TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

OPERATIONAL LEVEL

RECEIVER, DIGITAL SIGNAL PROCESSING, SINGLE, VLF - HF

CDR-3250 & CDR-3280

Cubic Communications, Inc.
9535 Waples Street
San Diego, California 92121-2953

Telephone: (858) 643-5800 Telefax: (858) 643-5803

Manual Part No. 2600-1021-1

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RECORD OF CHANGES

CHANGE	DATE	TITLE OF BRIEF DESCRIPTIONS	ENTERED BY
1	12 Aug 99	Engineering update. Page changes are as follows: Title Page, Record of Changes, ii & 3-1.	CCI Eng. Dept.
2	2 March 01	DCR 730428: Update Generated Spurious data in Specification table. Pages changed are as follows: Title Page, Record of Changes & 1-5.	CCI Eng. Dept.

FOREWORD

SCOPE

This manual contains information to obtain best performance from the CDR-3250 and CDR-3280 receivers. The information includes: a general description of the equipment, preparation for use and installation instructions, operating instructions, general theory of operation, maintenance instructions, preparation for reshipment, storage, and parts list.

PROPRIETARY DATA

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CORRECTION NOTICE

Information contained in this document is believed to be correct as of the publication date. If a variation is noted between the information in this manual and the equipment in your possession, contact the factory for clarification. Future issues will be updated if necessary.

RIGHTS RESERVED

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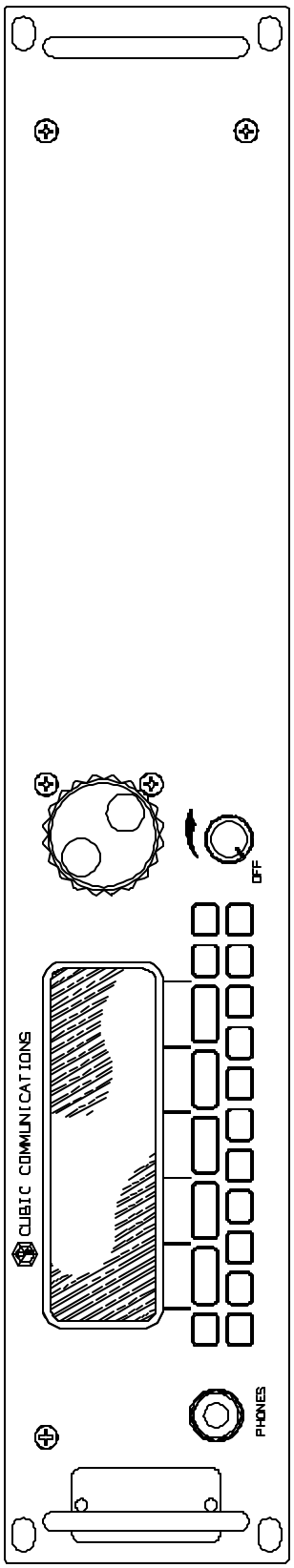


Figure 1-1A CDR-3250 Front View.

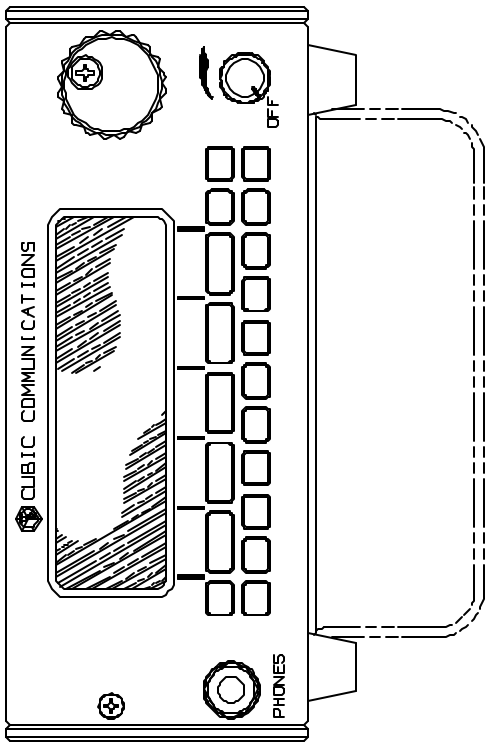


Figure 1-1B CDR-3280 Front View.

CHAPTER 1
GENERAL DESCRIPTION

1-1 INTRODUCTION.

This chapter contains an equipment description, equipment supplied and required, storage data, tools and test equipment, and a summary of safety precautions.

1-2 EQUIPMENT DESCRIPTION.

The CDR-3250 and CDR-3280 (figure 1-1) are multi-mode digital signal processing (DSP) receivers with a frequency range from 10 kHz to 30 MHz.

The receivers are operationally similar, but packaged in two different configurations. The receivers contain individually shielded modules mounted in a 19 by 3½-inch rack-mount chassis (CDR-3250), or 8½ by 3½-inch desktop chassis (CDR-3280). Two CDR-3280 receivers may be fastened together (using an optional dual rack-mount kit) to construct a standard 19-inch rack-mount configuration.

The receivers are controlled by a 19-button keypad and main adjustment knob used to select the receiver parameters. Five "soft keys" work in conjunction with the vacuum fluorescent digital display immediately above the soft keys.

In addition to soft key selections, the vacuum fluorescent digital display provides a variety of data including channel, mode, BFO setting, frequency, bandwidth, gain, local/remote control, an RF level meter, an AF level meter, and a FREQ meter. Additional information is displayed depending on soft key selections.

By proper selection of parameters, the receivers can detect a wide variety of signals. These include: amplitude modulation (AM), on/off keyed (CW), upper sideband (USB), lower sideband (LSB), independent sideband (ISB) (suppressed carrier and independent), and frequency modulation (FM). Frequency shift keyed (FSK) signals can be demodulated as single sideband suppressed carrier signals or as true FM signals.

The selected detector audio output is available on the NORM 600-ohm balanced line, rear panel speaker connection, or front panel PHONES jack. In all modes except ISB, the FM detector output is available as a DC-coupled video signal on a single-ended line. In ISB mode the USB signal appears on the NORM audio output, while the LSB signal appears on the ALT audio 600-ohm line. In all other demodulation modes, the AM detector output appears at the ALT audio output. This output may be used for multiplexed direction-finding (DF) signal processors.

A PHONES jack on the front panel provides for connection of an external speaker, or headphones. The audio level is controlled by the front panel power/volume control. The correct audio is automatically selected depending on the receive mode. However, when the ISB receive mode is selected, the operator must select either the normal (USB) or alternate (LSB) audio for application to the jack.

Either an internal or external reference frequency may be used. The external reference frequency is automatically sensed and used when connected to the rear panel.

The receivers may be remotely controlled (optional) by a companion RCU-3100 remote control unit (optional with serial bus only) or by any suitable bus controller using either an RS-232, or RS-422 serial interface bus, or an IEEE-488 parallel interface bus.

1-3 SPECIFICATIONS.

Refer to table 1-1 for specifications of the equipment.

1-4 EQUIPMENT FURNISHED.

Table 1-2 lists the items furnished, and optional items.

1-5 STORAGE DATA.

Refer to Chapter 7 for storage data.

1-6 TOOLS AND TEST EQUIPMENT.

Table 1-3 lists recommended tools and test equipment for operational level maintenance. There are no special tools or test equipment required.

1-7 SAFETY PRECAUTIONS.

Safety precautions are presented in this manual preceded by the word WARNING or CAUTION just prior to the point where the hazard is likely to be encountered. Warnings and cautions are defined as follows:

WARNING

Refers to a procedure or practice that, if not correctly followed, could result in injury, death, or long term health hazard.

CAUTION

Refers to a procedure or practice that, if not correctly followed, could result in equipment damage or destruction.

Table 1-1 CDR-3250/80 Specifications.

Item	Specification
FREQUENCY	
Tuning Range	10 kHz - 30 MHz
Resolution	1 Hz
Tuning Steps	Adjustable 1 Hz through 10 MHz
Internal Reference Frequency Stability	1 ppm over temperature (standard TCXO). 0.1 ppm over temperature (optional high-performance OCXO).
External Reference Frequency	10 MHz (Automatically switches to external reference when external reference signal is applied)
Synthesizer Lock Time	3 ms typical, 6 msec maximum
DETECTION MODES	LSB, USB, ISB, CW, AM, FM, FSK
DISPLAY	Full graphics vacuum fluorescent display
SCAN & SWEEP	
Channels	250 programmable channels stored in nonvolatile memory
Scan	Up to 250 channels
Sweep	f1 to f2 at selected steps. Up to 125 frequency bands programmable
Rate	1 - 100 channels/second
Adjustable Threshold	-112 to 0 dBm in 1/2 dB increments
RF SECTION	
Antenna Impedance	50 ohms
Antenna VSWR	Less than 3:1
Sensitivity for 10 dB SINAD (above 1.6 MHz).	AM (6 kHz BW 50% modulation): min. -105 dBm. FM (16 kHz BW 5 kHz dev. 400 Hz modulation, 20 dB sinad): -98 dBm. CW (500 Hz BW): min. -122 dBm. SSB (3 kHz BW): min. -113 dBm.
Protection	50 dB reflective attenuation. Activates at signal levels between +10 dBm and +20 dBm. Protects from input signals of levels up to 10 Watts.
Preselection	Eight suboctave bandpass preselector filters used from 1.6 to 30 MHz. Frequencies below 1.6 MHz are selected by two lowpass filters. Filter selection is automatic with tuned frequency selection.

Table 1-1 CDR-3250/80 Specifications-Cont.

Item	Specification
GAIN CONTROL	Automatic (AGC) or Manual (MGC)
AGC	
Dynamic Range	Output held within 1 dB over a 110 dB range
AGC Threshold	-112 dBm (Output level -3 dB with respect to a -60 dBm signal)
AGC Attack Time (SSB & CW)	Automatically selected
Fast	< 2 ms for 50 dB change (sweep/scan only)
Normal	< 10 ms for 50 dB change (product detector modes)
AGC Decay Time	20 ms to 4 seconds nominal for 50 dB change
AGC for AM or FM mode	Carrier derived average detection with 50 ms response time for 50 dB change
MGC	
Control Range	0 to 127.5 dB (nominal) gain reduction in 0.5 dB steps.
IF SECTION	
1st IF	40.456 MHz. Standard Filter BW = 22.5 kHz
2nd IF	456 kHz. Standard Filter BW = 30 kHz
3rd IF	24 kHz, Lowpass filter @ 80 kHz
(cont)	

Table 1-1 CDR-3250/80 Specifications-Cont.

Item	Specification
4th IF (DSP)	51 selectable bandwidths (100 Hz to 16 kHz). Bandwidths are effective bandpass filter bandwidths at the 3 dB down points. Shape factor is 3 dB to 60 dB (Better than 2:1, 400 Hz and above). Inband ripple is 1 dB max. Standard selectable bandwidths are as follows: No. BW (Hz) — No. BW (Hz) 0 100 — 26 2100 1 150 — 27 2200 2 200 — 28 2300 3 250 — 29 2400 4 300 — 30 2500 5 350 — 31 2600 6 400 — 32 2700 7 450 — 33 2800[1] 8 500 — 34 2900 9 550 — 35 3000 10 600 — 36 3100 11 650 — 37 3200 12 700 — 38 3300 13 800 — 39 3400 14 900 — 40 3500 15 1000 — 41 4000 16 1100 — 42 5000 17 1200 — 43 6000 18 1300 — 44 7000[2] 19 1400 — 45 8000[2] 20 1500 — 46 9000[2] 21 1600 — 47 10000[2] 22 1700 — 48 12000[2] 23 1800 — 49 14000[2] 24 1900 — 50 16000[2] 25 2000 [1]ISB mode restricted to 2800 Hz BW only. [2]Bandwidths from 7 kHz to 16 kHz are available in AM or FM only.
INTERFERENCE IMMUNITY	
IF Rejection	100 dB minimum
Image Rejection	100 dB minimum
Cross Modulation	Unmodulated wanted signal of -60 dBm together with a modulated (30% AM at 1 kHz) unwanted signal of -10 dBm spaced 100 kHz apart will produce less than 10% cross modulation of wanted signal.
Blocking	Attenuation of a wanted RF signal of -60 dBm and caused by an unmodulated signal of +10 dBm spaced 100 kHz away is less than 3 dB.
Oscillator Reradiation	-110 dBm, up to 1 GHz from receiver antenna connector into 50 ohms.
Spurious Responses	-120 dBm equivalent or less for -50 dBm input signals

Table 1-1 CDR-3250/80 Specifications-Cont.

Item	Specification
Generated Spurious	Above 0.14 MHz, two at no more than -110 dBm. All others less than -120 dBm
Intermodulation Distortion:	
2nd-order	Input intercept point of +40 dBm (+55 dBm above 1.6 MHz with 2600-1107-2 RF Analog module)
3rd-order	Input intercept point of +30 dBm
OUTPUTS	
WBIF	Wideband IF, 456 kHz, 20 kHz min. BW
NBIF (analog)	Narrowband IF reconstructed from I & Q equal to selected bandwidth, 455 kHz, -10 dBm ± 3 dB over dynamic range
Third IF (digital)	I & Q outputs from DSP
Video	Demodulated FM, 500mV peak to peak into 75 ohms (deviation equal to 30% of selected bandwidth)
FSK	Provides RS232 compatible output
C.O.R.	NORM and ALT Carrier Operated Relay signals
Audio Line Output (Normal)	600 ohms balanced pair on audio connector short circuit protected, less than 3% distortion at rated output, (FM mode only with de-emphasis on). AM, CW, LSB, USB, ISB: 0 dBm ±3 dB (Normal audio is the USB when ISB mode is selected). FM: 0.5 V/kHz AC coupled (4V p-p max.)
Audio Line Output (Alternate)	600 ohms balanced pair on audio connector short circuit protected, less than 3% distortion at rated output, (FM mode only with de-emphasis on). 0 dBm ±3 dB. (Alternate audio is the LSB when ISB mode is selected)
PHONES	0 to 2V p-p, 8 ohm load impedance to front panel phone jack. Short circuit protected. Speaker output in parallel to rear panel audio connector.
Reference	10 MHz , 0 dBm, 50 ohms nominal.
INPUTS	
Synthesizer Reference	10 MHz external standard, 0 dBm, 50 ohms
Antenna	50 ohms nominal
GENERAL DATA	
Power Requirements	90 - 260 VAC 47 - 440 Hz, 60 watts, switching mode power supply
Dimensions	CDR-3250 - 19" (48.2 cm) wide, 3.5" (8.9 cm) high, 22.03 (55.95 cm) deep CDR-3280 - 8.45" (2.17 cm) wide, 3.5" (8.9 cm) high, 22.25" (57.05 cm) deep
Weight	CDR-3250 - Approx 21.8 lbs. (9.9 kg) (Unpackaged) CDR-3280 - Approx 16.0 lbs. (7.25 kg) (Unpackaged)

Table 1-1 CDR-3250/80 Specifications-Cont.

Item	Specification
ENVIRONMENTAL DATA	
Temperature Range	0 to +50°C Operating, -40 to +85°C Storage.
OPTIONS	
RCU-3100 Remote Controller	(Serial bus option must be installed). Controls up to 10 receivers, expandable to 100 receivers. Line audio handling up to 10 receivers.
High-performance reference oscillator	OCXO, 0.1 ppm of tuned frequency
Serial Data Bus	RS-232 or RS-422
Parallel Data Bus	IEEE-488
Rack-Mount Slides	Slides for CDR-3250 for installation into 19-inch rack.
Dual Rack Mount Kit	Hardware and slides to fasten two CDR-3280 receivers together for installation in standard 19-inch rack
DC Power	20-32 VDC. 3A maximum

Table 1-2 Items Furnished.

Part No.	Nomenclature	Furn./Optl.
260001-XX[1]	CDR-3250 or CDR-3280 VLF - HF Digital Receiver	Furn.
696-012	AC power cord	Furn.
2600-1021-1	Technical manual	Furn.
2600-1009-1	Rack Mount Kit, Dual (for CDR-3280 only)	Optl. Not furnished
222-088	Mounting slides for rack mount (for CDR-3250 only)	Optl. Not furnished
222-026	Mounting brackets for slides	Optl. Not furnished
324-009/324-010	Audio Connector/Hood (cable end)	Optl. Not furnished
324-070/324-010	Digital Data Connector/Hood (cable end)	Optl. Not furnished
[1]XX indicates model number and factory installed options. Refer to identification plate on equipment.		

Table 1-3 Recommended Tools and Test Equipment (Or Equivalent).

Part No.	Nomenclature	Manufacturer
-	Screwdriver, Phillips 6 inch, No. 1	Any
-	Screwdriver, Phillips 6 inch, No. 2	Any
-	Driver, nut, 1/4 inch	Any
-	Wrench, open end, 3/16 inch	Any
-	Wrench, Allen, .050 inch	Any
-	Wrench, Allen, 1/16 inch	Any
-	Wrench, Allen, 7/64 inch	Any
HP8642B	RF signal generator	Hewlett Packard
465B	Oscilloscope	Tektronix
8050A	Digital multimeter (true RMS)	Fluke
HP5381A	Frequency counter[1]	Hewlett Packard
HP8568B	Spectrum analyzer[1]	Hewlett Packard
[1]Optional		

CHAPTER 2
PREPARATION FOR USE AND INSTALLATION INSTRUCTIONS

2-1 INTRODUCTION.

This chapter contains unpacking, inspection, installation, connections, and initial alignment procedures.

2-2 UNPACKING AND INSPECTION.

To unpack and inspect the receiver for damage, perform the following procedures:

WARNING

Do not drop the equipment when lifting or carrying. Personnel injury or equipment damage may occur.

1. Inspect the shipping carton for damage before unpacking the receiver.

NOTE

If the carton is damaged, open the carton in the presence of a shipping carrier agent if possible. If damage is found after the receiver is unpacked, retain the carton and packing materials for inspection.

2. Open the carton and remove the foam packing material on top of the receiver.
3. Lift the receiver from the carton.

NOTE

Save carton for possible reshipment.

4. Inspect the receiver for external damage including dents and scratches.

CAUTION

Do not attempt to operate the receiver if major damage is found.

2-3 INSTALLATION.

The receiver is designed for 19-inch rack mount (CDR-3250) or desktop (CDR-3280) operation in a relatively dust free environment with an ambient temperature range between 0 and +50°C. Optional slides may be provided for the CDR-3250. Follow the instructions provided with the slides for installation. An optional dual rack mount kit is available for the CDR-3280 to mount two units into a standard 19-inch rack. No special tools or additional materials are required for installation.

NOTE

See figure FO-1A (CDR-3250) and FO-1B (CDR-3280) for clearance requirements and mounting details.

2-4 CONNECTIONS.

Refer to table 2-1 and connect the antenna, power cable, and optional equipment to the unit. (See figure 2-1A (CDR-3250) and 2-1B (CDR-3280)).

NOTE

Refer to the RCU-3100 Technical Manual if the RCU-3100 remote controller is used.

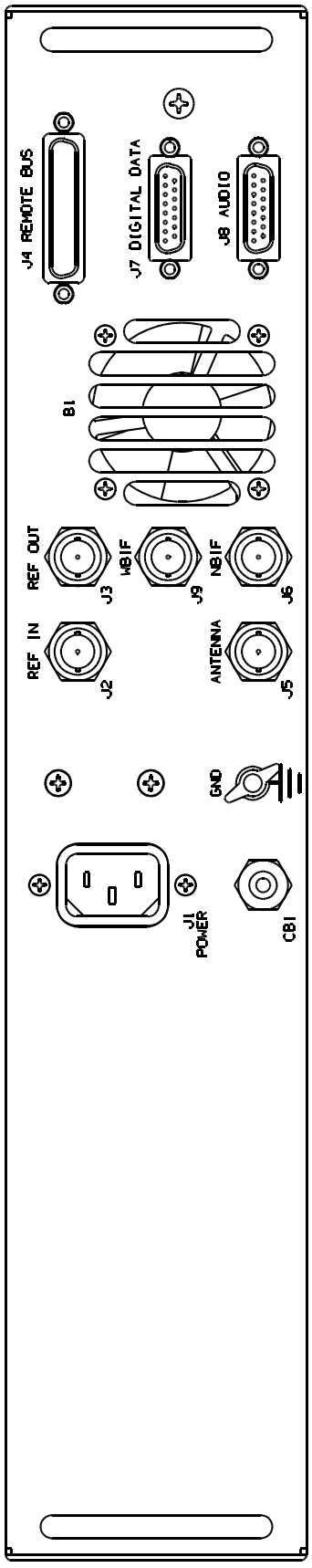


Figure 2-1A CDR-3250 Rear View.

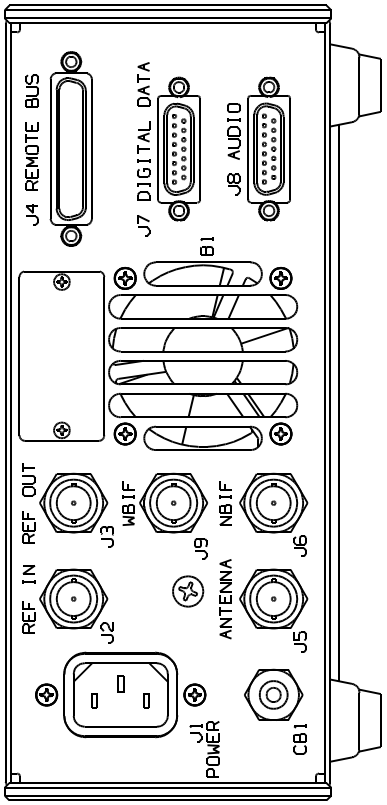


Figure 2-1B CDR-3280 Rear View.

Table 2-1 Rear Panel Connections.

Name	Connector On Unit	Recommended Mating Type	Description
POWER (J1)	IEC 320-C-13 (343-002)	NEMA 5-15P (696-012, Power Cord)	90 to 260 VAC, 47 to 440 Hz, single phase 60 watts max. Figure 2-2 shows the pin descriptions.
REF IN (J2)	BNC Jack (344-246)	BNC Plug (Customer Option)	Reference frequency in. Used to connect 10 MHz external frequency standard. 50 ohms, 0 dBm.
REF OUT (J3)	BNC Jack (344-246)	BNC Plug (Customer Option)	Reference frequency out. Used to connect to other receivers or equipment using the same reference frequency standard. If external reference is used, this signal is the same as applied to the REF IN connector. 50 ohms, 0 dBm.
SERIAL REMOTE CONTROL (J4) (Opt)	25-pin female D sub-miniature connector.	25-pin male D subminiature connector. (Customer Option)	(Optional daughter board in Digital module, and cable assembly must be installed). For external RS-232C or RS-422 remote control bus operation. Table 2-2 lists the pin descriptions. Refer to para 3-7.5.2.2.1 to set the serial bus configuration.
IEEE-488 REMOTE CONTROL (J4) (Opt)	IEEE-488 24-pin "blue ribbon" connector assy.	Standard IEEE-488 24-pin connector. (Customer Option)	(Optional daughter board in Digital module, and cable assembly must be installed). For external remote control bus operation. Table 2-3 lists the pin descriptions. Refer to para 3-7.5.2.2.2 to set the IEEE-488 bus address.
ANTENNA (J5)	BNC Jack (344-246)	BNC Plug (Customer Option)	Coaxial antenna connection. Impedance is approximately 50 ohms with a VSWR less than 3 to 1 at the receiver tuned frequency.
NBIF (J6)	BNC Jack (344-246)	BNC Plug (Customer Option)	Narrowband IF output signal. Centered at 455 kHz with a bandwidth equal to the selected bandwidth. This output may be connected to a spectrum analyzer or other equipment. The signal level is -10 dBm.
DIGITAL DATA (J7)	15-pin "D" subminiature male (324-009)	15-pin "D" subminiature female (324-070)	Used to connect I & Q outputs to external digital signal processing equipment. Table 2-4 lists the pin descriptions. Figure 2-3 shows the timing relationship.
AUDIO (J8)	15-pin "D" subminiature female (324-070)	15-pin "D" subminiature male (324-009)	Used to connect audio to optional RCU-3100 remote controller or other equipment. Table 2-5 lists the pin descriptions.
WBIF (J9)	BNC Jack (344-246)	BNC Plug (Customer Option)	Wideband IF (WBIF) output signal. Centered at 456 kHz (with a bandwidth of 30 kHz). This output may be connected to a spectrum analyzer or other equipment. For input signal levels between 0 and -60 dBm, the WBIF signal level is -30 dBm. For input signal levels below -60 dBm, the gain at the WBIF output is approximately 30 dB.
NOTE: Part numbers in parenthesis (000-000) indicate CCI part number if applicable.			

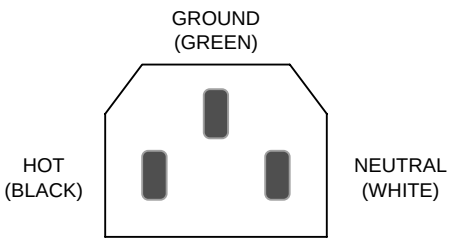


Figure 2-2 Power Connector (J1) Pin Descriptions.

Table 2-2 Serial Remote Control Bus Connector (J4) Pin Descriptions.

Pin	Signal	Remarks	Bus
2	TXD	Transmitted Data	RS-232
3	RXD	Received Data	RS-232
4	RTS	Request to Send	RS-232
5	CTS	Clear to Send	RS-232
7	GND	Signal Ground	RS-232
12	RSA	Request to Send A	RS-422
13	RSB	Request to Send B	RS-422
14	SDA	Send Data A	RS-422
15	SDB	Send Data B	RS-422
16	RDA	Receive Data A	RS-422
17	RDB	Receive Data B	RS-422
23	CSA	Clear to Send A	RS-422
24	CSB	Clear to send B	RS-422

NOTE: The pinout for the RS-232 interface follows the recommendations of the EIA standard. Since the EIA standard for RS-422 does not call out recommended pin assignments, these circuits are assigned to unused pins on the same connector as the RS-232 circuits.

Only one set of signals (RS-232 or RS-422) is active at any given time. Selection is made at the front panel of the receiver. The name "Transmitted Data" for RS-232 is synonymous with "Send Data" for RS-422. All circuits for the RS-422 interface consist of a differential pair of signal lines labeled A and B. Both lines must be connected to the circuit at the other end, A to A and B to B.

A receiver configured with the serial interface will operate as Data Terminal Equipment (DTE). This means that the circuits named Transmitted Data and Request to Send are outputs from the receiver and the circuits named Received Data and Clear to Send are inputs to the receiver. The electrical characteristics of the interface will conform to either EIA standard RS-232-C or EIA standard RS-422-A with the following exceptions.

When so configured from the front panel of the receiver, the line drivers associated with the Transmitted Data and Request to Send circuits for the unit will be in a high impedance state except when that unit has been commanded by the system controller to transmit. When done transmitting, the line drivers will return to the high impedance state. This feature, referred to as bus sharing or party line operation, allows multiple receivers to share a single circuit for the Transmitted Data signal to the system controller. In systems where only one receiver is connected to the external controlling device, this feature may be disabled from the receiver front panel.

(CONT)

Table 2-2 Serial Remote Control Bus Connector (J4) Pin Descriptions-Cont.

NOTE (CONT):

The Request to Send (RTS) and Clear to Send (CTS) handshake circuits are generally not used when the line drivers are configured for bus sharing operation. When the line drivers are not configured for bus sharing, the operation of the CTS and RTS lines is as follows: When a receiver is ready to accept remote control commands it will set the RTS circuit true. When it has received a message and is processing the commands, it will set the RTS circuit false until it is ready to receive another command. The receiver will only transmit messages to an external device when its CTS circuit is held true by the external device. The external device may stop the transmitted output of the receiver (to prevent buffer overflow for example) by taking the CTS circuit false. When the CTS circuit is again taken true, the receiver will begin transmitting where it left off. NOTE: When bus sharing is enabled from the receiver front panel, the state of the CTS circuit is ignored.

The number of CDR-3200 series receivers that may be connected to a single controller is dependent on the serial bus type and the line driver characteristics of the controller, but in general is at least 10 receivers for RS-232 operation and at least 30 receivers for RS-422 operation. Dual chassis models count as two receivers. The input resistance of the RS-232 line receivers is approximately 5000 Ohms. The CDR-3250/80 receiver contains no termination resistors for the RS-422 bus.

If connected directly to a computer interface also configured as DTE, a reversal of transmit and receive data (TXD and RXD or SD and RD) and request to send and clear to send (RTS and CTS or RS and CS) lines may be necessary. The Request to Send and Clear to Send lines may be jumpered together on the mating connector if required by the system. These reversals or jumpers are normally not required if units are connected through a modem. If a CDR-3200 series receiver is to be connected to another DTE device as its controller, the circuits must be swapped for proper operation as follows:

CDR-3200 Series Receiver		Other DTE Device
Transmitted Data	---------->	Received Data
Received Data	<----------	Transmitted Data
Request to Send	---------->	Clear to Send
Clear to Send	<----------	Request to Send
Signal Ground	----------	Signal Ground

CAUTION: Refer to note below EEPCLR command in table 3-5.

Table 2-3 IEEE-488 Remote Control Bus Connector (J4) Pin Descriptions.

Pin	Signal	Remarks
1	D1	Data Bit 1
2	D2	Data Bit 2
3	D3	Data Bit 3
4	D4	Data Bit 4
5	EOI	End Or Identify (Bus management)
6	DAV	Data Valid (Handshake)
7	NRFD	Not Ready For Data (Handshake)
8	NDAC	Not Data Accepted (Handshake)
9	IFC	Interface Clear (Bus management)
10	SRQ	Service Request (Bus management)
11	ATN	Attention (Bus management)
12	SHIELD	-
13	D5	Data Bit 5
14	D6	Data Bit 6
15	D7	Data Bit 7
16	D8	Data Bit 8
17	REN	Remote Enable (Bus management)
18	GND 6	Twisted with pin 6
19	GND 7	Twisted with pin 7
20	GND 8	Twisted with pin 8
21	GND 9	Twisted with pin 9
22	GND 10	Twisted with pin 10
23	GND 11	Twisted with pin 11
24	LOGIC GND	Signal common

NOTE: Cable requirements for the IEEE-488 bus are determined by the actual system design. Refer to the hardware installation instructions provided with the Bus Controller. The bus cables may be configured in either a star or daisy-chain. Any combination of the two configurations may be used provided the total cable length does not exceed 20 meters (65.5 feet) or 2 meters (6.5 feet) for each bus device connected, whichever is less. The IEEE-488 bus connector on the rear panel is the type specified in the IEEE-488-1978 standard and uses metric studs. Make sure the locking devices are engaged on all connectors in the system.

Table 2-4 DIGITAL DATA Connector (J7) Pin Description.

Pin	Signal	Remarks
1	SERCLK (-)	Serial clock inverted (0 to +5V)
2	SERCLK (+)	Serial clock (0 to +5V)
3	GND	Ground
4	FRSYNC (-)	Frame sync inverted (0 to +5V)
5	FRSYNC (+)	Frame sync (0 to +5V)
6	GND	Ground
7	SERDAT (-)	Serial data inverted (0 to +5V)
8	SERDAT (+)	Serial data (0 to +5V)
9	GND	Ground
10 - 14	NC	Not connected
15	GND	Ground
NOTE: (+) indicates standard TTL signal levels. (-) indicates standard TTL signal (logical complement). For differential operation, use both pins. TTL: V_{OH} = +2.5V, min; V_{OL} = +0.5V, max.		

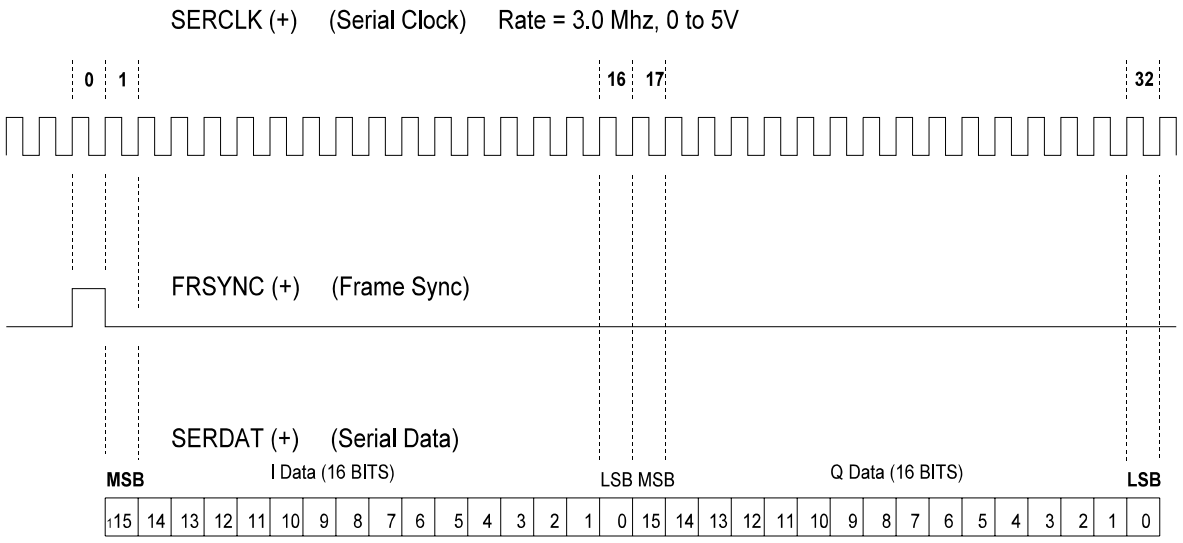


Figure 2-3 Digital Data Connector Signals (typical)

Table 2-5 AUDIO Connector (J8) Pin Descriptions.

Pin	Signal	Remarks
1	NORM BAL AUDIO	600 ohms balanced pair
2	NORM BAL RTN	
3	GND	
4	ALT BAL AUDIO	600 ohms balanced pair
5	ALT BAL RTN	
6	VIDEO RTN (GND)	
7	SPKR AUDIO	4 ohms or greater
8	SPKR RTN (GND)	
9	NORM C.O.R.	Normal channel Carrier Operated Relay[1] Low = squelch open, High = squelch closed. +20 volts @ 250 mA max load.
10	ALT C.O.R.	Alternate channel Carrier Operated Relay[1]
11	VIDEO (All modes except FSK or ISB) FSK Mode (RS-232-C)	Output level is ±1V for FM deviation of ±25% of selected bandwidth ± 8v Shift Values: VNAR: 50 Hz NAR: 85 Hz MED: 170 Hz WIDE: 850 Hz
12-15	NC	

[1]C.O.R. signals are switch closure to ground. External equipment must provide pull-up voltage.

CHAPTER 3
OPERATING INSTRUCTIONS

Section I. LOCAL CONTROL

3-1 INTRODUCTION.

This chapter contains both local (manual) and remote control (using a remote control bus) operating instructions for the receiver including a description of the controls and displays and operating procedures.

3-2 LOCAL OPERATION.

Local (manual) operation is performed using the front panel controls and displays.

3-2.1 *Controls and Display.* (See figure 3-1.) Table 3-1 lists the front panel controls, and display, and their functions.

3-2.2 *Parameter Entry.* Figure 3-2 shows the parameter entry controls and display used to change the receiver parameters. Each is described below.

3-2.2.1 *Vacuum Fluorescent Displays.* The vacuum fluorescent display shows two basic displays; normal, and data entry. The displays are described below.

3-2.2.1.1 *Normal Display.* The normal display (figure 3-3) shows the basic receiver parameters including channel number, skip, receive mode, squelch or BFO setting, operating frequency, bandwidth selection, AGC/MGC selection, local or remote control selection, the soft key menus, and NEXT to indicate that there are other soft key labels available in the menu. Five soft keys (unlabeled) are located below the menu. The labels for the soft keys appear in the menu display immediately above each key. When a soft key is pressed, the function above the key is selected. Pressing the NEXT key (when NEXT is displayed in the display) selects a different set of soft key labels.

3-2.2.1.2 *Data Entry Display.* The data entry display (figure 3-4) is present during most soft key entries. Basic receiver parameters are shown on the right side of the display. The center of the display is used for operator instructions and parameter entry display. (BFO frequency entry is shown).

3-2.2.1.3 *Meter Display.* Although not considered a basic display, the meter display (figures 3-5 and 3-6) shows the basic receiver parameters and can usually be displayed from the normal or data entry display when the MTR/MNU key is pressed. The soft key menu is replaced with two or three meters depending on the receive mode. In the ISB receive mode the FRQ meter is replaced with a SELECT soft key to allow selection of the ISB monitor mode. Each of the meters has an analog arrow that shows the approximate reading on the meter while the center of the meter shows a numeric reading. Each meter is described below.

NOTE

When the meters are displayed, the first four soft keys select the PRIMARY, SECONDARY, SCAN/SWEEP, or UTILITY soft key menus respectively. However, if the meters are displayed in a submenu (i.e. freq. change), these soft keys are not active.

RF meter - Indicates RF signal strength from -115 to +10 dBm (signals less than -115 dB displayed as "<115").

