0047	50V
C49	Ceramic	47P	50V
C50	Barrier Lay	0.1	25V
C51	Barrier Lay	0.1	25V
J1	Connector	TL-25P-02-V1	
J2	Connector	TL-25P-02-V1	
J3	Connector	TL-25P-02-V1	
J4	Connector	TL-25P-06-V1	
J5	Connector	TLB-P07H-B1	
J6	Connector	TLB-P06H-B1	
P1	Connector	TL-25H-02-A1	
P2	Connector	TL-25H-07-A1	
P3	Connector	TL-25H-06-A1	
B1	HPL P.C.B	B-635A	

[FRONT UNIT]

REF. NO.	DESCRIPTION	PART NO.
IC1	IC	μPD549C
IC2	IC	μPD4030
Q1	Transistor	2SC1636 ANY RANK
Q2	Transistor	2SC945 ANY RANK
Q3	Transistor	2SA1015Y
Q4	Transistor	2SA1015Y
Q5	Transistor	2SA1015Y
Q6	Transisjtor	2SA1015Y
Q7	Transistor	2SC945 ANY RANK
Q8	Transistor	2SA1015Y
Q9	Transistor	2SC1214 ANY RANK
D1	Diode	1SS53
D2	Diode	1SS53
D3	Diode	1SS53
D4	Diode	1SS53
D5	Diode	1SS53
D6	Diode	1SS53
D7	Diode	1SS53
D8	Diode	1SS53
D9	Diode	1SS53
D10	Diode	1SS53
D11	Diode	1SS53
D12	Diode	1SS53
D13	Diode	1SS53
D14	Diode	1SS53
D15	Diode	1SS53
D16	Diode	1SS53
D17	Zener Diode	WZ040
D18	Zener Diode	WZ056
D19	Diode	1SS53
D20	Diode	1SS53
D21	Diode	1SS53
D22	Diode	1SS53
D23	Diode	1SS53
D24	Diode	1SS53
D25	LED (XIT)	LN233RP
D26	LED (RIT)	LN233RP
D27	LED (TX)	LN233RP
D28	LED (RX)	LN333GP
D29	LED (MEMO)	LN433YP
D30	LED (SPLIT)	LN433YP
D31	Diode	1SS99
D32	Diode	1SS99
R1	Resistor	47K R25
R2	Resistor	470K ELR25
R3	Resistor	47K ELR25
R4	Resistor	22K ELR25
R5	Resistor	47K R25
R6	Resistor	47K ELR25
R7	Resistor	47K ELR25
R8	Resistor	47K ELR25
R9	Resistor	47K ELR25
R10	Array	RM6-473K
R11	Array	RM8-473K
R12	Resistor	100 R25
R13	Resistor	100 R25
R14	Resistor	47K ELR25
R15	Resistor	47K ELR25
R16	Resistor	47K ELR25
R17	Resistor	100K ELR25
R18	Resistor	39K ELR25

[FRONT UNIT]

REF. NO.	DESCRIPTION	PART NO.
R19	Resistor	560 ELR25
R20	Variable Resistor	K122-5N1212-1MA
R21	Variable Resistor	K121B0 1KB
R23	Trimmer	33K H0651A
R24	Variable Resistor	K122-5N1212-10KB500KC
R25	Variable Resistor	K121-B0-1MB
R27	Variable Resistor	K12B 10KAx2
R28	Variable Resistor	K12C 10KBx210KA
R29	Resistor	22K R25
R31	Resistor	33K R25
R33	Trimmer	33K H0651A
R34	Resistor	470K R25
R36	Resistor	2.2K R25
R37	Variable Resistor	K12C 10KB1KB10KB
R39	Trimmer	10K H1051C(SR19D)
R40	Trimmer	10K H1051C(SR19D)
R41	Trimmer	10K H1051C(SR19D)
R42	Resistor	47K R25
R43	Resistor	10K ELR25
R44	Resistor	29K R25
R45	Trimmer	10K H0651A
R46	Resistor	47K R25
R47	Resistor	15K R25
R49	Trimmer	4.7K H0651A
R50	Trimmer	10K H0651A
R51	Variable Resistor	S2011G1 10KB
R52	Variable Resistor	S2011G1 10KB
R53	Resistor	22 ELR25
R54	Resistor	27K ELR25
R55	Resistor	10 ELR25
R56	Resistor	680 ELR25
R57	Resistor	1K ELR25
R58	Resistor	1K ELR25
R59	Resistor	1K ELR25
R60	Resistor	1.2K ELR25
R61	Resistor	1.2K ELR25
R62	Resistor	1.2K ELR25
R63	Trimmer	10K H1052A
R64	Trimmer	10K H1052A
R65	Variable Resistor	K121B0 10KB
R66	Resistor	470 R25
R68	Resistor	4.7K R25
R69	Resistor	470K R25
R70	Resistor	3.3K ELR25
C1	Barrier Lay	0.1 25V
C2	Barrier Lay	0.1 25V
C3	Ceramic	0.001 50V
C5	Ceramic	0.0022 50V
C6	Ceramic	0.0022 50V
C7	Ceramic	0.0022 50V
C8	Ceramic	0.0022 50V
C9	Ceramic	0.0022 50V
C10	Ceramic	0.0022 50V
C11	Barrier Lay	0.047 25V
C12	Mylar	0.15 50V
C13	Barrier Lay	0.1 25V
C14	Barrier Lay	0.0047 50V
C15	Electrolytic	47 16V
C16	Electrolytic	47 16V
C17	Electrolytic	47 16V
C18	Ceramic	0.0047 50V
C19	Electrolytic	1000 6.3V
C20	Electrolytic	220 16V

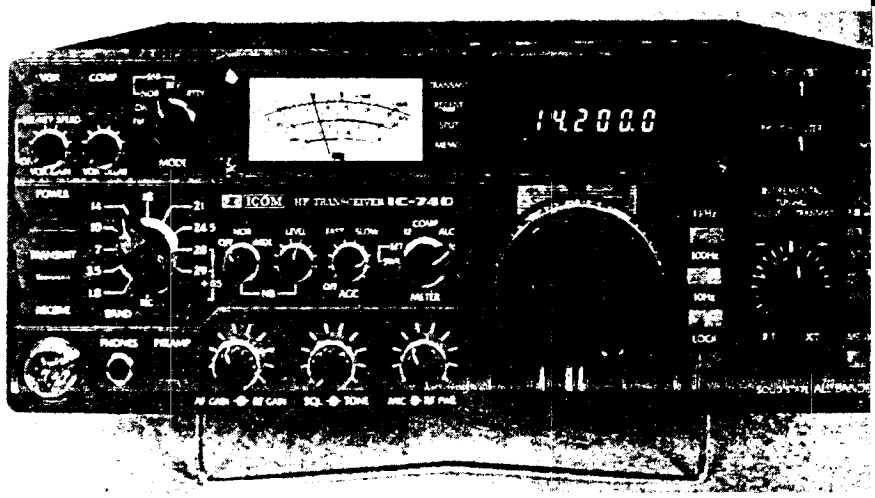
[FRONT UNIT]

REF. NO.	DESCRIPTION	PART NO.
C21	Electrolytic	47 16V
C22	Electrolytic	47 16V
C23	Ceramic	0.0047 50V
C24	Ceramic	0.01 50V
C25	Electrolytic	10 16V
L1	Transformer	LB-119
L3	Choke Coil	LAL04NA101K
L4	Choke Coil	LAL04NA101K
L5	Choke Coil	LAL04NA101K
L6	Choke Coil	LAL04NA101K
L7	Choke Coil	LAL04NA101K
L8	Choke Coil	BT01RN1-A61
L9	Choke Coil	BT01RN1-A61
S1	Push-Sw (POWER)	TW-0068
S2	Lever-Sw (SEND)	M2012J-1K
S3	Push-Sw (P. AMP)	SPJ312E
S4	Push-Sw (0.5MHz)	SPJ322H
S5	Push-Sw (XIT)	SPJ322H
S6	Push-Sw (RIT)	SPJ522E
S7	Push-Sw (COMP.)	SPJ522E
S8	Push-Sw (VOX)	SPJ512E
S9	Push-Sw (P.B.T)	PS-135-A22S
S10	Push-Sw (FIL)	PS-135-A22S
S11	Push-Sw (NOTCH)	PS-135-A22S
S12	Rotary-Sw (METER)	SBU1026
S13	Rotary-Sw (MODE)	SPU2045
S14	Rotary-Sw (N.B)	SBU1023
S15	Push-Sw (VFO. STEP)	SUN411A
S16	Push-Sw (SPLIT)	SUN411A
S17	Lever-Sw (MARKER)	MS621C HS-6210
S18	Lever-Sw (MONITOR)	MS611A HS-611A
S19	Rotary Encoder	LA24007
FL1	Lamp	BQ044-3258A
J1	Mic Connector	FM214-8SS
J2	Phones Jack	LJ035-1-2
J3	Connector	TL-25P-06-L1
J4	Connector	TL-25P-06-L1
J5	Connector	TL-25P-06-V1
J6	Connector	TL-25P-05-V1
J7	Connector	TL-25P-07-V1
J8	Connector	TL-25P-07-V1
J9	Connector	TL-25P-03-V1
J10	Connector	TL-25P-04-L1
J11	Connector	TL-25P-04-V1
J12	Connector	TL-25P-04-L1
J13	Connector	TL-25P-07-L1
J14	Connector	TL-25P-11-L1
J15	Connector	TL-25P-12-L1
J16	Connector	TL-25P-09-L1
J17	Connector	TL-25P-07-L1
J18	Connector	TL-25P-10-L1
J19	Connector	TL-25P-07-V1
J20	Connector	TL-25P-06-V1
J21	Connector	TL-25P-06-V1
J22	Connector	TL-25P-05-V1
J23	Connector	TL-25P-03-V1
J24	Connector	TL-25P-07-V1
J25	Connector	TL-25P-04-V1
J26	Connector	TL-25P-07-V1
J27	Connector	TL-25P-04-V1

Equipment Review

The Icom IC740

hf transceiver



by Peter Hart, G3SJX*

Introduction

The current Icom range of hf transceivers comprises three models—the IC720A, reviewed in *Rad Com* February 1982, giving nine-band transceiver operation with additional general coverage receiver; the IC730 eight-band mobile transceiver; and the latest addition, the IC740. (See "Postscript" —*Ed)*

The IC740 is a 12V fully solidstate synthesized 100W transceiver covering the nine hf bands and offering an extensive range of facilities. The unit is fully compatible with the standard range of matching Icom accessories, including the IC2KL linear and ICAT500 atu. Band switching for these items is controlled automatically from the IC740. An internal mains psu is available as an optional extra. The review transceiver was powered by the Icom ICPS15 mains power unit.

