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Product Introduction

Welcome to the MaxTrac•LS trunked mobile radio family! Your choice of the Motorola MaxTrac•LS means you have selected the highest of standards in design, quality, and performance.

The MaxTrac•LS, shown in Figure 1, gives you the flexibility to operate on both conventional repeater systems and the popular, 10-group LTR® trunking system. The radio supports up to 10 trunking systems, which lets you maintain communications while roaming from area to area. The radio also supports up to 10 conventional channels, which gives you the freedom to switch to a conventional repeater or to communicate directly with other two-way radios.

This manual is designed to acquaint you with all the features, care, and service issues of the MaxTrac•LS to better serve all your communication needs.



Figure 1 - MaxTrac•LS Mobile Radio

Standard Features and Benefits

The following features are standard with the MaxTrac•LS radio.

LTR trunked operation

- ◆ 10 systems
- ◆ 10 groups per system
- ◆ Fast system access
- ◆ Automatic retry
- ◆ Communications privacy
- ◆ Flexible fleet structuring
- ◆ Telephone interconnect, when used with an optional Touch-Code microphone, allows you to make and receive telephone calls through a properly-equipped trunking system

Conventional operation

- ◆ 10 channels
- ◆ Talkaround operation lets you bypass repeaters
- ◆ Busy channel lockout keeps radio users from hearing conversations outside of their designated group

Ergonomic design

- ◆ Bright, two-digit display with built-in scan type indication
- ◆ All controls are on the front panel
- ◆ System and group indicators
- ◆ Compact palm microphone
- ◆ 3 Watt internal speaker - front mounted

Ease of operation

- ◆ Scan function allows the radio to automatically scan across

any combination of 10 systems/groups/channels

- ◆ Time-Out Timer automatically shuts off transmitter after a programmable amount of transmission time
- ◆ Selective call helps eliminate wasted air time trying to reach an unattended radio.

Rugged, dependable design

- ◆ Designed to MIL-STD 810 C and D for shock and vibration, the toughest environmental test for a mobile radio.
- ◆ 15 or 35 watt power output|
- ◆ $\pm 0.00025\%$ frequency stability
- ◆ Power-up check validates correct operation each time the radio is turned on

Flexible installation capabilities

- ◆ Field reprogramming capability
- ◆ Non-locking trunion with hardware
- ◆ 10 ft. power cable
- ◆ 12V DC negative ground
- ◆ 3 dB gain antenna with 14 ft. cable

Optional Accessories

The following accessories for your MaxTrac•LS radio are available from your Motorola dealer.

Microphones

- ◆ Touch-Code microphone - provides a DTMF keypad for ease in dialing; also available with a back-lit keypad and last number auto-dial
- ◆ Full-sized palm microphone - provides a larger size and heavier microphone, preferred by many radio users
- ◆ Noise-cancelling microphone - for use in high noise environments
- ◆ Handset - a cellular-style handset (without DTMF keypad), which replaces the standard compact microphone

Speakers

- ◆ External speaker - 5 watt output for high noise environments
- ◆ Public address speaker - 6 watt output

Mounting options

- ◆ Key lock mounting bracket - secures the radio in a mounting tray using a two-piece, lockable, detachable trunnion
- ◆ Extra stability mounting plate - used with non-locking mounts for protection against shock and vibration

Control station kit

- ◆ Converts the MaxTrac•LS mobile into a desktop control station by adding a power supply, angled mounting tray, and desk microphone

Miscellaneous

- ◆ Mini-UHF connector - can be crimped onto the end of the antenna cable

- ◆ External alarm relay kit - provides relay with cable kit for connection to horn or lights
- ◆ Ignition switch cable
- ◆ Expanded accessory connector provides great flexibility in adding external hardware such as Public Address. Ask your Motorola Representative for more information.

Radio Feature Programming

The following features of your radio can be programmed by your dealer:

- ◆ Conventional and trunked frequencies
- ◆ Trunked systems and groups
- ◆ Squelch
- ◆ Transmit Time-Out Timer
- ◆ External Alarm
- ◆ Scan list
- ◆ Busy Channel Lockout
- ◆ Receiving and displaying incoming ID
- ◆ Radio Check
- ◆ Telephone memory dialing list

Advantages Of Trunking

Trunking allows many users to share a fixed number of communication channels without interfering with one another. Telephone companies for years have used trunking to make the most efficient use of their equipment, and similar trunking methods have been adapted to two-way radio communication.

A trunked radio system allows a large number of users to share a relatively small number of frequencies. When a mobile operator keys the microphone to establish communications with someone else in the system, the system automatically assigns a communication path - a repeater and its frequency. Once the conversation has ended, the repeater is freed for other users. Trunking pools all the repeater air time, and this maximizes the amount of air time available to any one mobile unit and minimizes channel congestion.

Some of the key benefits of trunked two-way radio systems are:

- ◆ No channel monitoring required prior to transmission
- ◆ Fast system access
- ◆ Automatic channel selection
- ◆ Privacy among members of the same group
- ◆ Uninterrupted conversations.

Quick Reference

Front Panel Controls

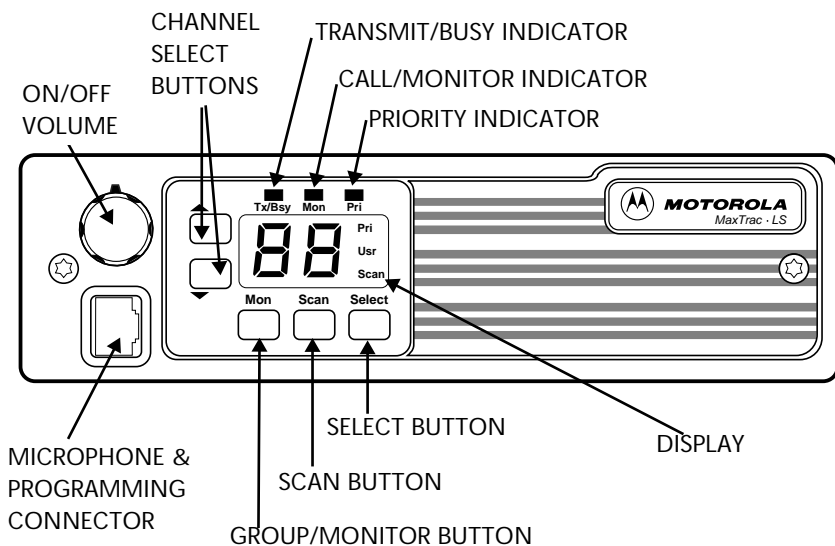


Figure 2 - MaxTrac•LS Front Panel

ON/OFF VOLUME KNOB

Powers the radio on and off and adjusts the speaker volume.

