TECHNICAL MANUAL

OPERATION AND MAINTENANCE INSTRUCTIONS

OPERATIONAL LEVEL

EXCITER, DIGITAL SIGNAL PROCESSING, SINGLE, MF - HF

T-4150
&
T-4180

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Manual Part No. 2607-1021-1

Revision B
Change 2

1 November 1997
29 January 1998

RECORD OF CHANGES

CHANGE	DATE	TITLE OF BRIEF DESCRIPTIONS	ENTERED BY
1	1 Nov 97	Engineering update. Pages changed are as follows: Title Page, Record of Changes, 2-7, 3-45 thru 3-47, 4-1, 8-1/(8-2 blank), & FP-9/FP-10(blank)	CCI Eng. Dept.
2	29 Jan 98	Customer comments. Pages changed are as follows: Title Page, Record of Changes, iv, 1-4, 2-3. FO-3, Annex A, & Annex B	CCI Eng Dept.

FOREWORD

SCOPE

This manual contains information to obtain best performance from the T-4150/80 exciter. 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

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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The T-4150/80-9 when use with the PS-7130A and PA-5050A comprises the CTX-1000 System. This system is FCC certified for aeronautical base station usage. FCC identification number is NVSCTX-1000.

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LIST OF ILLUSTRATIONS

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 T-4150/80 (figure 1-1) is a multi-mode digital signal processing (DSP) exciter with a frequency range from 1.6 to 30 MHz.

The exciter contains individually shielded modules mounted in an 8½ by 3½-inch desktop chassis. Two T-4180 exciters may be fastened together (using an optional dual rack-mount kit) to construct a standard 19-inch rack-mount configuration.

The exciter is controlled by a 19-button keypad and main adjustment knob used to select the exciter 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, modulation mode, frequency, bandwidth, gain, local/remote control, an RF level meter, and an AF level meter. Additional information is displayed depending on soft key selections.

By proper selection of parameters, the exciters can generate a wide variety of signals. These include: on/off keyed (CW), amplitude modulation (AM), upper sideband (USB), upper sideband - full carrier (USBfc), upper sideband - partial carrier (USBpc), lower sideband (LSB), lower sideband - full carrier (LSBfc), lower sideband - partial carrier (LSBpc), independent sideband (ISB) (suppressed carrier and independent), frequency shift keyed (FSK), frequency modulation (FM), and frequency modulation facsimile (FMfax).

The selected audio input is provided on a 600 ohm balanced line. Normal and alternate (LSB audio when ISB is selected) audio are simultaneously input on separate 600 ohm balanced lines.

A MIC/KEY jack on the front panel provides for connection of an external microphone or CW key. The audio level is automatic. The audio is automatically applied to the correct modulator depending on the modulation mode. However, when ISB modulation is selected, microphone audio is directed to the normal audio channel only.

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 exciters may be remotely controlled 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, items required but not 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 T-4150/80 Specifications-Cont.

Item	Specification
Noise and Distortion	In-band Noise: -105 dBc/Hz. In-band Intermodulation Distortion (IMD): 50 dB below either tone of two equal signals producing +21 dBm PEP
Spurious Broadband Emissions	Per MIL-STD-188-141A, Paragraph 5.3.2.1 and Table II Harmonic Outputs: -65 dBc maximum All Other Discrete Spurious: -80 dBc
Carrier Suppression	-60 dBc for a single tone at +27 signal output
Keying Characteristics	Attack Time Delay: 3 ms maximum to 90 percent of full steady state output Release Time Delay: 3 ms maximum to 10 percent of full steady state output Keying Time: Defined as time from "key down" to RF output or "key up" to reduce RF output
Modulation Input Characteristics	Unbalanced Audio Input Impedance: 150 ohms ± 10 percent over 500 to 7000 Hz passband Audio Input Level: -45 to -15 dBm ref. 150 ohms Balanced Audio Input Impedance: 600 ohms, 0 dBm nominal Audio Level Control: Automatic audio level control holds PEP audio at standard level ± 1 dB over the 30 dB input range FM deviation up to 5 kHz Amplitude Modulation up to 95%
INPUT/OUTPUTS	
Audio Line Input (Normal)	600 ohms balanced pair on audio connector 0 dBm ±3 dB (Normal is the USB when ISB modulation mode is selected).
Audio Line Input (Alternate)	600 ohms balanced pair on audio connector 0 dBm ±3 dB. (Alternate audio is LSB when ISB modulation mode is selected)
MIC	20mV p-p nominal, 150 ohm input impedance to front panel mic jack. Mic key in parallel with rear panel audio connector keyline.
Reference In	10 MHz, 0 dBm, 50 ohms nominal.
RF Output	+27 dBm max. into 50 ohms. Optimum spurious outputs are obtained for output levels of +21 dBm to +27 dBm. When the optional power amplifier requires drive of less than +21 dBm, the insertion of a suitable external attenuator is recommended.
RF On/Off	TTL Level or open collector (LOW = off; HIGH or open = on)
MANUAL LEVEL CONTROL (MLC)	-33 to +27dBm (nominal) in 1 dB steps.
IF SECTION	
1st IF	24 kHz. DSP generated, lowpass filter @ 80 kHz
2nd IF	456 kHz. Standard Filter BW = 18 kHz
3rd IF	40.456 MHz. Standard Filter BW = 22.5 kHz

Table 1-1 T-4150/80 Specifications-Cont.

Item	Specification
DESIGN AND CONSTRUCTION	
Workmanship	MIL-E-16400, Paragraph 3.17 as a guideline
Interchangeability	All identical units, assemblies, and replacement parts are physically, electrically and functionally interchangeable
FINISH	
Front Panel & Chassis Cover	FED-STD-595 chip 26307, semi-gloss grey enamel
Chassis	Corrosion protected following guidelines established in Paragraph 3.4 of MIL-E-16400
Handles and Silkscreen Markings	Matte black
OPTIONS	
High-performance reference oscillator	OCXO, 0.1 ppm of tuned frequency
Serial Data Bus	RS-232 or RS-422
Parallel Data Bus	IEEE-488
Dual Rack Mount Kit	Hardware and slides to fasten two T-4180 exciters together for installation in standard 19-inch rack

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 exciter 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 exciter.

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 exciter is unpacked, retain the carton and packing materials for inspection.

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

NOTE

Save carton for possible reshipment.

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

CAUTION

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

2-3 INSTALLATION.

The exciter is designed for desktop operation in a relatively dust free environment with an ambient temperature range between 0 and +50°C. An optional dual rack mount kit is available for the T-4180 to mount two units into a standard 19-inch rack. No special tools or additional materials are required for installation.

NOTE

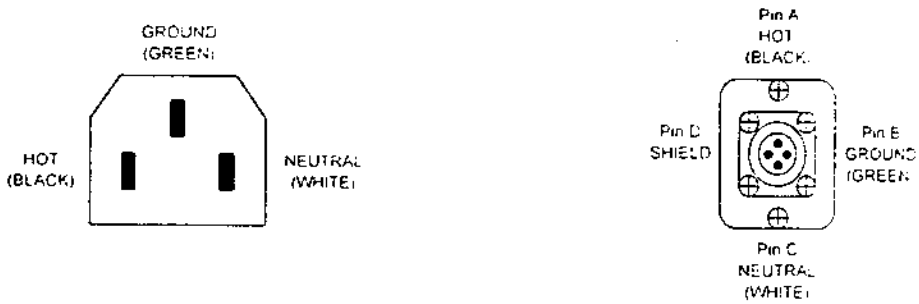
See figure FO-1 for clearance requirements and mounting details.

2-4 CONNECTIONS.

Refer to table 2-1 and connect the output, power cable, and optional equipment to the unit. (See figure 2-1).

Table 2-1 Rear Panel Connections.

Name	Type	Mating Type	Description
T-4150 POWER (J1)	MS3122A10-4P (344-426)	G6F10-4SNH (Burndy) also 4ea. rm20m-13d28 pins rqrd.	90 to 260 VAC, 47 to 440 Hz, single phase 60 VA (80 VA max @ 400 Hz input). Figure 2-2 shows the pin descriptions.
T-4180 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 VA (80 VA max @ 400 Hz input).. 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.
OUTPUT +27 dBm (J3)	BNC Jack (344-246)	BNC Plug (Customer Option)	Coaxial output connection. Impedance is approximately 50 ohms with a VSWR less than 3 to 1 at the exciter tuned frequency. Optimum spurious outputs are obtained for output levels of +21 dBm to +27 dBm. When the optional power amplifier requires drive of less than +21 dBm, the insertion of a suitable external attenuator is recommended.
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.
PA CONTROL (J5)	15-pin "D" subminiature male (324-009)	15-pin "D" subminiature female (324-070)	Used to connect external power amplifier. Table 2-4 lists the pin descriptions.
AUDIO (J6)	15-pin "D" subminiature female (324-070)	15-pin "D" subminiature male (324-009)	Used to connect audio from line inputs or other equipment. Table 2-5 lists the pin descriptions
NOTE: Part numbers in parenthesis (000-000) indicate CCI part number if applicable.			



T-4180 T-4150

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

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 exciter 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 exciter 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 exciter (to prevent buffer overflow for example) by taking the CTS circuit false. When the CTS circuit is again taken true, the exciter will begin transmitting where it left off. NOTE: When bus sharing is enabled from the exciter front panel, the state of the CTS circuit is ignored.

The number of T-4100 series exciters 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 exciters for RS-232 operation and at least 30 - exciters for RS-422 operation. Dual chassis models count as two exciters. The input resistance of the RS-232 line exciters is approximately 5000 Ohms. The exciter 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 T-4100 series exciter is to be connected to another DTE device as its controller, the circuits must be swapped for proper operation as follows:

T-4100 Series Exciter		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 2-4 PA CONTROL Connector (J5) Pin Description.

Pin	Signal	Remarks
1	NU	Not used
2	NU	Not used
3	GND	Ground
4	NU	Not used
5	PA KEY/	Output line - Open drain pull-down to ground (40V, 0.5A max.)
6	GND	Ground
7	PADAT (+)	Serial data (0 to +5V)
8	PADAT (-)	Serial data inverted (0 to +5V)
9	GND	Ground
10 - 15	NC	Not connected
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.		

Table 2-5 AUDIO Connector (J6) 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	GND	
7	MIC/CW KEY	5V open ckt; 0.8 mA short circuit
8	GND	
9	NC	Not connected
10	TX KEY	Output line - Open drain pull-down to ground (40V, 0.5A max.)
11	RF DISABLE'	LOW = RF off; TTL HIGH or open = RF on.
12-15	NC	Not connected

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 exciter 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 exciter 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 exciter parameters including channel number, modulation type, audio source, carrier level, operating frequency, bandwidth 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. (See figure 3-2) 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.

NOTE

The `CarLev:` part of the display changes to reverse video when the TX_KEY and the PA_KEY signals are set, i.e., when the optional power amplifier is turned on. The display reverts back to normal when these signals are off.