Principal features

The IC740 is an amateur-bands-only transceiver without the general coverage receive facility offered by the IC720A. Each tuning range is 700kHz wide, with 28MHz covered in four overlapping ranges. Twin vfos are provided, tuning in 10Hz, 100Hz or 1kHz steps, which results in tuning rates of 1, 10 or 100kHz per revolution of the 50mm diameter control knob. Split frequency transmit-receive operation within any one range is possible, and one frequency in each range may be stored in memory. Digital frequency readout to 100Hz resolution is provided by a particularly bright and easy-to-read blue fluorescent display. Operational modes are usb, lsb, cw, fm (optional extra) and 170Hz shift rtty. RTTY uses the IARU Region 2/3 tone standard of 2,125 and 2,295Hz which requires the i.f. shift to be offset when using terminal units intended for use with the Region 1 tones (1,275 and 1,445Hz).

Other facilities include receiver passband tuning and i.f. shift, multifunction controllable noise blanker, clarifier operating on receive and/or transmit, selectable receiver rf amplifier, variable speed agc plus off, notch filter and all mode squelch. Transmitter facilities include speech processor, vox, transmission monitor, extensive metering with a single meter, and a quiet fan.

The rear panel carries interface connections for auxiliary linear, transverters and receiver audio, antenna, low power output, receiver antenna input/output, cw and rtty key jacks, external speaker and memory backup. An external 9—12V supply applied to the memory backup socket will enable the vfo and memory frequencies to be retained when the IC740 is switched off. However, the current drain of 7mA precludes the use of dry batteries. As there is no auxiliary transmitter af input, rtty and sstv audio tones etc must be inserted via the microphone socket.

A number of optional extras are available. These include internal mains psu, fm board, electronic keyer board, additional i.f. filters for cw bandwidths, and marker module.

The transmitter requires a microphone with built-in preamplifier. The Icom IC-HM7 is provided as standard.

Description

This small transceiver measures 28·6 (w) by 11·1 (h) by 37·4cm (d) and weighs 8kg without internal psu. The circuitry is constructed on 10 main printed boards with several additional subsidiary boards on four sides of a sturdy supporting framework which also provides screening. The pa compartment with integral heatsink and fan is mounted at the rear, and all interconnections are via miniature multiway pcb plug and sockets and a cable harness assembly. Where options are not fitted, the relevant connectors hang loose in the wiring. The front panel is diecast, and an attractive appearance has been achieved. The control layout is very compact but people with large fingers may find some of the controls just a little too small. Horizontal slider pots are used for the i.f. shift/pbt and notch filter controls. A 9cm diameter speaker is mounted on the top of the case.

A simplified block diagram of the IC740 is shown in Fig 1. The transceiver is triple conversion with intermediate frequencies of 39·7315MHz, 9·0115MHz and 455kHz, and much of the circuitry is common to both transmit and receive. Broad band circuitry is used throughout, hence eliminating the need for a preselector or pa tuning.

On receive, incoming signals pass through band-switched lowpass and bandpass filters and a switchable push-pull grounded gate fet rf amplifier. The first mixer is a discrete double-balanced diode ring up-converting to 39·7315MHz, followed by twin monolithic roofing filters, i.f. amplifiers and second mixer. The second mixer is similar to the first and converts down to the second i.f. of 9·0115MHz. The signal then continues through the main i.f. filters, i.f. amplifiers and notch filter and is converted down to the third i.f. of 455kHz. After further filtering and amplification, the signal is demodulated in a product detector. Integrated circuit mixers are used for the third receiver mixer and product detector. Audio power is generated in an ic and additional af filtering is used on cw.

On transmit, ssb is generated at 455kHz, processed and converted via the 9·0115MHz and 39·7315MHz i.fs to signal frequency. Many of the mixers and filters are common to both receive and transmit, as can be seen from the block diagram. Four stages of broadband amplification at final frequency raise the power output to the nominal 100W p.e.p. level.

Local oscillator drive for the signal frequency mixer lies in the frequency range 41·2315—69·7315MHz. This is provided by one of four vcos,

*42 Gravel Hill, Addington, Croydon, Surrey.

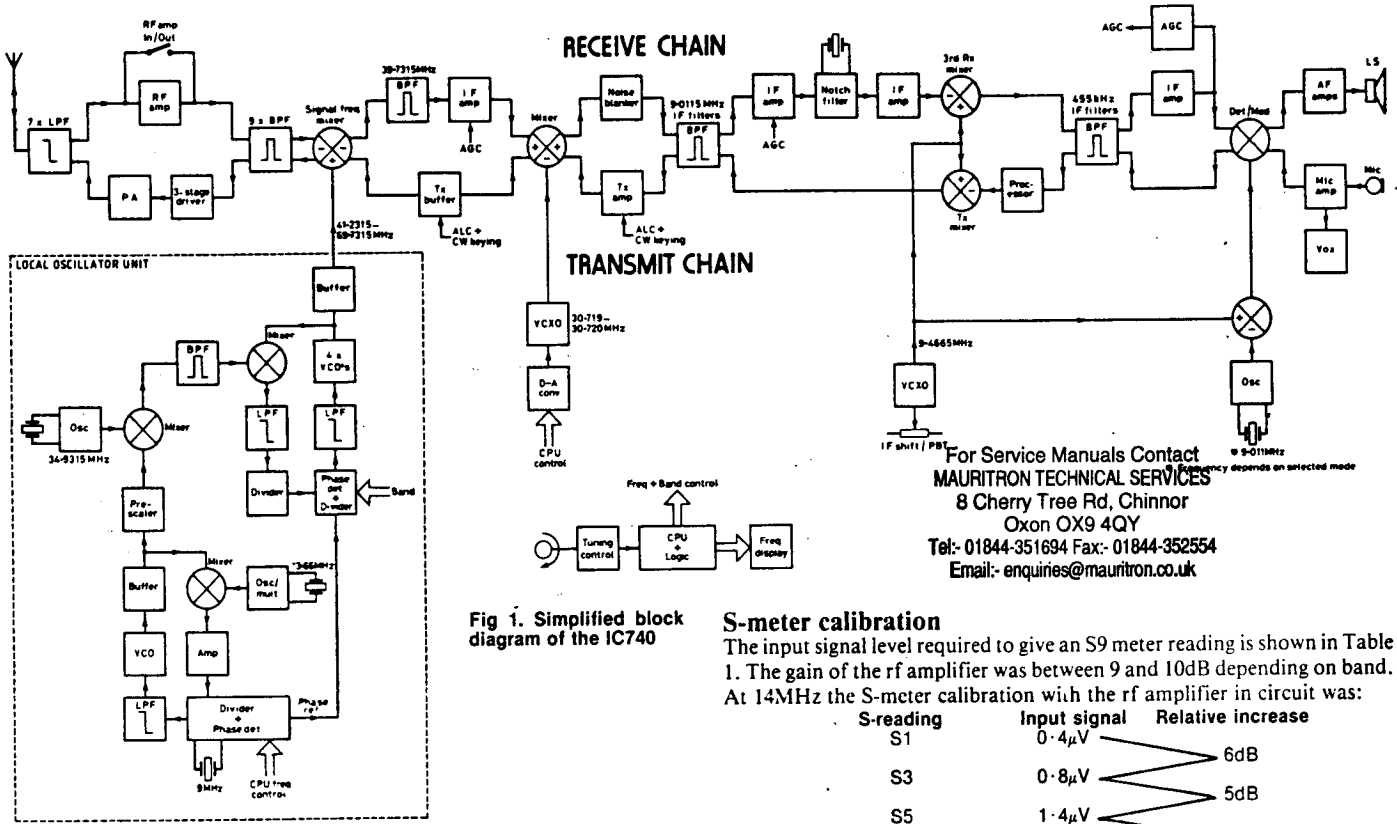


Fig 1. Simplified block diagram of the IC740

each with a limited tuning range. Two phase-locked loops are used in the local oscillator unit with frequency and band data derived from the cpu. The cpu is possibly a four-bit cmos single chip microcomputer. The local oscillator frequency is stepped in 1kHz intervals. Steps of 10 and 100Hz are provided by shifting the frequency of the second mixer oscillator injection over a total range of 1kHz. The front panel tuning knob controls a photochopper. Oscillator drive for the receiver third mixer is a vcxo on nominally 9·4665MHz which is controlled by the i.f. shift/pbt function. Product detector injection is derived by mixing this vcxo with a fixed oscillator on 9·011MHz. The precise operation of the pbt/i.f. shift facility is not obvious from the manual.

Measurement technique

The measurement technique was similar to that used in previous reviews [1]. All signal input voltages are given as pd across the antenna terminal. When performing transmitter or receiver two-tone intermodulation measurements, the amplitude of intermodulation products generated is quoted with respect to either tone of the test signal.

Unless otherwise stated, all measurements were made on ssb with the audio gain set to give about 100mW af output, shift/pbt central, tone control central and rf preamp switched in.

Receiver measurements

Sensitivity

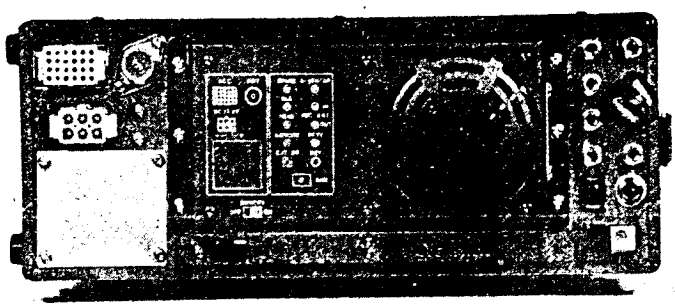
Table 1 shows the sensitivity results obtained on ssb with the rf amplifier switched both in and out. With the amplifier switched in, these figures indicate a noise floor of around −135 to −136dBm or a noise figure of 5 to 6dB. With the amplifier switched out, these figures become −127 to −130dBm for the noise floor, and 11 to 14dB for the noise figure.

S-meter calibration

The input signal level required to give an S9 meter reading is shown in Table 1. The gain of the rf amplifier was between 9 and 10dB depending on band. At 14MHz the S-meter calibration with the rf amplifier in circuit was:

S-reading	Input signal	Relative increase
S1	0·4μV	
		6dB
S3	0·8μV	
		5dB
S5	1·4μV	
		5dB
S7	2·5μV	
		7dB
S9	5·6μV	
		24dB
S9 + 20	89μV	
		17dB
S9 + 40	630μV	
		16dB
S9 + 60	4·0mV	

With the rf amplifier out of circuit these figures are 10dB greater. The S-meter is rather over generous, and linearity fair to poor.



Rear view of the IC740

Spurious responses

Table 2 shows the rejection of the primary image frequency which occurs 79·463MHz above the frequency to which the receiver is tuned, together with the rejection of the first i.f. on 39·7315MHz, half first i.f. on 19·866MHz and second i.f. on 9·0115MHz. There was no detectable response on any band at the 455kHz i.f.