AF meter - Indicates audio level at the 600 ohm output on the rear panel from -50 to +12 dBm.

FRQ meter - (Not shown when ISB mode is selected). Indicates the frequency of a carrier type signal with respect to the center of the IF bandwidth. When exactly on center frequency, the display should read 000. When the bandwidth is at or below 2 kHz, the meter displays in Hz. When bandwidth is above 2 kHz, meter displays in kHz.

NOTE

Either the normal display or the meter display may be displayed as the default. Pressing the MTR/MNU key will alternately select either display. Refer to paragraph 3-7.5.4 to change the default setting.

3-2.2.1.4 *ISB Monitor Mode.* When ISB mode is selected, there are separate squelch and AGC decay setting for the normal (USB) and alternate (LSB) channels. The ISB Monitor mode determines which channel is affected by changing these parameters in the normal way, and which channel is displayed by the RF and AF meters. The current ISB Monitor mode is indicated in the normal display by a small “U” or “L” following the “ISB” in the mode display, see figure 3-6.

From the front panel the ISB Monitor mode is changed by selecting the meter display and pressing the SELECT soft key. From the remote control interface the ISB Monitor mode (also referred to as the ISB Access Mode) is changed with the **V*** command.

3-2.2.2 *Controls.* (See figure 3-2). Table 3-2 lists the parameter entry controls, the display and their functions.

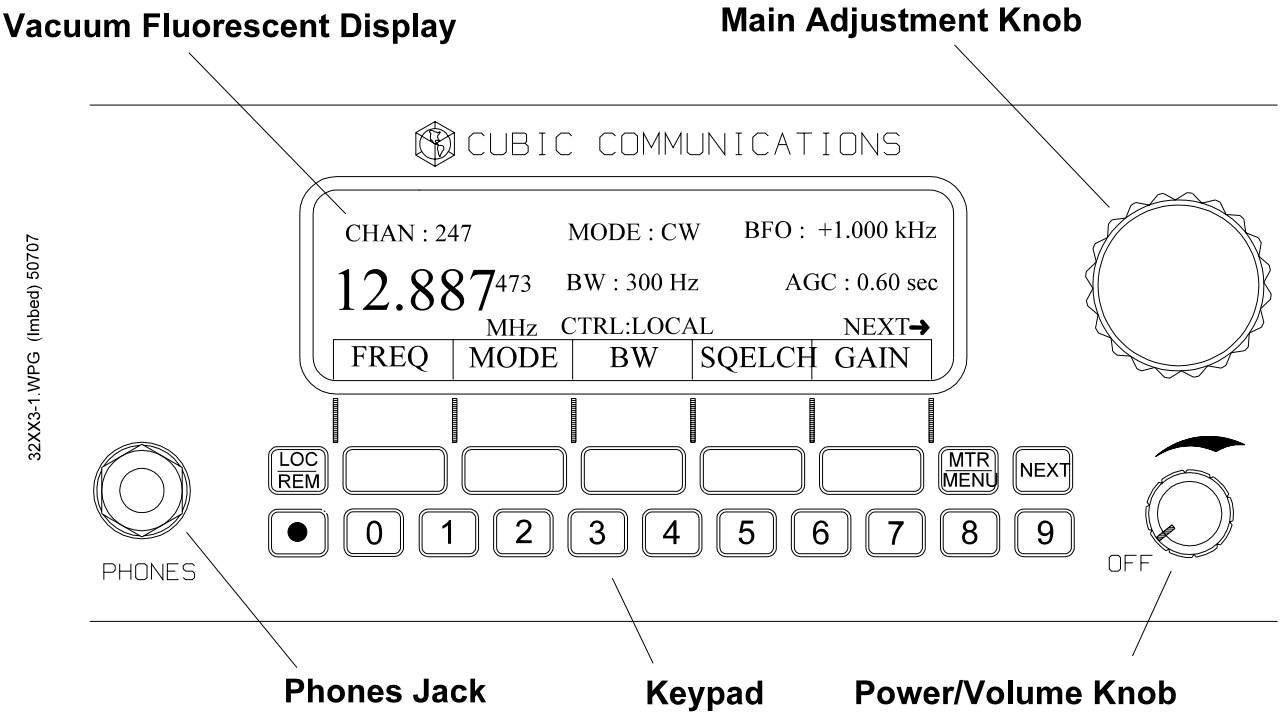


Figure 3-1 Front Panel Controls and Display.

Table 3-1 Front Panel Controls And Display.

Control	Function
Vacuum Fluorescent Display	Provides display of receiver parameters and other data to the operator.
Main Adjustment Knob	Provides analog adjustment of parameters using optical digital encoder on shaft of knob.
Power/Volume Knob	Combination power on/off switch and volume control for PHONES jack
Keypad	Provides data entry of receiver parameters.
PHONES	Headphone jack

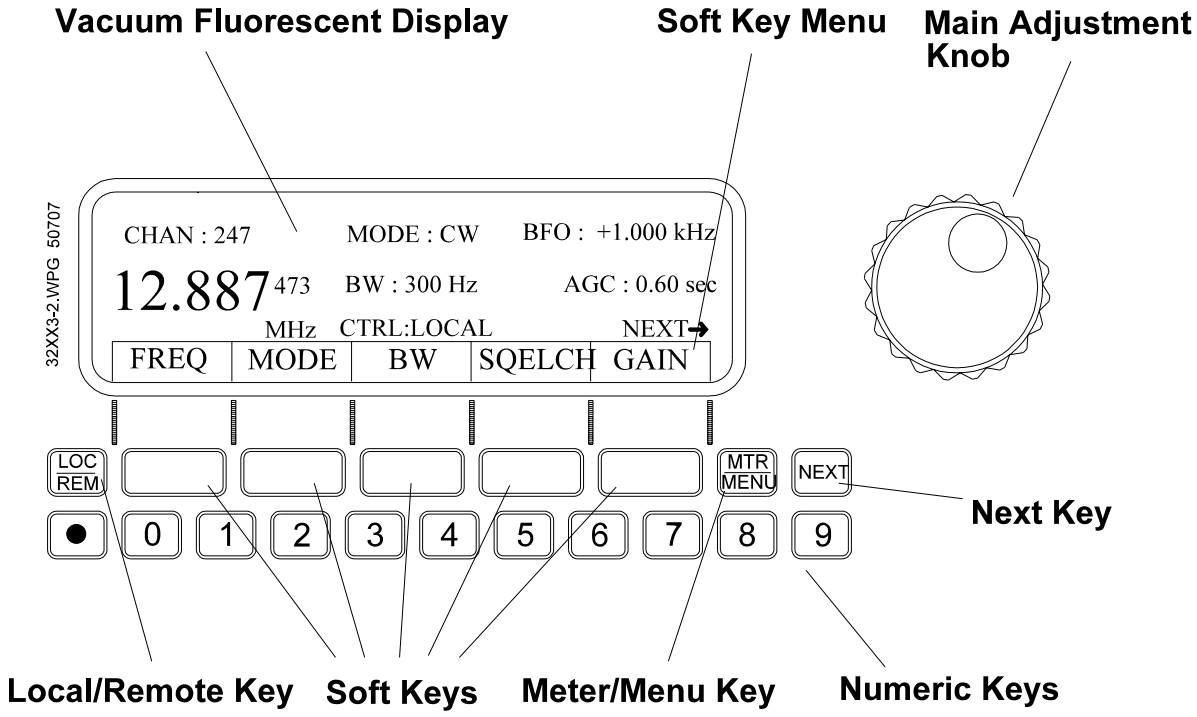


Figure 3-2 Parameter Entry Controls and Display.

Table 3-2 Parameter Entry Controls.

Control	Function
LOC/REM Key	Pressing the LOC/REM key selects either local (manual) or remote control of the receiver. When the desired control mode is selected CTRL:LOCAL or CTRL:REMOTE is displayed in the lower center of the vacuum fluorescent display.
Soft Keys	Five soft keys (unlabeled) are provided below the soft key menu. Each key corresponds to the menu selection immediately above the key. When a soft key is pressed, the function above the key is selected for parameter entry. Pressing the NEXT key allows a different set of soft keys to appear in the soft key menu.
MTR/MNU Key	The MTR/MNU key selects either the soft key menu display or the meter display.
Numeric Keys	The numeric keys are used to select numbers or decimal point for entry.
NEXT Key	The NEXT key allows selection of the next soft key menu.
Main Adjustment Knob	The main adjustment knob has a digital encoder on the knob's shaft that allows incrementing and decrementing numeric entries without using the numeric keys. Using the knob can save time in most cases by eliminating key presses.

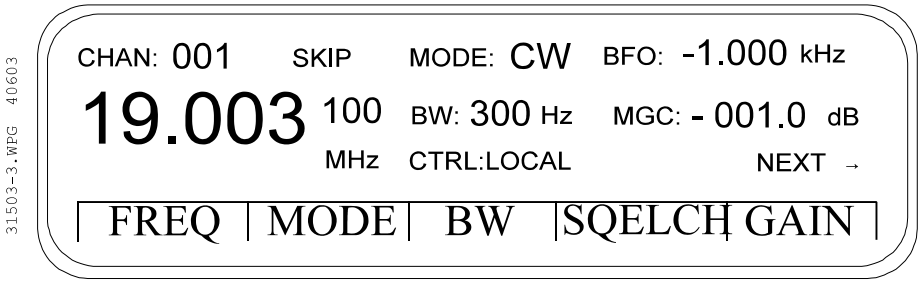


Figure 3-3 Normal Display.

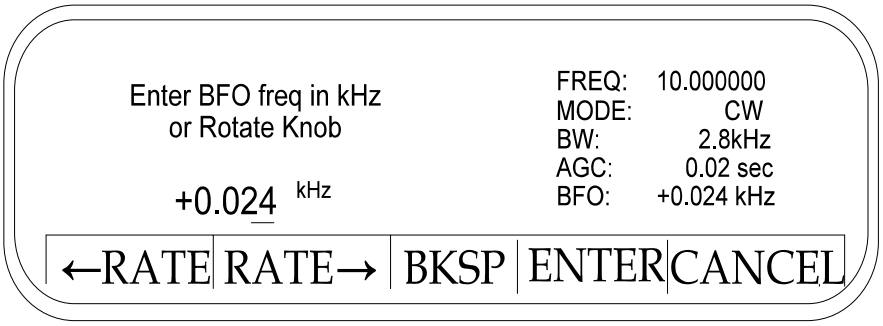


Figure 3-4 Data Entry Display.

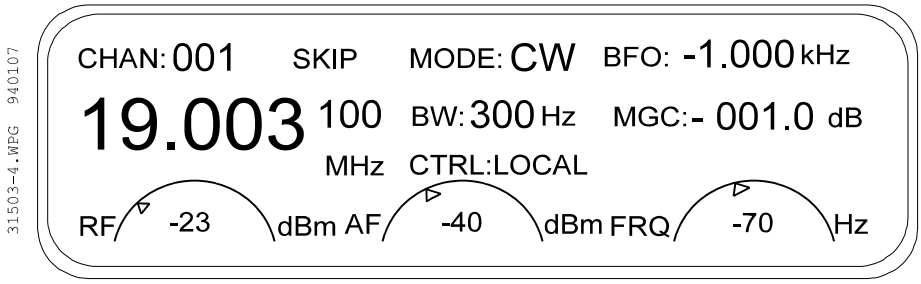


Figure 3-5 Meter Display.

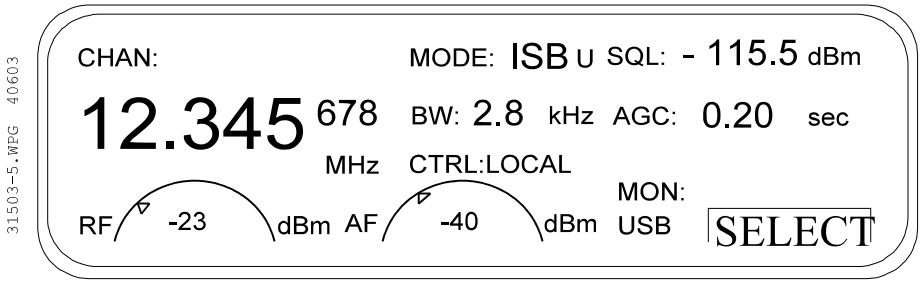


Figure 3-6 Meter/ISB Display.

3-3 POWER ON AND INITIAL SET UP.

To turn on and initially set up the receiver do the following:

1. Set the power/volume knob on.
2. Observe the display for initialization displays then the normal display.
3. Plug headphones or speaker into the PHONES jack.
4. Adjust the volume as desired.
5. To shut down the receiver, set the power/volume knob to OFF.

NOTE

If the receiver is remotely controlled, the receiver must be initially configured for bus operation. The receiver's bus parameters must match the parameters of the remote controller. Perform the remote control configuration procedures in paragraph 3-7.5.2.2.

3-4 EMERGENCY OPERATION.

There are no emergency operating procedures.

3-5 INITIAL ADJUSTMENTS AND CONTROL SETTINGS.

There are no initial adjustments or control settings necessary.

3-6 NORMAL OPERATION.

Receiver functions are set or changed by watching the front panel display, while using the keypad (and/or main adjustment knob) to select and enter the parameters. If the meter display is shown (figure 3-5 or 3-6), press the MTR/MNU key to show the normal display containing the soft key menu (figure 3-3). Refer to paragraph 3-7 to set or change receiver parameters.

3-7 SETTING OR CHANGING RECEIVER PARAMETERS.

When the receiver is first powered on, a power-on self test (POST) tests key circuits in the receiver, and performs a built-in test equipment (BITE) test. If a failure is detected, the display shows the failure code. When no failures are detected, the receiver displays the primary soft key menu. Each of the four main soft key menus are described in paragraph 3-7.1. The secondary and subsequent main soft key menus are selected by pressing the NEXT key. Pressing the MTR/MNU key while in most menus causes the receiver to switch to the METER display.

The following paragraphs lists the soft key menus used to change receiver parameters. Shaded keys indicate the next logical key to press in a particular sequence. If no shading is shown the operator has a choice of keys to press. Figure 3-7 shows a flow chart of all soft key menus.

NOTE

To cancel the current operation and return to the main menu, press the CANCEL soft key when displayed. To return to the function group menu press the RETURN soft key when displayed. This key allows the operator to continue entering other related functions without returning to the main menu. To return to the main menu press the DONE soft key when displayed.

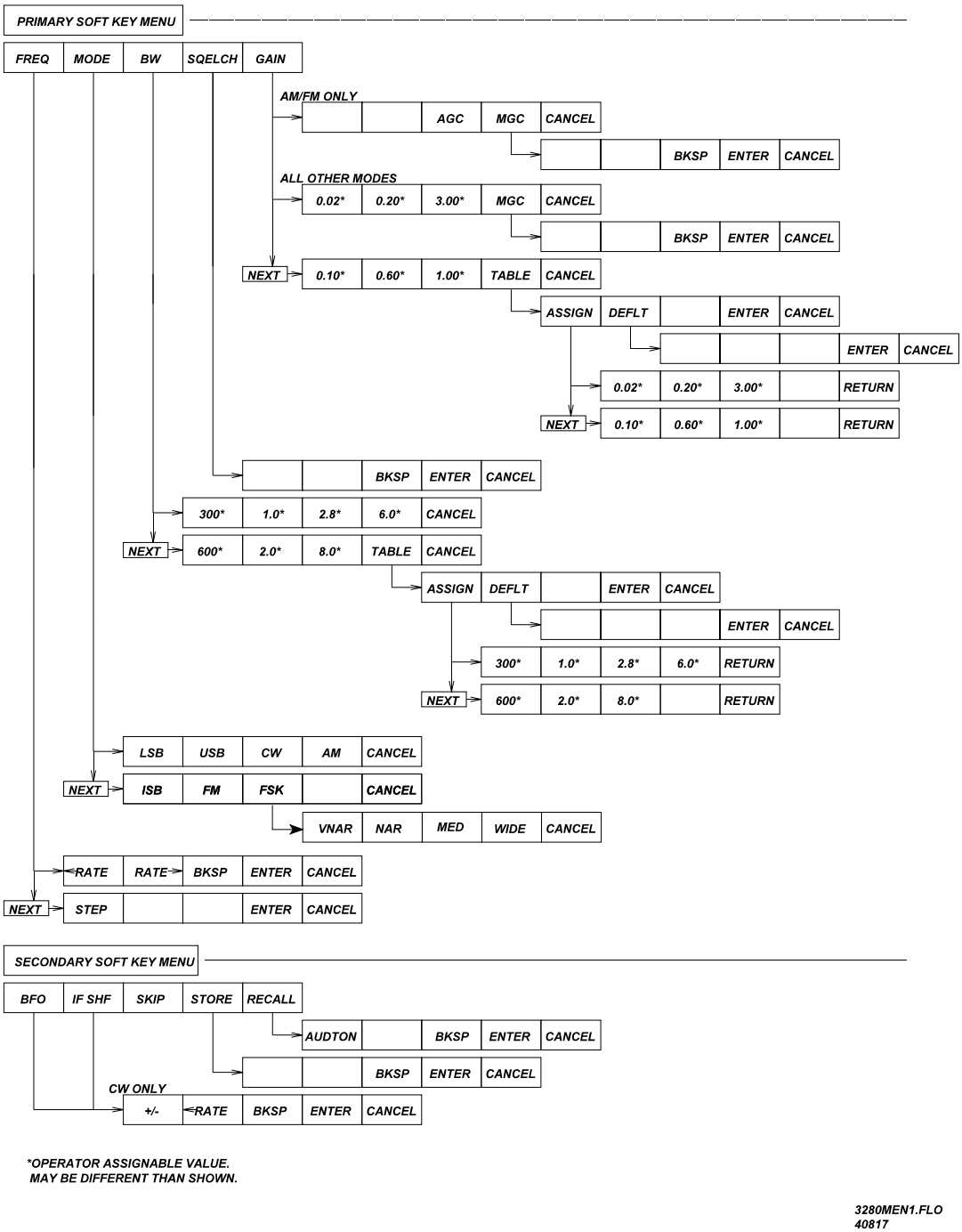
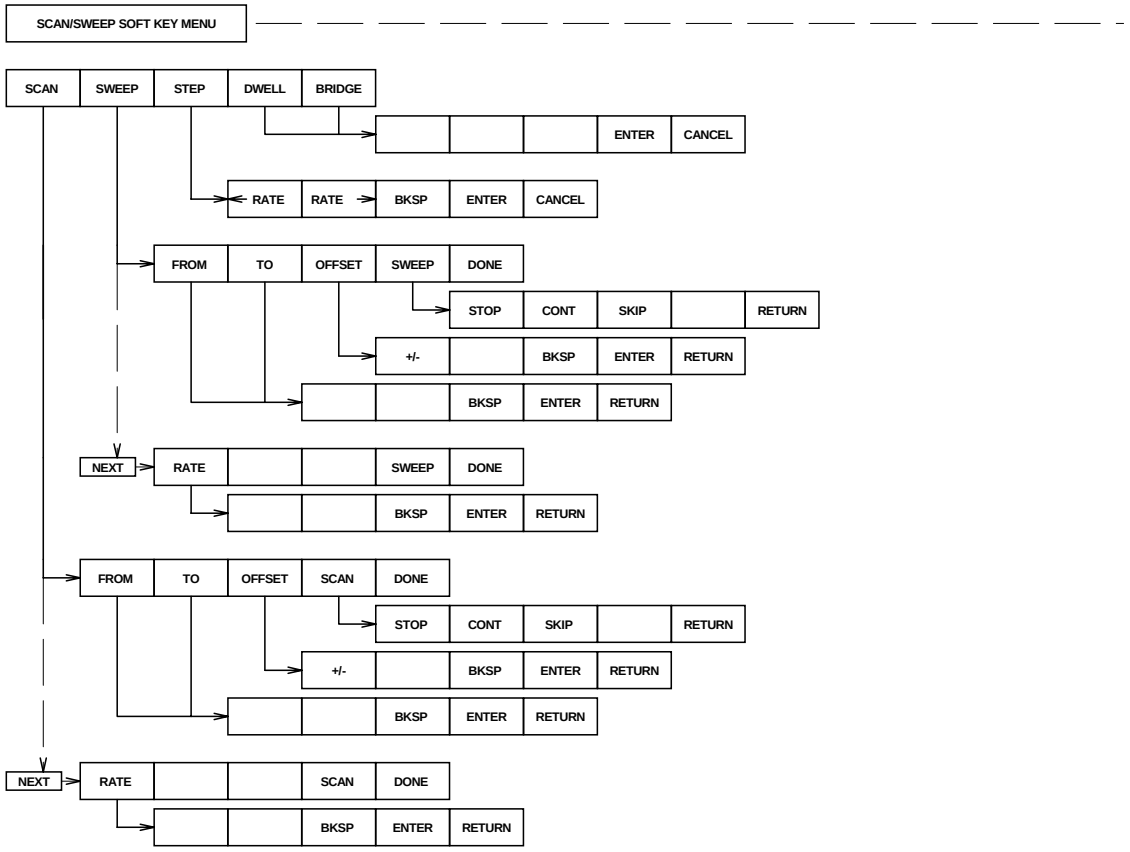


Figure 3-7 Soft Key Menus Overall Flow Diagram (Sheet 1 of 3).



3150MEN2.FLO
920928

Figure 3-7 Soft Key Menus Overall Flow Diagram (Sheet 2 of 3).

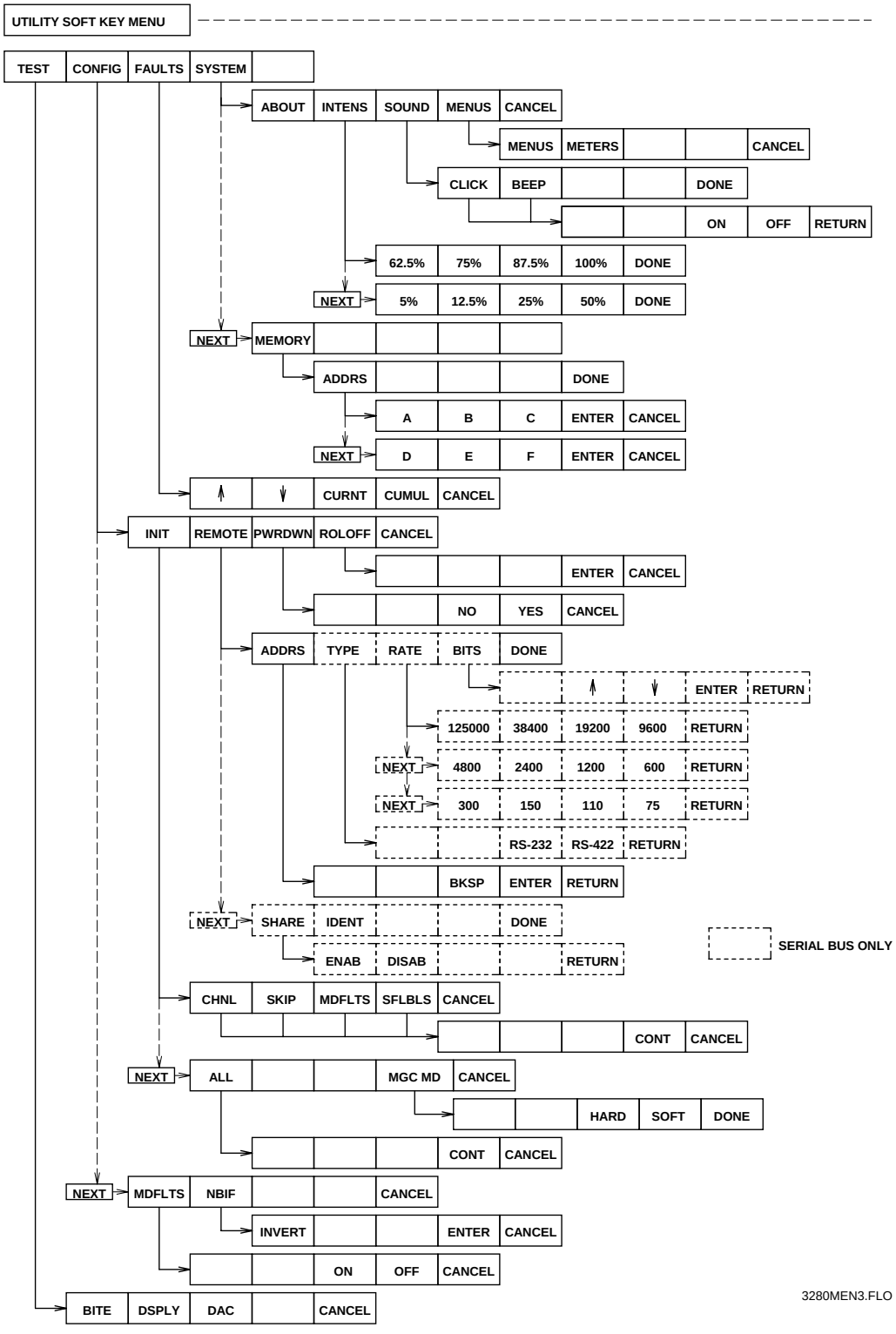
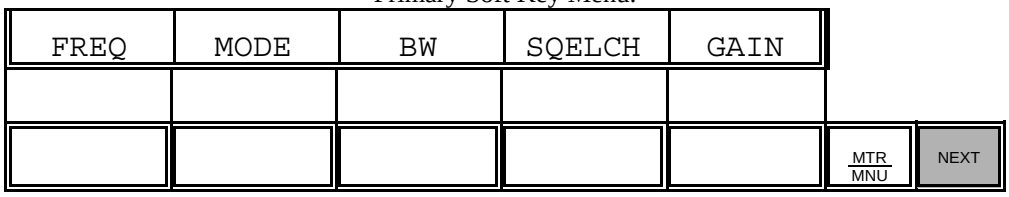


Figure 3-7 Soft Key Overall Flow Diagram (Sheet 3 of 3)

3-7.1 *Basic Soft Key Menus.* Four basic soft key menus can be displayed; primary, secondary, scan/sweep, and utility. Each menu is described below.

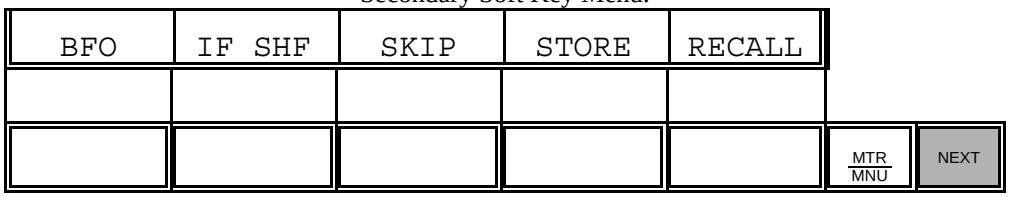
A. Primary Soft Key Menu. This menu is displayed after power up and completion of POST testing.

Primary Soft Key Menu.



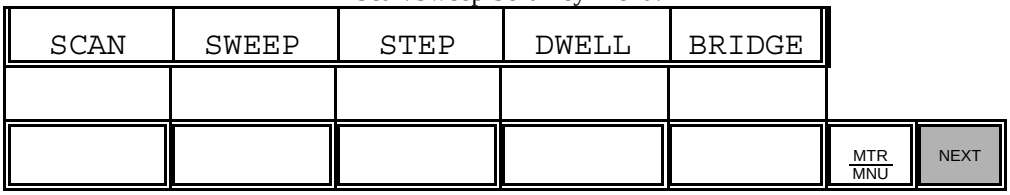
B. Secondary Soft Key Menu. This menu is displayed by pressing the NEXT key while the primary soft key menu is shown.

Secondary Soft Key Menu.



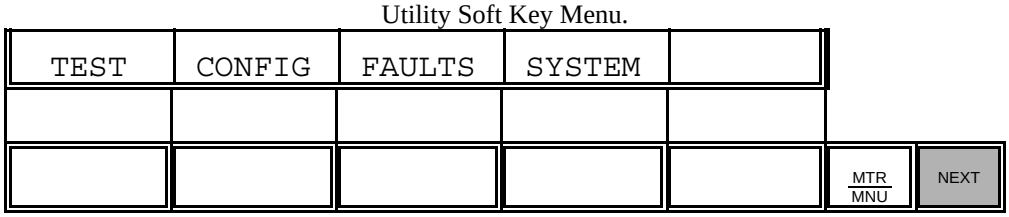
C. Scan/Sweep Soft Key Menu. This menu is displayed by pressing the NEXT key while the secondary soft key menu is shown.

Scan/Sweep Soft Key Menu.



D. Utility Soft Key Menu. This menu is displayed by pressing the NEXT key while the scan/sweep soft key menu is shown.

Utility Soft Key Menu.



Pressing NEXT while in this menu restores the primary soft key menu.

Each basic soft key menu is detailed in the following paragraphs.

3-7.2 *Primary Soft Key Menu.* The following paragraphs detail the primary soft key menu parameter entries.

3-7.2.1 *Frequency.* This function sets or changes the receiver frequency.

Primary Soft Key Menu.

FREQ	MODE	BW	SQELCH	GAIN		
					MTR/MNU	NEXT

Press the FREQ key to adjust the receive frequency. The following menu appears.

FREQ Entry Soft Key Menu.

←RATE	RATE→	BKSP	ENTER	CANCEL		
					MTR/MNU	NEXT

Change the receive frequency with the keys or main adjustment knob. Repeatedly pressing the RATE keys moves a bar under the digits in the display. The bar under the digit indicates the tuning resolution of the main adjustment knob.

NOTE

The BKSP (backspace) key clears the previously entered digit and allows entry of correct digit.

Press the NEXT key and the following menu appears.

FREQ Entry - NEXT Soft Key Menu.

STEP			ENTER	CANCEL		
					MTR/MNU	NEXT

Press STEP to cause the main adjustment knob to change in the same frequency increments as programmed for the sweep function. (Refer to paragraph 3-7.4.3 to set the step increment.) While rotating the main adjustment knob the display will change by the step frequency amount.

3-7.2.2 *Mode.* This function selects the receiver reception mode.

Primary Soft Key Menu.

FREQ	MODE	BW	SQELCH	GAIN		
					MTR/MNU	NEXT

Press the MODE key to change the receive mode. The following menu appears.

MODE Soft Key Menu.

LSB	USB	CW	AM	CANCEL		
					MTR/MNU	NEXT

Press the desired receive mode, or press the NEXT key and the following menu appears.

MODE - NEXT Soft Key Menu.

ISB	FM	FSK		CANCEL		
					MTR/MNU	NEXT

Press the desired receive mode, or press the NEXT key to show the previous menu.

NOTE

When ISB reception mode is selected, a small U or L will be shown after the ISB in the display. This indicates which sideband's audio (upper or lower) is being monitored (sent to the PHONES jack and shown on the display). When in ISB, the upper sideband audio is always applied to the NORM audio line and the lower sideband audio is always applied to the ALTN audio line on the rear panel connector. Separate AGC and squelch settings are available for each sideband.

The ISB monitor mode may be changed when the meter display is shown. Press the MTR/MNU key as shown below to select the meters display.

Primary Soft Key Menu.

FREQ	MODE	BW	SQELCH	GAIN		
					MTR/MNU	NEXT

The following display appears.

ISB Monitor Soft Key Menu.

(RF Meter Display)		(AF Meter Display)		SELECT		
					MTR/MNU	NEXT

Press SELECT to toggle the ISB monitor mode (Upper or Lower).

MODE - NEXT Soft Key Menu.

ISB	FM	FSK		CANCEL		
					MTR/MNU	NEXT

When FSK is selected, the following menu appears.

MODE - NEXT - FSK Soft Key Menu.

VNAR	NAR	MED	WIDE	CANCEL		
					MTR/MNU	NEXT

Press the desired FSK shift value where VNAR = 50 Hz, NAR = 85 Hz, MED = 170 Hz, and WIDE = 850 Hz.

3-7.2.3 *Bandwidth.* This function sets or changes the receiver bandwidth.

NOTE

In ISB mode the bandwidth is fixed at 2.8 kHz. In USB, LSB, or CW, only bandwidths between 100 Hz and 6.0 kHz can be selected. In AM or FM modes all bandwidths between 100 Hz and 16.0 kHz may be selected.

Primary Soft Key Menu.

FREQ	MODE	BW	SQELCH	GAIN		
					MTR/MNU	NEXT

Press BW to change the bandwidth. The following menu appears.

BW Soft Key Menu.

300*	1.0*	2.8*	6.0*	CANCEL		
					MTR/MNU	NEXT

Press the desired bandwidth key or press the NEXT key to display additional bandwidths.

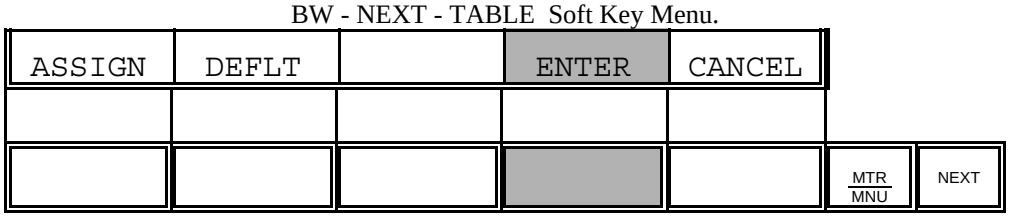
BW - NEXT Soft Key Menu.

600*	2.0*	8.0*	TABLE	CANCEL		
					MTR/MNU	NEXT

Press the desired bandwidth key or press the TABLE key for additional bandwidths.

*Operator assignable value. May be different than shown.

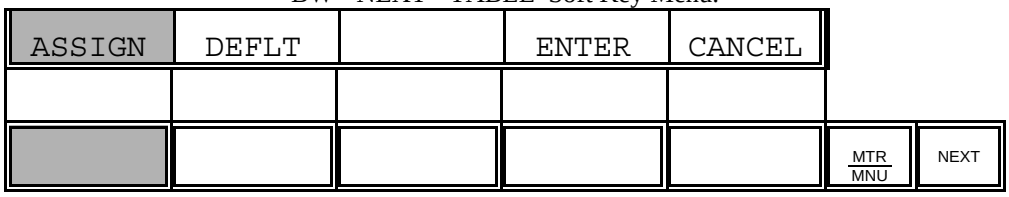
BW - NEXT - TABLE Soft Key Menu.



When the TABLE key is pressed BW: XXX is shown in the display. Rotate the main adjustment knob to select and change one of fifty-one bandwidths from 100 Hz to 16.0 kHz (or 6.0 kHz) depending on receive mode. After the desired bandwidth is displayed, press the ENTER key to enter the receiver bandwidth and exit the Bandwidth menu. If the CANCEL key is pressed instead of the ENTER key, the receiver reverts back to the original bandwidth.

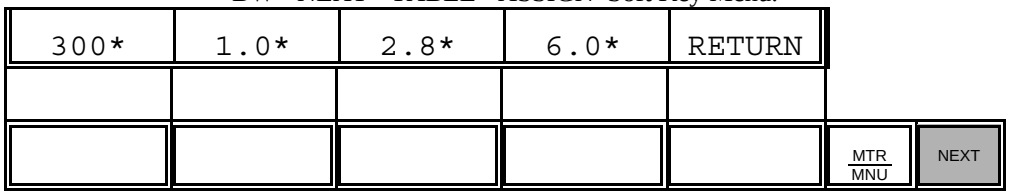
3-7.2.3.1 *Assigning Bandwidths to Soft Key Labels.* The bandwidth soft key labels may be assigned different values from the bandwidth table using the ASSIGN function. To assign the bandwidths select the BW - NEXT - TABLE soft key menu as shown below. Rotate the main adjustment knob to select the desired bandwidth in the display.

BW - NEXT - TABLE Soft Key Menu.



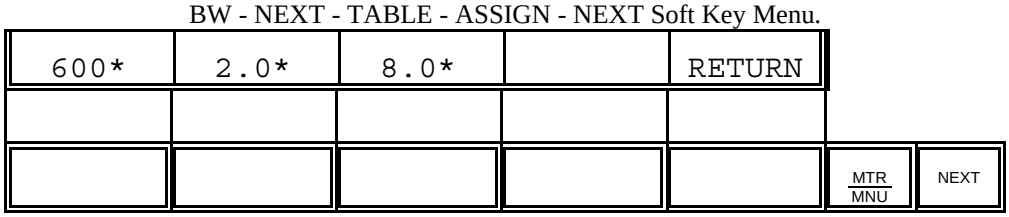
Press the ASSIGN key to select the desired bandwidth from the table to the soft key menu. The following menu is displayed.

BW - NEXT - TABLE - ASSIGN Soft Key Menu.