3-2.2.1.2 *Data Entry Display.* The data entry display (figure 3-4) is present during most soft key entries. Basic exciter parameters are shown on the right side of the display. The center of the display is used for operator instructions and parameter entry display. (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 RF and audio levels. It 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 modulation mode. In the ISB modulation mode, the AF2 meter shows the alternate audio input. 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.

RF meter - Indicates RF output level from -33 to +27 dBm (output of less than -33 dBm displayed as "<-33").

AF meter - Indicates normal audio level at the rear panel 600 ohm input or front panel microphone input from -50 to +12 dBm.

AF2 meter - Indicates alternate audio level at the rear panel 600 ohm input from -50 to +12 dBm. (ISB modulation mode only).

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.

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

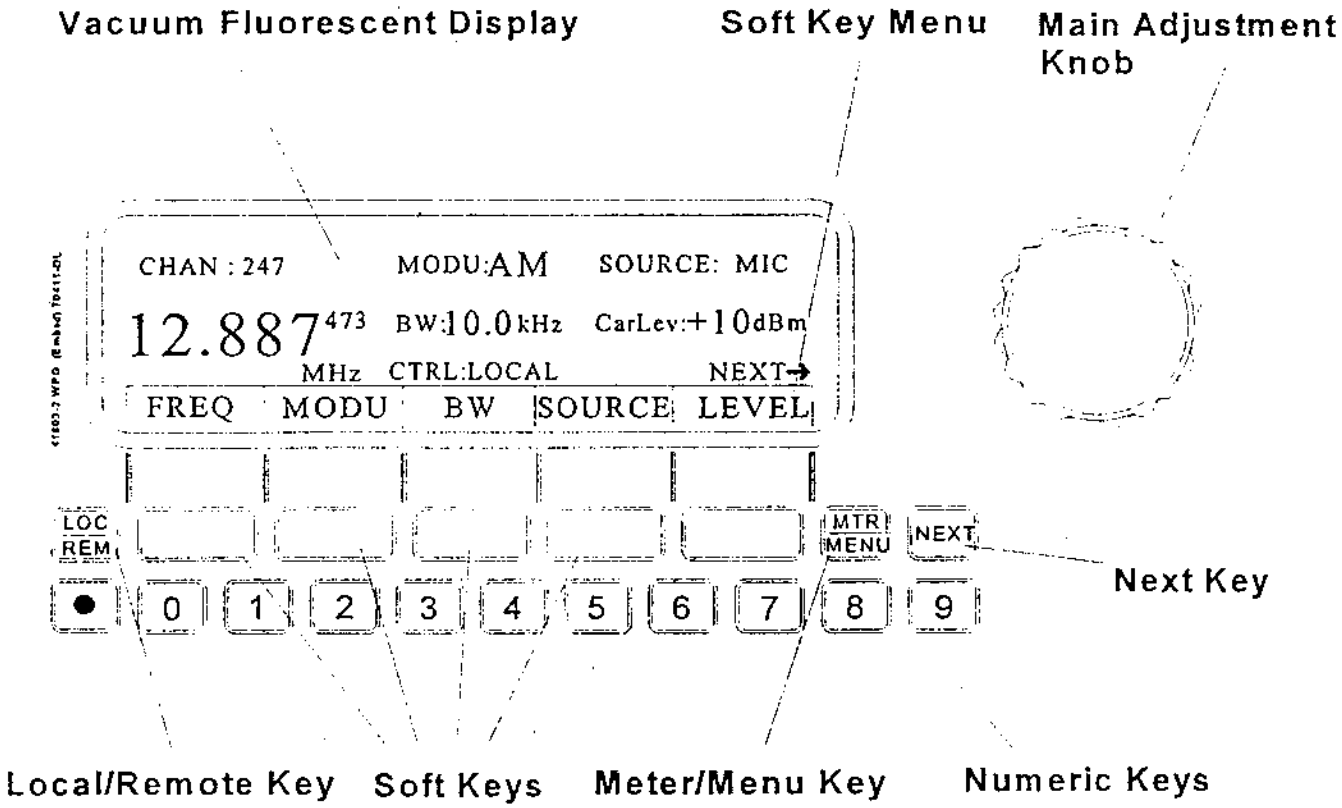


Figure 3-2 Parameter Entry Controls and Display.

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 exciter. 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.

3-3 POWER ON AND INITIAL SET UP.

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

1. Set the power switch ON.
2. Observe the display for initialization displays then the normal display.
3. To shut down the exciter, set the power switch to OFF.

NOTE

If the exciter is remotely controlled, the exciter must be initially configured for bus operation. The exciter'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.

Exciter 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 exciter parameters.

3-7 SETTING OR CHANGING EXCITER PARAMETERS.

When the exciter is first powered on, a power-on self test (POST) tests key circuits in the exciter, 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 exciter 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 exciter to switch to the METER display.

The following paragraphs lists the soft key menus used to change exciter 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.

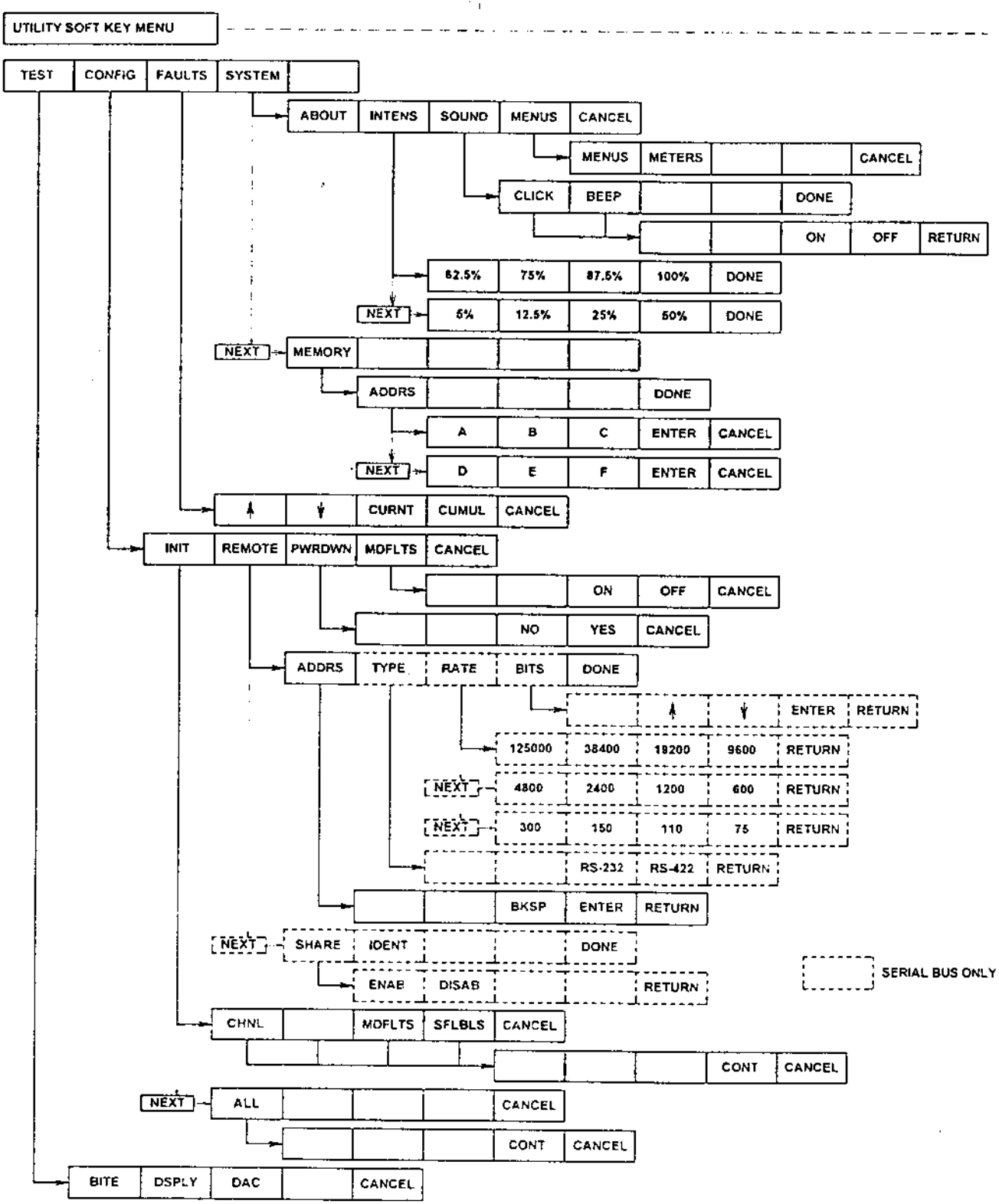


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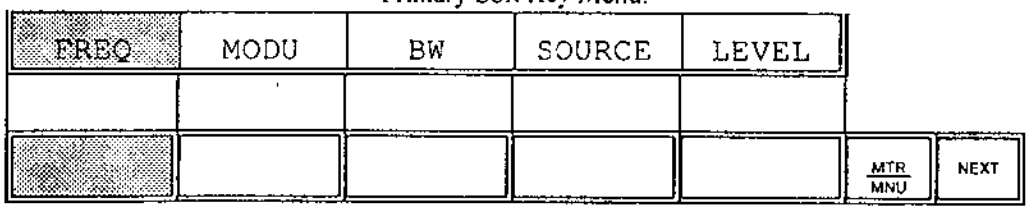
Figure 3-7 Soft Key Menus Overall Flow Diagram (Sheet 2 of 2).

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

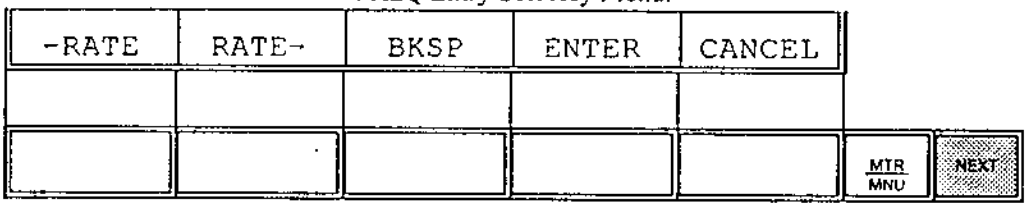
3-7.2.1 *Frequency.* This function sets or changes the exciter frequency.

Primary Soft Key Menu.



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

FREQ Entry Soft Key Menu.



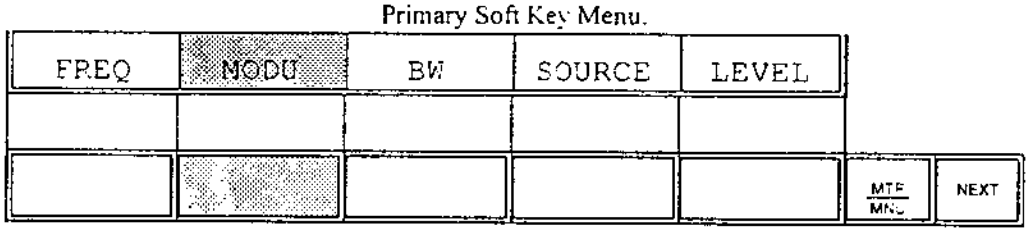
Change the transmit frequency with the keys or main adjustment knob. Repeatedly pressing the RATE keys moves a bar under the digits in the display. The bar under the digit indicates the tuning resolution of the main adjustment knob.

