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# MESSENGER 120A/121A SERVICE MANUAL ADDITION



## GENERAL

This service manual addition describes the differences between the Messenger 120A and the Messenger 120; and the Messenger 121A and the Messenger 121 transceivers. Also included in this addition is a Messenger 120A/121A components layout (the Messenger 120A selective signaling components are darkened), schematic diagrams and a complete parts list. For complete transceiver service information and test setups, refer to the Messenger 120/121 Service Manual, Part No. 001-0120-001.

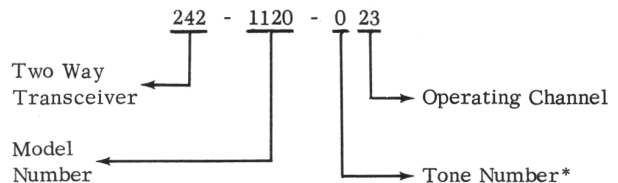
## DESCRIPTION

The Messenger 120A, Part No. 242-1120-xxx, and the Messenger 121A, Part No. 242-1121-xxx, are five channel citizens radio transceivers. Both transceivers come fully equipped for operation in any vehicle with a 12 VDC negative ground electrical system. The 117 VAC power supply, Part No. 239-0125-002, is available as an extra cost accessory to convert the mobile transceiver into a base station.

The Messenger 120A and 121A are similar to the Messenger 120 and 121 with the exception of the new Volume and Squelch controls and the improved audio circuitry. The First Audio Amplifier, Q7, and the Audio Driver, Q8, are silicon transistors for increased reliability and are referenced to ground to eliminate the need to use ungrounded test equipment.

The Messenger 120A also includes a selective signaling section which allows silent operation of the receiver until a call is received from a unit in your system. There are ten possible tone frequencies available and the trans-

ceiver part number includes the tone number and the channel number of the crystal installed at the factory. Refer to the following part number breakdown for details:



\* Refer to Messenger 120/121 Service Manual, Part No. 001-0120-001, Table 6-2 for tone frequencies.

## SPECIFICATIONS

### GENERAL

Frequency Range	26.965 to 27.255 MHz
Channels	5
Overall Dimensions	5.9 cm H x 15.7 cm W x 23.6 cm D (2.3 in H x 6.2 in W x 9.3 in D)
Weight	
Unit	1.1 kg (2.4 lbs)
Shipping	1.7 kg (3.7 lbs)
Microphone	Lightweight handheld microphone with neoprene coiled cord, hang-up stud, cyclolac case and push-to-talk switch

Circuitry	M120A: 21 transistors, 15 diodes and 2 thermistors M121A: 14 transistors, 10 diodes and 2 thermistors
Frequency Control	$\pm 0.005\%$ crystal, $-30^{\circ}\text{C}$ to $+60^{\circ}\text{C}$ transmit and receive
Antenna Impedance	50 ohms
Compliance	FCC Type Accepted Part 95 D
Power Requirements	0.4 ampere receive, squelched 1.3 amperes transmit, full modulation
Circuit Protection	2 ampere fuse

#### RECEIVER

Sensitivity	10 dB (S+N)/N at $0.5\mu\text{V}$ input
Selectivity	6 kHz bandwidth at -6 dB 30 kHz bandwidth at -60 dB
Spurious Rejection	50 dB except image of 10 dB
Audio Output Power	3 watts
Tight Squelch	$60\mu\text{V}$ minimum and $2000\mu\text{V}$ maximum
Squelch Sensitivity	1 dB or less signal change for 40 dB quieting at $1\mu\text{V}$
Intermediate Frequency	455 kHz
AGC Characteristics	Flat within $\pm 6$ dB from 250,000 to $5\mu\text{V}$ with 15 dB rolloff from 5 to $0.5\mu\text{V}$
Noise Limiting	10 dB maximum
Speaker Impedance	8 ohms
Audio Frequency Response	+1 dB, -18 dB from 300 to 3000 Hz

#### TRANSMITTER

Emission	6A3, amplitude modulated
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RF Power Output	4 watts maximum at 13.8 VDC
RF Spurious and Harmonic Attenuation	50 dB minimum

Audio Frequency Response	+1 dB, -6 dB from 300 to 3000 Hz
Modulation	80% minimum

#### MINIMUM PERFORMANCE SPECIFICATIONS

(The specifications listed in this section are absolute service minimums.)