CHANNEL/MODE SELECT BUTTONS (▲▼)

Allow you to select conventional channels and trunking systems. A single press selects the previous/next available channel or system. Continue pressing to scroll backwards/forwards through the available channels and systems.

TRANSMIT/BUSY INDICATOR (Tx/Bsy)

A red indicator that comes on while your radio is transmitting,

goes off while your radio is receiving, and blinks when the selected channel is busy or you attempt to transmit outside the range of the selected trunked system.

CALL/MONITOR INDICATOR (Mon)

An amber indicator that comes on when a channel is being monitored (enabled by the Mon button). The indicator flashes when an incoming trunked call occurs (that is, when a trunked group or ID is decoded).

PRIORITY INDICATOR (Pri)

A green indicator that flashes during a priority scan to indicate activity on the Priority 1 channel. The indicator remains on continuously to indicate activity on a Priority 2 channel. Refer to page 27 for more information on priority scan.

MICROPHONE & PROGRAMMING CONNECTOR

Provides the connection for the radio's microphone. Also used by the dealer for RSS programming.

GROUP/MONITOR BUTTON (Mon)

When the radio is tuned to a trunking system, this button allows you to select the trunking group. When the radio is tuned to a conventional channel, a short press causes the current channel to be monitored, while a long press (2 seconds) causes the radio to un-squelch so that the volume can be adjusted.

SCAN BUTTON (Scan)

A short press activates and deactivates the scan function, as described on page 25. A long press (2 seconds) allows you to add or delete channels from the user scan list, as described on page 27.

SELECT BUTTON (Select)

When used with other radio controls, performs a variety of functions. Activates and deactivates Call Alert, Radio Check, and Phone Interconnect. While scanning is active, pressing Select adds, deletes, and sets priorities of channels in the user scan list.

DISPLAY

Refer to the next page for information on the display.

Display

The two-digit display shows the conventional channel or trunked system/group to which the radio is currently tuned. A single digit (0-9) indicates a conventional channel. Two digits indicate a trunked group, with the first digit identifying the system and the last digit identifying the group. The display can also show the type of scan in effect, as described on page 25. The following table lists and describes other display codes that can appear.

Table 1 - MaxTrac.LS Display Codes

If you see this...	It means that...	Take this action...
CA	Someone has sent you a Call Alert page.	Press the PTT or any button to stop the paging signal. Refer to page 21 for more information.
CH	Someone has sent a radio check to determine if your radio is turned on and within range.	Press the PTT or any button to clear the display.
HL	The External Alarm is active. An incoming call will activate your horn and lights. (HL = Horn/Lights)	To turn off an active alarm, press any button or take the microphone off hook. To deactivate External Alarm, press the Select button. Refer to page 15 for more information.
PH	Someone is calling your radio from a telephone.	Switch to your telephone transmit group and press the PTT to answer the call. Refer to page 19 for more information.
SC	Someone is sending you a Voice Selective Call.	The radio unmutes and a voice message follows. After the transmission is complete, the radio returns to normal operation.

Tones

The following table lists MaxTrac•LS radio tone signals and their meanings.

Table 2 - MaxTrac.LS Signal Tones

If you hear...	It means that...	Take this action...
TALK PROHIBIT TONE A siren-like tone when the PTT is pressed.	You made an unsuccessful attempt to access the trunked system. Normally this occurs when the radio is out of range.	Try again when you are in a better location, for example, when on a hill or closer to the system.
	The system is out of service.	Wait until the system is back in operation and try again.
BUSY TONE A continuous <i>bah bah bah</i> when the PTT is pressed.	All available channels are busy, or the radio is continuously trying to access the system.	Release the PTT switch and try again a few moments later, or hold the PTT until you get access.
VALID KEY TONE A high-pitched <i>chirp</i> when a button is pressed.	The button press was accepted.	Proceed with desired function.
INVALID KEY TONE <i>Bonk</i> tone when a button is pressed.	You pressed an illegal button for the current operation.	Select another function.
TIME-OUT TIMER TONE A siren-like tone while transmitting.	The present transmission will end in four seconds.	Finish your transmission before your transmitter is disabled.

Basic Operation

Turning the Radio On

1. Turn the On/Off Volume knob to the right until it clicks. You will hear a chirp tone.

NOTE: Each time it is turned on, the radio performs a self check to validate correct operation. If the radio is not operating at the exact parameters set in the factory or field, you will hear a 5 second warning tone instead of the normal chirp tone. This indicates the radio should be serviced immediately.

2. The unit automatically switches to the trunking system/group or conventional channel the unit was on when last turned off.
3. Set the volume by turning the On/Off Volume knob clockwise. One half turn equals about 50% output.

Receiving

1. Select the trunking system or conventional channel with the ▲ and ▼ buttons.
 - ◇ A single press of the ▲ or ▼ button moves to the previous/next channel. Hold down the button to scroll backwards/forwards through the channels.
 - ◇ A conventional channel is indicated by a single digit (0-9) in the display.
 - ◇ A trunking system is indicated by two digits in the display. The left digit is the trunking system number. The right digit is the trunking group.

2. To select a trunking group press the Mon button while on a trunking system. Each press of the Mon button while on a trunking system causes the radio to scroll through the group choices.

Monitoring a Conventional Channel

1. If you wish to monitor a conventional channel press the Mon button while the radio is displaying the desired conventional channel.
2. You may also enable the monitor function by taking the microphone off hook when the radio is on the desired conventional channel.