To check for internally-generated spurious signals, the antenna socket

Table 1. Receiver measurements (1)

Frequency	Sensitivity for 10dB s + n:n RF amp in	RF amp out	Input for S9 RF amp in	RF amp out
1·8MHz	0·13μV (−125dBm)	0·28μV (−118dBm)	8μV	22μV
3·5MHz	0·11μV (−126dBm)	0·22μV (−120dBm)	6·3μV	18μV
7MHz	0·11μV (−126dBm)	0·25μV (−119dBm)	6·3μV	20μV
10MHz	0·13μV (−125dBm)	0·28μV (−118dBm)	6·3μV	20μV
14MHz	0·13μV (−125dBm)	0·32μV (−117dBm)	5·6μV	18μV
18MHz	0·13μV (−125dBm)	0·32μV (−117dBm)	6·3μV	20μV
21MHz	0·13μV (−125dBm)	0·32μV (−117dBm)	5·6μV	20μV
24MHz	0·13μV (−125dBm)	0·28μV (−118dBm)	6·3μV	18μV
28MHz	0·13μV (−125dBm)	0·28μV (−118dBm)	6·3μV	18μV

Table 2. Receiver measurements (2)

Frequency	Image rejection	9·0115MHz i.f. rejection	39·7315MHz i.f. rejection	19·866MHz half i.f. rejection
1·8MHz	76dB	—	>117dB	—
3·5MHz	87dB	—	>111dB	—
7MHz	94dB	110dB	109dB	—
10MHz	90dB	111dB	>113dB	—
14MHz	74dB	105dB	109dB	>120dB
18MHz	83dB	114dB	>112dB	88dB
21MHz	75dB	108dB	>110dB	81dB
24MHz	88dB	115dB	69dB	96dB
28MHz	100dB	110dB	51dB	>100dB

Note: dashes signify an unmeasurable response.

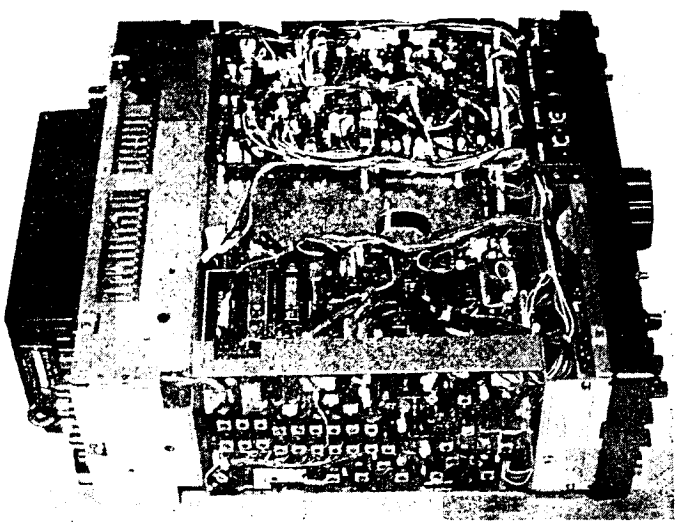
was terminated in 50Ω and the receiver carefully tuned across each band in turn. Fourteen spurii were logged, only one was strong enough to move the S-meter (3·863MHz S1) and eight were located in the 28MHz band.

Other spurious responses were checked by setting the signal generator on either side of the on-tune frequency and noting the amplitude for any responses obtained corresponding to an S1 meter reading. The generator was tuned from 100kHz off frequency down to 1MHz, and from 100kHz off frequency up to vhf. Generator harmonics, image and i.f. responses were ignored.

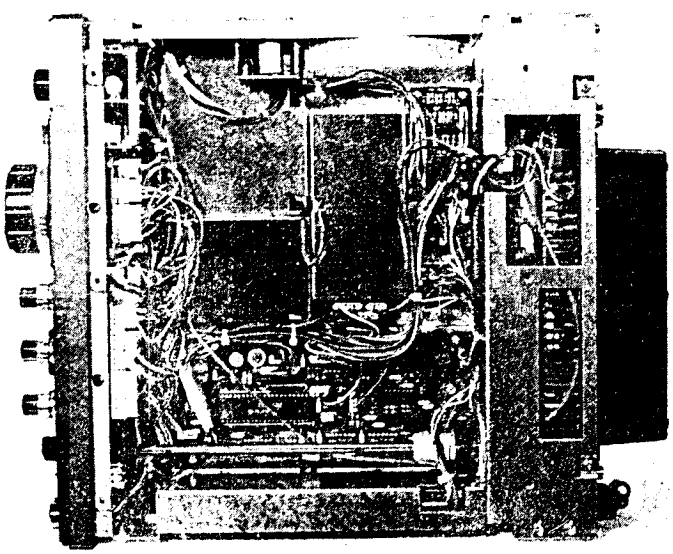
Frequency	Worst response	Other responses
1·8MHz	80mV	Two up to 250mV
3·5MHz	35mV	10 up to 250mV
7MHz	25mV	Several around 100mV
10MHz	14mV	Several around 100mV
14MHz	25mV	Several around 100mV
18MHz	22mV	Several around 100mV
21MHz	15mV	Several around 100mV
24MHz	32mV	Several around 100mV
28MHz	18mV	Six up to 250mV

AGC performance

The agc system in the IC740 exhibited a very soft threshold. AGC started to take effect at about 0·4μV. A 20dB increase in signal to 4μV resulted in a 7dB increase in audio output. The audio then remained within 1dB for a further 100dB increase in signal level. The attack time was measured as 100–150ms for a 40dB increase in signal level depending on agc speed setting and signal level. The decay time for a 40dB decrease in level varied from 1 to 3s depending on level at the slowest setting, and 0·2 to 0·7s at the fastest setting.



Top and side view of the IC740 with covers removed



Bottom view of the IC740 with covers removed

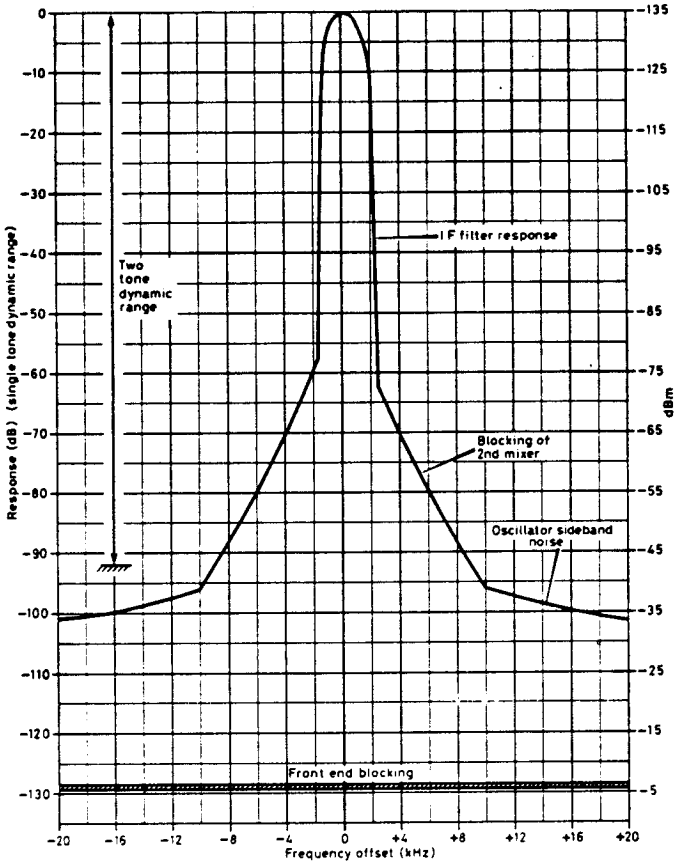


Fig 2. IC740 effective selectivity curve on usb (2·5kHz bandwidth)

Selectivity

It was only possible to measure about 60dB down the filter skirts with the conventional method of measurement due to close-in blocking of the 39·7315MHz i.f. amplifier or second mixer. The results were:

Response	Bandwidth	Response	Bandwidth
−3dB	2·15kHz	−30dB	3·63kHz
−6dB	2·82kHz	−40dB	3·80kHz
−10dB	3·17kHz	−50dB	3·93kHz
−20dB	3·46kHz	−60dB	4·06kHz

The response was a little asymmetrical. The notch filter depth was measured as about 30dB but the response was fairly broad.

Oscillator sideband noise

Reciprocal mixing measurements were made at a frequency of 21·4MHz using a signal generator and crystal filter as described in [2]. It was not possible to measure closer than 10kHz to the on-tune frequency of the receiver due to close-in blocking. Measurements on ssb (approx 2·5kHz bandwidth) were:

Frequency offset	Input level	Level with respect to noise floor
10kHz	−39dBm	96dB
15kHz	−36dBm	99dB
20kHz	−34dBm	101dB
30kHz	−28dBm	107dB
40kHz	−23dBm	112dB
50kHz	−21dBm	114dB
75kHz	−18dBm	117dB
100kHz	−17dBm	118dB
150kHz	−15dBm	120dB
200kHz	−13dBm	122dB
300kHz	−9dBm	126dB

These measurements indicate an oscillator noise sideband performance of −130dBC/Hz at 10kHz off-tune.

Blocking

Two distinct causes of blocking were identified in the receiver. With frequency offsets greater than 10kHz (measured up to 200kHz), blocking occurred at −6dBm (110mV) with the rf amplifier in, or +4dBm (350mV) with the rf amplifier out. This result was independent of on-tune signal level, as would be expected with no agc applied to the rf amplifier. At these offsets, blocking was occurring in the signal frequency mixer. At frequency offsets below 10kHz the blocking performance deteriorated rapidly due to the unwanted signal passing through the 39·7315MHz roofing filter and

blocking the second mixer. This blocking level varied according to on-tune signal level due to agc. With the rf amplifier switched in the results were:

Frequency offset	Blocking level 100μV on-tune signal	Blocking level 10μV on-tune signal
8kHz	10mV	1·8mV
5kHz	2mV	400μV
3kHz	630μV	130μV

The effective selectivity curve is shown in Fig 2.

Third-order intermodulation

Measurements were made with signal spacings of 25kHz on ssb with a bandwidth of nominally 2·5kHz.

Frequency	RF amplifier	Third-order intercept	Dynamic range
7MHz	IN	+4·5dBm	93dB
7MHz	OUT	+14·5dBm	95dB
28MHz	IN	+1dBm	90dB
28MHz	OUT	+11dBm	92dB

The dynamic range quoted is the two-tone spurious free dynamic range related to the receiver noise floor. No degradation in the intermodulation performance was observed at any setting of the noise blanker. No closer-spaced tone measurements were made, but with spacings less than 10kHz a severe degradation would be expected considering the blocking results.

In-band linearity was assessed with signal spacings of 200Hz, centred in the i.f. passband [3]. With the rf amplifier in, −40dB third-order products were generated with input signals of 3μV reducing to −30dB at 70μV and −20dB at 10mV. A rapid degradation occurred with input signals greater than 10mV. Reducing the rf gain control marginally improved the intermodulation products, but reducing the agc speed resulted in a severe degradation.

