MDM SERIES

DMR TIER II TDMA & ANALOG MOBILE RADIO

USER MANUAL

maxon®
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DMR
DIGITAL MOBILE RADIO ASSOCIATION

UHF & VHF Transceiver

* User Manual is subject to change without notice.

Printed in Korea

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Maxon America, Inc.

Table of Contents

Thank You for Purchasing the MDM Series Radio!

1. Before operating the radio, please read the user manual carefully.
2. Functions and specifications are subject to be changed without notice for improvement of the radio performance.

1. Features of the MDM Series

Maxon's high-powered MDM Series is an acutely designed compact DMR Digital/Analog Mobile Radio. Packed with popular digital features such as messaging, AES Encryption, contact lists, and call recording. MDM Series Mobile Radio can be turned into a Base Station with a cabinet enclosure, power supply, and desk mic. The external accessory connector can be used in various ways, contact your local dealer for more information.

- OLED Display
- 2,048 Programmable Channels, 64 Zones (1,024 Max Ch Per Zone)
- ETSI Standard DMR Protocol Tier 1 & 2
- VHF (50W) / UHF (45W) Maximum output power
- 6 selectable transmit power levels
- Power Source DC+13.6V ±15%
- Automatic Mixed Mode detects and switches between DMR & Analog Mode
- Mixed Channels (Digital & Analog)
- Contact List capacity of 240
- Remote Radio Stun / Revive
- Transmit and Receive Text Messages
- CTCSS, DCS
- Call Recording
- Data compatible between Moto TRBO and HYT
- BCL (Busy Channel Lock)/BCLO (Busy Channel Lock Override)
- Lone Worker (Digital Channels Only)
- Selectable Squelch Level (0~5)
- Encryption (AES256 Standard)
- 4W @ 8 Ohms Audio Output
- Heavy-Duty Microphone
- Internal or External Speaker
- TX Interruption, Priority call- Factory Option
- Motorola/DMRA AES256 Encryption - Factory Option
- SFR (Single Frequency Repeater) - Factory Option for MDM-4000 Series

2. Specifications

Frequency Range	MDM-4124/2124 (136~174 MHz) MDM-4424/2424 (406 ~470 MHz)
Frequency Stability	±1.5ppm (-30 to +60°C)
Programmable Channels	2,048 Channels
Zone	64 (1 Zone = Max 1,024 Channels)
Channel Bandwidth	12.5KHz
Digital Vocoder	AMBE++
Dimensions	44.5mm (H)X165 (W)X172 (D)
Weight	1.1Kg
Power Source	DC +13.6V, ±15%
Current Drain (Maximum)	Receive mode, rated audio out - 1A (Audio Max) Transmit mode - 11A Standby mode - 150mA

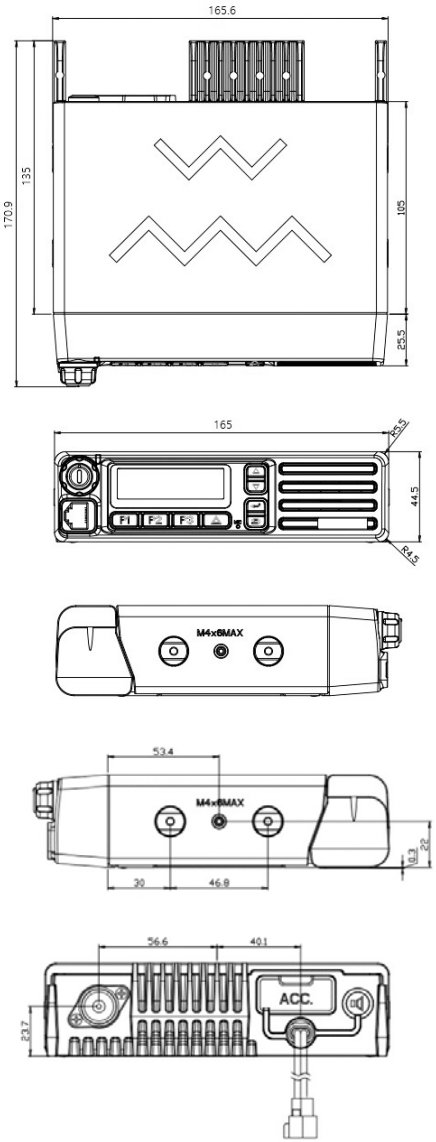
Receiver

Sensitivity	0.25uV (BER 1%)
Selectivity	70dB (12.5KHz)
Spurious & Harmonic Rejection	36 dBm (< 1GHz) -30 dBm (> 1GHz)
FM Hum & Noise Ratio	40dB (12.5KHz)
Audio Output Power	4 Watt/8-ohm load
Audio Distortion	Less than 3%
Audio Response	+1, -3 dB from 6dB per octave de-emphasis Characteristic from 300 ~ 3000Hz
Input Impedance	50 ohms

