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**MTR 2000™**  
**Station/Repeater/Receiver**

**Product Planner and Ordering Guide**

**R4-2-97B**

**November, 1997**



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# MTR2000™ Station Overview

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## Introduction

The Motorola MTR2000™ Base Station/Repeater/Receiver provides a modular, flexible analog station design for today's communication systems and those of the future. The stations are available for use in Conventional, SmartNet, and SmartZone Analog systems as well as regional system applications such as ArcNet and MPT1327. Also, the MTR2000™ station design allows for upgrades within systems through hardware and/or software to avoid total infrastructure replacement.

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## MTR2000™

The MTR2000™ station provides synthesized frequency generation in the VHF, 350 MHz, UHF, 800 MHz and 900 MHz FM bands and is rated for continuous duty operation over temperatures ranging from -30°C to +60°C, exceeding EIA/TIA requirements. *Note: The 350 MHz band will NOT be FCC or ETS certified.*

The MTR2000™ station utilizes 5.25" H x 19" W x 16.5" D (133 x 483 x 419 mm) of space to house the power amplifier, exciter, power supply, control, wireline, and receiver modules. The entire station weighs only 40 pounds (19 kg) not including a cabinet or other peripheral equipment. The station ships standard in specially designed shipping box for mounting in a customer-procured EIA/TIA standard 19" cabinet or open rack. The station can also be shipped with cabinet mount or modular rack mount configurations.

The station is divided into functional modules that separate the frequency band specific and transmitter power specific circuits from other circuits and has separate modules for control and wireline interface. These modules are self-contained functional blocks with module-specific alarms. This design facilitates the field replaceable unit (FRU) concept of field repair to maximize system up-time.

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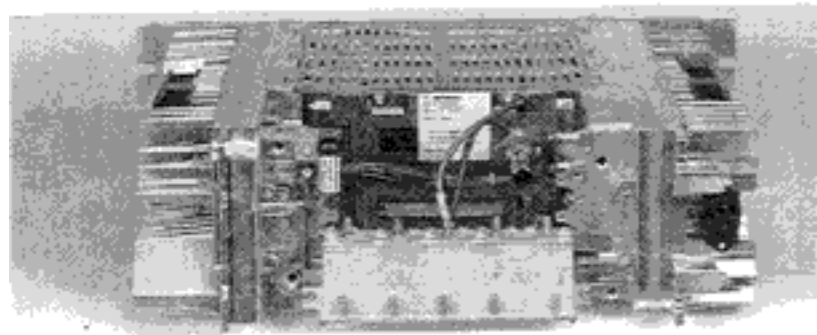
## MTR2000™ Station Overview (Continued)

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### MTR2000™ Graphic



Front View



Rear View

MTR2000™ Station  
UHF (403-470 MHz)  
100 Watts

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## Features

### Conventional Model

The standard MTR2000™ model (T5544-RNSG or T5766-RPG), ships configured for analog conventional operation when ordered with the X597 System Software Option. Additional parameters are selected through the Radio Service Software on a per-channel basis, based on the modulation type selected during station configuration.

The following are standard features:

- Continuous Duty Cycle Operation
- Synthesized Frequency Generation
- Two Type N Female Antenna Connectors
- 2/4 Wire Audio (Can be configured with the Radio Service Software)
- 1.5 PPM Frequency Stability on VHF/UHF
- 1.0 PPM Frequency Stability on 350/800/900 MHz
- External Reference Capability
- Crossband Operation
- Capable of NPSPAC Frequencies
- Switching Power Supply to operate over a wide range of voltages (from 85-264 VAC) and frequencies (47-63 Hz)
- Station Diagnostic Tests—Fixed Set of Tests Factory run upon Start-up and Reset

Optionally, the MTR2000™ station may be configured with:

- European/South African/Australian Wireline Interface
- Single Internal Circulator PA protection from transmitter intermodulation and antenna mismatch (standard on 100/75 Watt High Power PA)
- Double Internal Circulator PA protection from transmitter intermodulation and antenna mismatch (standard on 30 Watt Low Power PA)
- DC only power supply
- Additional RF Peripherals
- MRTI Interface
- Wild Card Programming
- Multi Coded Squelch Interface

In addition, the following features are included. These features ship in a preset condition, but may be altered through the use of Radio Service Software.

- 32 Tx/Rx Frequencies—Factory Programmed with 1 Tx, 1 Rx (Base Stations)  
Note: Remote control access is limited by TRC capabilities.
- 12.5 kHz or 25 kHz Operation—Factory Programmed to 12.5 kHz  
Note: The FCC requires that 900 MHz is used at 12.5 kHz only
- 1 Tx and 1 Rx (PL or DPL) Squelch Code per channel—Factory Programmed to CSQ
- Base Station Identification (BSI)—Factory Programmed as BLANK
- Repeater Time-Out-Timer—Factory Programmed to 60 sec
- Wireline Time-Out-Timer—Factory Programmed to 120 sec
- Push-To-Talk Priority—Factory Programmed to W>R>L
- Repeater Drop-Out-Delay—Factory Programmed to 2 seconds

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## Features (Continued)

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**Receiver Model** The MTR2000™ Analog Receiver model (T5731-RNSG or T5769-RPG) ships configured for analog conventional operation when ordered with the X597 System Software Option. Receiver personality and parameters are selected through the Radio Service Software on a per-channel basis, based on the modulation type selected during receiver configuration.

The following are standard features:

- Synthesized Frequency Generation
- One Type N Female Antenna Connector
- 2/4 Wire Audio (Can be configured with the Radio Service Software)
- 1.5 PPM Frequency Stability on VHF/UHF
- 1.0 PPM Frequency Stability on 350/800/900 MHz
- Switching Power Supply to operate over a wide range of voltages (from 85-264 VAC) and frequencies (47-63 Hz)
- Receiver Diagnostic Tests—Fixed Set of Tests Factory run upon Start-up and Reset
- Capable of NPSPAC Frequencies

Optionally, the standard receiver may be configured:

- European/South African/Australian Wireline Interface.
- DC only power supply
- Additional RF Peripherals
- Wild Card Programming
- Multi Coded Squelch Interface

In addition, the following features are included. These features ship in a preset condition, but may be altered through the use of Radio Service Software.

- 32 Rx Frequencies—Factory Programmed with 1 Rx
- Note: Remote control access is limited by TRC capabilities.
- 1 Rx (PL or DPL) Squelch Code per channel – Factory Programmed to CSQ
- 

### **6809 Trunked Models**

The MTR2000 Station/Receiver ships with 6809 trunking capability when ordered with X997-Smartnet operation, or X51-SmartZone operation. This allows the station to operate in the following trunking applications:

- |                          |                              |
|--------------------------|------------------------------|
| • SmartNet Operation     | • SmartZone Operation        |
| • Privacy Plus Operation | • Telephone Interconnect     |
| • 6809 Controller        | • Console Priority Interface |

Trunked models ship with the same standard features as the conventional model and must be field programmed with the Radio Service Software. All trunked stations ship standard with a 25 foot trunking cable for connection to the Central Controller. Options are available to increase the cable length to 50, 75 or 100 feet.

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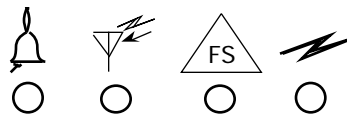
# Diagnostics

## MTR2000™ Diagnostics

Diagnostic tests are available for the station control, wireline, exciter, power amplifier, and receiver. If a problem occurs during station operation, it is logged as an alarm that is read with Radio Service Software (RSS). The station operator can then evaluate the problem. The station will maintain an Alarm Log with the name of the diagnostic test that has failed and the time since the last power up. The alarm log will contain the last 100 alarms and the number of times the particular test has failed since power up. The alarm messages will identify the module that failed along with the fault condition.

## Front Panel Status Indicators

The front panel of the MTR2000™ Station contains 4 LED displays which are designed to easily show the functional status of the station. Front panel indicators will identify alarm levels to service personnel. The station has been designed for modular service and repair. Customers can purchase spare modules (Field Replaceable Units) if desired. Please refer to the price pages for the part numbers for spare modules and kits. Due to the high percentage of parts that are surface mounted, board level repairs be handled at the System Support Center in Schaumburg, Illinois or other appropriate System Support Centers Worldwide.



Label	LED Color	Status	Condition
Status	Off		No Power Present
	Green	On	Station Operating Normally
	Green	Flashing	Station is in Service Mode
	Red	Flashing	Station Operational but Not Fully Functional - Minor Failure
	Red	On	Station Not Operational - Major Failure
	Green/Red	Flashing	Station in Bootloader Mode
RX On	Green	One	Receive Mode, Receiver Active
Failsoft	Yellow	Flashing	Trunked Failsoft Mode
PA Key	Green	On	Transmit Mode, PA Keyed
	Green	Flashing	PA Keyed, Transmit Power reduced due to Fault

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# Specifications

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## Specification Definitions

Listed alphabetically are the definitions of some of the specifications described above. Information on whether the preferred specification would be smaller or larger is also given. The name given in brackets { } is the terminology as defined by the new EIA / TIA document 603.

- (1) Audio Distortion (Percent/%)—A measure of accuracy of reproducing the original signal. Applies to transmitter and receiver. The benefit is clearer audio reception. The preferred specification is smaller.
- (2) Audio Response (Decibels/dB)—Accuracy of reproduction of high and low frequency signals. Applies to transmit and receive. An audio bandwidth should also be given to say at what frequency the +/- dB pertains, or the specification will have no meaning. The preferred specification is closer to zero.
- (3) Bandwidth: As it applies to T-T or R-R (Megahertz/MHz) – The maximum frequency separation from the lowest to the highest frequency without degradation of specifications. The preferred specification for multi-channel radios should be wide enough to include all the channels that are used, depending upon the application.
- (4) Bandwidth: As it applies to T-R Spacing (Megahertz/MHz)—The specified frequency separation between the transmitter and receiver is band dependent. The preferred specification is generally smaller, although it depends upon the specific customer requirements.
- (5) FM Hum and Noise (Decibels/dB)—The level of the audio signal with respect to the background noise or hiss present in the audio. Applies to the transmitter or receiver. The preferred specification is larger.
- (6) Frequency Stability (+/-% OR parts per million/ppm OR parts per billion/ppb) – The ability to stay on the assigned frequency over a temperature range of -30° to +60°C. The benefit is increased coverage, less interference and reduced background noise. The preferred specification is smaller, which implies a greater stability.
- (7) Harmonic Emissions (Negative Decibels/-dBc)—Similar to spurious outputs (described below); multiples of the frequency of the final power amplifier (transmitter). The benefit is reduced interference to nearby radios. The preferred specification is more negative.
- (8) Isolation {Intermodulation Attenuation} (Decibels/dB)—Reduces transmitter intermodulation by preventing undesired signals from entering into the transmitter's PA. This is accomplished by using circulators or isolators. The preferred specification is larger. This specification is especially important at dense sites.

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## Specifications (Continued)

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**Specification  
Definitions**

- 9) Off-Channel Acceptance {Signal Displacement} Bandwidth (OAB) (Kilohertz/kHz)—Amount the signal can be off the tuned frequency and still be received. The preferred specification is larger and must be at least as good as the frequency stability of the transmitting subscriber units.
- 10) Rated System Deviation (RSD)—Typically defined by the channel spacing. For example, for 25 kHz channel spacing is equivalent to an RSD of 5 kHz.
- 11) Receiver Intermodulation/IMR (Decibels/dB)—Mixing of undesired signals which interferes with the desired signal. This is important if the R-R bandwidth is large. The benefit is less interference. The preferred specification is larger.
- 12) Selectivity {Adjacent Channel Rejection} (Decibels/dB)—Ability of the receiver to detect the desired signal, while rejecting signals on adjacent channels. The benefit is less interference. The preferred specification is larger. Effective system performance may be limited by the interfering subscriber units' transmitter noise.
- 13) Sensitivity (Microvolts/ $\mu$ V)—The ability of the receiver to detect and amplify weak signals. The benefit is increased coverage. 12 decibels SINAD is the threshold for intelligible voice communications. 20 decibels quieting point is the amount of signal without voice modulation required to quiet or reduce background noise by 20 dB. In 1982, EIA/TIA changed its standard to SINAD because it is a more accurate measurement. The preferred specification is smaller.
- 14) Spurious Outputs (Negative Decibels/-dBc)—Undesired transmitter output signals. The benefit is reduced interference with other radios nearby. The preferred specification is more negative.
- 15) Spurious (Image) Response (Decibels/dB)—Ability of the receiver to reject certain types of undesired or interfering signals related to the operating frequency. The preferred specification is larger.

