TW7000-MSOP

TW7000

HF Transceiver

Operator Manual

Datron World Communications Inc.
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Datron World Communications, Inc.

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Limitations of Warranty: This warranty does not cover:

Physical damage to the equipment or its parts that does not involve defects in design, material, or workmanship, including damage by impact, liquids, temperature, or gases.

Damage to the equipment or its parts caused by lightning, static discharge, voltage transients, or application of incorrect supply voltages.

Defects or failures caused by unauthorized attempts to repair or modify the equipment.

Defects or failures caused by Buyer abuse or misuse.

Return of Equipment - Domestic: To obtain performance of any obligation under this warranty, the equipment must be returned freight prepaid to the Technical Support Services. Datron World Communications Inc., 3030 Enterprise Court, Vista, California 92081. The equipment must be packed securely. Datron shall not be responsible for any damage incurred in transit. A letter containing the following information must be included with the equipment.

a. Model, serial number, and date of installation.
b. Name of dealer or supplier of the equipment.
c. Detailed explanation of problem.
d. Return shipping instructions.
e. Telephone or fax number where Buyer may be contacted.

Datron will return the equipment prepaid by United Parcel Service, Parcel Post, or truck. If alternate shipping is specified by Buyer, freight charges will be made collect.

Return of Equipment - International: Contact Datron or your local Representative for specific instructions. Do not return equipment without authorization. It is usually not possible to clear equipment through U.S. Customs without the correct documentation. If equipment is returned without authorization, Buyer is responsible for all taxes, customs duties, clearance charges, and other associated costs.

Parts Replacement: The following instructions for the supply of replacement parts must be followed:

a. Return the parts prepaid to “Parts Replacement” Datron World Communications Inc., 3030 Enterprise Court, Vista, California 92081; and
b. Include a letter with the following information:
1. Part number
2. Serial number and model of equipment
3. Date of installation

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1/95

Safety Considerations

This product and manual must be thoroughly understood before attempting installation and operation. To do so without proper knowledge can result in equipment failure and bodily injury.

Caution: Before applying ac power, be sure that the equipment has be properly configured for the available line voltage. Attempted operation at the wrong voltage can result in damage and voids the warranty. See the manuals section on installation. DO NOT operate equipment with cover removed.

Earth Ground: All Datron products are supplied with a standard, 3-wire, grounded ac plug. DO NOT attempt to disable the ground terminal by using 2-wire adapters of any type. Any disconnection of the equipment ground causes a potential shock hazard that could result in personal injury. DO NOT operate any equipment until a suitable ground has been established. Consult the manual section on grounding.

Servicing: Trained personnel should only carry out servicing. To avoid electric shock, DO NOT open the case unless qualified to do so.

Various measurements and adjustments described in this manual are performed in ac power applied and the protective covers removed. Capacitors (particularly the large power supply electrolytics) can remain charged for a considerable time after the unit has been shut off. Use particular care when working around them, as a short circuit can release sufficient energy to cause damage to the equipment and possible injury.

To protect against fire hazard, always replace line fuses with ones of the same current rating and type (normal delay, slow-blow, etc.). DO NOT use higher value replacements in an attempt to prevent fuse failure. If fuses are failing repeatedly this indicates a probable defect in the equipment that needs attention.

Use only genuine Datron factory parts for full performance and safety of this product.

Made in the USA

CONTENTS

CHAPTER 1
INTRODUCTION

The TW7000

The TW7000 HF SSB transceiver provides a complete range of both voice and data operation over the entire 1.6 to 30 MHz HF spectrum. The TW7000 is microprocessor-controlled and features a state-of-the-art DDS-based synthesizer for extremely fast switching applications. A custom LCD provides channel and frequency data, feedback on other front panel control functions, BITE information and order-wire text messages. The TW7000 has continuous tuning and up to 1000 memory channels that can be arranged in multiple scan groups. It has simplex and half-duplex capability, and a full alphanumeric keypad for frequency or text entry.

This manual describes the TW7000, its installation, operation and features. For complete technical coverage of the transceiver, refer to the TW7000-MS technical manual.

Description of Equipment

The TW7000 includes the basic receiver/transmitter and accessories. The accessories include a DC power cable (C991829), an operator manual (TW7000-MSOP) and two spare DC 25A fuses (550011).

The TW7000 is powered from any DC source that provides 13.8V at a maximum of 25A. Optimal performance is achieved when the input voltage is in the range of 11 to 15.5V.

The 50 ohm, UHF, female, RF output connector is used with broadband antennas, narrowband antenna tuners and power amplifiers.

The TW7000 can be programmed and operated from its front panel, or from an external computer utilizing a wide variety of interface standards including RS232, 422 and 485.

TW7000 audio accessories include a heavy-duty hand microphone, a dynamic desk microphone, a Morse key and headphones.

Specifications

Note: *Specifications are subject to change without notice or obligation.*

Characteristic	Specification
General	
Frequency range	1.6 to 30 MHz (TX); 100 Hz to 30 MHz (RX); 10 Hz channel spacing
Preset channels	256 standard, 1000 optional
Scanning	Multiple scan groups, operator-selectable scan rates (with ALE option)
Channel Programming	From front panel or remotely via computer or dedicated remote control console
Frequency stability	0.5 ppm
Modes	USB, LSB, CW, AME; simplex or half-duplex
Input power	11 to 16 Vdc
Input power Protection	Reverse polarity, transient and under/over-voltage
Antenna port	50 ohms, SO-239 type connector
Antennas	50 ohms or automatic antenna tuner (AT7000B, RAT1000C) for narrowband
Interface	Control: two RS32 COM ports; COM1 only configurable as EIA RS-422/423/485 port with 7000RS option Audio: 600 ohms, balanced and isolated
Transmitter	
RF Power output	125W PEP, 100W average; programmable - three levels
Duty cycle	Continuous service, all modes
Harmonics	-60 dB (2 to 30 MHz) nominally
Receiver	
Sensitivity	-113 dBm at 10 dB SINAD

Characteristic	Specification
Attenuator	+20 dB, operator switchable
Audio	5W into 4 ohm; 0 dBm into 600 ohms
Mechanical, Environmental	
Size (H x W x D)	3.5 in. x 13 in. x 17 in. (8.9 cm x 33 cm x 43 cm)
Weight	21 lbs. (9.5 kg)
Cooling	On-demand fan (internal)
Temperature	-30°C to +60°C, operating
Shock, vibration	Per MIL-STD-819

TW7000 Variations

The following variations are available for the TW7000. Options described here may not be available on your transceiver. For more information about these variations, contact DWC.

TW7000C — Designed for computer control. A blank front panel replaces the standard front panel.

TW7000E — Designed for extended control use. A line driver panel replaces the standard front panel. It is used with the TW7201E control head for remote operation up to 15m (50 ft.).

TW7000PP — Allows the addition of the TW5830 Pre/Postselector kit for co-sited operation.

Note: *The TW7000 is not field upgradeable to a TW7000PP.*

TW7000RF — Designed for long distance remote-only use beyond 2 km. A blank front panel replaces the standard front panel and an internal modem card (7000RF) is installed. For full-function FSK remote control, use with the TW7201F.

TW7000RI — Designed for remote-only use up to 2 km. The standard front panel is replaced with a blank front panel and an internal modem card (7000RI) is installed. For full-function, real time, DHSL remote control, use with the TW7201I.

TW7000RX — Receiver only. It includes the full receiver functions of the TW7000, excluding transmit features.

TW7000TX — Transmitter only. It includes the full transmitter functions of the TW7000, excluding receiver features.

Internal Options

The following internal options are available in the TW7000.

7000ACH	Additional channels. Increases operational channel capacity to 1000.
7000ALE	FED-STD-1045 compatible adaptive system. Provides complete 1045 capability, including link quality analysis, auto-linking, sounding, and orderwire message transmission and reception.
7000ALE-141B	MIL-STD-188-141B (Appendix A). Provides mandatory 141B capability, including link quality analysis, auto-linking, sounding, and orderwire message transmission and reception.
7000CW	500 Hz narrowband filter for CW operation.
7000CW1	500 Hz narrowband filter for CW operation and wideband for data applications.
7000ENCR	High-level voice encryptor uses enhanced domain transform (EDT) ciphering techniques providing long-term security.
7000FALC	Fast ALC loop for use with linear amplifiers that utilize peak detecting ALC like the TW1000D.
7000HS	High stability reference oscillator allows 0.1 parts per million frequency stability.
7000HS-FALC	High stability reference oscillator and fast ALC loop operation.
7000NB	Impulse-type noise blanker used in high-noise environments.
7000RCDR	Combines receive and transmit audio and routes them to Accessory 2.
7000RF	Internal modem allows remote contact from the TW7201F FSK controller.
7000RI	Internal modem allows remote contact from the TW7201I DHSL controller.
7000RS	Modem interface board configures the COM1 port to provide an RS-422, RS-423 or RS-485 2-wire bidirectional serial interface using an alternative data protocol for external control of the radio. The required interface must be specified when ordered. This is in addition to the standard RS232 interface.