#### Receiver

Sensitivity	7 dB (S+N)/N at $0.5\mu\text{V}$ input
Audio Output Power	0.075 watt minimum at $0.5\mu\text{V}$ 2.5 watts with less than 10% distortion at $1000\mu\text{V}$ input
Tight Squelch	$30\mu\text{V}$ minimum and $2000\mu\text{V}$ maximum
AGC Characteristics	$15 \pm 4$ dB rolloff from 500 to $0.5\mu\text{V}$

#### Transmitter

RF Power Output	4 watts maximum at 13.8 VDC 2.8 watts minimum at 13.8 VDC
Modulation	70% minimum, positive and negative peaks

#### SELECTIVE SIGNALING (Messenger 120A only)

Tone Channels	Ten available with plug-in tone frequency determining elements
Sensitivity	$0.5\mu\text{V}$
Tone Frequencies	750, 825, 895, 985, 1095, 1210, 1280, 1420, 1545 or 1615 Hz
Call Time	4 seconds, after 3 seconds the "call" light comes on and tone sounds for remaining 1 second
Tone Channel Bandwidth	50 Hz $\pm 20\%$ at rated voltage

## PARTS LIST

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
BRACKETS			C101	22 $\mu$ F 16V aluminum	510-4006-004
BK1	Bracket, cabinet mounting	016-1884-003	C102	0.10 $\mu$ F $\pm$ 20% 16V Y5S	510-3210-104
BK2	Same as BK1		C103	4700 pF $\pm$ 20% 50V Y5L disc	510-3204-472
BK3	Bracket, crystal block	016-1886-001	C104	47 $\mu$ F 10V aluminum	510-4003-004
BK5	Dash mounting bracket	017-1249-001	C105	0.022 $\mu$ F $\pm$ 5% 25V polystyrene	510-1101-223
BK6	Bracket, fnt panel mtg (M121A)	016-1944-007	C106	0.033 $\mu$ F $\pm$ 20% 16V Y5S	510-3210-333
CAPACITORS			C107	100 $\mu$ F 10V aluminum	510-4003-005
C1	6.8 $\mu$ F $\pm$ 20% 35V dipped	510-2045-689	C108	0.10 $\mu$ F $\pm$ 20% 16V Y5S	510-3210-104
C2	4700 pF $\pm$ 20% 50V Y5L disc	510-3204-472	C110	330 $\mu$ F 4V aluminum	510-4001-005
C3	27 pF $\pm$ 5% 200V N750 ceramic	510-3220-270	CHASSIS PARTS		
C4	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103	CH1	Front panel	032-0271-011
C5	150 pF $\pm$ 5% 100V 1DM15	510-0001-151	CH2	Cabinet assembly	023-2920-001
C6	6.8 $\mu$ F $\pm$ 20% 35V dipped	510-2045-689	CH3	Rear panel	017-1628-002
C7	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103	DIODES		
C8	470 pF $\pm$ 5% 100V 1DM15	510-0001-471	CR1	1N67A germ diode	523-1500-067
C9	0.047 $\mu$ F $\pm$ 20% 16V Y5S	510-3210-473	CR2	Same as CR1	
C10	1.0 $\mu$ F $\pm$ 20% 35V dipped	510-2045-109	CR3	1N881/1N645 diode	523-1500-881
C11	0.56 $\mu$ F $\pm$ 20% 35V	510-2005-568	CR5	Same as CR3	
C13	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103	CR6	1N4003 200V 1A rect	523-0501-002
C14	Same as C13		CR7	1N881/1N645 diode	523-1500-881
C15	27 pF $\pm$ 5% 200V N150 ceramic	510-3216-270	CR8	Same as CR7	