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## Specifications (Continued)

### General Specifications

Following are the MTR2000™ Specifications, as measured per the revised EIA/TIA 603 Standards:

GENERAL SPECIFICATION	MTR2000™ VHF	MTR2000™ 350 MHz	MTR2000™ UHF	MTR2000™ 800 MHz	MTR2000™ 900 MHz
Tx Sub-band Range High Power	132-154/150-174 MHz	NA	403-435/435-470 MHz	851-870 MHz	935-941 MHz
Tx Sub-band Range Low Power	132-174 MHz	335-405 MHz	403-470 MHz	NA	NA
Rx Range Wideband Electronic Preselector	132-174 MHz	335-405 MHz	403-470 MHz	806-825 MHz	896-915 MHz
Rx Sub-band Range Narrow Preselector	132-154/150-174 MHz	NA	403-435/435-470 MHz	NA	NA
Number of Channels	32	32	32	32	32
Channel Spacing	30 kHz/25 kHz/12.5 kHz	25 kHz/12.5 kHz	25 kHz/12.5 kHz	25 kHz/12.5 kHz	12.5 kHz
Frequency Generation	Synthesized	Synthesized	Synthesized	Synthesized	Synthesized
Power Supply Type	Switching	Switching	Switching	Switching	Switching
Power Supply Input Voltage	85-264 VAC	85-264 VAC	85-264 VAC	85-264 VAC	85-264 VAC
Power Supply Input Frequency	47-63 Hz	47-63 Hz	47-63 Hz	47-63 Hz	47-63 Hz
DC Only Operation (Full Power)	14.2V (1-40W, 1-30 W) 28.6V (25-100W)	14.2V (2-40W)	14.2V (2-40W, 2-30 W) 28.6V (25-100W)	28.6V (20-75W)	28.6V (20-75W)
DC Revert Operation	14.2V (1-40W, 1-30 W) 28.6V (25-100W)	14.2V (2-40W)	14.2V (2-40W, 2-30 W) 28.6V (25-100W)	28.6V (20-75W)	28.6V (20-75W)
T/R Separation (With Duplexer)	1.5 MHz	NA	5 MHz	45 MHz	39 MHz
External Reference Input Impedance Voltage	50 1 V p-p	50 1 V p-p	50 1 V p-p	50 1 V p-p	50 1 V p-p
Temperature Range (Ambient)	-30°C to 60°C	-30°C to 60°C	-30°C to 60°C	-30°C to 60°C	-30°C to 60°C

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## Specifications (Continued)

### MTR2000™ Transmitter Specifications

TRANSMITTER SPECIFICATION	MTR2000™ VHF	MTR2000™ 350 MHz	MTR2000™ UHF	MTR2000™ 800 MHz	MTR2000™ 900 MHz
Power Output	1-30W, 1-40W 25-100W	2-40W	2-30W, 2-40W 25-100W	20-75W	20-75W
Electronic Bandwidth	Full sub-band	Full sub-band	Full sub-band	Full sub-band	Full sub-band
Isolation Internal Circulator External Circulator Internal + External Circ	40 dB 70 dB 70 dB	No Circulators offered with 350 MHz	40 dB 70 dB 70 dB	40 dB 70 dB 70 dB	40 dB 70 dB 70 dB
Spurious and Harmonic Emissions Attenuation	-85 dBc	-85 dBc	-85 dBc	-80 dBc	-80 dBc
Deviation 25/30 kHz 12.5 kHz	±5 kHz ±2.5 kHz	±5 kHz ±2.5 kHz	±5 kHz ±2.5 kHz	±5 kHz ±2.5 kHz	NA ±2.5 kHz
Line Audio	-20 dBm to 0 dBm variable	-20 dBm to 0 dBm variable	-20 dBm to 0 dBm variable	-20 dBm to 0 dBm variable	-20 dBm to 0 dBm variable
Audio Response 300-3000 Hz referenced to 1000 Hz at line input.	+1, -3 dB from 6 dB per octave preemphasis.	+1, -3 dB from 6 dB per octave preemphasis.	+1, -3 dB from 6 dB per octave preemphasis.	+1, -3 dB from 6 dB per octave preemphasis.	+1, -3 dB from 6 dB per octave preemphasis.
Audio Distortion	Less than 3% @ 1000 Hz @ 60% RSD	Less than 3% @ 1000 Hz @ 60% RSD	Less than 3% @ 1000 Hz @ 60% RSD	Less than 3% @ 1000 Hz @ 60% RSD	Less than 3% @ 1000 Hz @ 60% RSD
FM Hum and Noise for 1 kHz tone @ 60% RSD with 750 µs deemphasis (300 to 3000 Hz Bandwidth) Wireline Output 25/30 kHz 12.5 kHz	50 dB nominal 45 dB nominal	45 dB nominal 45 dB nominal	50 dB nominal 45 dB nominal	50 dB nominal 45 dB nominal	NA 45 dB nominal
Frequency Stability	1.5 PPM External Reference Optional	1.0 PPM External Reference Optional	1.5 PPM External Reference Optional	1.0 PPM External Reference Optional	External Reference Required
RF Output Impedance	50	50	50	50	50

Continued on next page

## Specifications (Continued)

### MTR2000™ Receiver Specifications

RECEIVER SPECIFICATION	MTR2000™ VHF	MTR2000™ 350 MHz	MTR2000™ UHF	MTR2000™ 800 MHz	MTR2000™ 900 MHz
IF Frequencies (1st, 2nd)	44.85 MHz/ 450 kHz	73.35 MHz/ 455 kHz	73.35 MHz/ 455 kHz	73.35 MHz/ 455 kHz	73.35 MHz/ 455 kHz
Electronic Preselector Bandwidth	42.0 MHz	70.0 MHz	67.0 MHz	19.0 MHz	19.0 MHz
Narrow Preselector Bandwidth	4.0 MHz	NA	4.0 MHz	NA	NA
Sensitivity 12 dB Sinad 30 kHz 25 kHz 12.5 kHz	0.35 µV 0.35 µV 0.35 µV	NA 0.35 µV 0.35 µV	NA 0.35 µV 0.35 µV	NA 0.35 µV 0.35 µV	NA NA 0.35 µV
Sensitivity 20 dBQ	0.50 µV	0.50 µV	0.50 µV	0.42 µV	0.42 µV
Selectivity 30 kHz 25 kHz 12.5 kHz	80 dB 80 dB 75 dB	80 dB 75 dB	80 dB 75 dB	80 dB 70 dB	NA 70 dB
Intermodulation Rejection 30 kHz 25 kHz 12.5 kHz	85 dB 85 dB 80 dB	82 dB 79 dB	85 dB 80 dB	85 dB 85 dB	NA 85 dB
Spurious and Image Rejection with High Performance Narrow Preselector	90 dB	NA	90 dB	NA	NA
Spurious and Image Rejection with Electronic Preselector (Nominal Values)	85 dB	85 dB	85 dB	90 dB	90 dB
Off Channel Acceptance	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz
Wireline Output	-20 dBm to 7 dBm, 1 kHz tone	-20 dBm to 7 dBm, 1 kHz tone	-20 dBm to 7 dBm, 1 kHz tone	-20 dBm to 7 dBm, 1 kHz tone	-20 dBm to 7 dBm, 1 kHz tone

Continued on next page

## Specifications (Continued)

### Receiver Specifications, Continued

RECEIVER SPECIFICATION	MTR2000™ VHF	MTR2000™ 350 MHz	MTR2000™ UHF	MTR2000™ 800 MHz	MTR2000™ 900 MHz
Audio Response	+1, -3 dB from 6 dB / octave deemphasis. 300-3000 Hz referenced to 1000 Hz at line output.	+1, -3 dB from 6 dB per octave deemphasis. 300-3000 Hz referenced to 1000 Hz at line output.	+1, -3 dB from 6 dB per octave deemphasis. 300-3000 Hz referenced to 1000 Hz at line output.	+1, -3 dB from 6 dB per octave deemphasis. 300-3000 Hz referenced to 1000 Hz at line output.	+1, -3 dB from 6 dB per octave deemphasis. 300-3000 Hz referenced to 1000 Hz at line output.
Audio Distortion	3 % 1000 Hz @ 60% RSD	3 % 1000 Hz @ 60% RSD	3 % 1000 Hz @ 60% RSD	3 % 1000 Hz @ 60% RSD	3 % 1000 Hz @ 60% RSD
FM Hum and Noise for 1 kHz tone @ 60% RSD with 750 μs deemphasis (300 to 3000 Hz Bandwidth) Wireline Output: 25/30 kHz 12.5 kHz	50 dB nominal 45 dB nominal	50 dB nominal 45 dB nominal	50 dB nominal 45 dB nominal	50 dB nominal 45 dB nominal	NA 45 dB nominal
Frequency Stability	1.5 PPM External Reference Optional	1.0 PPM External Reference Optional	1.5 PPM External Reference Optional	1.0 PPM External Reference Optional	External Reference Required
RF Input Impedance	50	50	50	50	50

### Input Power (Varies with Options)

Power Output	AC Line 117V/220V		14 VDC		28 VDC	
	Standby	Transmit	Standby	Transmit	Standby	Transmit
<b>VHF</b>						
40/30 Watt	0.5A/0.3A	2.3A/1.3A	1.7A	11.5A	--	--
100 Watt	0.6A/0.4A	4.5A/2.5A	--	--	1.0A	11.5A
<b>350 MHz</b>						
40 Watt	0.5A/0.3A	2.4A/1.3A	1.5A	9.0A	--	--
<b>UHF</b>						
40/30 Watt	0.5A/0.3A	2.4A/1.3A	1.7A	8.5A	--	--
100 Watt	0.6A/0.4A	5.4A/2.9A	--	--		
<b>800 MHz</b>						
75 Watt	0.5A/0.25A	4A/2A	--	--	1A	11A
<b>900 MHz</b>						
75 Watt	0.5A/0.25A	4A/2A	--	--	1A	10A

Continued on next page

Specifications (*Continued*)

**Dimensions and Weights**

<b>Measurement</b>	<b>MTR2000™ Station/Receiver</b>	
Exact Dimensions	<b>Station Only :</b>	5.25" H x 19" W x 16.5" D 133 mm x 483mm x 419 mm
Weight	<b>Station Only:</b>	40 lbs/19 kg
Modular Rack Dimensions	<b>30" Modular Rack:</b>	30" H x 22" W x 20" D 762 mm x 559 mm x 508 mm
	<b>45" Modular Rack:</b>	45" H x 22" W x 20" D 1143 mm x 559 mm x 508 mm
	<b>52" Modular Rack:</b>	52" H x 22" W x 20" D 1321 mm x 559 mm x 508 mm
Modular Rack Weight	<b>30" Modular Rack:</b>	52 lbs (24 kg)
	<b>45" Modular Rack:</b>	59 lbs (27 kg)
	<b>52" Modular Rack:</b>	61 lbs (28 kg)
Cabinet Dimensions	<b>30" Indoor Cabinet:</b>	30" H x 22" W x 20" D 762 mm x 559 mm x 508 mm
	<b>46" Indoor Cabinet:</b>	46" H x 22" W x 20" D 1168 mm x 559 mm x 508 mm
	<b>60" Indoor Cabinet:</b>	60" H x 22" W x 20" D 1524 mm x 559 mm x 508 mm
Cabinets Weight	<b>30" Indoor Cabinet:</b>	66 lbs (30 kg)
	<b>46" Indoor Cabinet:</b>	75 lbs (34 kg)
	<b>60" Indoor Cabinet:</b>	102 lbs (46 kg)
Duplexer Dimensions	<b>VHF:</b>	5.25" H x 17" W x 18" D 133 mm x 431 mm x 451 mm
	<b>UHF:</b>	5.25" H x 17" W x 10.5" D 133 mm x 431 mm x 265 mm
	<b>800 MHz:</b>	3.5" H x 15" W x 5.5" D 89 mm x 374 mm x 140 mm
	<b>900 MHz:</b>	3.5" H x 15" W x 5.75" D 89 mm x 374 mm x 140 mm
External Dbl Circ Dimensions	<b>All Available Bands:</b>	3.5" H x 10.33" W x 5.25" D 89 mm x 262 mm x 132 mm

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# Technical Station Description

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## **Station Overview**

The MTR2000™ station houses an entire station in just 3 rack units (5.25" or 133 mm). Key station modules can be easily located on the MTR2000™ Station. On either station side are the Power Supply and Power Amplifier. Within the station core is found the cluster assembly (includes the controller, exciter, receiver modules) and an options card cage (which holds wireline and options boards, such as the Aux I/O board). RF, System and power connections are made at the rear of the station.