7000VEM — DSP-based voice enhancement provides superior voice recognition and signal-quality improvement in noisy environments.

Note: *This option is still available for older radios but the DSP-based enhancement is now a standard feature on newer radios.*

7000WB1 — Wideband data filter providing 300 to 3300 Hz with tailored group delay characteristics for data operation.

TW7000AIRSELCALL

Operating with N-1304A (or equivalent) SELCAL devices and Datron power amplifiers, it adds a secondary control line to the radio and allows use of the ICAO-mandated ground-to-air SELCAL 3-tone system.

Conventions

Bold type denotes all items displayed on the front panel and any button that is pressed. For example:

- Press **C**, **041**, and **E**.

  Display: **CH FREQ**
  041 13.330,000 MHz
  RX

- Press **ALPHA** and **17**.
- Press **STATUS**.

Referenced Manuals

- TW7000-MS Transceiver Technical manual
- 7000ALE-MSOP ALE Radio Control Operator manual
- 7000ENCR-MSOP High-Level Encryption Operator manual
- TW7201I-MS DHSL Remote Control Operator/Technical manual
- TW7201F-MS FSK Remote Control Operator/Technical manual
- RC2-MSOP Radio Control 2 Software Operator manual

CHAPTER 2
INSTALLATION

This section provides information necessary to install the TW7000 in its operating environment. Power, antenna, and accessory connections are discussed. System diagrams are provided to show the proper connections to a variety of accessories.

Unpacking and Inspection

When unpacking the TW7000, carefully remove the equipment from its container and inspect it for any possible damage. If anything is damaged, notify Datron. Check the equipment against the packing list. Save the original container and packing materials for storage or reshipping purposes.

Location Considerations

The TW7000 can be deployed successfully in various locations, in a number of different configurations, depending on whether remote or extended control is used. Information in this section pertains to the main body of the TW7000, whether it is controlled locally or from a remote site.

Fixed Station

Unless otherwise specified when ordered, the TW7000 is shipped ready for operation. It is also available for mounting in a rack, provided the appropriate rack kit is ordered.

Make sure the temperature at the location is within the specified range, and that there is adequate ventilation around the rear of the TW7000 for air flow. The TW7000 uses an on-demand fan for cooling the internal heat sink during periods of prolonged transmit operation. The intake and exhaust vents for this fan are located on the rear panel. Provide sufficient space during installation for the cooling air to circulate properly.

To prevent unwanted noise, locate the TW7000 as far away as possible from electrostatic and magnetic field-generating equipment.

When attaching external cables to the TW7000, allow for sufficient slack in the cables. This prevents damage from sharp bends and ensures easy disconnection.

Vehicular or Marine

To operate the TW7000 in a particular vehicle or shipboard location, Datron offers rack, mobile and shock mount kits suitable for most installations.

2.1 Front Panel Connections

Two 6-pin microphone connectors on the front panel are wired in parallel and suitable for use by various audio accessories.

Figure 2-1. Front Panel Connections

The TW7000 front panel hosts two 6-pin microphone connectors. These two connectors are wired in parallel and are compatible with various audio accessories. The input impedance is 150 ohms (nominal). The TW7000 supports most dynamic, ceramic or magnetic headphones. The following low-level audio accessories come with military connectors.

Table 2-1 Audio Accessories

Part Number	Description
PM	Heavy-duty palm microphone
DM	Dynamic desk microphone
KEY	Morse key
EP	Headphones
EPL	Lightweight headphones

All Datron audio accessories have the correct mating connector. Datron offers mating adapters for other low-level audio accessories.

2.2 Rear Panel Connections

The rear panel of the TW7000 is fabricated from aluminum sheet metal and attached to the rear panel bezel by 6 screws. The pattern of punched holes on right-side is the air intake for the internal heat sink. The left-side hole pattern is the air exhaust. Between them are the rear panel connectors and the fuse holder. Behind the panel is an input power protection circuit board. Ribbon cables connect the rear panel to the motherboard.

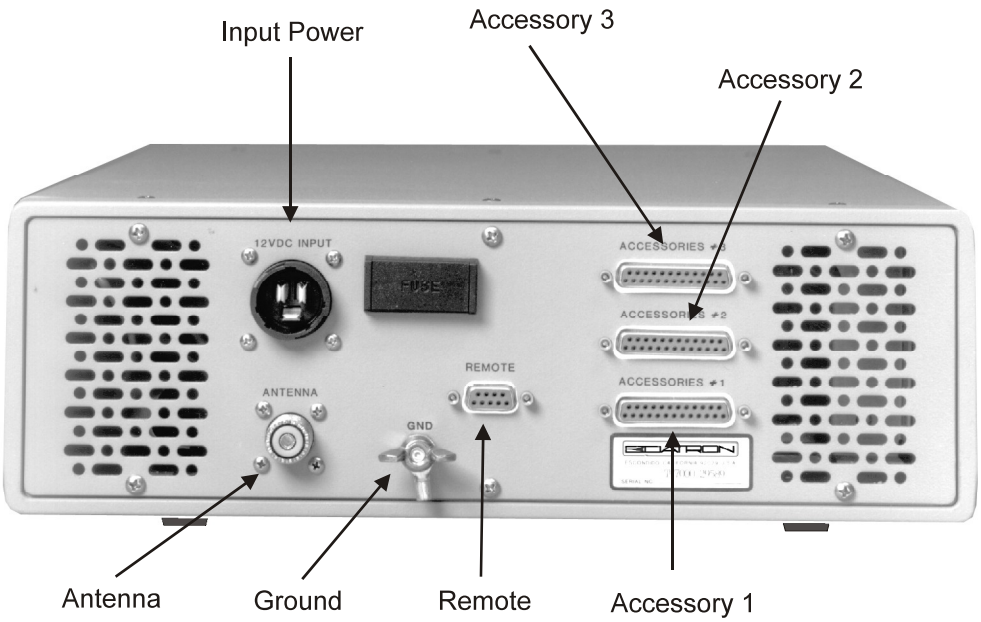


Figure 2-2. TW7000 Rear Panel

Power to the TW7000

Input power is nominally 13.8 Vdc, with a maximum current requirement of approximately 25A. The recommended operational voltage range of the TW7000 is 11 to 15.5 Vdc. The **12VDC INPUT** connector on the rear panel is a 2 pin 25A circular receptacle having a square mounting flange with 2 male pins. The mating plug is attached to the input DC power cable (C991829) supplied with the TW7000. This cable has two 12 AWG conductors, is 6.5 ft. long, and open-ended for convenient connection to a variety of +12 Vdc sources. For specific connections, refer to Figure 2-3 on page 2-6.

The DC power connection between the TW7000 and its power source should be as short as possible. If a DWC power cable is not available, use a 14 AWG cable for runs up to 3 feet, a 12 AWG cable for runs to 9 feet, or a 10 AWG cable for longer runs.

Three DC power supplies, available from Datron, are recommended for use with the TW7000 when a +12 Vdc primary power source is not available.

PF3000 — Heavy duty power supply permits continuous duty operation. Operates from 110/220 VAC, 50/60 Hz, with switchable input range. Requires a C991829 cable.

PF7000 — Heavy duty FSK power supply permits continuous duty operation. Operates from 110/220 VAC, 50/60 Hz, with universal input. It requires a C991879 cable.

The fuse holder (pin 346877) on the rear panel contains a 25A, 3-AG fuse and a spare fuse of the same value.

Antenna Connection

The TW7000 is designed to work into a 50 ohm RF impedance. The output RF antenna connector is a type SO-239 connector. Broadband antennas can be connected directly to this output, while narrowband antennas require antenna tuners such as Datron's RAT7000B or RAT1000C. For specific connections, refer to Figure 2-4 on page 2-7.

Part Number	Description
ABB100AN	2 MHz to 30 MHz, 125W, 144 ft. (43.9m) broadband standard length antenna.
ABB100BN	2 MHz to 30 MHz, 125W, 112 ft. (34.1m) broadband shorter length antenna.
701408	1.8 MHz to 54 MHz 300W (continuous) folded dipole, 90 ft. (27.4m).
ABB1000AN	2 MHz to 30 MHz, 1000W, 144 ft. (43.9m) broadband standard length antenna.
ABB1000BN	2 MHz to 30 MHz, 1000W, 34.1m 112 ft. (34.1m) broadband shorter length antenna.
701408-1	1.8 MHz to 54 MHz 1 kW (continuous) folded dipole, 90 ft. (27.4m).

