



1. Description

1.1 The common circuits board (as shown in the schematic at the end of this section) consists of the following circuits: (a) RF power control, (b) squelch, (c) IDC, and (d) regulator.

1.2 The theory of operation and troubleshooting information for each of these circuits except the regulator circuit is presented in other sections of this manual as follows:

- RF power control: Transmitter Section
- squelch circuit: Receiver Section
- IDC: Synthesizer Section

2. Theory of Operation (Regulator)

2.1 INTRODUCTION

The regulator supplies the voltages the radio needs. It consists of: (a) reference circuit, (b) +9.6 V regulator, (c) +5.0 V regulator, and (d) shutback circuit.

2.2 REFERENCE CIRCUIT

The reference circuit uses a zener diode (part of HY1001), an operational amplifier (U1001B), and a factory-adjusted resistor network to generate a reference voltage of approximately 7.0 V at its output (U1001B-4). This reference output voltage is then used to generate both the 5.0 V and 9.6 V supply voltages.

2.3 9.6 V REGULATOR

The 9.6 V regulator is protected against short circuits. If a short circuit occurs in the regulator, it forward-biases CR1002, switching it on and removing the drive power from output transistor Q1001.

2.4 5.0 V REGULATOR

The 5.0 V regulator is protected against excessive output currents. A foldback current-limiting circuit senses the voltages across R1002 and R1003. If the output current reaches a predetermined level, Q1003 switches on, blocking the drive to output transistor Q1002.

2.5 SHUTBACK CIRCUIT

2.5.1 The shutback circuit is designed to turn off both regulators (the 5.0 V and the 9.6 V) whenever the supply voltage rises above (or goes below) a predetermined level. If the supply voltage reaches 20.5 V, CR1005 turns on, causing Q1006 to turn on. Consequently, Q1005 loses its input drive, thus causing the 9.6 V regulator to turn off. Moreover, this also forward-biases CR1003, thus causing the 5.0 V regulator to turn off.

2.5.2 When the supply voltage (SW B+) falls below 9.0 V, U1001A switches states, causing Q1006 to turn on and, consequently, both regulators to turn off. In this case, CR1004 causes the reference voltage to U1001A-1 to change in the shutback mode. Consequently, both regulators remain shut off until the supply voltages rise at least one volt above the critical level of 9.0 V.

3. Regulator Troubleshooting Procedure

The regulator troubleshooting procedure covers the following situations:

- failure of both the 5.0 V and 9.6 V regulators
- failure of only the 5.0 V regulator
- failure of only the 9.6 V regulator

3.1 FAILURE OF BOTH REGULATORS

(1) Inspect P401 and the main front plug and verify that they are inserted properly.

(2) Measure SW B+ at P401 on the common circuits board. The normal indication is 10.5 to 16 V. If SW B+ is outside the normal range, the low or high-line shutdown circuit may have been activated, shutting off the regulators. Adjust SW B+ to the proper voltage and recheck the regulators' outputs. If SW B+ is zero, check the continuity of the SW B+ and ground lines to isolate the fault.

(3) Measure the voltage at the Q1006 collector. It should be less than 0.6 V. If it is not, repair the shutback circuit.

(4) Measure the voltage at HY1001-9. It should be 7 ± 0.1 V. If it is not, repair the 7 V reference circuit.

Note

If this procedure fails to remedy the problem, then repair each regulator separately.

3.2 FAILURE OF 5 V REGULATOR

(1) Check the output of the 9.6 V regulator at P401-11 and verify that it is 9.6 ± 0.1 V. If it is not, carry out the procedure in Section 3.1 above.

(2) With the radio turned off, check that the resistance between P401-12 and ground is greater than 100 ohms. If it is not, isolate the fault. (It will not necessarily be on the common circuits board.)

(3) With the power turned on, measure the voltage difference between U1001-12 and P401-12. It should be less than 2.5 V. If it is, proceed to Step 5; otherwise go to Step 4.