The station is designed for easy serviceability. After the front panel has been removed, all cluster assembly module and options boards can be removed from the front without requiring access to the rear of the station. With a minimum of screws and connections, other modules such as the power supply and power amplifier, can be easily replaced from an unracked station.

With the MTR2000™ station, peripherals such as additional circulators and low pass filters are mounted in a peripheral tray adjacent to the radio station. All I/O cables for the peripherals are terminated with connectors at labeled locations on the back of the peripheral tray.

## **Cluster Assembly**

Within the station core can be found the cluster assembly, which includes the controller, exciter, and receiver modules. These 3 modules are interconnected before they are placed into the station. Only the controller module of the cluster assembly connects to the station backplane board, which in turn routes the signals between the cluster assembly and options boards. The backplane also provides connections external to the station.

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# Technical Station Description (Continued)

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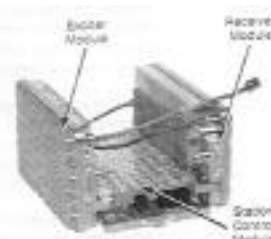
Station/ Cluster  
Assembly/  
Control  
Module  
Graphics

MTR2000™ Station  
(Front Panel Removed)



MTR2000™ Station  
(Front Panel Removed)

Cluster Assembly



Cluster Assembly



KUHz External  
Reference Signal      Service  
Signal      PDS      Microphone

Station Control Module (SCM) Connections  
Station Control Module (SCM) Connections

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## Technical Station Description (Continued)

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### **Station Control Module**

The Station Control Module (SCM) utilizes a microprocessor to provide functions such as transmitter/receiver management, internal station data signaling/audio routing control with priorities, and support for external interfaces. The module also supports Digital Signal Processors (DSPs) to handle all station digitized audio processing. These processing functions include receiver demodulation, de/pre-emphasis filtering, splatter filtering, squelch, transmitter IDC (Instantaneous Deviation Control), PL/DPL encoding and decoding, as well as the various system signaling functions. The DSP also performs analog audio processing for the wireline interface, including Tone Remote Control decoding, and Status Tone encoding. The control module is one of three cluster assembly modules.

The SCM manages power control of the Station. The SCM's microprocessor controls thermal derating, antenna relay control, low battery derating, loop leveling, power control, synthesizer loading, fan control and high VSWR protection. When necessary, the microprocessor will signal the station to reduce station output power.

A connector to hook up a higher powered external speaker is standard in the event one is needed. (Order kit numbers HSN1000 and 01-85180U01 for a 6 Watt external speaker and cable kit.)

Finally, the control module also contains an RS232 connector for the Radio Service Software (RVN4148), 5 MHz frequency net input (requires X747 External Reference Cable), and a microphone (GMN6147) connector.

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*Continued on next page*

## Technical Station Description (Continued)

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### **Receiver Modules**

The MTR2000™ station utilizes a receiver design that has the capability through the Radio Service Software to be programmed for 12.5 kHz and 25 kHz bandwidths, on a per channel basis. (The FCC requires that 900 MHz is used at 12.5 kHz only). This allows a single station to be programmed to function in various bandwidths without changing hardware. The receiver module can be broken down into two main frequency sensitive components: the receiver board and the preselector. Two receiver configurations are available for UHF and VHF station frequency bands, only one configuration is available in the 350, 800, and 900 MHz station frequency bands.

### **Wide Receiver**

The standard configuration for UHF, VHF, and 350 MHz stations utilizes a receiver module that includes a wide (electronic varactor-tuned) preselector. This wide preselector is best suited for low density RF environments, when stations are used with external multicouplers, or when multifrequency operation beyond 4 MHz is required. This wide receiver uses a single receiver module used to cover the entire band, 132-174 MHz, 335-405 MHz, and 403-470 MHz.

### **Narrow Receiver**

The optional configuration (X265) for UHF and VHF stations utilizes a receiver module and an externally mounted High Performance narrow preselector. This configuration provides better performance for customers intending to locate the MTR2000™ with other stations in the same frequency band.

The optional High Performance narrow external VHF and UHF preselectors are tuned to cover a 4 MHz section within the operating bandwidth of the receiver module without any change in performance. On VHF Stations, two ranges of external preselectors cover the entire band: 132-154 MHz and 150-174 MHz. (If frequencies in the 150-154 MHz overlap region is specified, the lower band preselector may be selected with the X326 option, otherwise the 150-174 MHz preselector will be automatically selected.) On UHF Stations, two ranges preselectors cover the entire band: 403-433 MHz and 433-470 MHz.

The 800 and 900 MHz station includes as standard a high performance preselector covering the entire band, 806-825 MHz or 896-915 MHz. The 350 MHz station is not offered with a high performance preselector.

For more information on receiver and preselector bandwidths, refer to frequency specification section.

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## Technical Station Description (Continued)

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**Transmitter** The MTR2000™ station utilizes a transmitter design that has the capability through the Radio Service Software to be programmed for 12.5 kHz and 25 kHz bandwidths, on a per channel basis (The FCC requires that 900 MHz is used at 12.5 kHz only). This allows a single station to be programmed to function in various bandwidths without changing hardware. The transmitter is comprised of two main frequency sensitive components: the Exciter and the Power Amplifier (PA).

**Exciter Module** The Exciter module (part of the cluster assembly) contains the transmit VCO (Voltage Controlled Oscillator) and the transmit synthesizer. Due to the MTR2000™ Exciter design, a single exciter module supports the entire range for each of the station bands (132-174 MHz, 335-405 MHz, 403-470 MHz, 851-870 MHz, 935-941 MHz). The Exciter Module provides a constant power output level to the Power Amplifier.

**Power Amplifier** The Power Amplifier (PA) module contains the intermediate power amplifier (IPA), final module, harmonic filter, and directional couplers for power control and diagnostics. The Power Amplifier module is enclosed in a metal casting which includes the cabinet mounting bracket.

The Power Amplifier is protected through the use of smart power control which makes sure the station is always transmitting at the proper power output. This prevents users from pushing the transmitter past its rated limits, by entering a higher number in the Radio Service Software, and over stressing the components. Smart power control also provides enhanced diagnostics, increased dynamic range, and the elimination of mechanical tuning. The Power Amplifier module is laser tuned in the factory so no adjustments are needed during installation to optimize the station. Power leveling adjustments are made via software. Under extreme thermal conditions, the MTR2000™ power amplifier will gradually reduce output power in order to protect the PA from damage. This reduction is designed to maintain long term PA reliability. At all times the PA will meet or exceed the EIA/TIA 603 standard for transmitter operation in high ambient conditions.

Modulation sensitivity and power output are adjusted electronically for each channel, improving performance and eliminating adjustments for service and final test. Temperature sensing devices are placed on the power amplifier and circulator heatsinks to monitor temperature and report back to the microprocessor in the Station Control Module. When necessary, fans (high power stations only) will be turned on and cool the station to keep it at the optimum operating temperature.

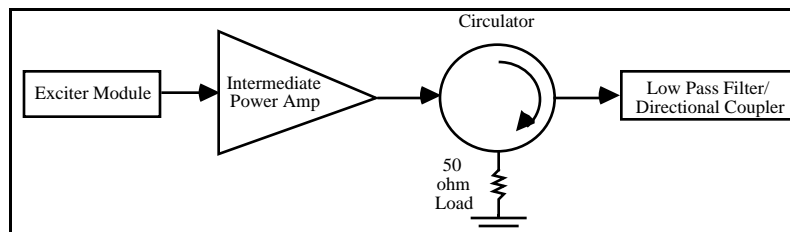
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## Technical Station Description (Continued)

### High Power PA

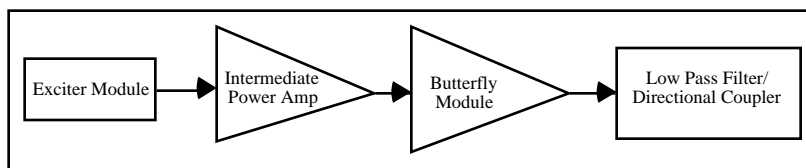
The 100 Watt (VHF/UHF) and 75 Watt (800/900 MHz) power amplifier contains an internal circulator for improved intermodulation specifications and increased reliability. The single circulator provides the necessary transmitter isolation from potentially interfering signals at crowded antenna sites. The high power station PA is equipped with a forced air convection cooling fan.



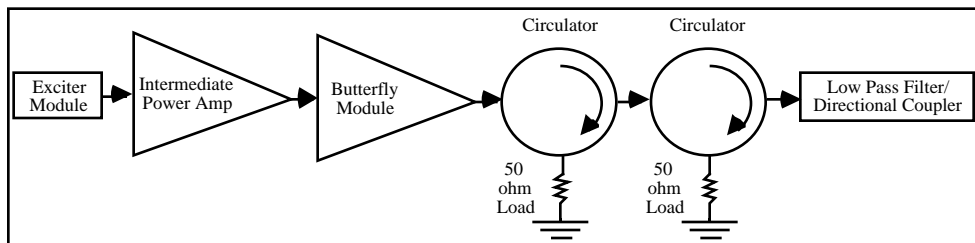
75/100 Watt Transmitter

### Low Power PAs

Two versions of the low power PAs are available with VHF and UHF stations - with and without an internal double circulator. The 40 Watt PA does not include a circulator, whereas the 30 Watt PA does include a double circulator. The double internal circulator offers improved intermodulation specifications, increased reliability, and isolation from potentially interfering signals at crowded antenna sites. The 40 and 30 Watt PAs do not utilize a fan. (The 40 Watt 350 MHz station is not offered with an internal double circulator.)



40 Watt Transmitter



30 Watt Transmitter

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## Technical Station Description (Continued)

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### Options Card Cage

The standard MTR2000™ station is equipped with an options card cage, supporting up to 3 options cards within the station. The first option slot is used for the 4 wire or 8 wire Wireline interface module depending on how the station is ordered. The second option slot is used for the Aux I/O interface module which ships standard on trunked stations or can be ordered as an option on conventional stations (Option X151). The remaining option slot is designated for future station applications.

### Wireline Module

In the MTR2000™ stations, the 4 wire Wireline interface module is standard on all models. The wireline module takes up 1 slot within the options card cage. The telephone line enters the station through the back via a 4 wire Wireline Connector. The can be easily field configured to 2 or 4 wire operation via RSS. The wireline interface is capable of Tone Remote Control (TRC), and supports a wireline output range of -20 dBm to +7 dBm. Two versions of 4 wire Wireline boards are available, a standard board and a European/South African/Australian version (option X216).

There is an optional 8 wire Wireline interface module available by ordering Option U113 for Trunked Console Priority. The 8 wire Wireline module allows stations to be configured for both Telephone Interconnect and Console Priority Interface.

There is an omit wireline module option for conventional stations (Option X84) for instances where no wireline control is needed, such as with standalone repeater operation.

The European/South African/Australian 4 wire Wireline module has been designed to meet the European Line Safety Specification, EN1003/EN60950, the line interface specification, ETS300 450 and several additional national specs. This wireline module contains a line matching jumperfield. All country dependent matching requirements are concentrated into 5 country groups. A group is selected by the setting of 4 jumperplugs. *Note: The 8 wire Wireline has not been submitted for these approvals.*

### Auxiliary I/O Board

The Auxiliary I/O board is included as a standard feature on all trunking stations. It is not a standard feature on conventional stations. It can be ordered as an option (X151). The Aux I/O board is installed within the options card cage and takes up 1 slot. It is connected to a 96-pin connector located on the backplane of the station. Auxiliary equipment connections are routed from the system connector to the Aux I/O board connector.