Accessory Connections

A variety of external accessories are available from DWC for use with the TW7000. For some of these accessories and their control cabling, refer to Figure 2-5 on page 2-8. For more information on any individual accessory, refer to the manual for that piece of equipment.

There are three accessory connectors on the rear panel, each with different pin assignments. If multiple accessories are required that share one or more of the accessory connectors, an external accessory combiner box (TW7000IOX) can be attached to any of these connectors. Each of the three connectors on the rear panel is a D-Submini socket with 25 pins. For the location of these connectors, refer to Figure 2-2 on page 2-3.

External Encryption	The TW7000 has provision for an embedded encryption board, the 7000ENCR option. External encryption can also be used with the TW7000 and connected to Accessory 1 or Accessory 2.
EIA Data Interface Standards	The TW7000 interfaces with a variety of data communications equipment (DCE) or data terminal equipment (DTE) using EIA standards RS-232, RS-422, RS-423 or RS-485. Accessory 1 is configured to provide the standard I/O port (COM1) for these interfaces. The RS232 protocol is standard; all others are optional. It is necessary to order the 7000RS option and to specify the required protocol so the appropriate interface chip is inserted into the processor. If the 7000RS option is installed, the COM1TXD and COM1RXD becomes a 2-wire bidirectional RS422/485 interface. A 3-wire RS-232 interface is also available on Accessory 2.
Automatic Antenna Tuners	The TW7000 interfaces with the complete line of DWC automatic antenna tuners including the AT/RAT7000B and RAT1000C.
Data Terminal Interface	The TW7000 interfaces with its own line of data terminals or to other external units using Accessory 1.
External Printers	A standard parallel printer connects to Accessory 1 for printing a hard copy of text messages stored in the TW7000.
External Speaker	An external speaker attaches to the TW7000 at Accessory 2.
External High-Power Amplifiers	The TW7000 interfaces with all existing DWC high-power RF booster amplifiers using Accessory 3.
Remote Connector	The TW7000 can be operated remotely using a TW7201I or TW7201F remote control head that communicates to the receiver through an optional DHSL (7000RI) or FSK (7000RF) modem installed in the receiver. The TW7000 connects to the remote head through a remote cable (C992307). The remote cable connects to the TW7000 through the rear panel 9-pin **REMOTE** connector (the TW7201I and TW7201F use the same remote cable). For more information about the TW7201F and TW7201I remote heads, refer to the RT7201F-MS and RT7201I-MS Technical manuals.