NOTE

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

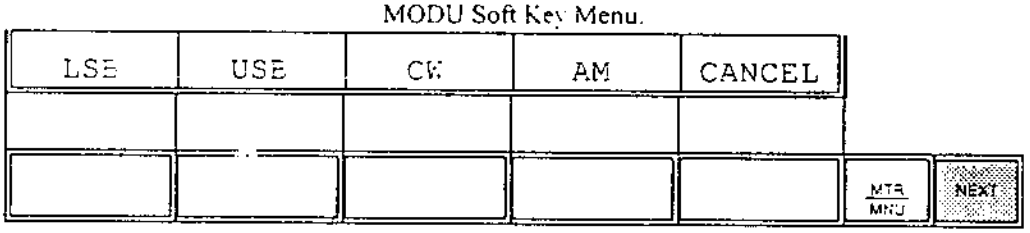
3-7.2.2 *Modu.* This function selects the exciter modulation mode.

Primary Soft Key Menu.



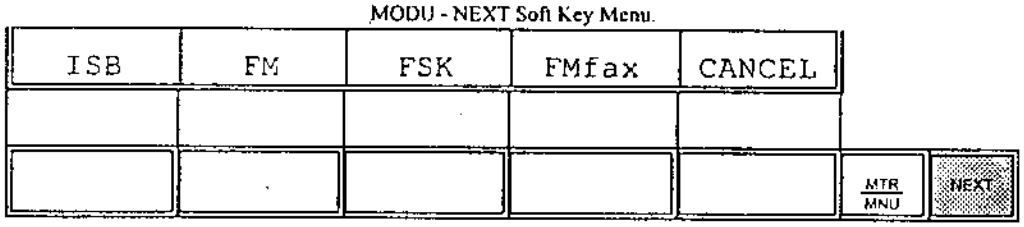
Press the MODU key to change the modulation mode. The following menu appears. (Refer to table 3-3 for a description of each modulation mode).

MODU Soft Key Menu.



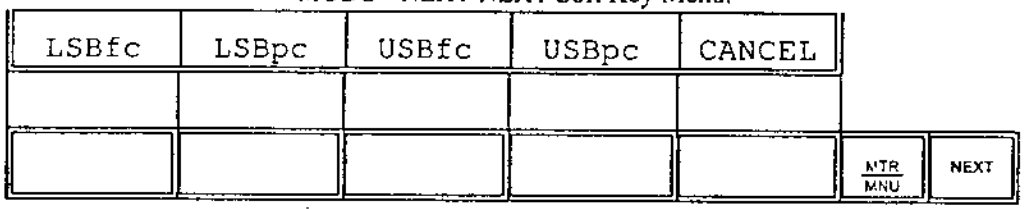
Press the desired transmit modulation mode, or press the NEXT key and the following menu appears.

MODU - NEXT Soft Key Menu.



Press the desired transmit modulation mode, or press the NEXT key to show the additional modulation modes.

MODU - NEXT NEXT Soft Key Menu.



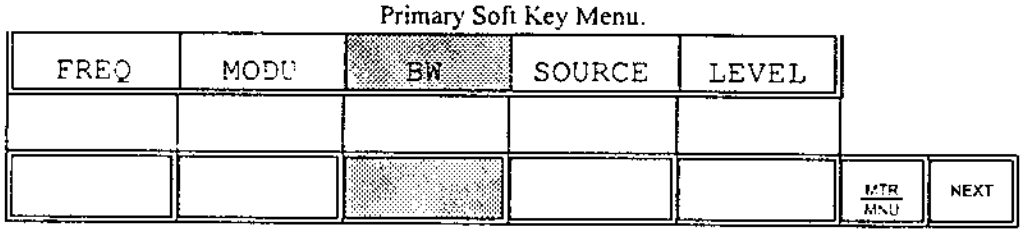
Press the desired transmit modulation mode, or press the NEXT key to show the first modulation mode menu.

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

NOTE

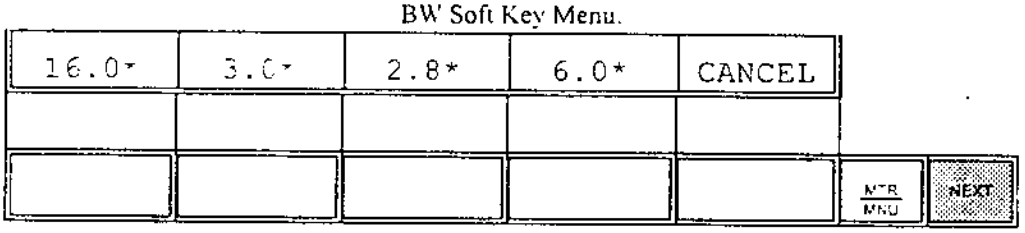
In ISB modulation mode the bandwidth is fixed at 2.8 kHz. In USB, or LSB only bandwidths between 100 Hz and 6.0 kHz can be selected. In AM or FM modulation modes all bandwidths between 100 kHz and 16.0 kHz may be selected. There are no CW bandwidth settings.

Primary Soft Key Menu.



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

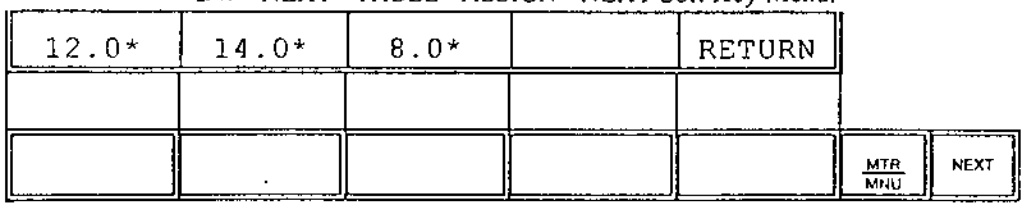
BW Soft Key Menu.



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

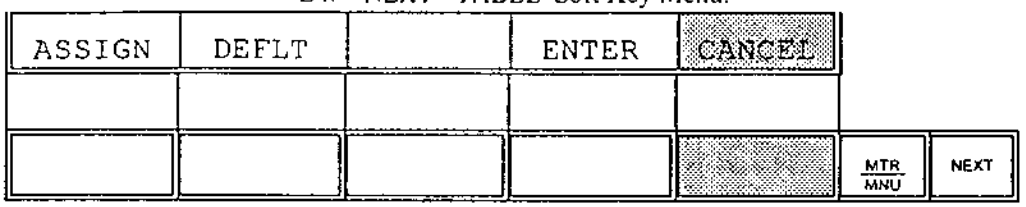
*Operator assignable value. May be different than shown.

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.



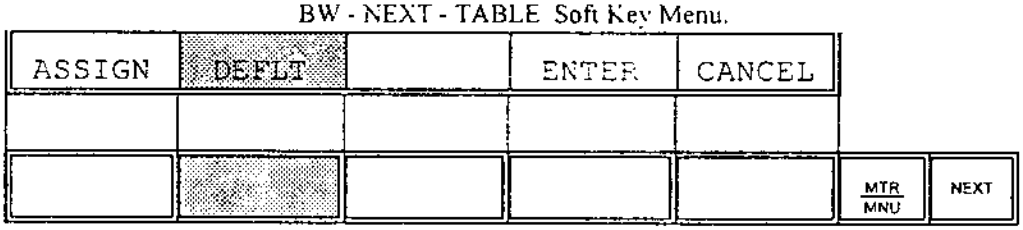
Press the CANCEL key or assign additional bandwidths if desired.

3-7.2.3.2 *Assigning Default Bandwidths To Transmit Modulation Modes.* Bandwidths may be assigned to transmit modulation 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

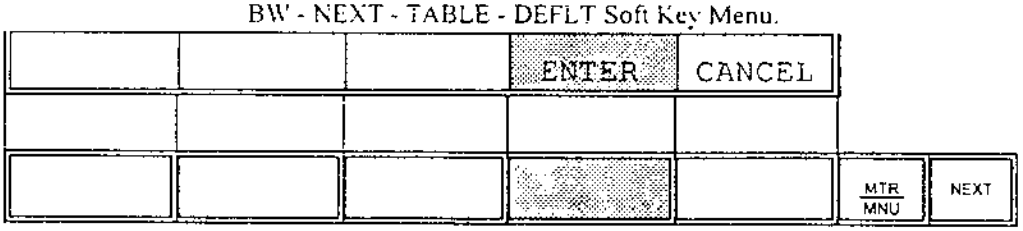
The desired transmit modulation mode (to be assigned a bandwidth value) must be selected before selecting this function. USB and LSB share the same default bandwidth. Modulation mode default settings may be enabled or disabled through keypad configuration. Refer to section 3-7.5.2.3.

BW - NEXT - TABLE Soft Key Menu.



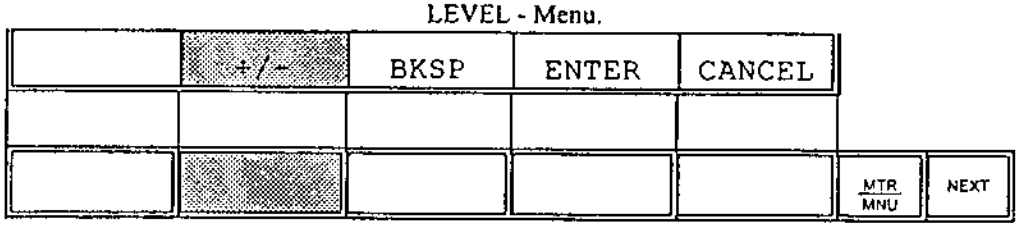
Press the DEFLT key and the following menu appears

BW - NEXT - TABLE - DEFLT Soft Key Menu.



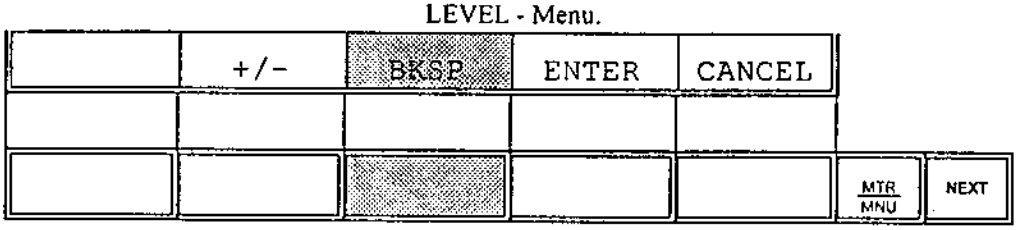
Press the ENTER key to assign the bandwidth to the selected transmit modulation mode.