The Aux I/O board contains the following circuitry:

- 16 general purpose inputs which interface with external equipment
- 16 general purpose outputs which interface with external equipment
- Jumper fields providing optional buffering for Station Control Module signals

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*Continued on next page*

## Technical Station Description (Continued)

**Power Supply** The MTR2000™ station is designed with a switching power supply, which has the ability to operate over a wide range of voltages (85-264 VAC) and frequencies (47-63 Hz) without any modifications or jumper changes. The power supply is enclosed in a metal casting which is utilized as the mounting bracket.

There are four different power supplies available with the MTR2000™ station. (AC or DC, High or Low Power, see chart below.) The supply that is included with the station will be determined by the Transmitter power level and input power required. The power supply for the 100/75 Watt station includes a self-contained, thermostatically controlled cooling fan. The power supply for the 40 Watt (and below) stations do not utilize a cooling fan. The standard station power supplies support AC Power (and an Interface to an external Battery Revert Charger); DC only power supplies are available as an option (X121).

Power Supply Type	AC Supply	DC Only Power Supply
<b>500 Watt Power Supply</b>	Standard on 100, 75 Watt Stations	Option X121
<b>250 Watt Power Supply</b>	Standard on 40, 30 Watt Stations and Satellite Receivers	Option X121

**Battery Revert Charger** The standard AC supply does not have battery charging or battery reverting capability, and should not be directly connected to batteries. The Standard AC power supply does have a connection for AC power and an interface to a battery charger. Battery charging and reverting applications require the use of an external Motorola Approved Battery Reverting Charger.

Battery Reverting Charger	Model Number	Both Cables Required
<b>12V Charger for use with 30 and 40 Watt Stations</b>	L1883	Z691, Charger Load Cable Z692, Charger Battery Cable
<b>24V Charger for use with 75 and 100 Watt Stations</b>	L1884	Z691, Charger Load Cable Z692, Charger Battery Cable

Consult the Battery Reverting Charger Detailed Technical Specifications and Ordering Guide for additional information, R16-9-2.

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# Installation

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## Site Design

There are certain rules that must be followed when designing a site with MTR2000™ Stations. Since the Station is only 3 rack units (5.25 inches) high, the natural tendency of the site designer is to pack as many radios into an area as possible. When cooling radios, the environment in which the radios are installed is just as important as the actual heatsink designs for the electronics. For example, a 100 watt MTR2000™ station will dissipate over 300 Watts of energy, and some planning must go into the ventilation, and in exceptional cases, air conditioning of the sites.

It is not recommended to install batteries in the cabinet with the station and the external battery charger. Hydrogen and oxygen gases produced during electrolysis are colorless and odorless. The hydrogen gas is of particular concern since it produces a potentially explosive atmosphere when it reaches a 4% level of concentration in the air. The room containing the battery must have sufficient natural or forced air ventilation to prevent a build-up of gas exceeding 2% of the room's occupied volume. In addition, the gas must be vented to the outside rather than recirculated. Therefore, installing a battery in the cabinet could cause serious venting problems.

A convenient location should be chosen with regard to power, control line, and antenna access. The station should also be readily accessible for future maintenance and servicing. The station is designed to be front-side serviceable. Rear access may be needed to change I/O cables or to remove the peripheral shelf. Rear access will also be necessary for the initial installation.

## RF Cabling Protection and Site Grounding Lightning Protection

Providing adequate lightning protection is critical to a safe and reliable communications site. Telephone lines, RF transmission cables, and AC and DC power lines must all be protected to prevent lightning energy from entering the site building. RF transmission lines from the antenna, down the tower, and into the building must be grounded. All RF transmission lines, including unused spares, must contain a Polyphaser® surge suppresser. Further information can be found in the Motorola Quality Standards Fixed Network Equipment Installation manual, R56 (Part # 68-81089E50). The antenna lightning and surge suppresser equipment can be ordered from the MTR2000™ price pages.

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## Installation (Continued)

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### Cabinet and Rack Stacking

Depending on the floor-to-ceiling height available, the MTR2000™ cabinets and racks may be stacked. It is necessary to securely fasten the bottom cabinet or modular rack to the floor or other rigid surface capable of supporting the load of the totally stacked configuration. Order kit number TRN7750 for hardware for between two cabinets or modular racks that are stacked. The maximum number of cabinets or modular racks that can be stacked is as follows:

- 30" modular rack—Maximum 3 per stack (90" total height)
- 45" modular rack—Maximum 2 per stack (90" total height)
- 52" modular rack—Maximum 2 per stack (104" total height)
- 30" cabinet—Maximum 3 per stack (90" total height)
- 46" cabinet—Maximum 2 per stack (92" total height)
- 60" cabinet—Not stackable

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## Installation (Continued)

### Mounting the MTR2000™ in a Cabinet or Rack

#### CABINET MOUNT

- High Power Station - The mounting of only ONE STATION PER CABINET is recommended. More than one station per cabinet will result in degradation of thermal specifications at high ambient temperatures.
- Low Power Station - In order to maintain thermal spec of -30° to +60° C the low power station MUST be mounted in a rack or in a cabinet with additional cooling. A single low power station mounted in a cabinet without additional cooling will result in thermal spec performance of -30° to +54° C

Appropriate precautions should be taken to ensure that the station ambient temperature does not exceed +60° C (+140° F). Consult System Engineering for cooling requirements.

If multiple stations are required AND THERMAL SPEC DEGRADATION IS ACCEPTABLE the following can be followed without the use of cabinet fans. Up to three stations can be mounted in a 30" or larger cabinet with two Rack Units of spacing between each station. Following this recommendation will result in thermal spec performance of -30° to +40° C.

#### RACK MOUNT

Multiple MTR2000™ stations can be mounted in an open rack without degradation of specification as indicated below. To maintain thermal specifications low power stations require 3 Rack Units of spacing between stations and high power stations require 1 Rack Unit of spacing between stations.

<b>Cabinet/Rack Height and RU Available</b>	<b>MTR2000 Low Power Station 3 RU Spacing</b>	<b>MTR2000 High Power Base 1 RU Spacing</b>	<b>MTR2000 Receiver 1 RU Spacing</b>
30" Cabinet/15 RU	1 per cabinet*	1 per cabinet**	1 per cabinet**
46" Cabinet/23 RU	1 per cabinet*	1 per cabinet**	1 per cabinet**
60" Cabinet/30 RU	1 per cabinet*	1 per cabinet**	1 per cabinet**
30" Modular Rack/16 RU	3 per rack**	4 per rack**	4 per rack**
45" Modular Rack/24 RU	4 per rack**	6 per rack**	6 per rack**
52" Modular Rack/27 RU	5 per rack**	7 per rack**	7 per rack**

\* Additional cabinet fan or cooling may be needed. Please Contact System Engineering.

\*\*Although a larger number of stations could potentially fit within the cabinet, the use of additional stations will result in a degradation of specifications in high ambient temperature environments. Does not include space required for peripherals.

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## Installation (Continued)

### Thermal Requirements

The following chart shows the typical power dissipated for each station to help determine ventilation and air conditioning requirements.

<b>TYPE OF STATION</b>	<b>TOTAL POWER DISSIPATED (WATTS)</b>	<b>TOTAL POWER DISSIPATED (BTU/HR)</b>
VHF MTR2000™-30 Watt	165	565
VHF MTR2000™-40 Watt	165	565
VHF MTR2000™-100 Watt	320	1090
350 MHz MTR2000™-40 Watt	175	600
UHF MTR2000™-30 Watt	180	615
UHF MTR2000™-40 Watt	180	615
UHF MTR2000™-100 Watt	340	1160
800 MHz MTR2000™-75 Watt	335	1145
900 MHz MTR2000™-75 Watt	365	1245

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## Installation (Continued)

### Phone Line Requirements

Most Telephone companies recognize either "3002" or "Type 5" as designations to define phone line types and associated electrical specifications. Telephone lines meeting the specifications for either of these types are acceptable for use with the station. The table below shows the specifications for "3002" or "Type 5" phone line types.

<b>Tone Remote Phone Line Requirement</b>	<b>Type 5 Specifications</b>	<b>3002 Specifications</b>
Loss Deviation	±4.0 dB	±4.0 dB
C-Notched Noise	51 dBrnCO	51 dBrnCO
Attenuation Distortion: 504 to 2504 Hz 404 to 2804 Hz 304 to 3004 Hz	-2.0 to +8.0 dB -2.0 to +10.0 dB -3.0 to + 12.0 dB	-2.0 to +8.0 dB 2.0 to +10.0 dB -3.0 to +12.0 dB
Signal to C-notched Noise Ratio	24 dB	24 dB
Envelope Delay Distortion: 804 to 2604 Hz	1750 μS	1750 μS
Intermodulation Distortion: R2 R3	27 dB 32 dB	25 dB 30 dB
Phase Jitter: 20 to 300 Hz 4 to 300 Hz	10 Degrees 15 Degrees	25 Degrees 30 Degrees
Frequency Shift	±3 Hz	±5 Hz

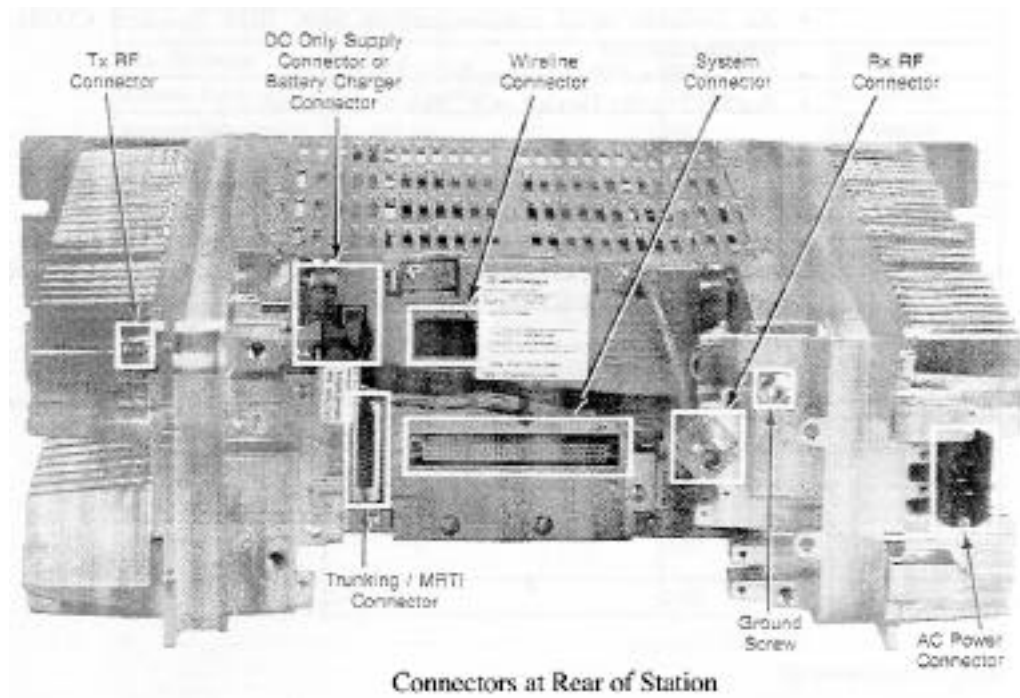
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## Installation (Continued)

### MTR2000™ Station Connections

The figures below show the backplane of the MTR2000™ station and the interconnect locations.

Connector Number	Connector Name	Connector Type
J1	Option Board #1 Interface	96 Pin
J2	Option Board #2 Interface	96 Pin
J3	Station Control Board Interface	96 Pin
J4	Wireline Board Interface	96 Pin
J5	System Connector	96 Pin
J6	Wireline	4 Wire - Wire Trap Terminal Block
J7	Trunking/MRTI Connector	DB25 Connector
P7	PA Control	10 Pin
P8	Power Supply	8 Pin
P10	Antenna Relay/PTEMP+	3 Pin



Connectors at Rear of Station

Connectors at Rear of Station

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## Installation (Continued)

### Quick Reference Guide to Common User Interface Points

The following table refers to the commonly used pins on the MTR2000™ system connector on the backplane of the station (schematic reference J5).

