

SERVICE MANUAL



MODELS M400
M400E

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M400 ALIGNMENT PROCEDURE

Equipment Required

FM Signal Generator
AC Voltmeter capable of reading 455 KHz
Frequency Counter
DC Voltmeter, preferably digital type

A. VCO Adjustment

1. Program 512 MHz into Channel 9.
2. Adjust L203 for a voltage of 14.0 volts at the Junction of R211 and C227.
3. Program 144 MHz into Channel 9. Voltage at Junction of R211 and C227 should read 1.3 to 2.7 volts.
4. Program 50 MHz into Channel 9.
5. Adjust L201 for a voltage of 17.0 volts at Junction of R211 and C227.
6. Program 30 MHz into Channel 9. Voltage at Junction of R211 and C227 should read 1.8 to 3.2 volts.

B. Netting Adjustment (VCO Bd.)

1. Program 40.3 MHz into Channel 1.
2. Adjust C202 for a frequency of 51.0000 MHz (+150 Hz) at Junction of R224 and R225.

C. Receiver - Low Band

1. Program 39.8 MHz into Channel 1.
2. With Signal Generator (no modulation) accurately set on frequency, tune L102 and L103 (in that order) for MAXIMUM signal on TP101. Reduce generator's output if necessary to properly peak these coils.
3. Very carefully tune L112 for MAXIMUM signal on TP101.
4. Modulate signal with 1 KHz modulation 3 KHz deviation. Tune L114 for MAXIMUM audio.

D. Receiver - UHF Band

1. Program 465 MHz into Channel 1.
2. Accurately set Signal Generator to 465 MHz.
3. Adjust C136, C143, C132 and L108 (in that order) for MAXIMUM signal on TP101. Repeat until no improvement is noted.

E. Receiver - High Band

1. Program 159.9 MHz into Channel 1.
2. Set core of L106 in approximately 6 turns from flush with top of coil form.
3. Accruately set Signal Generator to 159.9 MHz.
4. Tune L105, L106 and L107 (in that order) for MAXIMUM signal on TP101.

M400E ALIGNMENT PROCEDURE

A. VCO Adjustment

1. Program 512 MHz into Channel 9.
2. Adjust L203 for a voltage of 14.0 volts at the Junction of R211 and C227 (Brown wire).
3. Program 144 MHz into Channel 9. Voltage at Junction of R211 and C227 should read 1.3 to 2.7 volts.
4. Program 90 MHz into Channel 9.
5. Adjust L201 for a voltage of 17.0 volts at Junction of R211 and C227.
6. Program 66 MHz into Channel 9. Voltage at Junction of R211 and C227 should read 1.8 to 3.2 volts.

B. Netting Adjustment (VCO Bd.)

1. Program 77.7 MHz into Channel 1.
2. Adjust C202 for a frequency of 67.0000 MHz (+150 Hz) at Junction of R224 and R225.

C. Receiver - Mid Band

1. Program 78 MHz into Channel 1.
2. With Signal Generator (no modulation) accurately set on frequency, tune L102 and L103 (in that order) for MAXIMUM signal on TP101. Reduce generator's output if necessary to properly peak these coils.
3. Very carefully tune L112 for MAXIMUM signal on TP101.
4. Modulate signal with 1 KHz modulation 3 KHz deviation. Tune L114 for MAXIMUM audio.

D. Receiver - UHF Band

1. Program 465 MHz into Channel 1.
2. Accurately set Signal Generator to 465 MHz.
3. Adjust C136, C143, C132 and L108 (in that order) for MAXIMUM signal on TP101. Repeat until no improvement is noted.

E. Receiver - High Band

1. Program 159.9 MHz into Channel 1.
2. Set core of L106 in approximately 6 turns from flush with top of coil form.
3. Accurately set Signal Generator to 159.9 MHz.
4. Tune L105, L106 and L107 (in that order) for MAXIMUM signal on TP101.

M400 SPECIAL RF ALIGNMENT PROCEDURE
HIGH BAND (133-167 MHz), UHF (380-480 MHz)

NOTE: Connect jumper from Pin 9 of IC109 to ground. Holes are provided (see part placement), this jumper will allow you to enter frequencies outside the normal frequency range of the receiver.

A. VCO Adjustment

1. Program 480 MHz into Channel 9.
2. Adjust L203 for a voltage of 14.0 volts (DVM) at the Junction of R211 and C227.

A. VCO Adjustment Continued

3. Program 135 MHz into Channel 9. Voltage at Junction of R211 and C227 should read 1.3 to 2.7 volts (DVM).

B. UHF Band (380-480 MHz)

1. Program 430.1 MHz into Channel 1.
2. Adjust C136, C143, C132 and L108 (in that order) for MAXIMUM signal on TP101. Repeat until no improvement is noted.
3. Check 12 db SINAD sensitivity or 14 db Quieting - (.6 uv).

C. High Band (133-167 MHz)

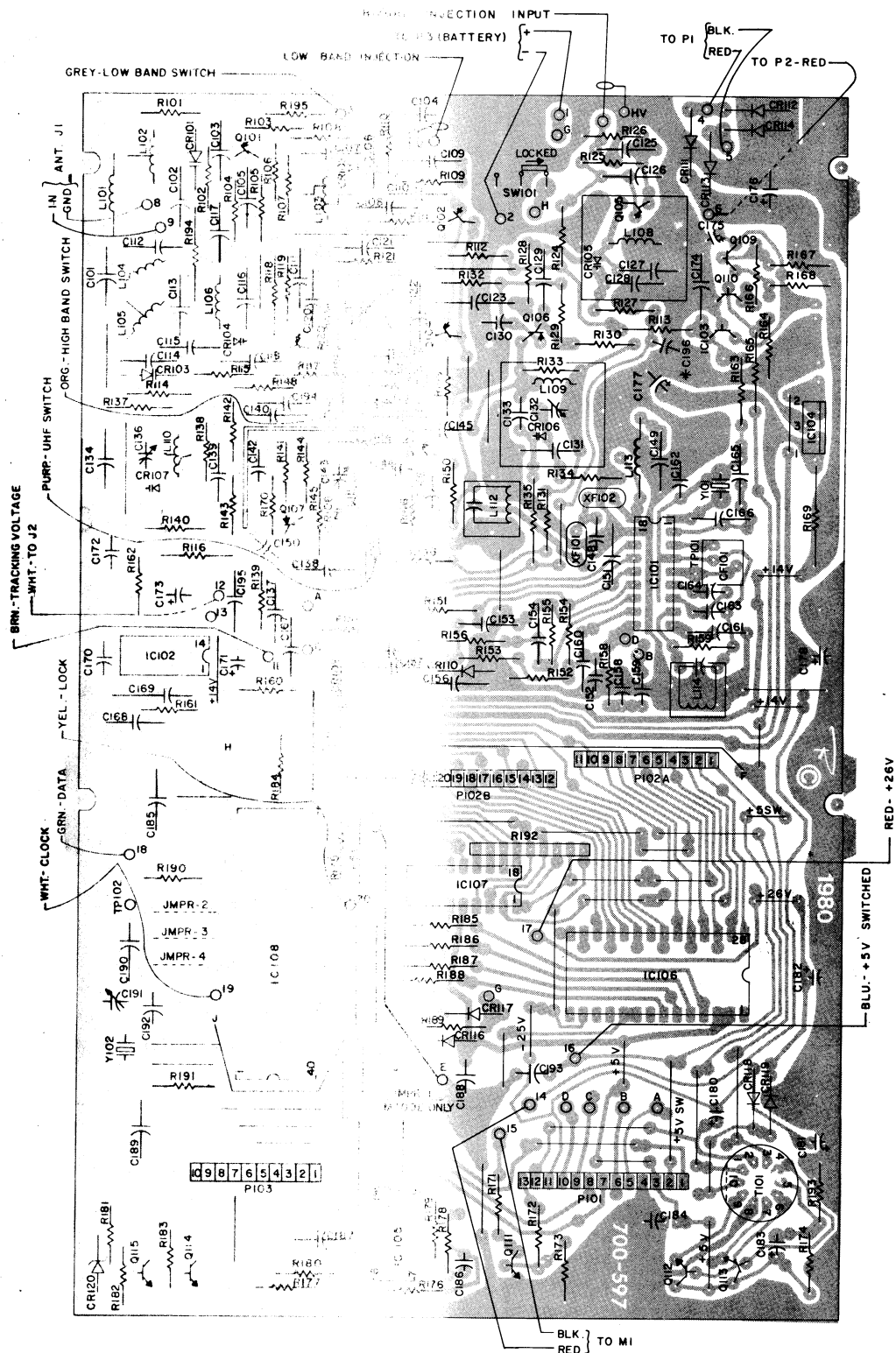
1. Program 145.9 MHz into Channel 1.
2. Set core of L106 in approximately 6 turns from flush with top of coil form.
3. Tune L105, L106 and L107 (in that order) for MAXIMUM signal on TP101.
4. Check sensitivity (.6 uv).