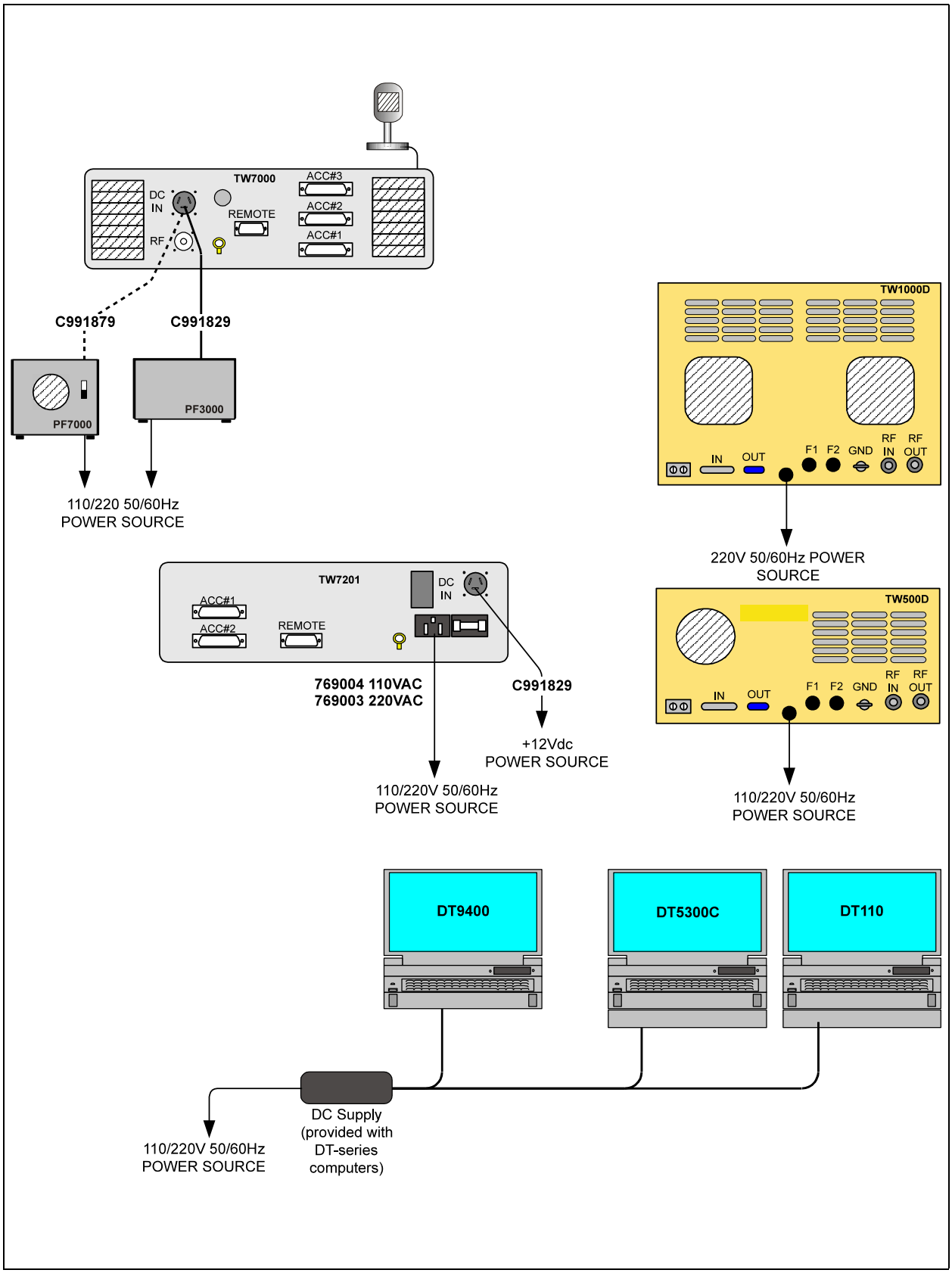


Figure 2-3. Power Cabling Accessories

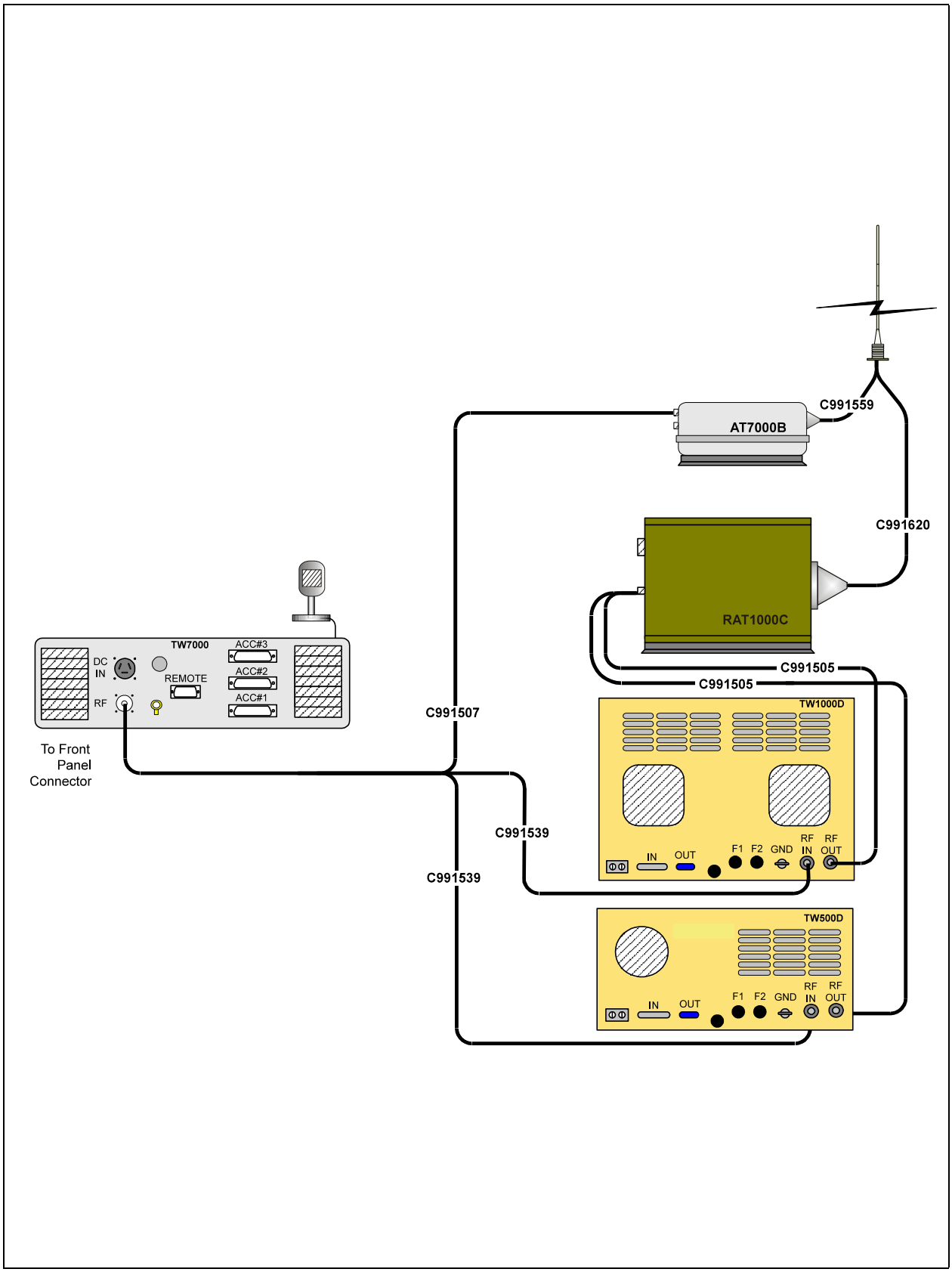


Figure 2-4. RF Cabling Accessories

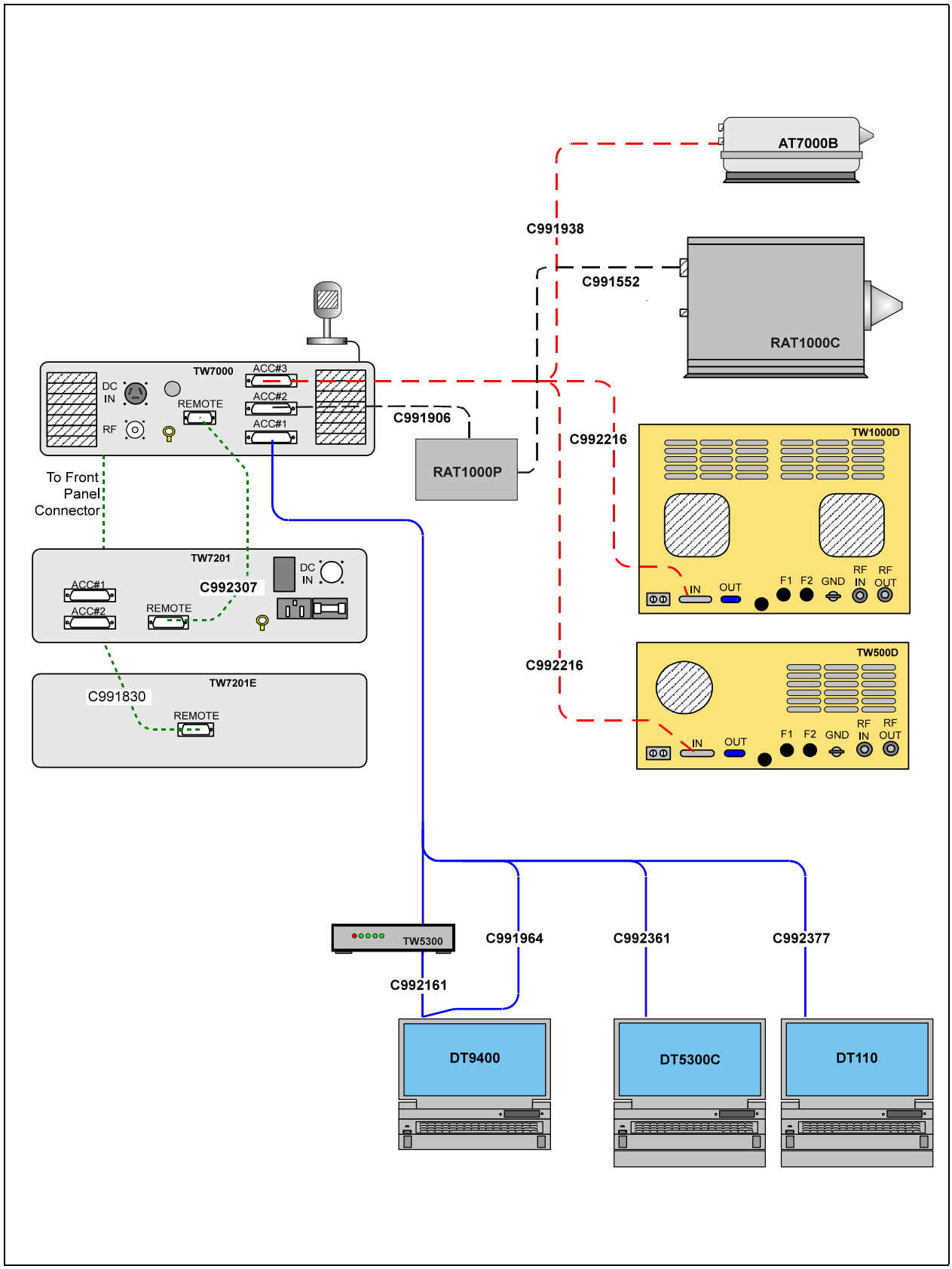


Figure 2-5. Control Cabling Accessories

Remote Control The TW7000 can be controlled remotely using a computer, an extended front panel or a or remote control head.

Computer Control — You can control the TW7000 remotely from a standard computer using Accessory connectors 1 or 2 on the rear panel. A custom software program is available from DWC that runs on any PC using Windows™. For the connections to use, refer to “EIA Data Interface Standards” on page 2-5.

Extended Front Panel Control — You can remove the front panel of the TW7000 and replace it with a line driver panel (TW7000E) to control it remotely. This special version of the radio is used to control operations from distances up to 50 feet.

FSK and DHSL Remote Control — You can control the TW7000 remotely from longer distances using the TW7201F and the TW7201I remote control heads. Both control heads require that you install modem interface boards (7000RF or 7000RI) inside the TW7000. The TW7201F uses FSK and is for long-range remote requirements, while the TW7201I uses DHSL and is for real-time control up to 2 km.

These modem-based remote control units connect to the TW7000 via the remote connector on the rear panel. This connector is a circular MIL-C 10 with 9 pins.

For a complete description of these pins, refer to the TW7201F FSK Remote Control Head (TW7201F-MS) technical manual or the TW7201I DHSL Remote Control Head (TW7201I-MS) technical manual.

Operations Check

The TW7000 is completely aligned and tested prior to shipment. However, to insure proper functioning, perform an operations check. This information is provided in the maintenance chapter of the TW7000 technical manual (TW7000-MS).

CHAPTER 3

OPERATION

These procedures discuss using the front panel to program the radio. To program the radio from a computer, refer to the Radio Control 2 operator manual (RC2-MSOP); the 7000ALE option must be installed in the radio.

Powering the TW7000

Use the Power/Volume knob to turn on the TW7000. Power is off in the full counterclockwise position. Increase the speaker volume by turning the knob clockwise. When the radio is on, the version level of the software is displayed.

Display: **TW7000**
VER 701xx (where xx is the version level)

The BITE system runs automatically and verifies that the boards are functional.

Display: **TW7000**
MODULES OK

The BITE system searches for any installed options. These options are displayed as is the current channel number (upper left corner), channel frequency (upper center) and clarifier offset (if any, below the frequency).

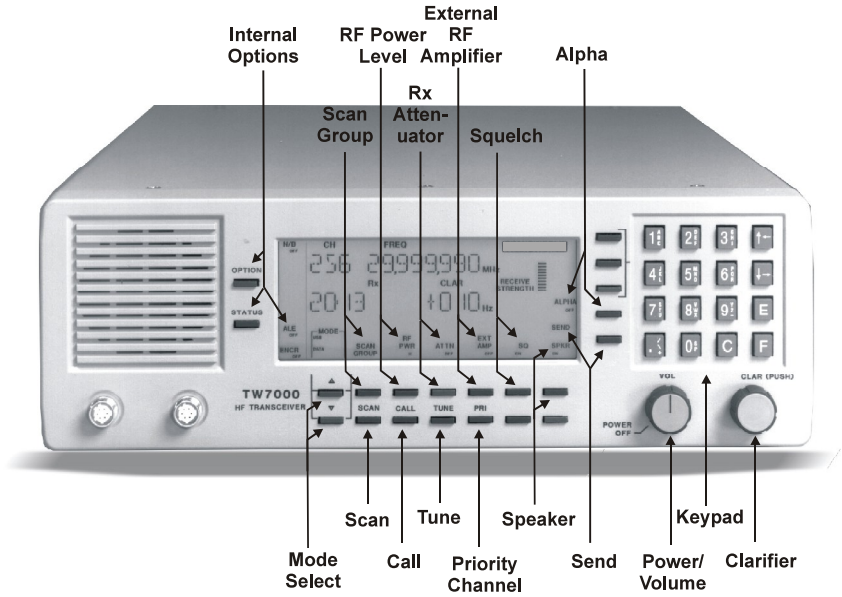


Figure 3-1. TW7000 Front Panel

Using Knobs, Buttons and Indicators

The front panel of the TW7000 is designed for easy use. Knobs, buttons and displayed indicators guide the operation of the TW7000 including access to advanced features from menus. For the placement of these knobs, buttons and indicators, refer to Figure 3-1 on page 3-1.