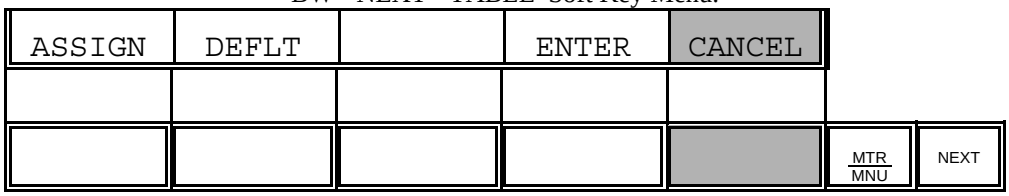
Press the desired soft key to reassign to a bandwidth, or press the NEXT key to display the additional bandwidth menu.

BW - NEXT - TABLE - ASSIGN - NEXT Soft Key Menu.



Press the desired soft key to assign to a bandwidth. The following menu is displayed.

BW - NEXT - TABLE Soft Key Menu.



Press the CANCEL key or assign additional bandwidths if desired.

3-7.2.3.2 *Assigning Default Bandwidths To Receive Modes.* Bandwidths may be assigned to receive modes as default settings using the DEFLT function. To assign the bandwidths select the BW - NEXT - TABLE soft key menu as shown below. Rotate the main adjustment knob to select the desired bandwidth as shown in the display.

NOTE

The desired receive mode (to be assigned a bandwidth value) must be selected before selecting this function. USB and LSB share the same default bandwidth. Mode default settings may be enabled or disabled through keypad configuration. Refer to section 3-7.5.2.3.

BW - NEXT - TABLE Soft Key Menu.

ASSIGN	DEFLT		ENTER	CANCEL		
					MTR/MNU	NEXT

Press the DEFLT key and the following menu appears.

BW - NEXT - TABLE - DEFLT Soft Key Menu.

			ENTER	CANCEL		
					MTR/MNU	NEXT

Press the ENTER key to assign the bandwidth to the selected receive mode.

3-7.2.4 *Squelch.* This function sets or changes the receiver squelch level.

Primary Soft Key Menu.

FREQ	MODE	BW	SQELCH	GAIN		
					MTR/MNU	NEXT

Press the SQELCH key to select the SQELCH menu.

SQELCH Soft Key Menu.

		BKSP	ENTER	CANCEL		
					MTR/MNU	NEXT

Enter the squelch level in dBm using the keypad or main adjustment knob. Range = -000.0 dBm to -115.5 dBm. Press ENTER when done.

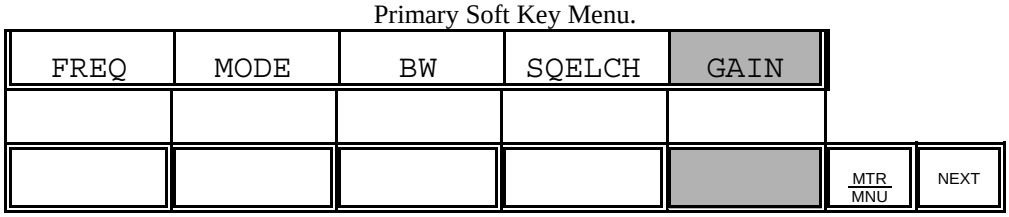
3-7.2.5 *Gain.* This function sets or changes the receiver gain control mode or selects the AGC decay time.

NOTE

Gain soft key selections are different depending on receive mode selected. AGC decay time is fixed in both AM and FM modes at 0.05 seconds. Additionally, the FM mode uses Fast Attack/Slow Decay in all bandwidths greater than 6 kHz. Refer to the appropriate section below.

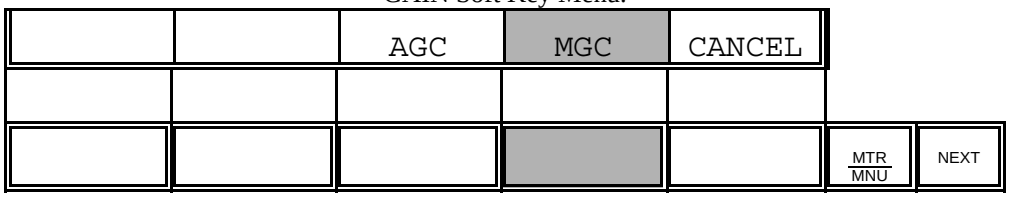
AM or FM Mode Selected.

Primary Soft Key Menu.



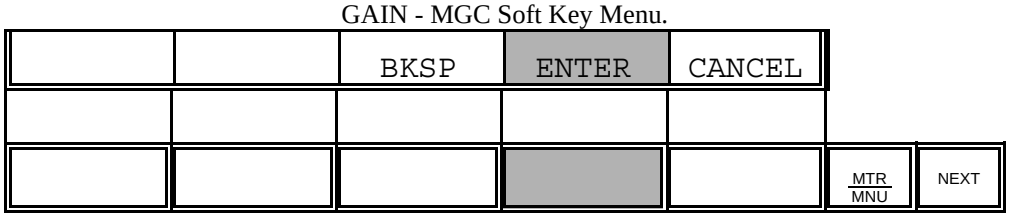
Press the GAIN key to select the AGC or MGC. The following menu appears.

GAIN Soft Key Menu.



Press the AGC key to select automatic gain control, or press the MGC key to select manual gain control. If MGC is selected, the following menu appears.

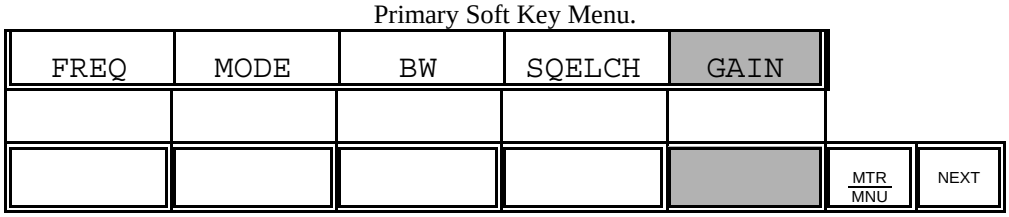
GAIN - MGC Soft Key Menu.



Select the manual gain value using the keypad or main adjustment knob. Press the ENTER key when the desired manual gain is displayed. Range = -000.0 dB to -127.5 dB in .5 dB steps.

Any Other Mode Selected.

Primary Soft Key Menu.



Press the GAIN key to select the AGC or MGC. The following menu appears. The numeric key labels in the display indicate AGC decay times in seconds.

GAIN Soft Key Menu.

0.02*	0.20*	3.00*	MGC	CANCEL		
					MTR/MNU	NEXT

Press the desired AGC decay setting, or press the NEXT key for more settings.

GAIN - NEXT Soft Key Menu.

0.10*	0.60*	1.00*	TABLE	CANCEL		
					MTR/MNU	NEXT

Press the desired AGC decay setting, or press the TABLE key for more settings.

GAIN - NEXT - TABLE Soft Key Menu.

ASSIGN	DEFLT		ENTER	CANCEL		
					MTR/MNU	NEXT

Select the AGC decay value using the main adjustment knob only. Range = 0.00 sec. to 4.00 sec. Press the ENTER key when done.

GAIN Soft Key Menu.

0.02*	0.20*	3.00*	MGC	CANCEL		
					MTR/MNU	NEXT

When the GAIN soft key menu is displayed, press the MGC key to select manual gain control. The following menu appears.

GAIN - MGC Soft Key Menu.

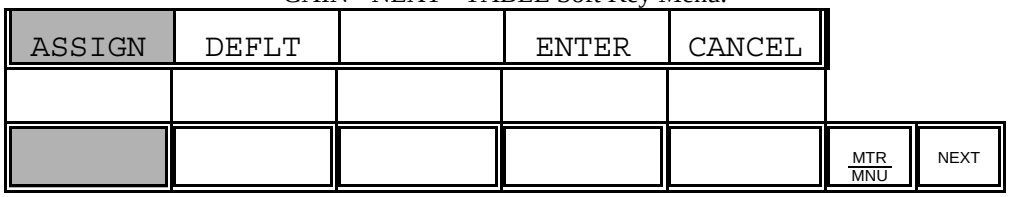
		BKSP	ENTER	CANCEL		
					MTR/MNU	NEXT

Select the manual gain value using the keypad or main adjustment knob. Press the ENTER key when the desired manual gain is displayed. Range = -000.0 dB to -127.5 dB in .5 dB steps.

*Operator assignable value. May be different than shown.

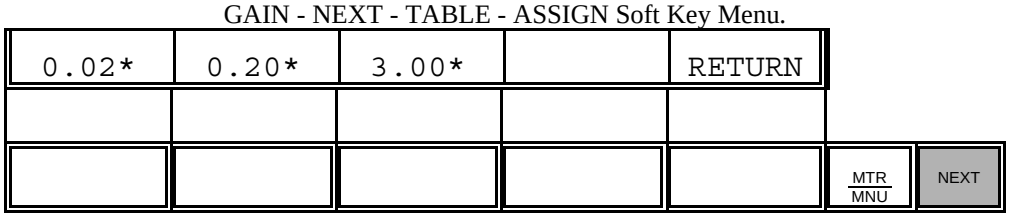
3-7.2.5.1 *Assigning AGC Decay Time Values to Soft Key Labels.* The AGC soft key labels may be assigned different values from the AGC table using the ASSIGN function. To assign the AGC labels, select the GAIN - NEXT - TABLE soft key menu as shown below. Rotate the main adjustment knob to select the desired AGC time as shown in the display.

GAIN - NEXT - TABLE Soft Key Menu.



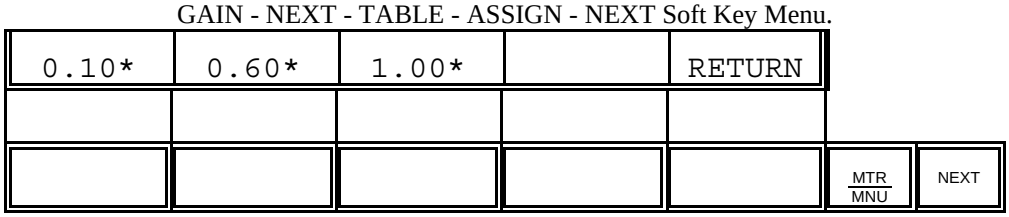
Press the ASSIGN key to select the desired AGC decay time from the table. The following menu is displayed.

GAIN - NEXT - TABLE - ASSIGN Soft Key Menu.



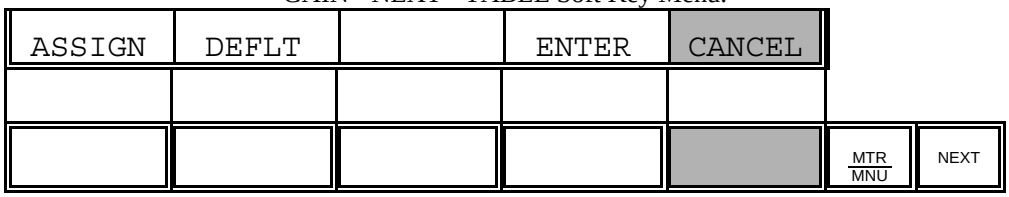
Press the desired soft key to reassign to an AGC decay time, or press the NEXT key to display the additional AGC soft key menu.

GAIN - NEXT - TABLE - ASSIGN - NEXT Soft Key Menu.



Press the desired soft key to reassign to an AGC decay time. The following menu is displayed.

GAIN - NEXT - TABLE Soft Key Menu.



Press the CANCEL key or assign additional AGC soft keys if desired.

3-7.2.5.2 *Assigning Default AGC Values To Receive Modes.* AGC values may be assigned to receive modes as default settings using the DEFLT function. To assign the AGC values, select the GAIN - NEXT - TABLE soft key menu as shown below.

NOTE

The desired receive mode (to be assigned an AGC value) must be selected before selecting this function. USB and LSB share the same default AGC value. Mode default settings may be enabled or disabled through keypad configuration. Refer to paragraph 3-7.5.2.3.

GAIN - NEXT - TABLE Soft Key Menu.

ASSIGN	DEFLT		ENTER	CANCEL		
					MTR/MNU	NEXT

Rotate the main adjustment knob to select the desired AGC as shown in the display. Press the DEFLT key and the following menu appears.

GAIN - NEXT - TABLE - DEFLT Soft Key Menu.

			ENTER	CANCEL		
					MTR/MNU	NEXT

Press the ENTER key to assign the AGC setting to the selected receive mode.

3-7.3 *Secondary Soft Key Menu.* The following paragraphs detail parameter entry from the secondary soft key menu. To display the secondary soft key menu, press the NEXT key from the primary soft key menu.

3-7.3.1 *BFO.* This function can only be set in the CW reception mode and is used to vary the tone of the beat note produced by the received signal and the beat frequency oscillator (BFO).

Secondary Soft Key Menu.

BFO	IF SHF	SKIP	STORE	RECALL		
					MTR/MNU	NEXT

Select BFO to change the BFO setting. The following menu appears.

BFO Soft Key Menu.

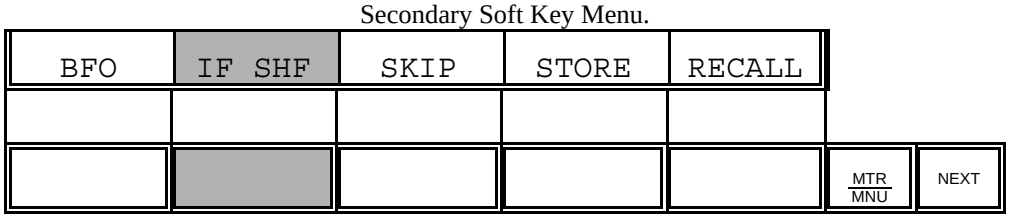
+/-	←RATE	BKSP	ENTER	CANCEL		
					MTR/MNU	NEXT

Select the BFO frequency using the +/- key on the soft key menu and the numeric keys, or use the main adjustment knob. Repeatedly pressing the RATE key moves a bar under the digits in the display. The bar under the digit indicates the tuning resolution of the main adjustment knob.

Press ENTER when the desired BFO frequency is displayed. Range = -6.000 to +6.000 kHz.

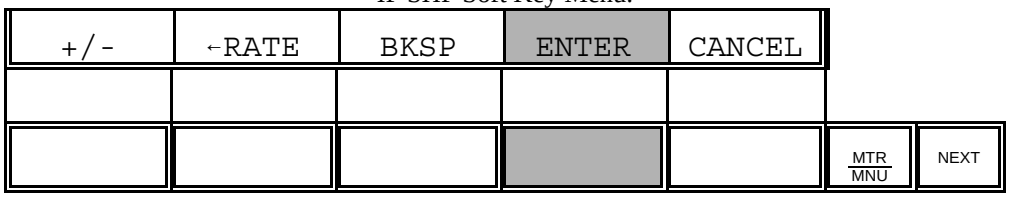
3-7.3.2 *IF Shift.* This function can only be set in the CW reception mode and is used to shift the bandpass up or down from the displayed frequency. This function helps reduce reception of unwanted adjacent signals.

Secondary Soft Key Menu.



Select IF SHF to select the IF shift. The following menu appears.

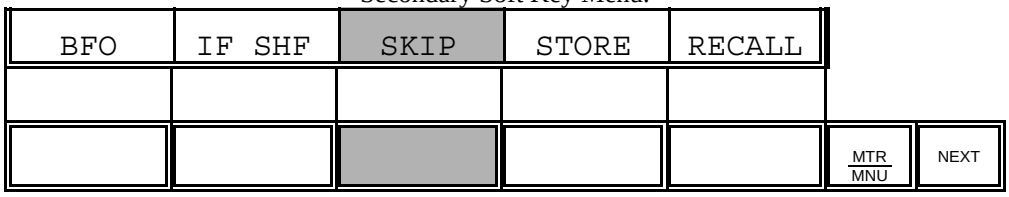
IF SHF Soft Key Menu.



Select the amount the IF is shifted using the +/- key on the soft key menu and the numeric keys, or use the main adjustment knob. Repeatedly pressing the RATE key moves a bar under the digits in the display. The bar indicates the tuning resolution of the main adjustment knob. Press ENTER when the desired IF shift is displayed. Range = -6.000 to +6.000 kHz.

3-7.3.3 *Skip.* This function sets (or clears) the skip flag associated with the current receiver operating parameters. If these parameters are stored in a memory channel, that channel will be skipped (or not skipped) in any subsequent sweep or scan operation. When the skip flag is set, "SKIP" will appear in the display.

Secondary Soft Key Menu.

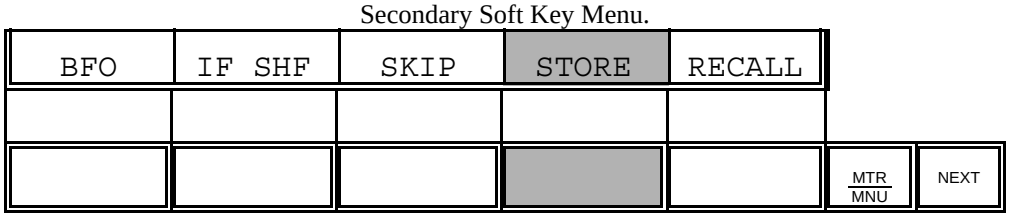


Press the SKIP key to toggle the skip flag on or off.

3-7.3.4 *Store.* This function stores all current receiver parameters in a selected memory channel. All receiver parameters are first entered using the keypad and/or main adjustment knob. The memory channel is then selected and all data is copied to the memory channel.

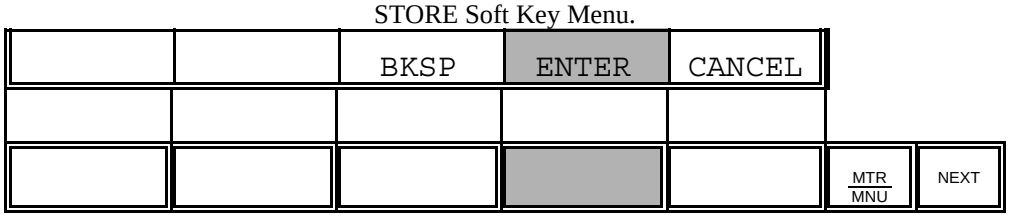
The following parameter settings may be stored in each memory channel: Frequency, receive mode, bandwidth, AGC on or off, normal channel AGC decay, alternate channel (ISB) AGC decay, manual gain, BFO, skip flag on or off, normal channel squelch, alternate channel (ISB) squelch, IF shift, step size, dwell time, and bridge time.

Secondary Soft Key Menu.



Press the STORE key to store current parameters in a memory channel. The following menu appears.

STORE Soft Key Menu.



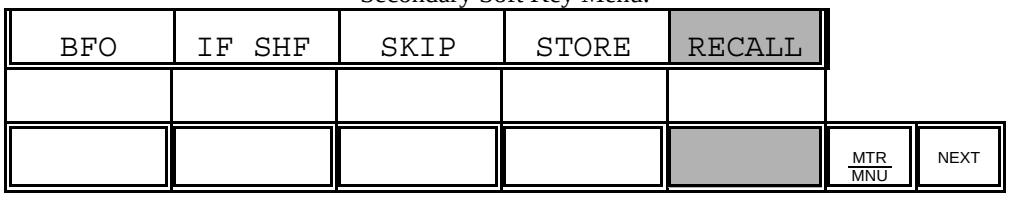
Select a memory channel to store current parameters using the numeric keys or main adjustment knob. Press the ENTER key when the desired channel is displayed. Range = 000 to 249.

NOTE

The BKSP key erases the previously entered digit if the keypad is used for numeric entry.

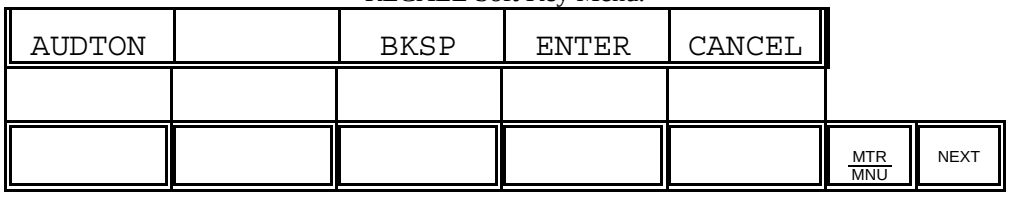
3-7.3.5 *Recall.* This function recalls all receiver parameters for a selected memory channel as current receiver parameters.

Secondary Soft Key Menu.



Press the RECALL key to recall memory channel parameters. The following menu appears.

RECALL Soft Key Menu.



Select a memory channel for display using the numeric keys or main adjustment knob. When the desired channel is displayed, press ENTER to select that channel and return to normal operation. Range = 000 to 249.

NOTE

When AUDTON (audition) is off, the contents of a selected memory channel is shown on the display but the receiver remains set to current parameters. When AUDTON is on, the contents of the selected memory channel are displayed, and the receiver changes to the parameters set in the memory channel recalled as the channel number is varied.

3-7.4 *Scan/Sweep Soft Key Menu.*

The following paragraphs detail parameter entry from the sweep/scan soft key menu. To display the sweep/scan soft key menu, press the NEXT key from the secondary soft key menu.

3-7.4.1 *Scan.*

NOTE

Before performing a scan function, frequencies and other parameters to be sampled should be determined and set into designated memory channels.

Scan is the sequential continuous recall of a sequence of memory channels. The CPU in the receiver uses the data stored in each channel to select frequency, mode, bandwidth, squelch level, gain, dwell time, bridge time and all other stored parameters to operate the receiver. The receiver will stop on a frequency (for the current dwell time) when a received signal exceeds the squelch level set in the channel. If the signal goes away before the dwell timer has timed out, the receiver will continue to scan. If the dwell timer times out before the signal goes away the receiver continues the scan. If the dwell time is set to zero, the receiver remains on frequency until the signal falls below the squelch level, and then continues the scan. The operator may offset the squelch level from the value set in each memory channel before starting the scan.

Scan/Sweep Soft Key Menu.

SCAN	SWEEP	STEP	DWELL	BRIDGE		
					MTR/MNU	NEXT

Press the SCAN key and the following menu appears.

Scan/Sweep - SCAN Soft Key Menu.

FROM	TO	OFFSET	SCAN	DONE		
					MTR/MNU	NEXT

Press the FROM key and the following menu appears.

Scan/Sweep - SCAN - FROM Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Select the desired starting channel using the keypad or main adjustment knob, and press ENTER. The menu will switch back to the Scan/Sweep - SCAN menu as shown below.

Scan/Sweep - SCAN Soft Key Menu.

FROM	TO	OFFSET	SCAN	DONE		
					MTR/MNU	NEXT

Press the TO key and the following menu appears.

Scan/Sweep - SCAN - TO Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Select the desired ending channel using the keypad or main adjustment knob, and press ENTER. The menu will switch back to the Scan/Sweep - SCAN menu as shown below.

Scan/Sweep - SCAN Soft Key Menu.

FROM	TO	OFFSET	SCAN	RETURN		
					MTR/MNU	NEXT

Press OFFSET (if desired) to offset the scan squelch level for all channels during the scan. The receiver normally uses the squelch level set into each channel throughout the scan. The following menu appears if OFFSET is selected.

Scan/Sweep - SCAN - OFFSET Soft Key Menu.

+/-		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Select the desired squelch offset setting and press ENTER. The menu will switch back to the Scan/Sweep - SCAN menu as shown below.

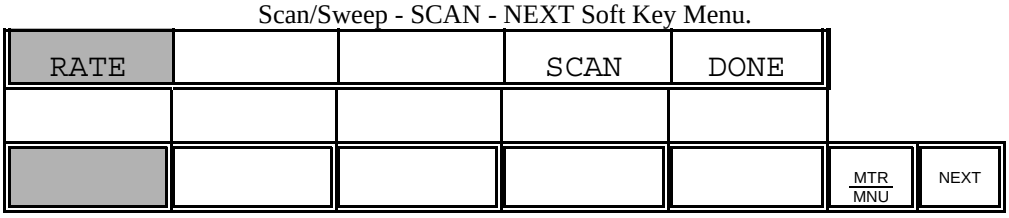
Scan/Sweep - SCAN Soft Key Menu.

FROM	TO	OFFSET	SCAN	DONE		
					MTR/MNU	NEXT

Press the NEXT key and the following appears

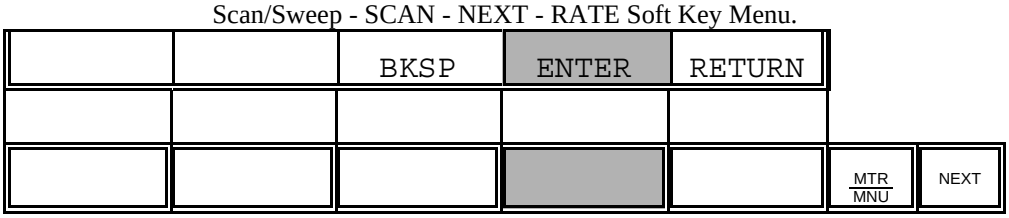
.

Scan/Sweep - SCAN - NEXT Soft Key Menu.



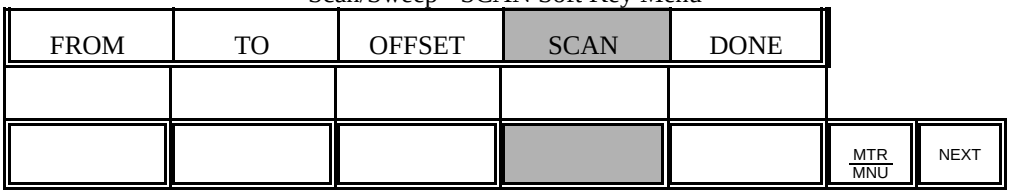
Press the RATE key to change the scan rate, and the following menu appears.

Scan/Sweep - SCAN - NEXT - RATE Soft Key Menu.



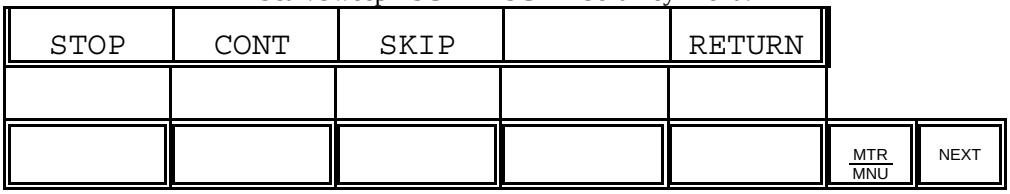
Change the scan rate using the main adjustment knob and press the ENTER key. The following menu appears.

Scan/Sweep - SCAN Soft Key Menu



Press the SCAN key to start the scan. The receiver will scan channels between the FROM and TO channels selected. The following menu appears.

Scan/Sweep - SCAN - SCAN Soft Key Menu.



Press STOP to stop the scan, or CONT to continue the scan after stopping. Press SKIP to skip a channel when dwelling or bridging on that channel, and to set the skip flag for that channel. That channel will be skipped during sweep or scan until the skip flag is cleared. Rotate the knob to change the scan rate during the scan if desired.

3-7.4.2 *Sweep.*

NOTE

Before performing a sweep function, frequencies and other parameters to be sampled should be determined and set into designated memory channels.

Sweep is the sequential stepping of the receiver frequency between a designated frequency in a FROM memory channel to the designated frequency in a TO memory channel. The FROM frequency is selected from an **even** numbered channel (000, 002, 004, etc.). The TO frequency is selected from an **odd** numbered channel (001, 003, 005, etc.). Since there are 250 channels (000 - 249), up to 125 bands of frequencies can be swept depending on TO/FROM channel selection.

The receiver may be set to sweep in two different ways; single band sweep, and multi-band sweep. Each is described below.

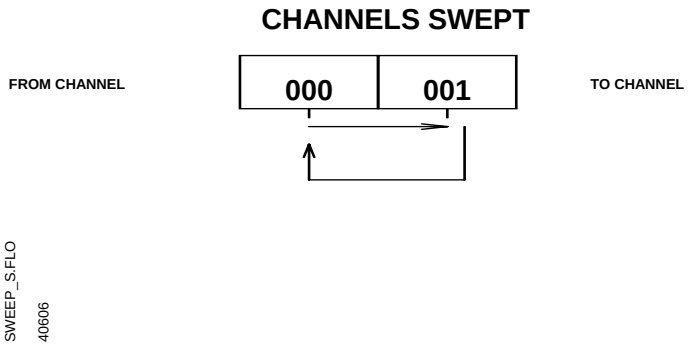
A. **Single-Band Sweep**

In a single-band sweep the TO channel is always the next higher numerical channel above the FROM channel. Only the frequencies between the FROM channel and the next higher TO channel are swept. All parameters (initial frequency, threshold level, reception mode, bandwidth, AGC, frequency step size, skip flag, etc.) used during the sweep are selected from the FROM channel.

The frequency step size contained in the FROM channel controls the amount the frequency is incremented during the sweep. The sweep continues until the frequency would exceed the frequency stored in the TO channel. When the frequency in the TO channel would be exceeded, the sweep starts over starting with the frequency in the FROM channel. The sweep continues over and over again until the STOP key is pressed.

SINGLE-BAND SWEEP EXAMPLE:

FROM Channel	**TO Channel**
000	001
Frequency = 10.000000	Frequency = 11.000000
Step size = 0.050000	



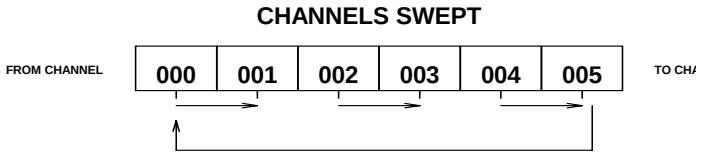
Frequencies swept = 10.000000, 10.050000, 10.100000, 10.150000, 10.200000, 10.250000, ...10.950000, 11.000000, 10.000000, 10.050000 etc.

B. **Multi-Band Sweep.**

In a multi-band sweep the TO channel is higher than the next higher numerical channel above the FROM channel. Frequencies between the FROM channel and the next higher odd channel will be swept like the single-band sweep. However, instead of going back to the FROM channel, the parameters from the next higher even number channel are used and the sweep continues. The step size contained in each of the even numbered channels in the sweep controls the amount the frequency is incremented during the sweep of that band. The sweep continues (with each band's parameters determined by successive even numbered channels) until the frequency would exceed the frequency stored in the TO channel. When the frequency in the TO channel would be exceeded, the sweep starts over starting with the frequency in the FROM channel. The sweep continues over and over again until the STOP key is pressed.

MULTI-BAND SWEEP EXAMPLE:

FROM Channel	FROM Ch +1	Next Even Ch	Next Even Ch +1	TO Ch -1 (even)	TO Channel
000	001	002	003	004	005
Frequency = 10.000000	Frequency = 11.000000	23.000000	23.999999	15.000000	16.000000
Step size = 0.050000		Step size = 0.100000		Step size = 0.100000	



Sweep starts using the frequency and all other parameters contained in memory channel 000.
When the frequency in channel 001 would be exceeded, the sweep continues using the frequency and all other parameters in channel 002.
When the frequency in channel 003 would be exceeded, the sweep continues using the frequency and all other parameters in channel 004.
When the frequency in channel 005 would be exceeded, the sweep starts over again using the frequency and all other parameters in channel 000.

Frequencies swept = 10.000000, 10.050000, 10.100000, 10.150000, 10.200000, 10.250000, ...10.950000, 11.000000, 23.000000, 23.100000, 23.200000, ... 23.800000, 23.900000, 15.000000, 15.100000, 15.200000, 15.300000,.....15.900000, 16.00000, 10.000000, 10.050000, 10.150000, etc.

NOTE

If the skip flag is set in a particular even numbered channel in the sequence, the receiver will immediately skip to the next consecutive even numbered channel.

The receiver will stop on a frequency (for the current dwell time), when the signal exceeds the preset threshold level. If the signal goes away before the dwell timer has timed out, the receiver will continue the sweep. If the dwell timer times out before the signal goes away the receiver continues the sweep. If the dwell time is set to zero, the receiver remains on frequency until the signal falls below the preset threshold level. The operator may offset the threshold level from the value set in the even numbered channels before starting the sweep. If the frequency in the TO channel is lower than the frequency in the FROM channel, the receiver sweeps from the higher to the lower frequency.

To start and stop the sweep function, do the following:

Scan/Sweep Soft Key Menu.

SCAN	SWEEP	STEP	DWELL	BRIDGE		
					MTR MNU	NEXT

Press the SWEEP key and the following menu appears.

Scan/Sweep - SWEEP Soft Key Menu.

FROM	TO	OFFSET	SWEEP	DONE		
					MTR MNU	NEXT

Press the FROM key and the following appears.

Scan/Sweep - SWEEP - FROM Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR MNU	NEXT

Select the desired **even** numbered channel containing the sweep starting frequency and press ENTER. The menu will switch back to the Scan/Sweep - SWEEP menu as shown below.

Scan/Sweep - SWEEP Soft Key Menu.

FROM	TO	OFFSET	SWEEP	DONE		
					MTR MNU	NEXT

Press TO key and the following appears.

Scan/Sweep - SWEEP - TO Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR MNU	NEXT

Select the desired **odd** numbered channel containing the sweep ending frequency and press ENTER. The menu will switch back to the Scan/Sweep - SWEEP menu as shown below.

Scan/Sweep - SWEEP Soft Key Menu.

FROM	TO	OFFSET	SWEEP	DONE		
					MTR/MNU	NEXT

Press OFFSET (if desired) to offset the sweep squelch level during the sweep. The receiver adds the offset value to the squelch level setting for each even channel in the sweep. The following menu appears if OFFSET is selected.

Scan/Sweep - SWEEP - OFFSET Soft Key Menu.

+/-		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Select the desired squelch offset setting and press ENTER. The menu will switch back to the Scan/Sweep - SWEEP menu as shown below.

Scan/Sweep - SWEEP Soft Key Menu.

FROM	TO	OFFSET	SWEEP	DONE		
					MTR/MNU	NEXT

Press the NEXT key and the following menu appears.

Scan/Sweep - SWEEP - NEXT Soft Key Menu.

RATE			SWEEP	DONE		
					MTR/MNU	NEXT

Press the RATE key to change the sweep rate, and the following menu appears.

Scan/Sweep SWEEP - NEXT - RATE Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Change the sweep rate using the main adjustment knob and press the ENTER key. The following menu appears.

Scan/Sweep - SWEEP Soft Key Menu.

FROM	TO	OFFSET	SWEEP	DONE		
					MTR/MNU	NEXT

Press the SWEEP key to start the sweep. The receiver will sweep the band or bands of frequencies between the FROM and TO channel frequencies using the parameters set in the FROM channel. The following menu appears.

Scan/Sweep - SWEEP - SWEEP Soft Key Menu.

STOP	CONT	SKIP		RETURN		
					MTR/MNU	NEXT

Press STOP to stop the sweep, CONT to continue the sweep after stopping. Press SKIP to skip an unwanted frequency when dwelling or bridging on that frequency and to store the frequency in the list of skip frequencies used during sweep. Rotate the knob to change the sweep rate during the sweep if desired.

3-7.4.3 *Step.* When the sweep function is enabled, the receiver will sample a selected frequency, and then "step" to the next frequency. The step function determines the amount of frequency change between steps.

NOTE

The step setting may also be used as the frequency increment when tuning the receiver manually with the FREQ soft key menu and the main adjustment knob. This allows frequency increments other than powers of ten to be assigned to the knob.

Scan/Sweep Soft Key Menu.

SCAN	SWEEP	STEP	DWELL	BRIDGE		
					MTR/MNU	NEXT

Press the STEP key to select the step frequency size for the sweep function. The following menu appears.

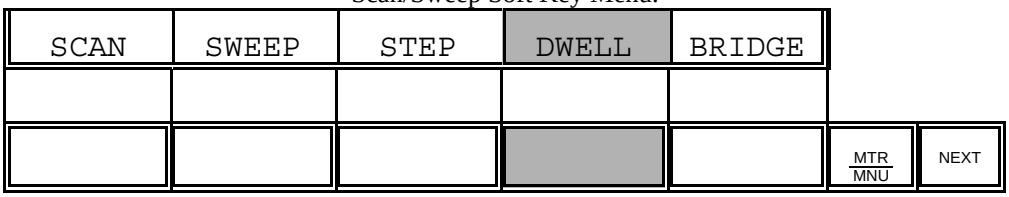
STEP Soft Key Menu.

←RATE	RATE→	BKSP	ENTER	CANCEL		
					MTR/MNU	NEXT

Select the step frequency size with the numeric keys, or main adjustment knob. Pressing the RATE keys to move a bar under the digits in the display. The bar under the digit indicates the tuning resolution of the main adjustment knob. Press ENTER when the desired step frequency size is displayed.

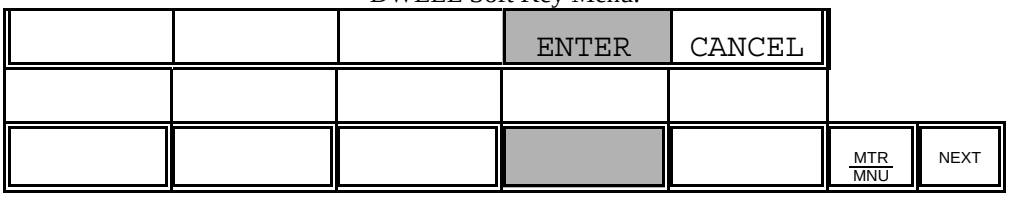
3-7.4.4 *Dwell.* The dwell time setting is the time duration (in seconds) the receiver remains on a channel or frequency that has exceeded the squelch level. This function is only used in the scan or sweep function. If the dwell time is set to zero, and the signal exceeds the squelch level, the receiver will stay on this channel or frequency until the signal falls below the squelch level. (See figure 3-8)

Scan/Sweep Soft Key Menu.