Controlling Squelch

1. To unsquelch the radio while on a conventional channel, press the Mon button for 2 seconds. This unmutes the speaker. You may then adjust the volume with the On/Off Volume knob.
2. To return the radio to coded squelch operation, press the Mon button again.
3. The monitor and unsquelched modes are reset each time the ▲ or ▼ buttons are pressed.

Using Call/Monitor

1. The Mon indicator flashes on a trunking system when a call group or ID is decoded.
2. To clear the flashing Mon indicator, press any button.

Transmitting on a Trunked System

1. Press the PTT (Push To Talk) button.
2. If the Tx/Bsy indicator stays on continuously, continue to push the PTT and speak into the microphone in a normal voice.
3. If the Tx/Bsy indicator does not stay on continuously, release the PTT and try again later. If you hear tone(s) when you push the PTT button, the radio is alerting you that certain system conditions exist. Refer to Table 2 on page 12.
4. If your radio has the Time-Out-Timer function activated, transmission will terminate if you hold down the PTT button for more than a pre-programmed time period (from 1 to 255 seconds - programmed using RSS software). When time-out occurs, a siren-like alert tone sounds 4 seconds before the transmission is cut. To resume transmitting, release the PTT button and push again.

Transmitting on a Conventional Channel

1. The red Tx/Bsy indicator will flash if there is another unit active on the channel. Do not transmit if anyone else is using the channel.
2. When you press the PTT on your microphone, the Tx/Bsy indicator will stay on continuously to indicate that you are “on the air.” If you hear tone(s) when you push the PTT button, the radio is alerting you that certain system conditions exist. Refer to Table 2 on page 12.
3. If your radio has the Time-Out-Timer function activated, transmission will terminate if you hold down the PTT button for more than a pre-programmed time period (from 1 to 255 seconds - programmed using RSS software). When time-out occurs, a siren-like alert tone sounds 4 seconds before the transmission is cut. To resume transmitting, release the PTT button and push again.

Activating the External Alarm Option

This feature allows you to be alerted of calls when you are outside your vehicle. Through an external relay, the horn or lights of the vehicle will activate for 6 seconds when a call is received. Call Alert pages and Telephone Interconnect calls will also activate the external alarm.

1. Press the Select button to activate the External Alarm feature. In some radios, multiple presses may be required and the Scan Feature must also be turned off. The external alarm is active whenever the display shows HL (Horn/Lights).
2. Press any button or take the microphone off-hook to turn off an active alarm.
 - ◇ Since there is a delay between receiving a radio call and activating the external alarm, an operator near the vehicle who sees or hears the Call Alert indication will be able to turn off the external alarm before it sounds, if desired.
3. If desired, the Scan feature can be active at the same time as the External Alarm by first activating the alarm feature, then pressing the Scan button.
4. Press the Select button to deactivate the External Alarm feature.

Telephone Interconnect

Your MaxTrac•LS radio may be equipped with Telephone Interconnect, which allows you to make calls to landline telephones through the trunking system. Calls between the mobile operator and landline user are private, if the mobile initiates them. Calls that the landline user initiates can be private or include a whole group.

Keep in mind that the mobile operator can either talk or listen at one time, whereas the landline user has duplex (talk and listen) operation. This means a mobile operator who is speaking will not hear an interruption from the landline user. Therefore, the landline user should be warned to listen for the beep before speaking.

To Place A Telephone Call

1. Select your phone transmit group, then press and release the PTT.
 - ◇ The phone transmit group is a special trunking group that allows you to access the landline telephone system. Contact your system operator for more details.
2. Listen for the dial tone.
 - ◇ If you hear a busy tone (*bah-bah-bah*), it means the system is busy; hang up and try again later. When a channel becomes available, you will hear a dial tone and can dial the number.
3. Use the Touch-Code microphone to dial the number. If your radio has been pre-programmed with telephone numbers and you wish to dial one of those numbers, refer to Step 4.
 - ◇ Be sure to hold the key down until you hear a *beep*. Continue pressing the key until the *beep* ends.

- ◇ If the number is mis-dialed, hang up by pressing the # button on the Touch-Code microphone and start over.
4. If your radio has been pre-programmed with telephone numbers and you wish to dial one of those numbers, do the following:
 - ◇ Press the Select button to access the list of numbers. Note that the display alternates between PH and the number you have selected.
 - ◇ Use the ▲ and ▼ buttons to scroll through the list of numbers to the number you wish to dial.
 - ◇ Press the PTT to dial the number.
 5. Keep these points in mind during your conversation:
 - ◇ The telephoned party should be informed that you are using a radio and that replies should be made only after you have finished transmitting. The telephoned party will hear a soft *beep* after you release the PTT. Explain that only one person can talk at a time.
 - ◇ If the telephoned party speaks while you are transmitting, you will not be able to hear what they say. Proceed with the conversation in a normal two-way radio manner by pushing the PTT to transmit and release to listen.
 - ◇ The maximum call duration is determined by the traffic loading of the trunking system. Both parties will hear a high pitched alert tone fifteen seconds before the call times out; you will then have fifteen seconds to complete your conversation.
 6. To disconnect the call and return to dispatch operation, press the # button on the Touch-Code microphone. Then select your normal receive group with the Mon button.
 - ◇ If the call is not disconnected, you will hear an illegal function *bah* tone after a short period.
 - ◇ Other types of calls, except system calls, will not be allowed while the telephone interconnect is engaged.

To Receive A Telephone Call

1. To make a call to the radio, the landline party will dial an interconnect terminal phone number. If the system is busy, the landline party hears a normal busy signal, and must hang up and try again. If the phone line is open, the caller will hear a high pitched tone. The caller should then enter the access code assigned to the desired radio unit. Both the landline and the radio user will hear a ringing tone and the MaxTrac•LS display will also flash PH.
2. To answer, select your phone transmit group and press the PTT. Refer to Step 5 on the previous page for points to keep in mind while using Telephone Interconnect.
3. To disconnect the call and return to dispatch operation, press the # button on the Touch-Code microphone. Then select your normal receive group with the Mon button.
 - ◇ If the call is not disconnected, you will hear an illegal function *bah* tone after a short period.
 - ◇ Other types of calls, except system calls, will not be allowed while the telephone interconnect is engaged.
4. If the mobile unit is equipped with the External Alarm feature, described on page 15, engage it before you leave the vehicle. When a telephone call is received, the vehicle's horn will sound or the lights will flash for six seconds.