(4) Isolate the component with the excessive voltage drop. An excessive drop across R1009 may be caused by:

- excessive Q1002 base current because of a defective transistor or open collector lead
- a fault in the 5 V current limiter circuit (Q1003, R1004, R1005, and R1016) causing Q1003 to turn on

- a shorted printed circuit board runner

- a defective R1009

An excessive drop across Q1002 or R1002 is probably due to a fault in the component with the abnormal voltage drop.

(5) Measure the voltage at U1001-13. It should be 5 ± 0.1 V. If it is, replace HY1001 or U1001; if not, repair the 7 V reference circuit.

(6) Measure the voltage at HY1001-9. It should be 7 ± 0.1 V. If so, replace HY1001 or U1001; if not, repair the 7 V reference circuit.

(7) Measure the voltage difference between U1001-14 and P401-12. It should be zero. If so, go to the next step; otherwise proceed as follows: if CR1003 is forward biased, repair the shutback circuit; otherwise replace R1010 or U1001.

(8) Measure the voltage at U1001-12 and find out why the feedback loop does not function properly.

3.3 FAILURE OF 9.6 V REGULATOR

(1) Check output voltage at P401-12. If it is 5.0 V, go to the next step; otherwise, perform the procedure for failure of both regulators.

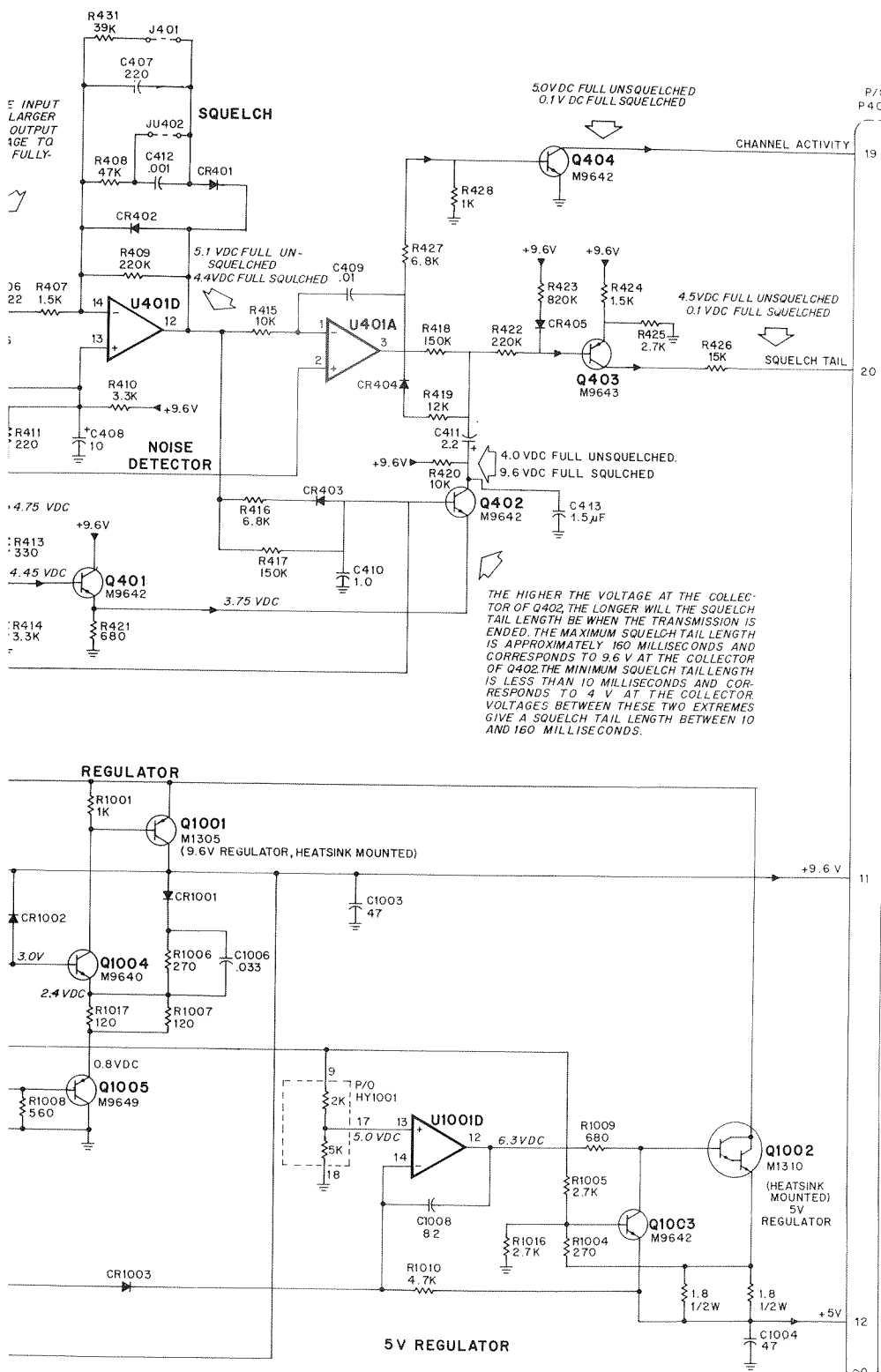
(2) Check output voltage at P401-11. It should be 9.6 ± 0.1 V. If it is too low, go to Step 3; if too high, go to Step 6.