Press the DWELL key to select the dwell on signal time for sweep or scan. The following menu appears.

DWELL Soft Key Menu.



Select the desired dwell on signal time for the sweep and scan function. Enter 0 for no time-out. Press ENTER when done. Range = 0 - 9 seconds.

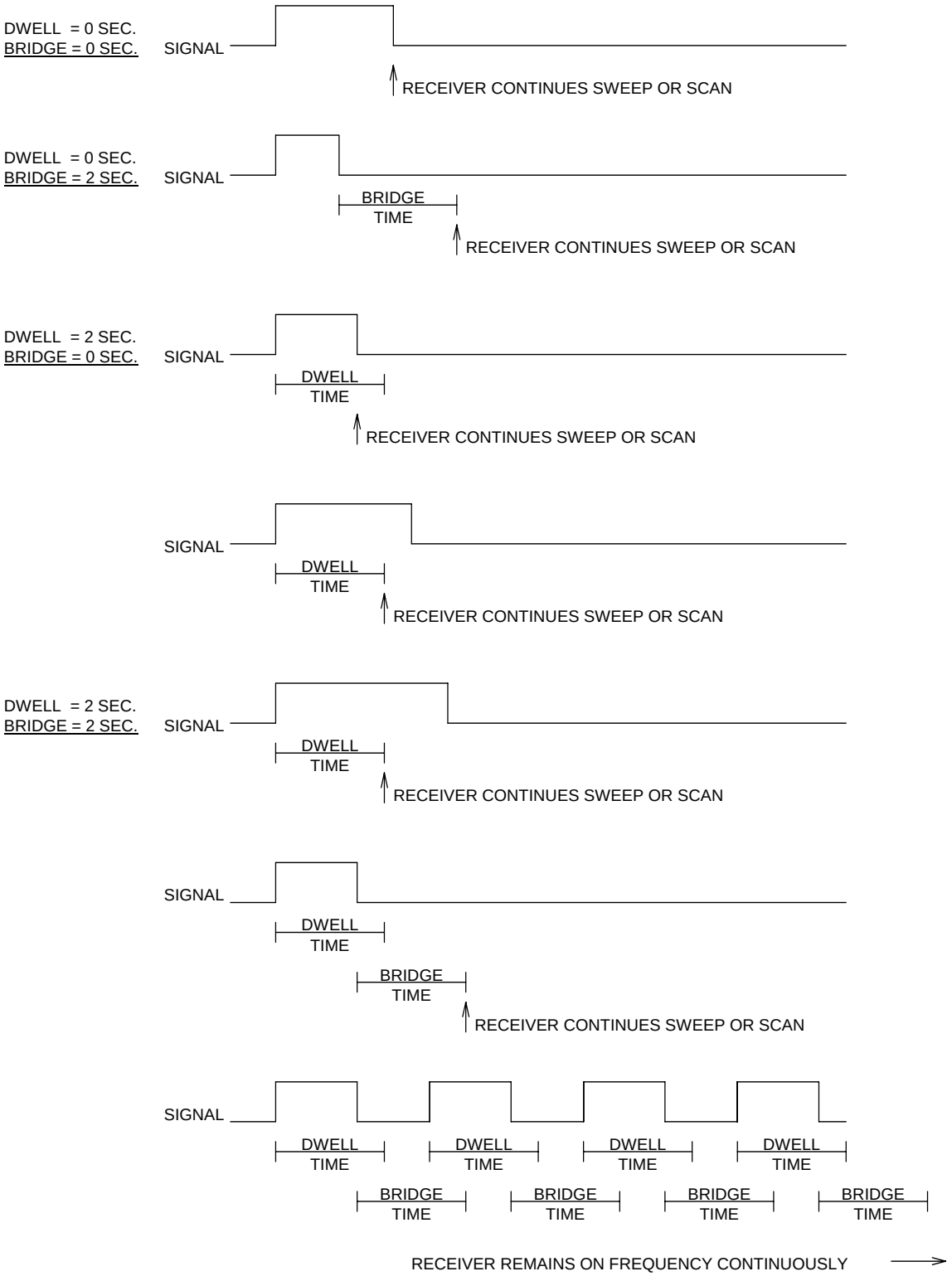
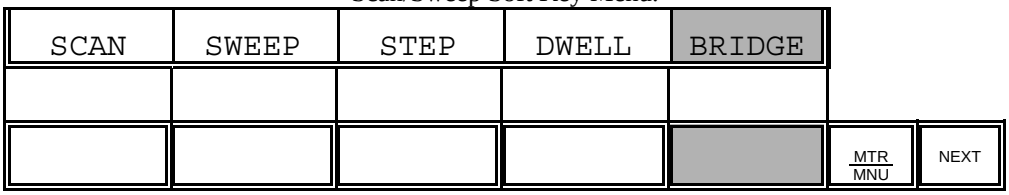


Figure 3-8 Dwell Time/Bridge Time Relationship.

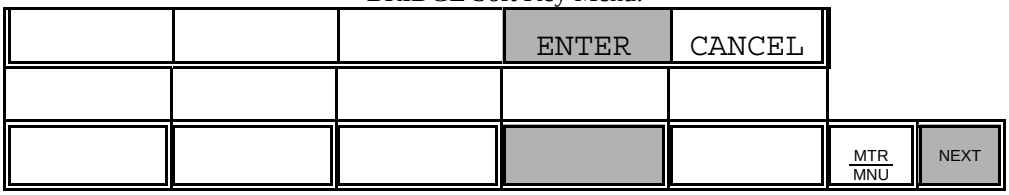
3-7.4.5 *Bridge.* (See figure 3-8.) The bridge time function may be used to monitor intermittent signals. This function supplements the dwell time function by causing the receiver to stay on frequency longer than the preset dwell time during sweep or scan. The bridge timer is activated during dwell time if a signal is present and then goes below the preset squelch level. If the signal returns before bridge timeout, dwell time is restarted from zero. The receiver stays on a frequency where intermittent signals are found until; (1) the signal stays on longer than the dwell time setting; or (2) the signal stays off longer than the bridge time setting. If bridge time is set to zero, the bridge timer is disabled.

Scan/Sweep Soft Key Menu.



Press the BRIDGE key to select the bridge time between signals for the sweep and scan function. The following menu appears.

BRIDGE Soft Key Menu.

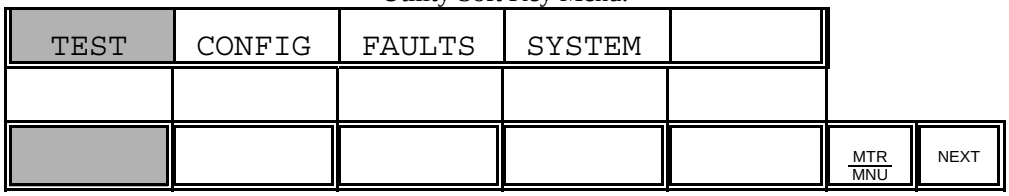


Enter the bridge time using the keys or main adjustment knob. Enter 0 for no bridge time. Press ENTER when done. Range = 0 - 9 seconds.

3-7.5 *Utility Soft Key Menu.* The following paragraphs detail parameter entry from the utility soft key menu. To display the utility soft key menu, press the NEXT key from the Scan/Sweep soft key menu.

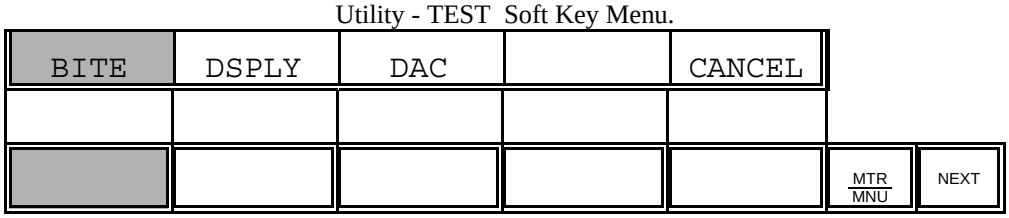
3-7.5.1 *Test.* This function allows selection of receiver tests.

Utility Soft Key Menu.



Press the TEST key to perform receiver tests. The following menu appears.

Utility - TEST Soft Key Menu.



Press the BITE soft key to select the built-in test equipment test. Observe the display for fault information.

Utility - TEST Soft Key Menu.

BITE	DSPLY	DAC		CANCEL		
					MTR/MNU	NEXT

Press the DSPLY soft key to select the front panel display test. After the test is complete, press any soft key when prompted. The normal display will be shown with the primary soft key menus.

Utility - TEST Soft Key Menu.

BITE	DSPLY	DAC		CANCEL		
					MTR/MNU	NEXT

NOTE

When this test is activated, the receiver stops processing incoming signals, and a fault indication may appear. This is normal.

Press the DAC soft key to select test outputs from the digital-to-analog converter in the digital module. The display will show what certain test point indications should be. After running the DAC test, power cycle the receiver to restart normal operation.

3-7.5.2 *Configuration.* This function configures the receiver by initializing (clearing) non-volatile memory, setting the remote control parameters, and setting the default settings.

Utility Soft Key Menu.

TEST	CONFIG	FAULTS	SYSTEM			
					MTR/MNU	NEXT

Press the CONFIG key to select the receiver configuration. The following menu appears.

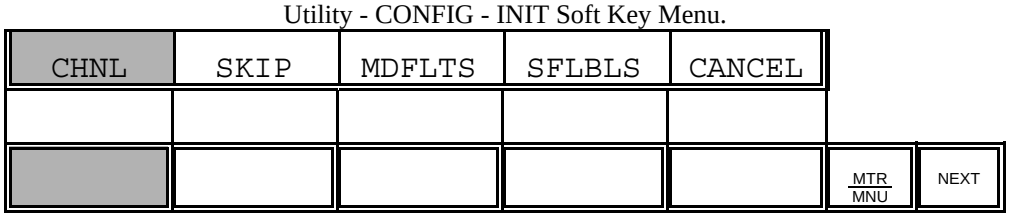
3-7.5.2.1 *Clearing Non-Volatile Memory.* To initialize (clear) non-volatile memory select the Utility - CONFIG soft key menu as shown below.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

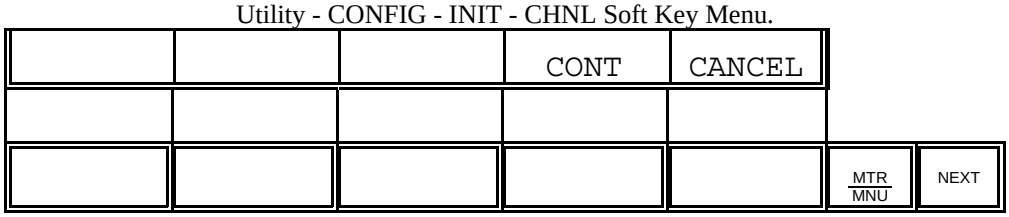
Press INIT to initialize (clear) the non-volatile memory. The following menu appears.

Utility - CONFIG - INIT Soft Key Menu.



Press CHNL to initialize (clear) the memory channels and change them to factory default settings. The following menu appears.

Utility - CONFIG - INIT - CHNL Soft Key Menu.



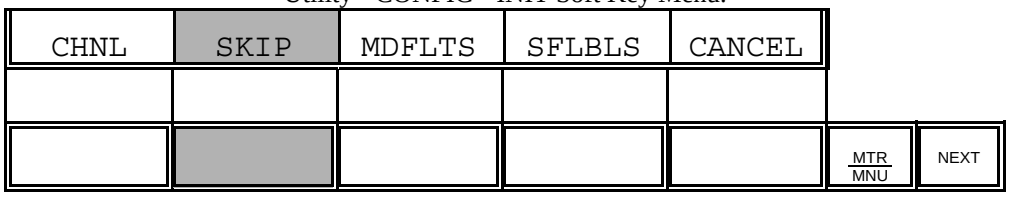
Press CONT to continue or CANCEL to cancel the function.

NOTE

To confirm the factory default settings after initialization, ensure the Mode Default function is off. The memory channel factory default settings are:

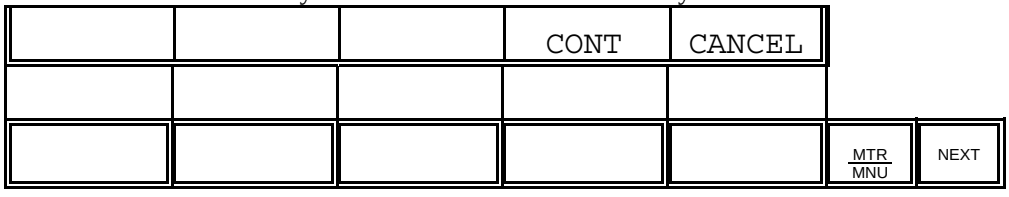
Frequency: 10.0 MHz
Receive mode: AM
Bandwidth: 6 kHz
BFO: -1000 Hz
AGC: ON
AGC decay: 60 ms
MGC: 0 dB
Step size: 10 kHz
Dwell time: 3 Seconds
Bridge time: 3 seconds
Skip flag: off
IF Shift: 0 Hz
Squelch: Lower limit

Utility - CONFIG - INIT Soft Key Menu.



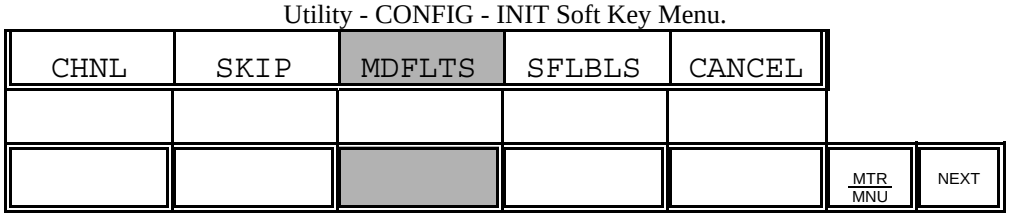
Press SKIP to initialize (clear) the sweep skip table of all frequencies for the sweep function. The following menu appears.

Utility - CONFIG - INIT - SKIP Soft Key Menu.



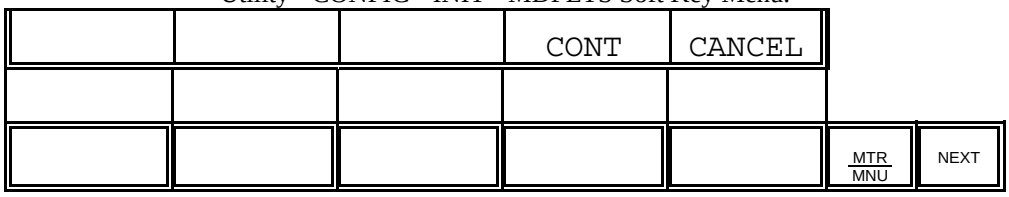
Press CONT to continue or CANCEL to cancel the function.

Utility - CONFIG - INIT Soft Key Menu.



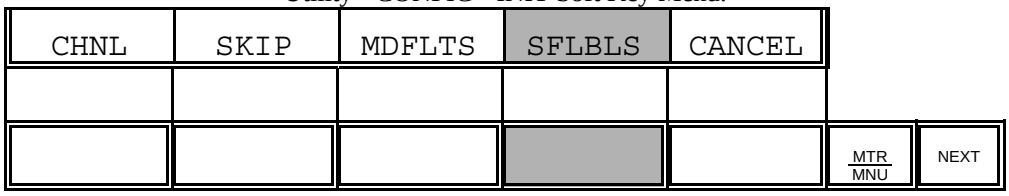
Press MDFLTS to reset the mode default setting for BW and AGC to initial values. The following menu appears.

Utility - CONFIG - INIT - MDFLTS Soft Key Menu.



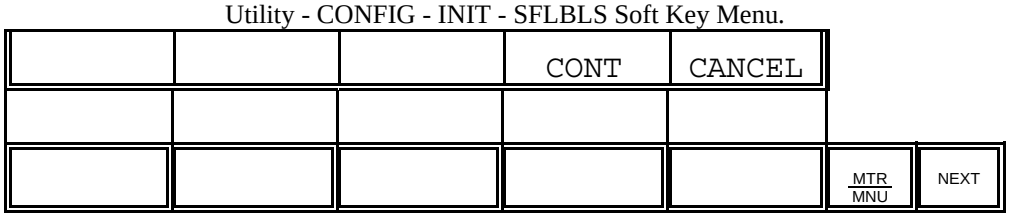
Press CONT to continue or CANCEL to cancel the function.

Utility - CONFIG - INIT Soft Key Menu.



Press SFLBLS to reset the soft key labels for BW and AGC to initial values. The following menu appears.

Utility - CONFIG - INIT - SFLBLS Soft Key Menu.

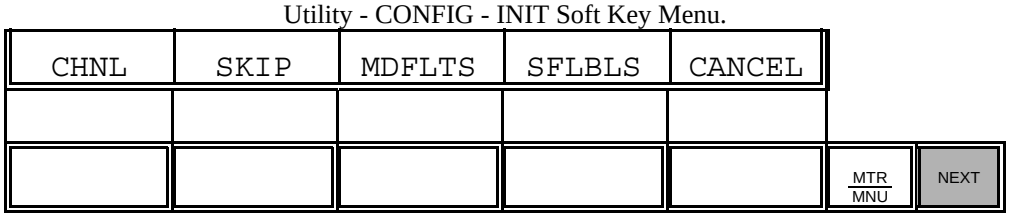


Press CONT to continue or CANCEL to cancel the function.

To initialize all of the functions press the NEXT key from the Utility - CONFIG menu.

NOTE
When the following function is performed, all non-volatile memory data will be lost.

Utility - CONFIG - INIT Soft Key Menu.



Press the NEXT key and the following menu appears.

Utility - CONFIG - INIT - NEXT Soft Key Menu.

ALL			MGC MD	CANCEL		
					MTR/MNU	NEXT

Press the ALL key to reset all non-volatile memory values to default settings.

Utility - CONFIG - INIT - NEXT - ALL Soft Key Menu.

			CONT	CANCEL		
					MTR/MNU	NEXT

Press CONT to continue or CANCEL to cancel the function.

Utility - CONFIG - INIT - NEXT - Soft Key Menu.

ALL			MGC MD	CANCEL		
					MTR/MNU	NEXT

Press MGC MD to reset the manual gain control to hard or soft. The following menu appears.

Utility - CONFIG - INIT - NEXT - MGC MD Soft Key Menu.

		HARD	SOFT	DONE		
					MTR/MNU	NEXT

Press the HARD key to operate in Manual Gain Control Mode (MGC). Press the SOFT key to protect the operator from excess audio if an incoming signal exceeds the set gain threshold. By selecting the SOFT MGC mode the receiver will have a fixed gain below the selected signal level and Automatic Gain Control (AGC) above the selected signal level.

3-7.5.2.2 *Configuring Receiver Remote Control Operation.* Two basic remote control buses are optionally available; serial or IEEE-488. Refer to the correct sub-paragraph below for the installed configuration.

3-7.5.2.2.1 *Serial Bus.* (If so equipped). To configure the receiver serial bus remote control operation, select the Utility - CONFIG soft key menu as shown below.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

Press REMOTE to change the remote control bus configuration. The following menu appears.

Utility - CONFIG - REMOTE Soft Key Menu.

ADDRS	TYPE	RATE	BITS	DONE		
					MTR/MNU	NEXT

Press ADDRS to select the receiver's bus address. The following menu appears.

Utility - CONFIG - REMOTE Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Enter the receiver's bus address using the keypad or knob (range = 000 - 254). Press ENTER when done.

NOTE
Pressing the RETURN key switches to the Utility - CONFIG - REMOTE soft key menu without changing the original address.

Utility - CONFIG - REMOTE Soft Key Menu.

ADDRS	TYPE	RATE	BITS	DONE		
					MTR/MNU	NEXT

Press the TYPE key to select the remote control bus type. The following menu appears.

Utility - CONFIG - REMOTE - TYPE Soft Key Menu.

		RS-232	RS-422	RETURN		
					MTR/MNU	NEXT

Press the desired remote control bus type key.

Utility - CONFIG - REMOTE Soft Key Menu.

ADDRS	TYPE	RATE	BITS	DONE		
					MTR/MNU	NEXT

Press the RATE key to change the serial bus rate. The following menu appears.

Utility - CONFIG - REMOTE - RATE Soft Key Menu.

125000	38400	19200	9600	RETURN		
					MTR/MNU	NEXT

Select the desired serial bus baud rate, or press the NEXT key and the following menu appears.

Utility - CONFIG - REMOTE - RATE - NEXT Soft Key Menu.

4800	2400	1200	600	RETURN		
					MTR/MNU	NEXT

Select the desired serial bus baud rate or press the NEXT key again.

Utility - CONFIG - REMOTE - RATE - NEXT - NEXT Soft Key Menu.

300	150	110	75	RETURN		
					MTR/MNU	NEXT

Select the desired serial bus baud rate, or press the NEXT key to return to the first RATE menu.

Utility - CONFIG - REMOTE Soft Key Menu.

ADDRS	TYPE	RATE	BITS	DONE		
					MTR/MNU	NEXT

Press the BITS key to configure the serial bus line parameters. The following menu appears.

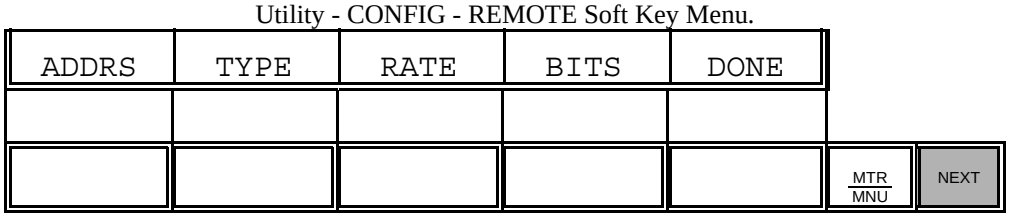
Utility - CONFIG - REMOTE - BITS Soft Key Menu.

	↑	↓	ENTER	RETURN		
					MTR/MNU	NEXT

Press the up or down arrows to select new line parameters as shown on the display and listed in the following table. Press the ENTER key when the desired parameters are displayed.

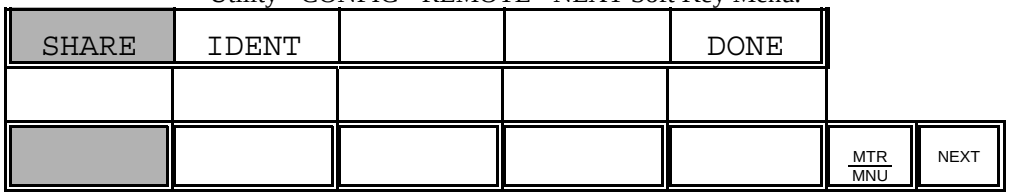
DATA BITS	STOP BIT	PARITY
8	2	ODD
8	1	ODD
7	2	ODD
7	1	ODD
8	2	EVEN
8	1	EVEN
7	2	EVEN
7	1	EVEN
8	2	NO
8	1	NO
7	2	NO
7	1	NO

Utility - CONFIG - REMOTE Soft Key Menu.



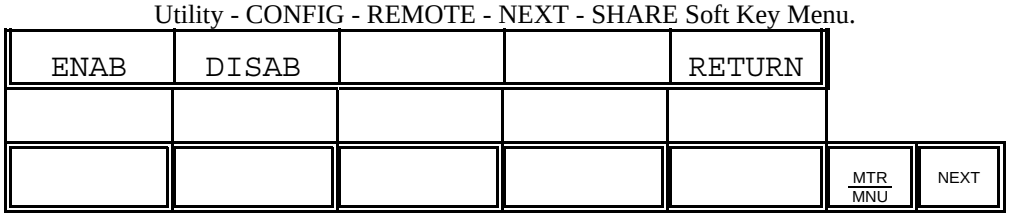
Press the DONE key to return to the primary soft key menu, press the NEXT key and the following menu appears.

Utility - CONFIG - REMOTE - NEXT Soft Key Menu.



Press the SHARE key to select party line or single bus. The following menu appears.

Utility - CONFIG - REMOTE - NEXT - SHARE Soft Key Menu.



Press ENAB to enable bus sharing for party line bus, or select DISAB for single receiver on bus.

Utility - CONFIG - REMOTE - NEXT Soft Key Menu.

SHARE	IDENT			DONE		
					MTR/MNU	NEXT

Press the IDENT key to send the identification message out over the bus. The message identifies the manufacturer, the equipment name, the firmware version number, and date, and copyright notice. This message is less than 125 characters long.

3-7.5.2.2.2 *IEEE-488 Bus.* (If so equipped). To configure the receiver IEEE-488 bus remote control operation, select the Utility - CONFIG soft key menu as shown below.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

Press REMOTE to change the remote control bus configuration. The following menu appears.

Utility - CONFIG - REMOTE Soft Key Menu.

ADDRS				DONE		
					MTR/MNU	NEXT

Press ADDRS to select the receiver's bus address. The following menu appears.

Utility - CONFIG - REMOTE Soft Key Menu.

		BKSP	ENTER	RETURN		
					MTR/MNU	NEXT

Enter the receiver's bus address using the keypad or knob (range = 000 - 030). Press ENTER when done.

3-7.5.2.3 *Configuring Receiver Default Settings.* To configure the receiver's default settings select Utility - CONFIG soft key menu as shown below.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

Select PWRDWN to determine if the current receiver operating parameters will be saved or not when the receiver is turned off. The following menu appears.

Utility - CONFIG - MEMORY Soft Key Menu.

		NO	YES	CANCEL		
					MTR/MNU	NEXT

Press NO or YES as desired, and the display goes back to the primary menu.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

Press ROLOFF to set the low frequency -3 dB corner in Hertz for the SSB modes. The following menu appears. Choose the desired roll off using the main adjustment knob. (Range = 0 - 1,000 Hz.)

Utility - CONFIG - ROLOFF Soft Key Menu.

			ENTER	CANCEL		
					MTR/MNU	NEXT

Press ENTER to select the displayed roll off.

Utility - CONFIG Soft Key Menu.

INIT	REMOTE	PWRDWN	ROLOFF	CANCEL		
					MTR/MNU	NEXT

Press the NEXT key. The following menu appears.

Utility - CONFIG - NEXT Soft Key Menu.

MDFLTS	NBIF			CANCEL		
					MTR/MNU	NEXT

Press the MDFLTS key to turn the BW and AGC mode defaults on or off. The following menu appears.

Utility - CONFIG - NEXT MDFLTS Soft Key Menu.

		ON	OFF	CANCEL		
					MTR/MNU	NEXT

Press the ON or OFF key to select whether default values for BW and AGC are selected when the receive mode is changed. The display returns to the Primary Menu.

Utility - CONFIG - NEXT Soft Key Menu.

MDFLTS	NBIF			CANCEL		
					MTR/MNU	NEXT

Press the NBIF key to adjust the NBIF output center frequency over a limited range of frequencies. The following menu appears.

Utility - CONFIG - NEXT Soft Key Menu.

INVERT			ENTER	CANCEL		
					MTR/MNU	NEXT

Press the INVERT key to select an invert output spectrum or a normal non-invert output spectrum. Adjust the frequency range by rotating the adjustment knob.

NOTE

Units with a low pass filter output circuit, the frequency range is 8-30 kHz. Units with a bandpass filter output circuit, the frequency range is 450-460 kHz. These values are saved in non-volatile memory and needs to be set once unless EEPROM memory is cleared. When this occurs, the value is set to +455 kHz. (Units with the low pass filter output circuit, this will produce an output centered at 20 kHz inverted.

3-7.5.3 *Faults.* This function allows review of current or cumulative faults.

Utility Soft Key Menu.

TEST	CONFIG	FAULTS	SYSTEM			
					MTR/MNU	NEXT

Press FAULTS key to show the current or cumulative faults in the receiver. The following menu appears.

Utility - FAULTS Soft Key Menu.

↑	↓	CURNT	CUMUL	CANCEL		
					MTR/MNU	NEXT

The initial display shows the current fault status. Press CUMUL to switch to display of cumulative faults since power was turned on. Press CURNT to switch back to display of current faults. When pressed, the ↑ ↓ keys allow scrolling through multiple faults. Up to 16 current (CURNT) or cumulative (CUMUL) faults may be displayed. If the fault light is lit on the vacuum fluorescent display, press the CURNT key to display the fault list. The faults do not appear in any significant order on the list. To display the cumulative faults that have occurred since the receiver was turned on, press the CUMUL key. Identical recurring faults will only appear once on the list. Refer to paragraph 5-5.2.3 for details.

3-7.5.4 *System.* This function allows selection of system related items including: software version identification, display intensity, sound, and menu display default.

Utility Soft Key Menu.

TEST	CONFIG	FAULTS	SYSTEM			
					MTR/MNU	NEXT

Press SYSTEM to select system related items. The following soft key menu appears.

Utility - SYSTEM Soft Key Menu.

ABOUT	INTENS	SOUND	MENUS	CANCEL		
					MTR/MNU	NEXT

Press the ABOUT key to display the receiver identification and software version number. Press the NEXT key to show the DSP firmware version number. Press any soft key to return to the normal display.

Utility - SYSTEM Soft Key Menu.

ABOUT	INTENS	SOUND	MENUS	CANCEL		
					MTR/MNU	NEXT

Press the INTENS key to change the intensity of the front panel display. The following soft key menu appears.

Utility - INTENS Soft Key Menu.

62.5%	75%	87.5%	100%	DONE		
					MTR/MNU	NEXT

Select the desired display intensity, and press DONE; or press the NEXT key and the following menu appears.

NOTE
Display may not be visible in bright ambient light if 5% intensity is selected.

Utility - INTENS - NEXT Soft Key Menu.

5%	12.5%	25%	50%	DONE		
					MTR/MNU	NEXT

Select the desired display intensity, and press DONE; or press the NEXT key to return to the previous menu.

Utility - SYSTEM Soft Key Menu.

ABOUT	INTENS	SOUND	MENUS	CANCEL		
					MTR/MNU	NEXT

Press the SOUND key to select the sound options. The following menu appears.

Utility - SYSTEM - SOUND Soft Key Menu.

CLICK	BEEP			DONE		
					MTR/MNU	NEXT

Press CLICK to enable key clicks on or off when keys are pressed. The following menus appears.

Utility - SYSTEM - SOUND - CLICK Soft Key Menu.

		ON	OFF	RETURN		
					MTR/MNU	NEXT

Select ON or OFF. Press RETURN to return to the previous menu.

Utility - SYSTEM - SOUND Soft Key Menu.

CLICK	BEEP			DONE		
					MTR/MNU	NEXT

Press BEEP to enable warning beeps. The following menus appears.

Utility - SYSTEM - SOUND - BEEP Soft Key Menu.

		ON	OFF	RETURN		
					MTR/MNU	NEXT

Select ON or OFF. Press RETURN to return to the previous menu.

Utility - SYSTEM Soft Key Menu.

ABOUT	INTENS	SOUND	MENUS	CANCEL		
					MTR/MNU	NEXT

Press MENUS to display the soft key menus or the meters as the default. The following menu appears.

Utility - SYSTEM - MENUS Soft Key Menu.

MENUS	METERS			CANCEL		
					MTR/MNU	NEXT

Press the MENUS key to set the normal display to show the soft key menus as the default. Press the METERS key to set the normal display to show the meters as the default. When METERS is the default, menus may be accessed directly from a meters display as discussed in paragraph 3-2.2.1.3.

Utility - SYSTEM Soft Key Menu.

ABOUT	INTENS	SOUND	MENUS	CANCEL		
					MTR/MNU	NEXT

Press the NEXT key and the following menu appears.

Utility - SYSTEM - NEXT Soft Key Menu.

MEMORY						
					MTR/MNU	NEXT

Press the MEMORY key to observe the HEX/ASCII display of memory (factory use only). The following menu appears.

Utility - SYSTEM - NEXT - MEMORY Soft Key Menu.

ADDRS				DONE		
					MTR/MNU	NEXT

Use the main adjustment knob to scroll through the memory locations, or press the ADDRS key and the following menu appears.

Utility - SYSTEM - NEXT - MEMORY - ADDRS Soft Key Menu.

A	B	C	ENTER	CANCEL		
					MTR/MNU	NEXT

Use the numeric keypad and the letter soft keys above to select specific hexadecimal memory locations for display. To enter hexadecimal letters D, E, and F, press the NEXT key and the following menu appears.

Utility - SYSTEM - NEXT - MEMORY - ADDRS - NEXT Soft Key Menu.

D	E	F	ENTER	CANCEL		
					MTR/MNU	NEXT

Select the desired address location and press ENT.

Section II. REMOTE CONTROL

Two different interface standards are available for the CDR-3250/80 receiver: Serial and IEEE-488. The serial interface includes both unbalanced (RS-232) and balanced (RS-422) line interfaces. To configure the receiver's hardware for Serial or IEEE-488 operation, it is only necessary to change a small plug-in daughter board in the Digital Module, and the rear panel mounted bus plate with its associated cable. The control firmware detects the interface type at power up and then operates it. Refer to Chapter 2 for installation and electrical characteristics.

Parameters associated with the remote control interface can be checked and changed from the front panel of the receiver. For the IEEE-488 interface the only parameter that may be set is the receiver's talk and listen address. For the serial interface, the bus address, bus type (RS-232 or RS-422), baud rate, bus sharing option, and line parameters may be set. (Line parameters include number of data bits, number of stop bits and parity options).

NOTE

For remote control operation using the RCU-3100 remote control unit, refer to the RCU-3100 Technical Manual.

Each type of interface is described below.

3-8 REMOTE OPERATION USING SERIAL BUS.

The receiver may be optionally operated under remote control using a serial bus and a suitable controller. To operate in this manner, press the LOC/REM key until CTRL:REMOTE appears on the display. The LOC/REM key has positive control over the remote control function. However, the bus controller may allow control or prevent local control when the receiver is in the REMOTE mode.

Ensure that the communications parameters are set in accordance with the system requirements. Refer to Chapter 2 for the correct installation procedures. The bus address, bus type (RS-232 or RS-422), baud rate, number of data bits, type of parity used, and number of stop bits must match the requirements of the system controller. Refer to paragraph 3-7.5.2.2.1 to configure the remote control line parameters for the serial bus.

3-8.1 *Serial Bus Description.* The serial interface includes both unbalanced (RS-232) and balanced (RS-422) line interfaces. The control firmware is designed to detect the interface type (serial, IEEE-488, or none) at power up. However, it does not detect the type of serial bus. This must be selected by the operator (refer to paragraph 3-7.5.2.2.1).

3-8.2 *Serial Bus Message Format.* All transmissions, in either direction, conform to the message format shown in figure 3-9. All transmitted and received characters will be encoded and interpreted as conforming to the ASCII character code except for the reply to the TB? (Pan Data Block Request) message. Refer to the description of the TB? message in table 3-5 for details.

Each character in the message is passed in an asynchronous serial format as shown in figure 3-10. The number of data bits, number of stop bits, parity options and baud rate are all selectable from the front panel of the receiver through the keypad. These selections are stored in non-volatile memory. All characters are in ASCII code.

3-8.3 *Serial Bus Message Types.* All messages are divided into two major categories: command messages and status messages. Each category is discussed in the following paragraphs:

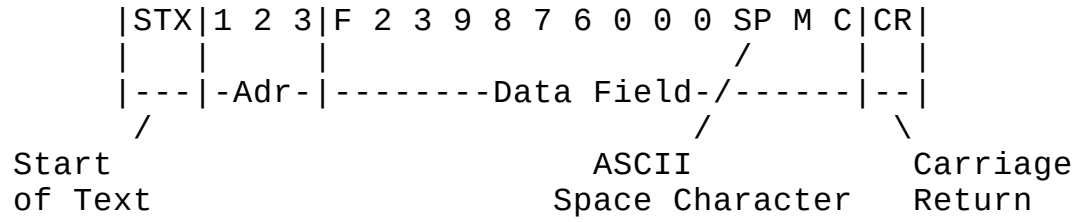
3-8.3.1 *Serial Bus Command Messages.* Command messages are sent from the controller to the receiver and are subdivided into two classes as follows:

3-8.3.1.1 *Serial Bus Radio Command Messages.* Radio command messages contain commands that are passed to the receiver. They may command the receiver to change operational parameters or to report back operational status.

3-8.3.1.2 *Serial Bus Interface Command Messages.* Interface command messages contain commands that are acted upon by the communications interface in the receiver. These commands cause the interface to change modes or report status.