Group Telephone Interconnect Receive Only

In a group telephone call, the landline caller enters the access code of the group. The group mobile operators do not have to take any action to be included in the conversation. If the group is busy, the caller hears up to 20 seconds of fast ringing tones. When the connection is made the landline caller hears a high pitched *dit-dit-dit* talk permit tone indicating the conversation may begin. The mobiles hear the voice, without preliminary tones. All mobiles, whether or not equipped with telephone interconnect, may receive and respond to such calls.

If involved in a conversation with a group, the landline caller will hear up to 20 seconds of a high pitched tone from the trunking system before the call times out. If the conversation is not completed in 20 seconds, the landline caller must redial to continue the conversation.

Selective Signaling

The Mon indicator remains on continuously in normal operation to indicate that monitor mode is active. To indicate an incoming selective call, the Mon indicator will flash and the display will show the appropriate letter abbreviations.

Receiving a Voice Selective Call

1. When a Voice Selective Call is received, a one time 2 beep alert tone will sound, the amber Mon indicator will flash, and the display will show SC.
2. The radio will unmute and a voice message will follow. After the transmission is completed, the radio returns to normal operation.

Receiving a Call Alert

1. When a Call Alert is received, the amber Mon indicator will flash and a series of 4 alert tones will sound. The display will show CA. Depending on the signalling format used, a voice message may follow.
2. A Call Alert “leaves a message” for the mobile operator. The Mon indicator continues to flash, the CA remains on the display, and the alert tones repeat every 10 seconds.
3. To cancel the Call Alert notification, press the PTT or any other button. The radio will then return to normal operation.

NOTE: You cannot receive Call Alert pages if you are talking on your radio, are out of range, or have turned off your radio.

Sending an Identification Number

1. Every time the PTT key is pressed, the radio automatically transmits a unit identification (ID) number.
2. While holding the PTT key, you will hear a tone while the unit ID number is being sent out. Do not begin talking until the tone ends.

Selective Signaling and Channel Scan

Selective signaling and scan are compatible. However, during scan operation, a selective call on a particular channel could be missed since the radio may not be checking that channel when the selective call is sent.

It is recommended that priority scan be selected and the signaling channel be designated a priority channel to improve the likelihood that the selective call will be received.

Using the Call List for Sending Selective Messages

Activating the Call List

Pressing the Select button activates the Call List. The most recently used ID number and the call letters will alternately be displayed. The following call letters may be displayed when using a call list.

- ◆ SC (Voice Selective Call) - Call a particular unit or group with a voice message.
- ◆ CA (Call Alert) - Select a unit or group and leave a “callback” indicator.
- ◆ CH (Radio Check) - Check to see if a unit is turned on and within range.

These letters will alternate on the display with the unit or group ID number.

Changing Call List Letters and ID Numbers

Each press of the Select button causes the display to move down the list of call letters which have been programmed in the unit.

Pressing the ▲ and ▼ buttons will change the ID numbers. All Call List ID numbers will be displayed with each set of call letters. However, some ID's may not be compatible with certain call types. For example, a group ID cannot be Radio Checked. In such cases, pressing the PTT will result in a low pitched tone which indicates that the function is not available.

Sending a Signaling Message

Once the desired call letters and ID numbers have been selected, pressing the PTT will send the message. The display will revert to the pre-programmed transmit channel to send the signaling message and the channel will be briefly displayed.

Receiving an Acknowledgment

Depending on the signaling format used, the sending radio may look for an acknowledgment from the receiving unit on Call Alert and Radio Check calls.

The sending radio will show an A and 4 alert tones will sound if the target unit received and acknowledged the call. If no acknowledgment is received, the sending unit will make another 4 tries. If unsuccessful, a -A will be displayed and a low pitched tone will sound to indicate no acknowledge.

Exiting the Call List

Press the Select button to exit the signaling call list. Repeated pressing of the Select button takes you through the sequence of call letters to the channel display for normal operations.

Scan

Scan is a feature that allows your MaxTrac•LS mobile radio to search for and lock onto active channels or groups. The radio offers five different types of scan, using either a pre-programmed scan list (programmed into the radio using RSS software) or a user-programmable scan list (programmed into the radio from the front panel.).



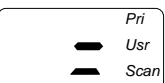


Turning Scan On or Off

1. Press the Scan button.
2. The radio scans only when the microphone is on-hook. The channel display will blink and a green segment will light to indicate that scan is functional, as shown in Table 3.
3. Use the Select button to select the scan types, which are described in Table 3.
 - ◇ As shown in the table, some scan types use pre-programmed scan lists (programmed into the radio using RSS software), while some scan types require you to program your own scan lists. Refer to page 27 for information on how to program user scan lists.
 - ◇ If you have not programmed a user scan list, you will not be able to access the User Scan or Priority User Scan.
 - ◇ The radio can be pre-programmed (through RSS) to use one of three different types of scanning sequences:
 - Revert Scan - Causes the radio to move immediately to the mode and group on which you receive a call. The radio remains on this new mode/group until the next call is received, but will continue to scan. This is most appropriate for dispatcher control stations.
 - Search Scan - Causes the radio to lock onto the first system where it sees a valid home channel. If this home

channel is lost for more than three scan cycles, the radio will begin scanning for a new system. This is best suited for roaming applications.

- Normal Scan- Causes operation in normal talkback scan.
4. When an active channel is detected, the channel number will be displayed and you will hear the call.
 5. To leave scan, press the Scan button again.

