SECTION 1
INTRODUCTION

1.1 SCOPE

This instruction manual contains information necessary for the installation, operation and maintenance of the receiver.

1.2 DESCRIPTION

1.2.1 GENERAL

The MSR 5050 is a compact rugged, fully automatic, solid state receiver. It is designed as a continuous duty, HF/SSB receiver, covering the frequency range of 1 kHz to 30 MHz. The receiver is ruggedized and packaged to meet military specifications for vibration and shock environments.

The MSR 5050 is an HF communications receiver with capabilities comparable to the most advanced receivers in regard to ease of operation, reliability, cost-effectivity and maintainability.

Depending on the options specified, the MSR 5050 has the following capabilities:

1) Choice of direct frequency selection or sweep tuning - in one receiver!

2) Tuning in 10 Hz increments from 10 kHz to 30 MHz.

3) The MSR 5050 can automatically scan up to 99 easily programmed channels, either sequentially or in groups.

4) Frequency stability of 1 part in 10^6 as standard (1 part in 10^8 optional).

5) ISB

6) All usual reception modes, including LSB, USB, ISB, CW, RTTY, AM and NBFM (RTTY requires external modem).

7) Keypad selection of standard and optional bandwidths.

8) Provision for internal automatic preselector.

9) Computer control.

10) Remote control over telephone lines.

11) Synthesized precision BFO, with 10 Hz increments, for use when an offset, but very stable, BFO signal is required.

The receiver has been designed and constructed to facilitate quick and easy field service and/or repair. Featuring modular construction, the front panel, rear panel and power supply assemblies are removable with only a screw driver and the PC boards simply unplug from the mother board.

The receiver is composed of major subassemblies. A general description and function of these assemblies are provided in Sections 1.2.2 through 1.2.8.

1.2.2 CHASSIS/MOTHER BOARD

All subassemblies in the receiver are electrically or mechanically

connected to the chassis/mother board. The chassis houses all plug in PC boards and provides shielding. The mother board contains all interconnecting wiring in the receiver. All plug-in PC edge connectors. Keys on the connectors discourage plugging PC boards in the wrong slots.

1.2.3 FRONT PANEL ASSEMBLY

The front panel is a rugged aluminum assembly to which all controls and the speaker are mounted. The LED indicators and associated circuitry are mounted on the display and keypad boards which attach to the panel. The panel assembly can be removed from the receiver, by removing four nuts, three screws and four cable connectors.

1.2.4 LOGIC BOARD

The logic board contains the microprocessor, memory and receiver control logic. The receiver channel memory is a CMOS type which is kept alive by a lithium battery with a 10 year typical life. Signals from the logic board provide frequency information to the synthesizer; and band, filter, AGC, and mode information to the receiver modules.

1.2.5 RECEIVER SIGNAL PATH

The receiver signal path consists of six PC boards: (1) speaker amplifier, (2) audio/squelch, (3) IF filter, (4) mixer, (5) high pass filter, and (6) low pass filter.

The receiver signal path processes the received signal from the antenna to the speaker, using inputs from the synthesizer.

A double conversion scheme is used, with the first intermediate frequency (IF) at 59.53 MHz and the second IF at 5.00 MHz. Two sets of crystal filters (one set at each IF) determine the radio bandwidth.

1.2.6 SYNTHESIZER

The synthesizer consists of four PC boards: (1) major loop, (2) translator loop, (3) minor loop and (4) reference board. The synthesizer is a three loop design which provides the receiver with the first local oscillator (LO) from the major loop board, the second LO from the translator loop board and the third LO from the reference board to the receiver. All frequencies are derived from a temperature compensated crystal oscillator (TCXO) on the reference board. If a fault causes any of the loops to lose lock, the loss-of-lock LED will light on the appropriate board(s), reception will be inhibited, and the front panel BITE display will indicate code E1.

1.2.7. REAR PANEL ASSEMBLY

The rear panel assembly is an aluminum assembly which contains the power supply assembly and various external interface connectors. It attaches to the receiver chassis with nine screws and is easily removable as a unit.