Speaker

Mute the speaker by pressing the **SPKR** button (located beneath the **SPKR** icon on the lower right side of the display). The status of the speaker (**ON** or **OFF**) is displayed under this icon.

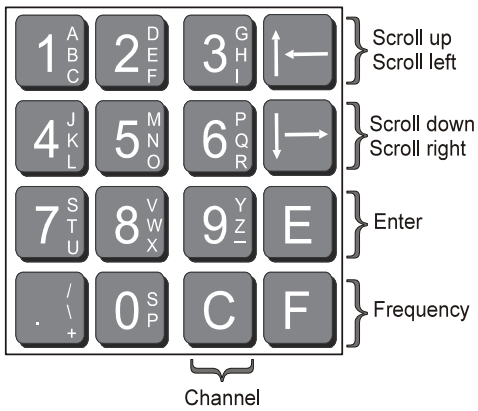
Clarifier

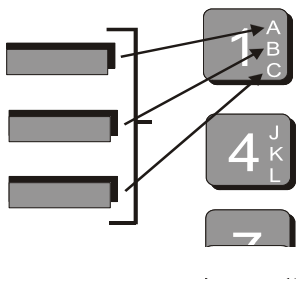
Turn the **CLAR** knob counterclockwise for negative offset and clockwise for positive offset (USB mode). The knob has continuous rotation and provides a maximum of -600 Hz and +600 Hz offset in 10 Hz steps. This value is shown on the right side of the display and is nulled by turning the knob until the offset reads +000 Hz, or by pressing the knob (off). When the clarifier is off, no clarifier information is displayed. Pressing the knob a second time restores the previous offset and refreshes the display.

Keypad

The keypad is for entering numeric or alpha characters, saving data once entered, selecting channels and frequencies, and scrolling within menus.

- To enter numbers, press the desired keypad number. The display has a permanent decimal and comma in the frequency field. If a value is entered that is below 10.000000 MHz, use the decimal button.
- When composing a message or entering address names, alpha characters are entered from the keypad using a combination of two buttons. Examples:



Press the top bracketed button and **1** to enter character **A**. Press the middle bracketed button and **1** to enter character **B**. Press the bottom bracketed button and **1** to enter character **C**.	

- To enter a space, press any bracketed button and **0**.
- To delete a character, use the left and right arrows to position the cursor and press the **C** button. All trailing characters move to the left.
- To scroll through the menu selections, use the up and down arrow buttons. These arrows convert to left and right scrolling when editing in the text message mode. The scrolling rate remains constant for the duration of time an arrow button is held down. The arrows remain active until another control function is selected.
- To select a channel, press **C.** To select a frequency, press **F**. Press **E** to enter selections into memory.

Send

Press the **SEND** button to send an ALE call to the last station with an established link. For a more detailed description, refer to “Placing an ALE Call” on page 3-17.

Alpha

Press the **ALPHA** button to access the Alpha Menu. The Alpha button is in the group of five buttons immediately to the right of the display. The **ALPHA** button is the fourth from the top. To exit the menu, press **ALPHA** again.

Mode Select

Select an operational mode by pressing the **MODE** buttons located beneath the mode icon on the lower left side of the display. Use these buttons to scroll through the following choices.

Mode	Description
USB	Upper sideband voice: Standard voice grade IF filter and voice AGC time constants.
LSB	Lower sideband voice: Standard voice grade IF filter and voice AGC time constants.
USB/LSB DATA	FSK AGC time constants, optional USB/LSB wideband data filter, 300-3300 Hz bandwidth.
USB/LSB AME	Same as USB/LSB mode with addition of carrier in transmit mode at a level of -6 dB relative to PEP.
USB PCS	Same as USB mode with addition of carrier in transmit mode at a level of -16 dB relative to PEP.
USB/LSB CW	Optional narrowband filter with 500 Hz bandwidth.

These modes are displayed only if a mode option is installed (7000WB1 or 7000CW). The mode buttons are disabled if the Lockout or Frequency Blank functions are turned on. For information on these functions, refer to “Using Menus to Change Settings” on page 3-5.

Scan Group A scan group is a collection of channels grouped together. After you define your scan groups, use the **SCAN GROUP** button to select a particular scan group. For more information on selecting scan groups, refer to 7000ALE operator manual (7000ALE-MSOP).

Scan Press the **SCAN** button to begin scanning the channels in the selected scan group. Pressing **SCAN** a second time terminates the scan sequence and the TW7000 reverts to the last channel scanned.

RX Attenuator The **ATTN** button changes the status of the input receiver attenuator from **ON** (+20 dB input RX pad) to **OFF**, or vice versa.

Squelch The **SQ** button changes the status of the squelch circuit from **ON** to **OFF**, or vice versa. In the **ON** setting, background noise is muted.

External RF Amplifier The **EXT AMP** button provides push-to-talk (PTT) control from Accessory 3 of the TW7000 to an external amplifier. To automatically set and lock RF power in the **H** (high power) position, set it to **ON**. To restore control, set it to **OFF** and the TW7000 no longer requires an external amplifier.

Tune If automatic antenna tuners like the AT/RAT7000B or RAT1000C are connected to the TW7000, press the **TUNE** button to activate the tune cycle.

Call The **CALL** button initiates a call sequence in the ALE option. If this option is not installed or if it is turned off, this button is disabled. For information on placing ALE calls, refer to “Placing an ALE Call” on page 3-17.

Internal Options The **OPTION** and **STATUS** buttons change the status of certain installed options. These options are:

Option	Displayed Icon
FED-STD-1045A or MIL-STD -188-141B ALe	ALE
Noise Blanker	NB
Voice Enhancement	OPT
Encryption	ENCR

When an option is installed in the TW7000, a corresponding icon is shown on the outer edge of the display area. The icon and the option’s current status (**ON** or **OFF**) is displayed.

To change the status of an installed option:

1. Press **OPTION** or **STATUS**. The icon of the last entered option flashes.
2. If you want a different option, press **OPTION** until the desired icon flashes.

3. Press **STATUS** to toggle between **ON** and **OFF** (or between **1**, **2**, **3**, **4**, and **OFF** in the case of the Encryption option).

If you press a button other than **OPTION** and **STATUS**, the icon stops flashing and the radio performs the function of that button. The icon also stops flashing after a time-out of 10 seconds.

RF Power Level

The **RF PWR** button allows scrolling through the **L** (low), **M** (medium), and **H** (high) power settings. Default settings for the three RF power levels are as follows.

RF Power Level	Factory Preset	ALPHA 5 Setting
L (low)	10W (average power)	10
M (medium)	25W (average power)	30
H (high)	100W (average power)	200

To change these values, refer to “Using Menus to Change Settings” on page 3-5.

Priority Channel

The **PRI** button adjusts the TW7000 to a channel defined as the priority channel. The priority channel is preset at the factory to channel 001. To change the number of the priority channel, refer to “Using Menus to Change Settings” on page 3-5.

Using Menus to Change Settings

The TW7000 provides two menus for adjusting settings. The Alpha menu provides access to the ALE submenu, which includes a set of functions for changing settings specific to the ALE option.

To access the Alpha menu:

1. Press **ALPHA** to display the first function on the menu.
2. Press the number of the desired function.
3. Press **E** to enter the selection.

Once you select and enter a function, use the arrow buttons on the keypad to scroll through any further selections within that function. Press **E** to enter a selection.

For example, press **ALPHA 17** and **E** to access the ALE submenu.