Name	Description	Pin Number	Pin Signal Characteristics
RdStat	TTL compatible logic output indication Rx. Activation status.	C2	0.0 to 0.2 Vdc with squelched receiver, 4.8 to 5.2 Vdc with unsquelched receiver.
Disc. Rx. Audio	Unfiltered and unsquelched discriminator audio without de-emphasis.	C17	80 mV min. to 400 mV maximum for 60% system deviation. Output level is RSS programmable.
RSSI	DC output volts related to received carrier level.	C11	$0.2 \pm 0.1$ Vdc for -120 dBm to $3.4 \pm 0.2$ Vdc for -40 dBm carrier. Linear variation with carrier level @ 40 mV/dBm.
Cntrl 14.2 V	14.2 volts dc output.	A18, B18, C18, C32, B32, C32	Total current through all of these pins should not exceed 1 Amp.
5 V	5.0 volts dc output.	A20, B20, C20	Total current through all of these pins should not exceed 500 mA.
GND	Ground.	A19, B19, C19, A27, B27, C27, A31, B31, C31	Total current through all of these pins should not exceed 1.5 Amp.
Aux. Tx Audio	Tx modulation input from external source.	A17	Fixed sensitivity @ 172 mVrms for 60% system deviation. RSS programmable for pre-emphasized or flat response. DC offset +2.4 V. High impedance input.
Ext. PTT	External Tx. keying signal.	C10	Grounding Ext. PTT pin causes Tx key. 5.0 Vdc on pin when Tx is not keyed. Note: To transmit signaling code (PL/DPL) by external PTT, it should be mapped (via RSS) to Wireline and external modulation input should be routed to wireline.
AC_Fail	Logic output to indicate failure of AC line input.	A4	Requires a Battery Revert dc supply. Line goes to high (5.0 Vdc) if AC fails.
Wireline Pair 3+/-	Additional wireline for other functions.	C28, C30	Line sensitivity and operation identical to line pairs 1 and 2.
Wireline Pair 4+/-		B28, B30	

## Installation (Continued)

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### Station Maintenance Connections

The table below provides a description of the maintenance connections located on the front of the Station Control Module

Connector Name	Function	Details
5/10 MHz External Reference Signal (J5603)	External Reference signal for internal system clock	5 MHz or 10 MHz external reference may be used. Select desired frequency through RSS. High impedance input. Minimum level is 1Vpp for either type of input. Maximum level should not exceed 3Vpp.
Service Speaker (P5601)	Output to Power Voice speaker	Adjustable between 0 to 500 mV across 1 Kohm @ 60% system deviation. Audio signal appears between pins 3 and 4 on the connector. Must use speaker type HSN1000 via adapter cable part no. 01-85180U01.
RSS (P5600)	Serial Port	For connection to serial port of a computer via cable part no. 30-82056X02. The Radio Service Software (RSS) application is run on the computer.
Microphone (P5602)	Local Microphone Input	Use local microphone type GMN6147 or equivalent. Modulation sensitivity for 60% system deviation is typically 300 mV. This microphone should be equipped with 3 control buttons for speaker volume control, Rx. monitor and Intercom control functions.

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## Installation (Continued)

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### Station Configuration using RSS

Once the station has been installed, it will be necessary to use the Radio Service Software (RSS) to choose the station's configuration and alignment. The MTR2000™ Station/Receiver is supported with an MS-Windows based RSS (RVN4148), complete with Online Help and Hypertext (includes pictures). MS Windows is required. With this version of RSS, several data windows of one codeplug or multiple codeplugs may be open at the same time. This may be useful in verifying parameters of several codeplugs or copying values from one codeplug to another.

### Computer Configuration for RSS

The computer must be configured with specific hardware and software configurations in order to support RSS operation.

#### Hardware Requirements:

- 80/386 microprocessor or later
- 8 MBytes of RAM is recommended, more RAM speeds up operation
- The RSS and Online Help require 5 MByte of Hard disk space to install. An additional 1 MByte is required if the option to create printable help files is chosen during installation.
- At least one 3.5" floppy drive (High Density Format): optional CD ROM Drive
- An available serial communications port, IBM Standard COM1...4 ( to connect station)
- VGA (640 x 480) or Super VGA Display
- Screen Pointer Device (e.g., mouse, trackball.....)

#### Software Requirements:

- MS-DOS, version 5.0 or higher
- Microsoft Windows 3.1, 3.11 or Windows 95
- MS word or another word processing application capable of reading .rtf (rich text format) files, in order to print entire sections of Online Help. (Note: It is possible to print out topic by topic directly from Online Help itself.)

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**RSS  
Programmable  
Parameters**

Option	Range	Default	RSS window
Repeater/Base Operation	N/A	Base	Edit Station Configuration
DC power Supply	Enabled, Disabled	Disabled	Edit Station Configuration
MRTI Enable	Enabled, Disabled	Disabled	Edit Station Configuration
Main Standby Enable	Enabled, Disabled	Disabled	Edit Station Configuration
Access Code Enable	Enabled, Disabled	Disabled	Edit Station Configuration
Access Code Button	Permits creation of Access Code table		Edit Station Configuration
System Type	Conventional, Smartnet, Smartzone	Conventional	Edit Station Configuration
Frequency Reference	Internal Standard, External 5 MHz, External 10 MHz.	Internal Standard	Edit Station Configuration
Wireline Board Type	None, TTN5066 2 Wire, TTN5066 4 Wire, TTN5067 2 Wire, TTN5067 4 Wire, TTN5068 4 Wire, TTN5068 8 Wire.	None	Edit Station Configuration
Option Board Type	None, CLN6698 Aux I/O.	None	Edit Station Configuration
Receiver	None, 132 - 174 MHz, 335-405 MHz, 403 - 470 MHz, 806-825 MHz, 896-901 MHz		Edit Station Configuration
Transmitter	None, 132 - 174 MHz, 335-405 MHz, 403 - 470 MHz, 850-870 MHz, 935-941 MHz		Edit Station Configuration
Max Deviation	0 - 100 %	92	RF Options
Antenna Relay	Enabled, Disabled	Disabled	RF Options
Antenna Relay Delay	30 - 900 ms	30	RF Options
Call Sign Interval	1 - 495 Minutes	15 Minutes	RF Options
Startup Channel	1 - max channel number	1	RF Options
Last Active Channel on Warmstart	Enabled, Disabled	Disabled	RF Options
Remote Control Type	None, Tone	Tone	Wireline
Equalization	Enabled, Disabled	Disabled	Wireline
Status Tone	Enabled, Disabled	Disabled	Wireline
Status Tone Frequency	300 - 3400 Hz	2175 Hz	Wireline
Line Squelch	Enabled, Disabled	Disabled	Wireline
Line Squelch Level	- 50 - 0 dBm	-28 dBm	Wireline
Line Squelch Hysteresis	0 - 6 dB	2 dB	Wireline
Duplex Type	Full, Half	Half	Wireline

## Installation (Continued)

### RSS Programmable Parameters

Parameter	Range	Default	RSS window
TRC, CPI	Enabled, Disabled	Disabled	Wireline
TRC, Automatic Level Control	Enabled, Disabled	Disabled	Wireline
TRC, TX Notch Filter	Enabled, Disabled	Disabled	Wireline
TRC, RX Notch Filter	Enabled, Disabled	Disabled	Wireline
TRC, Input Port	1,2	1	Wireline
TRC, HLG T Frequency	300 - 3400 Hz	2175 Hz	Wireline
TRC, LLGT Undetect Time	20 - 2000 ms	150 ms	Wireline
Function Tone	None, TX when LLGT received, TX Off, TX On, Monitor, Repeater Off, Repeater On, RX PL Off, RX PL On, TX PL Off, TX PL On, Select Channel, Wait, Alarm Off, Alarm On, Selective Alarm On, Selective Alarm Off, MRTI Off, MRTI On	None	TRC Commands
Automatic Frequency Calculation	Enabled, Disabled	Disabled	Channel RF
Receive	Enabled, Disabled	Enabled	Channel RF
Receive Frequency	Band dependent	Lowest Frequency in band	Channel RF
Bandwidth	12.5 kHz, 25 kHz, APCO 25 kHz	12.5 kHz	Channel RF
Transmit	Enabled, Disabled	Enabled	Channel RF
Transmit Frequency	Band dependent	Lowest Frequency in band	Channel RF
Deviation	2500, 4000, 5000 Hz	2500 Hz	Channel RF
Transmit Idle Frequency	Band dependent	Lowest Frequency in band	Channel RF
Power Level, Normal	PA dependent	Maximal possible Power	Channel RF
Power Level, Battery	PA dependent	Maximal possible Power	Channel RF
Analog RX Activation	Off, Always, PL, Carrier & PL	Carrier	Channel Audio
Modulation Type	Analog	Analog	Channel Audio

*Continued on next page*

**RSS  
Programmable  
Parameters**

<b>Parameter</b>	<b>Range</b>	<b>Default</b>	<b>RSS window</b>
Aux Tx Audio Control	Flat, Same as Wireline	Flat	Channel Audio
De-Emphasis	Enabled, Disabled	Enabled	Channel Audio
Pre-Emphasis	Enabled, Disabled	Enabled	Channel Audio
Noise Canceller	Enabled, Disabled	Disabled	Channel Audio
Compander	Enabled, Disabled	Disabled	Channel Audio
RX Signal Inversion	Enabled, Disabled	Disabled	Channel Audio
MRTI	Enabled, Disabled	Disabled	Channel Audio
Alarm Tone Over WL	Enabled, Disabled	Enabled	Channel Audio
Alarm Tone Over Air	Enabled, Disabled	Disabled	Channel Audio
Call Sign	Space, A-Z, 0-9, ., : ; ? / \ - ( ) =	None	Channel Audio
Call Sign Over Wireline	Enabled, Disabled	Disabled	Channel Audio
External PTT Mapping	None, Microphone, Wireline, Repeater, Call Sign, Aux Audio, Aux Audio & Wireline, Aux Audio & Receiver	Microphone	Channel PTT
PTT Time Out Timer Wireline	Enabled, Disabled	Enabled	Channel PTT
PTT Time Out Timer Wireline	10 - 2550 sec, Step 10	120 sec	Channel PTT
PTT Time Out Timer Local	Enabled, Disabled	Disabled	Channel PTT
PTT Time Out Timer Local	10 - 2550 sec, Step 10	60 sec	Channel PTT
PTT Time Out Timer Repeater	Enabled, Disabled	Enabled	Channel PTT
PTT Time Out Timer Repeater	10 - 2550 sec, Step 10	60 sec	Channel PTT
PTT Priority	high, medium, low	Wireline- high, Repeater-medium, Local-low	Channel PTT
TX PL Type	None, PL, DPL	None	Channel Encoder
TX PL Code	67.0 - 250.3 Hz	67.0 Hz	Channel Encoder
TX DPL Code	One out of DPL list	O23	Channel Encoder
Access Code (replaces PL/DPL screens when enabled)	One of Access Code list	None	Channel Encoder
RX PL Type	None, PL, DPL	None	Channel Decoder
RX PL Code	67.0 - 250.3 Hz	67.0 Hz	Channel Decoder
RX DPL Code	One out of DPL list	O23	Channel Decoder
Access Code (replaces PL/DPL screens when enabled)	One of Access Code list	None	Channel Decoder