NOTE: On B. (UHF Band) and C. (High Band) Alignment: If your frequencies favor just a portion of the band, you can select a frequency near the center of frequencies of interest for tune-up and follow the above procedure.

10.8 MHz IF Conversion

1. Connect a jumper from Pin 13 of IC109 to ground. Holes are provided, (see parts placement).
2. Replace Y101 with a 10.345 MHz crystal, (Regency Part Number 2301-3151-605).
3. Replace XF101 and XF102 with a 10.8 MHz filter, (Regency Part Number 2705-3271-800).
4. Readjust L112; See Alignment, Step C3. (This step is not usually necessary for proper performance).

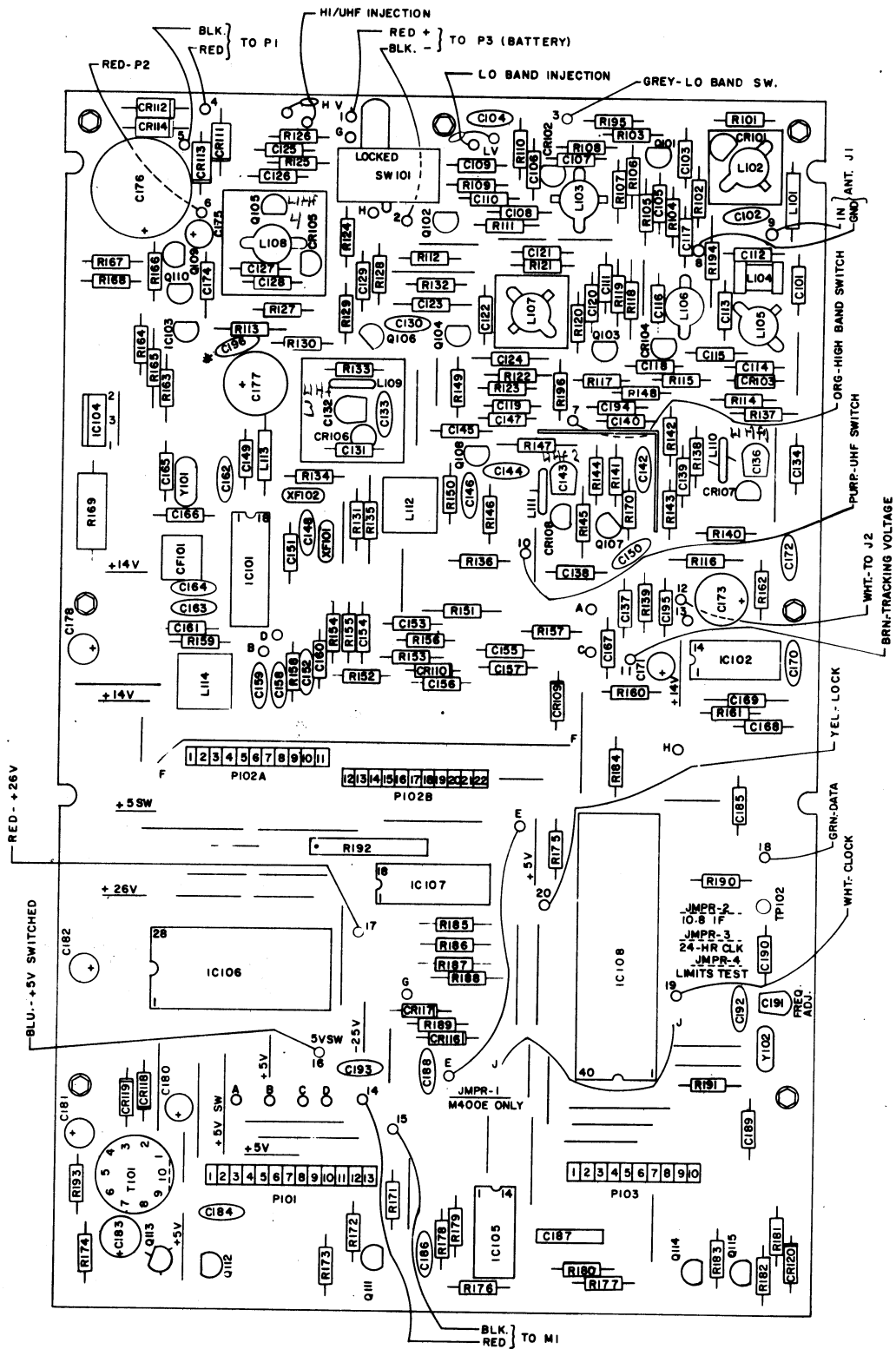
MAIN BOARD 700-597



NOTE: LETTERS, EXCEPT H, V & L, V DESIGNATE POINT-TO-POINT (JUMPER) WIRING ON BOARD.
 ALL OFF-BOARD WIRING CONNECTS TO THE VCO BOARD UNLESS NOTED OTHERWISE.
 *C196 NOT USED ON SOME MODELS.