Alpha Menu

Table 3-1. Alpha Menu

ALPHA Function	Description
1	Not used
2	Not used
3	Not used
4	Not used
5	RF POWER (TX)
6	FREQ BLANK (blanks LCD frequency and disables mode changes)
7	LOCKOUT (disables frequency and mode changes
8	RECEIVE SET Rx ONLY (disables TX operation)
9	Not used
10	ALARM TIMER ON/OFF
11	SET ALARM
12	Not used
13	Not used
14	Not used
15	Not used
16	Not used
17	ALE SUBMENU (access to the ALE functions in Table 3-2)
18	RECEIVE SET Rx/Tx (activated TX operation)
19	RF POWER ATU SET (tune power set)
20	BITE TEST INITIATED
21	OPTION 1 TYPE (Voice Enhancement Modulation)
22	COM 1 BAUD (comport configuration)
23	COM 2 BAUD (comport configuration)
24	BACKLITE OUT (ON/OFF)
25	FREQ INC HZ (frequency increment from 1 Hz to 10 MHz)
26	TEST REAR PANEL I/O (factory test)
27	ENC PASSWORD (Encryption menu)
28	PTT TIMER (sets maximum PTT time)
29	PRINTER
30	CLONE RADIO
31	Not used

Table 3-1. Alpha Menu (continued)

ALPHA Function	Description
32	CW HOLD TIME
33	SPLIT SITE (2 radios: TX and RX)
34	CLARIFIER ON/OFF
35	100 CHANS

Alpha Menu Described

(5) RF POWER

For changing RF power output settings of the TW7000. The factory defaults for the three power output levels are 10, 30, and 200. To change a value:

1. Connect a power meter to the antenna connector on the rear of the TW7000. Press **RF PWR** (Figure 3-1) until the desired level (**L**, **M**, or **H**) is displayed.
2. Press **ALPHA 5** and **E**. The current power level is displayed.
3. CW key the TW7000 and scroll to the power level indicated on the power meter. When the desired power level is displayed, press **E**.
4. Adjust the other two levels in the same manner.
5. Press **E** twice to exit this mode.

(6) FREQ BLANK

Allows blanking of the display's frequency so that only the channel number is displayed. Each time you press **ALPHA 6** the selection toggles between **ON** and **OFF**.

Note: *Setting to **ON** disables the mode select buttons.*

(7) LOCKOUT

Prohibits changing any of the channel frequencies. Every time you press **ALPHA 7**, the selection toggles between **ON** and **OFF**.

Note: *Setting to **ON** disables the mode select buttons.*

(8) RECEIVE SET Rx ONLY

For making the displayed channel a receive-only channel by locking out the PTT. The status is automatically set to **ON** whenever you press **ALPHA 8**. Press **ALPHA 18** (TX) to reverse the receive-only state.

(10) ALARM TIMER

To automatically change the status of the timer from **OFF** to **ON** whenever **ALPHA 10** is pressed. In the **ON** position, you can set the alarm using **ALPHA 11**.

(11) SET ALARM Sets a time for the sounding of the internal alarm. Turn the alarm **ON** using **ALHPA 10**. Enter the year, date, hour, and minute pressing **E** after each value.

(17) ALE SUBMENU Allows you to configure the ALE system. For information about the ALE submenu and how the system is configured, refer to “ALE Submenu Described” on page 3-11.

(18) RECEIVE SET Rx/Tx

Automatically makes the displayed channel an RX and TX channel. Entering **ALPHA 8** changes the setting back to an RX channel.

(19) RF POWER ATU SET

For entering an RF power to use during the tune cycle for an external automatic antenna tuner. The factory default setting is 12. Enter a level from 0 to 33.

(20) BITE TEST INITIATED

Automatically starts the TW7000 BITE system.

(21) OPTION 1 TYPE

Allows activation of the Voice Enhancement option if the 7000VEM is installed in the option card slot. For more information, refer to “Activating Voice Enhancement” on page 3-18.

(22) COM 1 BAUD For configuring the TW7000 COM1 port if you are working from a computer. Use the arrow buttons to scroll through and enter the baud rate, data bits, stop bits, and parity.

(23) COM 2 BAUD For configuring the TW7000 COM2 port if working from a computer. Use the arrow buttons to scroll through and enter the baud rate, data bits, stop bits, and parity.

(24) BACKLITE Automatically toggles between **ON** and **OFF**.

(25) FREQ INC HZ For determining how much a frequency is increased or decreased each time you press an arrow button to change it. The default is set to 100 Hz. Available increments are 1 Hz to 10 MHz.

(26) TEST REAR PANEL I/O

For factory use only.

(27) ENC PASSWORD To access the Encryption menu for configuration, if the 7000ENCR option is installed. For detailed information, refer to the 7000-series high-level encryption operator manual (7000ENCR-MSOP).

(28) PTT TIMER Provides the ability to change the internal PTT time-out. It is set for any length of time from one second to one hour. Entering **0** sets it to **OFF** (no time-out). The default is 300 seconds.

(29) PRINTER Automatically prints complete channel information for the TW7000, if an external printer is connected.

(30) CLONE RADIO Allows the ability to clone another transceiver by downloading all frequency and channel settings.

(32) CW HOLD TIME For setting the continuous wave hold time, in msec.

(33) SPLIT SITE For configuring 2 radios: receive only (master), transmit only (slave). The receive radio controls the transmitter.

- Polling is set to **1** (**OFF**) or **2** (**ON**).
- Alarm timer sets the interval in minutes between system polling from the receiver to the transmitter.
- FP alarm activates the internal alarm when loss of communication occurs. Set to **1** (**OFF**) or **2** (**ON**).
- External alarm activates the external alarm when loss of communication occurs. Set to **1** (**OFF**) or **2** (**ON**).

(34) CLARIFIER For toggling the clarifier between **ON** and **OFF**. (Primarily for the RT7000 which does not have an off/on clarifier switch on the front panel.)

(35) 100 CHANS Supports the RAT1000 (1 kW tuner with 14 memory channels) or the RAT1000C (with 100 memory channels). Selecting this feature turns it **ON** or **OFF**.

ALE Menu

Table 3-2. ALE Submenu - ALPHA 17

ALE Function	Description
1	SCAN RATE
2	SCAN GRP (scan group)
3	TUNE GRP (tune group)
4	Rx SELCT (tune select)
5	SELF ADRS (self address)
6	SELF NAME
7	OTHR ADRS (other address)
8	OTHR NAME (other name)
9	MOD GRP (modify scan group)
10	SND SELCT (sound select)
11	SND ADRS (sound address)
12	SND LEN (sound length)
13	SND INT (sound interval)
14	CALL LIM (call limit)
15	SLF TMOUT (self time-out)
16	OTR TMOUT (other time-out)
17	AUTO FILL
18	LQA EXCNG (Link Quality Analysis exchange)
19	LQA DECAY (Link Quality Analysis decay)
20	BER THRSD (BER threshold)
21	GOLAY THD (Golay threshold)
22	ERR THRSD (error threshold)
23	MESSG OUT (message out)
24	NEW MESSG (new message)
25	MESSG IN (message in)
26	HANDSHAKE
27	NET ADRS (network address)
28	NET NAME (network name)
29	NET SLOT (network slot)
30	NET OTHER (network other)
31	SET TO
32	GET LQA
33	EXIT MENU

ALE Submenu Described

To access ALE functions, enter **ALPHA 17** from the Alpha menu. Move through the ALE menu in one of two ways:

- Press the desired function number and press **E** or
- Use the arrow buttons to scroll through the menu to the function and press **E**.

For information on placing an ALE call, refer to "Placing an ALE Call" on page 3-17. For detailed ALE operating instructions, refer to the 7000ALE Radio Control Program Operator Manual (7000ALE-MSOP).

(1) SCAN RATE — For selecting the rate at which scanning proceeds. The arrow buttons toggle between **2** and **5** channels per second. The number to the left of the scan rate refers to option 1 or option 2. Two seconds per channel is option 1 and 5 seconds per channel is option **2**.

(2) SCAN GRP — For selecting an ALE scan group (from 0 to 9). This becomes the specified scan group when using **(3) TUNE GRP** and **(9) MOD GRP**.

(3) TUNE GRP — For automatically tuning an ALE scan group (from 0 to 9). This tunes all the channels in that scan group.

(4) Rx SELCT — For selecting a receive type: **1** for normal ALE receive/transmit (**Rx/Tx**); **2** for receive only (**Rx ONLY**); or **3** for channel setup (**CH Rx/Tx**) of the RC2 software.

(5) SELF ADRS — For selecting an address number to review, change, or add for this station (from 00 to 19). To enter a new self address, enter the number. To change an existing address, scroll to the number and enter a new one.

(6) SELF NAME — For entering a new self address name for the address number selected in **(5) SELF ADRS**. Any existing address name is briefly displayed. Use the alpha characters on the keypad to enter from 3 to 15 characters (no spaces or punctuation). To delete a name enter three periods **(...)**.

(7) OTHR ADRS — For selecting an address number to review, change or add for a station where messages are sent (from 00 to 99). To enter a new other address, enter the number. To change an existing address number, scroll to the number and enter a new one.