## Installation (Continued)

### RSS Programmable Parameters

Parameter	Range	Default	RSS window
Decoder 1/2 Type	None, Select 5, Single Tone	None	Channel Decoder
Decoder 1/2 Tone System	ZVEI 1, ZVEI 2, ZVEI 3, EEA, CCIR, MCCIR	ZVEI 1	Channel Decoder
Decoder 1/2 Sequence	0 - 9, A - F	'	Channel Decoder
Decoder 1/2 Extended First Tone	Tone System Time - 10000 ms, Step 10	70 ms	Channel Decoder
Decoder 1/2 Single Tone	300 - 3000 Hz for 25 kHz systems 300 - 2500 Hz for 12.5 kHz systems	2175 Hz	Channel Decoder
Decoder 1/2 Single Tone Duration	100 - 3000 ms	1000 ms	Channel Decoder
Analog Repeater Activation	Off, Always, Carrier, PL, Carrier & PL, Decoder 1, Decoder 1 & Carrier, Decoder 1 & PL, Dec 1 & Carrier & PL	Off	Channel Repeater
Analog Repeater Deactivation	Off, Decoder 1, Decoder 2	Off	Channel Repeater
Analog Repeater Hold-In	Off, Always, Carrier, PL, Carrier & PL	Off	Channel Repeater
Drop Out Delay	0 - 2550 sec	2 sec	Channel Repeater
Repeater Hold-Off Delay	0 - 2550 sec	0 sec	Channel Repeater
Analog Repeater Boost	Enabled, Disabled	Disabled	Channel Repeater
Connect Tone 1	0 - 7	0	6809 Trunking
Connect Tone 2	Enabled, Disabled	Disabled	6809 Trunking
Connect Tone 2	0 - 7	0	6809 Trunking
Smart Connect Tone Decoder	None, Unsquelch, Mute Tickle	Mute Tickle	6809 Trunking
Smart Connect Tone Disable Delay	0 - 1000 ms	700 ms	6809 Trunking
Failsoft	Enabled, Disabled	Disabled	6809 Trunking
Failsoft Line TRC Encode	Enabled, Disabled	Disabled	6809 Trunking
Failsoft Carrier Squelch	Enabled, Disabled	Disabled	6809 Trunking
Failsoft Dual Connect Tone Only	Enabled, Disabled	Disabled	6809 Trunking
RSTAT Mode	Normal, Dual Connect Tone	Normal	6809 Trunking
RX Discriminator Type	MTR2000/Quantar/Micor, MSF	MTR2000 / Quantar / Micor	6809 Trunking
Trunking Tickle Source	TX Data Line, Mute Line	TX Data Line	6809 Trunking
Trunking Tickle Time Out Time	1 - 72 s	1 s	6809 Trunking
Wildcard	Permit creation of Wildcard files		Wildcard

## Installation (Continued)

**RSS Screen** The following graphics show a few screens from the Windows™ based version of the Ra Service Software (RSS), which illustrate some of the programmer's available choices.

The screenshot shows the 'Channel Information - VHF.PCF' window. On the left, the 'Option' list includes RF, Audio, PTT, Encoder, and Decoder. 'Channel #' is set to 1. The main area is titled 'Channel 1 of 1' and contains two sections: 'RF Frequencies' and 'Power Level'. The 'RF Frequencies' section has an unchecked 'Automatic Frequency Calculation' checkbox. The 'Receive' checkbox is checked, with a frequency of 132.00000 MHz, a bandwidth of 12.5 kHz, and a deviation of 2500 Hz. The 'Transmit' checkbox is also checked, with a frequency of 132.00000 MHz and a TX Idle frequency of 132.00000 MHz. The 'Power Level' section shows 'Normal' and 'Battery' both set to 30 Watts. At the bottom, there is a status bar that reads 'Uncheck to disable this option'. On the right side, there are 'OK', 'Cancel', and 'Help' buttons.

Channel Information - RF Window

The screenshot shows the 'Channel Information - VHF.PCF' window with the 'Decoder' option selected. The 'Option' list on the left now highlights 'Decoder'. The main area is titled 'Channel 1 of 1' and contains three sections: 'RX PL', 'Decoder 1', and 'Decoder 2'. The 'RX PL' section shows 'Type' as 'PL', 'PL Code' as 'XZ', and a frequency of 67.0 Hz. The 'DPL Code' is '023'. The 'Decoder 1' and 'Decoder 2' sections are identical, both showing 'Type' as 'None', 'Tone System' as 'ZVEI 1', 'Sequence' as '0', 'Ext. First Tone' as 70 ms (unchecked), 'Single Tone' as 2175 Hz, and 'Duration' as 1000 ms. On the right side, there are 'OK', 'Cancel', and 'Help' buttons.

Channel Information Decoder Window

# Installation (Continued)

RSS Screen

The 'Wireline - VHF.PCF' window contains the following settings:

- Remote Control Type:** None
- Spectra-TAC:**
  - Equalization
  - Status Tone Frequency: 2175 Hz
- Wireline:**
  - Line Squelch Level: -28 dBm
  - Hysteresis: 2 dB
- Duplex Type:**
  - Full
  - Half
- TRC:**
  - CPI
  - Automatic Level Control
  - Tx Notch Filter
  - Rx Notch Filter
  - TRC Input Port: 1
  - HLGT Frequency: 2175 Hz
  - LLGT Undetect Time: 150 ms

Check to enable this option

Wireline Window

The 'TRC Commands - VHF.PCF' window contains the following settings:

- Function Tone:**
  - Guard Tone
  - 2050 Hz (selected)
  - 1950 Hz
  - 1850 Hz
  - 1750 Hz
  - 1650 Hz
  - 1550 Hz
  - 1450 Hz
  - 1350 Hz
  - 1250 Hz
  - 1150 Hz
  - 1050 Hz
  - 950 Hz
  - 850 Hz
  - 750 Hz
  - 650 Hz
- Command List:**
  - 1 Select Channel: 3
  - 2 Wait: 200 ms
  - 3 TX On
  - 4 None
  - 5 None
  - 6 None
  - 7 None
  - 8 None

Tone Remote Control - Commands Window

## Ordering Guidelines

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- All Models** All MTR2000™ Stations and Receivers operate in an analog (25/12.5 kHz) mode (The FCC requires that 900 MHz is used at 12.5 kHz only). The mode changes are configurable with the Radio Service Software.
- Station Models** The stations provide as standard features: wireline control, up to 32 conventional transmit and receive frequencies (Remote control access is limited by TRC capabilities), coded squelch (PL or DPL), variable time-out-timer, push-to-talk priority, repeater drop-out delay, channel bandwidth, and base station ID. These features ship in a preset condition, but may be altered through the use of Radio Service Software. Base stations with a single antenna require an optional antenna relay (Option Number X371), and repeaters include either two antenna connectors or one connector if a factory installed duplexer (Option Number X182) is ordered.
- Receiver Models** The receivers provide as standard features: wireline control, up to 32 conventional receive frequencies (Remote control access is limited by TRC capabilities), coded squelch (PL or DPL), and channel bandwidth. These features ship in a preset condition, but may be altered through the use of Radio Service Software.
- UHF/VHF Models** For VHF and UHF base stations, transmit and receive frequencies can be separated by the full frequency sub-band selected. If the optional High Performance preselector (X265) is used, receive frequency separation can be up to 4.0 MHz without degradation of narrow preselector specifications. Transmit and receive frequencies must be separated by a minimum of 1.5 MHz in VHF and 5 MHz in UHF when using a duplexer. If the frequency spread requirements are tighter, an alternate duplexer may be required.
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## Ordering Guidelines (Continued)

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### Steps to Follow - Stations

All stations must be ordered with Frequency/Power, System Software, and Station Operation options. Use the following steps when ordering an MTR2000™ Station:

- 1) Indicate the MTR2000™ Model as the main line item. The model will be either T5544 (RNSG) or T5766 (RPG).
- 2) Show ONE frequency pair for factory tuning on the order. Only the frequency shown on the order will be programmed in the factory; all other frequencies must be programmed via the RSS! If ordering a multi-channel radio, choose the middle frequency pair.
- 3) Next, select an option to indicate the frequency band and power level desired and list it as the next sub-item on the order. The option should be one of the following:

#### VHF

- X330 = 40–1 Watt VHF MTR2000™ 132-174 MHz (No Internal Circulator)
- X345 = 30–1 Watt VHF MTR2000™ 132-174 MHz (2 Internal Circulators)
- X530 = 100–25 Watt VHF MTR2000™ 132-154 or 150-174 MHz (1 Internal Circulator. Lower bandsplit may be selected with the X325 option.)

#### 350 MHz

- X983 = 40-2 Watt 350 MHz MTR2000™ 335-405 MHz (No Internal Circulator)

*Note: 350 MHz station is not FCC or ETS certified and is not CE compliant for use in Europe.*

#### UHF

- X340 = 40-2 Watt UHF MTR2000™ 403-470 MHz (No Internal Circulator)
- X341 = 30–2 Watt VHF MTR2000™ 403-470 MHz (2 Internal Circulators)
- X540 = 100-25 Watt UHF MTR2000™ 403-435 or 435-470 MHz (1 Internal Circulator)

#### 800 MHz

- X450 = 75-20 Watt 800 MHz MTR2000™ 851-870 MHz (1 Internal Circulator)

*Note: 800 MHz station is not ETS certified and is not CE compliant for use in Europe.*

#### 900 MHz

- X460 = 75-20 Watt 900 MHz MTR2000™ 935-941 MHz (1 Internal Circulator)

*Note: 900 MHz station is not ETS certified and is not CE compliant for use in Europe.*

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*Continued on next page*



## Ordering Guidelines (Continued)

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### Steps to Follow - Stations

- 4) Choose a System Software Option and list it as the next sub-item on the order.
    - X597 = Conventional Software Operation
    - X997 = Smartnet 6809 Analog Trunking Software Option (Not offered on T5766, RPG Model, in all distribution channels.)
    - X51 = SmartZone 6809 Analog Trunking Software Option (Not offered on T5766, RPG Model, in all distribution channels.)
  - 5) For Conventional stations (option X597), choose a station operation option and list this option as the next sub-item. The station operation options are:
    - X580 = Repeater Operation (Tx Rx)
    - X622 = Base Station Operation (Does not include an antenna relay, if required order option X371.)

Note: This step is not required when ordering a trunking station.
  - 6) After completing the above steps, add any additional sub-items which are required to the order.
- 

### Steps to Follow - Receivers

All receivers must be ordered with Frequency and System Software options. Use the following steps when ordering an MTR2000™ Receiver:

- 1) Indicate the MTR2000™ Radio Model as the main line item. The Model is either T5731(RNSG) or T5769 (RPG).
  - 2) Show ONE receive frequency for factory tuning on the order. Only the frequency shown on the order will be programmed in the factory; all other frequencies must be programmed via the RSS! If ordering a multi-channel receiver, choose the middle frequency pair.
  - 3) Next, select an option to indicate the frequency band desired and list it as the next sub-item on the order. The option should be one of the following:
    - X319 = VHF (132-174 MHz) MTR2000™ Receiver
    - X943 = 350 MHz (335-405 MHz) MTR2000™ Receiver  
*Note: 350 MHz station is not FCC or ETS certified and is not CE compliant for use in Europe.*
    - X320 = VHF (403-470 MHz) MTR2000™ Receiver
    - X600 = 800 MHz (806-825 MHz) MTR2000™ Receiver  
*Note: 800 MHz station is not ETS certified and is not CE compliant for use in Europe.*
    - X663 = 900 MHz (896-915 MHz) MTR2000™ Receiver  
*Note: 900 MHz station is not ETS certified and is not CE compliant for use in Europe.*
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## Ordering Guidelines (Continued)

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- 4) Choose a System Software option and list it as the next sub-item on the order.
    - X597 = Conventional Operation
    - X997 = Smartnet 6809 Analog Trunking Operation (Not offered on T5769, RPG Model, in all distribution channels.)
    - X51 = SmartZone 6809 Analog Trunking Operation (Not offered on T5769, RPG Model, in all distribution channels.)
  - 5) After completing the above steps, add any additional sub-items which are required to the order.
-

## Available Options/Kits/FRUs

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### Options for MTR2000™

#### WIRELINER OPTIONS

A 4 wire wireline board is included with each station. The following options replace the standard board or its capabilities.

- Omit Wireline Remote Control (X84) = For standalone repeater applications. This option is not compatible with X269 (Spectra TAC).
- 4 Wire Europe/South Africa/Australia Wireline Interface (X216) = For 4-wire conventional European/South African/Australian applications. Countries supported include: Australia, Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, United Kingdom, former USSR, former Yugoslavia.
- Console Priority Interface (U113) = Replaces the standard 4 wire Wireline interface with the 8 wire Wireline interface. *Note: This board is not CE certified for use in Europe.*
- Spectra-TAC/DigiTAC (X269) = Not compatible with option X84 (Omit Wireline). Status tones are selectable 300-3400 Hz. Default is 2175 Hz.