EARLY MODELS

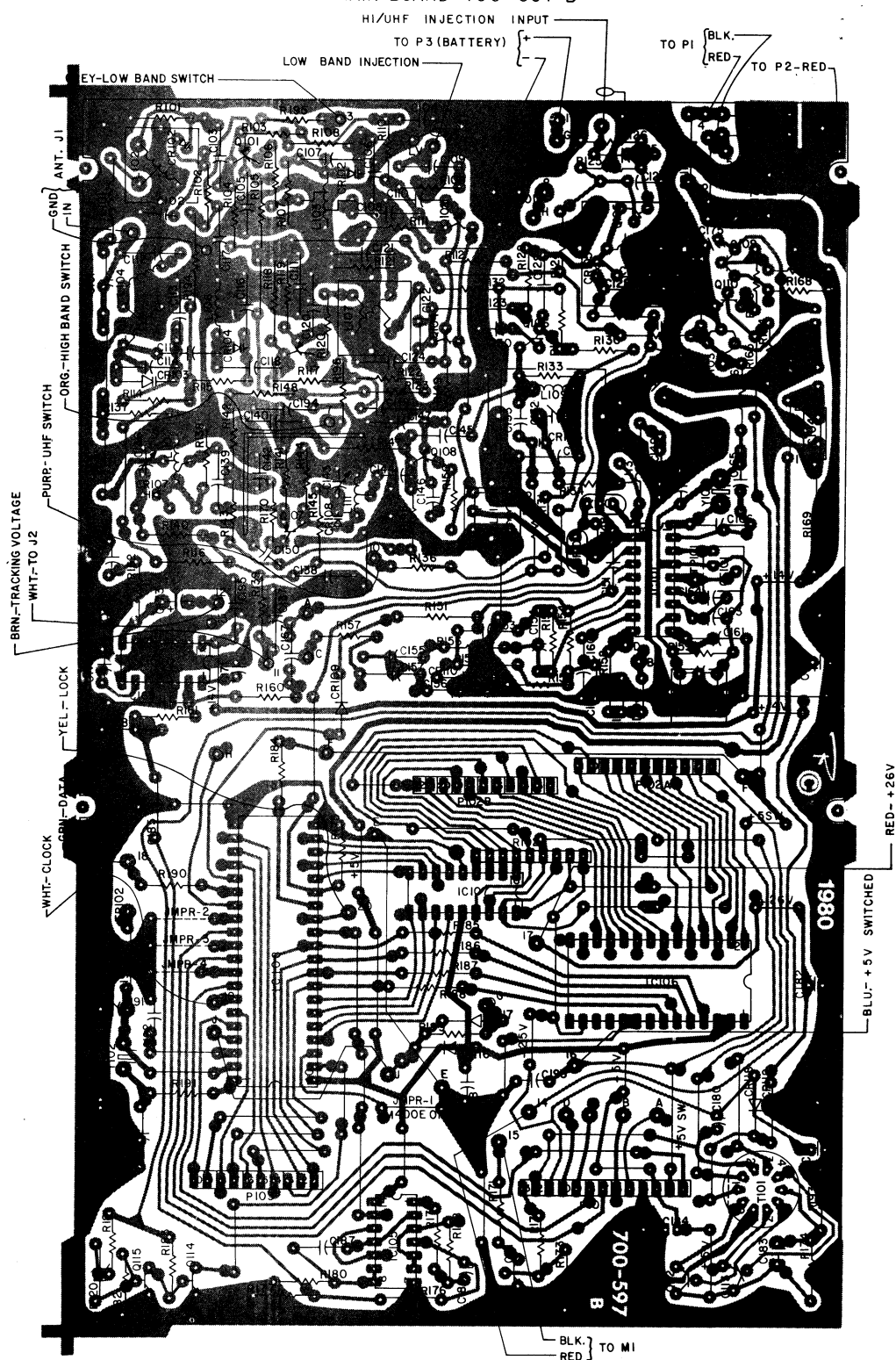
MAIN BOARD 700-597 B



NOTE: LETTERS, EXCEPT H V & LV, DESIGNATE POINT-TO-POINT (JUMPER) WIRING ON BOARD.
 ALL OFF-BOARD WIRING CONNECTS TO THE VCO BOARD UNLESS NOTED OTHERWISE.
 * C196 NOT USED ON SOME MODELS.

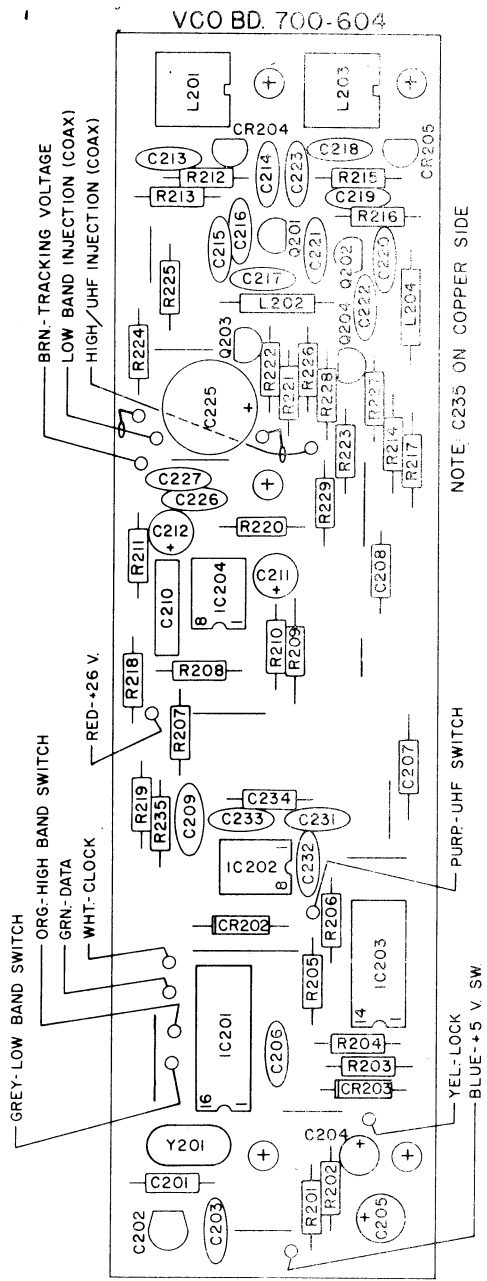
LATER MODELS

MAIN BOARD 700-597 B

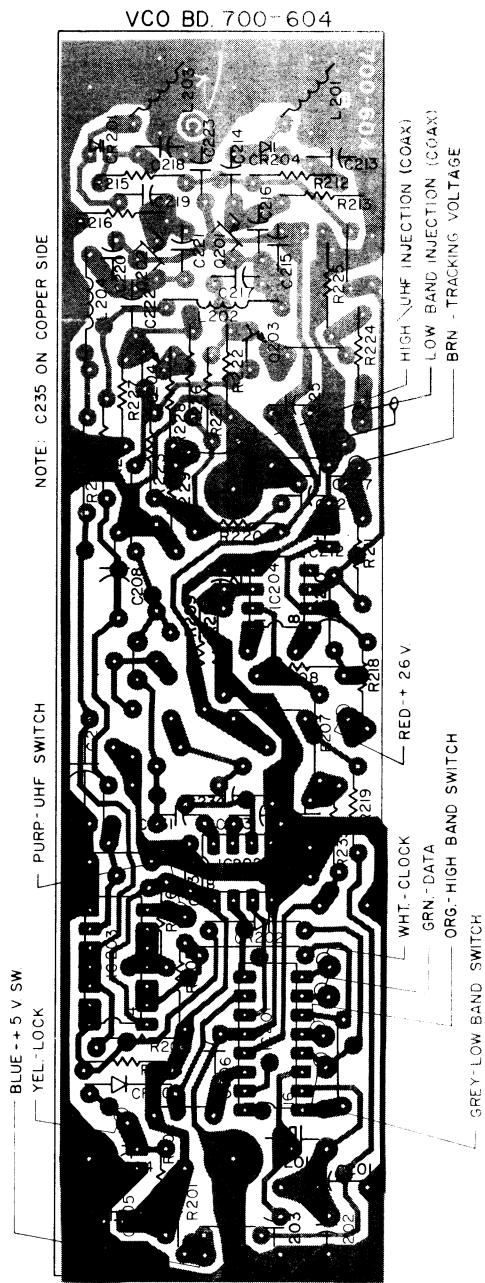


NOTE: LETTERS, EXCEPT HV & LV, DESIGNATE POINT TO POINT (JUMPER) WIRING ON BOARD.
 ALL OFF-BOARD WIRING CONNECTS TO THE VCO BOARD UNLESS NOTED OTHERWISE.
 *C196 NOT USED ON SOME MODELS.