Table 3 - MaxTrac.LS Scan Types

Display	Type of Scan	Description
	All Group Scan (Pre-programmed)	Scans all LTR trunking groups, as determined by the scan list pre-programmed into the radio using RSS software.
	Scan (Pre-programmed)	Scans all channels, groups, and systems in both LTR and conventional modes, as determined by the scan list pre-programmed into the radio using RSS software.
	User Scan (User programmed)	Scans all channels, groups, and systems in both LTR and conventional modes, as determined by the scan list you program into the radio.
	Priority User Scan (User programmed)	Operates the same as User Scan, but gives longer scan time to first and second priority channels; activity on these channels will always be immediately heard. Refer to page 27 for information on selecting channel priorities in the user scan list.
	Priority Scan (Pre-programmed)	Operates the same as Scan, but gives longer scan time to first and second priority channels; activity on these channels will always be immediately heard. Priority channels for the pre-programmed scan list are set using RSS software.

Responding to Scanned Channel Activity

1. When the microphone is lifted off-hook, the radio will suspend scanning and return to the channel displayed before entering scan.
2. If you wish to respond to a transmission on another channel, press the ▲ or ▼ button to reach the desired channel. Scan will resume after replacing the microphone on-hook.
3. When scanning with priority, the green Pri indicator will flash to indicate activity on the Priority 1 channel and light continuously to indicate activity on the Priority 2 channel.

Creating or Modifying the User Scan List

1. Hold the Scan button for 2 seconds until you hear a second *chirp* tone and the channel number flashes.
2. The displayed channel can be added or deleted from the user scan list by pressing the Select button. A vertical segment in the upper left corner of the display will light to indicate that the flashing channel has been added to the scan list. The segment will disappear when the channel is deleted.
3. Use the ▲ and ▼ and Select buttons to add or delete channels in the user list.
4. You can add up to 10 channels to the user scan list. If you attempt to add more than 10 channels, the radio will respond with an invalid key tone (*bonk*).

Selecting Priorities for the User Scan List

1. Use the ▲ and ▼ buttons to select the desired channel, then hold the Select button down for two seconds. The Pri indicator will flash to indicate that this is the first priority (Priority 1) channel.
2. Repeat the process to select a second priority channel. The Priority 2 channel will be indicated by a steady light on the Pri indicator.
3. The Priority 1 channel must be programmed first, followed by the Priority 2 channel. Deleting either priority channel will delete both channels simultaneously.

To Delete A Nuisance Channel

1. While receiving an undesired transmission during scan, hold down the Select button for two seconds and the nuisance channel will be temporarily deleted (until you exit scan mode or the radio is turned off).
2. Priority channels and the home channel cannot be deleted.

Installation

Before You Start . . .

Licensing

Your radio is completely adjusted, tested, and inspected before shipment. However, FCC regulations state that a station license must be obtained for each radio installation (mobile or base) by the owner of the equipment. The station licensee is responsible for ensuring the transmitter power, frequency, and deviation are within the limits permitted under the station license.

No technician's license is required for installing and maintaining radio equipment. However, the frequency and deviation of the transmitter must be checked on installation and at least annually.

Power Protection Circuitry

The MaxTrac•LS mobile you are installing has been tested for proper transmitter power output before leaving the factory. Each radio is set to the proper output power level while connected to an accurate 50 ohm load impedance. Once the power level has been set, the internal power control/protection circuitry will reduce the power output whenever it senses a load impedance significantly different from 50 ohms. This protection circuitry greatly enhances the radio's reliability with minimal performance degradation.

If you check transmitter output power levels during installation, be sure you are using a good 50 ohm load, with a minimum of adapters and using short test cables. Any load variation from 50 ohms may cause an apparent reduction in output power due to the normal operation of the control/protection circuitry. These variations in power with other than 50 ohms load impedance will be most pronounced in the 800 MHz band since cables, meters, con-

nectors, etc. have larger effects in that band. If power seems to be unusually low (greater than can be explained by the normal calibration differences you experience), check your test setup. If power output goes up as you improve the quality of the load impedance (be sure to de-key when making any changes in load), the control/protection circuitry is performing normally.

Typical mismatches in the load impedance (greater than 1.2:1 VSWR) may result in a 10-20% variation in the actual measured power output. Within these limits, the radio operates normally and you should not attempt to service it.

Installation Planning

Mobile Radios

Planning is the key to fast, easy radio installation. Before a hole is drilled or a wire is run, inspect the vehicle and determine how and where you intend to mount the antenna, radio, and accessories. Plan wire and cable runs to provide maximum protection from pinching, crushing, and overheating.

Base/Control Stations

The base/control station option provides the radio with a desk microphone and power supply for use at a fixed location. All operations are the same as the mobile, except for the desk microphone.

Choose a location for your base/control station as close as possible to where the antenna cable enters the building. Be sure 117V AC, 60 Hz power is available. Make sure sufficient air can flow around the radio to permit adequate cooling.

Recommended Tools For Installation

The following tools are recommended for proper installation of your new radio.

- ◆ Portable Drill
- ◆ Hammer

- ◆ Center Punch
- ◆ 5/16" Hex Nut Driver
- ◆ 1/4" Hex Nut Driver
- ◆ Phillips #2 Screwdriver
- ◆ TORX Screwdriver, T25
- ◆ 3/8" Diameter Drill Bit
- ◆ 5/16" Diameter Drill Bit
- ◆ 5/32" Diameter Drill Bit

Antenna Mounting

The best mounting location for the antenna is in the center of a large, flat conductive surface. In almost all vehicles, these requirements are best satisfied by mounting the antenna at the center of the roof. Some vehicles have a large trunk lid that provides a good antenna location. If the trunk lid is used, connect grounding straps between the trunk lid and vehicle chassis to insure the trunk lid is at chassis ground. See the instruction manual supplied with the antenna for complete installation information.

Radio Mounting

Non-Locking Trunnion/High Power Sleeve

The standard non-locking trunnion (or sleeve used on high power 800 MHz) allows the radio to be mounted to a variety of mounting surfaces. Be sure the mounting surface is able to adequately support the weight of the radio. Allow sufficient space around the radio for free air flow for cooling. Be sure the unit is close enough to the vehicle operator to permit easy access to operating controls. Although the trunnion can be mounted to a plastic dashboard, it is recommended that the mounting screws be located so they penetrate the supporting metal frame of the dashboard.

Floor Mount

A floor mount wedge is available which allows the radio to be tilted at either 45 or 60 degrees. The sleeve mounting hardware which is standard with 35 Watt 800 MHz models mates with this wedge. If the wedge is to be used with other models, the sleeve must be ordered separately.