Audio

The maximum audio power output into an 8Ω load was measured as 1·8W before the onset of clipping, and at this level the distortion was about one per cent. Maximum audio output could be achieved with a 1μV input signal.

Transmitter measurements

Measurements on 10, 18 and 24MHz were not made on the review transceiver, as the transmitter circuitry on these bands was inhibited.

CW power output, harmonics and spurii

The maximum cw power output together with harmonics and spurii were as follows:

Frequency	Power output	Harmonics	Other spurii
1·8MHz	82W	−57dB	−72dB at ±300kHz
3·5MHz	81W	−56dB	−55dB at ±2MHz
7MHz	77W	−55dB	Three −65 to −70dB
14MHz	80W	−56dB	Four −60 to −70dB
21MHz	83W	−58dB	Six −58 to −72dB
28MHz	88W	−57dB	Several −55 to −80dB

The harmonic output quoted is the worst level, in general the 3rd, with the 2nd, 4th and 5th being a few decibels lower. The rf power control reduced the output down to about 6W minimum.

Fig 3 shows the cw keying waveform and rf envelope when keying at speeds of 40wpm. Rise and fall times are about 2ms with a constant delay of 10ms between the keying signal and the rf output.

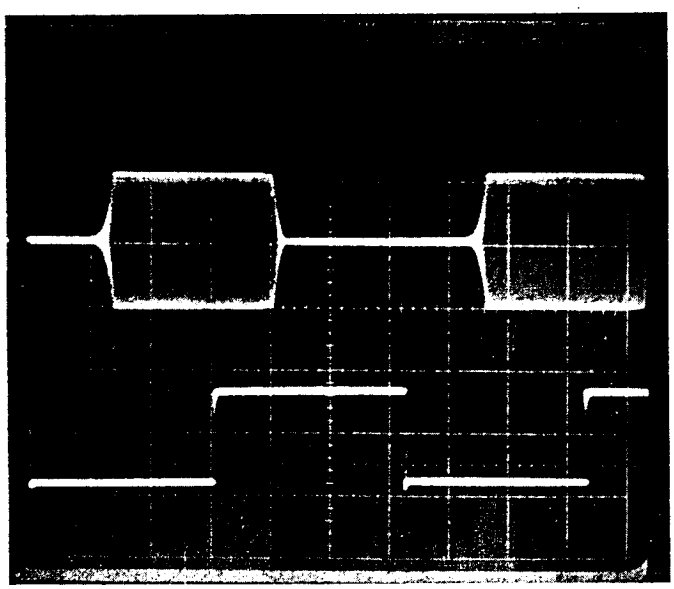


Fig 3. CW keying waveform (bottom) and rf envelope (top) at 40wpm. Horizontal scale 10ms/div

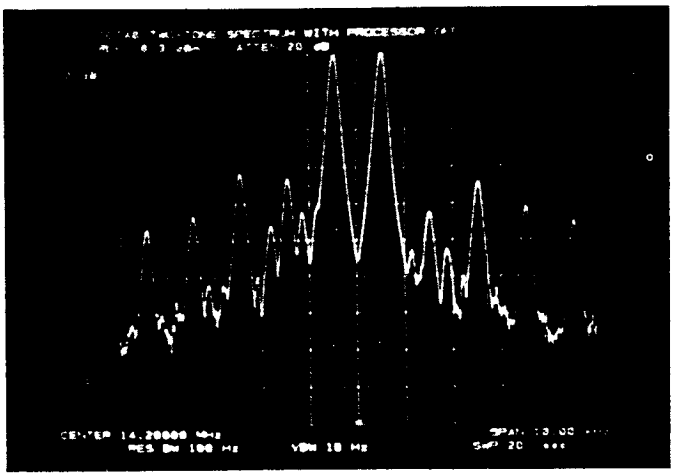


Fig 4. Two-tone transmitter spectrum with processor off. Vertical scale 10dB/division. Horizontal scale 1kHz/division

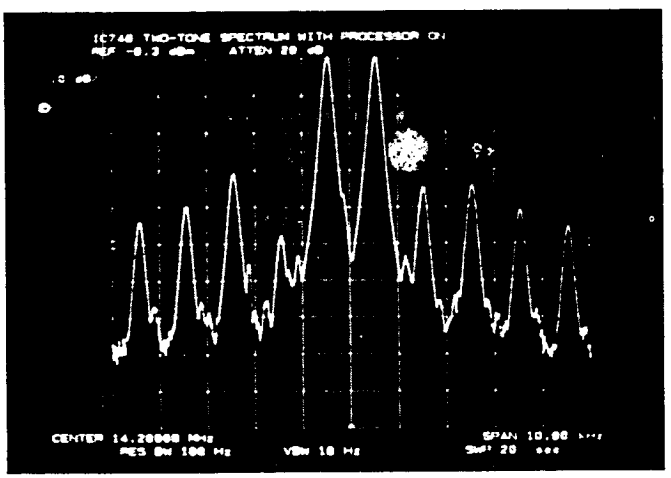


Fig 5. Two-tone transmitter spectrum with processor on. Vertical scale 10dB/division. Horizontal scale 1kHz/division

SSB power output and distortion

It is a little unclear from the manual how far into alc it is recommended to drive the transmitter. With two-tone af drive and the mic gain set to give a meter reading at the top of the alc scale, high levels of distortion were observed with the processor switched out. With the processor in circuit and the mic gain control reduced, much lower distortion levels were observed. These high levels of distortion were due to overloading of the audio or balanced modulator stages, possibly due to insufficient i.f. gain. A single 1kHz audio tone driving the transmitter to full alc with the processor out gave audio harmonics of −25dB. With the processor in, or audio drive reduced to give half alc reading, audio harmonics reduced to −60dB. Two-tone power and distortion measurements were as follows:

(1) PROCESSOR OFF

Frequency	Max alc: Power output p.e.p.	Max alc: Third order ips	Half alc: Power output p.e.p.	Half alc: Third order ips
1·8MHz	93W	−20dB	69W	−31dB
3·5MHz	92W	−22dB	69W	−34dB
7MHz	94W	−18dB	69W	−38dB
14MHz	93W	−18dB	69W	−33dB
21MHz	94W	−20dB	71W	−29dB
28MHz	98W	−19dB	74W	−25dB

(2) PROCESSOR ON

Frequency	Max alc: Power output p.e.p.	Max alc: Third order ips	Half alc: Power output p.e.p.	Half alc: Third order ips
1·8MHz	87W	−28dB	68W	−30dB
3·5MHz	86W	−31dB	68W	−34dB
7MHz	86W	−36dB	69W	−40dB
14MHz	87W	−26dB	69W	−33dB
21MHz	90W	−20dB	71W	−30dB
28MHz	94W	−20dB	74W	−25dB

1·8MHz, ips at ±10kHz were −55dB, and at ±20kHz −70dB. These figures improved with increasing frequency to −65dB and −80dB respectively at 28MHz.

The carrier suppression varied between 45 and 60dB depending on af level and selected sideband. The sideband suppression with a 1kHz audio tone was better than 60dB.

Audio

With the processor off, 370mV af input was required at the microphone socket to drive the transmitter to maximum output. This reduced to 25mV with the processor on. The audio response was rather strange. With the processor on, the audio response was 300Hz to 2·7kHz at the −6dB points, but with the processor off the lf response extended down to below 50Hz, suggesting that the carrier frequency was not positioned correctly with respect to the filter passband.

Transmitter noise output

The measurement technique is briefly described in [2]. A number of discrete low-level sidebands (−80 to −90dB) were observed up to 20kHz on either side of the carrier. These originated in the synthesized local oscillator. Noise measurements at full output on cw were:

Frequency offset	Noise output	Noise output with respect to carrier in a 2·5kHz bandwidth
5kHz	−65dBm/Hz	−80dB
10kHz	−81dBm/Hz	−96dB
20kHz	−84dBm/Hz	−99dB
50kHz	−88dBm/Hz	−103dB

The measured noise at 10kHz offset corresponds to −130dBC/Hz and agrees closely with the receiver reciprocal mixing measurements.

Frequency indication and stability

The frequency drift at 28MHz was exceptionally low, even for a frequency synthesizer. From switch-on, the frequency drifted 5Hz during the first 15min and a further 2Hz during the next hour. The digital readout was accurate to within the resolution of 100Hz, and on cw the frequency readout was correct for a beat note of 800Hz.

Low power (transverter) output

Eight volts at 50mA applied to pin 11 of the accessory connector enables the transverter output and disables the pa. A cw output of −3 to −5dBm was available on all bands, and −6dBm p.e.p. on ssb for −30dB intermodulation products. The spurious outputs on most bands were rather high. Fig 6 shows the output spectrum on 28MHz, with a number of spurii −60 to −80dB down on the wanted signal.

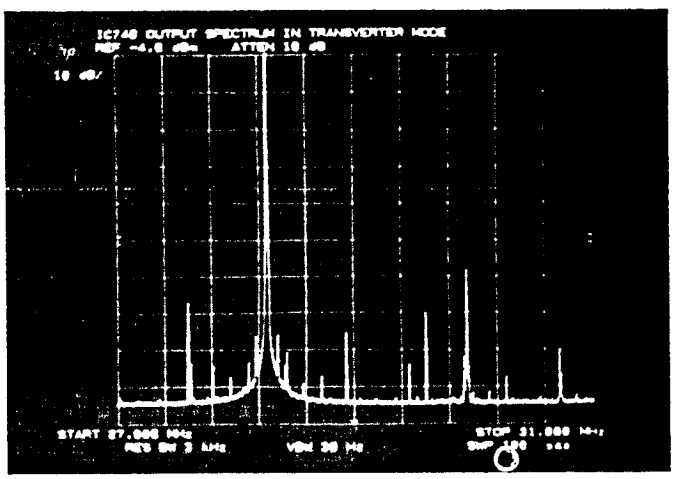


Fig 6. Transverter low-power output spectrum on 28MHz. Horizontal span 27 to 31MHz. Vertical scale 10dB/division

Low voltage supply

Satisfactory operation was obtained down to a supply voltage of 10·5V where transmitter power had dropped by 30 per cent. Below 10V, changes in frequency occurred.

On the air results

With no preselector or pa tuning, this transceiver is very convenient and easy to use. The receiver performed very well with both weak signals on 28MHz and strong signals on 7MHz. With the preamplifier out on 7MHz, signals were very clean with no trace of intermodulation products or overloading. The audio quality was very good. When tuning close to a strong carrier on a quiet band, clicks were audible, in particular when the 100Hz digit changed from 4 to 5. All step synthesizers seem to suffer from this problem, caused by an increase in oscillator sideband noise when the frequency is changing. The IC740, however, seems to be much better than many other synthesized transceivers in this respect, including the IC720A. Tuning steps of 10Hz were generally preferred for both cw and ssb, but the tuning rate is annoyingly slow. A better solution in the reviewer's opinion would be a compromise of 20Hz tuning steps but far more steps/revolution of the tuning knob, such as 500, to give a tuning rate of 10kHz/revolution. On cw, single signal reception could not be obtained unless the pbt or i.f. shift control was offset from the central position. This seemed surprising. Note that cw always tunes as in the lsb mode. The twin vfos were very useful and the agc characteristic very good. The close-in blocking observed during measurements was not obvious in listening tests, but the effect of this type of problem is rather subtle. The phone jack is compatible with stereo headphones.