LATER MODELS

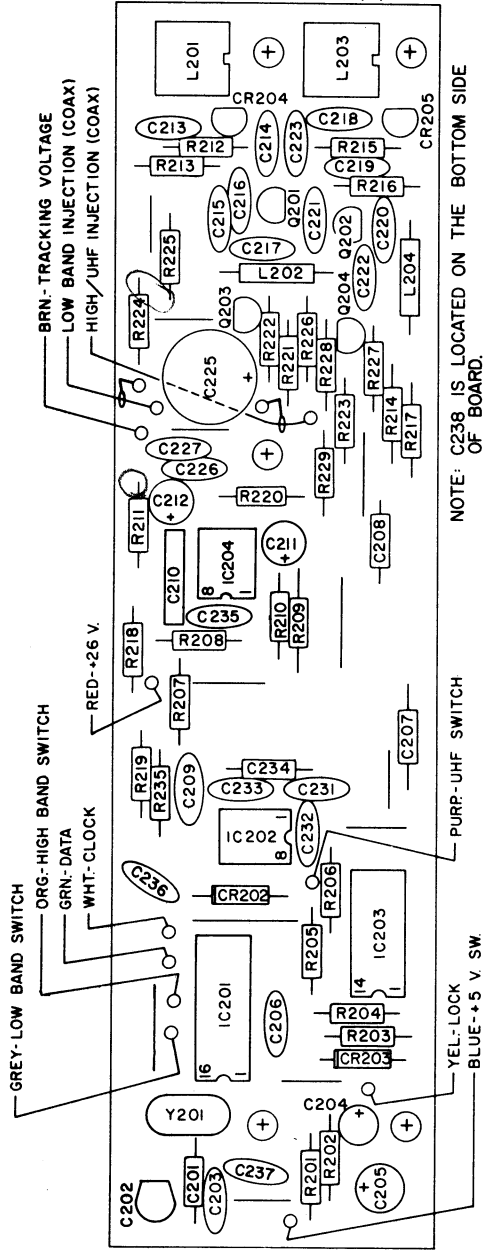


EARLY MODELS



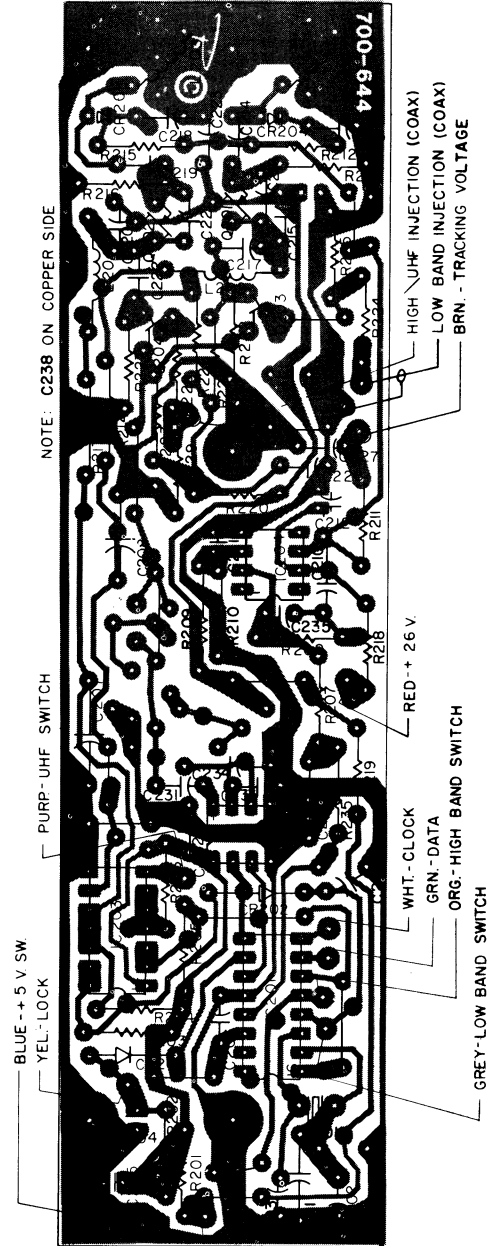
EARLY MODELS

VCO BD. 700-644



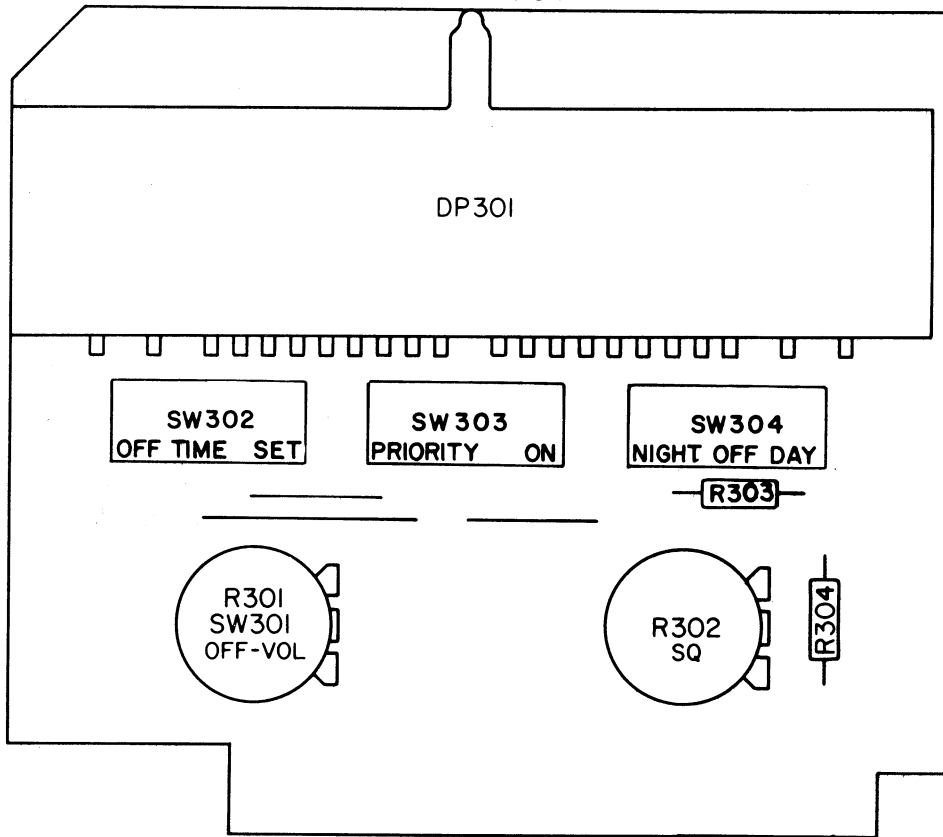
LATER MODELS

VCO BD. 700-644

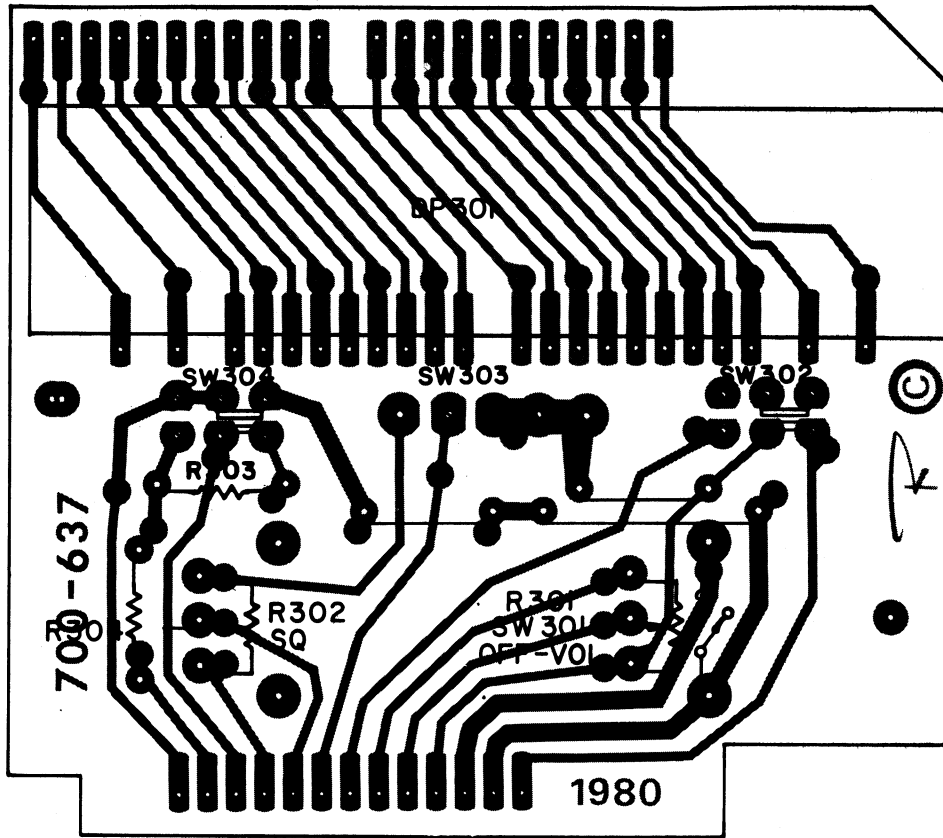


LATER MODELS

DISPLAY BD.
700-637



DISPLAY BD.
700-637



NOTE: SW302 & SW304 ARE 3-POSITION SWITCHES

M400

All voltages taken with Digital Voltmeter. Receiver on Manual, Channel 101, unless otherwise indicated.

	Emitter (source)	Base (gate)	Collector (drain)
Q101 (Lo Band)	5.0	4.2	.28
Q102 (Lo Band)	6.3	5.5	0
Q103 (Hi Band)	5.0	4.2	.28
Q104 (Hi Band)	6.3	5.5	0
Q105	3.7	3.9	0
Q106 (UHF)	5.4	7.2	.4
Q107 (UHF)	7.0	6.2	0
Q108	6.1	5.3	0.1
Q109	16	15.2	15.9
Q110	0	0.7	0.1
Q111	0	0 (day)	16 (day)
		0.7 (night)	0.1 (night)
Q112	.02	1.2	5.0
Q113	.02	1.2	5.0
Q114	0	0.6	5.0
Q115	0	0.8	0.6

Pins	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
IC101	7.8	7.3	7.6	7.8	1.0	1.0	1.0	7.8	2.6	1.9	0.8	2.4	2.5	0	6.6	0	0	2.0