(8) OTHR NAME — For entering a new or different name for the other address selected in **(7) OTHR ADRS**. Any existing other address is briefly displayed. Use the alpha characters on

	the keypad to enter from 3 to 15 characters (no spaces or punctuation). To delete a name enter three periods **(...)**.
(9) MOD GRP	For modifying or defining the channels to include in a scan group for scanning. Scroll to the channel to set. To include a channel in a scan group, enter **1** (**ON**). To remove a channel from a group enter **2** (**OFF**).
(10) SND SELCT	For enabling or disabling sounding. Enter **1** for sound **OFF** and **2** for sound **ON**.
(11) SND ADRS	For setting the sounding feature to the self address selected in **(5) SELF ADRS**.
(12) SND LEN	For setting the length of each sounding transmission. The recommended sounding length is 5 or 10 seconds.
(13) SND INT	For setting the time intervals for sounding. Enter from 1 minute to 24 hours (0001 to 1439 minutes).
(14) CALL LIM	For limiting the number of attempts made on each channel when trying to establish an ALE link (00 to 99).
(15) SLF TMOUT	For setting the length of time this (self) transceiver remains linked after the transmission of all outgoing messages (000-600 in 15-second intervals).
(16) OTR TMOUT	For setting the length of time the other radio remains linked when there are no incoming responses (000-600 in 15-second intervals).
(17) AUTO FILL	For indicating if you want the radio to automatically add the address of any station ALE hears to the list of approved other addresses. Enter **1** for **OFF** and **2** for **ON**, or use the arrows to toggle between **OFF** and **ON**.
(18) LQA EXCNG	For requesting that a calling or called station exchange a measurement of the link quality received on the other end. Enter **1** for **OFF** (no request) and **2** for **ON** (yes request), or use the arrows to toggle between **OFF** and **ON**.
(19) LQA DECAY	For entering the time period in which an LQA memory cell linearly decays from a state of perfect (30) to a state of dead (0). Selectable in periods of 0, 1, 2, 4, or 8 hours.

(20) BER THRSD For entering the acceptable bit error rate threshold (00 to 48) for received ALE words. A threshold of 00 allows for no errors while a threshold of 48 is the maximum amount of allowable errors. The factory default is set to 48 allowable errors.

(21) GOLAY THD For controlling the error correcting capability threshold (0 to 4). A value of 0 allows for no corrections while a value of 4 is the maximum amount of corrections allowable. The factory default is set to 3 allowable errors.

(22) ERR THRSD For controlling the number of errors allowed before a word is rejected (0 to 4). A value of 0 allows for no errors while a value of 4 is the maximum amount of errors allowable. The factory default is set to 3 allowable errors.

(23) MESSG OUT For assigning a number to an outgoing message (from 0 to 9). Enter a new assigned number or an existing number to review or change. To enter a new or different message, use **(24) NEW MESSG**.

(24) NEW MESSG For creating a new outgoing message for the number assigned in **(23) MESSG OUT**. Any existing message is briefly displayed. Use the alpha characters on the keypad to create a new message up to 90 characters.

(25) MESSG IN For selecting an incoming message for review (from 0 to 9). Messages are deleted when a tenth message is received.

(26) HANDSHAKE For setting the message exchange compatibility with other radios. Enter **1** for **NO Tx,** or **2** for **NO Rx**.

(27) NET ADRS For assigning a number to a network address. Enter a new number or an existing number to review or change. To enter a new or different address name, use **(28) NET NAME**.

(28) NET NAME For entering a new network address for the number assigned in **(27) NET ADRS**. The address you last entered is briefly displayed. Use the alpha characters on the keypad to enter up to 15 characters. To delete a name enter three periods (**...**).

(29) NET SLOT For assigning network timing slots to stations for network call responses (01-16). You must set **(27) NET ADRS** and **(28) NET NAME** first.

(30) NET OTHER	For indicating whether a station is part of the network or not. Scroll to find and display the ID number of the station. Enter **1** for **ON** (part of the network) or **2** for **OFF** (not part of the network).
(31) SET TO	For selecting a Other station (address) to determine it's LQA score for each of its channels. Applies to radios with software version 701BD or later. Use the up and down arrow buttons on the keypad to scroll through the Other Addresses until the desired other station is found. Or, enter the number using the keypad. Press **E** to enter the selection (the Other ID and Other Address line goes blank). To view the LQA score for each channel for that address, select **(32) GET LQA**.
(32) GET LQA	For viewing the LQA score of the channels for the Other Address selected using **(31) SET TO**. The radio displays the LQA score for the first channel of the selected address. There are two score positions for each channel. The first score position is an analysis of the Other address by this radio with a range of 1 to 9. The second score position is an analysis of this radio with a possible range of 1 to 9. Scroll through the channels to view their scores.
(33) EXIT	Exits the ALE Submenu.

Programming Channels and Frequencies

The TW7000 associates a frequency, mode, clarifier status, and offset value (if on) to each channel number. These can be different for each channel and you can view them whenever you enter that channel number. Once frequencies are set to channels, you can assign channels to scan groups.

Note: *Scan groups are defined by channel number, not by frequency. Changing the frequency of a channel also changes the frequency of that channel within each scan group.*

Selecting a Channel and Scrolling

1. Press **C**.
2. Enter the desired 3-digit channel number.
3. Press **E**. The channel number with its frequency and the clarifier offset is displayed.
4. Use the arrows on the keypad to scroll through the channel numbers.

Entering a Channel Frequency

The TW7000 accepts transceiver frequencies that range from 0.100000 MHz to 30.000000 MHz in the receive mode and 1.6 MHz to 30.000000 MHz in the transmit mode. Simplex operation uses identical RX and TX frequencies and must be in the transmit mode range. Enter semi-duplex (split frequency) as an RX frequency first and then as a TX frequency. If you enter a frequency that is out of range, an error message is displayed and the previous frequency restored.

When you enter a frequency, always include the decimal point unless there are all zeros after the decimal point. You do not need to enter leading or trailing zeros.

Entering a frequency between 0.100000 MHz and 1.6 MHz in the simplex mode makes the radio receiver-only (PTT inhibited).

Entering a Simplex Frequency

Follow the steps below to select a channel and assign a new frequency:

1. Press **C** and enter the 3-digit channel number.
2. Press **E**.
3. Press **F** and enter the frequency in MHz, including the decimal point.
4. Press **E**. The channel number updates with the new frequency.

Example: To change the frequency of channel 041 from 13.330000 MHz to 8.572000 MHz:

1. Press **C** and **041** and **E**.

   Display: **CH FREQ**
   041 13.330000 MHz
   Rx

2. Press **F** and **8.572** and **E**.

   Display: **CH FREQ**
   041 8.572000 MHz
   Rx

Entering a Semi-duplex Frequency

Follow the steps below to select a channel and assign a new frequency:

1. Press **C** and enter the 3-digit channel number.
2. Press **E** and **F**.

   Display: **xx. xxx, xxx**
   Rx

3. Enter the receive frequency.
4. Press **F** again.

   Display: **xx. xxx, xxx**
   Tx

5. Enter the transmit frequency and press **E**. The new channel frequency is displayed.
6. Press **F** to toggle between the receive and transmit frequencies.

Example: To enter an RX frequency of 21.2 MHz and a TX frequency of 29.3 MHz on channel 41:

1. Press **C** and **41** and **E**.

   Display: **CH FREQ**
   041 xx.xxx,xxx (where xx.xxx,xxx is the existing channel frequency)

2. Press **F** and **21.2**.

   Display: **041 21.200000**
   Rx

3. Press **F** and **29.3** and **E**.

   Display: **041 29.300000**
   Tx

Note: *If you enter any numbers after pressing **F**, the existing frequency changes.*

Assigning RX Only Channels

To automatically limit a channel to a receive-only operation, enter **ALPHA 8**. To convert the channel back to a standard RX/TX channel, enter **ALPHA 18**.

Change a displayed frequency by pressing **F** and using the up arrow button to increase the frequency and the down arrow button to decrease the frequency. Press **E** to store the new frequency in channel memory.

Note: *The default frequency increment is 100 Hz for scrolling. To change this increment, access **ALPHA 25**.*

Using the Manual Channel

The manual channel allows you to create frequencies without worrying about over-writing a frequency on another channel. This channel is defined as channel 000. Frequency settings on the manual channel can be copied to a fixed channel.

To copy the channel 000 data to another channel:

1. Press **C** and enter the 3-digit channel number to indicate where data is stored.
2. Press **C** and **E**. This copies data from the manual channel to the new channel. Data is retained in the manual channel.

Placing an ALE Call

The ALE option automatically selects frequencies that support communication traffic between stations in a network. This section does not cover the ALE option in detail. For detailed instruction on ALE operations, refer to the 7000ALE Radio Control Program Operator Manual (7000ALE-MSOP).