Good quality reports were received on transmit in conjunction with the IC-HM7 microphone. Slight distortion was obtained with the microphone gain control set high. On cw, local stations reported a clean transmission with no obvious clicks, although at some frequencies very low level sidebands could be heard.

For a short time this transceiver was used in conjunction with the IC2KL linear. With automatic band tracking and no tune-up whatsoever, this combination was a delight to use.

Manual

A 25-page instruction manual is provided which covers installation and operation of the equipment, a circuit diagram and board layouts, but nothing else. The circuit diagram is difficult to follow and appears to have errors.

Conclusion

The IC740 is a small hf transceiver ideally suited for base, portable or mobile operation. The broadband concept makes the equipment very easy to use. The receiver performance is generally good, offering a two-tone dynamic range of over 90dB, good strong signal performance and excellent sensitivity. The reciprocal mixing is good for a synthesized transceiver, but close-in dynamic range is limited by blocking. The transmit power is a little lower than most transceivers.

The current price without psu is £769 incl VAT. The fm board, keyer, marker and cw filters are extra.

Acknowledgements

The reviewer would like to thank G3RQZ and G3UFY for critical on-the-air comments, and Thanet Electronics of Herne Bay for the loan of the review equipment.

References

[1] "The Icom IC720A hf transceiver", P. J. Hart, G3SJX. *Rad Com* February 1982, pp 129-33.

[2] "The Yaesu Musen FT102 hf transceiver" P. J. Hart, G3SJX. *Rad Com* January 1983, pp 32-6.

[3] "The Trio TS830S hf transceiver", P. J. Hart, G3SJX. *Rad Com* July 1982, pp 576-80.

Postscript

Since this review was written, two further models of hf transceiver, the IC751 and the IC745 have been added to the Icom range—*G3SJX*. □

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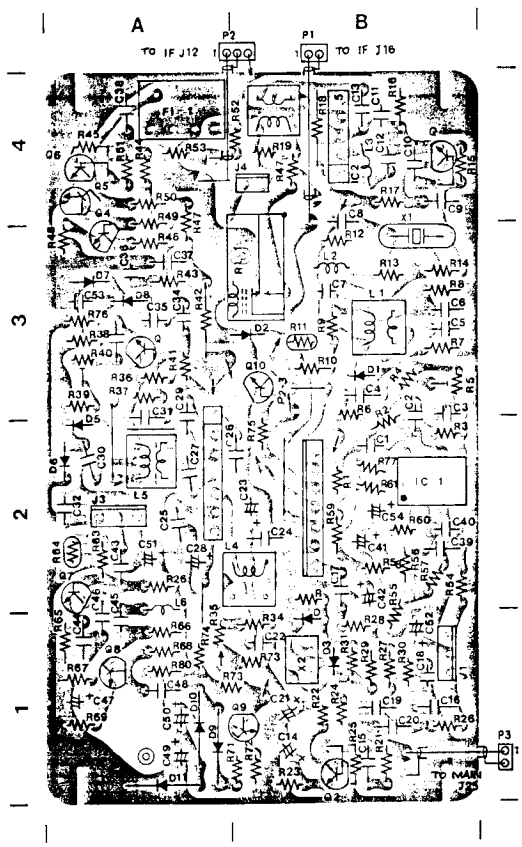

UNIT LAYOUT

F SW-D BOARD
F SW-C BOARD

F DISPLAY BOARD

F VR-B BOARD
F SW-F BOARD

OPTION ELE KEY UNIT
OPTION FM UNIT
MAIN UNIT

IF UNIT FILTER BOARD
IF UNIT
RF UNIT
OPTION MAKER UNIT
RF UNIT 2nd MIXER BOARD

MARKER UNIT

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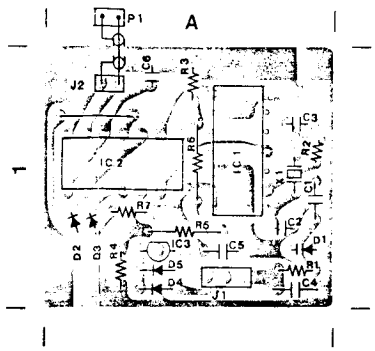

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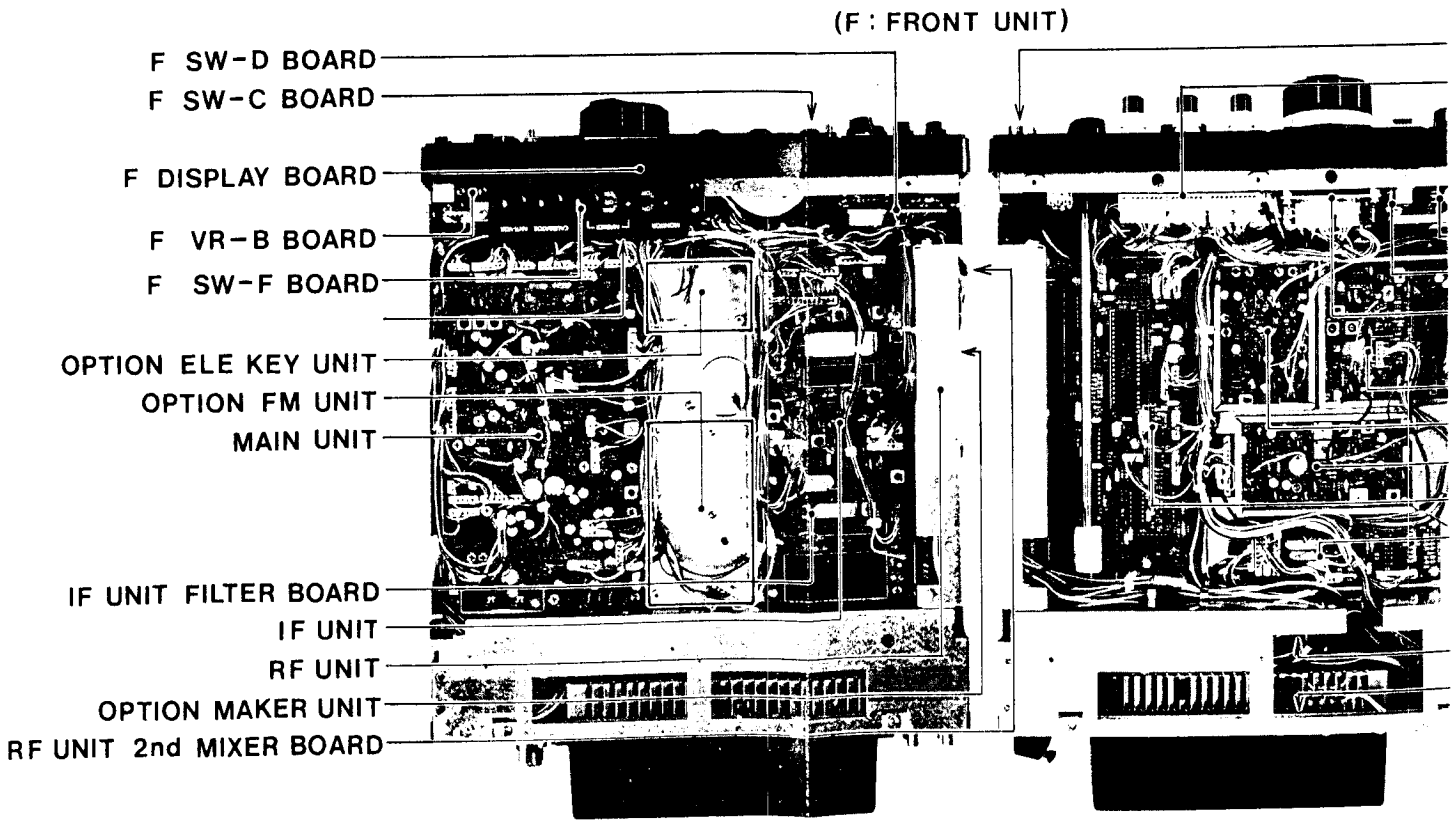

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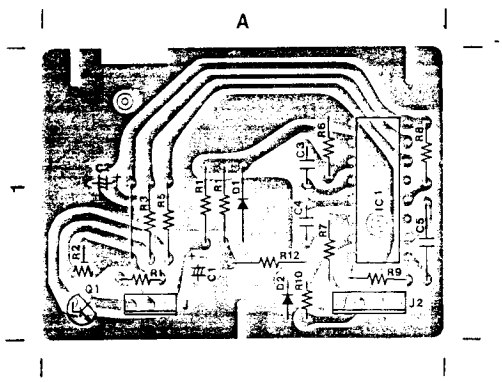
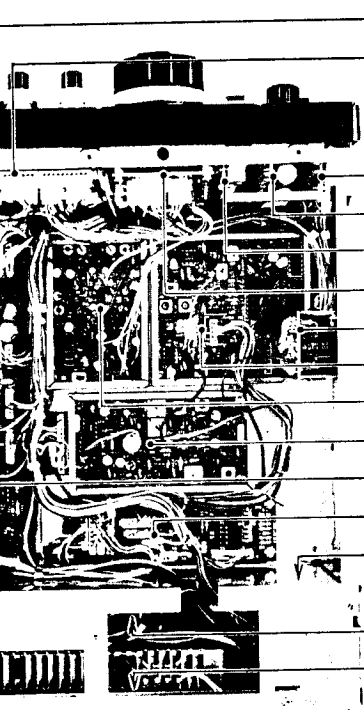
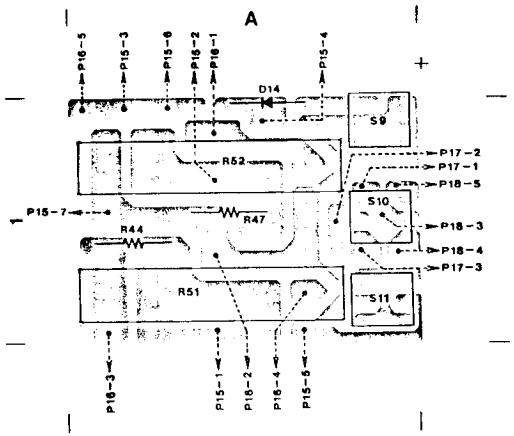