Pins	1	2	3	4	5	6	7	8	9	10	11	12	13	14
IC102	8.3	0.1	0	0	0	0.1	0	8.0	0	0	0	0	0	16

Pins	1	2	3
IC103	16	0	8.0

Pins	1	2	3
IC104	14.5	0	5.0

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14
 IC105 4.8 0 5.0 0 5.0 5.0 0 0 0 5.0 0 5.0 5.0 5.0

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
 IC106 -25V 5.0 5.0 0.3 0.3 0.4 .4 0 0 0 2.0 -22 -27 -27 -25 -25 -25 -25 -25

21 22 23 24 25 26 27 28
 -25 -25 -25 -25 -25 -25 -25 -25

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
 IC107 -18 -14 -16 -12 5.0 1.7 1.2 1.5 1.0 1.7 1.6 2.0 .26 0 -25 -10 -27 -12

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
 IC108 2.1 1.5 1.0 4.8 5.0 5.0 5.0 0 0 5.0 0 5.0 5.0 0.1 0.1 5.0 5.0 5.0 0

21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40
 0 0.3 2.0 1.7 1.7 6.6 5.0 5.0 5.0 1.2 1.2 1.5 1.5 1.0 1.5 1.2 1.7 0 5.0 5.0

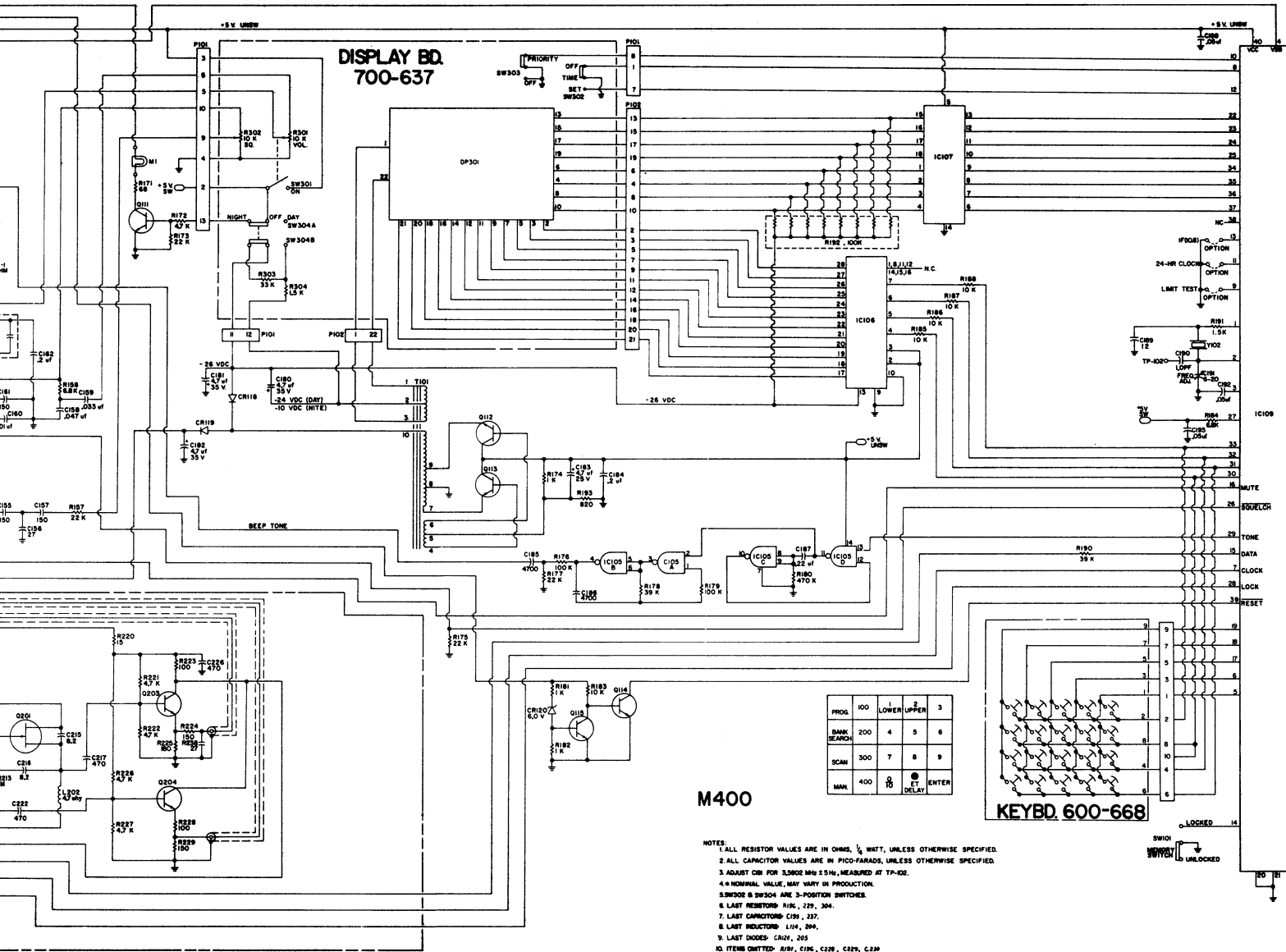
	Emitter (source)	Base (gate)	Collector (drain)
Q201 (FET)	3.1	0	4.9
Q202 (FET)	3.0	0	4.9
Q203	1.5	2.3	3.5
Q204	1.5	2.3	3.5
Q205	1.0	1.7	2.6