The power supply assembly is a linear type operating from 115 or 230 VAC. It consists of a PC board assembly mounted to a heatsink containing pass transistors which supply the +5, +9, and +13 VDC for the receiver. The assembly is removable from the rear panel by four screws. Electrical disconnect is via two molex connectors.

1.3 TECHNICAL SPECIFICATIONS

All specifications at 115 VAC, 60 Hz operation at 25°C unless otherwise specified.

Frequency Range	10 kHz to 30 MHz in 10 Hz increments.
Tuning Controls	Keypad entry or continuous tune by variable rate TUNE knob.
Frequency Stability	± 1 PPM (standard) ± .01 PPM (option)
BFO Tuning Range	± 9.99 kHz (10 Hz steps)
BFO Tuning Control	Keypad entry or continuous tune by variable rate TUNE knob.
Channel Operation	
Channel Storage	Up to 99 channels programmable for frequency, BFO, AGC speed, Mode and IF bandwidth by keypad.
Channel Scan	Automatic scan of channels in memory in 6 programmable blocks.
Sensitivity	SSB: -113 dBm for 10 dB (S+N)/N AM (6 kHz bandwidth): -97 dBm for 10 dB (S+N)/N CW 2.7 kHz bandwidth): -113 dBm for 10 dB (S+N)/N FM (with option): -97 dBm for 10 dB (S+N)/N (Sensitivity degraded 6 dB below 2 MHz in addition to 6 dB per octave below 0.5 MHz).
Operating Modes	Standard: AME (A3H), CW (A1), LSB, USB (A3J upper and lower), and FSK (F1 with optional external modem) Optional: ISB (A3B) and NBFM (F3)

Selectivity (Fc = 5.000 MHz)

BANDWIDTH	MODE	6dB BANDWIDTH	60 dB BANDWIDTH
*VWide	AM, CW, FSK, FM	12 kHz Min (3dB)	40 kHz Max
Wide	AM, CW, FSK	5 kHz Min	18 kHz Max
Med	AM, CW, FSK	2.7 kHz Min	6 kHz
*Narrow	AM, CW, FSK	1 kHz Min	6 kHz Max
*VNar	AM, CW, FSK	400 Hz Max	4 kHz Max
Med	USB	<300 & >3000Hz	>-1.5 & <4.5 kHz
Med	LSB	>-300 & <-3000 Hz	<1.5 & >-4.5 kHz
*Med	ISB	Same as USB & LSB	Same as USB & LSB

*Optional Equipment
NOTE: Optional FM board includes separate VWide filter which is used only when FM mode is required.

IF and Image Rejection	80 dB minimum
External Spurious Rejection	70 dB minimum
Internal Spurious Rejection	99.5% below 0.2 μV
Intermodulation Distortion (In Band)	For two equal 0.1 volt input signals that produce tones of 1100 and 1700 kHz, the IM products shall be at least 30 dB below the audio tones.
Intermodulation Distortion (Out-of-Band)	Two 3 mV signal at +30 and +60 kHz removed from the receiver frequency shall produce less audio output than a 1 μV desired signal.
Crossmodulation	With a desired signal of 100 μV unmodulated, the level of an interfering 30% modulated signal ± 100 kHz from the desired signal shall be at least -18 dBm to cause an audio output 20 dB below the reference.
Blocking	With a desired signal of 50 μV, the level of an undesired signal removed ± 30 kHz shall be at least -14 dBm to reduce the audio output by 3 dB.
Oscillator Reradiation	Signals at the antenna connector due to internal oscillators (59.54 -89.53 MHz first L.O.; 54.53 MHz second L.O.; 5.0 MHz third L.O.) shall be less than -73 dBM (2 to 30 MHz) and less than -55 dBm (<2mHz).
Unwanted Sideband Rejection	The response of a signal 1 kHz below/above tuned receiver frequency shall be down 50 dB in USB/LSB mode with respect to the response in LSB/USB mode.
Audio Output	Not less than 4 watts at 10% maximum distortion into 3 ohms load.
Speaker	Not less than 10 mW at 5% maximum distortion on into 600 ohms.
Phone	Internally adjustable (Audio Squelch Board) from less than -10 to not less than +10 dBm at not more than 5% distortion into 600 ohms.
Standard and Optional ISB 600 ohm line	Not less than 34 dB at 100 μV, SSB mode.
Ultimate (S+N)/N	