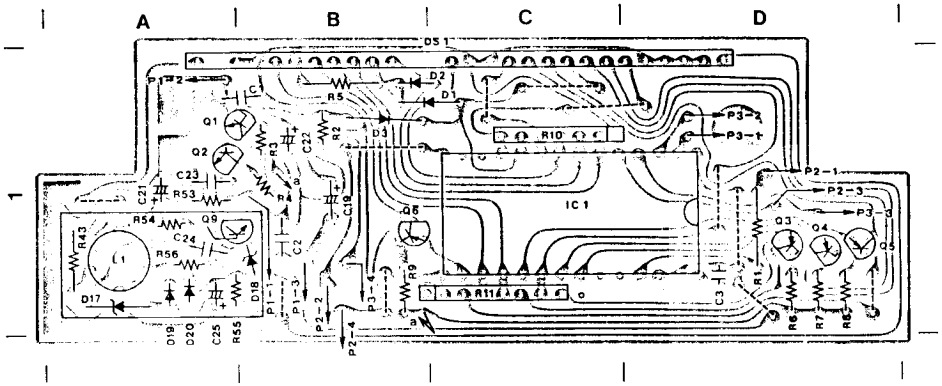
ICOM IC-740 BOARD LAYOUT

FRONT UNIT

■ VR-B BOARD



■ DISPLAY BOARD



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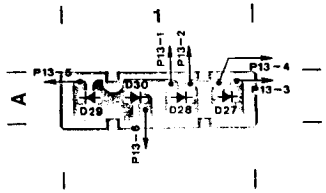
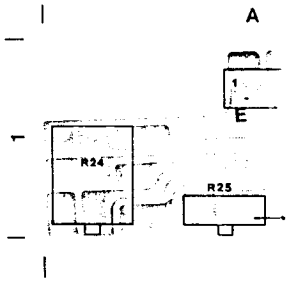


■ VR-C BOA



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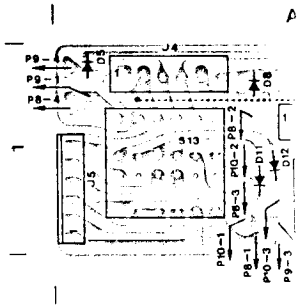

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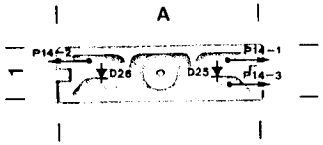

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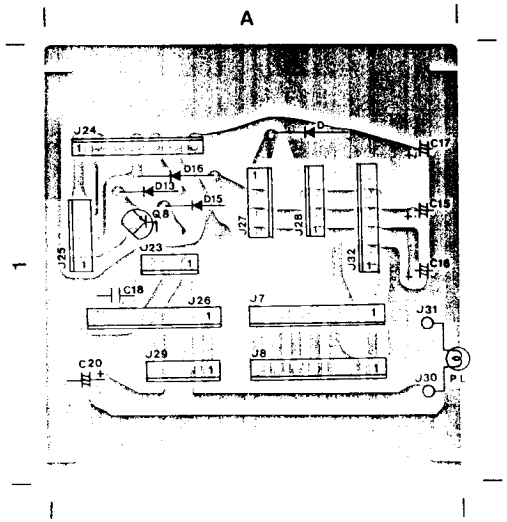

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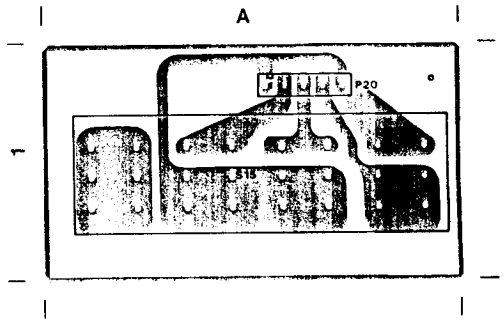

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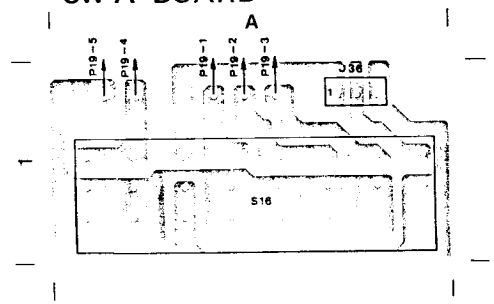
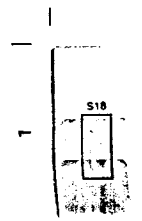




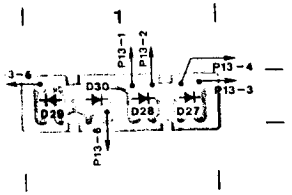
MAIN UNIT

A | B | C | D | E | F | G

UF UNIT

AYOUT

■ LED BOARD



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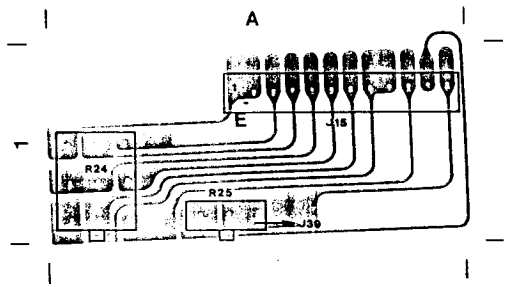

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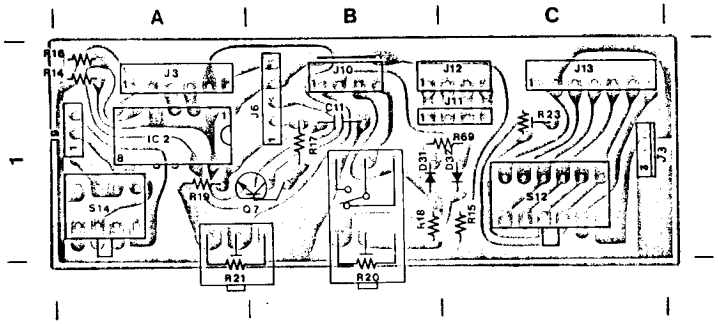

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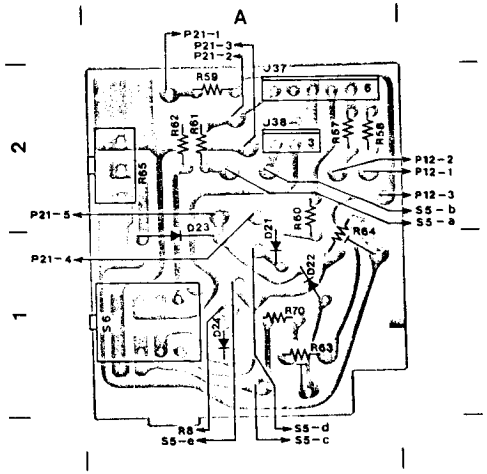

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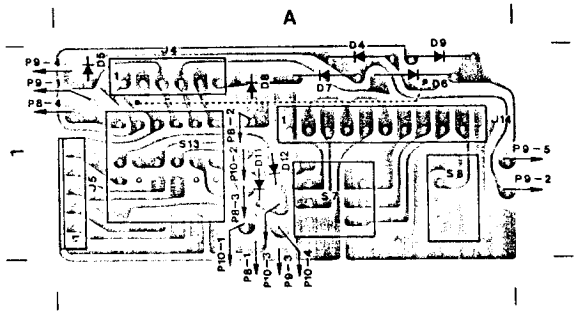

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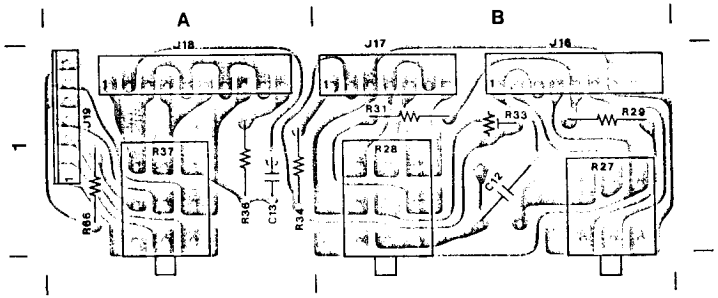

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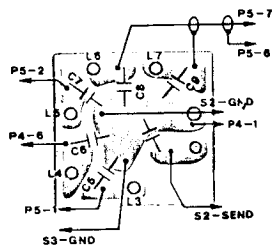

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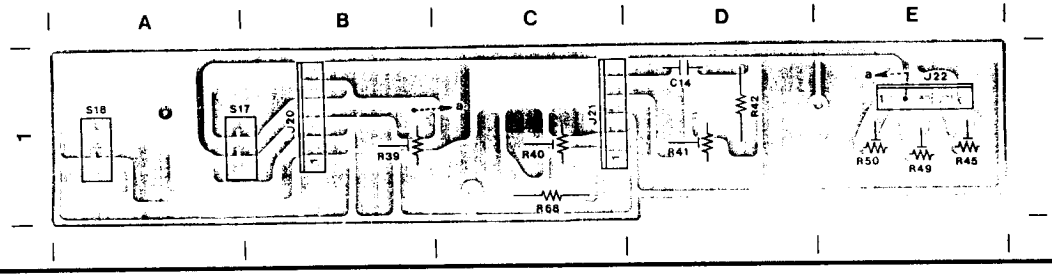

For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
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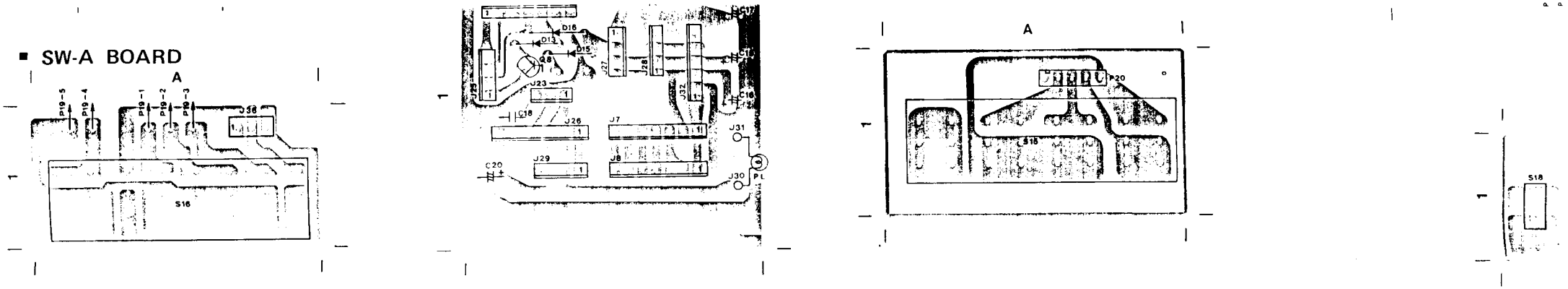
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