(3) With the radio turned off, check the resistance between P401-11 and ground. If it is greater than 30 ohms, go to the next step; otherwise, make the necessary checks to isolate the fault, which is not necessarily on the common circuits board.

(4) With power turned on, measure the voltage at Q1006 base. It should be greater than 10 V. If it is, go to the next step; otherwise replace HY1001, U1001, or Q1006. A voltage higher than 2.5 V but lower than 10 V indicates that Q1006 may be defective.

(5) Replace Q1001 or repair the circuit board.

(6) Measure the voltage at Q1006 collector. It should be less than 0.5 V. If it is, replace Q1001 or repair the circuit board; otherwise, replace U1001 or HY1001.

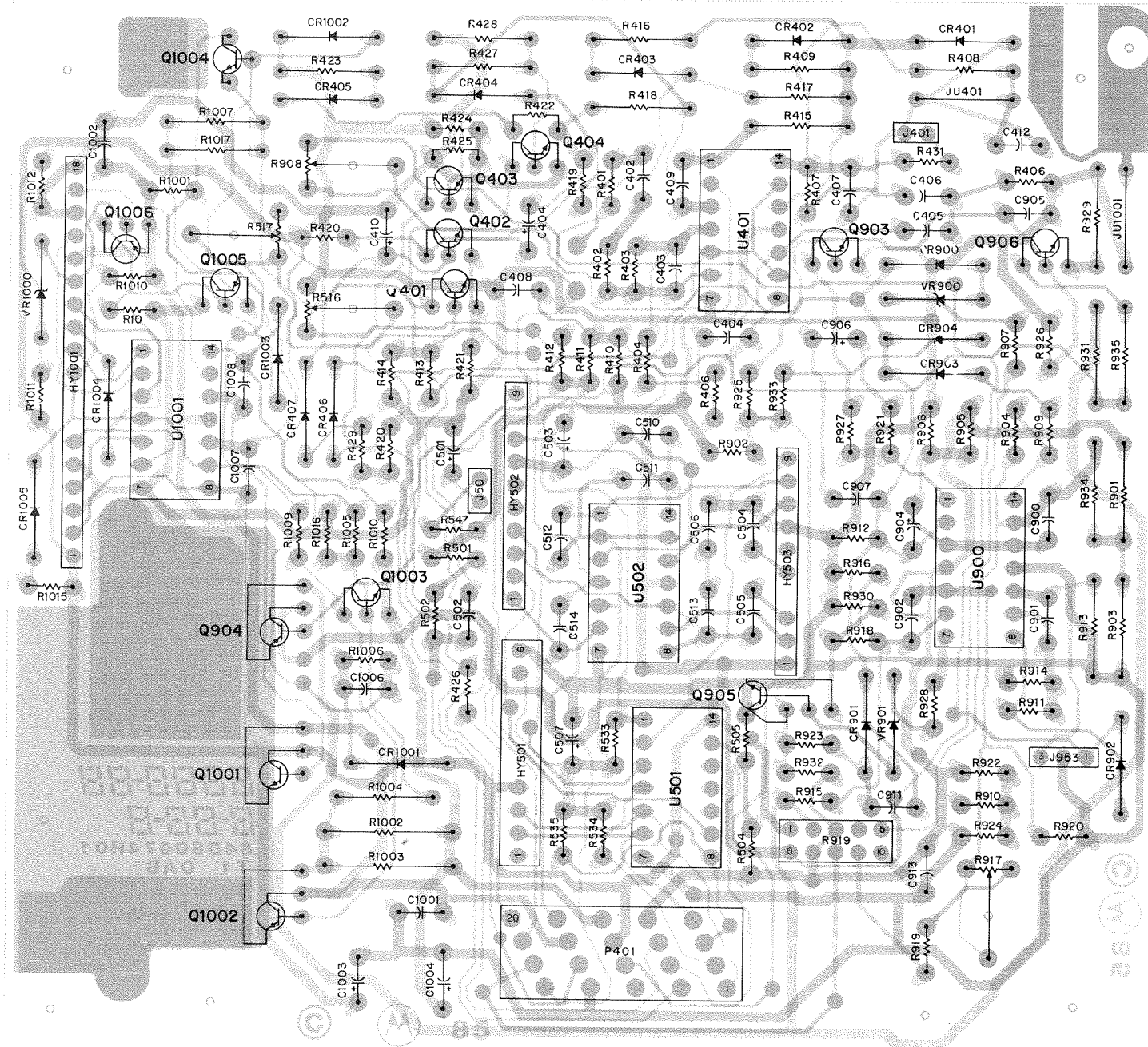


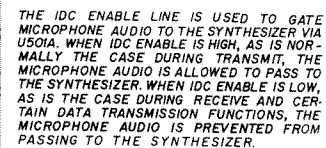
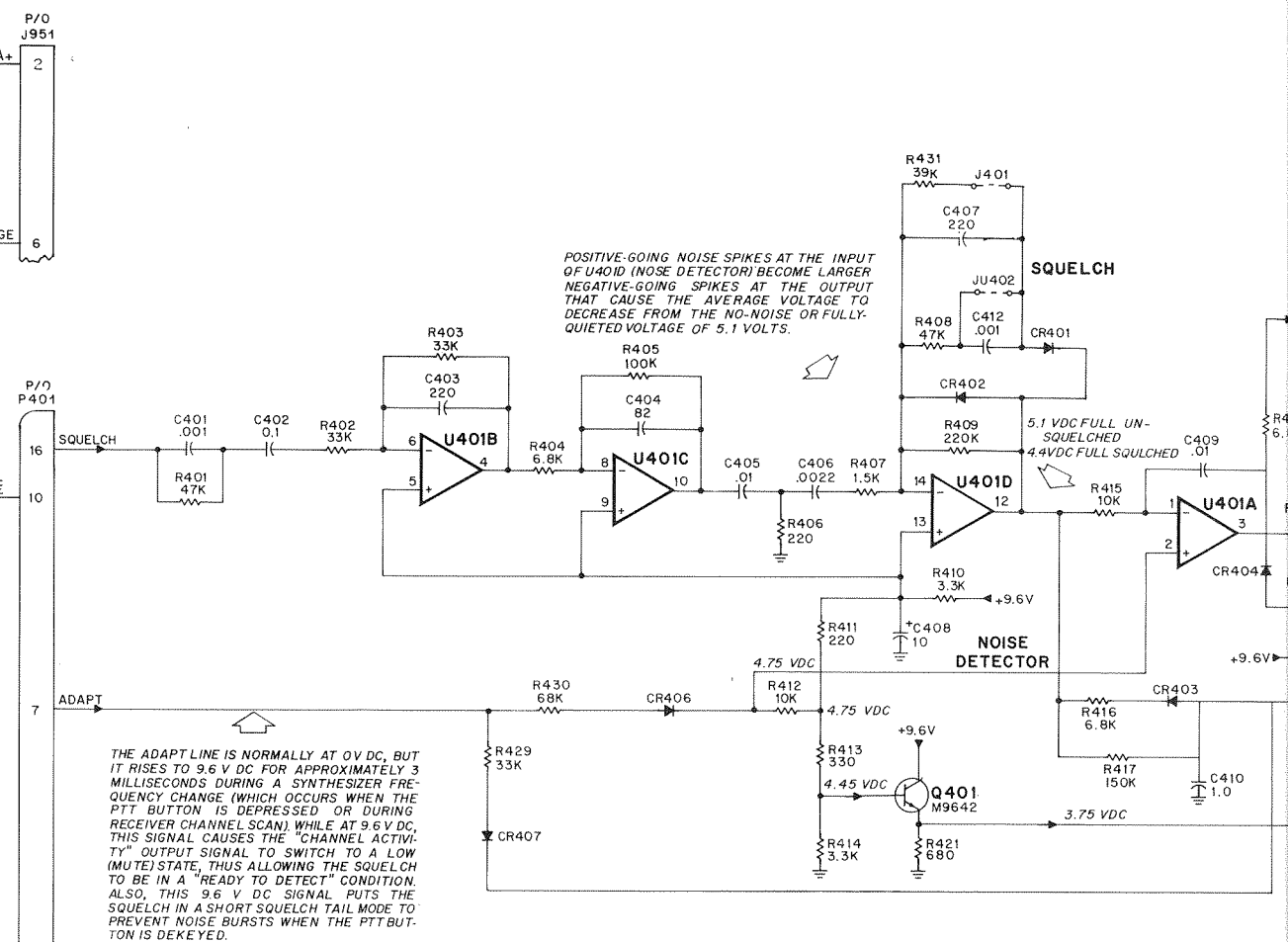
JUMPER TABLE		
STANDARD LOW BAND	JUMPER	FUNCTION
OUT	J401	IN FOR DVP
IN	JU402	OUT FOR DVP
OUT	J501	IN FOR HANDHELD CONTROL HEAD

NOTES:

- UNLESS OTHERWISE INDICATED, RESISTOR VALUES ARE IN OHM, CAPACITOR VALUES ARE IN MICROFARADS.
 - INTEGRATED CIRCUITS ON THIS BOARD ARE CMOS DEVICES. CONSEQUENTLY, PROPER CARE SHOULD BE TAKEN WHILE HANDLING THESE DEVICES.
 - TYPES AND CONNECTIONS FOR THE INTEGRATED CIRCUITS USED ON THIS BOARD ARE AS FOLLOWS:
- | REF. DESIG. | TYPE | VCC (PIN) | GND (PIN) | DESCRIPTION |
|-------------|----------------|-------------|-----------|------------------------|
| U401, 502 | 29M06 OR 67C04 | 9.6 V (11) | (7) | QUAD OP AMP |
| U501 | 84L14 OR 73C01 | 9.6 V (4) | (7) | QUAD TRANSMISSION GATE |
| U1001 | 29M06 OR 67C04 | SW B+ (11) | (7) | QUAD OP AMP |
| U900 | 67C01 | K 9.4 V (4) | (11) | QUAD OP AMP |
- ALL VOLTAGES SHOWN ARE REFERENCED TO "A-".
 - ALL VOLTAGES SHOWN ON THE RF POWER CONTROL ARE MEASURED UNDER THE FOLLOWING CONDITIONS:
 - 13.6 A, VOLTAGE
 - 50-OHM RADIO TERMINATION
 - 105-WATT SET OUTPUT POWER
 - JU1001 PROVIDES AN ADDITIONAL B- CONNECTION TO THE INTERNAL CASTING.