C16	470 pF 500V Y5U disc	510-3204-471	CR9	Same as CR7	
C17	4700 pF $\pm$ 20% 50V Y5U disc	510-3204-472	CR13	1N67A 80V 30 mA germ.	523-1000-067
C18	0.22 $\mu$ F +80/-20% 3V Y5T disc	510-3009-224	CR101	1N67A germ. diode	523-1500-067
C19	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103	CR102	Same as CR101	
C20	22 $\mu$ F $\pm$ 20% 15V tubular	510-2003-220	CR103	1N881/1N645 diode	523-1500-881
C21	150 $\mu$ F 25V aluminum	510-4006-006	CR104	Same as CR103	
C22	6.8 $\mu$ F $\pm$ 20% 35V dipped	510-2045-689	CR105	10V J 1W zener	523-2503-100
C23	Same as C22		CR106	1N881/1N645 diode blk.	523-1000-881
C24	56 $\mu$ F $\pm$ 20% 5V tubular	510-2001-560	LAMPS		
C25	1.0 $\mu$ F $\pm$ 20% 35V dipped	510-2045-109	DS1	2172D 14.4V 0.12A clear	549-3001-005
C26	0.022 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-223	DS2	Same as DS1	
C27	Same as C26		DS101	Same as DS1	
C28	4700 pF $\pm$ 20% 50V Y5U disc	510-3204-472	ELECTRICAL PART		
C29	22 pF $\pm$ 5% 200V N750 ceramic	510-3220-220	EP9	0.14 x 0.13 ferrite bead	517-2002-001
C30	Same as C29		HARDWARE		
C31	150 pF $\pm$ 5% 200V N750 ceramic	510-3220-151	HW6	Spk. pad foam ring	574-5006-001
C32	1000 pF $\pm$ 20% 1KV Y5S disc	510-3261-102	JACKS		
C33	43 pF $\pm$ 5% 200V N150 ceramic	510-3216-430	J1	CC encl. min. phone jack	515-2001-011
C34	4700 pF $\pm$ 20% 50V Y5U disc	510-3204-472	J2	Antenna jack	142-0101-002
C35	0.047 $\mu$ F $\pm$ 20% 50V Y5U disc	510-3002-473	J3	Red terminal bush assembly	023-3370-001
C36	1000 pF $\pm$ 20% 1KV Y5S disc	510-3061-102	INDUCTORS		
C37	27 pF $\pm$ 5% 200V NPO ceramic	510-3213-270	L1	13 $\mu$ H choke	542-3003-001
C38	1000 pF $\pm$ 20% 1KV Y5S disc	510-3261-102	L2	Same as L1	
C39	100 pF $\pm$ 5% 200V N150 ceramic	510-3216-101	L3	10 1/2 T ind. 0.75-1.0 $\mu$ H	542-1005-010
C40	300 pF $\pm$ 5% 100V 1DM15	510-0001-301	L4	4 1/2 T ind. 0.24-0.32 $\mu$ H	542-1005-004
C41	330 pF $\pm$ 5% 100V 1DM15	510-0001-331	L5	20 mH audio choke	542-8001-011
C42	4700 pF $\pm$ 20% 1.4KV Z5U	510-3001-472	L8	6.8 $\mu$ H RF choke	542-3004-689
C43	1000 $\mu$ F 16V aluminum	510-4006-005	L101	864-1056 mH var. ind.	542-8006-104
C44	220 $\mu$ F 16V aluminum	510-4006-004			
C45	1 pF $\pm$ 5% 500V composition	510-9002-109			
C46	Same as C45				
C48	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103			
C50	1.0 $\mu$ F $\pm$ 20% 35V dipped	510-2045-109			
C51	Same as C50				
C55	100 $\mu$ F 10V aluminum	510-4003-005			
C56	0.047 $\mu$ F $\pm$ 20% 16V Y5S	510-3210-473			
C57	Same as C56				
C58	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103			
C65	0.010 $\mu$ F $\pm$ 20% 50V Y5U	510-3202-103			