LEVEL - Menu.



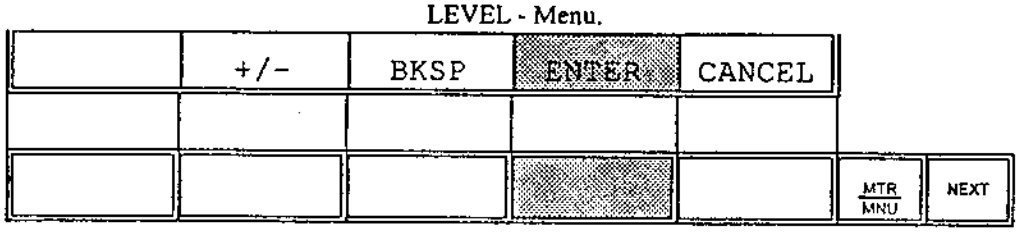
Press the +/- key to toggle the polarity of the power level entry.

LEVEL - Menu.



Input the power level into the exciter by rotating the knob or entering the digits into the keypad. Press the backspace key to delete the last digit entered.

LEVEL - Menu.



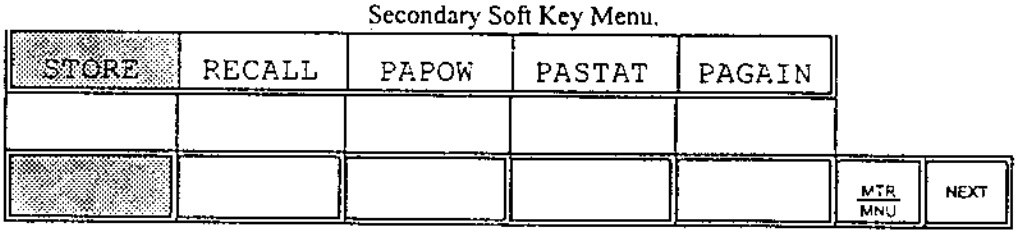
Press the LEVEL key to assign the output power level to the exciter.

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 *Store.* This function stores all current exciter parameters in a selected memory channel. All exciter 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.

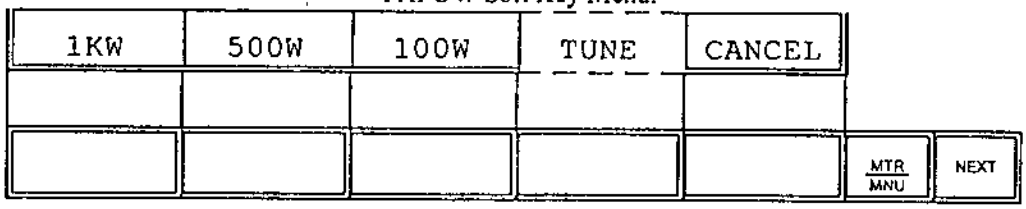
The following parameter settings may be stored in each memory channel: frequency, power level, exciter modulation mode, audio source, bandwidth, hop rate, and dwell time.

Secondary Soft Key Menu.



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

PAPOW Soft Key Menu.



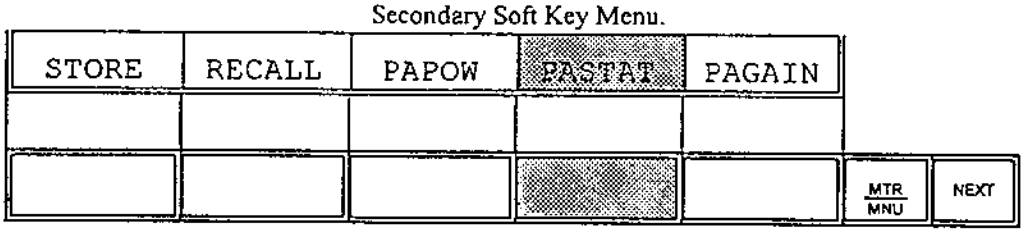
CAUTION

When any of the above soft keys are pressed (except CANCEL), the exciter and PA-5050A are automatically keyed. The attenuator in the PA-5050A is automatically adjusted to produce the selected RF power level output.

Press the desired soft key to select the RF power level for the PA-5050A power amplifier. If the optional ACIU is installed. pressing the TUNE soft key directs the Antenna Coupler to tune with 100 watts of power from the PA-5050A. The TUNE soft key only appears if the ACIU is installed.

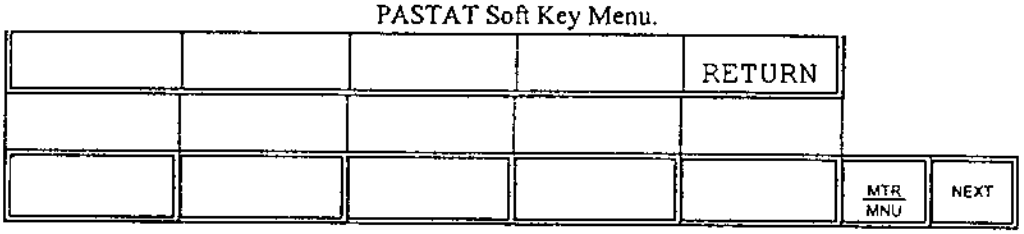
3-7.3.4 *PASTAT.* This function causes the current status of the PA-5050A power amplifier to be displayed. .

Secondary Soft Key Menu.



Press the PASTAT key to show the current PA-5050A power amplifier status. The following menu appears.

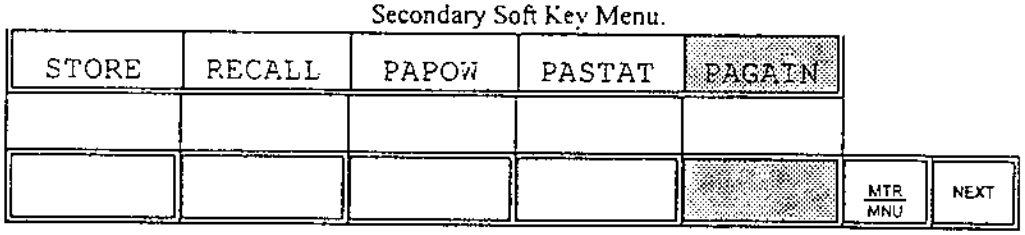
PASTAT Soft Key Menu.



View the current PA-5050A status information, and then press RETURN to return to the normal display.

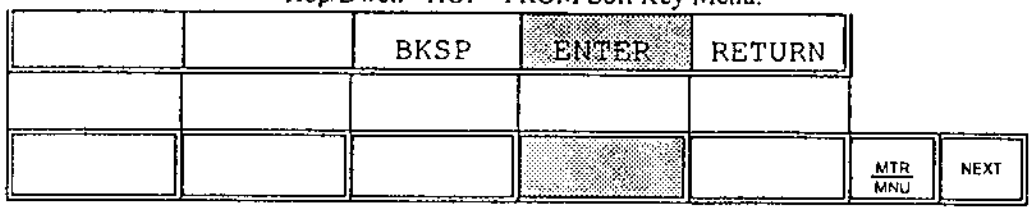
3-7.3.5 *PAGAIN.* This function allows the operator to adjust the gain of the PA-5050A power amplifier (if installed).

Secondary Soft Key Menu.



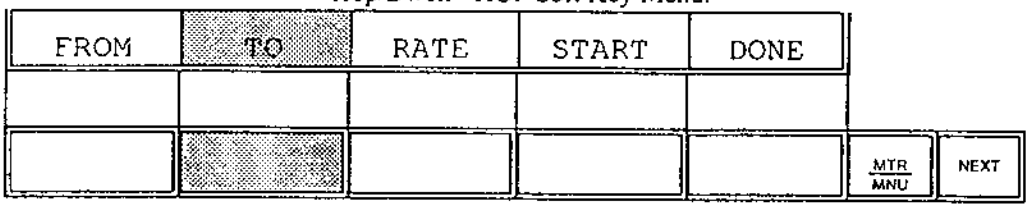
Press the PAGAIN key to input the gain of the PA-5050A power amplifier. The following menu appears.

Hop/Dwell - HOP - FROM Soft Key Menu.



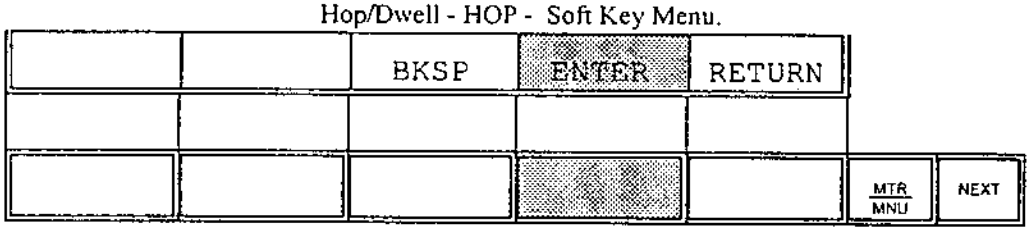
Select the desired starting channel using the keypad or main adjustment knob, and press ENTER. The menu will switch back to the Hop/Dwell - HOP menu as shown below.

Hop/Dwell - HOP Soft Key Menu.



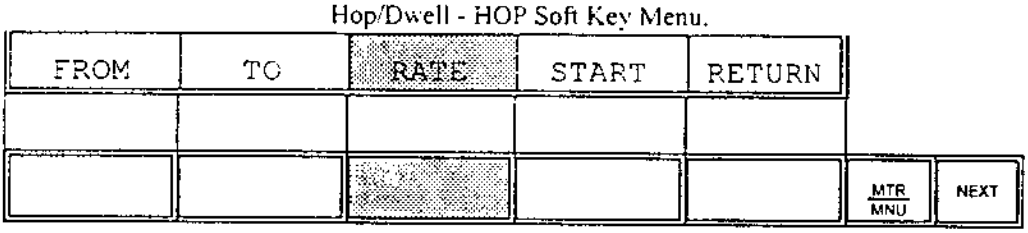
Press the TO key and the following menu appears.

Hop/Dwell - HOP - Soft Key Menu.



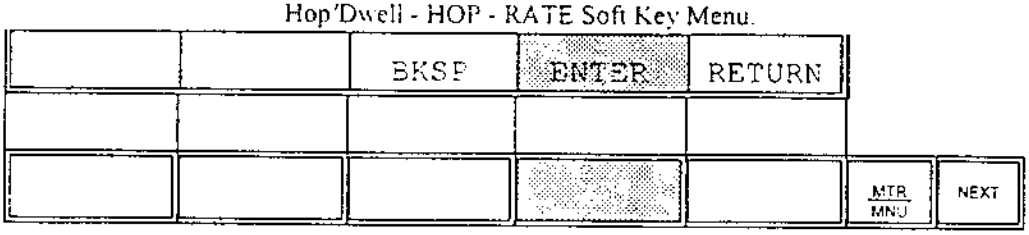
Select the desired ending channel using the keypad or main adjustment knob, and press ENTER. The menu will switch back to the Hop/Dwell - HOP menu as shown below.