Extra Stability Mounting Tray

The optional extra stability mounting tray is used in conjunction with the non-locking trunnion. If the radio is mounted on a rounded surface, you may need to install shim washers (not provided) between the bracket and the mounting surface. Shims are necessary to tilt the radio, because the heavy duty bracket blocks the standard trunnion adjustments. Follow instructions provided with the option.

NOTE: The extra stability mounting tray is not needed for the 35 Watt model as the sleeve mounting already provides maximum stability.

Locking Trunnion

The optional locking trunnion consists of a two piece trunnion type mounting bracket equipped with a key lock and associated mounting screws and is designed to facilitate easy removal. The locking trunnion may be mounted on either metal or plastic surfaces, provided the mounting surface adequately supports the weight of the radio. Follow instructions provided with the option.

Before attempting to install the locking trunnion, examine the vehicle for suitable mounting locations. This bracket requires a flat mounting surface, 8" x 12" minimum with adequate clearance for inserting the radio. The chosen location should be convenient to the vehicle operator and provide access to the power and the antenna connectors. Be careful to choose a location that permits the locking trunnion to be removed from the mounting bracket. Vehicle operation should never be impaired by the location of the trunnion or radio.

Note that the locking trunnion is not compatible with the 35 Watt 800 MHz models, and overhead mounting is not recommended.

Starting the Installation

DC Power Cable Installation

The radio must be operated only in negative ground electrical systems. Reverse polarity does not damage the radio; however, radio protection circuits cause the cable fuse to open. Check the vehicle ground polarity before you begin installation to prevent wasted time and effort.

The 8-foot DC power cable shipped with the radio is long enough for installation in most vehicles. Begin the power cable installation in the following manner.

1. Determine a routing plan for the power cable with reference to where the radio is to be mounted.
2. Locate an existing hole with a grommet in the vehicle firewall, or drill a 3" access hole at the location for passing the power cable into the engine compartment. Install a grommet with 1/4" I.D. in the access hole to avoid damage to the cable.
3. From inside the vehicle, feed the red and black leads (without lugs attached) through the access hole and into the engine compartment. See Figure 3.

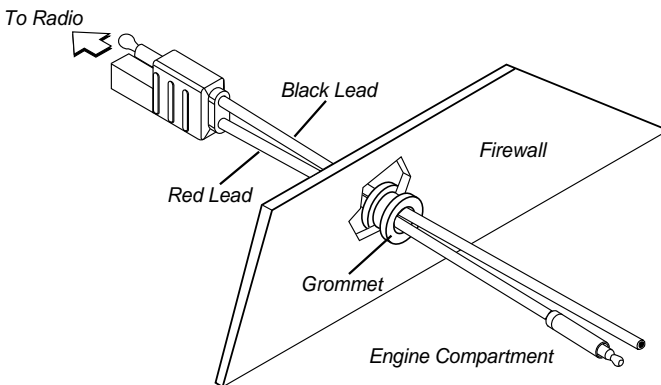


Figure 3 - Power Cable Routing Into the Engine Compartment

4. Locate the nearest available vehicle chassis ground mounting point and shorten the black lead to remove excess cable length.
5. Install ring lugs (supplied) onto stripped end of power cable black lead, and onto stripped end of red lead on fuse holder. See Figure 4.
6. Locate the fuse holder as close to the battery as possible and away from any hot engine component. Mount the fuse holder using the provided mounting hole and dress wires as necessary. Connect the fuse holder red adapter lead plus to the mating receptacle on the red lead of the power cable. See Figure 4.
7. Connect the power cable black lead directly to the vehicle chassis ground.
8. Connect the power cable red lead from the fuse holder to the positive (+) battery terminal. Make sure the adapter cable is connected to the main power cable red lead.
9. Plug fuse into in-line fuse holder as shown in Figure 4.

NOTE: Failure to mount the red lead of the power cable kit directly to the battery may result in severe alternator whine interference and cause radio to revert to mode 1 each time power is removed.

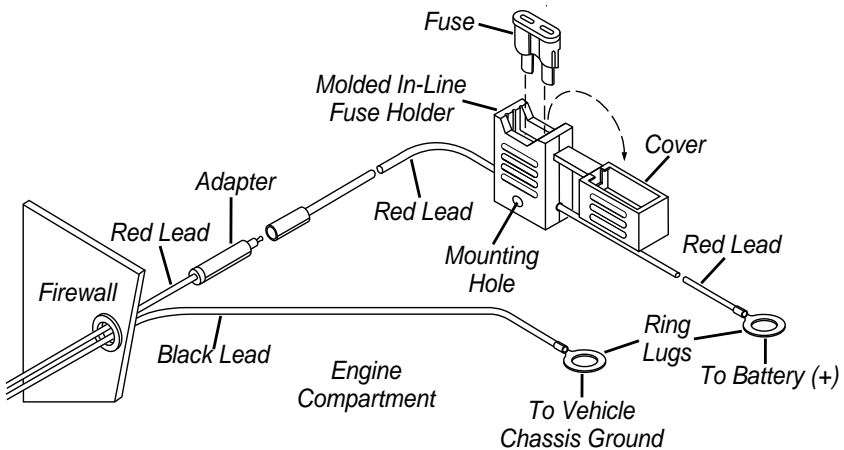


Figure 4 - Power Cable Assembly

Non-Locking Trunnion Installation

1. Select the location to mount your radio - either on the transmission hump or under the dashboard. See Figure 5.
2. Using the trunnion mounting bracket as a template, mark the positions of the holes on the mounting surface. Use the innermost four holes for a curved mounting surface such as the transmission hump, and the four out most holes for a flat surface such as under the dash.
3. Center punch the spots you have marked and drill a 5/32" hole at each.
4. Secure the trunnion mounting bracket to the surface with the four (10-16x3/4") screws provided.