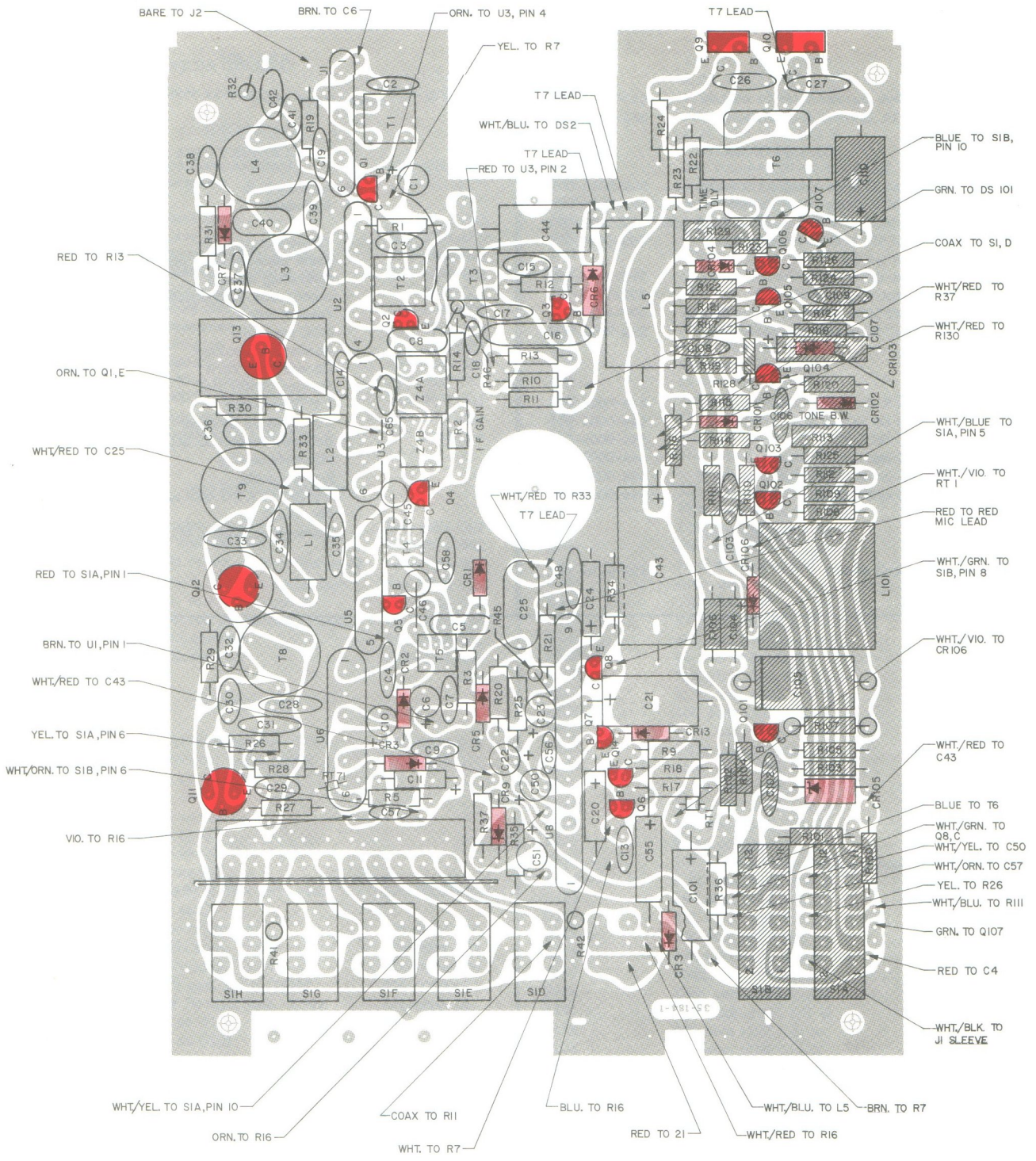


## PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
	SPEAKER		R9	120 ohm $\pm 10\%$ 1/2 W	569-1504-121
LS1	Speaker assembly	023-2927-001	R10	5.6K ohm $\pm 10\%$ 1/2 W	569-1504-562
	MICROPHONE		R11	1.2K ohm $\pm 10\%$ 1/2 W	569-1504-122
MK1	Microphone Assembly	023-2708-012	R12	680 ohm $\pm 10\%$ 1/2 W	569-1504-681
	Includes:		R13	2.2K ohm $\pm 10\%$ 1/2 W	569-1504-222
CH1	Case front	032-0216-002	R14	1.0K ohm $\pm 10\%$ 1/2 W	569-1504-102
CH2	Case back	023-2701-003	R16	10K volume/ON-OFF control	562-0016-005
HW1	Screw 4-20 PH slotted	575-5504-024	R17	1.0K ohm $\pm 10\%$ 1/2 W	569-1504-102
HW2	Cushion, adhesive back	018-0920-002	R18	3.3K ohm $\pm 10\%$ 1/2 W	569-1504-332
ML1	Grille cloth	018-0919-001	R19	1.5K ohm $\pm 10\%$ 1/2 W	569-1504-152
MP1	Cord clamp	016-1798-001	R20	3.3K ohm $\pm 10\%$ 1/2 W	569-1504-332
MP2	Resonator	018-0918-002	R21	470 ohm $\pm 10\%$ 1/2 W	569-1504-471
MP3	Actuator	032-0218-001	R22	27 ohm $\pm 10\%$ 1/2 W	569-1504-270
NP1	Johnson nameplate	559-0036-001	R23	470 ohm $\pm 10\%$ 1/2 W	569-1504-471
NP2	Viking medallion	559-0037-001	R24	1.0 ohm $\pm 10\%$ 1/2 W	569-2503-109
S1	DPDT microphone switch	583-3001-011	R25	330 ohm $\pm 10\%$ 1/2 W	569-1504-331
U1	Cup assembly	023-2707-001	R26	5.1K ohm $\pm 5\%$ 1/2 W	569-1503-512
W2	6 conductor coiled cord	597-2001-004	R27	510 ohm $\pm 5\%$ 1/2 W	569-1503-511
	MECHANICAL PARTS		R28	51 ohm $\pm 5\%$ 1/2 W	569-1503-510
MP1	Heat sink for Q12	013-1074-001	R29	120 ohm $\pm 10\%$ 1/2 W	569-1504-121