Hop/Dwell - HOP Soft Key Menu.



Press RATE (if desired) to set the rate the exciter changes channels during hopping operation. The following menu appears if RATE is selected.

Hop/Dwell - HOP - RATE Soft Key Menu.

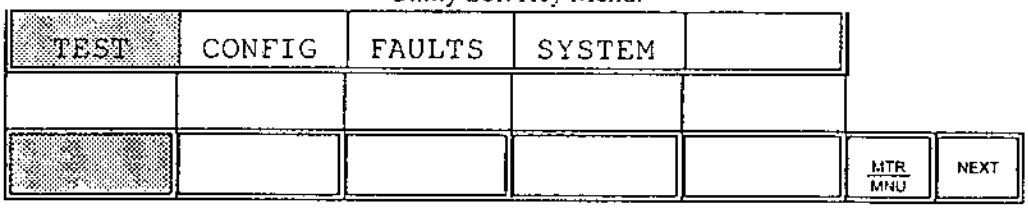


Select the desired hop rate and press ENTER. The menu will switch back to the Hop/Dwell - HOP menu as shown below.

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 Hop/Dwell soft key menu.

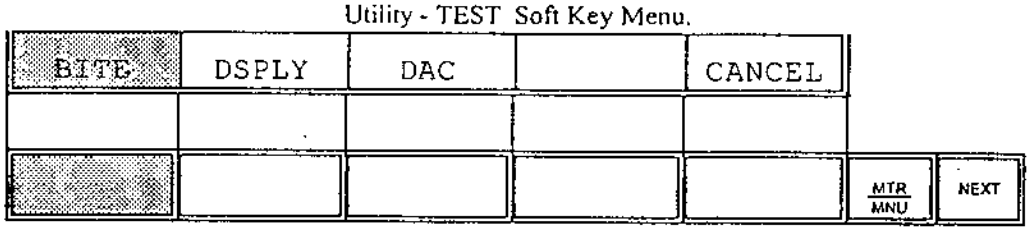
3-7.5.1 *Test.* This function allows selection of exciter tests.

Utility Soft Key Menu.



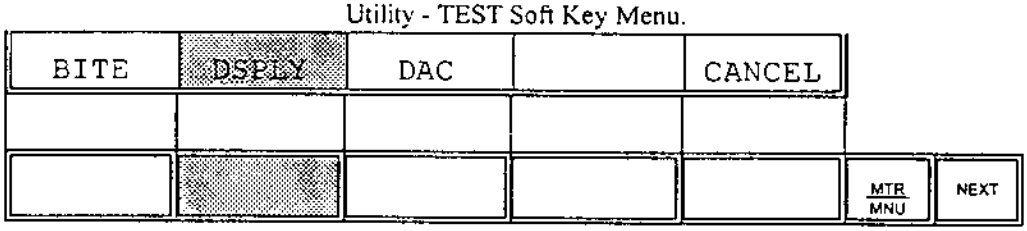
Press the TEST key to perform exciter tests. The following menu appears.

Utility - TEST Soft Key Menu.



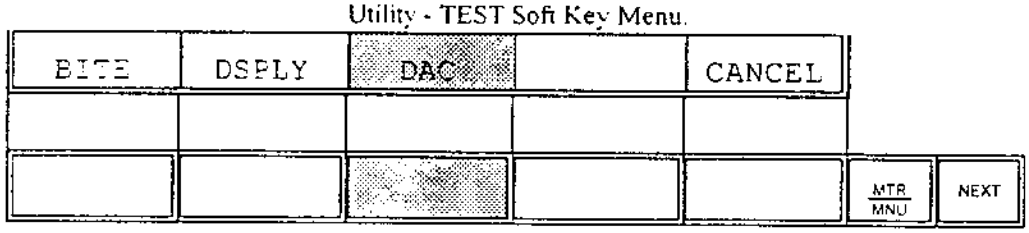
Press the BITE soft key to select the built-in test equipment test. Observe the display for fault information.

Utility - TEST Soft Key Menu.



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 menu.

Utility - TEST Soft Key Menu.

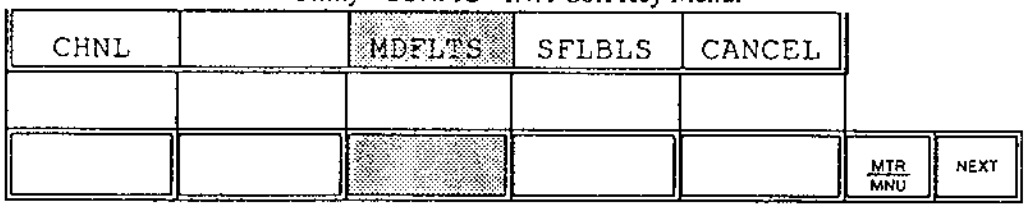


NOTE

When this test is activated, the exciter stops transmitting signals, and a fault indication may appear. This is normal.

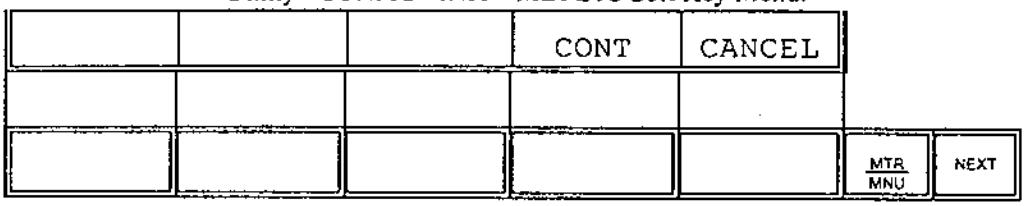
Press the DAC soft key to select test outputs from the digital-to-analog converter in the digital module. The display will show what certain test point indications should be.

Utility - CONFIG - INIT Soft Key Menu.



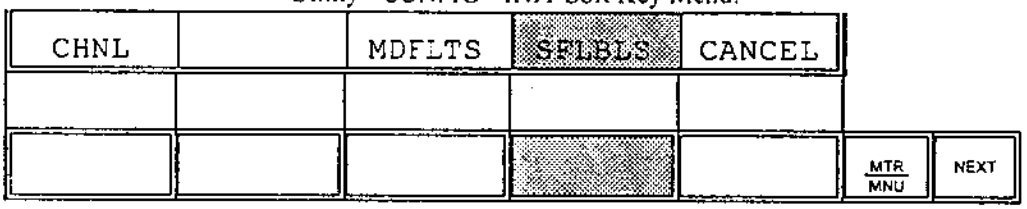
Press MDFLTS to reset the default BW setting to the initial value. The following menu appears.

Utility - CONFIG - INIT - MDFLTS Soft Key Menu.



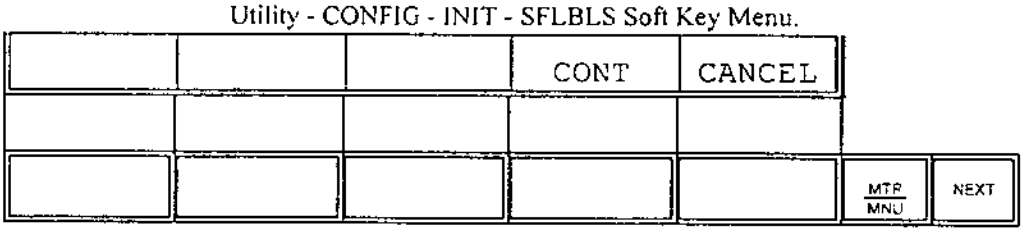
Press CONT to continue or CANCEL to cancel the function.

Utility - CONFIG - INIT Soft Key Menu.



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

Utility - CONFIG - INIT - SFLBLS Soft Key Menu.



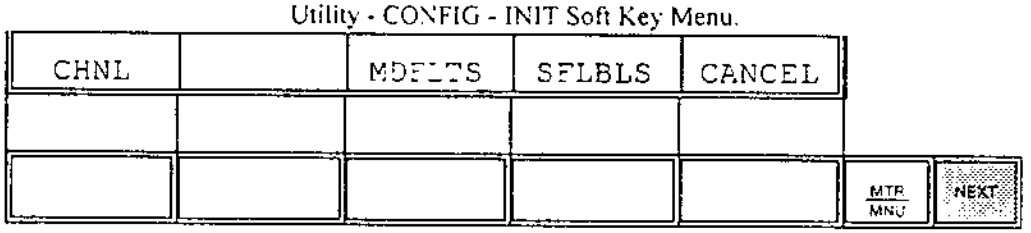
Press CONT to continue or CANCEL to cancel the function.

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

NOTE

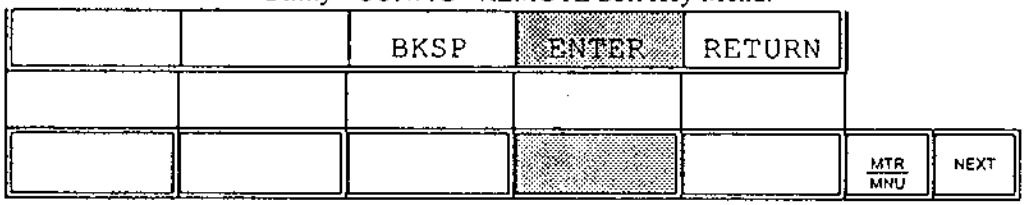
When the following function is performed, all non-volatile memory data will be lost.

Utility - CONFIG - INIT Soft Key Menu.



Press the NEXT key and the following menu appears.

Utility - CONFIG - REMOTE Soft Key Menu.

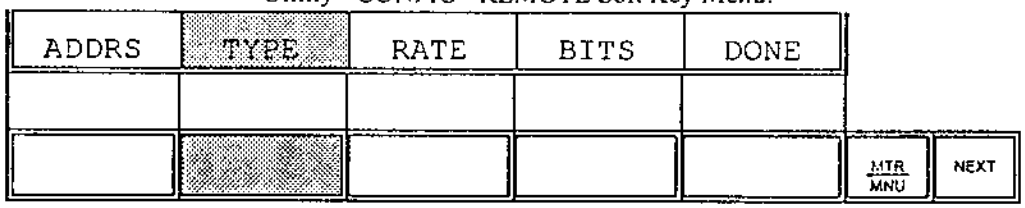


Enter the exciter's bus address using the keypad or knob (range = 000 - 254). Press ENTER when done.