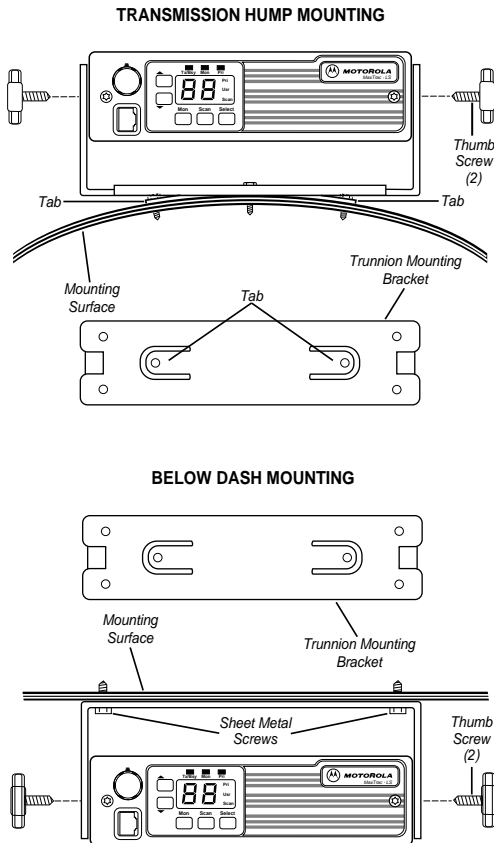


Figure 5 - Methods of Trunnion Mounting Radio

5. Place the radio in the trunnion mounting bracket and secure it with the two thumb screws provided.
6. To complete your radio installation plug the power cable into the radio power connector. See Figure 6.
7. Mount the antenna using the instructions provided with the antenna kit. Run the coaxial cable to the radio mounting location. If necessary, cut off the access cable and install the cable connector.
8. Connect the antenna cable connector to the radio antenna connector on the rear of the radio. See Figure 6.
9. Mount the microphone clip. Follow instructions provided with the microphone clip.
10. Plug the Microphone into the front panel connector. Your microphone has a telephone type connector at the end of its cord. Connect and disconnect your radio microphone in the same manner you connect and disconnect your telephone handset.

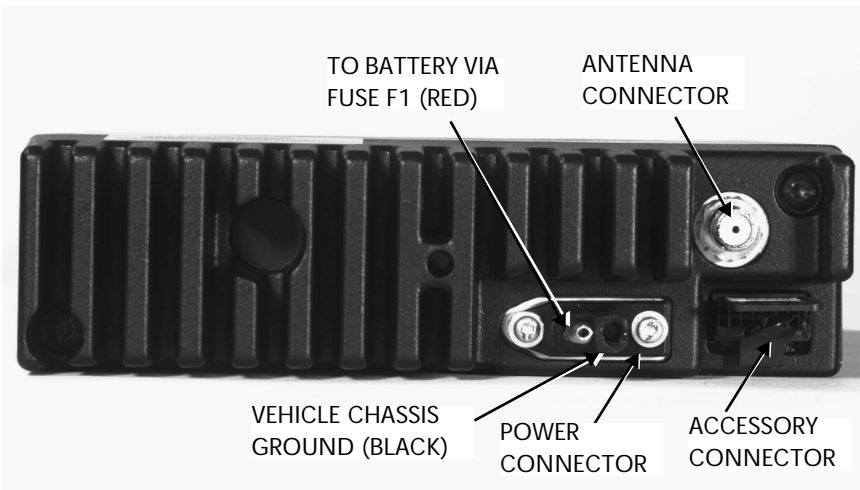


Figure 6 - Connections to Radio Rear Panel

Sleeve Mounting Bracket Installation

Your radio uses a specially designed three point sleeve mounting bracket for on or under dash mounting. To mount your radio on the floor an optional accessory, the Mounting Wedge, is available (Kit No. HLN9450).

Dash mount your radio as follows:

1. Select the location to mount your radio either ON or UNDER DASH. See Figure 7.
2. Using the sleeve mounting bracket as a template, mark the positions of the holes on the mounting surface.

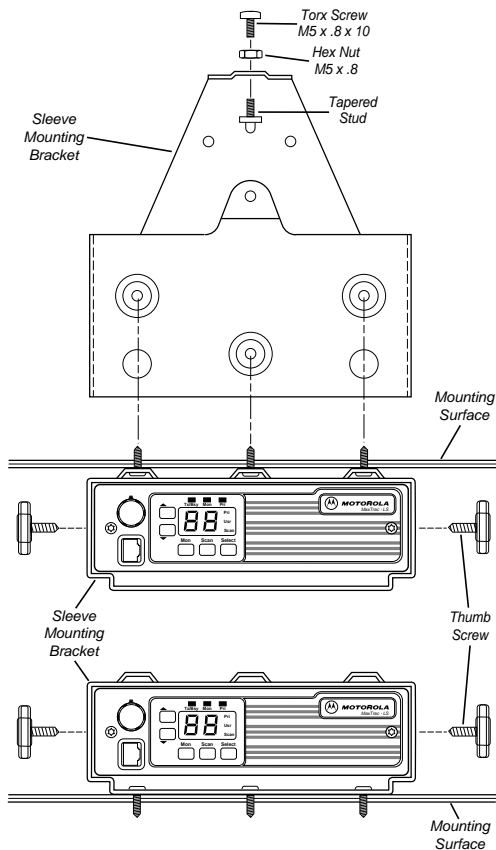


Figure 7 - Sleeve Mount for Radio

3. Center punch the spots you have marked and drill a 5/32" hole at each.
4. Secure the sleeve mounting bracket to the surface with the four (10-16x3/4) screws provided.
5. If there is sufficient room in the rear of the bracket to install the M5.0.8x 10mm screw, proceed with step 7.
6. Install the tapered stud and nut in the rear hole of the sleeve mounting bracket as shown in Figure 7.
7. Insert the radio into the sleeve mounting bracket guiding the tapered pin into the hole in the rear of the heatsink, and secure it with the two thumb screws provided. If you have skipped step 6 above, install the MSxO.8x10mm Torx screw in the rear of the bracket to secure the radio.
8. To complete your radio installation, push the power cable into the radio power connector. Mount the antenna using the instructions provided with the antenna kit. Run the coaxial cable to the radio mounting location. If necessary, cut off the access cable and install the cable connector, making sure that the connector is properly crimped and soldered to ensure maximum performance.
9. Connect the antenna cable connector to the radio antenna connector on the rear of the radio.
10. Mount the microphone clip. Follow instructions provided with the microphone clip.
11. Plug the Microphone into the front panel connector. Your microphone has a telephone type connector at the end of its cord. Connect and disconnect your Radio Microphone in the same manner you connect and disconnect a telephone handset.