3-8.3.2 *Serial Bus Status Messages.* Status messages are sent from the receiver to the controller and are subdivided into two classes as follows:

3-8.3.2.1 *Serial Bus Radio Status Messages.* Radio status messages contain information about the operational status of the receiver. These messages are sent as a reply to radio command messages that request a status report.



NOTES:

The first character of a transmission will always be STX (start of text, ASCII code 02).

The second, third, and fourth characters will contain the address in decimal, with the most significant digit first, of the receiver sending the transmission or to which it is being sent by the controller. The address code for any receiver may be any number from 000 to 254 provided that it is not used by any other unit connected to the bus. Address 255 is reserved for "broadcasting" to all receivers on the bus (refer to paragraph 3.8.6). The controller has no address. All three digits must be transmitted. Addresses less than 100 must be filled with '0' digits on the left. The address is set from the front panel with the soft key sequence CONFIG6 REMOTE6 ADDRS.

The fifth character of the transmission is the beginning of the data field. This field may contain as few as one or as many as 250 characters. The data field may contain one or more messages. If more than one message is contained in the data field, each message must be separated from the next by one or more blank (space) characters.

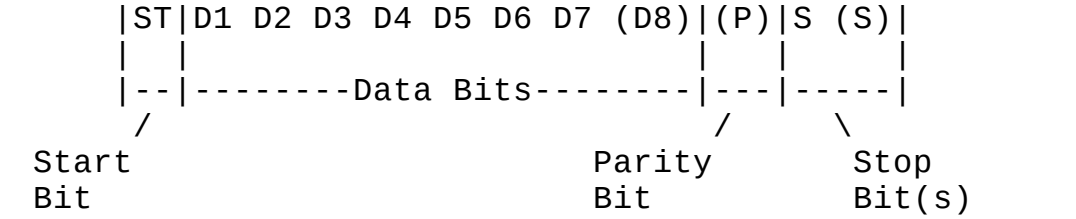
Any number of messages may be included in the data field provided that the maximum number of characters is not exceeded. There are, however, certain request for status commands that may not be mixed with any other request for status commands in the same transmission. These messages will be noted as such in table 3-5.

The final character of the transmission will be a CR (carriage return). This character will follow the last character of the data field.

This transmission above from the controller is addressed to the receiver with address 123 and contains two messages: "F23987600" and "MC".

When sending messages to the receiver that require numeric values as arguments, it is not necessary to include leading zeros. For example, to send a message to change the frequency to 5.67 MHz, the command message "F5670000" may be given in place of "F05670000". When a request for a status message is made, the reply will always include any leading zeros so that the value may be extracted by counting characters in the message.

Figure 3-9 Serial Bus Message Format.



NOTES: Information is passed in full duplex as characters in an asynchronous serial format. Each character consists of a start bit, 7 or 8 data bits with the least significant bit sent first, an optional parity bit which may provide odd or even parity, and one or two stop bits. The serial transmission rate may be set to each of the following standard rates: 75, 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, and 125000 bits per second. Number of data bits, number of stop bits, parity options and baud rate are all selectable from the front panel of the receiver through the keypad from the CONFIG 6 REMOTE menu. The selected values take effect immediately when changed and are stored in non-volatile memory.

Figure 3-10 Serial Bus Character Format.

3-8.3.2.2 *Serial Bus Interface Status Messages.* Interface status messages contain error status information caused by a previous command message or other source. When the receiver is in the acknowledge mode, it will respond to all command messages (except X and V) with an interface status message unless the command explicitly requested a status message.

3-8.4 *Serial Bus Message Protocol.* The interface system operates in one of three modes: normal, acknowledge, or independent. These modes are selected by sending the receiver the appropriate interface command message. Each of the three modes are discussed in the following paragraphs:

3-8.4.1 *Serial Bus Normal Mode.* In Normal Mode the receiver unit will process messages that are addressed to it but no response will be sent back unless the Command Message was a request for Status Message (Radio or Interface). The controller can verify that its Command Message(s) was received without error by sending a Command Message requesting a reply Status Message either immediately after sending the original Command Message, or after having sent Command Messages to other receiver units. This mode allows the fastest throughput of commands to a large group of receivers because the controller does not have to wait for each receiver unit to process the message(s) before moving on to the next receiver unit.

3-8.4.2 *Serial Bus Acknowledge Mode.* In Acknowledge Mode a receiver unit will always respond to Command Messages with a Status Message after it has processed the Command Message (except for the X and V commands). If the Command Message was for a reply Radio Status Message, and no errors or faults have been detected, the reply will be the requested Status Message. In all other cases, the receiver unit will respond with an Interface Status Message. This mode reduces maximum throughput because the controller must wait for the reply Status Message before issuing another command, but it simplifies the controller's job when it wants to verify the reception of its Command Messages and maximum throughput is not needed.

3-8.4.3 *Serial Bus Independent Mode.* In Independent Mode the receiver will send a specific Status Message whenever a squelch break occurs. This will occur independently of any Command Messages. Independent Mode is intended to be used only in non-controller systems with a terminal or printer unless the controller implements a method of handling contention. Three sub modes are available: Independent Mode 1 which causes a frequency and channel number report (**F?** and **CN?**) to be sent, Independent Mode 2 which causes a complete status message (R?) to be sent, and Independent Mode 3 which causes a signal strength report (SS?) to be sent. These modes can be used to keep a printed record of signals detected during sweep or scan operation.

3-8.5 *Line Driver Operation.* When Bus Sharing is enabled through the receiver's front panel, that receiver's Transmitted Data and Request to Send line drivers are maintained in a high impedance state at all times except when it is required for that unit to transmit. In Normal Mode operation, this only occurs when the unit has received a Command Message that requests a reply Status Message. In Acknowledge Mode, all commands will caused the addressed unit to transmit.

The line drivers will be turned on and placed into the mark state for at least one full character time before the first character (the STX) is transmitted.

3-8.6 *Broadcast Address.* All receivers equipped with the serial interface will respond to address 255 the same as its actual configured address. This is referred to as the broadcast address. If a single transmission is sent to this address, each receiver on the bus will respond to the commands in the transmission as if they were sent to it individually. This feature may be used to cause a group of receivers to act in unison, or to reduce the time it takes to initialize a group of receivers to a set of common parameters.

The broadcast address must not be used to request status from a group of receivers or when the receivers are operating in the acknowledge mode, since this would cause bus contention as all receivers would reply at the same time. With only one receiver on the bus it is possible for the controller to determine the unit's address by sending a status request to the broadcast address and examining the address field in the reply, since the reply message contains the unit's configured address. This can be used during system integration as a troubleshooting aid.

3-8.7 *Serial Bus Message Definition.* All messages are ASCII encoded and inserted into the data field of transmissions as defined in paragraph 3-8.2. Messages from the controller may use lower or upper case for all alphabetic characters. The receiver always uses upper case.

Each message that can be sent using the bus controller is listed in the following tables:

- Table 3-3. Serial Bus Interface Command Messages.
- Table 3-4. Serial Bus Interface Status Messages.
- Table 3-5. Radio Command and Status Messages

Most Radio Status Messages use the same format as the Radio Command Message for that parameter (except for the X? command.). For example, the reply to the Radio Command Message "L?" (current Squelch setting) is "L123" in the same format as the Radio Command Message to change the Squelch.

All Radio Status Messages (except the reply to the TB? command) are made up of fixed length strings so that values may be parsed by counting the characters of the Status Message. Messages which return a numeric value will be padded with zeros on the left to give the same number of characters as the same message with the maximum value. When more than one parameter is being reported, the individual parameters are separated by a blank (space) character.

Table 3-3 Serial Bus Interface Command Messages.

Message	Definition
:NORM	Set NORMAL interface mode
:ACKN	Set ACKNOWLEDGE interface mode
:IND1	Set INDEPENDENT mode 1
:IND2	Set INDEPENDENT mode 2
:IND3	Set INDEPENDENT mode 3
:?	Request Interface Status Message

Table 3-4 Serial Bus Interface Status Messages.

Message	Definition
OK:NORM	No errors, NORMAL Mode
OK:ACKN	No errors, ACKNOWLEDGE Mode
OK:IND1	No errors, INDEPENDENT Mode 1
OK:IND2	No errors, INDEPENDENT Mode 2
OK:IND3	No errors, INDEPENDENT Mode 3
TE:EEPR	Testing error - EEPROM corrupted
TE:POST	Testing error - power on self test error
LE:PRTY	Line error - parity
LE:FRMG	Line error - framing
LE:OVRN	Line error - overrun
IE:OVFL	Interface error - buffer overflow
IE:IVAL	Interface error - illegal value
IE:UNKN	Interface error - unrecognized message
RE:FALT	Radio error - fault has been detected

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
!		Continue operation from a wait condition caused by power on self test (POST) failure. This is the remote control equivalent of "press any key to continue".
A*		Enable or disable Automatic Gain Control (AGC) operation. Replace the * with 1 to enable AGC operation or 0 to disable AGC operation. When AGC operation is disabled, the current Manual Gain setting is in effect.
A?		Request current status of AGC (on or off).
AK?		AGC attack time report requests the current AGC attack time used with the fast attack, slow decay AGC used in all modes except AM. The reply format is the same as for the AGC attack time command above. This command is only available over the remote control bus.
AKn		AGC attack time command, sets the AGC attack time used with the fast attack, slow decay AGC (all modes except AM). The character 'n' is replaced with a digit between 1 and 9. The value 9 gives the original 'normal' attack time, with smaller values reducing the attack time proportionately. The AGC attack time is not stored in non-volatile memory. When power is first applied the the unit, the AGC attack time is set to the normal value, AK9. This command is only available over the remote control bus.
An		(AGC on/off) is expanded to add the Gain Hold feature. The argument 'n' is one of the following values: 0 MGC operation, as before 1 AGC operation, as before 2 Reserved 3 Gain Hold mode. Current gain setting is 'frozen'. This mode is not available when ISB operation is selected and is only available over the remote control bus.
B±1234		Change BFO offset. The ± character represents the sign of the desired value, and is replaced with either - or +. The digits 1 through 4 represent the value of the offset in Hertz with the character 1 representing the 1 kilohertz digit and the 4 representing the Hertz digit. The BFO setting is only used when the mode is CW. Any changes to the BFO when the mode is not CW will result in an Unrecognized Command error. (Range: -6000 to +6000 Hz).
B?		Request current BFO setting.
BI		Perform the built-in-test-equipment (BITE) test sequence. This command may take several seconds to complete. To see the results of the BITE test, send the **BI?** command.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
BI?[1]	**BInnnnnnnnnn**	BIte Status: Each of the **n** characters represents one of the tests performed when the BITE sequence is performed and is replaced with a 1 to indicate that the test failed or a 0 to indicate that the test passed. Starting with the first (left most) **n** character, the definition of each test bit is as follows: 1. Test freq: 0.375 MHz, USB, normal channel 2. Test freq: 1.125 MHz, LSB, alternate channel 3. Test freq: 2.625 MHz, USB, normal channel 4. Test freq: 2.225 MHz, LSB, alternate channel 5. Test freq: 3.750 MHz, USB, normal channel 6. Test freq: 5.250 MHz, LSB, alternate channel 7. Test freq: 8.250 MHz, USB, normal channel 8. Test freq: 11.250 MHz, LSB, alternate channel 9. Test freq: 17.250 MHz, USB, normal channel 10. Test freq: 27.750 MHz, LSB, alternate channel
BT#		Change Bridge Time. **#** represents a one character number to select the bridge time in seconds between signals when the receiver has stopped on a signal during scan or sweep operations. (Range: 0 through 9)
BT?		Request current Bridge Time.
C?		Request report of all parameters that are now different from those reported in the last Radio Status Message for each parameter.
CFxx		Set selected configuration parameter into non-volatile memory. Replace the xx with one of the following choices:
BSn		Enable or disable bus sharing. Replace the n with 1 to enable or 0 to disable bus sharing.
MDn		Enable or disable mode defaults. Replace the n with 1 to enable or 0 to disable mode defaults.
MH		Receiver operates in Manual Gain control (MGC).
MS		Protects the operator from excess audio should a signal exceed the gain threshold. The receiver has a fixed gain below the operator's selectable signal level and automatic gain control (AGC) above the threshold level.
PSn		Enable or disable the saving/restoring of the front panel parameters when power is removed/applied. Replace the n with a 1 to enable saving or a 0 to disable saving the parameters.
SRnnnn		Set the SSB low frequency roll off corner frequency. Replace the nnnn with a 1 to 4 digit decimal number giving the desired roll off in hertz. (Range: 0 - 1000 Hz).
CL		CLear all 250 memory channels to default parameters.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
CN?	**CN123 or CN---**	Request the current channel number: The characters **123** represent the three digits of the current channel number. If the radio parameters have been changed since the last channel was recalled the reply message will take the second form with dashes in place of the digits.
CO		Continue a stopped Scan or Sweep operation.
CRnnn?[1]	**F12345678 M* W1234 L123 A* Y123 G123 B±1234 I±1234 SK* P12345678 D9 BT9**	Request Channel Parameters: The actual reply will be a single string of characters. The reply is shown on multiple lines here only for readability. The fields of this message are as described for each reply individually. Fields are separated by a single space.
CS		Clear all Skip frequencies stored in the skip table used during sweep operation.
D#		Change Dwell Time. # represents a one character number to select the dwell time in seconds after signal detection during scan or sweep operations. (Range: 0 through 9)
D?		Request current Dwell Time.
DP123		Dump/Preset the current AGC value to the gain reduction value indicated by digits **123**. Refer to **G123** command for gain reduction settings. When this command is sent, the receiver gain reduction is immediately set to this value. Used in conjunction with **FAQ#** command. To allow fastest possible operation in the remote mode, this command should be sent to the receiver directly following the Recall Channel (**RC**) command. **DP000** is automatically set when the receiver uses its internal sweep and scan functions. If DP is sent without following digits, **DP000** is assumed.
(cont)		

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
EEPCLR		Clear the entire contents of the receiver's non-volatile memory. All user selected configuration items will be set to the original factory values. These values are: All 250 memory channels to default parameters. Front panel parameters stored at power down to default parameters Clear all frequencies from sweep skip table Soft key assignments for bandwidth and AGC Mode defaults enabled Mode defaults reset to original values Front panel Local/Remote selection to Remote **!** Receiver bus address to 000 **!** Bus type to RS-232 (serial only) **!** Baud rate to 19,200 bps (serial only) **!** Line Parameters to 8 bits, no parity, 1 stop bit (serial only) **!** Bus sharing On (serial only) SSB Roll off to 400 Hz Saving of parameters on power down disabled Display intensity to 100% Keypad clicks and beeps enabled Soft key menus shown by default Reference mode to Automatic NOTE: Execute this command with extreme caution! When the receiver changes to the default interface parameters listed above with dots (**!**), the remote controller will need to change to these values also unless they are already set. Never use this command when more than one receiver is connected to the bus as they will all be set to address 000. Receiver local operation may also be affected by this command.
F12345678		Change receiver operating Frequency. Digits 1 through 8 represent the eight digits of the receiver operating frequency with 1 representing the most significant (10 MHz digit) and 8 representing the least significant (1 Hz). (Range: 0 to 30 MHz or F00000000 through F30000000)
F?		Request current frequency.
(cont)		

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
FA?[1]	**FAnnnnnnnnnnnnnnn**	Request the Faults, Accumulated: The 16 **n** characters indicate the accumulated status of the fault conditions with each n replaced with a 1 to indicate the fault is true or a 0 to indicate that the fault is not true. Starting with the first (left most) n character, the definition of each fault bit is as follows: 1. Software error interrupt has occurred 2. Fault detected in RF Analog Module 3. Fault detected in Synthesizer output or fine loop 4. Fault detected in Synthesizer step loop 5. Fault detected in Power Supply Module 6. DSP processor not responding to requests 7. EEPROM does not accept programming 8. Serial bus time-out Fault (check CTS if bus sharing is disabled) 9. GPIB timeout: ready to talk but not addressed 10. GPIB timeout: got talk address but no handshake 11. Serial bus UART detected overrun error 12. Serial bus UART detected parity error 13. Serial bus UART detected framing error 14. Illegal bus address for bus type 15. Not currently used 16. Not currently used
(cont)		

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
FAQ#		Turn Fast Acquisition mode on/off. **#** represents a one character number to turn the Fast Acquisition mode on or off. Where 0 = off, and 1 = on. The fast acquisition mode permits cycling between stored channels within the memory of the receiver using the remote bus to step channels. The facility makes use of the standard recall facilities within the receiver, but enables them to be done faster than otherwise possible. The speed is made possible by preventing certain display operations during recall. The display reverts to a **"Fast Acquisition"** display using minimum graphics when in remote. Only the channel and frequency are updated to the display with a special fast format. When enabled, the receiver will not accept commands to change operating mode, bandwidth, AGC on/off, AGC decay, or MGC setting. Sweep and scan modes may not be entered. If any of these commands are sent, a command not allowed fault will be generated. **RELEVANT COMMANDS** **FAQ0** or **K** - Turn off fast acquisition mode **FAQ1** - Turn on fast acquisition mode **RCnnn** - Recall stored parameters in channel number nnn. (Leading zeros may be omitted) **DP** - AGC Dump **Notes On Usage** 1. The receiver must be set to REMOTE using the LOC/REM key on the front panel. 2. The command **FAQ1** is sent to turn on the fast acquisition mode. The change in display format will be noted when **FAQ1** is sent. 3. **RCnnn** will recall any settings previously stored in channel nnn and automatically commence recalling within 2 msec of receipt of the **RCnnn** command. Faster operation is available when the modulation and filter associated with the recalled channel is the same as the previous channel. 4. Subsequent recalls to **RC2, RC10, RC6,** etc., can be made in any order. 5. Enabling/disabling local mode using the front panel LOC/REM key turns on/off the special display. 6. The command **FAQ0** or **K** exits fast acquisition and returns the display to normal. 7. Frequency offset and audio output level are not updated. 8. Output may be noisy or distorted. **Example Sequence** **FAQ1 RC1 DP** **RC2 DP** **RC10 DP** etc. etc.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
FAQ?	**FAQ#**	Request current Fast Acquisition mode. **FAQ1**=on, **FAQ0**=off
FC?[1]	**FCnnnnnnnnnnnnnnn**	Request Faults, Current: Indicates current fault status (Refer to **FA?** above).
FS?[1]	**FS***	Request Fault Status: The character ***** will be replaced with a 0 if no faults are currently detected, or by 1 if one or more faults are currently detected. For detailed status of current and accumulated faults use the **FC?** and **FA?** commands.
FSK?	**FSK0** **FSK1**	Positive: Normal Data Sense Negative: Inverted Data Sense
FSffffffff, ddd		Special Frequency command, sets the operating frequency to the value ffffffff. The current AGC value is dumped to the preset value ddd. When this command is executed, the display is not updated, and will continue to show the previous settings. Units and limits for the two parameters are the same as for the F12345678 and the DP123 commands. Note: the dump parameter is given in units of dB, not 1/2 dB as other commands use. Leading zeros may be omitted from each argument field to reduce communication time.
G123		Change Manual Gain. Digits **1** through **3** represent the significant figures of the IF gain reduction from full gain. This number is in units of 1/2 dB and is implicitly negative. To convert the desired actual manual gain reduction in dB, multiply it by 2. For example, to set a gain of -123.5 dB, send **G247**. (Range: 0 through 255 corresponding to 0 to 127.5 dB).
G?		Request current Manual Gain setting.
H?	**Hsnn**	Gain Hold adjustment report, requests the current Gain Hold setting. The reply is in the same format as the Gain Hold command. This command is only available over the remote control bus.
Hsnn		Gain hold adjustment. The 's' is replaced with the '+' or '-' sign and the 'nn' is replaced with the amount of offset to be applied to the gain in Gain Hold mode in 1/2 dB units. Range -24 to +24 (+/- 12 dB). When the command is repeated, the value used is the offset from the original gain value set when the A3 command was first sent. This command is only available over the remote control bus.
ID?[1]	**(----------)**	Identify: The reply to this command is a message that identifies the manufacturer, the equipment name, the firmware version number and date, and a copyright notice. This message is less than 125 characters in length.
IDD?[1]	**(----------)**	Identify DSP: The reply to this command is a message the gives the date and version number of the firmware in the DSP processor. This message is less than 80 characters in length.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
I±1234		Change IF Shift setting. The **±** character represents the sign of the desired value, and is replaced with either - or +. The digits 1 through 4 represent the value of the IF Shift in Hertz with the character 1 representing the 1 kilohertz digit and the 4 representing the Hertz digit. The IF Shift setting is only used when the mode is CW. Any changes to the IF Shift when the mode is not CW will result in an Unrecognized Command error. (Range: -6000 to +6000 Hz).
I?		Request current IF Shift setting.
K		Cancel. Stops sweep or scan operation and clears all sweep and scan parameters.
L123		Change the Squelch Level. Digits 1 through 3 represent the significant figures of the signal level that must be present to open the squelch or to stop a sweep or scan. This number is in units of 1/2 dB and is implicitly negative. To convert the desired actual squelch level in dBm, multiply it by 2. For example, to set a squelch level of -103.5 dBm, send L207. Changes made with this command are affected by the current ISB Access Mode. (Range: 0 through 231 representing 0 through -115.5 dBm).
L?		Request current Squelch Level setting.
M*		Change receiver operating Mode. ***** represents a one character code chosen from the following set: **L** for LSB, **U** for USB, **I** for ISB, **C** for CW, **A** for AM, and **F** for FM. When the mode is changed, some of the other receiver parameters are set to new values as defaults. If these other parameters are also being changed, set the new mode first before changing the other parameters. In addition, CDR-3200 models that include an FSK detector module will respond to the following mode codes: **V** for very narrow shift FSK, **N** for narrow shift FSK, **M** for medium shift FSK, and **W** for wide shift FSK.
M?		Request current mode.
MSGnnmmm		Display message command, clears the display and writes an optional message in the display. The characters 'nn' are replaced with the count of characters in the optional message. Both digits are required. The characters 'mmm' are replaced with the message characters to display. If blanking only is desired (no message) the command 'MSG00' should be sent. The maximum message length is 31 characters. When counting characters, all characters including spaces must be counted. This command is only available over the remote control bus.
NBIF?	**NBIFsnnn**	NBIF frequency, requests the current NBIF frequency setting. The reply syntax is the same as for the NBIF frequency setting command.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
NBIFsnnn		Narrow Band IF output frequency setting allows adjustment of the NBIF output center frequency over a limited range of frequencies, depending on the hardware option installed. The 's' character is replaced with a '+' character to select a normal non-inverted output spectrum, or a '-' to select an inverted output spectrum. The 'nnn' characters are replaced with the desired frequency in kilohertz. For units with the bandpass filter output circuit the frequency range is 450-460. For units with the low pass filter output, the frequency range is 8-30. This command is available from the front panel as well as the remote control bus. The front panel key sequence is CONFIG->NEXT->NBIF. The NBIF frequency is saved in non-volatile memory and only needs to be set once unless the EEPROM memory is cleared. When this occurs, the value is set to +455 kHz. (In units with the low pass filter output circuit, this will produce an output centered at 20 kHz, inverted.)
O±12		Change the threshold Offset used in scan or sweep operation to adjust the squelch level setting for all channels. The **±** character represents the sign of the offset (+ or -), 1 represents the 10s of dB, and 2 represents the units of dB. (Range: -30 through +30)
O?		Request the current threshold Offset.
P12345678		Change SteP Size. **12345678** represent the step size during sweep operation as a frequency increment with 1 Hz resolution. The 1 represents the 10 MHz units and the 8 represents the 1 Hz units. (Range: 1 Hz through 10 MHz)
P?		Request current SteP Size.
PO?[1]	**POnnnnnnnn**	Request most recent POST results: Each of the n characters represents one of the tests performed when the POST sequence is run and is replaced with a 1 to indicate that the test failed or a 0 to indicate that the test passed. Starting with the first (left most) **n** character, the definition of each test bit is as follows: 1. Controller program ROM sum check failed 2. RAM test failed 3. EEPROM CRC test failed 4. DSP processor failed ROM test 5. DSP processor failed external RAM test 6. DSP processor failed internal RAM test 7. DSP processor failed FIFO/DIRECT test 8. BITE test failed
R?[1]	**V* F12345678 M* W1234 L123 A* Y123 G123 B±1234 I±1234 SK* P12345678 D9 BT9 O-20 CN123 FS* SNxy SR1234 X12**	Request receiver operating parameter status: The actual reply will be a single string of characters. The reply is shown on multiple lines here only for readability. The fields of this message are separated by a space and are described for each reply individually.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
RC###		ReCall operating parameters from memory channel. **###** represents the three digits of the memory channel from which to recall the parameters. Recalled data is entered immediately. This command is also used to set the starting channel for a scan or sweep operation in which case it is followed by a Scan or Sweep command. (Range: 0 through 249)
RSccc,ffff ffff,ddd		Special Recall command, performs a recall of the channel number specified by the number ccc. In addition, the frequency from the recalled channel is ignored, and the frequency is set to the value ffffffff. The current AGC value is dumped to the preset value ddd. When this command is executed, the display is not updated, and will continue to show the previous settings. Units and limits for the three parameters are the same as for the RC###, F12345678, and DP123 commands. Note: the dump parameter is given in units of dB, not 1/2 dB as other commands use. Leading zeros may be omitted from each argument field to reduce communication time.
S*?[1]		Request receiver meter reading. Replace the ***** with an **S** to request signal strength, an **A** to request audio output level, and an **F** to request frequency error. The value returned will be for the currently selected ISB Access Mode. Frequency error may only be requested when receiver operating mode is not ISB.
SA?	**SA±123**	Request audio output level: The **±** character represents the sign of the value and will be either + or -. Digits 1 through 3 represent the significant digits of the audio output level in dB below one milliwatt in units of 1/10 dBm. The 1 represents the 10s of dB, the 2 represents the 1s of dB, and 3 represents the 1/10s of dB (Range: -50.1 through +12).
SC###		Begin SCan of memory channels. **###** represents the three digits of the highest memory channel to be scanned. The scan begins at the memory channel most recently recalled with the **RC###** command. (Range: 0 through 249)
SF?	**SF±12345**	Request frequency tuning error: The **±** character represents the sign of the value and will be either + or -. Digits 1 through 5 represent the significant digits of the frequency error in Hertz where 1 represents the 10 kHz digit and 5 represents the 1 Hz digit. (Range: bandwidth dependent).
SG?	**SGbbbbbbbb**	Request status of last GPIB Service Request: Each **b** character is replaced with a 0 to indicate that the corresponding bit was not the reason for the last SRQ, or a 1 to indicate that the corresponding bit was responsible for the last SRQ. See figure 3-11 for Serial Poll response byte bit positions.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
SK*		Controls the receiver Skip parameter. The ***** is replaced with a 1 to set or enable the skip function, and a 0 to clear the skip function. The actual action depends on the current state of the receiver. If not scanning or sweeping, **SK1** sets the skip flag in the current operating parameters and **SK0** clears the skip flag in the current operating parameters. If the **SK1** command is followed by a store operation, that channel will be skipped in any subsequent scan or sweep operation. If the command **SK1** is given during scan operation and the receiver is dwelling or bridging on a channel, the skip flag is automatically stored in that channel and the scan proceeds to the next channel. If the command **SK1** is given during sweep operation and the receiver is dwelling or bridging on a frequency, that frequency is stored in a table of sweep skip frequencies and it will be skipped in any further sweep operations. The command **SK0** has no effect if the receiver is sweeping or scanning.
SK?		Request current Skip Flag status.
SMbbbbbbbb		Set the SRQ mask byte (IEEE-488 interface only). Controls the generation of the SRQ message for each of the conditions in the Serial Poll response byte. Each **b** represents one bit in the Serial Poll. See paragraph 3-9.4 for a description of the Serial Poll response byte. For each **b** character that is replaced with a 1, that bit will allowed to generate an SRQ. Bits replaced with a 0 will not be allowed to generate an SRQ. The default condition at power on is to allow all bits to generate SRQ.
SN?	**SNxy**	Request Scan/Sweep Status: The character **x** will be replaced with one of the following: **C** when the receiver is currently scanning (even if stopped) **W** when the receiver is currently sweeping (even if stopped) **N** when the receiver is not scanning or sweeping The character y will be replaced with one of the following: **D** when the scan or sweep is dwelling **B** when the scan or sweep is bridging **S** when the scan or sweep is stopped **N** when the scan is not dwelling, bridging, or stopped
SP		StoP the Scan or Sweep operation in progress but save parameters.
SR####		Set the step rate for sweep and scan operations to **####** milliseconds per step. Legal values range from 10 to 5000.
SR?		Request the current Step Rate.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
SS?	**SS±123**	Request signal strength: The **±** character represents the sign of the value and will be either + or -. Digits 1 through 3 represent the significant digits of the signal strength in dB relative to one milliwatt where: **1** represents 100 dB, **2** represents 10 dB, and **3** represents unit dB increments. (Range: -116 through +012).
ST###		STore current operating parameters into memory channel. **###** represents the three digits of the memory channel being stored to.
SW###		Begin SWeep of frequency bands. **###** represents the three digits of the highest odd numbered memory channel from which to take the sweep stop frequency. The sweep starts at the frequency of the channel most recently recalled with the **RC###** command. (Range: 0 through 249)
(cont)		

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
T#		Set the Special Step Mode. This command is used to change the operation of the receiver when sweeping. The receiver outputs signal strength data characterizing the sweep. The manner in which the operation is changed depends on the character that replaces the # as follows: NOTE: This mode is not accessible from the front panel menus. 0 Cancel Special Step Mode. Sweep returns to normal operation. This is the default condition at power up. 1 Reserved. 2 Set Pan Sweep "one-sweep" data collection mode. In this mode the sweep function is modified to collect signal strength data from the frequencies setup in the sweep. The receiver does not stop when signals are detected above the squelch threshold. At the end of one sweep the receiver stops sweeping and a block of signal strength data is made available at the remote control interface. The **TB?** command will then cause the receiver to send this data block to the remote controller. 3 Set Pan Sweep "free run" data collection mode. This mode is the same as the one-sweep mode (T2) except that the receiver does not stop sweeping when one sweep has been completed. The receiver continues to sweep and each new sweep's data replaces the previous sweep data in the output queue. When requesting a data block in this mode the receiver always responds with the most recent sweep data. 4 Set Pan Sweep "buffered" data collection mode. This mode is the same as the free run mode (T3) except that the output queue keeps up to 5 blocks of sweep data available for sending to the controller. When a request command (**TB?**) is sent by the controller, the receiver will transmit the oldest data block that has not already been sent. If more than 5 sweeps have been completed before the queue has been read by the controller, the oldest data blocks are overwritten. In this way the 5 most recent unread blocks are always maintained. The block sequence number that is part of the returned data block message may be used to detect queue overrun. NOTE: Due to buffer size and sweep time considerations, the number of frequencies that will be allowed with the sweep command (**SW###**) when any of the Pan Sweep modes is in effect is limited. If this limit is exceeded, the receiver will respond to the **SW###** command with **IE:IVAL**.
T?[1]		Request the current Special Step Mode setting.

Table 3-5 Radio Command and Status Messages.

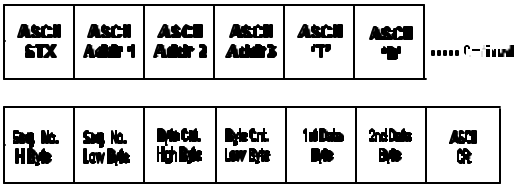
Syntax	Reply	Description
TB?[1]	**(Refer to description)**	Request the Block signal strength: The reply to this command is a specially formatted block of data created by the receiver when sweeping in one of the Pan Sweep data collection modes (T2, T3, and T4). If Special Step Mode T4 is set, and more than one block of data is available in the output queue, a separate **TB?** command must be sent for each one. This reply message contains 8 bit non-ASCII data so serial interface units must have their line parameters set for 8 data bits. Following the normal ASCII STX, three character ASCII address, and the message type header TB, are a variable number of 8 bit bytes that give the sweep number, the data byte count, and the data bytes themselves. This data format is illustrated below:  The two bytes following the TB message header are the block sequence number. This is a 16 bit value with the high byte sent first and is assigned by the receiver when the block of sweep data is assembled. This number can be used to verify that data blocks are not being created faster than they are being read by the controller. The first block after beginning a sweep will be number zero. If more than 65,535 sweeps have been taken since the sweep was begun, this number starts again from zero. The next two bytes give the number of data bytes that follow. This is a 16 bit value with the high byte sent first. Following the byte count are the actual data bytes. The first data byte represents the signal strength of the first frequency visited in the sweep, the second data byte represents the second frequency visited in the sweep, and so forth for each frequency in the sweep. Frequencies that are stored in the sweep skip table are not visited in the sweep and will not have associated data bytes. This means that the number of data bytes in the reply message may be less that the number calculated based on the start frequency, the stop frequency, and the step size. (Send the CL command to prevent this). Each data byte is a signed two's complement number that represents the signal strength of the energy present on the visited frequency in dBm. The range is approximately -115 to +12 dBm. Following the last data byte is an ASCII CR (carriage return) character. This is the last character of the reply message and is included for consistency with the other messages. It should not be confused with a data byte.

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
TG?	**TGnnn**	Total Gain Reduction report, requests the amount of total gain reduction currently in effect. The reply is in the format 'TGnnn' with the characters nnn replaced with the actual total gain reduction in units of 1/2 dB. This command is only available over the remote control bus.
V*		Select the ISB Access Mode. The ***** is replaced with the letter **N** to select access to the normal channel (USB) parameters or with the letter **A** to select access to the alternate channel (LSB) parameters. ISB Access Mode affects the following commands: **Y, Y?** (AGC Decay) **L, L?** (Squelch Level). There are two different parameter values for each of these commands (for the two channels of ISB, Normal and Alternate). The current setting of the ISB Access Mode determines which channel is affected (or reported on) by the respective radio command or status request. The default ISB access mode is **N** (normal channel). This setting applies until the V command is sent for the first time after power up. This command is not affected by the setting of the **X** (local/remote) command. The ISB Access Mode command also affects the reply to the following status request commands: **SS?** (Signal Strength report) **SA?** (Audio Level report) NOTE: For all modes except ISB, the receiver takes its parameters from the Normal channel so when changes are desired to affect the above parameters when the mode is other than ISB (including LSB), the ISB Access Mode should be set to **N** (normal). For example, if the current operating mode is LSB and the ISB Access Mode is set to **A** (alternate), sending the **L** (squelch level) command will have no affect on the current operation of the receiver. If the mode is subsequently changed to ISB, The previously set squelch level will be in effect for the alternate (LSB) output channel.
V?		Request the current ISB access mode.
(cont)		

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
Wnnnn		Change receiver IF bandwidth. **nnnn** is a two to four digit number that represents the IF bandwidth in units of 10 Hz. (e.g. for an IF bandwidth of 2700 Hz, **nnnn** is replaced with the digits 270). The selected bandwidth must be on the list of available bandwidths below. The range is limited under certain conditions. In ISB mode the bandwidth is fixed and need not be sent. For all other modes other than AM and FM, the maximum bandwidth is limited to 6 kHz. The following is a list of bandwidths available in the CDR-3250 receiver (all bandwidths are in Hertz): 100 800 2100 3400 150 900 2200 3500 200 1000 2300 4000 250 1100 2400 5000 300 1200 2500 6000 350 1300 2600 7000 400 1400 2700 8000 450 1500 2800 9000 500 1600 2900 10000 550 1700 3000 12000 600 1800 3100 14000 650 1900 3200 16000 700 2000 3300
W?		Request current IF Bandwidth.
X*		Switch between local and remote control operation (serial interface only). The ***** is replaced with the character 0 to enable the receiver front panel and disable all remote change parameter commands (except this command and the **V*** command), or the character 1 to enable all remote control commands and disable all front panel keypad input (except the LOC/REM key). The receiver front panel may always override the remote controller by pressing the LOC/REM key until the display shows LOCAL). The power on default state is **X1**.
X?	**Xab**	Request remote control status (serial interface only): The letter **a** is replaced with a 1 to signify that remote control is enabled from the remote controller or a 0 to signify that remote control has been disabled from the remote controller, and the letter **b** is replaced by a 1 to indicate that remote control operation has been selected from the receiver front panel or a 0 to signify that remote control operation has been disabled from the receiver front panel. For the receiver to respond to change parameter commands from the remote controller, both the remote controller and the front panel selections must be enabled (receiver replies **X11** to **X?**).

Table 3-5 Radio Command and Status Messages.

Syntax	Reply	Description
Y123		Change receiver AGC decay time. Digits 1 through 3 represent the significant digits of the AGC decay time in units of 10 ms. With the 1 representing the units of seconds digit, 2 the 100s of milliseconds, and the 3 the 10s of milliseconds. Values must be taken from the following list: 0, 1, 2, 3, 4, 6, 8, 10, 20, 30, 40, 60, 80, 100, 200, 300, 400 and represent decay times ranging from 0.00 to 4.00 seconds. For example, to set the AGC decay time to 0.6 seconds, the command **Y60** would be sent. The AGC Decay setting has no effect in the AM and FM modes. Changes made with this command are affected by the current ISB Access Mode.
Y?		Request current AGC Decay Time.