NOTE

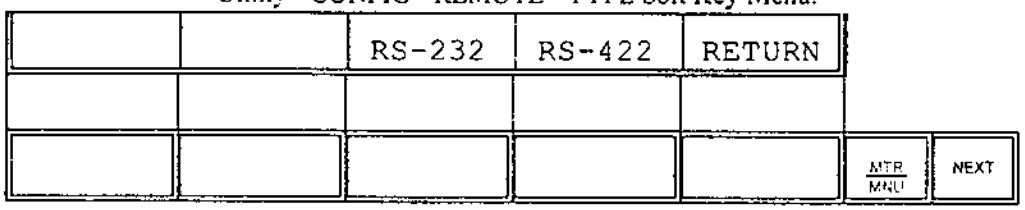
Pressing the RETURN key switches to the Utility - CONFIG - REMOTE soft key menu without changing the original address.

Utility - CONFIG - REMOTE Soft Key Menu.



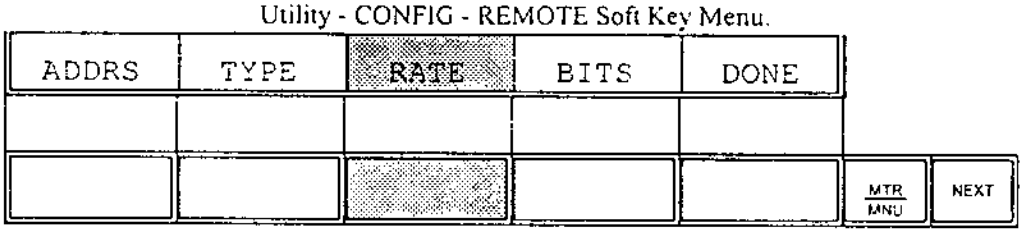
Press the TYPE key to select the remote control bus type. The following menu appears.

Utility - CONFIG - REMOTE - TYPE Soft Key Menu.



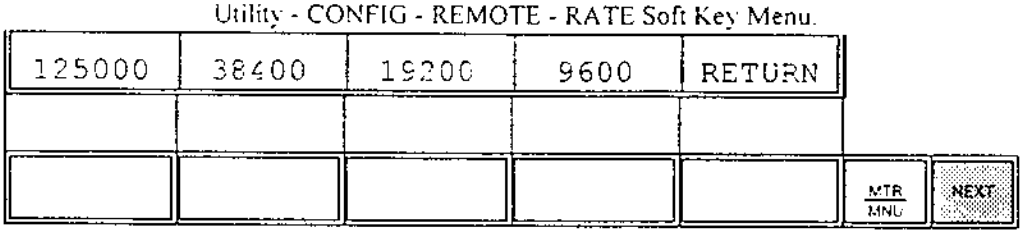
Press the desired remote control bus type key.

Utility - CONFIG - REMOTE Soft Key Menu.



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

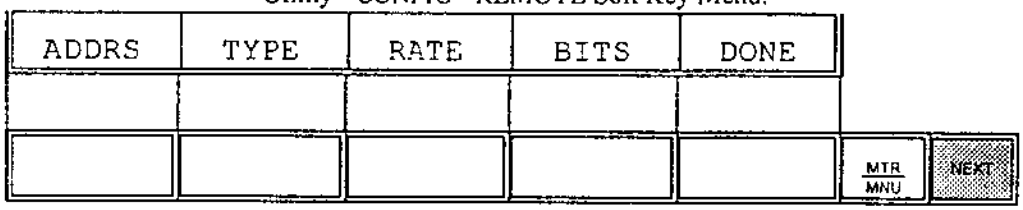
Utility - CONFIG - REMOTE - RATE Soft Key Menu.



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

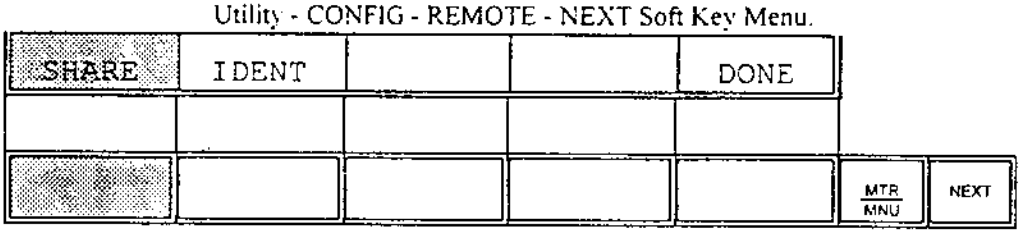
DATA BITS	STOP BIT	PARITY
8	2	ODD
8	1	ODD
7	2	ODD
7	1	ODD
8	2	EVEN
8	1	EVEN
7	2	EVEN
7	1	EVEN
8	2	NO
8	1	NO
7	2	NO
7	1	NO

Utility - CONFIG - REMOTE Soft Key Menu.



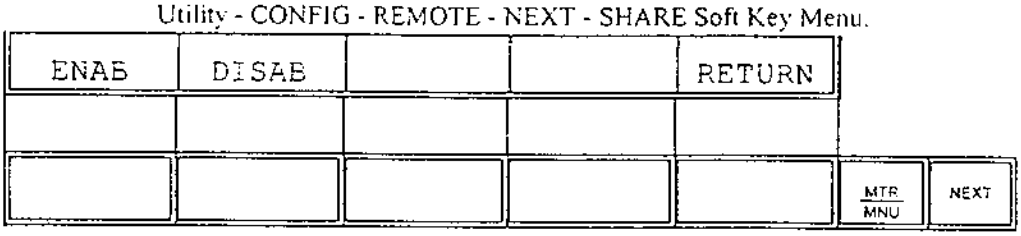
Press the DONE key to return to the primary soft key menu, press the NEXT key and the following menu appears.

Utility - CONFIG - REMOTE - NEXT Soft Key Menu.



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

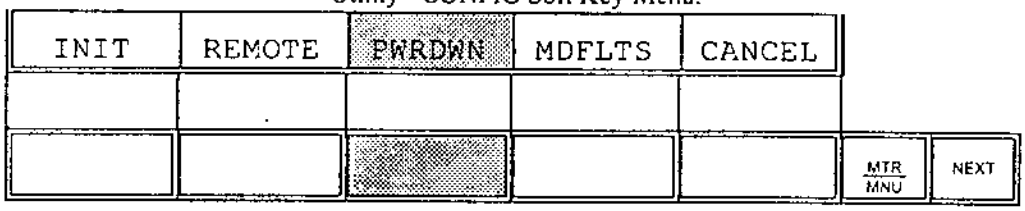
Utility - CONFIG - REMOTE - NEXT - SHARE Soft Key Menu.



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

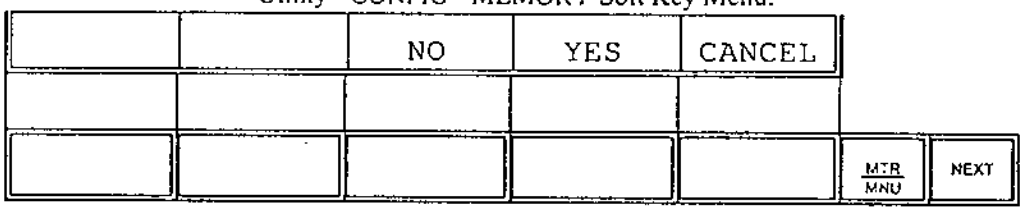
3-7.5.2.3 *Configuring Exciter Default Settings.* To configure the exciter's default settings select Utility - CONFIG soft key menu as shown below.

Utility - CONFIG Soft Key Menu.



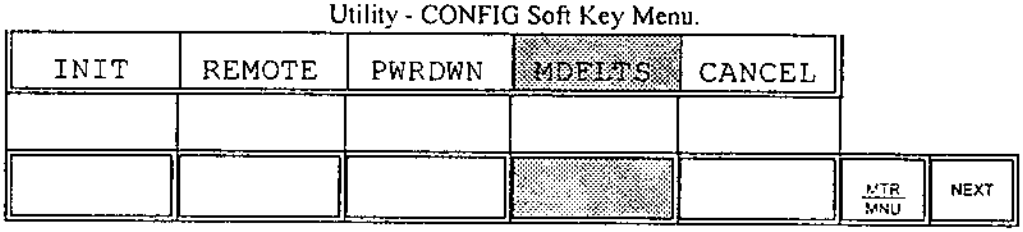
Select PWRDWN to determine if the current exciter operating parameters will be saved or not when the exciter is turned off. The following menu appears.

Utility - CONFIG - MEMORY Soft Key Menu.



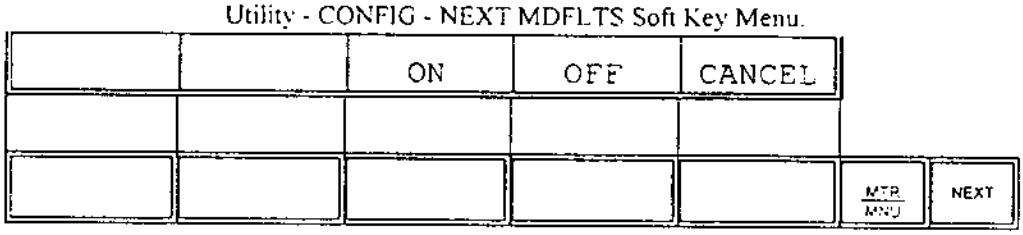
Press NO or YES as desired, and the display goes back to the primary menu.

Utility - CONFIG Soft Key Menu.



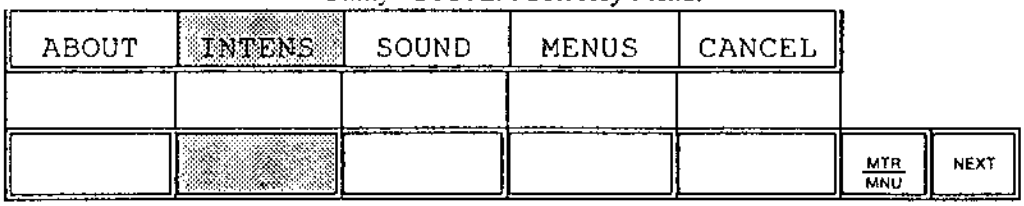
Press the MDFLTS key to turn the BW modulation mode defaults on or off. The following menu appears.

Utility - CONFIG - NEXT MDFLTS Soft Key Menu.



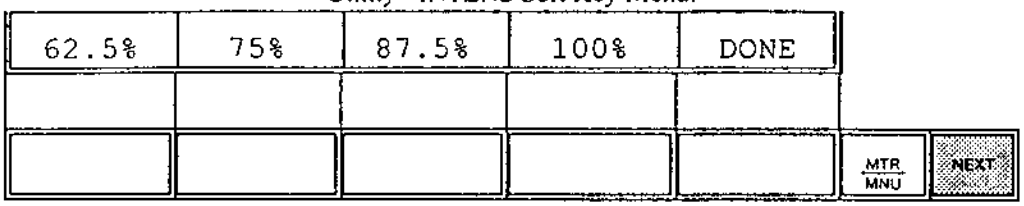
Press the ON or OFF key to select whether BW reverts to default values when the transmit modulation mode is changed.

Utility - SYSTEM Soft Key Menu.