Safety Information

FCC Precautions

The FCC, with its action in General Docket 79-144, March 13, 1986, has adopted a safety standard for human exposure to radio frequency electromagnetic energy emitted by FCC regulated equipment. Motorola subscribes to the same safety standard for the use of its products. Proper use of this radio will result in exposure below government limits.

The following precautions are recommended:

- ◆ DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.
- ◆ DO NOT operate the transmitter of a fixed radio (base station, microwave, the rural telephone RF equipment) or marine radio when someone is within two feet (0.6 meter) of the antenna.
- ◆ DO NOT operate the transmitter of any radio unless all RF connectors are secure and any open connectors are properly terminated.
- ◆ DO NOT operate the equipment near electrical blasting caps or in an explosive atmosphere.
- ◆ All equipment must be properly grounded according to Motorola installation instructions for safe operation.
- ◆ All equipment should be serviced only by a qualified technician.

Refer to the appropriate section of the product service manual for additional pertinent safety information.

Installation Safety Warning

- ◆ Consider the occupants' safety when you choose a location for the radio. Do not mount the radio overhead or on a sidewall unless you take special precautions
- ◆ If someone were to remove the radio and fail to replace it properly, road shock could bump the radio loose, and the falling radio could, in some circumstances, cause serious injury to the driver or a passenger. In a crash, even when properly installed, the radio could break loose and become a dangerous projectile.
- ◆ If you must mount the radio overhead or on a sidewall, give it the added protection of a retaining strap.

Operational Safety Warnings

WARNING - For vehicles equipped with electronic anti-skid systems, see “ANTI-SKID BRAKING PRECAUTIONS” Publication, Motorola Number 68P81109E34.

WARNING - For vehicles equipped with electronic ignition systems, check the service manual for warnings about the use of two-way radio equipment in the vehicle.

WARNING - It is mandatory that radio installations in vehicles fueled by liquefied petroleum gas conform to the following standard:

National Fire Protection Association standard NFPA 58 applies to radio installations in vehicles fueled by liquefied petroleum (LP) gas with LP gas container in the trunk or other sealed-off space within the interior of the vehicles. This standard requires that:

- ◆ Any space containing radio equipment shall be isolated by a seal from the space in which the LP gas container and its fittings are located.
- ◆ Remote (outside) fitting connections shall be used.
- ◆ The container space shall be vented to the outside.

Antenna Installation

CAUTION - For installation of antennas with mobile radio equipment with transmitter power in excess of 7 watts:

Nonmetallic Body Vehicles - In nonmetallic body vehicles with transmitters at any frequency having a power output in excess of 7 watts, do not install any type of antenna closer than 2 feet in distance from any occupant of the vehicle. Failure to follow this procedure may result in the exposure of the vehicle occupants to radio frequency energy levels higher than recommended by the American National Standards Institute (ANSI).

Metal Body Vehicles - In metal body vehicles with transmitters at any frequency having a power output in excess of 7 watts, it is mandatory that when using a glass mount antenna the installation instructions covering the location of the antenna at the top of the front or rear window and the cable routing be followed exactly as described. Failure to follow this procedure may result in the exposure of the vehicle occupants to radio frequency energy exposure levels higher than recommended by the American National Standards Institute (ANSI).

For other antenna types follow the existing installation instructions. The best location for the antenna is at the center of vehicle roof. A good alternate location is at the center of the trunk lid.

IMPORTANT - If installations different from these recommendations have already taken place, immediately notify your local Service Representative so that appropriate corrective action can be taken.

NOTE: For Low Power Mobile Radios Or Cellular Radios (7 Watts Or Less), There Are No Antenna Type Or Installation Restrictions.

Converted Mobile Equipment

CAUTION - Motorola two-way radio products which have been designed for mobile operation should not be used as battery operated portable units. In such use there is the danger that the user or other persons will be exposed to excessive radio frequency energy levels. This warning applies to all two-way radio equipment radiating in excess of seven (7) watts RF power. Motorola strongly recommends that any product which converts high power equipment for portable operation not be used.



Glossary

Busy Channel Lockout

Busy channel lockout provides a form of “listening privacy” and protects other users on the channel from being “stepped on”. If enabled on the channel (through RSS), then your radio will behave in the following manner. If PTT is pressed while the channel is busy, the operator will hear a busy tone. Regardless of the action taken by the operator, he/she will not be allowed to monitor the channel. The only transmissions that will be heard are those from the operator’s same group. Whenever this group is talking, the radio will be allowed to transmit and receive at will. However, if the channel is vacant when PTT is pressed, the radio will immediately transmit.

Call Alert

Call Alert lets a caller leave a “page” on your unattended radio. When the you return to the radio, you will know to return the call.

DTMF

Dual Tone Multi-Frequency. A means of sending touch-tone telephone tones over a two-way radio channel, typically for dialing a landline telephone number using a telephone interconnect.

Mode

Another name for a radio channel.

PTT

Push-To-Talk. The switch located on the microphone which, when pressed, causes the radio to transmit. When the PTT is released, the radio receives.

Repeater

A special, fixed two-way radio that receives and re-transmits signals in order to improve communications coverage.

RSS

Radio Service Software. Used by dealers to pre-program certain functions of your radio, such as scan lists and the Time-Out Timer.

Squelch

Muting of an audio circuit when the received signal level falls below a pre-determined value. This prevents you from having to listen to constant static on your radio.

Talkaround

The ability to “talk around” a repeater by communicating directly with another mobile or portable radio.

Time-Out Timer

A programmable function that limits the amount of time the radio can transmit (that is, the amount of time the PTT can be pressed without releasing). When this function is activated, a warning tone sounds 4 seconds before the transmitter is cut off. The Time-Out Timer can be disabled or set to any value between 1 and 255 seconds using RSS.

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