COMMON CIRCUIT BOARD INTERCONNECT TABLE			
CONNECTOR	PIN #	WIRE COLOR	FUNCTION
P951	1	BLUE	REG. 9.6 V
	2	RED	A+
	3	GRN-WHT	KEYED 9.4 V TO TX BUFFER
	4	BLACK	TEMPERATURE SENSE
	5	YELLOW	CONTROL VOLTAGE
	6	GREEN	KEYED 9.4 V
	7	ORANGE	CURRENT LIMIT SENSE
	8	BROWN	B-
	9	BROWN	FORWARD POWER DETECT
	10	BLACK	B-
P953	1	BROWN	FORWARD POWER DETECT
	2	BLACK	B-
	3	RED	REFLECTED POWER DETECT





parts list

HLN4817A Common Circuits Board

MXW-1726-O

MXW-1726-O (2)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed, μF $\pm 5\%$, 100V unless otherwise stated
C401	08-11051A01	.001, 63V
C402	08-11051A13	.1, 63V
C403	21-11015B05	220 pF $\pm 10\%$
C404	21-11014B47	82 pF
C405	08-11051A07	.01, 63V
C406	08-11051A03	.0022, 63V
C407	21-11015B05	220 pF $\pm 10\%$
C408	23-11013E57	10 $\pm 20\%$, 25V, tantalum
C409	08-11051A07	.01, 63V
C410	23-11013F57	1 $\pm 20\%$, 35V, tantalum
C411	23-11013F59	2.2 $\pm 20\%$, 35V, tantalum
C412	08-11051A01	.001, 63V
C501	23-11013E57	10 $\pm 20\%$, 25V, tantalum
C502	08-11051A02	.0015, 63V
C503	23-11013E57	10 $\pm 20\%$, 25V, tantalum
C504	08-11051A02	.0015, 63V
C505	08-11051A03	.0022, 63V
C506	21-11014B47	82
C507	23-11013E57	10 $\pm 20\%$, 25V, tantalum
C510	21-11014B47	82 pF
C511-513	21-11014H40	43 pF
C900-904	21-11015D17	.0022 $\pm 10\%$
C905	08-11051A17	.47, 63V
C906, 907	23-11013D11	6.8 $\pm 10\%$, 20V, tantalum
C1001	08-11051A13	.1, 63V
C1002	21-11015B05	220 pF $\pm 10\%$
C1003	23-10818A11	47 $\pm 50\%$, -10%, 16V, electrolytic
C1004	23-84538G06	47 $\pm 20\%$, 20V, tantalum
C1006	08-11051A10	.033, 63V
C1007	21-11015B05	220 pF $\pm 10\%$
C1008	21-11014B47	82 pF
		diode (see note)
CR401-407	48-83654H01	silicon
CR900-904	48-83654H01	silicon
CR1001-1005	48-83654H01	silicon
		hybrid (see note)
HY501	51-82142K12	resistor network
HY502	51-82142K13	resistor network
HY503	51-82142K14	resistor network
HY1001	01-80715D03	hybrid regulator
		connector receptacle
J401, 501	28-84318M06	2-pin plug
J951	28-80052D01	male connector housing
J953	28-84324M02	3-contact housing
		transistor (see note)
Q401, 402	48-80182D08	NPN, type M8208
Q403	48-80182D09	PNP, type M8209
Q404	48-80182D08	NPN, type M8208
Q903	48-80182D08	NPN, type M8208
Q904	48-84411L10	PNP, type M1110
Q905, 906	48-80182D08	NPN, type M8208
Q1001	48-84413L05	PNP, type M1305
Q1002	48-84413L10	NPN, type M1310
Q1003	48-80182D08	NPN, type M8208
Q1004	48-00869640	NPN, type M9640
Q1005	48-80182D12	PNP, type M8212
Q1006	48-80182D09	PNP, type M8209
		resistor, fixed, Ω $\pm 5\%$, $\frac{1}{4}$ W unless otherwise stated
R401	06-11009E89	47k
R402	06-11009E61	3.3k
R403	06-11009E85	33k
R404	06-11009E69	6.8k
R405	06-11009E97	100k
R406	06-11009E33	220
R407	06-11009E53	1.5k
R408	06-11009A89	47k
R409	06-11009B06	220k