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 IC201 5.0 5.0 5.0 2.4 0 0 5.0 3.0 5.0 5.0 0.2 0.1 8.0 2.3 2.2 4.9

Pins 1 2 3 4 5 6 7 8
 IC202 2.3 2.3 3.8 0 0 0 3.0 4.9

Pins 1 2 3 4 5 6 7 8 9 10 11 12 13 14
 IC203 5.0 5.0 0.2 0.2 0.2 3.1 0 8.0 0.1 0.1 0.1 5.0 5.0 5.0

Pins 1 2 3 4 5 6 7 8
 IC204 0 2.3 2.3 0 0 7.9 21 9.2



**DISPLAY BD.
700-637**

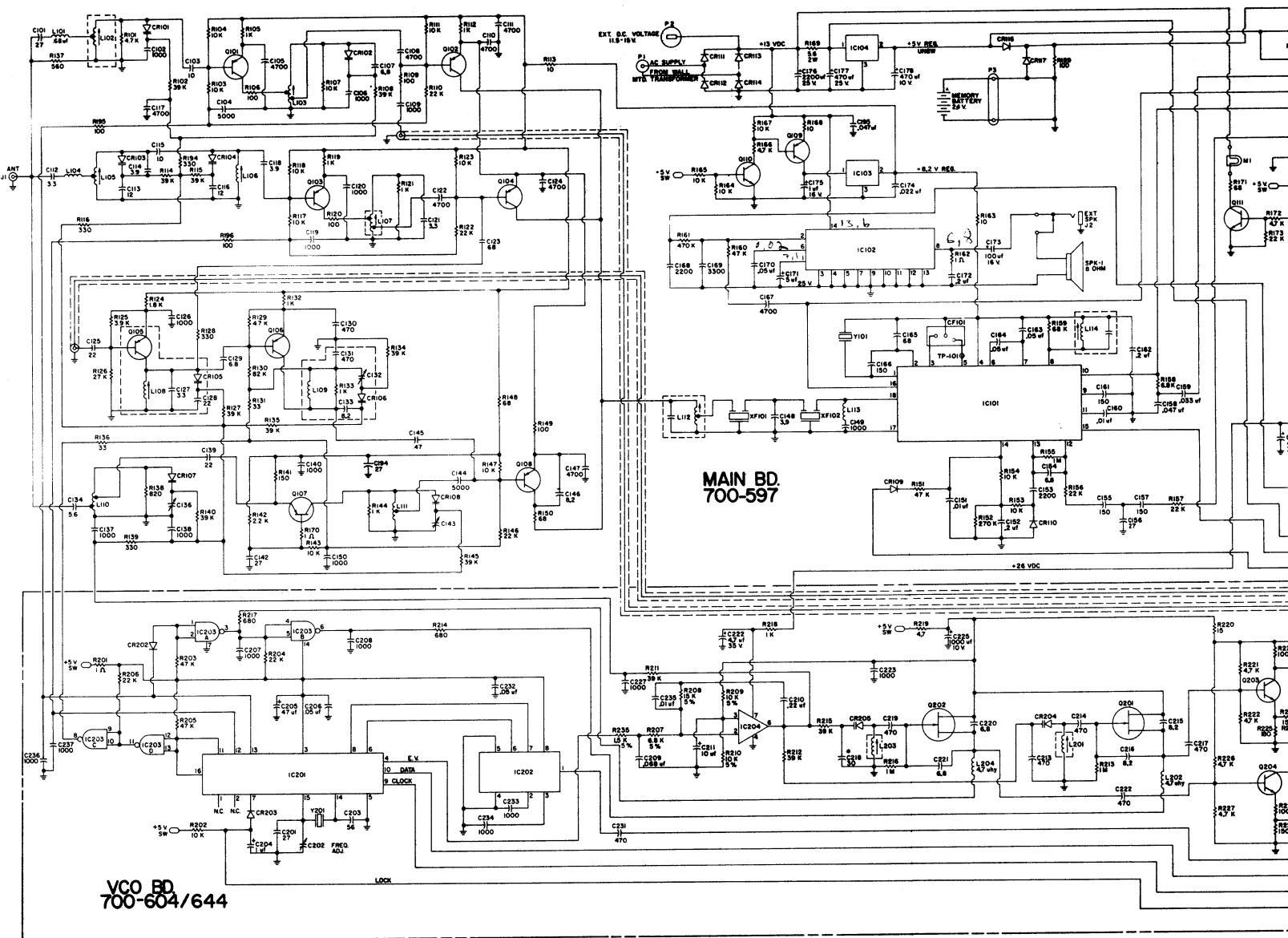
M400

KEYBD. 600-668

PRG#	100	LOWER	UPPER	2	3
BANK SEARCH	200	4	5	6	
SCAN	300	7	8	9	
MAX	400	0	10	ENTER DELAY	

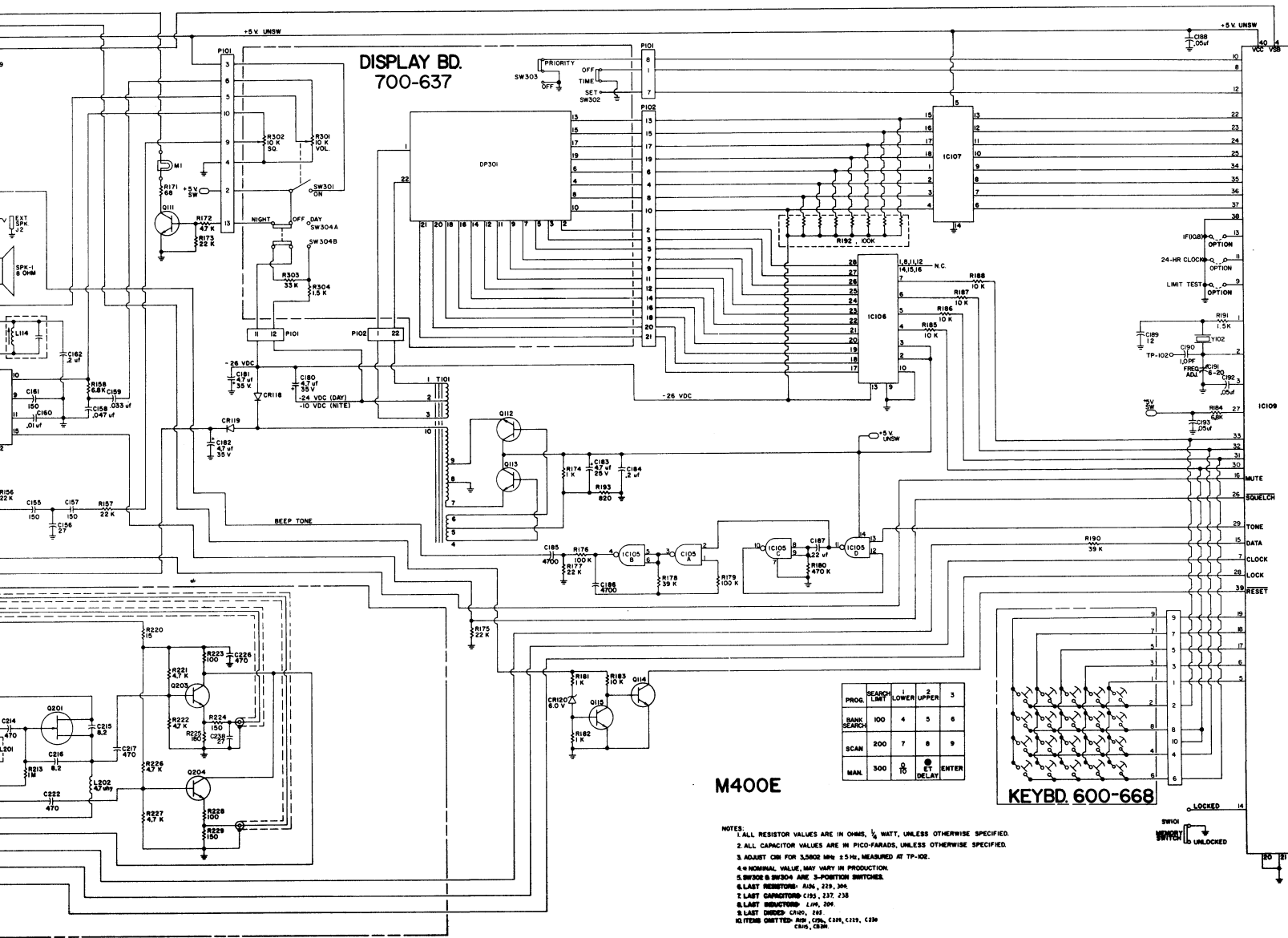
- NOTES:
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4 WATT, UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITOR VALUES ARE IN PICO-FARADS, UNLESS OTHERWISE SPECIFIED.
 3. ADJUST C18 FOR 3,500 Hz ± 5%, MEASURED AT TP-102.
 4. * NOMINAL VALUE, MAY VARY IN PRODUCTION.
 5. SW302 & SW303 ARE 3-POSITION SWITCHES.
 6. LAST RESISTORS: R136, 229, 304.
 7. LAST CAPACITORS: C196, 237.
 8. LAST INDUCTORS: L114, 204.
 9. LAST DIODES: CR27, 205.
 10. ITEMS OMITTED: R111, C186, C229, C229, C239, C240, C240.