Mute	Speaker and phone audio reduced 50 dB by external TTL signal (rear panel).
Squelch	Mutes speaker and phone audio by front panel control with threshold adjustment from noise to 30 μV.
Diversity	In USB both IF's controlled by the IF AGC with the largest signal for frequency diversity; inputs and outputs of AGC from each IF available for space diversity.
AGC	
Range	-97 to +13 dBm with less than 10 dB change in audio output (measured in SSB)
Attack-Time	Less than 10 milliseconds (AGC FAST)
Decay Time	(For 60 dB change in signal) AGC FAST - not greater than 50 mSec.; 30 mSec. typical. AGC Medium - 150 mSec. Min., 350 mSec. Max., 200 milliseconds nominal.
Antenna Input Protection	Protection up to 22 volts at 50 ohms.
Dimensions	Height 5.25 inches; width 19 inches; depth 17 5/8 inches (Exclusive of controls, connectors and handles).
Weight	30 pounds Max.
Power	115/230 VAC (+ 10% to specification, + 15% operational; 47 to 400 Hz, 75 watts Max.
Temperature	-10°C to +50°C - (115 VAC or 230 VAC)
Humidity	95% at +50°C for 24 hours
Shock	MIL-STD-810C, Method 516.2, Procedure V
Vibration	MIL-STD-810C, Curve AW, Method 514.2, Procedure X, Modified to 1.5 g from 5.5 to 50 Hz.

1.4 EQUIPMENT SUPPLIED

1.4.1 RECEIVER -Part Number 690024-000-XXX

1.4.2 KIT, ACCESSORY - Part Number 690024-017-001 consisting of:

a) Connector, Accessory, Part Number 600292-606-005

b) Fuses, 1 Amp, Slo-Blo (1) - Part Number 600006-396-019

c) Fuses, 0.5 Amp, (1) - Part Number 600006-396-014

d) Connector, RF, PL-259 - Part Number 600244-606-001

e) Card Puller - Part Number 600268-618-001

f) Cable, Power - Part Number 600078-102-001

1.43 Manual, Technical, Part Number 600249-823-001

1.5 OPTIONAL EQUIPMENT – NOT SUPPLIED

I.F. Filter Option:

Filter Option. Provides the following bandwidths. USB/LSB 2.7 kHz, CW/AM (v. wide) 12 kHz, CW/AM (wide) 6 kHz, CW/AM (narrow) 1 kHz, CW/AM (v. narrow) 400 Hz, CW/AM (medium) 2.7 kHz, Part Number 600083-700-001.

NOTE

BFO Option must be specified for reception of CW, RTTY or Data using 1 kHz or 400 Hz filters.

BFO Option:

Synthesized BFO tunable from 0 to + 9.99 kHz in 10 Hz steps. Recommended when Filter Option is specified. Part Number 600107-700-001.

Independent Sideband Options:

ISB Option "A". Specify this when the filter option is not installed. Reconfigures radio for ISB operation and provides additional audio channel for ISB. Same bandwidths as Filter Option "A". Part Number 600086-700-001.

ISB Option as above, except for use with Filter Option "B". (Part Number 600083-700-001) only. Same bandwidths as standard radio. Part Number 600086-700-002.

FM Option:

Provides capability for FM reception bandwidth (3dB) = 12 kHz min. Part Number 600085-700-001.

High Stability Option:

Oven controlled crystal oscillator provides stability of 1 part in 10^8. Part Number 600090-700-001.

Remote Control/Computer Control Options:

NOTE

Only one of the following options may be fitted in one receiver.

Current Loop/RS232/RS423 MIL 188 option: Internal modem gives choice of control; either by Current Loop or by RS232 interface at data rates from 50 to 9600 baud. Used for control of MSR 5050 by computer or by MSR 6406 Remote Control Unit. Part Number 600087-700-001.