R410	06-11009E61	3.3k
R411	06-11009E33	220
R412	06-11009E73	10k
R413	06-11009E33	220
R414	06-11009E61	3.3k
R415	06-11009A73	10k
R416	06-11009A69	6.8k
R417, 418	06-11009B02	150k
R419	06-11009E75	12k
R420	06-11009E73	10k
R421	06-11009E45	680
R422	06-11009F06	220k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R423	06-11009B20	820k
R424	06-11009E53	1.5k
R425	06-11009E59	2.7k
R426	06-11009E77	15k
R427	06-11009A69	6.8k
R428	06-11009A49	1k
R429	06-11009E85	33k
R430	06-11009E93	68k
R431	06-11009E87	39k
R501	06-11009E49	1k
R502	06-11009E43	560
R504	06-11009E65	4.7k
R505	06-11009E97	100k
R516	18-80087E08	10k, variable
R517	18-80087E11	10k, variable
R533-535	06-11009F06	220k
R547	06-11009E25	100
R901	06-11009A66	5.1k
R902	06-11009E73	10k
R903	06-11009A67	5.6k
R904	06-11009E81	22k
R905	06-11049R91	10k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R906	06-11049R27	2.15k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R907	06-11009E57	2.2k
R908	18-80087E01	25k, variable
R909	06-11009E83	27k
R910	06-11009E95	82k
R911	06-11009E59	2.7k
R912	06-11049R91	10k $\pm 1\%$, $\frac{1}{4}$ W, variable
R913	06-11009A73	10k
R914	06-11009E55	1.8k
R915	06-11049R91	10k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R916	06-11049R79	7.5k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R917	18-80087E04	1k variable
R918	06-11009E83	27k
R919	06-11049R91	10k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R920	06-11049R79	7.5k $\pm 1\%$, $\frac{1}{4}$ W, metal film
R921	06-11009E39	390
R922	06-11009E65	4.7k
R923	06-11009E85	33k
R924	06-11009E61	3.3k
R925	06-11009E73	10k
R926	06-11009E75	12k
R927	06-11009E59	2.7k
R928	06-11009E73	10k
R929	06-11009A33	220
R930	06-11009E35	270
R931	06-11009A41	470
R932	06-11009E65	4.7k
R933	06-11009E93	68k
R934	06-11009A73	10k
R935	06-11009A25	100
R1001	06-11009E49	1k
R1002, 1003	06-00125D72	1.8 $\pm 10\%$, $\frac{1}{2}$ W
R1004	06-11009A35	270
R1005	06-11009E59	2.7k
R1006	06-11009E35	270
R1007	06-11009A27	120
R1008	06-11009E43	560
R1009	06-11009E45	680
R1010	06-11009E65	4.7k
R1011	06-11009E81	22k
R1012	06-11009E35	270
R1014	06-11009F06	220k
R1015	06-11009E35	270
R1016	06-11009E59	2.7k
R1017	06-11009A27	120
		integrated circuit (see note)
U401	51-80067C04	quad op amp
U501	51-80073C01	bilateral quad switch
U502	51-80067C04	quad op amp
U900	51-80067C01	quad op amp
U1001	51-80067C04	quad op amp
		voltage regulator (see note)
VR900	48-82256C56	zener 8.8V
VR901	48-82256C03	zener 4.7 V
VR1000	48-82256C53	zener 18V
		mechanical parts
	14-83820M02	insulated thermal conductor
	04-84152B01	shoulder washer
	03-10905A05	machine screw (M3 \times .5 \times 8)

note: For best performance, order diodes, transistors, and integrated circuits by Motorola part number.