■ SW-A BOARD



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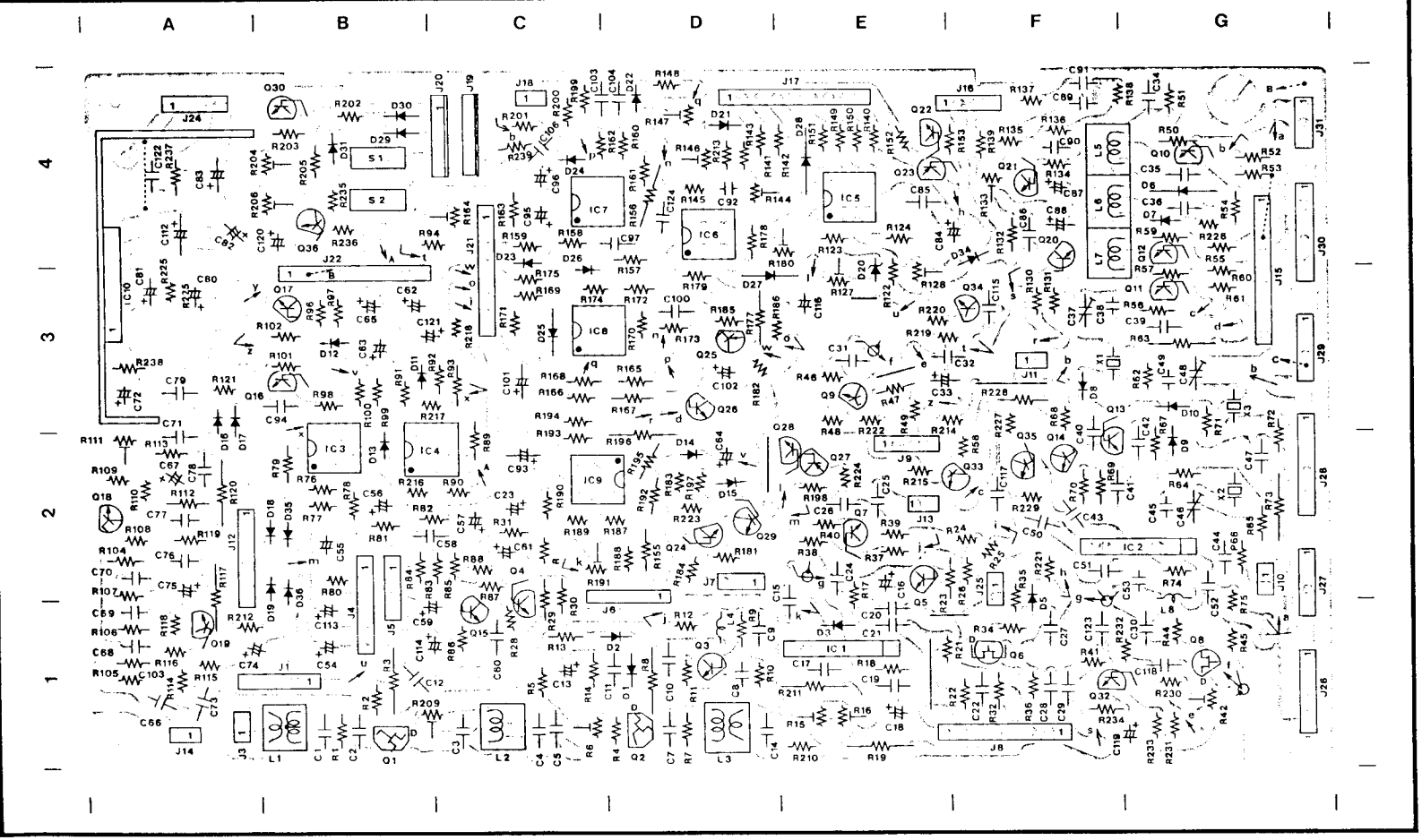
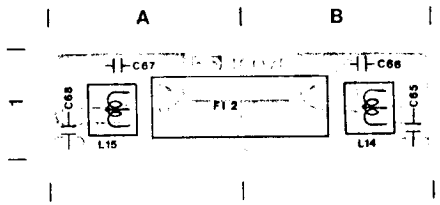


RF UNIT

■ FILTER BOARD



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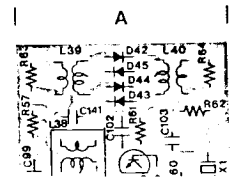

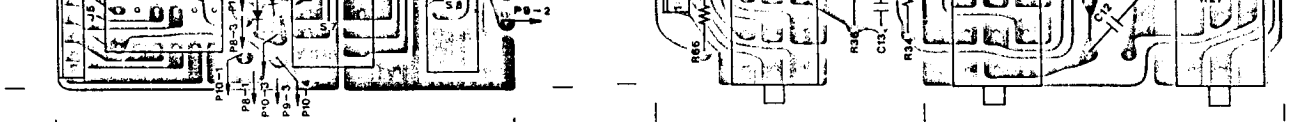

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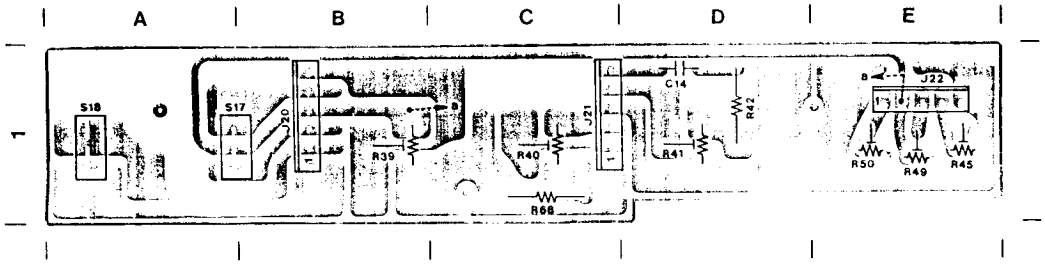

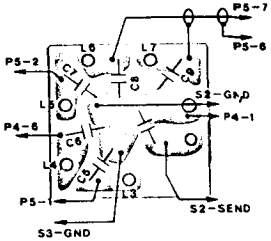

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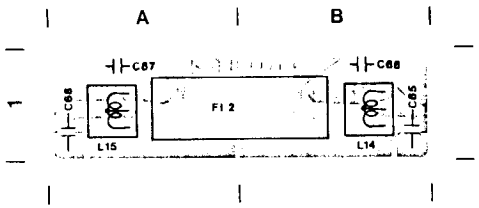

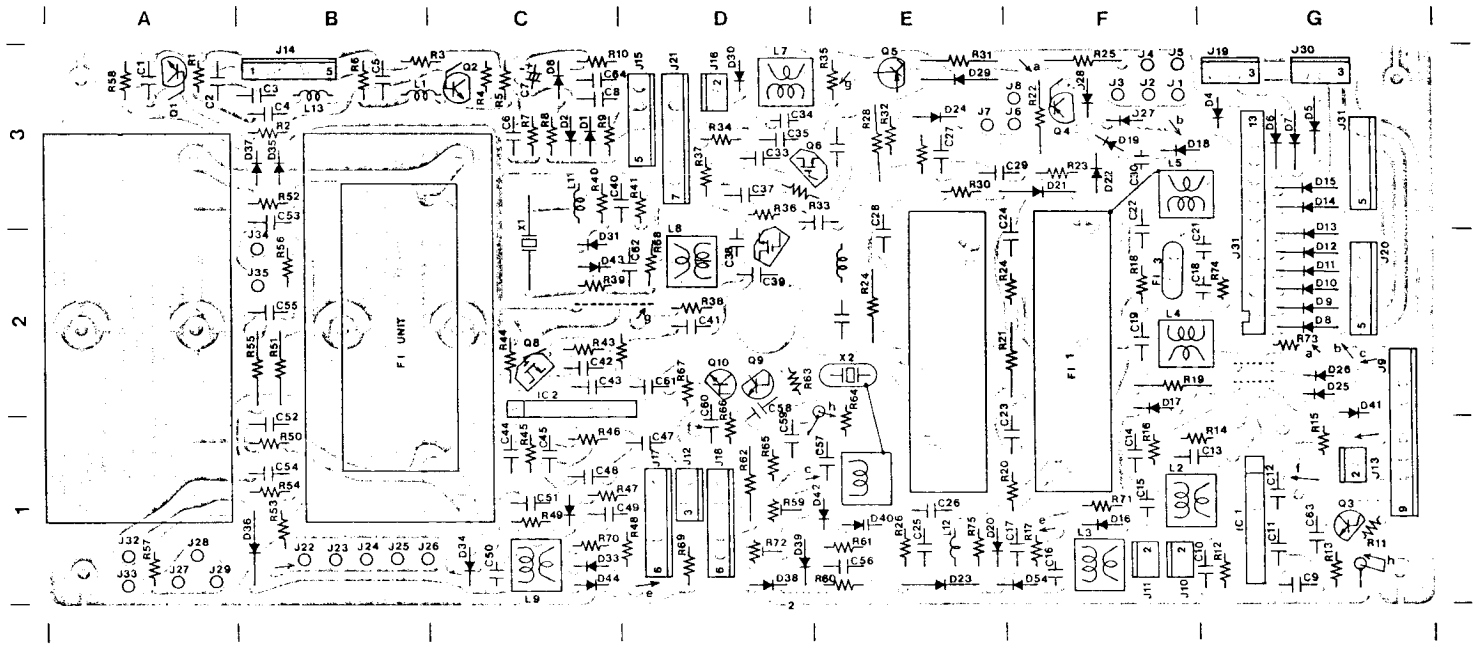

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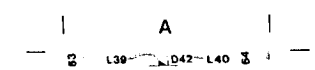