MAIN BD.
700-597

VCO BD
700-604/644



**DISPLAY BD.
700-637**

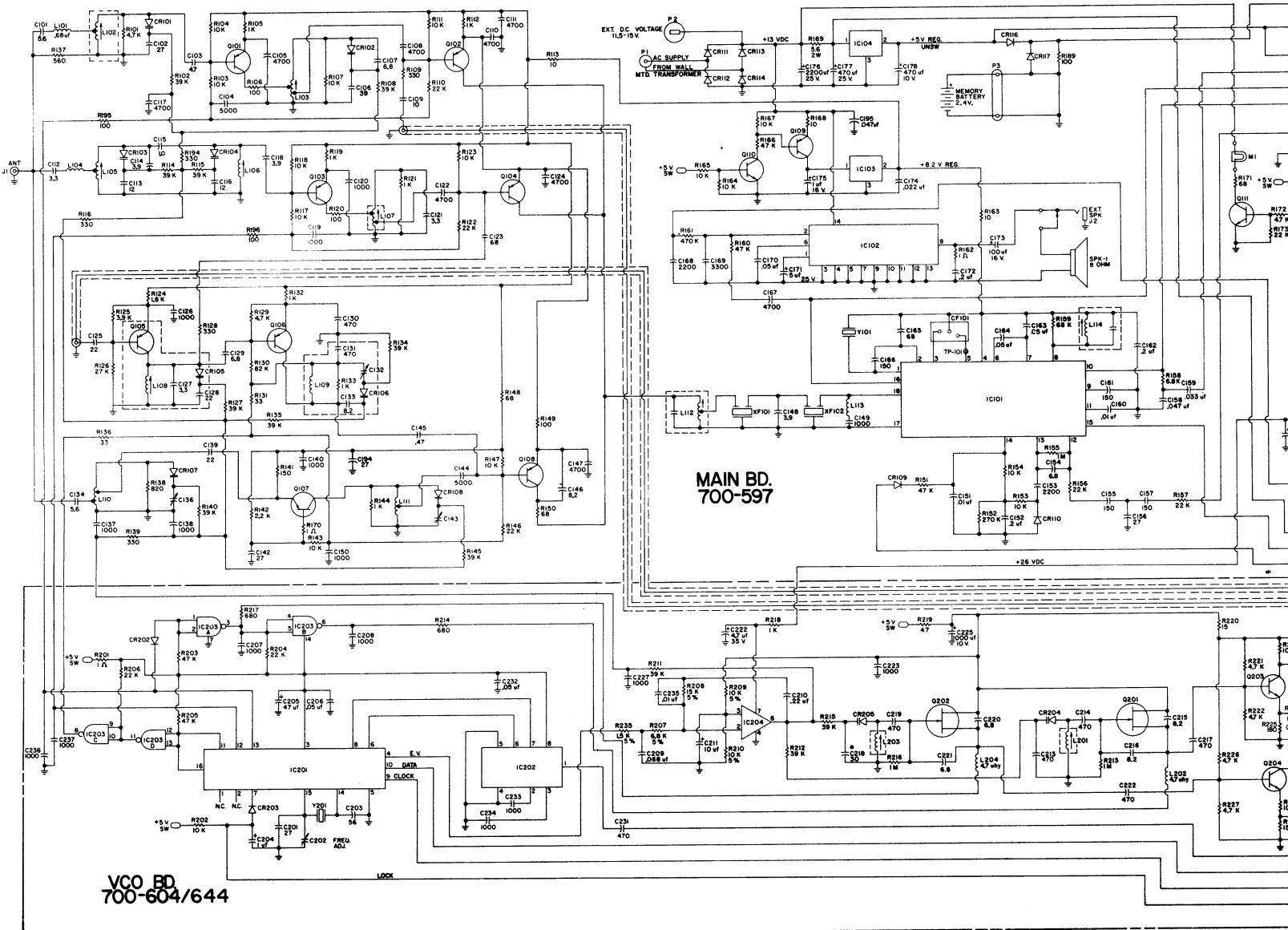
M400E

KEYBD. 600-668

PROG.	SEARCH	1	2	3
BANK	LOWER	4	5	6
SEARCH	UPPER	7	8	9
SCAN	0	10	ENTER	DELAY
MAX.	0	10	ENTER	DELAY

- NOTES:
1. ALL RESISTOR VALUES ARE IN OHMS, $\frac{1}{2}$ WATT, UNLESS OTHERWISE SPECIFIED.
 2. ALL CAPACITOR VALUES ARE IN PICO-FARADS, UNLESS OTHERWISE SPECIFIED.
 3. ADJUST C101 FOR 3.5802 MHz \pm 5 Hz, MEASURED AT TP-102.
 4. ϕ NOMINAL VALUE, MAY VARY IN PRODUCTION.
 5. SW302 & SW304 ARE 3-POSITION SWITCHES.
 6. LAST RESISTORS: R184, R229, 20K.
 7. LAST CAPACITORS: C193, R237, 238.
 8. LAST INDUCTORS: L105, 20K.
 9. LAST DIODES: CR100, 240.
 10. ITEMS OMITTED: R107, C204, C208, C210, C230, C240, C241.