To initiate an ALE call:

1. Press **OPTION** until the **ALE** icon flashes.
2. Press **STATUS** to turn the option **ON**.
3. Press **CALL**.
4. Scroll to find the desired calling option:
   THIS IS: Creates a link, exchanges messages, and remains linked.
   THIS WAS: Creates a link, exchanges messages, and then terminates the link.
   RE-LINK: Automatically chooses the best possible channel using the information from a prior **THIS IS** call.
   POLLING: Automatically completes a **THIS WAS** call on each of the scan group channels. Link quality information is recorded for each channel.
5. Press **CALL** to make the selection.
6. Scroll to the type of call to make: **INDIVIDUAL** or **NET**. Press **CALL** to make the selection.

   Display: **To:xx nnnn** (where xx is the destination address number and nnnn is the address name)
7. Scroll to the destination address.
8. Press **CALL**.

   Display: **FR-xx** (where xx is the self address number)
9. Scroll to display the self address.
10. Press **CALL**.

    Display: **AMD message** (Automatic Message Display)
11. Scroll to an existing message number, or select **NO AMD MSG** if you are not sending a message.

    Note: *To create a message, refer to the ALE submenu, function 24.*
12. Press **CALL** to attempt the ALE call.

    Display: **ALE LINK xxx** (where xxx is the channel selected)

    If you press **CALL** immediately after the message is sent, the call terminates and **CALL TERM** is displayed.

13. To initiate an ALE call to the last station with an established link, press **SEND**.

    Before attempting another call, terminate the previous link.

Note: *If the link quality on a **THIS IS** call is poor, press **CALL** immediately to end it. Press **CALL** again and select **RE-LINK**. Press **CALL** a third time and the TW7000 tries the link again using the second best channel. Repeat this for subsequent channels until the link quality is acceptable.*

Activating the Noise Blanker

The Noise Blanker option (7000NB) eliminates impulse-type interference in high-noise environments.

1. Press **OPTION** until the **NB** icon flashes.
2. Press **STATUS** to turn the option **ON**.

Activating Encryption

The Encryption option (7000ENCR) provides high-level security.

1. Press **OPTION** until the **ENCR** icon flashes.
2. Press **STATUS** to toggle between **1** and **OFF**. The **1** position turns the Encryption option on.

For detailed information on this security option, refer to the 7000-Series High-Level Encryption Operator Manual (7000ENCR-MSOP).

Activating Voice Enhancement

The DSP-based Voice Enhancement option (7000VEM) suppresses various types of noise and interference on voice communications.

The 7000VEM has two modes of operation. Mode 1 is for adaptive peaking and reduces atmospheric noise and static normal with HF signals. Mode 2 adds the ability to remove man-made interferences like ignition and power line noises.

1. Press **OPTION** until the **OPT** icon flashes.
2. Press **STATUS** to turn the option **ON**.
3. Press **ALPHA 21** and **E**.

   Display: **OPTION 1**
   TYPE x (briefly displays last mode entered)

4. Enter the mode (**1** or **2**) for this transceiver and press **E**.

Note: *The LCD will display **OPT 1 MODULE** during start-up.*

CHAPTER 4
SERVICING

Detailed servicing information is beyond the scope of this manual and only experienced personnel should make adjustments or attempt any serious service work. Reference to the TW7000-MS technical manual is essential.

The TW7000 is of modular construction. If spare boards are available, non-technical personnel are able to repair most faults in the field. It is strongly recommended that non-technical personnel receive instruction from experienced technicians in the replacement of boards.

The TW7000 has a BITE system that aids in troubleshooting down to the individual board level. When a fault occurs, a BITE fault message is displayed indicating the specific board affected. The BITE runs automatically on power up or whenever Alpha 20 is selected.

Routine Maintenance

The TW7000 normally requires no periodic maintenance except to check the calibration of the master oscillator. It is often convenient to program an unused channel to a known frequency standard such as WWV (radiates 10,000W on 5, 10 and 15 MHz). This enables regular checks of the frequency calibration.

Keep the exterior of the TW7000 clean by wiping it with a damp cloth, and polishing it with a soft dry cloth. Be sure all knobs are secure and connectors tight. When the TW7000 is opened, make sure coaxial connectors are tight and board connectors firmly in place. Remove any dirt or dust using compressed air.

Board Access and Replacement

The top and bottom covers are each retained by six screws. After removal of the retaining screws, lift the covers off the TW7000. For board locations, refer to Figure 4-1 on page 4-2

CAUTION: When the transmitter is operating, high RF voltages are present on the power amplifier and filter boards. Use caution as these RF voltages can cause burns.

All boards, with the exception of the power amplifier, filter, and front panel, are plug-in board assemblies and are easily accessible from the top of the radio.

The front panel assembly is attached to the TW7000 with two screws and a single-ribbon cable.

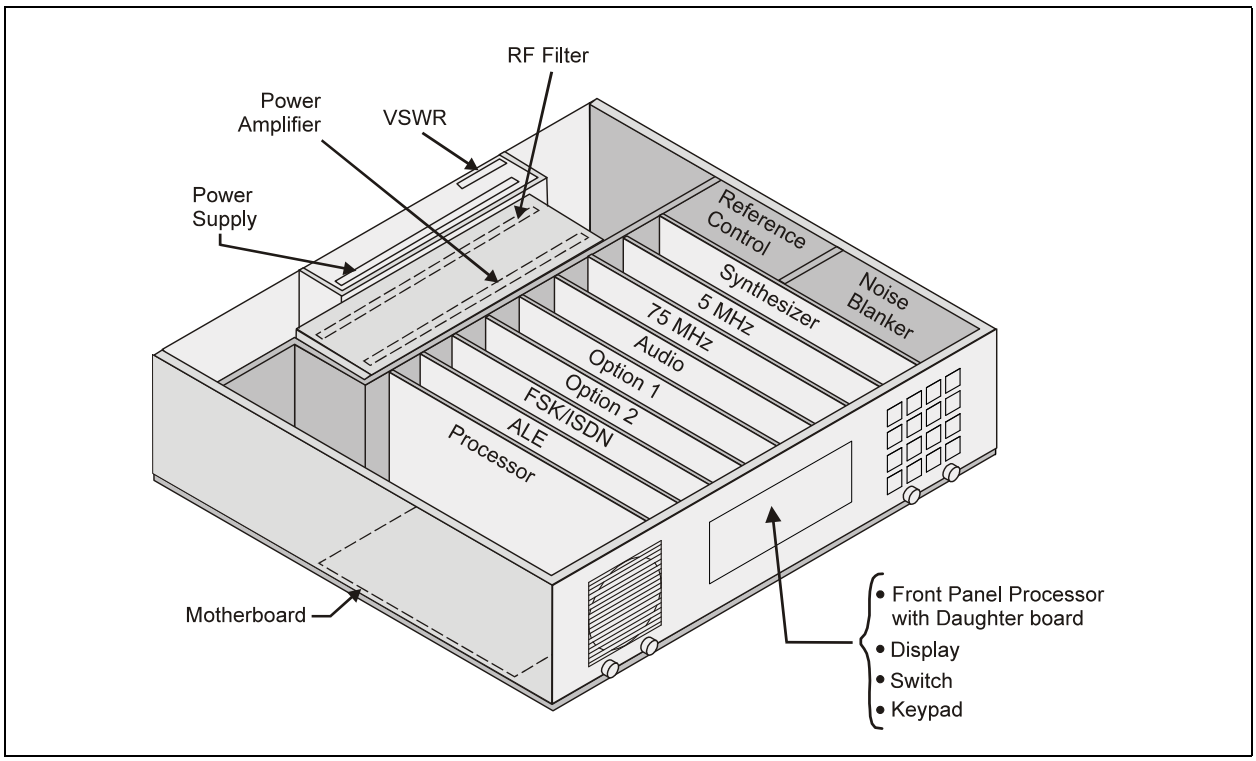


Figure 4-1. Board Locations

Field Level Servicing

The transceiver BITE system is designed to identify a faulty board. Feedback is presented on the front panel display. In a matter of minutes, the radio can be opened up, the faulty board removed, and a new one inserted. For detailed technical information, refer to the TW7000 technical manual (TW7000-MS).

Part Number	Description
004-00100 001-01111	Front Panel Processor Front Panel Daughter board
001-00201	VSWR detector
001-00206	Reference/Control board
001-00311	RF Amplifier board
001-00320	RF Filter board
001-00410	Power Supply
001-00600	Audio board
001-00710	75 MHz IF board
001-00800	5 MHz IF board

Part Number	Description
001-00901	Synthesizer board
001-01105 001-01107	Processor board with 7000ALE Processor board (no ALE)
001-01302	Carrier board with 7000ALE-141B option
001-01200	Squelch board

Datron offers the following maintenance tools to facilitate servicing the TW7000.

Part Number	Description
TW7000TK	Tool kit with card puller
SMTRK	Surface mount technology tool kit
7000EXT	Extender board kit and card puller