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

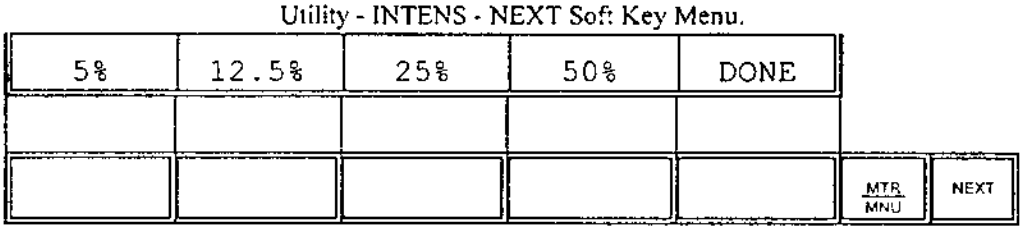
Utility - INTENS Soft Key Menu.



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

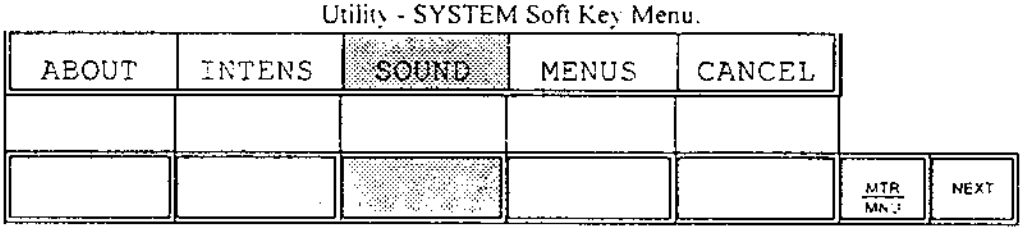
NOTE
Display may not be visible in bright ambient light if 5% intensity is selected.

Utility - INTENS - NEXT Soft Key Menu.



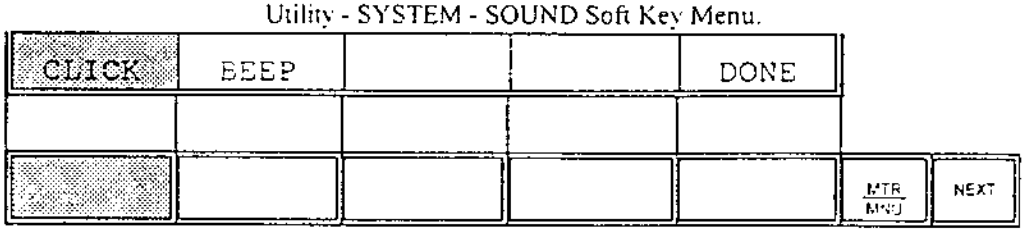
Select the desired display intensity, and press DONE; or press the NEXT key to return to the previous menu.

Utility - SYSTEM Soft Key Menu.



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

Utility - SYSTEM - SOUND Soft Key Menu.



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

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.

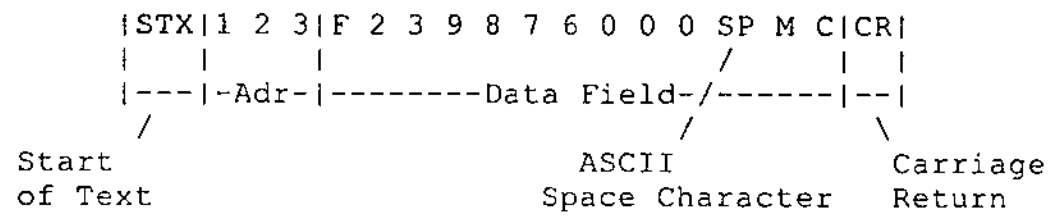
A	B	C	ENTER	CANCEL		
					MTR MNU	NEXT

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.



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 exciter sending the transmission or to which it is being sent by the controller. The address code for any exciter 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 exciters on the bus (refer to para 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 CONFIG- REMOTE- 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.

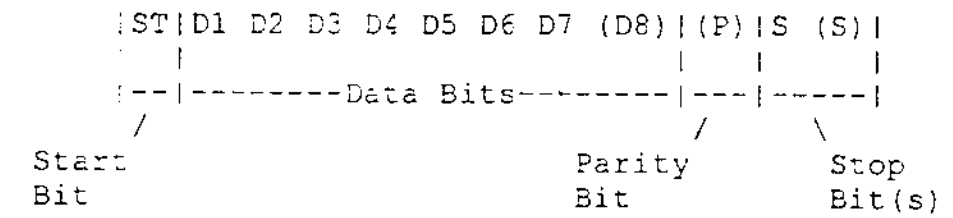
Any number of messages may be included in the data field provided that the maximum number of characters is not exceeded. There are, however, certain request for status commands that may not be mixed with any other request for status commands in the same transmission. These messages will be noted as such in table 3-6.

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 exciter with address 123 and contains two messages: "F23987600" and "MC".

When sending messages to the exciter 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 3-8 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 exciter through the keypad from the CONFIG - REMOTE menu. The selected values take effect immediately when changed and are stored in non-volatile memory.

Figure 3-9 Serial Bus Character Format.

Table 3-4 Serial Bus Interface Command Messages.

Message	Definition
:NORM	Set NORMAL interface mode
:ACKN	Set ACKNOWLEDGE interface mode
:?	Request Interface Status Message

Table 3-5 Serial Bus Interface Status Messages.

Message	Definition
OK:NORM	No errors, NORMAL Mode
OK:ACKN	No errors, ACKNOWLEDGE Mode
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	Exciter error - fault has been detected

Table 3-6 Exciter Command and Status Messages-Cont.

Command	Reply	Description
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.
BND?	BNDx	Request the PA-5050A low-pass filter band setting (if installed). x is the current low pass filter band setting. Range 0 to 7. This is determined by the frequency command.
C?	C_____	Request report of all parameters that are now different from those reported in the last Exciter Status Message for each parameter.
CFxx		Set selected configuration parameter into non-volatile memory. Replace the xx with one of the following choices:
MDn		Enable or disable mode defaults. Replace the n with 1 to enable or 0 to disable mode defaults.
BSn		Enable or disable bus sharing. Replace the n with 1 to enable or 0 to disable bus sharing.
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.
CL		CLear all 250 memory channels to default parameters.
CN?	CN123 or CN---	Request the current channel number. The characters 123 represent the three digits of the current channel number. If the Exciter 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 Hop operation.
CRnnn?[1]	F12345678 M* W1234 G÷23 D9	Request the parameters stored in channel nnn without recalling that channel. 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.
D?	D#	Request current Dwell Time.
D#		Change Dwell Time. # represents a one character number to select the dwell time in seconds after frequency tuning during hop operations. (Range: 0 through 9)

Table 3-6 Exciter Command and Status Messages-Cont.

Command	Reply	Description
FA?[1]	FAnnnnnnnnnnnnnnnn	Request a report of all accumulated faults. 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/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
FC?[1]	FCnnnnnnnnnnnnnnnn	Request a report of all current faults. Indicates current fault status (Refer to FA? above).
FLT?	FLTxxxxx	Request the PA-5050A fault status (if installed). xxxxx is fault status of each power module in the format: Driver; PA1; PA2; PA3; PA4. 1=FAULT 0=NONE. This is a logical or of the gain failure and the over temp failure (OT?).
FR?	FR#	Request current Fast Recall mode. FR1=on. FR0=off
(cont)		

Table 3-6 Exciter Command and Status Messages-Cont.

Command	Reply	Description
FWD?	FWDxxxx	Request PA-5050A forward power (if installed). xxxx is measured forward power in watts. Range of 0 to 1999 watts.
G?	G±23	Request current Carrier Level setting.
G±23		Change Carrier Level. Digits 2 and 3 represent the significant figures of the carrier gain in dBm. (Range: -33 through +27).
ID?[1]	(----------)	Request an identification message from the control processor. 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]	(----------)	Request an identification message from the DSP processor. 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.
IS?	IS#	Request the audio input source.
IS#		Set the audio input source. # is replaced as follows: 0 = MIC, 1 = LINE, 2 = 1 kHz, and 3 = noise
K		Cancel. Stops hop operation and clears all hop parameters.
KEY?	KEYx	Request PA-5050A transmitter key status (if installed). x is the transmit key status. 1=KEYED 0=IDLE
M?	M***	Request current modulation mode. Reply is the same as ** description below except a response of FSK for FS, and FAX for FX.
M**		Change exciter modulation mode. ** represents a one or two character code chosen from the following set: L for LSB, LF for LSBfc, LP for LSBpc, U for USB, UF for USBfc, UP for USBpc, I for ISB, C for CW, A for AM, F for FM, FX for FMfax, and FS for FSK. When the mode is changed, some of the other exciter 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. Refer to table 3-3 for a description of modulation modes.
OT?	OTxxxxx	Request PA-5050A over temp fault status (if installed). xxxxx is over temp shutdown status of each power module in the format: Driver:PA1:PA2:PA3:PA4. 1=SHUTDOWN 0=NORMAL
PA?	PAFxxxxxxxx SWRxx FWDxxxx REVxx ATNxxxx FLTxxxxx KEYx BNDx OTxxxxx	Request PA-5050A Status Message (if installed). This will reply with a complete status message of all settings. These are as follows: PAF, SWR, FWD, REV, ATN, FLT, KEY, BND, OT. See individual commands for definition
PAF?	PAFxxxxxxxx	Request PA-5050A frequency (if installed). xxxxxxxx is the frequency in Hz.

Table 3-6 Exciter Command and Status Messages-Cont.

Command	Reply	Description
SC###		This activates the frequency HOP function of the exciter by sequentially recalling memory channels. ### represents the three digits of the highest memory channel to be recalled. The recall begins at the memory channel most recently recalled with the RC### command. (Range: 0 through 249). The exciter will stop on a memory channel for the dwell time stored in the current channel, and then recall the next channel. All channel parameters including frequency, bandwidth, power etc. are changed in the exciter when the next channel is recalled. **CAUTION** Since the exciter is keyed every time the channel is changed during this operation, the HOP function should only be used with external equipment designed for this function. If frequency separation between channels is to great, damage to the external power amplifier and/or antenna system may occur due to high and rapid VSWR fluctuations.
SELCAL Option Command		The Selcal (Selective call) system is used withe the RS-232 serial bus. Each time the Selcal command is sent, the exciter sends two sets of two simultaneous audio tones. This can be four different tones. four of the same tones, or any combination of tones. (See Note 2)
SG?	SGbbbbbbbb	Request the reason for the last generated SRQ (IEEE-488 interface only). 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 3-10 for Serial Poll response byte bit positions.
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 Section Three 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 the current hop/dwell status. The character x will be replaced with one of the following: C when the exciter is currently hopping (even if stopped) N when the exciter is not hopping The character y will be replaced with one of the following: D when the exciter is dwelling S when the exciter is stopped N when the exciter is not dwelling or stopped

Table 3-6 Exciter Command and Status Messages-Cont.