SWITCH
LOCKED UNLOCKED



VCO BD
700-604/644

MAIN BD.
700-597

M400 PARTS LIST

RECEIVER BOARD

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>
<u>TRANSISTORS</u>		
Q101, 102, 103, 104, 105, 106, 108	PNP	4801-0000-026
Q107	PNP	4801-0000-029
Q109	PNP (White Top)	4801-0000-060
Q110, 114, 115	NPN	4801-0000-016
Q111, 112, 113	NPN	4801-00-0-005

INTEGRATED CIRCUITS

IC101	IF	3130-6056-500	EC9-860
IC102	Audio	3130-3157-614	740A
IC103	8V Reg.	3130-0000-014	981
IC104	5V Reg.	3130-0000-022	
IC105	Logic	3130-3157-628	
IC106	Logic	3130-3297-601	
IC107	Logic	3130-3281-602	
IC108	Not Used		
IC109	Processor	3130-6061-602	

DIODES

CR101, 103	Varactor	4809-0000-008
CR102, 104, 105, 107, 108	Varactor	4809-0000-005
CR106	Varactor	4809-0000-004
CR109, 110, 118, 119	Silicon, Signal	4805-1241-200
CR111, 112, 113, 114	Silicon, Rect.	4806-0000-004
CR115	Not Used	
CR116, 117	Germanium Junction, Signal	4807-1233-900
CR120	Zener, 6V	4808-0000-025

M400 PARTS LIST

RECEIVER BOARD

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>
<u>COILS</u>		
L101	RF Choke	1803-3293-801
L102	Ant., Low Band (White) (M400)	1800-3283-903
	Ant., Low Band (Org) (M400E)	1800-3152-013
L103	RF, Low Band (Orange) (M400)	1800-3283-904
	RF, Low Band (Vio) (M400E)	1800-3152-012
L104	RF Choke	1803-5125-903
L105	Ant., High Band, Primary (Brown)	1800-3152-001
L106	Ant., High Band, Secondary (Red)	1800-3152-002
L107	RF, High Band (Yellow)	1800-3152-014
L108	Tripler, 450 MHz	1800-3152-009
L109	UHF Osc	1800-3160-003
L110	UHF Ant	1800-3255-201
L111	UHF RF	1800-3160-005
L112	10.7 MHz	1800-6055-902
L113	RF Choke	1803-3268-201
L114	Quadrature	1800-6055-801

CAPACITORS

All values are PF, unless otherwise indicated.

C101	27, 5%, NPO (M400)	1538-0270-508
	5.6, 10%, NPO (M400E)	1538-0569-608
C102	1000 (M400)	1538-0102-703
	27, 5%, NPO (M400E)	1538-0270-508
C103	10, 5%, NPO (M400)	1538-0100-508
	4.7, 10%, NPO (M400E)	1538-0479-608
C104, 144	.005 MF	1503-0502-005
C105, 108, 110, 111, 122, 124 147, 167, 185	4700	1538-0472-806
C106	1000 (M400)	1538-0102-703
	39, 5%, NPO (M400E)	1538-0390-508
C107, 129, 154	6.8, 10%, NPO	1538-0689-608
C109	1000 (M400)	1538-0102-703
	10, 5%, NPO (M400E)	1538-0390-508
C112, 121, 127	3.3, 10%, NPO	1538-0339-608
C113, 116	12, 5%, NPO	1538-0120-508
C114, 118	3.9, 10%, NPO	1538-0399-608
C115, 190	1	1510-0010-900
C119, 120, 126, 137, 138, 140, 149	1000	1538-0102-703
C123	.68	1510-0688-900
C125, 128, 139	22, 5%, NPO	1538-0220-508
C130	470	1523-0471-002

RESISTORS

R109	100 OHM (M400)	4707-0101-032
	1K OHM (M400E)	4704-0102-032

M400 PARTS LIST

RECEIVER BOARD

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>
<u>CAPACITORS CONTINUED</u>		
C131	470	1538-0471-601
C132, 136, 143	Trimmer, 2.5-7 (Blue)	1517-3295-301
C133, 146	8.2, 10%, NPO	1500-0829-905
C134	5.6, 10%, NPO	1538-0569-608
C135		
C136		
C141		
C142	27, 10%, NPO	1500-0270-650
C143		
C145	.47, 10%	1510-0478-900
C148	3.9, 10%, NPO	1500-0399-905
C150	.001 MF	1503-0102-003
C151, 160	.01 MF	1538-0103-804
C152, 162, 172, 184	.2 MF	1502-0204-006
C153, 168	2200	1538-0222-806
C155, 157, 161, 166	150	1438-0151-601
C158	.047 MF, Mylar	1508-0473-610
C159	.033 MF, Mylar	1508-0333-610
C163, 164, 170, 188, 192, 193	.05 MF	1502-0503-003
C165	68, 5%	1538-0680-524
C169	3300	1538-0332-806
C171, 183	4.7 MF/25V Lytic	1513-0479-003
C173	100 MF/16V Lytic	1513-0101-002
C174	.022 MF	1538-0223-804
C175	1 MF/50V Lytic	1513-0010-004
C176	2200 MF/25V Lytic	1513-3254-703
C177	470 MF/10V Lytic	1513-3254-708
C178	47 MF/10V Lytic	1513-0470-001
C179		
C180, 181, 182	4.7 MF/35V	1513-0479-006
C186	.0047 MF, Mylar	1508-0472-610
C187	.22 MF, Mylar	1508-3300-302
C188		
C189	2.7, 10%, NPO	1538-0279-608
C191	Trimmer, 6-20(Blue)	1517-3295-301
C195	.047 MF	1539-0473-702

M400 PARTS LIST

RECEIVER BOARD

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>
<u>CRYSTALS</u>		
Y101	10.245 MHz	2301-3151-601
Y102	3.58 MHz	2342-3284-402
<u>FILTERS</u>		
XF101, 102	Crystal, 10.7 MHz	2705-3232-200
CF101	Ceramic, 455 KHz	2700-3274-100
<u>TRANSFORMER</u>		
T101	DC-DC Converter	5604-5151-200
<u>SWITCH</u>		
SW101	Memory Lock	5113-5155-201
LOGIC BOARD		
<u>TRANSISTORS</u>		
Q201, 202	FET	4811-0000-020
Q203, 204	NPN (Red Top)	4801-0000-035 103
<u>INTEGRATED CIRCUITS</u>		
IC201	Synthesizer	3130-6068-000
IC202	Counter	3130-6060-604
IC203	Logic	3130-3157-644
IC204	OP AMP	3130-3167-917
<u>DIODES</u>		
CR202, 203	Germanium	4807-1233-900
CR204, 205	Varactor	4809-0000-005

M400 PARTS LIST

LOGIC BOARD

<u>Item No.</u>	<u>Description</u>	<u>Part No.</u>
<u>COILS</u>		
L201	Oscillator	1800-5149-705
L202, 204	RF Choke	1803-3268-211
L203	Oscillator	1800-5149-705

CAPACITOR

C202	Trimmer, 4-11 PF	1517-3295-302
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CRYSTAL

Y201	11.2 MHz	2338-3283-201
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CONTROL/DISPLAY BOARD

	Keyboard (M400)	2001-6066-801
	Keyboard (M400E)	2001-6066-803
DP301	Display, 12 Digit	2000-6067-301
	Panel Light Assembly	1411-6065-402
R301/SW301	10K, Volume and Sw.	4751-3294-801
R302	10K, Squelch	4751-3278-101
SW302, 304	Switch, DPDT, Clock Day/Night	5113-5152-201
SW303	Switch, SPDT, Priority	5113-5154-001

MISCELLANEOUS

	Wall Plug/Charger, 120V	1100-6069-201
	Wall Plug/Charger, 240V	1100-6069-202
	Battery Pack, 2.4V	4000-3302-400
SPK-1	Speaker, 8 Ohms	1301-3299-602
	DC Power Cord	7011-1047-800
	Lamp, Keyboard, 2162D	3901-0000-011
	Antenna, Telescope	1201-5108-801
	Knob, Volume and Squelch	2402-6067-201
	Case, Top	1411-7052-904
	Case, Bottom	1411-7053-003
	Bracket, Mobile Mounting	1400-6070-800
	Knob, Mobile Mounting	2402-5148-702
	Bumper, Rubber Foot	1402-3291-202