NOTES:

[1]Status request commands marked with this note may not be mixed with any other status requests in a single transmission.

3-9 REMOTE OPERATION USING IEEE-488 BUS.

The receiver can be operated under remote control, using an IEEE-488 bus, if the optional IEEE-488 Remote Interface board and bus plate are installed. Select the remote mode by pressing the front panel REM/LOC switch until CTRL:REMOTE appears in the display. When REMOTE is selected, the bus controller determines whether the receiver is in the remote or local mode.

NOTE

The bus controller can command the receiver to enter the local mode. When the controller commands the receiver to enter the local mode, the front panel will display CTRL:LOCAL.

3-9.1 *IEEE-488 Bus Description.* The IEEE-488 bus uses a party-line bus structure consisting of 16 signal lines. (Refer to table 3-6.) Devices are connected in parallel to the bus and information is passed in a byte serial/bit parallel fashion. Refer to IEEE Std 488-1978 for a complete description of the IEEE-488 bus.

The sixteen signal lines are divided into three major functional groups: bus management lines, handshake lines, and data lines. There are five bus management lines, three handshake lines, and eight data lines. Data and message transfer is asynchronous. Devices connected to the bus may be talkers, listeners, or controller. Multiple controllers may be connected to the bus but only one controller may be in charge at a time. The controller dictates the role of the other devices by setting the ATN (attention) line true and sending the talk or listen addresses on the data lines. While the ATN line is true, all devices must listen to the data lines. When the ATN line is false, only devices that have been addressed will actively send or receive data. All others ignore the data lines.

Several listeners can be active simultaneously but only one talker can be active at a time. Whenever a talk address is put on the data lines (while the ATN is true), all other talkers will automatically be unaddressed.

The bus management lines conduct an orderly flow of information across the bus. The five bus management signals are defined in table 3-6.

The three handshake lines coordinate the transfer of data over the bus. Transfer is asynchronous and the transfer rate automatically adjusts to the speed of the source and acceptor. The transfer rate will be that of the slowest active device. The three handshake lines are defined in table 3-7.

The eight bidirectional data lines (D1 - D8) transfer the data bytes on the bus. The bus management signals determine which device sends and which devices receive the byte. The handshake lines determine how long the byte remains on the bus.

One 24-pin, D-type ("Blue Ribbon") interface connector provides parallel connection for the receiver. A maximum of fifteen devices, including the bus controller, may be connected to the bus. (Each CDR-3250/80 chassis is counted as one device.) Each receiver must have a unique address set on the front panel.

The receiver may act as a talker and a listener. The SRQ function is selectable by means of a switch on the rear panel. If the SRQ function is disabled, the receiver can not request controller attention for communication. Two other switches on the rear panel are used to select the unaddressed talk only and listen only modes.

3-9.2 *Device Capabilities.* The interface capabilities implemented in the receiver are listed in table 3-8.

3-9.3 *Talking and Listening.* Commands sent to the receiver are prefixed with the appropriate Listen Address message and then the message is sent in ASCII as detailed in table 3-5. Following the transmission, " Unlisten" message may be sent or another transmission may be sent while the unit is still addressed. Each transmission must end with CR (carriage return) character. In addition, *the EOI (End or Identify) line must be set true concurrently with the CR.* An example of the bus transaction necessary to change the receive frequency to 12.345 MHz is as follows:

<Listen Address> F 1 2 3 4 5 0 0 0 <CR with EOI>

The unit's configured remote control address serves as both its Talk Address and its Listen Address, and may range from 0 to 30. Multiple receivers may be addressed as listeners and will all accept message transmissions simultaneously when so addressed.

If the message sent to a receiver is a request for status (all messages that end with '?') the receiver will prepare a reply message and wait to be addressed as a talker. If the receiver does not receive its talk address within 5 seconds of the request for status, it will indicate a fault and stop waiting. If it receives the talk address within 5 seconds, it will perform the source handshake with the controller until all of the reply message has been sent. If the controller does not perform the acceptor handshake within 1 second of sending the talk address to the receiver, the receiver will time out, indicate a fault, and stop and return to normal operation. The receiver will assert the EOI line on the bus concurrently with sending the CR at the end of the status message. It is not recommended that request for status messages be sent to multiple receivers simultaneously.

Table 3-6 IEEE-488 Bus Management Signals.

Name (Mnemonic)	Description
Attention (ATN)	Causes all devices to interpret data on the bus as a controller command. When ATN is true, the bus is placed in the "Command Mode". All devices on the bus interpret data on the eight data lines as commands. When ATN is false, the bus is placed in the "Data Mode". All active listeners on the bus interpret data on the eight data lines as data.
Interface Clear (IFC)	Clears the bus. Sets the bus to an idle state.
Service Request (SRQ)	Alerts the controller to a need for communication.
Remote Enable (REN)	Enables devices to respond to remote program control when addressed by the controller.
End or Identify (EOI)	Indicates last byte of multibyte sequence.

Table 3-7 IEEE-488 Bus Handshake Lines.

Name (Mnemonic)	Description
Data Valid (DAV)	Sent by source to indicate that data on the bus is valid. All active devices on the bus can accept the byte as true information.
Not Ready for Data (NRFD)	Sent by acceptor to indicate that a device is not ready to accept data.
Not Data Accepted (NDAC)	Sent by acceptor to indicate that the data byte has not yet been read from the bus.

Table 3-8 IEEE-488 Implemented Interface Capabilities.

Mnemonic	Description
SH1	Source Handshake, complete capability
AH1	Acceptor Handshake, complete capability
T6	Basic Talker, with serial poll and unaddress if MLA, no Talk Only mode
TE0	No Extended Talker
L4	Basic Listener, unaddress if MTA, no Listen Only mode
LE0	No Extended Listener
SR1	Service Request, complete capability
RL2	Remote Local, no local lockout
PP0	Parallel Poll, no capability
DC1	Device Clear, complete capability
DT0	Device Trigger, no capability
C0	Controller, no capability
E2	Three state line drivers

3-9.4 *SRQ and Serial Poll Response.* The receiver will assert the Service Request uniline message (SRQ) when any of several conditions occur. The status of each of these conditions is given in the Serial Poll response byte. The conditions and their location in the Serial Poll response byte are shown in figure 3-11.

The Signal Present, Fault, and Local Control bits will generate an SRQ on the bus whenever that state changes, either from true to false or from false to true. Both Bad Message and Bad Value bits are cleared upon receipt of a valid command message.

When an SRQ message is received by the controller, each device on the bus should be Serial Polled to determine which device is requesting service. Bit 6, the SRQ bit will be sent as true by any device that is currently asserting the SRQ message. The controller may execute a Serial Poll with the receiver at any time to read its status.

It is possible for an SRQ to be generated and for the Serial Poll to show no change in status from previous polls. This can happen if the state of a bit has changed and then changed back before the poll is taken. For example, if a signal is detected and then goes away before the poll is read, the bit will still be read as false. This condition may be detected by sending the SG? status request. The reply to this status message is of the following form: SGbbbbbbbb where each b character in the reply corresponds to a bit in the serial poll response byte. If the b bit is a 1, that bit is the one that caused the last SRQ message.

Each bit of the serial poll response byte may be masked off to prevent it from generating an SRQ message on the bus. This message is of the form: SMbbbbbbbb where each b is replaced with a 1 to allow that bit to generate an SRQ or a 0 to 'mask off' that condition and prevent an SRQ from being generated. For example to allow all conditions to generate an SRQ except the Signal Present condition, send SM11111110. The default (power-on) status of this message is to allow all bits to generate an SRQ.

3-9.5 *Device Clear And Selected Device Clear Response.* When the receiver receives the Device Clear (DCL) command or the Selected Device Clear (SDC) command, the receiver responds in the same way as if it had received the K command. This command stops any pending sweep or scan condition and places the receiver into the normal state.

3-10 POWER UP AND TESTING CONSIDERATIONS.

Whenever power is applied to the receiver it will execute a Power On Self Test sequence. This sequence tests several functions inside the receiver including memory tests, DSP processor memory test, and a confidence test of the configuration options stored in non-volatile memory, and a BITE (built in test equipment) test of receiver functions. If any of these tests fails, the receiver will not enter into normal operation, but will wait for an operator action to ensure that any failures will not go unnoticed. From the front panel, the display will show the message "Hit any Key to Continue". Since it is often required that the receiver not send any unsolicited bus messages, receivers configured with the serial interface will not announce this wait condition over the bus. IEEE-488 units will assert the SRQ line and set bit 3 of the Serial Poll response byte. During this wait condition, the receiver will only respond to a limited subset of commands from the bus. These are:

`:?`	Request interface status message (serial only)
Serial Poll	Sent in response to a SRQ (IEEE-488 only)
`PO?`	Request results of Power On Self Test
`!`	Clear wait condition and proceed with startup

For serial interface units in this wait condition, if the `:?` command is sent, the receiver will respond with:

`TE:EEPR` or `TE:POST`

This indicates that the receiver is waiting. IEEE-488 units will indicate this condition in bit 3 of the Serial Poll response byte. This condition can only be cleared by sending the `!` command or by pressing any key on the front panel. To determine the reason for POST failure, the user should then request POST results (`PO?`) and if this shows BITE failure, also request the BITE results (`BI?`) after clearing the Power on Wait condition with the `!` command.

The proper way to structure a remote control program to handle this condition is to query each receiver for interface status (`:?` or SRQ/Serial Poll) before sending any other commands at power up and wait for the reply. A reply will not be sent until a wait condition has been entered or normal operation has been entered. If the wait condition is indicated, send the ! command and test again. This process should be repeated until the receiver responds with an interface status other than `TE:` (serial interface) or shows Serial Poll bit 3 clear (IEEE-488 interface).

3-11 EEPROM CLEARING.

If a POST failure was caused by a corrupted EEPROM (Interface Status TE:EEPR), send the **!** command to clear the entire EEPROM to default values. This will cause the remote interface parameters to revert to the factory defaults which may be different than those that were selected from the front panel. In this case, the remote interface may become inoperative, and the desired remote interface parameters will have to be re-entered from the front panel.

The factory default remote interface parameters for the serial interface are as follows:

Address	000
Baud Rate	19,200 bits per second
Bits	8 bits, 1 stop bit, no parity
Bus Type	RS-232
Bus Sharing	enabled

For units configured with the IEEE-488 interface, only the address parameter is significant.

7	6	5	4	3	2	1	0
	SRQ	BAD VALUE	BAD MSG	POWER ON WAIT	LOCAL CNTRL	FAULT	SIGNAL PRESNT

Signal Presnt This bit mirrors that status of the squelch. If the squelch is open, this bit is set true.

Fault This bit mirrors the status of the front panel FAULT annunciator.

Local Control When true, this bit indicates that the front panel LOC/REM switch has selected LOCAL operation, overriding the remote control bus.

Power on Wait This bit indicates that the receiver has failed the Power-On Self Test and is waiting for a front panel key press or the remote control ! command.

Bad Msg The last command message was not recognized as a valid command.

Bad Value The last command message was recognized, but contained an out of range numeric value.

SRQ The receiver is asserting the SRQ message on the bus when this bit is true.

Figure 3-11 IEEE-488 Serial Poll Response Byte.

CHAPTER 4
GENERAL THEORY OF OPERATION

4-1 INTRODUCTION.

This chapter contains a block diagram description of the CDR-3250/80. Each of the boards/modules are discussed in the paragraphs below: (See figure FO-2.)

4-2 BLOCK DIAGRAM DISCUSSION.

4-2.1 *AC Receptacle /RFI Filter.* The AC Receptacle/RFI Filter keeps internally generated power supply switching noise off the AC input line. When the front panel power switch (S1) is set on, power is applied to the POWER SUPPLY module through the AC Receptacle/RFI Filter, and through the circuit breaker (CB1) on the rear panel.

4-2.2 *AC Line Filter.* The AC Line Filter board keeps internally generated power supply switching noise off the AC input line. When the front panel POWER switch is set ON, input power is applied to the POWER SUPPLY module through the AC Line Filter board.

4-2.3 *Power Supply Module.* The POWER SUPPLY module is a switching regulated type that provides +8, +17, and -17 VDC to the receiver modules through the motherboard using 90 to 260 VAC input power (automatically sensed). A separate +12 volt output is used for the fan on the rear panel. Fault detector circuits send a fault signal to the Control Section in the Digital module if any of the voltages fall below a preset level.

4-2.4 *RF Analog Module.* The RF Analog module contains the optional preselector, first mixer, first IF gain control, first LO, second mixer, second LO, and third 3rd mixer circuits. Each section is discussed below.

4-2.4.1 *Preselector.* The preselector assembly consists of an overload protection circuit, BITE (built-in test equipment) circuit, ten automatically selected filters, and an RF amplifier. The tuning range of 0 to 499 or 0 to 1,599 kHz is selected by one-of-two lowpass filters. For frequencies at or above 1.6 MHz, the spectrum is divided into eight bands of bandpass filters.

The incoming RF signal is applied through the rear panel antenna connector to the module. An overload detector and BITE circuit protects the filters by opening the RF line if the signal level exceeds approximately +24 dBm (1/4 Watt). Protection is provided for inputs up to 10 Watts.

Control data from the Control Section in the Digital module automatically selects the correct filter for the selected receive frequency using PIN diode switches. The serial control DATA from the Control Section is clocked into the shift register circuit. At the proper time, the DATA is latched into the shift register by the RF ENABLE signal. The shift register data then selects the correct filter, or activates the built-in test (BIT).

Built-in test equipment (BITE) testing is provided by disconnecting the antenna signal and using the 48 MHz signal developed in the Third LO section of the RF Analog module as a substitute signal to perform the BIT. During the BITE test, the PRE LO signal, under CPU control, is divided down to either 0.375 MHz or 0.750 MHz in the preselector, and the receiver is set to the ISB mode.

Each fundamental frequency and some odd harmonics are sequentially used to check each preselector band and the rest of the receiver circuits. The frequencies used are: 0.375, 1.125, 2.625, 2.25, 3.75, 5.25, 8.25, 11.25, 17.25, and 27.75 MHz. If the signals are not detected in the audio board after a certain amount of time, the test fails and the Control Section in the Digital module causes a fault to be displayed on the front panel.

4-2.4.2 *First Mixer*. The first mixer section converts the input signal to the first intermediate frequency (1ST IF) of 40.456 MHz. The input signal applied to the first mixer is filtered by a 33 MHz lowpass filter. The filter rejects the first local oscillator (1ST LO) frequency preventing it from being radiated back out the antenna. The filter also rejects input signals at the 1ST IF and image frequencies. The RF signal is mixed with the tunable 1ST LO frequency from the Synthesizer module, producing the 1ST IF. After amplification, a bandpass filter ensures that only the 1ST IF will pass.

4-2.4.3 *First IF Gain Control*. The first IF gain control circuits provide "front-end" gain control. The GAIN CONTROL voltage developed in the DSP section of the Digital module is used to control PIN diode attenuators for three gain control stages. The gain control section's output is applied to the second mixer section as the 1ST IF at 40.456 MHz.

4-2.4.4 *First LO Driver*. The 1ST LO signal is tuned to the correct frequency depending on the receive frequency and receive mode selected. The 1ST LO driver consisting of a preamplifier and push-pull amplifier, provides the proper level 1ST LO signal to the 1ST mixer. A fault detector

sends the RF FAULT signal to the CPU if the 1ST LO signal level falls below a preset level.

4-2.4.5 *Second Mixer*. The second mixer section converts the 1ST IF at 40.456 MHz, to the 2ND IF of 456 kHz. The 1ST IF signal enters the section and is applied to the 2nd mixer. The 2ND IF at 456 kHz is produced by mixing the 1ST IF at 40.456 MHz with the 2ND LO frequency at 40.000 MHz. The signal is filtered, amplified, and applied to the third mixer, and to the rear panel as the WBIF signal.

4-2.4.6 *Second LO.* The second LO operates on a fixed frequency of 40.000 MHz. This frequency is derived by applying the 10 MHz reference signal to a pair of cascaded bipolar transistor frequency doublers. The first doubler is followed by a two-pole bandpass filter. The filter output drives the second doubler followed by a four-pole bandpass filter. The filter output is applied to the second LO driver in the second mixer circuit.

4-2.4.7 *Third Mixer*. The third mixer section converts the 2ND IF to the 3RD IF using the third LO signal. The 2ND IF signal enters the section and is applied to the 3rd mixer. The 3RD IF at 24 kHz is produced by mixing the 2ND IF at 456 kHz with the 3RD LO frequency at 480 kHz. The signal is filtered and amplified before leaving the section.

4-2.4.8 *Third LO.* The third LO circuit provides two fixed frequencies. The circuit uses a 48 MHz VCO phase locked to a 2 MHz reference (10 MHz ÷ 5) with a fixed loop divider of 24. The VCO signal is split and applied to the preselector for the BITE circuits, DSP circuits, and to a ÷100 circuit to generate the 480 kHz 3RD LO.

A fault detector sends the RF FAULT signal to the CPU if the loop looses lock.

Overall voltage gain through the module is approximately +72 dB.

4-2.5 *Synthesizer Module.* The synthesizer module provides the 1ST LO and 2ND/3RD LO frequencies used for signal frequency conversion. It also contains the reference frequency circuits for reference frequency generation and switching, and audio circuits for audio amplification and control.

Using the +8V, +17V, and -17V from the power supply, three internal voltage regulators (not shown) supply the required voltages to the entire module. These regulators are mounted directly to the module surface for optimum heat transfer.

4-2.5.1 *Control.* The serial control DATA from the digital module is clocked through a buffer into the fine phase-locked loop (PLL) circuits and through a shift register to the step PLL and audio circuits. At the proper time, the DATA is latched into the PLL circuits by the correct SYNTH ENABLE signal. The ENABLE signal also latches the data into the shift register for the audio section. The data latched into the PLL circuits is used to synthesize the desired frequencies from the 10 MHz reference. Two bits in the shift register select the correct audio source, and enable or disable the speaker.

4-2.5.2 *Reference Frequency.* The reference frequency source is automatically selected by a detector that senses the presence of an external reference signal. If the external reference is detected, it is used as the basis for the frequency generation. If the external reference is not sensed, the internal oscillator (TCXO or optional OCXO) is used for frequency generation. A potentiometer is used to adjust the internal reference if necessary.

The 10 MHz external reference frequency may be daisy-chained using the REF OUT connector on the rear panel. If the signal is not daisy-chained, the REF IN signal may be terminated if desired by connecting a 50 ohm load to the REF OUT jack.

4-2.5.3 *1st LO Generation.* The output loop circuits produce the 1ST LO signal for the first mixer circuits using the FINE LOOP and STEP LOOP inputs.

The frequency of the output loop VCO is controlled by mixing the VCO output with the STEP LOOP frequency. The resultant difference signal is frequency and phase compared with the FINE LOOP frequency to produce the output PLL DC control voltage.

The VCO output signal takes two paths. One path is filtered and becomes the 1ST LO signal. The other path is mixed with the STEP LOOP signal, producing a difference frequency. The difference frequency is filtered through a lowpass filter and applied to a phase/frequency detector circuit.

The phase/frequency detector compares the difference frequency with the FINE LOOP frequency and develops a DC control voltage through a loop filter keeping the VCO on frequency. A wrong-side frequency detector ensures the output frequency locks only to the difference of the STEP LOOP minus the VCO output frequency. If the VCO frequency is higher than the step loop frequency, the circuit disables the difference frequency which causes the DC correction voltage to drive the VCO to a lower frequency.

The signal leaves the module as the 1ST LO at 40.456 - 70.456 MHz in 1 kHz steps at a level of +10 dBm.

A fault detector sends the OUTPUT/FINE FAULT signal to the digital module if the output or fine loops lose lock.

4-2.5.4 *2nd/3rd LO REF Generation.* One path of the internal or external reference frequency signal is amplified and used as the 2nd/3rd LO REF signal at 10 MHz for application to the RF Analog module. The other path is split and used as the reference frequency for the fine and step loop PLL circuits.

4-2.5.5 *Audio.* The audio circuits are located in a separate shielded compartment in the synthesizer module. The shielding prevents interaction between the high-level audio and sensitive VCO circuits.

The NORM AUDIO and ALT AUDIO signals from the DSP Section in the Digital module are applied to the audio board. The ALT AUDIO signal supplies LSB audio during ISB mode operation only.

Audio from each of these inputs is applied directly to two line amplifiers. These amplifiers are used for the NORM and ALT line audio outputs. The line amplifiers are transformer coupled to achieve the desired balanced output. The line output levels are adjustable using potentiometers.

The audio inputs are also applied to an audio selector switch to route the desired audio signal to a third amplifier. This amplifier is used for the front panel PHONES jack. The amplifier's output is single-ended and protected by resistors. The VOL CONTROL voltage for the phones amplifier is supplied from the front panel volume control. During the BITE check, the audio signal is sensed by an audio detector. If the detector does not sense a signal during the test, the /DET AUDIO signal is not sent to the Control Section in the Digital module. The Control Section then causes the fault to be displayed, and stores it in memory. The speaker audio is disabled during the BITE check of the power-on self test (POST), but enabled during the operator selected BITE check. (Refer to paragraph 5-5.2).

4-2.6 *Digital Module.* The Digital module contains two major sections: the Control Section, and the DSP Section. Each of these sections is described below.

4-2.6.1 *Control Section.* The Control Section governs all aspects of the receiver's operation. The Control Section receives commands from the operator through the keypad or from the optional remote control bus, and provides status and data information to the operator through the front panel display and the remote control bus. All receiver operating parameters, such as frequency, mode, IF bandwidth, and gain are directly controlled by the Control Section. In addition, the Control Section can store up to 250 different sets of operating parameters into memory channels. These memory channels can be recalled individually, scanned sequentially, or used in pairs as band limits for frequency sweeps. The current operating parameters and the 250 memory channels are stored in non-volatile memory and are retained when power is removed.

The Control Section contains a microprocessor containing a 16-bit internal data bus, with an 8-bit external bus. The clock frequency is 16 MHz using an external 32 MHz crystal. The program is stored in a 128k x 8-bit flash memory, and data memory consists of a 32k x 8-bit static RAM IC. Channel memory and other miscellaneous non-volatile storage requirements are provided by an 8k x 8-bit EEPROM.

An encoder logic circuit receives data inputs from the front panel adjustment knob optical shaft encoder. The shaft encoder is mounted on the shaft of the knob and produces two signals used to determine the amount and direction of knob rotation. The keypad encoder provides the interface between the front panel keypad and the Control Section. A key press is sensed as an interrupt input to the processor. The full graphic vacuum fluorescent display in the front panel contains a processor bus interface connecting directly to the buffered data bus.

I/O ports provide all processor output to the analog and DSP sections of the receiver. D-latches are clocked by decoded addresses gated with a processor write signal. Some of these latched output lines are grouped together as enable, clock, and data lines and are operated by the processor as synchronous serial ports. Other latched output lines are used as direct control signals.

I/O signals include:

/FAULTs	Input from the modules indicating a fault condition.
/DET AUDIO	Input from Audio board in Synthesizer module to determine if BITE signals pass completely through receiver circuits.
CMD FLAG	Informs the DSP Section that the command register contains a CMD MSG ready for transfer.
CMD MSG	Control data from the Control Section to the DSP Section.

STATUS MSG	Receiver status information (current signal strength, audio output level, etc.) from the DSP Section.
STATUS RDY	External flag interrupt to inform the Control Section that the DSP Section's output register contains the STATUS MSG for transfer.
ENABLE	Enables each receiver module or circuit.
CLOCK	Clocks out the control data to all modules.
DATA	Control information to each module or circuit.
C.O.R.	Carrier operated relay signals to rear panel.

Either a serial or IEEE-488 remote interface plug-in daughter board is installed as the remote control option. If the receiver is configured for serial bus operation refer to paragraph 4-2.7. If the receiver is configured for IEEE-488 bus operation refer to paragraph 4-2.8.

4-2.6.2 *DSP Section.* The digital signal processing (DSP) section provides the following conventional receiver functions: fourth LO, fourth mixer, IF filtering, AGC, IF gain control, BFO, detection, demodulation, and receive frequency tuning resolution in 1 Hz steps.

The DSP section contains an analog to digital converter, digital signal processor, I & Q line driver, 128k x 8-bit flash memory, 64k x 32-bit SRAM, IF reconstruction circuit, and multiplexed digital to analog converter.

The DSP Section operates semi-independently from the Control Section. All communication between the Control Section and the DSP Section is through the I/O ports in the Control Section. When the receiver operating parameters are changed, the Control Section sends one or more commands to the DSP Section which makes the necessary changes to its operation, and then continues processing.

The analog-to-digital converter converts the 3RD IF analog signal at 24 kHz to a digital signal for the digital signal processor. The 3RD IF signal is applied to the A/D converter where it is sampled at a 96 kHz rate. This sampling rate is the DSP clock frequency (48 MHz) divided by 500. The 48 MHz is generated by the VCO in the Third LO section of the RF Analog module which also generates the 3RD LO signal. This selection of frequencies allows all internal signals to be phase locked to the reference frequency standard.

The broadband digitized 3RD IF signal from the A/D converter is applied to the digital signal processor where filtering and demodulation takes place mathematically. DSP functions are all performed by firmware within the DSP microprocessor.

(See figure 4-1). The sampled IF input signal from the A/D Converter at 96 ks/s is applied to a downconverter. This function produces the "I" (In-Phase) and "Q" (Quadrature) signals and reduces the sample rate to 24 ks/s. At this point the tuned frequency is represented by an I&Q vector rotating in either direction at up to 500 Hz (-500 to +500 Hz).

The I&Q signals are applied to a frequency translator function. The digital FINE LO signal, representing the fine tuning frequency, is also applied to the frequency translator. The translator applies a rotation between +500 Hz and -500 Hz to the vector which translates the tuned frequency to 0 Hz (no rotation). This process provides fine tuned I&Q signals with a resolution of 1 Hz.

The outputs of the frequency translator are independently applied to two identical lowpass Finite Impulse Response (FIR) filters. Fifty-one FIR filters can be selected ranging from 100 Hz to 16 kHz. This function provides the overall IF bandpass function in a conventional receiver.

The outputs of the FIR filters are applied to a complex scaling function. Digital gain control is applied to the complex scaling, effectively varying the signal gain. Either automatic or manual gain is provided when selected. AGC uses a combination of the values from the sampled IF and AM detected digital signals to provide both digital and front-end gain control. The front-end gain signal is used in the RF Analog module. When selected, the MGC signal is applied to the gain control function from operator input through the Control Section.

AM demodulation is done mathematically using the signal magnitude, which is calculated as the square root of the sum of the squares of the I&Q outputs of the FIR filters. The signal magnitude is also used to develop AGC when selected. SSB and CW demodulation uses the digital equivalent of a product detector. The signal is translated from 0 kHz to approximately 1 kHz using a numerically controlled oscillator (NCO). The NCO frequency is set either positive or negative, depending on whether USB or LSB reception is desired. In the ISB mode, the normal channel functions provide USB and are duplicated in an alternate channel to provide LSB. The functions include input frequency translation, IF filtering, and the product

demodulation using an independent BFO input. USB is provided by the normal channel during ISB operation.

FM demodulation is accomplished with FIR differentiator functions that determine frequency as a time derivative of phase. The IF FIR filtered I&Q components are applied to the FM demodulator where the FM demodulation is done mathematically. Instantaneous digital gain control is derived from the AM signal to effect hard limiting. The FM video output is available in all modes except ISB.

The NBIF signal is reconstructed from the digital IF data as follows: The complex (I&Q) IF data having a selectable bandwidth is centered at zero frequency. This data is upsampled from 24 ks/s to 96 ks/s, then translated by -25 kHz. The result is a real signal at 96 ks/s which is then applied to a D/A converter. The analog output has the desired bandwidth centered at K25 kHz, with spectral images centered at K25 kHz ±NC96kHz, where N is an integer. The pulse shaper shortens the analog pulse sufficiently that the spectral images corresponding to N. 5 are enhanced. Thus the images centered at (K25±5C96) = ±455 kHz are enhanced.

The signal is then applied to a multipole bandpass filter centered at 455 kHz to suppress the other spectral images before it is applied to the rear panel as the NBIF signal. Since this filter has a greater bandwidth than any of the digital IF filters, the bandwidth at the NBIF connector is determined by the digital IF filter selection.

The D/A converter converts the digital signals from the digital signal processor into the required analog signals. Input signals from the processor are applied to the converter where they are converted into analog signals for application to the appropriate circuits. Four signals are multiplexed through one D/A converter and separated using four sample/hold circuits. The signals then go through 4-pole active lowpass filters before leaving the circuit.

The signal outputs of the DSP section are selected by the firmware as determined by data from the Control Section.

Signal outputs include:

GAIN CONT — Automatic or manual gain control for the RF Analog module.

NORM AUDIO — Either AM, FM, CW, USB, LSB, or USB audio in ISB mode when selected by the Control Section.

ALT AUDIO — LSB audio in ISB mode when selected by the Control Section.

FM VIDEO — FM output to rear panel (except in ISB mode). DC coupled.

NBIF — Reconstructed narrowband IF signal to the rear panel for external equipment.

I & Q — Digital IF signals to the rear panel for external equipment.

4-2.7 *Serial Bus (Optional).* If the unit is optionally configured for serial bus remote control operation, the unit will contain the Serial Bus Remote Interface Board and the Serial Bus Cable Assembly. Each is described in the following paragraphs.

4-2.7.1 *Serial Bus Remote Interface Board.* The Serial Bus Remote Interface Board converts serial data from the bus to parallel data for the Control Section. It also converts parallel data from the Control Section to serial data for the serial bus. This board is installed at the factory as a plug-in daughter board in the Digital module, and uses a serial receiver-transmitter integrated circuit. The board contains line drivers and line receivers for both RS-232 and RS-422 bus types.

4-2.7.2 *Serial Bus Cable Assembly.* The optional Serial Bus Cable Assembly allows connection of the Serial Bus Remote Interface board to the rear panel, and contains a multipurpose connector for operation of either a RS-232C or RS-422A external serial bus.

4-2.8 *IEEE-488 Bus (Optional).* If the unit is optionally configured for IEEE-488 bus remote control operation, the unit will contain the IEEE-488 Remote Interface Board and the IEEE-488 Cable Assembly. Each is described in the following paragraphs.

4-2.8.1 *IEEE-488 Remote Interface Board.* The optional IEEE-488 Remote Interface Board contains an IEEE-488 controller, line transceivers, and associated circuits to provide a smooth and orderly flow of data between the Control Section in the Digital module and the external IEEE-488 bus. This board is installed at the factory as a plug-in daughter board in the Digital module.

4-2.8.2 *IEEE-488 Cable Assembly.* The optional IEEE-488 Cable assembly allows connection of the IEEE-488 Remote Interface Board to the rear panel, and contains a D-type connector for connection to the external bus.

4-2.9 *Front Panel.* The Front Panel contains a phones jack, power/volume control, main adjustment knob, 19-key conductive rubber keypad, and full graphic vacuum fluorescent display. The volume control uses +12V to

provide a variable control voltage to the audio board in the Synthesizer module. Each of the other assemblies are described below.

4-2.10 *Main Adjustment Knob.* The Main Adjustment Knob allows receiver parameter entry using a knob, instead of a keypad. This provides faster and easier operator entry for most parameters. The knob contains an optical shaft encoder that converts shaft rotation information into digital data for the Control Section in the Digital module. The encoder produces two signals used to determine the amount and direction of knob rotation.

4-2.11 *Keypad Board.* The Keypad board contains 19 conductive rubber keys accessible on the front panel that provide key press data to the keypad encoder in the Control Section in the Digital module. When a key is pressed, ground is applied to a 5-column, 4-row matrix providing a separate column and row signal to the keypad encoder in the Control Section in the Digital module.

4-2.12 *Display Module.* The Display module is a full graphic vacuum fluorescent display containing a 256 x 64 pixel matrix. Display data from the Control Section in the Digital module directly provides display information to an internal display controller which in turn drives the display.

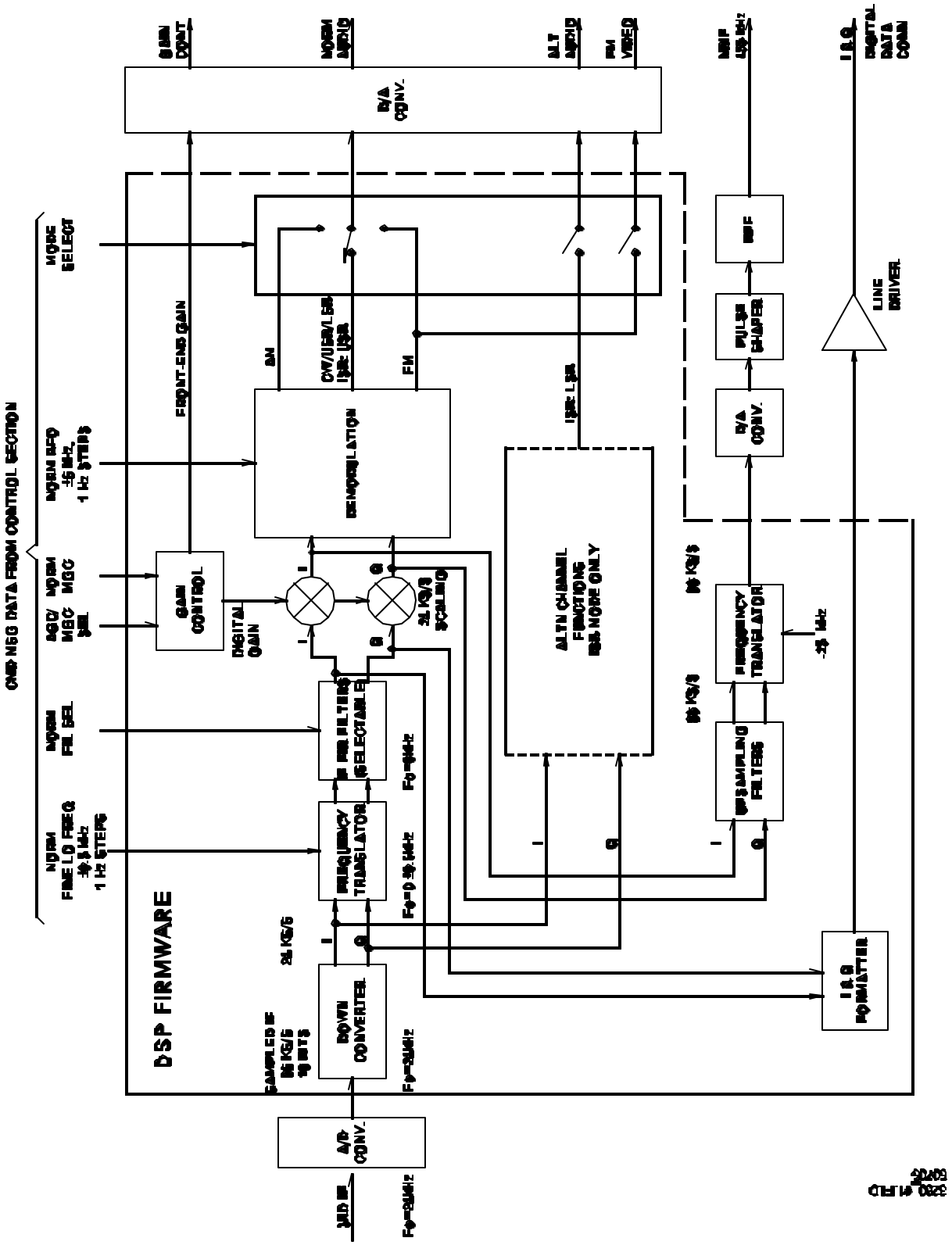


Figure 4-1 Digital Module DSP Firmware Functions.

CHAPTER 5
MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE

5-1 INTRODUCTION.

This chapter contains both preventive and corrective operational level maintenance instructions. The information includes cleaning and lubrication, inspection, performance verification, troubleshooting, and subassembly removal and replacement.

5-2 CLEANING AND LUBRICATION.

Clean the external surfaces and front panel of the unit every 2 weeks using a vacuum cleaner or small soft brush to remove any dirt or dust. Do not use any cleaning agents. There are no lubrication requirements.

5-3 INSPECTION.

If the unit is faulty or suspected to be faulty perform a visual inspection as follows:

5-3.1 *External Inspection.*

1. Check front panel for physical damage.
2. Check external case for physical damage.
3. Check rear panel for physical damage.
4. Check rear panel connectors for corrosion and loose connectors.
5. Check rear panel cables for frayed or broken wires.

5-3.2 *Internal Inspection.*

WARNING

With the front panel power/volume knob set OFF and the power cord plugged into the power source, high voltage shock danger is present internally at the rear panel POWER receptacle/RFI filter, optional AC Line Filter board, rear panel circuit breaker, and the front panel power switch connections.