MP2	Heat sink for Q13	014-0671-002	R30	47 ohm $\pm 10\%$ 1/2 W	569-1504-470
MP4	Strain relief, microphone cord	017-1766-001	R31	470 ohm $\pm 10\%$ 1/2 W	569-1504-471
MP5	0.58 x 0.28 black pushbutton	547-0006-020	R32	47K ohm $\pm 10\%$ 1/2 W	569-1004-473
MP7	Knob, volume & squelch	547-0008-014	R33	1.2K ohm $\pm 10\%$ 1/2 W	569-1504-122
MP50	Knob, call pushbutton M120A	547-0006-120	R34	330 ohm $\pm 10\%$ 1/2 W	569-1504-331
NP1	M121A overlay	559-2068-003	R35	150K ohm $\pm 10\%$ 1/2 W	569-1504-154
NP4	M120A overlay	559-2054-003	R36	10K ohm $\pm 10\%$ 1/2 W	569-1504-103
	TRANSISTORS		R37	68K ohm $\pm 10\%$ 1/2 W	569-1504-683
Q1	SI NPN 50 MHz amp. TO92	576-0003-018	R41	15 ohm $\pm 10\%$ 1/2 W	569-1004-150
Q2	SI NPN gen. purp. TO92	576-0003-011	R42	Same as R41	
Q3	Same as Q2		R45	15K ohm $\pm 10\%$ 1/4 W	569-1002-153
Q4	Same as Q2		R46	22 ohm $\pm 10\%$ 1/4 W	569-1002-220
Q5	Same as Q2		R101	470 ohm $\pm 10\%$ 1/4 W	569-1002-471
Q6	Same as Q2		R102	62 ohm $\pm 5\%$ 1/2 W	569-1503-620
Q7	Same as Q2		R103	56K ohm $\pm 10\%$ 1/2 W	569-1504-563
Q8	Same as Q2		R104	8.2K ohm $\pm 10\%$ 1/2 W	569-1504-822
Q9	MJE2480 SI NPN pwr. aud.	576-0002-026	R105	10K ohm $\pm 10\%$ 1/2 W	569-1504-103
Q10	Same as Q9		R106	1.2K ohm $\pm 10\%$ 1/2 W	569-1504-122
Q11	Silicon transistor	576-0004-035	R107	680K ohm $\pm 10\%$ 1/2 W	569-1004-684
Q12	27 MHz amp. TO39	576-0004-004	R108	680K ohm $\pm 10\%$ 1/2 W	569-1504-684
Q13	27 MHz amp. TO39	576-0004-005	R109	2.2M ohm $\pm 10\%$ 1/2 W	569-1504-225