#### MANUAL OPTIONS

- MTR2000™ Instruction/Field Service Manual (X436) = Includes station description, installation, operation, maintenance and FRU (Field Replaceable Unit) kit diagrams. Provide information to service the station to the FRU level.
- Delete Installation and Operational Manual (X287) = This option deletes the standard manual included with every station. This is recommended for use when multiple stations will be used at the same site and one manual per station is not needed.

#### RF PERIPHERALS

- High Performance Preselector (X265) = Recommended for dense RF site applications, especially when station is to be located with other stations in the same frequency band. May not be required when station is used with a multicoupler at an RF site. For multiple channel operation, the receiver frequency separation cannot be greater than 4.0 MHz. VHF High Performance Preselector ranges are 132-154 and 150-174 MHz. Order Low Range Descriptor (X326) if frequencies fall into overlap range stated above and the lower range is desired. UHF High Performance Preselector ranges are 403-433 and 433-470 MHz.

*Note: This option is not compatible on the 350 MHz and 800/900 MHz stations. (350 MHz is wide receiver only. High performance preselector is standard on 800/900 MHz.)*

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*Continued on next page*

## Available Options/Kits/FRUs (Continued)

### Options for MTR2000™

#### RF PERIPHERALS, Continued

- Antenna Relay (X371) = For base station applications with a single antenna.
- Factory Installed Duplexer (X182) = Allows a single pair of transmit and receive channels to share a common antenna. The duplexer requires 3 rack units of space and will always require a cabinet or rack to be ordered. The duplexer is factory tuned for single frequency operation only. It is not available for crossband operation. This option must be ordered with cabinet or modular rack options. If frequencies fall into the VHF overlap ranges stated below, and the lower range is desired, order Low Range Descriptor option (X327). Not compatible with X153.

*Note: Factory installed duplexer is not available with 350 MHz station.*

	VHF	UHF	800 MHz	900 MHz
<b>Freq Sub-band (MHz)</b>	132-146/144-160/158-174	403-435/435-470	RX=806-824 TX=851-869	RX=896-915 TX=935-941
<b>Min. Tx/Rx Separation</b>	1.5 MHz	5 MHz	45 MHz	39 MHz
<b>VSWR Max</b>	1.5 : 1	1.3 : 1	1.5 : 1	1.5 : 1
<b>Insertion Loss</b>	1.3 dB	1.0 dB	1.2 dB	1.0 dB
<b>Rx Isolation dB</b>	75	120	75	75
<b>Tx Isolation dB</b>	75	120	75	75
<b>Max Power</b>	150 Watt	250 Watt	400 Watt	500 Watt

- Circulator Tray Operation (X676) = Provides 70 dB isolation protection. Includes a Low Pass Filter and external RF peripheral tray. The Circulator Tray requires 2 rack units (3.5") of space and requires that a cabinet or modular rack be ordered. The circulator has the following sub-band breaks: VHF = 132-146 MHz, 144-160 MHz, 158-174 MHz; UHF = 403-470 MHz, 800 MHz = 851-870 MHz, and 900 MHz = 935-940 MHz. If frequencies fall into the VHF overlap ranges stated above, and the lower range is desired, order Low Range Descriptor option (X327). Not compatible with X153.

*Note: Factory installed external double circulator is not available with the 350 MHz station.*

#### EXTERNAL REFERENCE OPTION

- External Reference Cable (X747) = Adds an external reference cable that extends the control board external reference (5/10 MHz) connector to the rear of the station. External High Stability reference must be ordered separately.  
*Note: External Reference is required on all 900 MHz and narrowband (12.5 kHz) stations.*

*Continued on next page*

## Available Options/Kits/FRUs (Continued)

### Options for MTR2000™

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#### VHF SUB-BAND OVERLAP OPTIONS

- Transmitter Low Range Descriptor (X325) = For High Power (100W) stations only, order this option when the frequencies fall within the overlapping VHF transmitter sub-band breaks and the lower range is required. For example, if the frequency ordered was 152.0000 MHz and you require the 132-154 MHz Power Amp rather than the 150-174 MHz model.
- Receiver Low Range Descriptor (X326) = For stations equipped with an External (Narrow) preselector, order this option when the frequencies fall within the overlapping VHF External Narrow Preselector sub-band breaks and the lower range is required. For example, if the frequency ordered was 152.0000 MHz and you require the 132-154 MHz preselector rather than the 150-174 MHz preselector.
- Peripheral Low Range Descriptor (X327) = Order this option when the frequencies fall within one of the overlapping VHF duplexer or external circulator sub-band breaks and the lower range is required. For example, if the frequency ordered was 145.0000 MHz and you require the 132-146 MHz duplexer or external circulator rather than the 144-160 MHz model.

#### TRUNKING OPTIONS

- 8 Wire Console Priority Capability (U113). = This option provides 8-wire console priority capability for trunking applications. It includes Spectra-TAC capability, X269. (Not compatible with Delete Wireline - X84 or Spectra-TAC - X269.)

**6809 Trunking Cables** - These options delete the 25 foot trunking cable that is standard with every 6809 trunked station.

- 50 Foot Trunking Cable (X337)
- 75 Foot Trunking Cable (X338)
- 100 Foot Trunking Cable (X339)

#### PRIMARY VOLTAGE OPTIONS

- DC Only Operation (X121) = Required for DC power source operation, negative ground. 14.2 VDC source (40 and 30 Watt models) or 28.6 VDC source (100 Watt models) for full power operation. Lesser voltage reduces output power.
- For Battery Charging see Price Book Section 2.2 Page 12 for Battery Reverting Charger. (Battery Reverting Charger Planner, R16-9-2)

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## Available Options/Kits/FRUs (Continued)

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### Options for MTR2000™

#### AC POWER CORDS

The standard station line cord includes a 110 VAC, 3 prong (grounded) plug (North America). Cord length is 2.5 m (8.2 ft). Alternate power cables are available for regional applications:

- Power Cable, Europe (X189) = Replaces standard US line cord with a European line Cord.
- Power Cable, UK (X162) = Replaces standard US line cord with a UK line Cord.
- Power Cable, Australia (X191) = Replaces standard US line cord with a Australian line Cord.

#### CONVENTIONAL AND 6809 OPTIONS

- System Connector Cable Kit (C540) = Adds the cable kit needed to interface to the system connector on the backplane of the station. Includes housing shell, 30 loose pins, 30 of 24 gauge, 2 meter long wires with a pin for header on one end and unterminated at the other end.
- Wild Card Operation (X233) = Allows the user to control station operations based on inputs to the station and/or station states. This is done through the RSS. Wild Card requires the Aux I/O module (standard on trunked stations or option X151 on conventional stations). Also requires System Connector Cable Kit (C540).

#### CONVENTIONAL ONLY OPTIONS

- Auxiliary Input/Output (X151) = Provides the hardware and software needed for COR Relay and RA/RT. This option requires the System Connector Cable Kit (C540). *NOTE: Auxiliary Input/Output is standard in trunked systems, the X151 is not required.*
- Main Standby Operation (C753) = Provides Main or Standby operation. Main mode or Standby mode can be changed by using Tone Remote Control, External Closure or Hot Switchover. Hot Switchover occurs when the operating station fails and the standby station sensing that the Main station has failed, takes over without manual intervention.

#### MRTI INTERFACE OPTIONS

These options do not include the MRTI unit. A larger cabinet will be required. Plant installations require either X425 or X462.

- MRTI Factory Install (X425) = MRTI and station must be on the same order. Requires L1159 with E961 option. This option is not compatible with X153.
- MRTI 2000 Factory Install (X462) = MRTI 2000 and station must be on the same order. Requires L1877 with E961 option. Not compatible with option X153.

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*Continued on next page*

## Available Options/Kits/FRUs (Continued)

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### Options for the MTR2000™

#### RACK MOUNT OPTION

- Rack Mount Configuration (X153) = Adds rack mounting hardware in the standard shipping box. This option does not include rack. Use this option when a MTR2000™ station to be installed in an existing customer supplied rack.

#### MODULAR RACK OPTIONS

The modular rack allows the factory to deliver racked equipment that can be easily installed without re-racking the equipment into larger open racks. These modular racks can be safely stacked to create any of the standard open rack sizes.

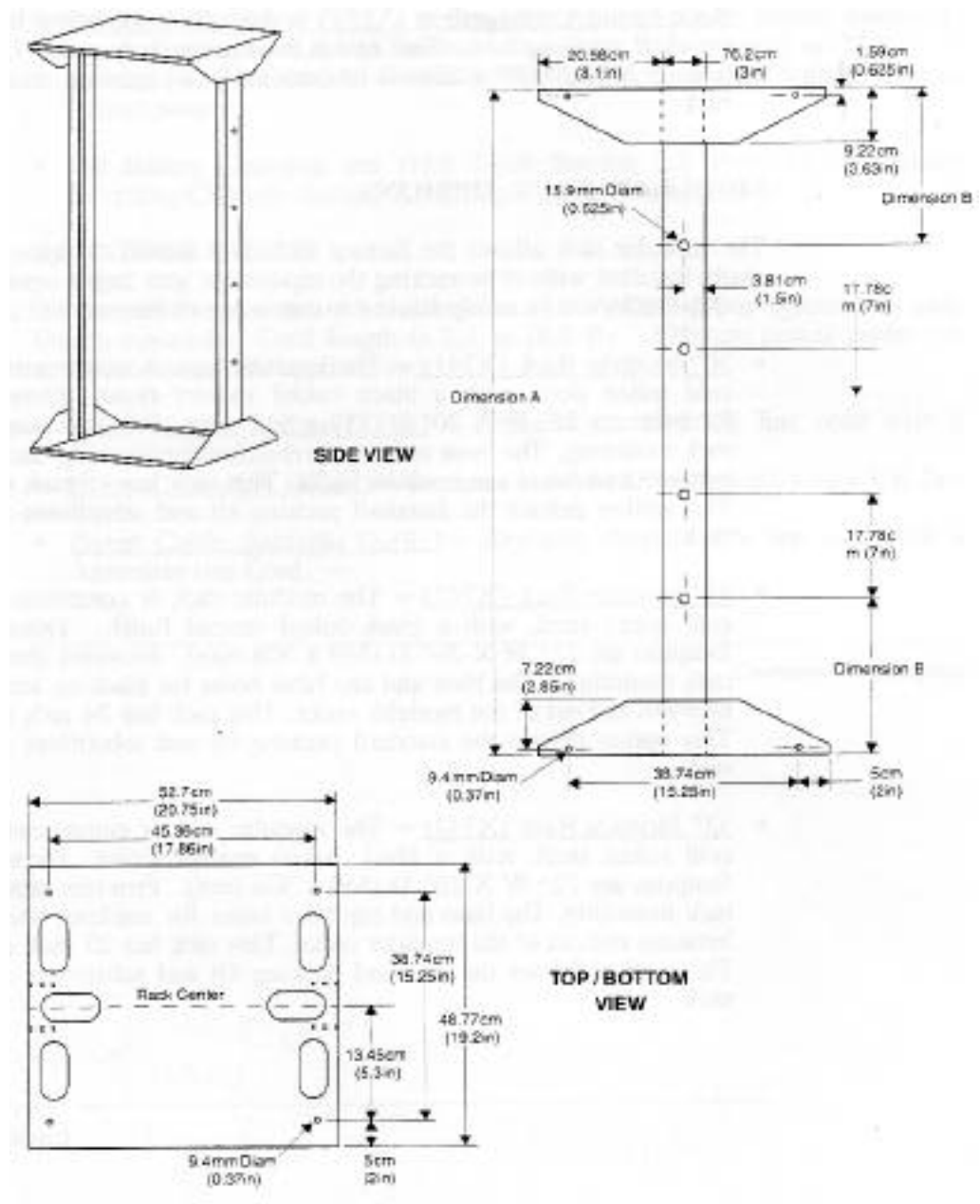
- 30" Modular Rack (X741) = The modular rack is constructed of 10 gauge cold rolled steel, with a black baked enamel finish. Dimensions of the footprint are 22" W X 20" D (559 x 508 mm). Provides standard 19" EIA rack mounting. The base and cap have holes for stacking and routing cable between and out of the modular racks. This rack has 16 rack units available. This option deletes the standard packing kit and substitutes a 30" modular rack.
- 45" Modular Rack (X742) = The modular rack is constructed of 10 gauge cold rolled steel, with a black baked enamel finish. Dimensions of the footprint are 22" W X 20" D (559 x 508 mm). Provides standard 19" EIA rack mounting. The base and cap have holes for stacking and routing cable between and out of the modular racks. This rack has 24 rack units available. This option deletes the standard packing kit and substitutes a 45" modular rack.
- 52" Modular Rack (X743) = The modular rack is constructed of 10 gauge cold rolled steel, with a black baked enamel finish. Dimensions of the footprint are 22" W X 20" D (559 x 508 mm). Provides standard 19" EIA rack mounting. The base and cap have holes for stacking and routing cable between and out of the modular racks. This rack has 27 rack units available. This option deletes the standard packing kit and substitutes a 52" modular rack.