CAUTION

When working on the receiver with covers removed and power applied, do not allow tools or metal objects to come in contact with receiver components. Equipment damage may occur.

CAUTION

Unit contains parts and assemblies sensitive to damage by electrostatic discharge (ESD). Use ESD precautionary procedures when touching removing or inserting parts.

1. Turn the unit off, and remove the power cord from the power source.
2. Remove the top and bottom covers of the unit as follows:
   CDR-3250: Using a no. 2 Phillips screwdriver, push down and turn all captive fasteners on the covers 1/4 turn counter-clockwise, and remove the covers.
   CDR-3280: Using a no. 1 Phillips screwdriver, remove 4 screws from both sides of chassis for each cover, and then remove the covers.
3. Check for loose modules and circuit boards.
4. Check for loose connectors, corrosion, or burn marks.
5. Check for frayed or broken wires.

5-4 PERFORMANCE VERIFICATION.

WARNING

With the front panel power/volume knob set OFF and the power cord plugged into the power source, high voltage shock danger is present internally at the rear panel POWER receptacle/RFI filter, the optional AC Line Filter board, rear panel circuit breaker, and the front panel power switch connections.

CAUTION

When working on the receiver with covers removed and power applied, do not allow tools or metal objects to come in contact with receiver components. Equipment damage may occur.

CAUTION

Unit contains parts and assemblies sensitive to damage by electrostatic discharge (ESD). Use ESD precautionary procedures when touching removing or inserting parts.

5-4.1 *Receiver Sensitivity.* This procedure is used to check that the receiver's sensitivity is at least 10 dB above the noise threshold. This procedure may also be used for troubleshooting by passing a signal through the receiver and verifying the proper output. If incorrect results are obtained, perform corrective maintenance in Section II of this Chapter.

1. Connect RF signal generator to the ANTENNA jack J5.
2. Set the RF signal generator output for a CW signal of 12.126 MHz at -113 dBm.
3. Connect true RMS voltmeter to the 600 ohm NORM audio output, J8 pins 1 and 2 on the rear panel.
4. Ensure equipment has warmed up at least 10 minutes.
5. Set the receiver frequency to 12.125 MHz in ISB reception mode.
6. Set receiver manual gain to -000.
7. Record voltmeter reading to establish reference.
8. Remove signal generator input to receiver.
9. Voltmeter should read at least 10 dB less than the reading obtained in step 7.
10. Connect voltmeter to the 600 ohm ALTN audio output, J8 pins 4 and 5 on the rear panel.
11. Set the receiver frequency to 12.127 MHz.
12. Record voltmeter reading to establish reference.
13. Remove signal generator input to receiver.
14. Voltmeter should read at least 10 dB less than the reading obtained in step 12.
15. Disconnect test equipment, and reconnect antenna.
16. Return receiver to normal configuration.

5-4.2 *Line Audio.* The following steps provide verification and adjustment procedures for the 600 ohm line audio outputs on the rear panel. If incorrect results are obtained, perform corrective maintenance in Section II of this Chapter. To verify/adjust the line audio outputs, do the following steps.

1. Connect RF signal generator to the ANTENNA jack J5.
2. Set the RF signal generator output for a CW signal of 12.126 MHz at -70 dBm.
3. Connect true RMS voltmeter to the 600 ohm NORM audio output, J8 pins 1 and 2 on the rear panel.
4. Ensure equipment has warmed up at least 10 minutes.
5. Set the receiver frequency to 12.125 MHz in ISB reception mode.
6. Set receiver AGC ON.
7. Voltmeter should read 0 dBm ± 3 dB. If not, remove top cover of receiver and adjust NORM AUDIO LINE ADJ potentiometer until correct reading is obtained. (See figure FO-5A (CDR-3250) or FO-5B (CDR-3280)).
8. Connect voltmeter to the 600 ohm ALTN audio output, J8 pins 4 and 5 on the rear panel.
9. Set the receiver frequency to 12.127 MHz.
10. Voltmeter should read 0 dBm ± 3 dB. If not, remove top cover of receiver and adjust ALT AUDIO LINE ADJ potentiometer until correct reading is obtained. (See figure FO-5A (CDR-3250) or FO-5B (CDR-3280)).
11. Replace top cover if removed.
12. Disconnect test equipment, and reconnect antenna.
13. Return receiver to normal configuration.

5-4.3 *Reference Frequency.* The following steps provide verification and adjustment procedures for the internal reference frequency.

NOTE

In the following procedure, a strong, off-the-air, accurate, frequency standard using amplitude modulation (such as WWV) may be used as the frequency standard. Use highest frequency possible below 30.0 MHz.

5-4.3.1 *Receiver Check.*

1. Ensure receiver and local frequency standard (if used) have warmed up for at least 10 minutes.
2. Connect known accurate frequency standard to ANTENNA jack J5.
3. Using 1 Hz frequency resolution, tune receiver to the same frequency as the frequency standard.
4. Set receiver to AM, 100 Hz BW, with AGC on.
5. Select METERS display on the front panel display.
6. Observe FRQ meter for 000 Hz ± 1 Hz.
7. If the frequency is not 000 ± 1 Hz, remove the top cover and adjust the INT REF ADJ potentiometer until correct reading is obtained. (See figure FO-5A (CDR-3250) or FO-5B (CDR-3280).)
8. Replace top cover if removed.
9. Return receiver to normal configuration.

5-4.3.2 *TCXO Check.*

1. Ensure receiver and local frequency standard (if used) have warmed up for at least 10 minutes
2. Connect the REF OUT J3 to the frequency counter.
3. If the frequency is not 10,000,000 ±1 Hz, remove the top cover and adjust the INT REF ADJ potentiometer until correct reading is obtained. (See figure FO-5A (CDR-3250) or FO-5B (CDR-3280).)
4. For better accuracy, connect J3 REF OUT to channel 1 of the oscilloscope and the local 10MHz frequency standard to channel 2.
5. Set the oscilloscope timebase to "X-Y" and observe the Lissajous pattern. Adjust the INT REF ADJ potentiometer until the pattern stops.

Section II. CORRECTIVE MAINTENANCE

5-5 TROUBLESHOOTING.

5-5.1 *Troubleshooting Philosophy.* Certain assumptions are made concerning the troubleshooting approach as applied to the receiver as follows:

1. All point-to-point wiring is correct. Therefore, no malfunction is the result of a wiring (or cable connector) fault.

NOTE

Suspected failure of cables or connectors require visual inspection and continuity tests using the appropriate diagrams. See figures FO-3, and FO-4 for interconnecting, schematic, and motherboard pin assignments.

2. Malfunctions are non-interactive. Each symptom of a problem is caused by a single malfunction and no additional failures occurred during the troubleshooting process.
3. Multiple faults can be isolated if they are non-interactive.
4. Preventive maintenance has been performed (Section I).

5-5.2 *Built-In Tests.* The CDR-3250/80 provides three types of testing: power-on self test (POST), built-in test equipment (BITE), and built-in test (BIT). Each is discussed below.

5-5.2.1 *POST.* The POST is performed automatically each time the receiver is powered on. Under firmware control, the POST sequences through a series of tests that checks the Control and DSP section of the Digital module, then activates the BITE check. If a failure is detected, the front panel display will show the failure. After recording the failure data, press any key on the front panel keypad to continue with operation. Depending on the failure, receiver functions may or may not be possible. If a BIT fault is detected after the POST, the front panel will show the fault indication in the display. POST results are also reported over the remote control bus.

5-5.2.2 *BITE.* The BITE check is controlled by the firmware and is a sequence that checks the signal path with two RF input signals and/or their odd harmonics. This test exercises the entire receiver signal path. Different frequencies are used to check each preselector filter. The BITE check is automatically performed during the POST, or may be selected manually at any time from the front panel, or the remote control bus. The speaker output is disabled during the POST BITE check, but is enabled during the manual BITE check.

(See figure FO-2). During the BITE check, the Control section in the Digital module activates the BITE circuits through the shift register in the Preselector section of the RF Analog module.

BITE Sequence The Control section firmware performs the BITE check in the following sequence:

1. Set receiver to ISB receive mode.
2. Send control data to Preselector to activate frequency divider and BITE switch.
3. Set bite control to produce a test frequency of 0.375 MHz and set gain to 6 dB above threshold.
4. Tune receiver to 0.374 MHz and check for USB audio (/DET AUDIO) signal.
5. Set bite control to produce a test frequency of 0.375 MHz and set gain to 6 dB above threshold.
6. Tune receiver to 1.126 MHz and check for LSB audio (/DET AUDIO) signal.
7. Set bite control to produce a test frequency of 0.375 MHz and set gain to 6 dB above threshold.
8. Tune receiver to 2.624 MHz and check for USB audio (/DET AUDIO) signal.
9. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
10. Tune receiver to 2.251 MHz and check for LSB audio (/DET AUDIO) signal.
11. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
12. Tune receiver to 3.749 MHz and check for USB audio (/DET AUDIO) signal.
13. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
14. Tune receiver to 5.251 MHz and check for LSB audio (/DET AUDIO) signal.
15. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
16. Tune receiver to 8.249 MHz and check for USB audio (/DET AUDIO) signal.
17. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.

18. Tune receiver to 11.251 MHz and check for LSB audio (/DET AUDIO) signal.
19. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
20. Tune receiver to 17.249 MHz and check for USB audio (/DET AUDIO) signal.
21. Set bite control to produce a test frequency of 0.750 MHz and set gain to 6 dB above threshold.
22. Tune receiver to 27.751 MHz and check for LSB audio (/DET AUDIO) signal.

5-5.2.3 *BIT.* During normal receiver operation, fault detectors are operating in the background. Table 5-1 lists the fault detectors, their locations and the fault signal sent to the Control section in the Digital module. If a fault is detected, the Control section stores the information in memory, causes the fault indication to be shown on the display, and sends the fault information over the remote control bus. The operator can view the current or cumulative faults (since power up) using the UTILITY FAULTS soft key menu.

5-5.3 *Troubleshooting Procedure.* Equipment troubleshooting should be performed in the following order:

1. Fault identification.
2. Initial checks.
3. Front panel display interpretation.
4. Signal tracing (If required).
5. Subassembly replacement.

5-5.3.1 *Fault Identification.* A fault is usually indicated by a fault indication on the front panel display, the bus controller detecting a fault bit, or by the receiver not detecting a known good signal.

5-5.3.2 *Initial Checks.* Before detailed troubleshooting, perform the following:

1. Check that the display on the front panel is on, and the power/volume knob is on. If the front panel display is off, and the power/volume knob is set to on, ensure that input power is correct.

NOTE

Display may not be visible in bright ambient light if 5% intensity is selected.

2. Check that valid frequency, bandwidth, and other parameters are correctly set.
3. Check for correct external reference frequency. If an external reference frequency is used, try disconnecting it, and recheck the receiver.
4. Check operation in both LOCAL and REMOTE.

5-5.3.3 *Front Panel Display Interpretation.* Further isolation is done by using the front panel to view the present or cumulative faults. To view the fault from the Primary soft key menu select **NEXT, NEXT, NEXT** to display the Utility soft key menu. Refer to paragraph 3-7.5.3 for further operation. Table 5-2 lists all fault messages, their meaning, and the maintenance action to take.

5-5.3.4 *Signal Tracing.* If the failed subassembly cannot be isolated using the initial check or front panel display interpretation, isolate the failed subassembly using conventional signal tracing techniques. Refer to chapter 4 and figure 5-1 for signal flow descriptions.

Signals are checked at various locations in the equipment using an RF signal generator and oscilloscope (see figures FO-2 through FO-5). Tables 2-1 through 2-5 lists signals at the rear panel connectors.

Table 5-1 Fault Detectors

Detector	Module Location	Fault Signal
Power Supply	Power Supply	PS FAULT
1st LO Driver	RF Analog	RF FAULT
3rd LO	RF Analog	RF FAULT
Output Loop PLL	Synthesizer	OUTPUT/FINE FAULT
Fine Loop PLL	Synthesizer	OUTPUT/FINE FAULT
Step Loop PLL	Synthesizer	STEP FAULT

Table 5-2 Front Panel Fault Messages.

Message	Meaning	Action To Take
Software Error Interrupt has occurred	Program failure	1. Recycle power 2. Replace Digital Module
Fault Detected in RF Module	1st LO signal not detected in RF Analog Module, or 3rd LO PLL lost lock	1. Check 2ND/3RD LO REF signal 2. Replace RF Analog Module 3. Replace Synth Module 4. Check wiring
Fault Detected in Synth: Fine or Output Loop	Fine or Output PLL lost lock	1. Check external reference frequency 2. Check internal reference frequency by applying external reference if available 3. Replace Synth Module
Fault Detected in Synth: Step Loop	Step PLL lost lock	1. Check external reference frequency 2. Check internal reference frequency by applying external reference if available 3. Replace Synth Module
Fault Detected in Power Supply Module	Voltage outputs out of tolerance	1. Check input power to receiver 2. Replace Power Supply Module 3. Replace AC Line Filter board
DSP Processor Not Responding to Rqst	DSP section not responding to a request for data from the Control Section.	1. Recycle power 2. Check DSP CLK signal (3rd LO PLL) 3. Replace Digital Module
EEPROM Does Not Accept Programming	Control Section non-volatile memory will not accept channel data, skip frequencies etc.	1. Recycle power 2. Replace Digital Module
Serial Bus Time-Out Fault - Check CTS	External remote controller has not sent the Clear To Send signal to the Control Section	1. Check remote controller program 2. Replace Digital Module 3. Replace Remote Connector board
Serial Bus UART Detected Overrun Error	Bus line error.	1. Check CONFIG parameters using front panel (must match external remote controller) 2. Check external remote controller configuration parameters 3. Replace Digital Module 4. Replace Remote Connector board
Serial Bus UART Detected Parity Error	Bus line error.	1. Check CONFIG parameters using front panel (must match external remote controller) 2. Check external remote controller configuration parameters 3. Replace Digital Module 4. Replace Remote Connector board
Serial Bus UART Detected Framing Error	Bus line error.	1. Check CONFIG parameters using front panel (must match external remote controller) 2. Check external remote controller configuration parameters 3. Replace Digital Module 4. Replace Remote Connector board

Table 5-2 Front Panel Fault Messages-Cont.

Message	Meaning	Action To Take
GPIB: Ready to Talk But Not Addressed	IEEE-488 external remote controller did not send address within allotted time.	1. Check remote controller 2. Replace Digital Module. 3. Replace Remote Connector board.
GPIB: Got Talk Addr But No Handshake	IEEE-488 external remote controller sent the correct address but did not take data from bus in allotted time.	1. Check remote controller 2. Replace Digital Module. 3. Replace Remote Connector board.
Illegal Bus Address for Bus Type	Configured receiver bus address out of limit.	1. Check CONFIG address using front panel. Limits = 000 - 254 serial bus, 00 - 30 IEEE-488 bus.

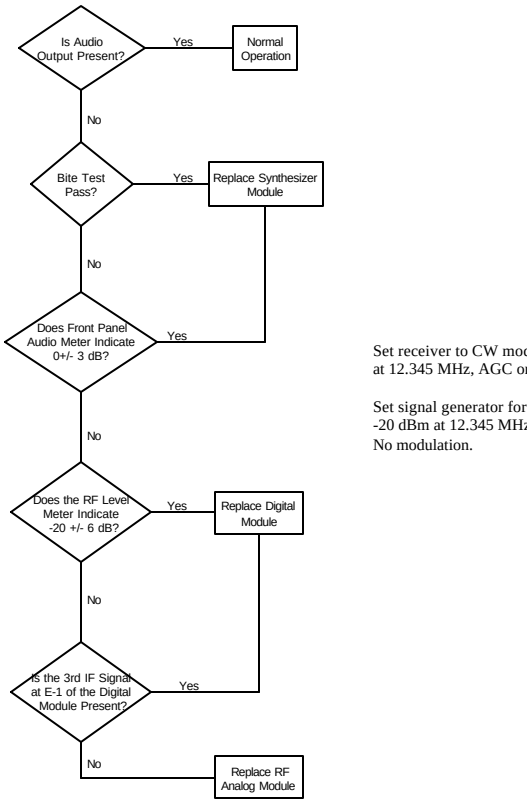


Figure 5-1 Signal Tracing Flow Chart

5-6 SUBASSEMBLY REMOVAL AND REPLACEMENT.

The following procedures describe removal and replacement procedures for subassemblies that may be removed and replaced at the operational level of maintenance:

No internal adjustments (except audio line output and internal reference adjustment) or component level maintenance should be performed at the operational level. These functions should be performed at the factory or an authorized repair depot.

WARNING

Turn off power and remove power cord before replacing subassemblies. Personnel injury or equipment damage may occur.

To remove the top or bottom cover, do the following: (Refer to figure FO-5A (CDR-3250) or FO-5B (CDR-3280) for locations.)

CDR-3250: Using a no. 2 Phillips screwdriver, push down and turn all captive fasteners on the cover 1/4 turn counter-clockwise, and remove the cover.

CDR-3280: Using a no. 1 Phillips screwdriver, remove 4 screws from both sides of chassis for each cover to be removed, and then remove the covers .

CAUTION

In the following procedures, to prevent damage to captive Allen screws or screw holes in the chassis, ensure captive Allen screws are completely retracted (but not removed) from module before pulling module from motherboard connector.

CAUTION

Module connectors may be difficult to separate. Pry gently on both sides of the connector to assist module removal.

NOTE

When removing subassemblies, save attaching hardware for subassembly replacement.

5-6.1 *Synthesizer Module.*

1. Remove top cover.
2. Using a 7/64 inch Allen wrench, loosen 8 Allen screws from module.
3. Pull module from motherboard connector.
4. To replace, reverse removal procedures.

5-6.2 *RF Analog Module.*

1. Remove top cover.
2. Remove Synthesizer module per paragraph 5-6.1.
3. Using a 7/64 Allen wrench, loosen 8 Allen screws from module.
4 Disconnect WBIF coaxial cable.
5. Pull module from motherboard connector.
6. To replace, reverse removal procedures.
7. Replace Synthesizer module per paragraph 5-6.1.

5-6.3 *Power Supply Module.*

1. Remove top and bottom cover.
2. Using a no. 2 Phillips screwdriver, remove 4 screws and attaching hardware from bottom of module.
3. Lift module from unit to disengage connector.
4. To replace, reverse removal procedures.

5-6.4 *AC Line Filter Board.*

1. Remove top and bottom cover.
2. On CDR-3280 only, remove Power Supply Module per paragraph 5-6.3 to reach AC Line Filter board attaching screws.
3. Using Phillips screwdriver, remove AC line filter shield.
4. Using Phillips screwdriver, remove 4 screws from bottom of board.
5. Disconnect all wires from board.
6. Lift board from unit.
7. To replace, reverse removal procedures.

5-6.5 *Digital Module.*

1. Remove bottom cover.
2. Using no. 1 Phillips screwdriver remove all screws from module cover.

NOTE

The optional Remote Control board is contained inside the Digital module, and is replaced as a separate subassembly.

3. Using no. 1 Phillips screwdriver remove 2 screws from remote control board inside module (if installed).
4. Lift remote control board with ribbon cable from module (if installed).
5. Disconnect keyboard ribbon cable.
6. Disconnect display ribbon cable.
7. Disconnect shaft encoder cable.
8. Replace cover on module.
9. Using a 7/64 inch Allen wrench, loosen 8 Allen screws from module.
10. Pull module from motherboard connector.
11. To replace, reverse removal procedures.

CAUTION

When reinstalling Digital module cover, ensure ribbon cable from Remote Control board is routed correctly. Ribbon cable may be damaged if pinched between cover and module housing or components.

5-6.6 *Remote Control Board (optional).*

1. Remove bottom cover.
2. Using no. 1 Phillips screwdriver remove all screws from Digital module cover.
3. Using no. 1 Phillips screwdriver remove 2 screws from remote control board inside Digital module.
4. Lift remote control board from module.
5. Remove ribbon cable from board.
6. To replace, reverse removal procedures.

5-6.7 *Keypad Board.*

1. Remove bottom cover.
2. Remove cable from Keypad board.
3. Using 3/16 inch wrench, remove 6 nuts and attaching hardware from board.
4. Lift board from unit.
5. Ensure rubber conductive keypad remains in place in front panel assembly.
6. To replace, reverse removal procedures.

5-6.8 *Keypad.*

1. Remove bottom cover.
2. Remove cable from Keypad board.
3. Using 3/16 inch wrench, remove 6 nuts and attaching hardware from board.
4. Lift board from unit.
5. Remove rubber conductive keypad from front panel assembly.
6. To replace, reverse removal procedures.

5-6.9 *Display Module.*

1. Remove top and bottom cover.
2. Remove top cover from Digital module.
3. Disconnect ribbon cables from Digital module board connecting to Keypad and Display module.
4. Replace Digital module cover.
5. Using no. 2 Phillips screwdriver, remove screws on each side of chassis securing front panel to chassis. On CDR-3250, also remove 2 screws from center of front panel near main adjustment knob.

CAUTION

In the next step be careful not to stress wires attached to front panel assembly components. Wires or connectors may break.

6. Carefully rotate top of front panel assembly away from chassis about 1 inch. Push front panel assembly down slightly, then rotate top of front panel assembly away from chassis to reach components on rear of front panel.
7. Using 1/4 inch nut driver, remove 3 nuts and attaching hardware securing module to front panel.
8. Lift module from unit.
9. To replace, reverse removal procedures.

5-6.10 *Power/Volume Knob.*

1. Using 0.05 inch Allen wrench, loosen set-screws, and remove knob from shaft.
2. To replace, reverse removal procedures.

5-6.11 *Main Adjustment Knob.*

1. Using 1/16 inch Allen wrench, loosen set-screws, and remove knob from shaft.
2. To replace, reverse removal procedures.

5-6.12 *Optical Shaft Encoder.*

1. Remove top cover.
2. Record wire color positions on connector, and remove connector from encoder.
3. Using no. 1/16 inch Allen wrench, loosen set-screws, and remove main adjustment knob from shaft.
4. Using 1/2 inch wrench, remove nut and attaching hardware securing shaft assembly to front panel.
5. Lift shaft encoder from unit.
6. To replace, reverse removal procedures.

5-6.13 *Fan Assembly.*

1 Remove bottom cover.
2. Using no. 1 Phillips screwdriver and 3/16 inch wrench, remove 4 screws and attaching hardware from fan assembly.
3. Cut tie wrap as necessary and disconnect fan cable from connector.
4. To replace, reverse removal procedures.

5-6.14 *Support Handles*

NOTE

To remove front handles on the CDR-3250, start at step 4.

1. Remove top and bottom cover.

NOTE

To replace either front panel handle, remove front panel. To remove either rear panel handle, remove rear panel.

2. Using no. 2 Phillips screwdriver, remove screws on each side of chassis securing front and/or rear panel to each side of chassis.
3. Without disconnecting any cables, carefully pull front and/or rear panel assembly away from chassis.
4. Using no. 2 Phillips screwdriver, remove 2 screws securing handles to front and/or rear panel.
5. To replace, reverse removal procedures.

5-7 SOFTWARE UPLOADING.

The receiver's control and DSP software may be replaced using the remote control connector on the rear of the unit to gain access to the unit's flash memory. Depending on which remote control option is installed in the receiver, the upload may be done using a DOS-based personal computer with a serial bus null-modem cable and one of the COMM ports on the PC, or an IEEE-488 cable and special interface card installed in the PC.

To access the upload menu, press and hold one of the front panel keys while turning the unit on. Refer to the upload documentation supplied with the software for details.

CHAPTER 6
PREPARATION FOR RESHIPMENT

6-1 INTRODUCTION.

This chapter contains information to prepare the unit for reshipment including disassembly and removal from the rack mount, packaging, and shipping.

6-2 DISASSEMBLY AND REMOVAL.

To disassemble and remove the unit from the rack mount, perform the following procedures:

1. Ensure the power knob is set to off.
2. Disconnect the input power cable.
3. Disconnect all cables from the rear panel.
4. Remove the unit from the rack mount if used.

6-3 PACKAGING.

NOTE

The unit should be packed in the original shipping container if available.

To package the unit for reshipment perform the following steps:

1. Ensure that there is sufficient foam packing material in the shipping container to protect the unit from any hard impact.
2. Cover the unit with foam or bubble-type packing material.
3. Place the unit in the center of the shipping container.
4. If using a cardboard packing carton, securely tape the seams of the carton's top cover, bottom cover, and side flaps with reinforced packing tape.
5. Attach labels or stamp in indelible ink the word FRAGILE on the top, bottom, and all sides of the container.

6-4 SHIPPING.

CAUTION

Unit contains parts and assemblies sensitive to damage by electrostatic discharge (ESD). Do not ship or store near strong electrostatic, electromagnetic, magnetic or radioactive fields.

There are no special shipping requirements for the unit. Commercial or military surface or air shipping services may be used.

CHAPTER 7
STORAGE

7-1 INTRODUCTION.

This chapter contains information for storage of the equipment including environmental conditions and any special preservation requirements.

7-2 STORAGE ENVIRONMENT.

The receiver should be stored indoors in the original shipping container (or similar container) as described in chapter 6. The humidity should be between 40 and 90% (non-condensing) with a temperature range of -40 to +75°C.

CAUTION

Unit contains parts and assemblies sensitive to damage by electrostatic discharge (ESD). Do not ship or store near strong electrostatic, electromagnetic, magnetic or radioactive fields.

7-3 PRESERVATION.

There are no special coverings or preservation materials required to store the receiver.

CHAPTER 8
PARTS LIST

8-1 INTRODUCTION.

This chapter contains the parts list for replaceable modules and chassis-mounted components at the operational maintenance level.

8-2 REPLACEABLE PARTS LISTING.

Table 8-1 lists replaceable modules and chassis-mounted components for the unit. (See figure FO-5A (CDR-3250) or FO-5B (CDR-3280) for locations.)

Table 8-1 Replaceable Parts.

Qty	Description	Part Number	Remarks	Mfr
1	Board, Keypad	260235-1		CCI[1]
1	Board, AC Line Filter	260340-1		CCI
1	Board, Serial Remote	260245-1	(Optional) In Digital Module. Cable below required.	CCI
1	Board, IEEE-488 Remote	260250-1	(Optional) In Digital Module. Cable below required.	CCI
1	Cable Assy, Fan	260395-1	Includes fan	CCI
1	Cable Assy, IEEE-488 to rear panel	260279-1	(Optional) IEEE-488 board rqrd	CCI
1	Cable Assy, Serial to rear panel	260386-2	(Optional) Serial board rqrd	CCI
4	Handle, Support	222-086	CDR-3250	CCI
4	Handle, Support	2600-4407-7	CDR-3280	CCI
1	Keypad, Rubber Conductive	260006-1		CCI
1	Kit, Dual Rack-Mount	2600-1009-1	CDR-3280 (Two receivers required)	CCI
1	Knob, 1/8 shaft	211-119	Power/volume	CCI
1	Knob Assy, 1/4 shaft	211-118	Main Adjustment CDR-3280	CCI
1	Knob, 1/4 shaft	260264-1	Main Adjustment CDR-3250	CCI
1	Module, Digital	2600-1105-1		CCI
1	Module, Synthesizer	2600-1106-1		CCI
1	Module, RF Analog (w/preselector)	2600-1107-2	(Standard)	CCI
1	Module, RF Analog (w/o preselector)	2600-1107-1	(Optional)	CCI
1	Module, Power Supply	260259-1		CCI
1	Module, Display	260018-2		CCI
1	Optical Shaft Encoder Assy	174-005		CCI
1	Power cord, AC	696-012		CCI

[1]Cubic Communications, Inc. (FSCM 59532)

ANNEX A

TECHNICAL MANUAL ANNEX

OPERATION AND MAINTENANCE INSTRUCTIONS

OPERATIONAL LEVEL

REMOTE CONTROL ONLY OPTION

NOTICE:
This annex is incomplete without the associated technical manual

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Cubic Communications Inc.
9535 Waples Street
San Diego, California 92121-2953

Telephone: (858) 643-5800 Telefax: (858) 643-5803

Rev. A **20 May 1997**

DESCRIPTION

This annex supplements the technical manual and contains difference data for certain units that can only be operated remotely. The units are identified by the substitution of the standard front panel with a special front panel containing a removable plate that exposes two 8-switch DIP circuits.

DIFFERENCES

The major differences are listed in table AN-1.

Table AN-1 Remote Control Only Option - Differences.

Item	Standard Version	Remote Control Only
Unit	Can be controlled locally or remotely.	Remote control only.
Front Panel	Contains Display, keypad, and controls for local or remote operation.	Contains removable plate exposing two 8-switch DIP circuits used to set parameters required for remote control operation.

Before operating the equipment, remove the plate on the front panel, refer to figure AN-1 and set the switches as indicated for correct remote operation. After the switches are set, replace the plate on the front panel. Except for the front panel, the equipment functions identically to the standard unit when operated in remote control. Refer to Chapter 3, Section II of the technical manual for operation

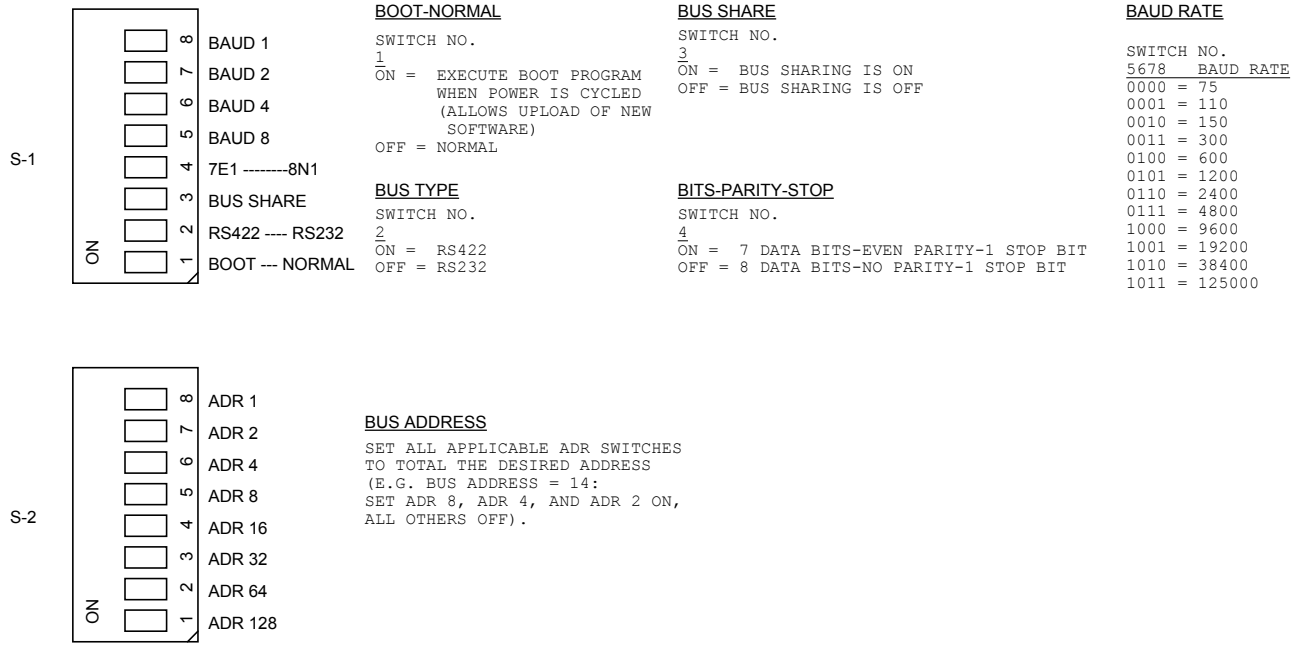

Figure AN-1 DIP Switch Settings.

DIP-SWITCH FRONT PANEL DOWN LOAD PROCEDURES

To down load the software via the DIP switch, follow the procedure as outlined below.

1. Turn the power off to the unit.
2. Set DIP Switch 1 on S1 to ON.
3. Set address on S2 to 3 for the Control Program, 1 for DSP1, or 2 for DSP2.
   a. Address 3; Set DIP Switches 7 & 8 of S2 to ON, all other DIP Switches on S2 set to OFF.
   b. Address 2; Set DIP Switches 7 of S2 to ON, all other DIP Switches on S2 set to OFF.
   c. Address 1, Set DIP Switches 8 of S2 to On, all other DIP Switches on S2 set to OFF.
4. Set DIP Switch 2 to the one of the following:
   a. For RS-232, set to OFF
   b. For RS-422, set to ON
   c. For IEEE 488, DIP Switch settings have no effect. (e.g. DIP Switches can be set to ON or OFF)
5. Set DIP Switch 3 on S1 to OFF.
6. Set the Baud Rate using DIP Switches 5 - 8 on S1 as follows:

BAUD	DIP SWITCH SETTING
38,400	5 & 7 set to ON 6 & 8 set to OFF
19,200	5 & 8 set to ON 6 & 7 set to OFF
9,600	5 set to ON 6 , 7, & 8 set to OFF
2,400	6 & 7 set to ON 5 & 8 set to OFF
1,200	6 & 8 set to ON 5 & 7 set to OFF

7. Using RCOMM with flow control off and the correct baud rate, select the upload file and depress the enter key.
8. Turn the power on to the unit.
9. Repeat steps 1 - 8 for each program to upload.
10. Reset the address switch to 0 or the desired address
11. Turn DIP Switch 1 on S1 to OFF
12. Power on the unit and verify download using ID? and IDD?

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ANNEX B

TECHNICAL MANUAL ANNEX

OPERATION AND MAINTENANCE INSTRUCTIONS

OPERATIONAL LEVEL

DC POWER SUPPLY OPTION FOR CDR-3250/80 RECEIVER

NOTICE:
This annex is incomplete without the associated technical manual

Cubic Communications Inc.
9535 Waples Street
San Diego, California 92121-2953

Telephone: (619) 643-5800 Telefax: (619) 643-5803

Issue 2.1
Change 2 30 January 1998

DC POWER SUPPLY OPTION

DESCRIPTION

This annex supplements the CDR-3250/80 technical manual and contains difference data for certain CDR-3250/80 models containing a DC power supply.

DIFFERENCES

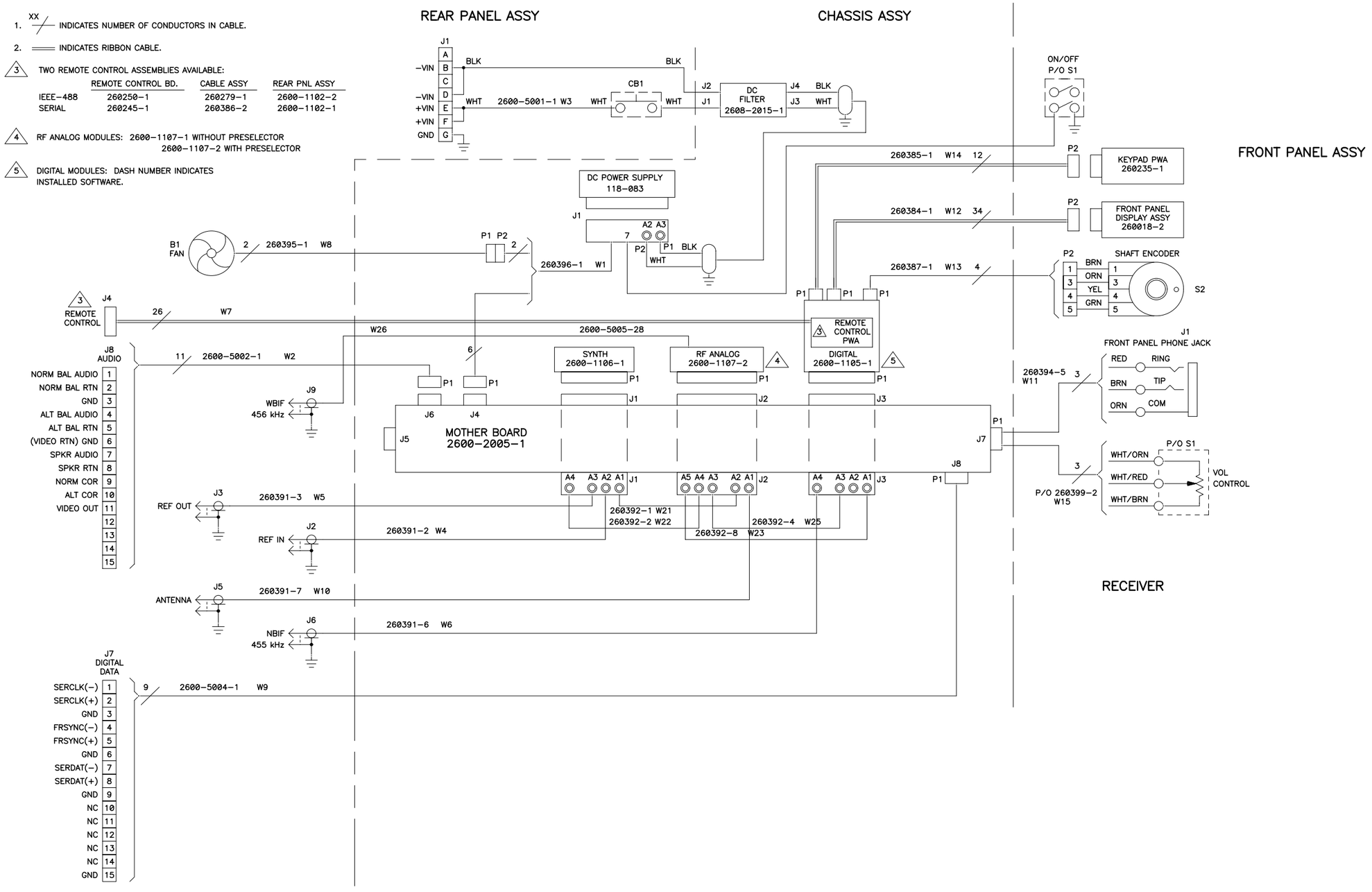
The major differences are as follows:

Item	AC Version	DC Version	Remarks
Power Requirements	90 - 260 VAC 47 - 440 Hz, 50 watts	20 - 32 VDC, 3A maximum	
Power Connector (rear panel)	Connector Type - IEC 320-C-13 (CCI P/N 343-002) mates with NEMA 5-15P (CCI P/N 696-012, Power Cord)	Connector Type - MS3452W16S-1P (CCI P/N 320-008) mates with MS3456W16S-1S (CCI P/N 320-009)	Refer to Pin Description table below
Line Filter	P/N 260340-1	P/N 2608-2015-1	
Power Supply Module	P/N 260259-1	P/N 118-083	

DC POWER Connector (J1) Pin Descriptions.