Q14	SI NPN gen. purp. TO92	576-0003-011	R110	220K ohm $\pm 10\%$ 1/2 W	569-1504-224
Q101	SI PNP 50 MHz amp. TO92	576-0003-017	R111	10K ohm $\pm 10\%$ 1/2 W	569-1504-103
Q102	Same as Q101		R112	Same as R111	
Q103	Same as Q101		R113	10K 1/8W tone bandwidth adjust	562-0004-103
Q104	SI NPN gen. purp. TO92	576-0003-011	R114	1.0K ohm $\pm 10\%$ 1/2 W	569-1504-102
Q105	Same as Q104		R115	56K ohm $\pm 10\%$ 1/2 W	569-1504-563
Q106	Same as Q104		R116	33K ohm $\pm 10\%$ 1/2 W	569-1504-333
Q107	SI NPN Darlington TO92	576-0007-001	R117	22K ohm $\pm 10\%$ 1/2 W	569-1504-223
	RESISTORS		R118	10K ohm $\pm 10\%$ 1/2 W	569-1504-103
R1	10K ohm $\pm 10\%$ 1/2 W	569-1504-103	R119	100K ohm $\pm 10\%$ 1/2 W	569-1504-104
R2	1.0K IF gain adjust	562-0019-102	R120	220K ohm $\pm 10\%$ 1/2 W	569-1504-224
R3	4.7K ohm $\pm 10\%$ 1/2 W	569-1504-472	R121	3.9K ohm $\pm 10\%$ 1/2 W	569-1504-392
R5	10K ohm $\pm 10\%$ 1/2 W	569-1504-103	R122	33K ohm $\pm 10\%$ 1/2 W	569-1504-333
R7	5K squelch control	562-0002-012	R123	33K ohm $\pm 10\%$ 1/4 W	569-1002-333
			R124	330K ohm $\pm 10\%$ 1/2 W	569-1504-334
			R125	4.7K ohm $\pm 10\%$ 1/2 W	569-1504-472
			R126	100K ohm $\pm 10\%$ 1/2 W	569-1504-104
			R127	18K ohm $\pm 10\%$ 1/2 W	569-1504-183
			R128	1.5K ohm $\pm 10\%$ 1/4 W	569-1002-152
			R129	25K 1/8 W time delay adjust	562-0004-253
			R130	150 ohm $\pm 10\%$ 1/2 W	569-1004-151
				THERMISTORS	
			RT1	Thermistor, 8K $\pm 10\%$	569-3001-001
			RT71	Same as RT1	