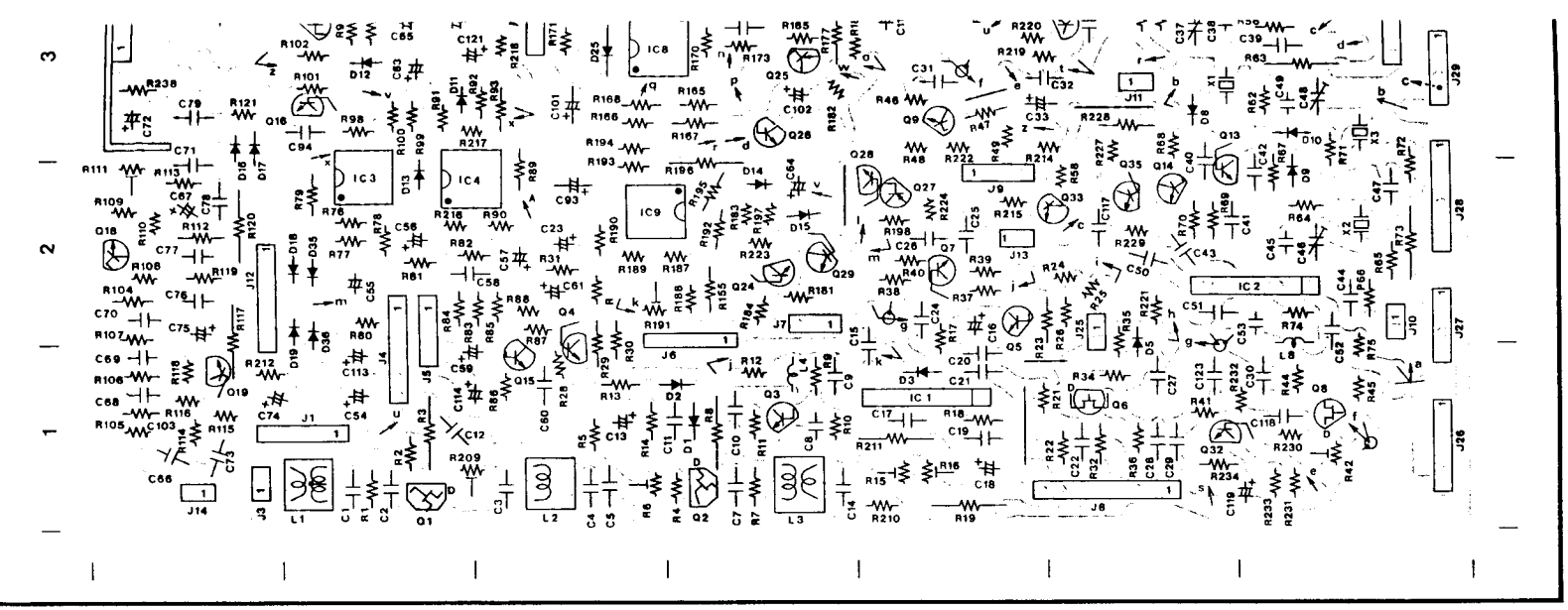

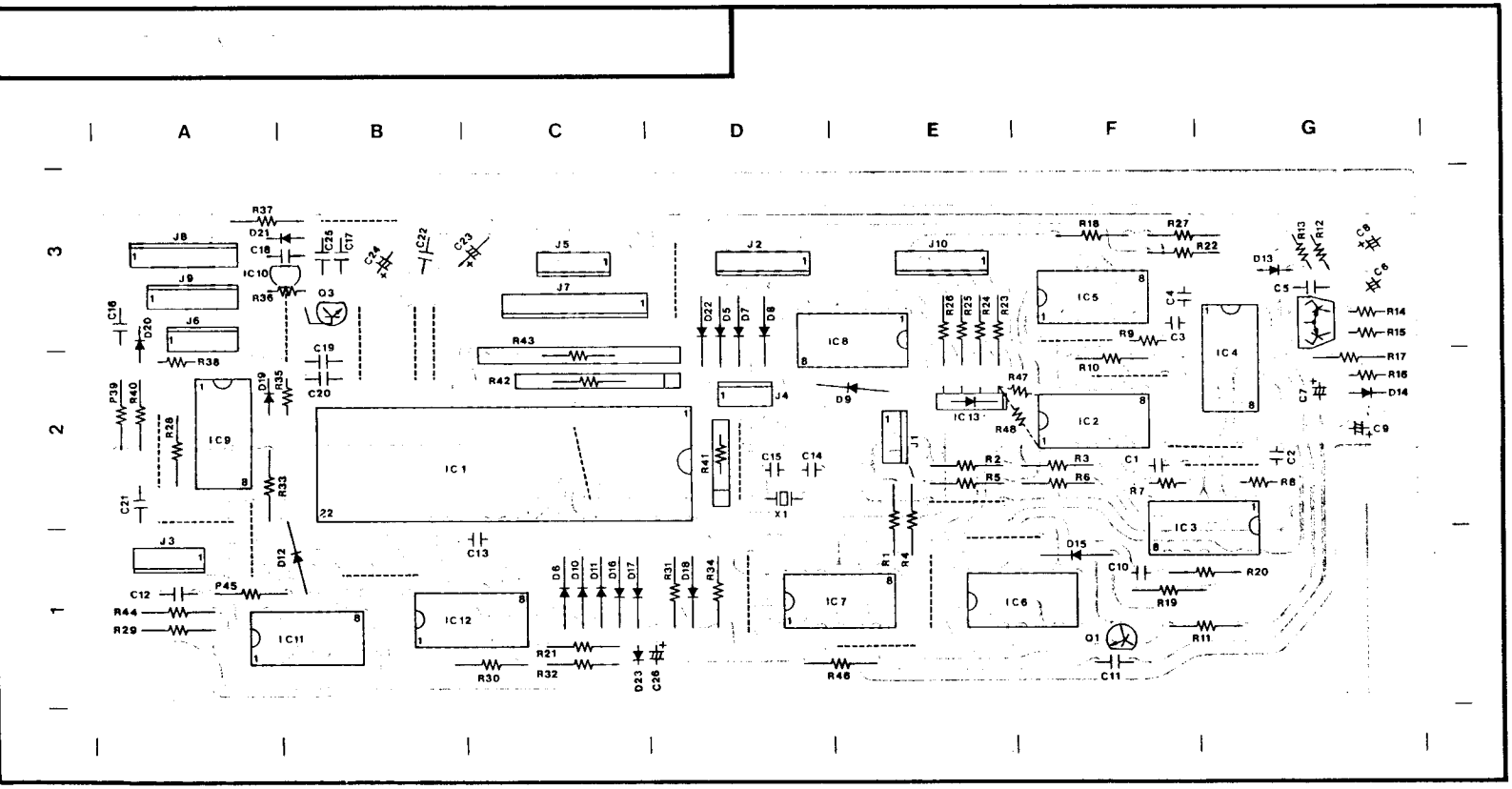

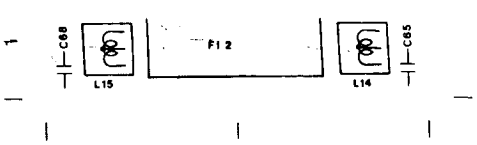

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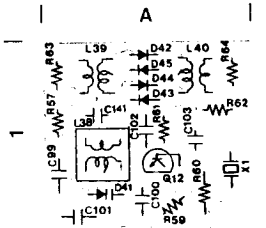

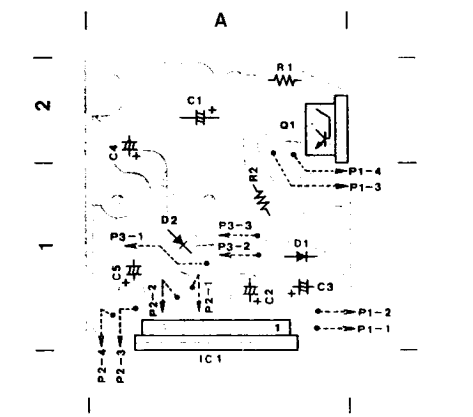

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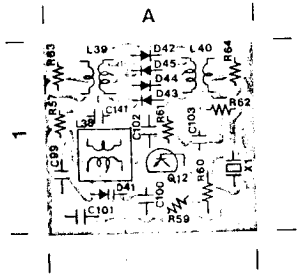

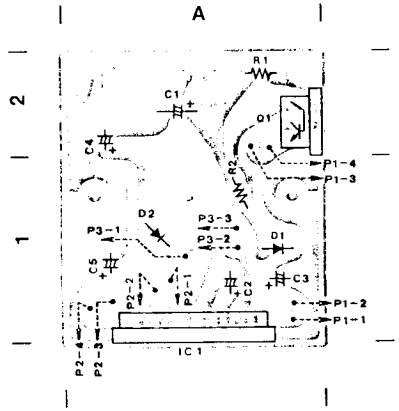

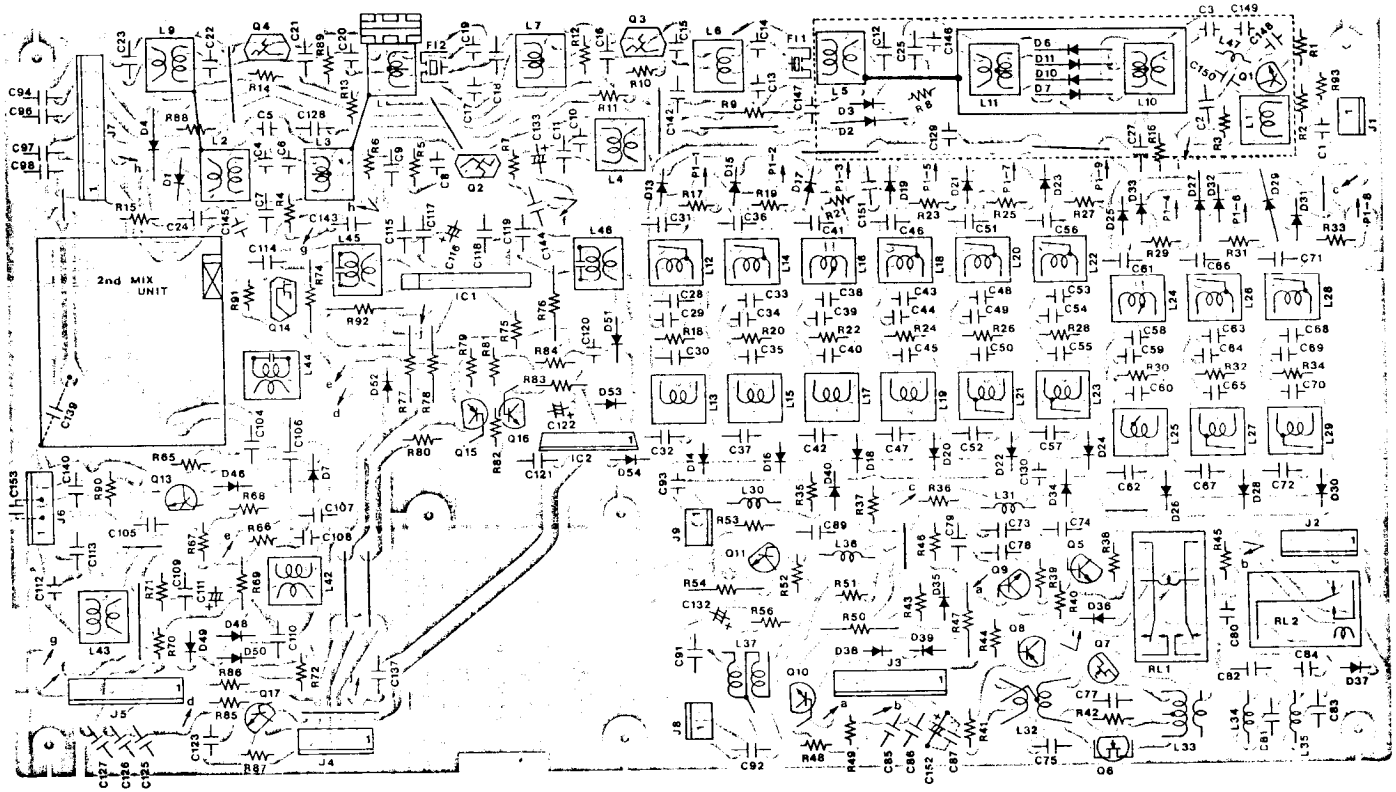

KEY HACK UNIT