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## Available Options/Kits/FRUs (Continued)

### Modular Rack Graphic



Continued on next page



## Available Options/Kits/FRUs (Continued)

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### Options for MTR2000™

#### CABINET OPTIONS

- 30" Indoor Cabinet (X52) = The cabinet is constructed of steel finished with exterior grade vinyl. Dimensions of the cabinet are 30" H X 22" W X 20" D (762 x 559 x 508 mm). Provides standard 19" EIA rack mounting inside the cabinet. The cabinet has holes in the bottom for easy stacking. There are also two 3 5/8" diameter knockouts near the rear of the cabinet in the top and bottom for routing cable between and out of the cabinets.
- 46" Indoor Cabinet (X308) = The cabinet is constructed of steel finished with exterior grade vinyl. Dimensions of the cabinet are 46" H X 22" W X 20" D (1165 x 559 x 508 mm). Provides standard 19" EIA rack mounting inside the cabinet. The cabinet has holes in the bottom for easy stacking. There are also two 3 5/8" diameter knockouts near the rear of the cabinet in the top and bottom for routing cable between and out of the cabinets.
- 60" Indoor Cabinet (X180) = The cabinet is constructed of steel finished with exterior grade vinyl. Dimensions of the cabinet are 60" H X 22" W X 20" D (1524 x 559 x 508 mm). Provides standard 19" EIA rack mounting inside the cabinet. The cabinet has holes in the bottom for easy stacking. There are also two 3 5/8" diameter knockouts near the rear of the cabinet in the top and bottom for routing cable between and out of the cabinets.

#### CABINET SLIDE RAIL OPTIONS

- Slide Rails Motorola Cabinet (X968) = Adds slides rails to stations shipping in a Motorola cabinet (X52, X308, X180) or may be added to stations that will be mounted in an existing Motorola Cabinet.
- When ordering option X968 for field cabinet installation it is necessary to order additional mounting rails from the Americas Parts Department. TWO of each of the following rails and EIGHT of the screws are required for the desired cabinet size.
  - Rails for 30" Cabinet - Part # 46-85398U01
  - Rails for 46" Cabinet - Part # 46-84274T01
  - Rails for 60" Cabinet - Part # 46-84273T01
  - Screws - Part # 03-12016A54
- Slide Rails Non-Motorola Cabinet (X346) = Adds slide rail kit in the standard shipping box. This does not include a cabinet. Use this option when a MTR2000™ station will be installed in an existing non-Motorola cabinet in the field. This is not compatible with X180, X308, X52, X676 or X182.

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## Available Options/Kits/FRUs (Continued)

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### Kits for the MTR2000™

#### **MULTI CODED SQUELCH KIT**

The Zetron Model 38 Repeater panel interfaces to the MTR2000 to provide up to 38 PL tones and 22 DPL tones as a standard feature. This must be ordered as a separate line item. It is NOT an option to the station.

- Model 38 Repeater Panel (TDN9946)
- Selective Calling Option (E380) = Replaces 38 PL tones and 22 DPL tones with 50 PL tones and 18 DPL tones. This is an option to the Model 38 Repeater Panel.
- Repeater Panel Interface Cable (CDN6351) = Provides the cabling required to interface the Model 38 Repeater Panel to the MTR2000.

#### **MISCELLANEOUS KITS**

- Radio Service Software/RSS (RVN4148) = For station configuration, alignment, and diagnostics. RSS requires Microsoft Windows™ for operation.
- RSS Interface Cable (30-82056X02) = An 8 contact (RJ45 Modular Jack) to 9 pin female sub-D null modem cable for connection between the SCM (Station Control Module) and the Serial Communications port on a PC running Radio Service Software (RSS). Wiring details can be found in the Help section of the RSS.
- Test Microphone (GMN6147) = Local test microphone for transmit audio and intercom. Four buttons provide PTT/Intercom, Volume Setting, Squelch (CSQ/PL toggle), and Intercom On/Off.
- External Speaker (HSN1000) = 6 Watt, 13.8 VDC local speaker.
- Cable Kit (01-85180U01) = For use with the external speaker.
- Antenna Lightning and Surge Suppressor Kit (RRX4025) = The kit is installed with the antenna transmission line and includes bulkhead mounting hardware. This kit comes with type N connectors.
- Hardware for Mounting the Antenna Lightning and Surge Suppressor (RRX4032) = This is the hardware for mounting the kit to the tower.
- Single Phone Line Suppressor (RRX4021) = 3 electrode gas tube protector. Encapsulated module virtually eliminates moisture and corrosion. The suppresser is molded of flame retardant plastic material, is UL Listed, and includes cover and fastening nut.

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- Dual Phone Line Suppressor (TRN4589) = 3 electrode gas tube protector.
  - 110/220 VAC Line Surge Protector (RRX4034) = Lightning and transient protector. Surge life of 10,000 occurrences at 200 Amps. Response time of less than 5 nanoseconds. UL Listed.
  - Stacking Hardware (TRN7750) = Hardware for between two cabinets or modular racks that are stacked.
  - Modular Rack Lift Hardware (TTN4087) = Reusable hardware for lifting modular racks.
  - System Connector Cable Kit (30-83908X02) = Provides housing shell to interface to 96 pin system connector, 30 loose pins, 30 of 24 gauge, 2 meter long wires with a pin for header on one end and unterminated at other end.
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## Available Options/Kits/FRUs (Continued)

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### MTR2000™ FRUs

- Field Replaceable Units (FRUs) are available for each module within a MTR2000™ station. Listed below are the kit numbers for the FRUs.

Note: 350, 800, and 900 MHz FRUs are not CE compliant for use in Europe.

CLN1233 = VHF Exciter (132-174 MHz)  
CLN1234 = UHF Exciter (403-470 MHz)  
CLD1030 = 350 MHz Exciter (335-405 MHz)  
CLN1235 = 800 MHz Exciter (851-870 MHz)  
CLF1280 = 900 MHz Exciter (935-940 MHz)

CLN1211 = VHF Receiver (Wide) (132-174 MHz)  
CLN1212 = VHF Receiver (Narrow) (132-174 MHz)  
CLN1213 = UHF Receiver (Wide) (403-470 MHz)  
CLN1214 = UHF Receiver (Narrow) (403-470 MHz)  
CLD1020 = 350 MHz Receiver (Wide Only) (335-405 MHz)  
CLN1215 = 800 MHz Receiver (w/High Performance Preselector) (806-825 MHz)  
CLF1270 = 900 MHz Receiver (w/High Performance Preselector) (896-915 MHz)

CLN1216 = High Performance External Preselector (Narrow) (132-154 MHz)  
CLN1217 = High Performance External Preselector (Narrow) (150-174 MHz)  
CLN1218 = High Performance External Preselector (Narrow) (403-433 MHz)  
CLN1219 = High Performance External Preselector (Narrow) (433-470 MHz)

*Note: High performance preselector FRU is not available with 350 MHz receiver (Wide only) and 800/900 MHz receiver (standard).*

CKN1039 = High Performance External Preselector Cable Kit  
CKN1040 = High Performance External Preselector Cable Kit when used with Antenna Relay

*Note: In order to get the appropriate cables and screws, one of the above kits must be ordered when ordering the High Performance External Preselector as a FRU.*

CLN1224 = VHF 100 Watt Power Amplifier (132-154 MHz)  
CLN1225 = VHF 100 Watt Power Amplifier (150-174 MHz)  
CLN1226 = VHF 40 Watt Power Amplifier (132-174 MHz)  
CLN1227 = VHF 30 Watt Power Amplifier (132-174 MHz)  
CLD1010 = 350 MHz 40 Watt Power Amplifier (335-405 MHz)  
CLN1228 = UHF 100 Watt Power Amplifier (403-435 MHz)  
CLN1229 = UHF 100 Watt Power Amplifier (435-470 MHz)  
CLN1230 = UHF 40 Watt Power Amplifier (403-470 MHz)  
CLN1231 = UHF 30 Watt Power Amplifier (403-470 MHz)  
CLN1232 = 800 MHz 75 Watt Power Amplifier (851-870 MHz)  
CLF1260 = 900 MHz 75 Watt Power Amplifier (935-940 MHz)

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## Available Options/Kits/FRUs (Continued)

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### **MTR2000™ FRUs**

CLN1201 = MTR2000™ Station Control Module  
CLN1202 = MTR2000™ Station Backplane  
CLN1203 = 4 Wire Wireline Module  
CLN1204 = 4 Wire Wireline Module (Europe/South Africa/Australia)  
CLN1205 = 8 Wire Wireline Module  
CLN1206 = Aux I/O Board

CLN1220 = 500 Watt (High Power) AC Power Supply  
CLN1221 = 250 Watt (Low Power) AC Power Supply  
CLN1222 = 500 Watt (High Power) 28.6 VDC Power Supply  
CLN1223 = 250 Watt (Low Power) 14.2 VDC Power Supply

CLN1207 = VHF Double External Circulator Tray (132-146 MHz)  
CLN1208 = VHF Double External Circulator Tray (144-160 MHz)  
CLN1209 = VHF Double External Circulator Tray (158-174 MHz)  
CLN1210 = UHF Double External Circulator Tray (403-470 MHz)  
CLN1279 = 800 MHz Double External Circulator Tray (851-870 MHz)  
CLF1290 = 900 MHz Double External Circulator Tray (935-940 MHz)

*Note: External double circulator FRU is not offered with the 350 MHz station.*

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# Checking The Order

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## Steps to Follow

Review the following checklists to make sure the order is correct!

<b>IF YOU ARE ORDERING...</b>	<b>THEN ASK YOURSELF...</b>
Conventional Operation	<ul style="list-style-type: none"><li>• If the order is for a repeater (Option X580), do you require a duplexer? (Option X182)</li><li>• If the order is for a base station (Option X622) with a single antenna, did you order an antenna relay? (Option X371)</li><li>• Did you order the RSS or have you included programming as part of the installation?</li></ul>
All Models	<ul style="list-style-type: none"><li>• Did you order the Test Microphone if it is required? (Main Line Item GMN6147)</li><li>• Did you order the 6 Watt external speaker and the cable kit if you want to test the station? (Main Line Items HSN1000 and 01-85180U01 respectively)</li><li>• Did you order the RSS for configuration, alignment and diagnostics?</li></ul>

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## Other Helpful Material

### Sources

Provided below are some additional sources of information available on MTR2000™.

<b>If you need more information about...</b>	<b>Then refer to...</b>
Operating, Installation, and Troubleshooting Procedures	MTR2000™ Installation and Operation Manual-68P81096E20 MTR2000™ VHF Instruction Manual-68P81096E30 MTR2000™ UHF Instruction Manual-68P81096E25 MTR2000™ 800/900 MHz Instruction Manual-68P81096E90
Programming Startup	MTR2000™ Radio Service Software Programming Startup Manual-68P81096E15
Specifications and Input Power Requirements	MTR2000™ VHF/UHF Spec Sheet – R3-2-1000 MTR2000™ 800/900 Spec Sheet – R3-2-1001 Dealer VHF Spec Sheet: MD-MTR-001 Dealer UHF Spec Sheet: MD-MTR-002