## PARTS LIST (cont'd)

SYMBOL NO.	DESCRIPTION	PART NO.	SYMBOL NO.	DESCRIPTION	PART NO.
SWITCH			CERAMIC FILTER		
S1	M120A channel selector switch	583-4008-008	Z4	Mech. filter 455-1	532-1004-001
	M121A channel selector switch	583-4008-006			
TRANSFORMERS			ACCESSORY PACK		
T1	10MM 27 MHz antenna transformer	592-5015-001		Accessory Pack	023-2931-003
T2	10MM 27 MHz mixer transformer	592-5015-002		Includes:	
T3	10MM 27 MHz oscillator transformer	592-5015-004		Connector package	023-2209-001
T4	7MM 455 kHz IF transformer	592-5020-004		Sheet metal screws panhead	575-9504-006
T5	Same as T4			Operating manual	002-0122-002
T6	Input/driver transformer	592-1007-004		Installation instructions	004-2001-001
T7	Output/mod transformer	592-1013-006		Part 95 rules	022-1635-001
T8	15-40 MHz oscillator transformer	592-5014-001		FCC form 505	022-1636-001
T9	25-50 MHz driver transformer	592-5014-002		Hardware envelope	023-2615-001
PEC's				CB warranty card	041-0419-014
U1	PEC R. F. amp. silicon	544-0003-011		Service center list	041-0419-016
U2	PEC 1st mixer silicon	544-0002-011		7 x 10 poly bag	041-0420-001
U3	PEC 1st I. F.	544-0003-043		Transmitter ID card	564-1001-001
U5	PEC 2nd I. F. silicon	544-0002-014		Reduced schematic M120A	564-3002-120
U6	PEC noise limiter germanium	544-0002-015		Microphone clip	537-9004-002
U8	PEC audio silicon	544-0002-026		Battery cable	023-1652-001
CRYSTAL SOCKET				8 inch, 18 AWG lead assembly, black	597-0001-011
X1	Crystal socket	126-0110-103		Reduced schematic M121A	564-3002-121



COMPONENTS LAYOUT  
(SOLDER SIDE VIEW)

MESSENGER 120A/121A  
ENGINEERING CHANGES

Revision B

<u>Components Changed</u>	<u>Schematic Location</u>	<u>From</u>	<u>To</u>	<u>New Part Number</u>	<u>Reason for Change</u>
C16	B3	510 pF	470 pF	510-3204-471	Oscillator starting
R1	A2	22K $\Omega$	10K $\Omega$	569-1504-103	Minimum tight squelch
R10	B3	6.8K $\Omega$	5.6K $\Omega$	569-1504-562	Oscillator starting
R23	C9	510 $\Omega$	470 $\Omega$	569-1504-471	Audio distortion

<u>Components Deleted</u>	<u>Schematic Location</u>	<u>Part Description</u>	<u>Reason for Change</u>
C9	A9	0.047 $\mu$ F $\pm$ 20% 16V Y5S	Audio distortion
CR11	A2	1N881 silicon diode	Minimum tight squelch
CR12	A6	1N881 silicon diode	Minimum tight squelch
R15	B1	680 $\Omega$ $\pm$ 10%, 1/2 W	Minimum tight squelch

<u>Components Added</u>	<u>Schematic Location</u>	<u>Part Description</u>	<u>New Part Number</u>	<u>Reason for Change</u>
R70	D6	1K $\Omega$ $\pm$ 10%, 1/4 W	569-1002-102	Transmit RF breakup
RT71	A9	8K $\Omega$ $\pm$ 10%, -4.4 therm	569-3001-001	Receiver degradation at cold temperatures