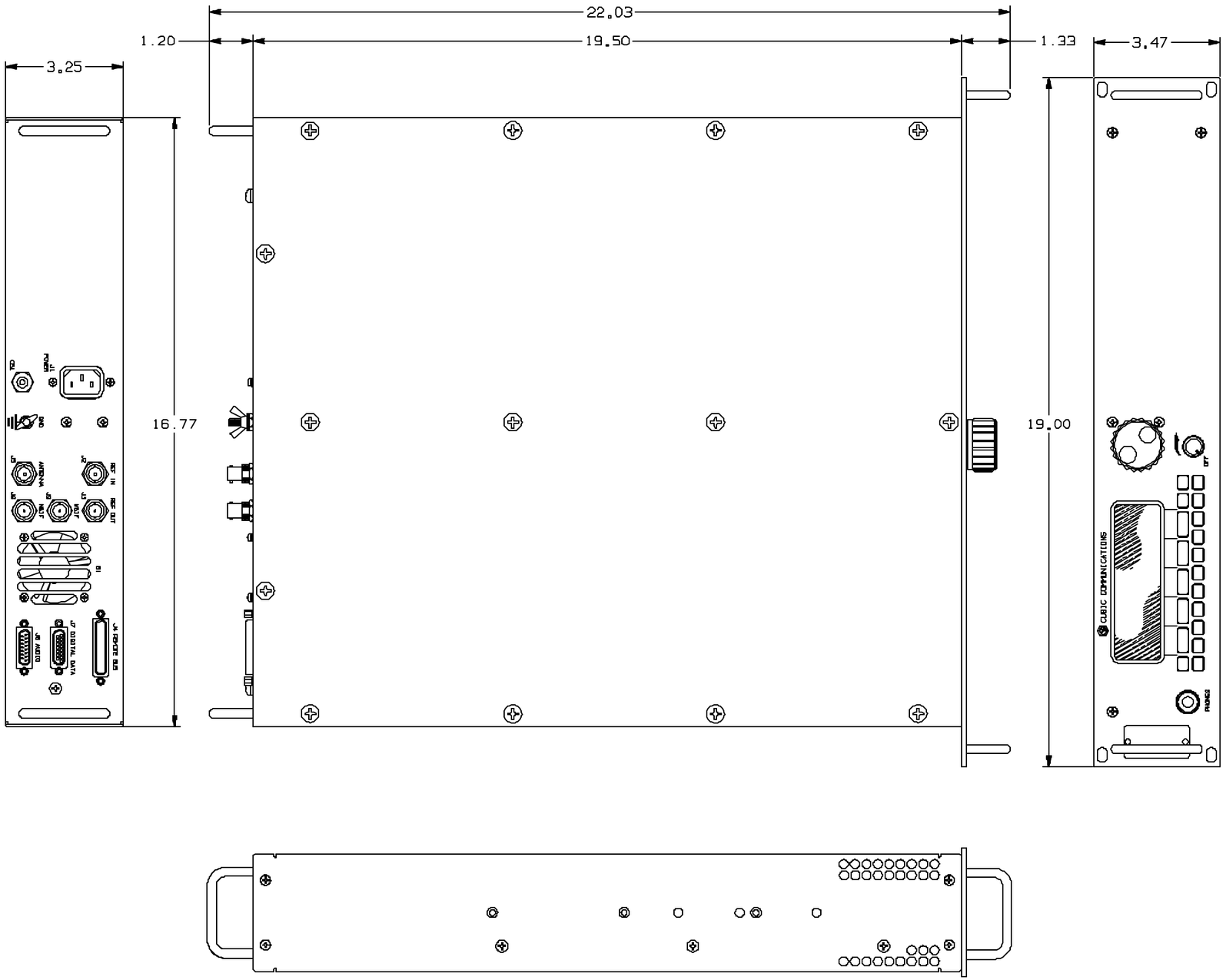
Pin	Signal	Remarks
A	NC	
B	POWER RETURN (GND)	
C	NC	
D	POWER RETURN (GND)	
E	+VDC IN	+20 to +32 VDC, 3A maximum
F	+VDC IN	+20 to +32 VDC, 3A maximum
G	SHIELD GROUND	

Except for input power, the receiver functions identically to the AC powered CDR-3250/80 unit. Refer to Foldout 3.1 (FO-3.1), on page AN-2B for the DC Interconnect drawing option.



2600-1005-3

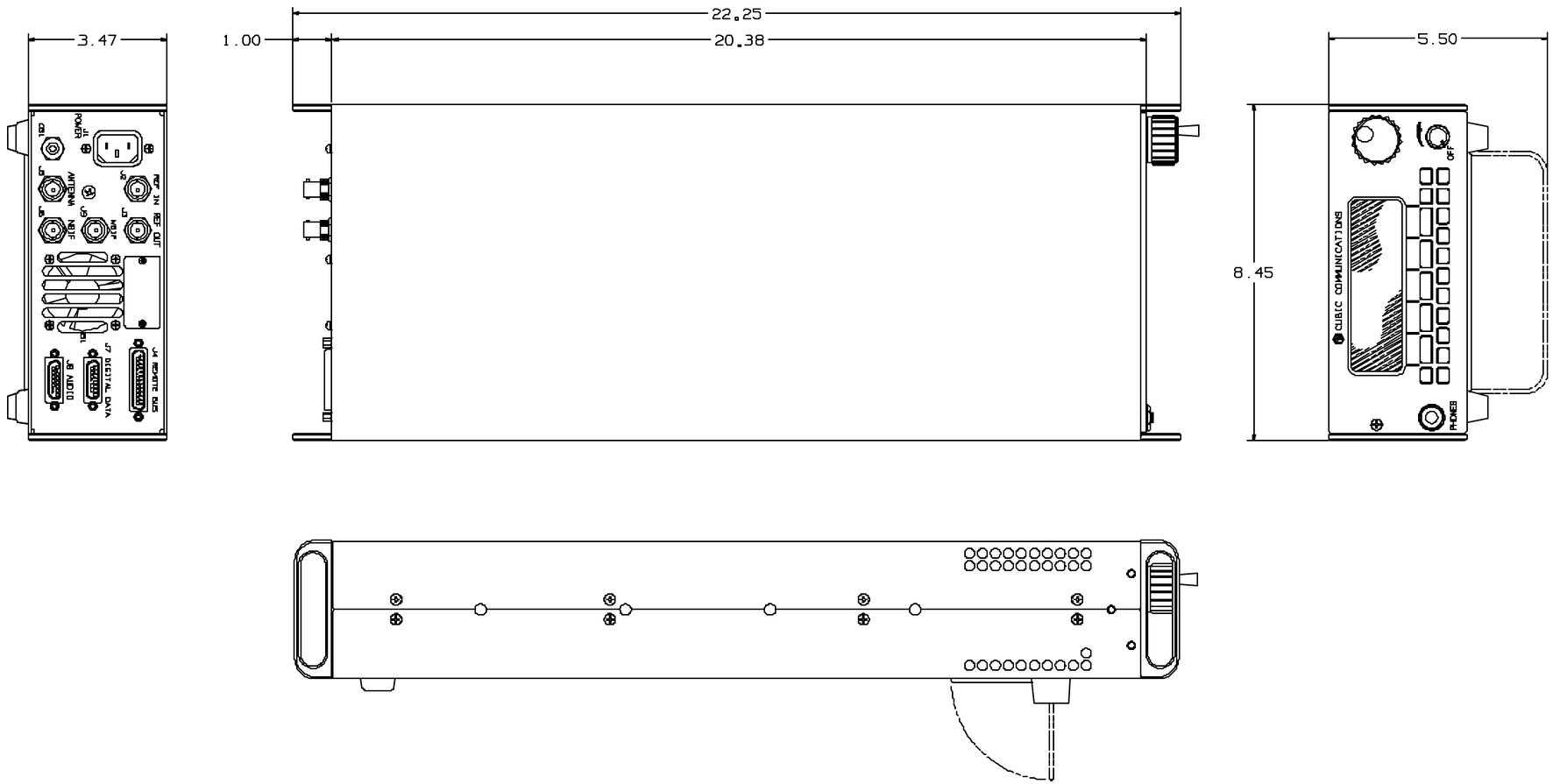
FO-3.1 CDR-3250/80 DC Interconnect Diagram AN-2B



OL3250.PRA

FO-1A. CDR-3250 Outline and Mounting Drawing.

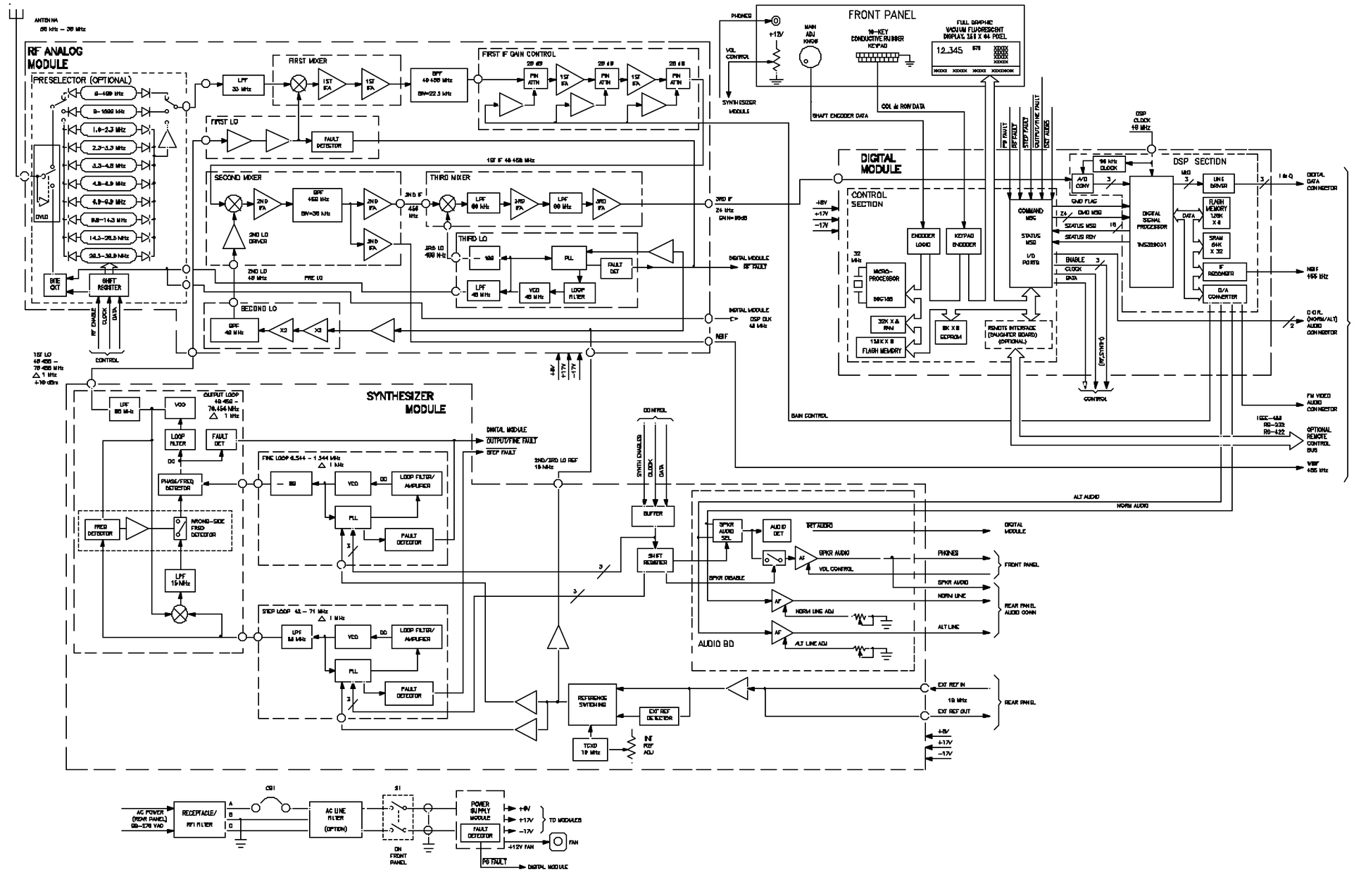
FO-1B. CDR-3280 Outline and Mounting



OL3280.PRA

Drawing.

FO-2. CDR-3250/80 Block Diagram.



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FO-3. CDR-3250/80 Interconnect

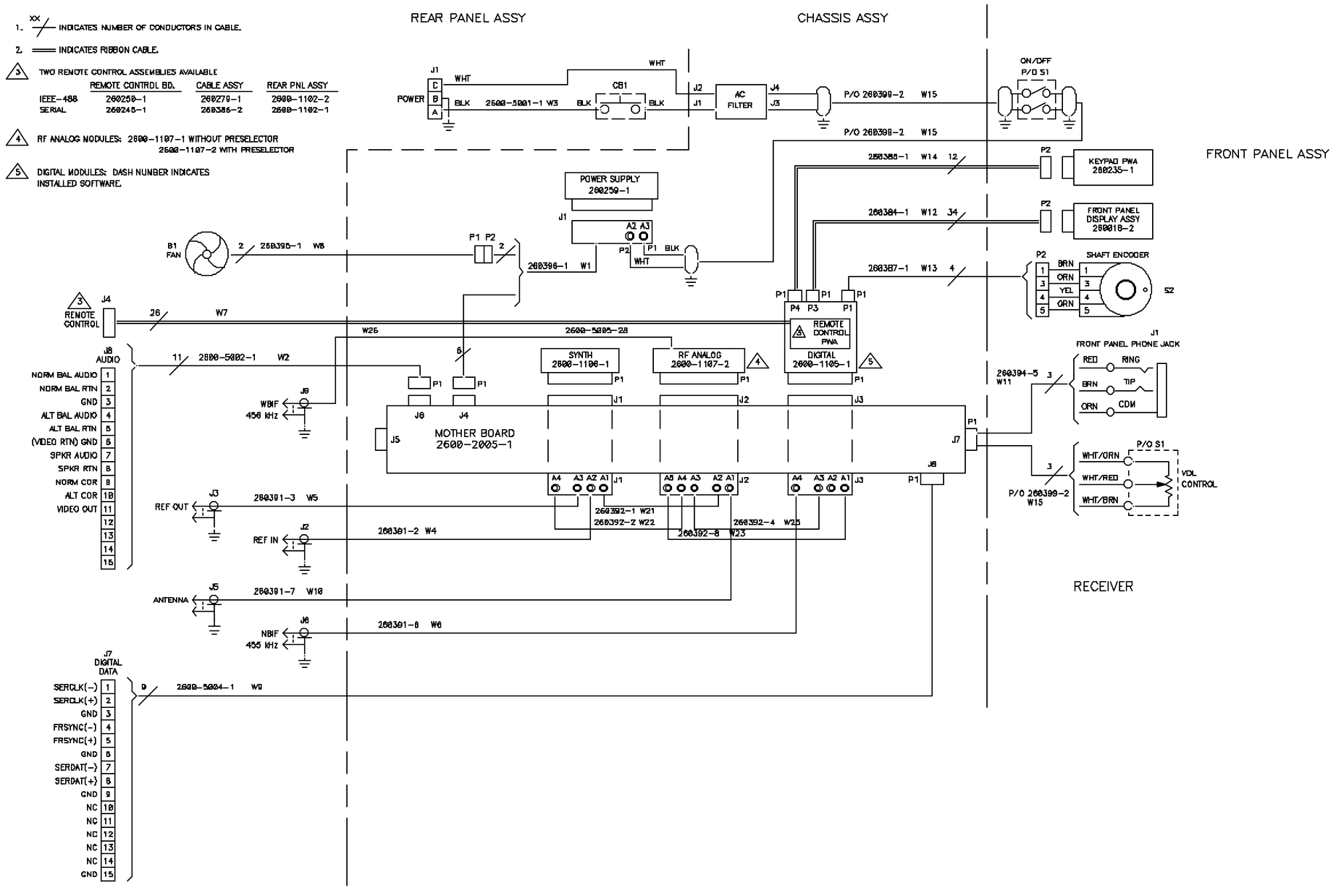
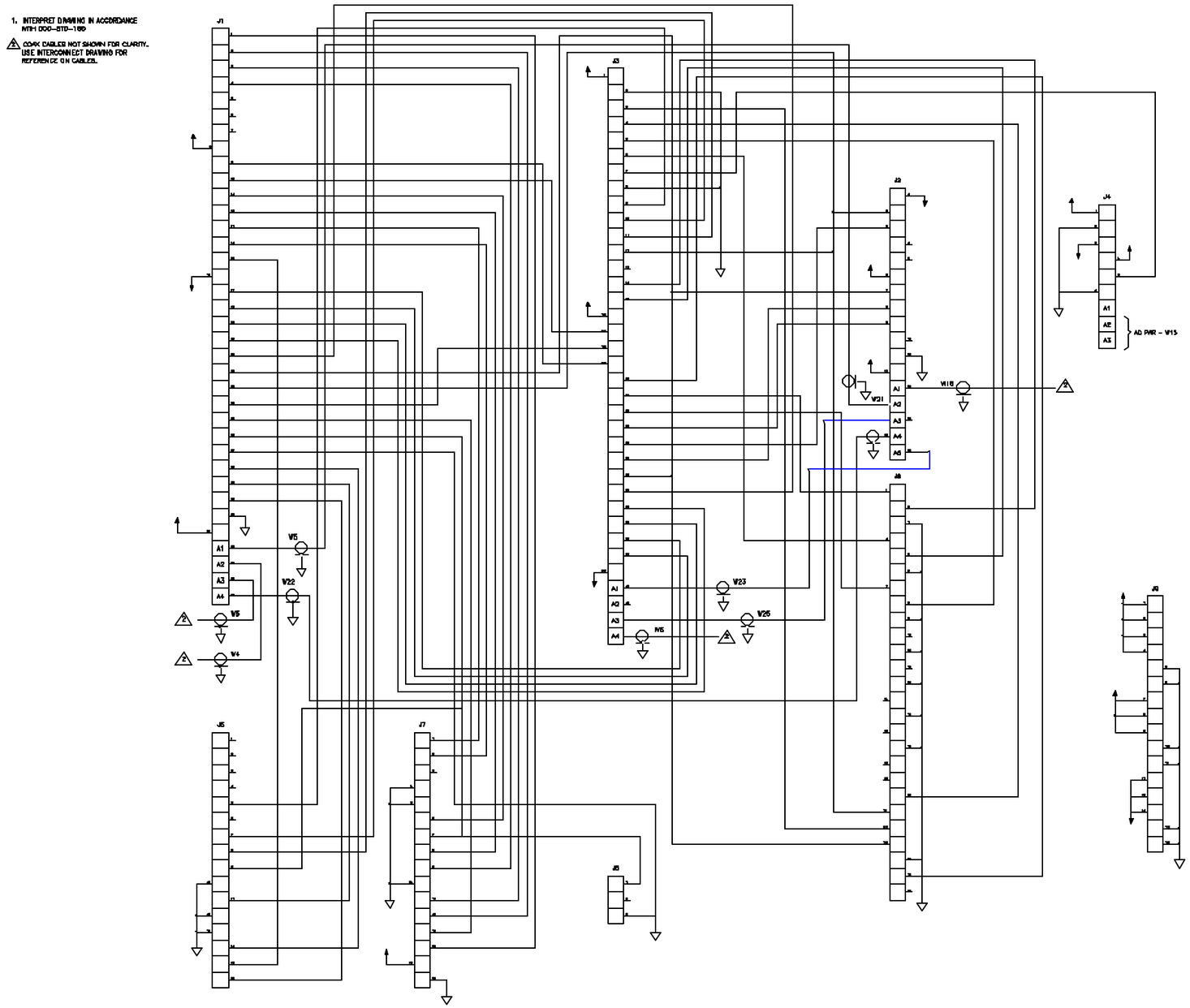


Diagram.

FO-4. CDR-3250/80 Motherboard



2600-2405B-1

Schematic (Sheet 1 of 2).

FO-4. CDR-3250/80 Motherboard

J1 SYNTHESIZER MODULE	
PIN NO	DESCRIPTION
1	NORM LINE VOL
2	ALT LINE VOL
3	NORM PHONE VOL
4	ALT PHONE VOL
5	NC
6	NC
7	NC
8	+8 VOLTS
9	AUDIO DET
10	NORM AUDIO
11	ALT PHONE TIP
12	ALT PHONE RING
13	NORM PHONE TIP
14	NORM PHONE RING
15	NORM BAL AUDIO
16	–17 VOLTS
17	1LO FAULT
18	STEP FAULT
19	STEP ENABLE
20	FINE ENABLE
21	EXT REF DN
22	SERIAL CLOCK
23	SERIAL DATA
24	ALT AUDIO
25	SPKR VOL
26	SPKR AUDIO
27	GND
28	ALT BAL AUDIO
29	ALT BAL RTN
30	NORM BAL RTN
31	GND
32	+17 VOLTS
A1	1LO (COAX)
A2	EXT REF IN (COAX)
A3	EXT REF OUT (COAX)
A4	2ND/3RD LO REF (COAX)

J2 RF ANALOG MODULE	
PIN NO	DESCRIPTION
1	–17 VOLTS
2	SERIAL DATA
3	AGC
4	NC
5	NC
6	+8 VOLTS
7	SERIAL CLOCK
8	RF ENABLE
9	RF FAULT
10	NC
11	GND
12	+17 VOLTS
A1	ANTENNA (COAX)
A2	1LO (COAX)
A3	3IF (COAX)
A4	2ND/3RD LO REF (COAX)
A5	DSP CLK (COAX)

J3 DIGITAL MODULE	
PIN NO.	DESCRIPTION
1	+17 VOLTS
2	GND
3	SPARE OUT 1
4	SPARE OUT 0
5	SERDAT(+)
6	FRSYND(–)
7	FS FAULT
8	GND
9	VIDEO OUT
10	NORM CDR
11	ALT CDR
12	SERIAL DATA
13	NC
14	SERCLK(+)
15	FRSYND(+)
16	+8 VOLTS
17	NORM AUDIO
18	ALT AUDIO
19	AUDIO DET
20	PRESEL ENABLE
21	SERCLK(–)
22	SERDAT(–)
23	RF FAULT
24	AGC
25	RF ENABLE
26	SERIAL CLOCK
27	EXT REF DN
28	FINE ENABLE
29	STEP ENABLE
30	1LO FAULT
31	STEP FAULT
32	–17 VOLTS
A1	DSP CLK (COAX)
A2	NC
A3	3IF (COAX)
A4	IF OUT (COAX)

J4 POWER SUPPLY	
PIN NO.	DESCRIPTION
1	+17 VOLTS
2	GND
3	–17 VOLTS
4	+8 VOLTS
5	FS FAULT
6	GND

J5 REAR PANEL SPEAKER JACK	
PIN NO.	DESCRIPTION
1	SPKR AUDIO
2	NC
3	GND

J6 REAR PANEL AUDIO CONNECTOR	
PIN NO.	DESCRIPTION
1	NC
2	NC
3	NC
4	NC
5	VIDEO OUT
6	NC
7	NORM CDR
8	ALT CDR
9	SPKR AUDIO
10	GND
11	ALT BAL RTN
12	GND
13	GND
14	ALT BAL AUDIO
15	NORM BAL AUDIO
16	NORM BAL RTN

J7 FRONT PANEL CONTROL	
PIN NO	DESCRIPTION
1	NORM PHONE TIP
2	NORM PHONE RING
3	NC
4	GND
5	GND
6	ALT PHONE TIP
7	SPKR AUDIO
8	ALT PHONE RING
9	ALT PHONE VOL
10	GND
11	NORM PHONE VOL
12	ALT LINE VOL
13	SPKR VOL
14	NORM LINE VOL
15	+17 VOLTS
16	GND

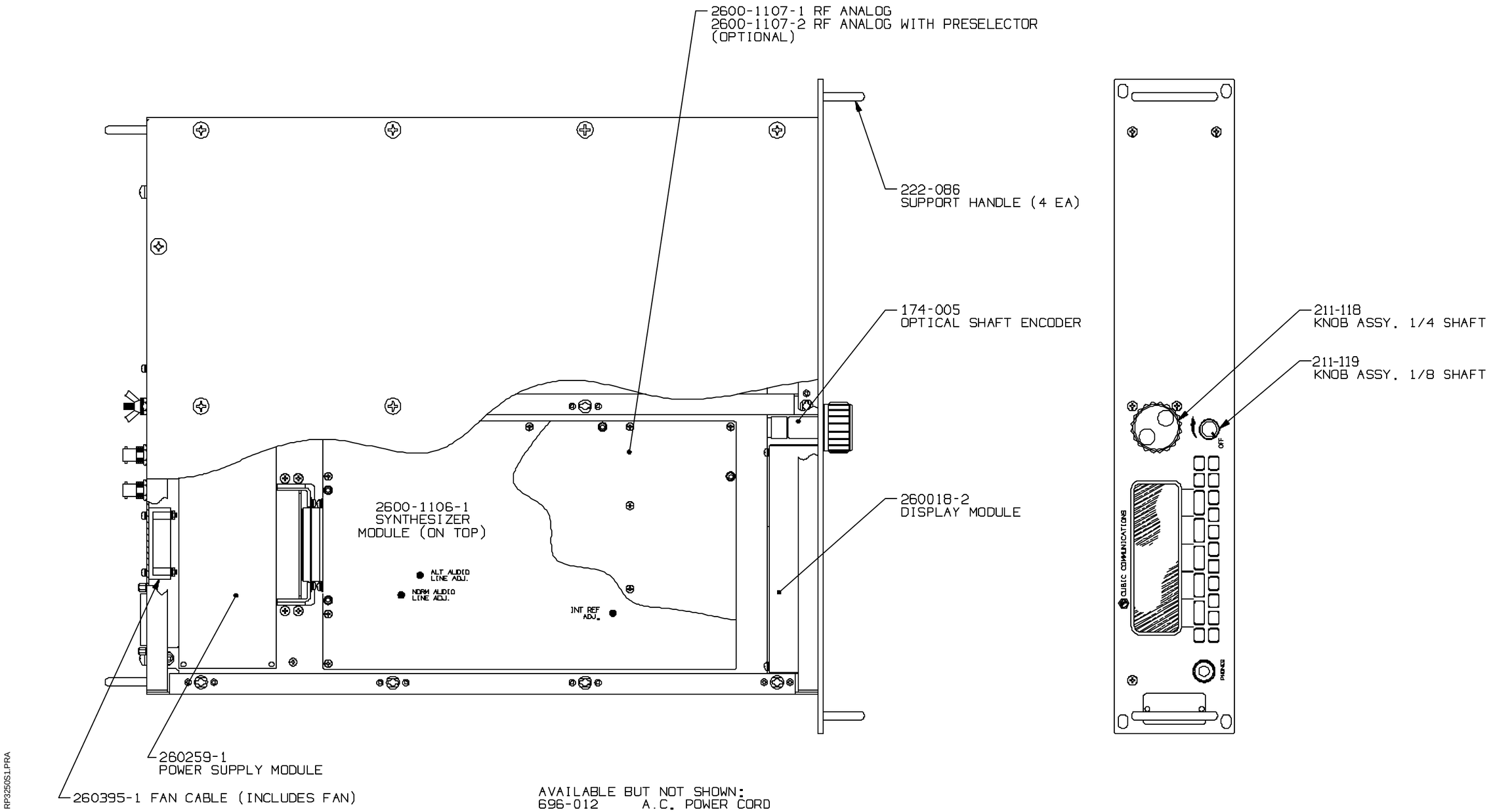
J8 SIGNAL INTERCONNECT	
PIN NO	DESCRIPTION
1	SERCLK(–)
2	SERCLK(+)
3	GND
4	FRSYND(–)
5	FRSYND(+)
6	GND
7	SERDAT(–)
8	SERDAT(+)
9	GND
10	NC
11	GND
12	NC
13	GND
14	NC
15	GND
16	NC
17	GND
18	NC
19	NC
20	SPARE OUT 0
21	SERIAL DATA
22	SPARE OUT 1
23	SERIAL CLK
24	GND
25	PRESEL ENABLE
26	NC

J9 MOTHERBOARD DC INTERCONNECT	
PIN NO	DESCRIPTION
1	+8 VOLTS
2	+8 VOLTS
3	+8 VOLTS
4	+8 VOLTS
5	GND
6	GND
7	+17 VOLTS
8	+17 VOLTS
9	+17 VOLTS
10	GND
11	GND
12	–17 VOLTS
13	–17 VOLTS
14	–17 VOLTS
15	GND
16	GND

2600-2405B-2

Schematic (Sheet 2 of 2).

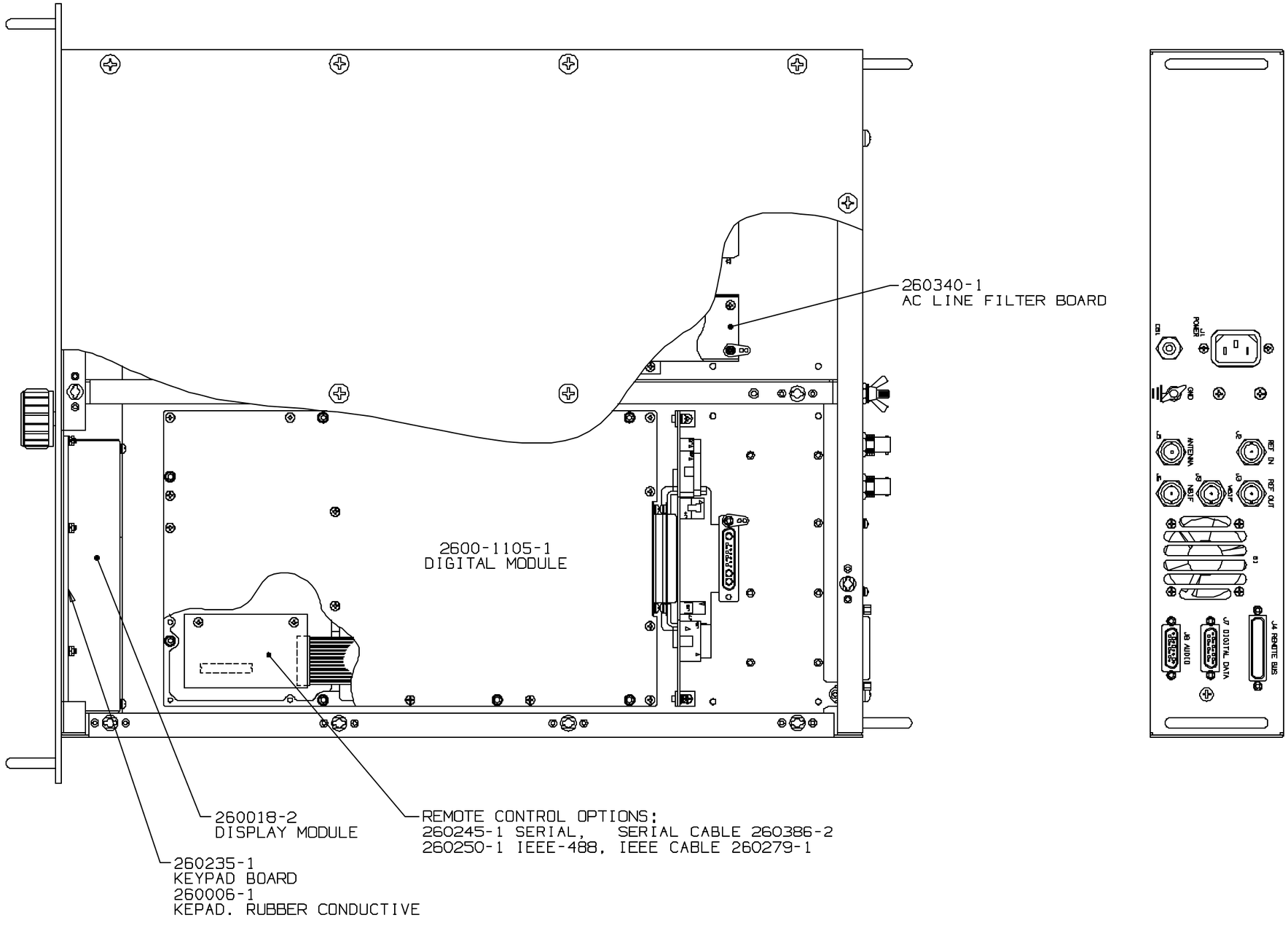
FO-5A. CDR-3250 Replaceable Parts



AVAILABLE BUT NOT SHOWN:
696-012 A.C. POWER CORD

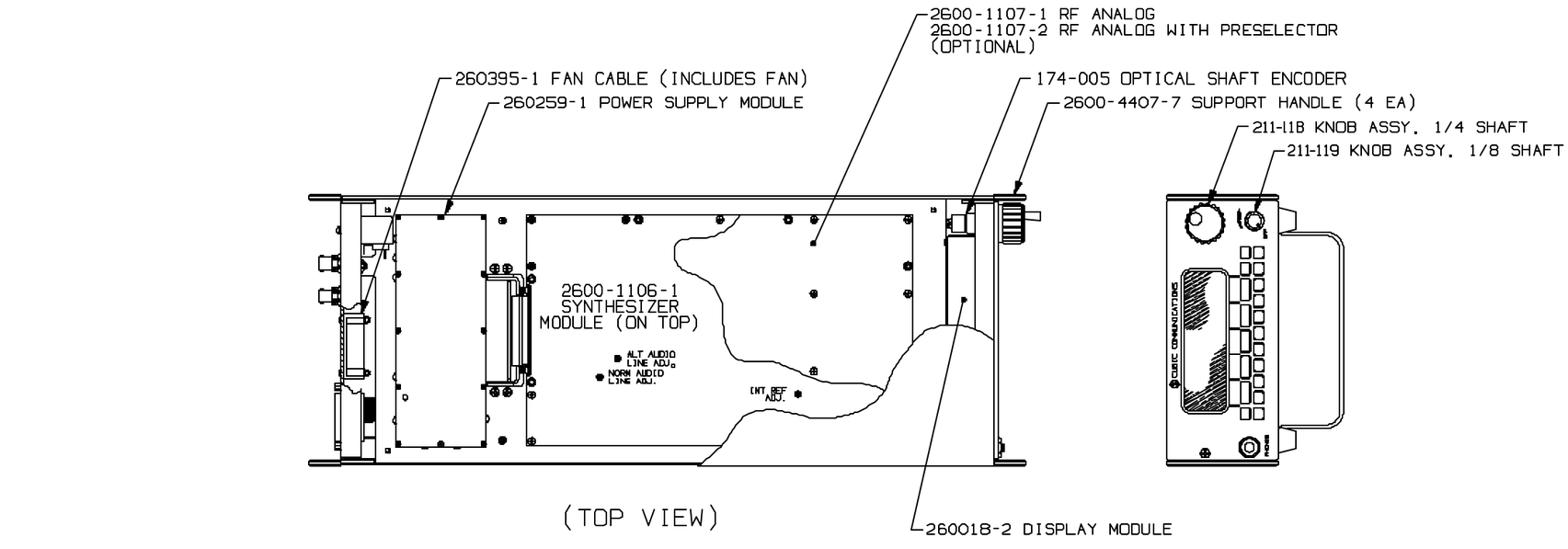
Locator Diagram (Sheet 1 of 2).

FO-5A. CDR-3250 Replaceable Parts



Locator Diagram (Sheet 2 of 2).

FO-5B. CDR-3280 Replaceable Parts



RP3280.PRA

Locator Diagram..