Command	Reply	Description
X?	Xab	Request the current remote control status (serial interface only). The reply to this message is different than the X change parameter command. 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 exciter front panel or a 0 to signify that remote control operation has been disabled from the exciter front panel. For the exciter to respond to change parameter commands from the remote controller, both the remote controller and the front panel selections must be enabled (exciter replies X11 to X?).
X*		Switch between local and remote control operation (serial interface only). The * is replaced with the character 0 to enable the exciter front panel and disable all remote change parameter commands (except this command), or the character 1 to enable all remote control commands and disable all front panel keypad input (except the LOC/REM key). The exciter 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.

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

[2]For SELCAL Option Command see addendum 2607-1023-1 (ADDENDUM FOR SELCAL SYSTEM COMMAND)

Table 3-7 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 3-8 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 3-9 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

3-11 EEPROM CLEARING.

If a POST failure was caused by a corrupted EEPROM (Interface Status TE:EEPR), send the EEPCLR 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	

FAULT	This bit mirrors the status of the front panel FAULT annunciator.
LOCAL CNTRL	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 exciter 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 exciter is asserting the SRQ message on the bus when this bit is true.

Figure 3-10 IEEE-488 Serial Poll Response Byte.

CHAPTER 4
GENERAL THEORY OF OPERATION

4-1 INTRODUCTION.

This chapter contains a block diagram description of the T-4150/80. 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 or optional locking connector provides connection of input power. AC power line filtering is only provided on the T-4180.

4-2.2 *AC Line Filter.* The AC Line Filter board provides additional power line filtering and 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, the circuit breaker (CB1) on the rear panel, and 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 exciter modules through the motherboard using 90 to 270 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 *Front Panel.* The Front Panel contains a microphone/key jack, power ON/OFF switch, main adjustment knob, 19-key conductive rubber keypad, and full graphic vacuum fluorescent display. Each of the assemblies are described below.

4-2.4.1 *Main Adjustment Knob.* The Main Adjustment Knob allows exciter 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.

4-2.4.2 *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.

4-2.4.3 *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.

4-2.5 *Digital Module.* The Digital module contains two major sections: the Control Section, and the DSP Section. Each of these sections is described below.

4-2.5.1 *Control Section.* The Control Section governs all aspects of the exciter'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 exciter operating parameters, such as frequency, modulation mode, and power level 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, or scanned sequentially for frequency hopping. 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 exciter. 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

line drivers and line receivers for both RS-232 and RS-422 bus types.

4-2.6.2 *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.

4-2.7 *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.

4-2.7.1 *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.

4-2.7.2 *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.

4-2.8 *Synthesizer Module.* The synthesizer module provides the 3RD LO frequency 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, five internal voltage regulators (not shown) supply the required voltages to the entire module. Three of these regulators are mounted directly to the module surface for optimum heat transfer.

4-2.8.1 *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 loop 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. One bit in the shift register selects the correct audio source.

4-2.8.2 *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. One path of the internal or external reference frequency signal is amplified and applied to the RF Analog module. The other path is split and used as the reference frequency for the fine and step loop PLL circuits.

4-2.8.3 *3rd LO Generation.* The output loop circuits produce the 3rd LO signal for the third 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 output loop VCO signal takes two paths. One path is filtered and becomes the 3RD 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 through a wrong-side lock detector.

The wrong-side lock 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 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. The signal leaves the module as the 3RD LO at 42.055 - 70.455 MHz in 1 kHz steps.

A fault detector sends the OUTPUT/FINE or STEP FAULT signals to the digital module if the output or fine loops, or step loop lose lock.

4-2.8.4 *Audio.* The audio board is located in a separate shielded compartment in the synthesizer module. The shielding prevents interaction between the high-level audio and sensitive VCO circuits.

Audio is applied from either the front panel MIC/KEY jack or the rear panel NORM (upper sideband),or ALT (lower sideband) balanced inputs. The audio from each of these inputs is applied directly to amplifiers. A switch controlled by the data from the digital module selects either the microphone or normal line input. After amplification, the audio is filtered using lowpass filters with an 8 kHz bandwidth.

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 switch 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, AC Line Filter board, rear panel circuit breaker, and the front panel power switch connections.

CAUTION

When working on the exciter with covers removed and power applied, do not allow tools or metal objects to come in contact with exciter 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. Using a no. 1 Phillips screwdriver, remove 4 screws from both sides of chassis for each cover to be removed, and then remove the cover.
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 switch 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 AC Line Filter board, rear panel circuit breaker, and the front panel power switch connections.

Section II. CORRECTIVE MAINTENANCE

5-5 TROUBLESHOOTING.

5-5.1 *Troubleshooting Philosophy.* Certain assumptions are made concerning the troubleshooting approach as applied to the exciter 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 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 T-4150/80 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 exciter 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, exciter 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 using eight different frequencies. This test exercises the entire exciter signal path. Different frequencies are used to check each postselector 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.

5-5.2.3 *BIT.* During normal exciter 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.

Table 5-1 Fault Detectors.

Detector	Module Location	Fault Signal
Power Supply	Power Supply	PS FAULT
1st LO/DSP Clock	RF Analog	RF FAULT
2nd LO Driver	RF Analog	RF FAULT
3rd LO Driver	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-Cont.

Message	Meaning	Action To Take
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 exciter 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 from RF Analog Module 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
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 exciter bus address out of limit.	1. Check CONFIG address using front panel. Limits = 000 - 254 serial bus, 00 - 30 IEEE-488 bus.

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 4 screws on each side of chassis securing front panel to chassis.

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 *Main Adjustment Knob.*

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

5-6.11 *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.

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 switch 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 exciter 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 +85°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 exciter.

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-5 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
1	Finger Guard, Fan	115-027		CCI
4	Handle, Support	2600-4407-7		CCI
1	Keypad, Rubber Conductive	260006-1		CCI
1	Kit, Dual Rack-Mount	2600-1009-1	(Two T-4180 exciters required)	CCI
1	Knob Assy, 1/4 shaft	260264-1	Main Adjustment	CCI
1	Module, Digital	2607-1101-1		CCI
1	Module, Synthesizer	2607-1102-1		CCI
1	Module, RF Analog	2607-1103-1		CCI
1	Module, Power Supply	260259-1		CCI
1	Module, Display	260018-1		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

OPERATING BY EMISSION DESIGNATORS

NOTICE:
This annex is incomplete without the associated technical manual

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ANNEX TO T-4150/80

OPERATING BY EMISSION DESIGNATORS

The following table provides information to operate the T-4150/80 using selected FCC emission designators.

T-4150/80 Operation by FCC Emission Designator.

Emission Designator	Modulation Mode	Audio Source	Description
A1A/A1B	CW	----	This is unmodulated continuous wave (CW) using the KEY input (on/off key)
A2A/A2B	AM	TONE	This is amplitude modulation using the KEY input and the programmed internal TONE signal as a modulating Subcarrier (modulated CW). The user must select AM modulation mode, program the desired frequency of the internal generated sine wave, and select the audio SOURCE to be TONE. Note: When the KEY is open, the RF output signal consists of the carrier only up to ½ second, i.e., when going from a KEY closed condition to a KEY open condition, the carrier is left on for an additional ½ second. The carrier is ramped up on key close and ramped down on key open. When the KEY is closed, the modulation tone signal is ramped up, and is immediately ramped down when the KEY is opened.
A3E	AM	MIC/LINE	This is standard analog AM modulation either from the MIC or NORM LINE audio input.
B8E	ISB	LINE	This is analog ISB modulation using the both the NORM and ALT LINE audio inputs.
F1A/F1B	FSK	LINE	This is the FSK modulation mode. The input signal is sampled and filtered from the NORM LINE audio input channel. If the filtered signal is positive, a positive frequency shift equal to ½ the programmed shift value is done, while for a negative input, the frequency shift is ½ the shift value subtracted from the center carrier frequency.
F1C	FMfax	LINE	This is analog FM Fax modulation. The input signal is sampled and filtered from the NORM LINE audio input channel. This is the same as FM modulation, except any DC component in the input signal is not filtered out.
F3C	FM	MIC/LINE	This is standard analog FM modulation using the MIC or NORM LINE audio input.
H2A/H2B	USBfc/LSBfc	TONE	This is USBfc or LSBfc (full carrier) modulation using the KEY input and the programmed internal TONE signal as a modulating Subcarrier. The user must select USBfc or LSBfc modulation mode, program the desired frequency of the internal generated sine wave, and select SOURCE to be TONE. Note: When the KEY is open, the output signal consists of the carrier only up to ½ second, i.e., when going from a KEY closed condition to a KEY open condition, the carrier is left on for an additional ½ second. The carrier is ramped up on key close and ramped down on key open. When the KEY is closed, the modulation tone signal is ramped up, and is immediately ramped down when the KEY is opened.
H3E	USBfc/LSBfc	MIC/LINE	This is analog USBfc or LSBfc modulation using the MIC or LINE audio input. USBfc is commonly referred to as AME.
J2A/J2B	USB/LSB	TONE	This is USB or LSB modulation using the KEY input and the programmed internal TONE signal as a modulating Subcarrier. The user must select USB or LSB modulation mode, program the desired frequency of the internal generated sine wave, and select SOURCE to be TONE. Note: When the KEY is open, the output signal consists of the carrier only up to ½ second, i.e., when going from a KEY closed condition to a KEY open condition, the carrier is left on for an additional ½ second. The carrier is ramped up on key close, and ramped down on key open. When the KEY is closed, the modulation tone signal is ramped up, and is immediately ramped down when the KEY is opened.
J3E	USB/LSB	MIC/LINE	This is standard analog USB or LSB modulation using the MIC or LINE audio input.
R2A/R2B	USBpc/LSBpc	TONE	This is USBpc or LSBpc (partial carrier) modulation using the KEY input and the programmed internal TONE signal as a modulating Subcarrier. The user must select USBpc or LSBpc modulation mode, program the desired frequency of the internal generated sine wave, and select SOURCE to be TONE. Note: When the KEY is open, the output signal consists of the carrier only up to ½ second, i.e., when going from a KEY closed condition to a KEY open condition, the carrier is left on for an additional ½ second. The carrier is ramped up on key close, and ramped down on key open. When the KEY is closed, the modulation tone signal is ramped up, and is immediately ramped down when the KEY is opened.
R3C/R3E	USBpc/LSBpc	MIC/LINE	This is analog USBpc or LSBpc modulation using the MIC or LINE audio input.

ANNEX B

TECHNICAL MANUAL ANNEX

OPERATION AND MAINTENANCE INSTRUCTIONS

OPERATIONAL LEVEL

DC POWER SUPPLY OPTION FOR T-4150/80 EXCITER

NOTICE:
This annex is incomplete without the associated technical manual

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Change 2

30 January 1998

DC POWER SUPPLY OPTION

DESCRIPTION

This annex supplements the T-4150/80 technical manual and contains difference data for certain T-4150/80 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 exciter functions identically to the AC powered T-4150/80 unit.