Transmitter

RF Power Output	5/10/20/30/40/50Watts
Spurious & Harmonic	-36 dBm (< 1GHz) -30 dBm (> 1GHz)
FM Hum & Noise Ratio	40dB (12.5KHz)
Audio Distortion	Less than 3%
Audio Response	+1, -3dB from 6dB per octave pre-emphasis Characteristic from 300 ~ 3000Hz
Input Impedance	50 ohms

3. Dimensions & Appearance



4. Assembly & Installation

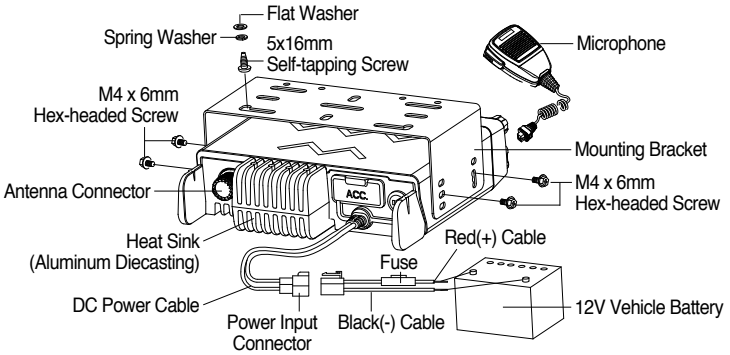


Figure 4-1) Parts & Installation

4.1 In-Box Contents

- DC power cable with 15A Fuse (1)
- Mounting Bracket (1)
- Screw set
- 5 x 16 mm self-tapping screws (4)
- Hex-headed screws with washer (4)
- Spring washers (4)
- Flat washers (4)

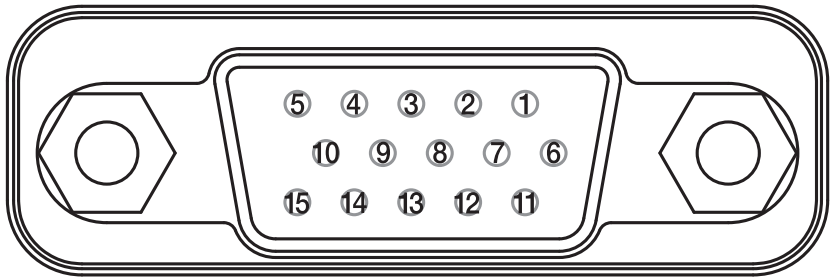
Microphone (with cable)

- ACC 800 (1)

Microphone hanger (with 4x16mm self-tapping screws) (1)
Instruction manual

4.2 Accessory Jack Layout

ACC (D-SUB 15 Pin Connector)



Pin No	Pin Name	Description	Specification	I/O
1	GPIO0	Currently Undefined	3.3V TTL	I/O
2	IGN	Ignition Signal Input	Power on: 8V	I
3	EXT_SPK	Loudspeaker Output	8 Ω, 4Watt	O
4	EXT_AUDIO	Audio Output	500mV	O
5	EXT_MIC	Audio Input	5k Ω	I
6	TXD/FCN1	TX Serial Data	3.3V TTL	O
7	RXD/FCN2	RX Serial Data	3.3V TTL	I
8	EXT_PTT	External PTT	PTT OFF: 3.3V(H) PTT ON: 0V(L)	I/O
9	GPIO2	Currently Undefined	3.3V TTL	I/O
10	COR	For Squelch Output	SQ ON: 3.3V SQ OFF: 0V	I/O
11	EXT/INPUT	Programmable	High Impedance	I/O
12	DC+5V	DC Power Supply	DC+5.0V Max 100mA	O
13	HR1	Horn Alert Signal Output	Max 3A	O
14	HR2	Horn Alert Signal Output	Max 3A	O
15	GND	Ground	Ground	-

Microphone Jack

Pin No	Pin Name	Description	Specification	I/O
1	MBL	Microphone Backlight	-	O
2	DC+13.6V	DC Power Output	13.6 ±15%	O
3	GND	Ground	Ground	-
4	PTT/TXD0	PTT/PC Serial Data	3.3V TTL	I
5	ME	MIC Ground	MIC Ground	-
6	MIC	MIC Signal Input	600 Ω	I
7	HOOK/RXD0	HOOK/PC Serial Data	3.3V TTL	I
8	DM	MIC Data Detection	High Impedance	I/O

Speaker Jack (3.5mm Phone Jack) 4Watt/8 Ω

Pin No	Pin Name	Description	Specification	I/O
1	SPO	External Speaker Output	4Watt/8 Ω	O
2	GND	Ground	Ground	O

DC Input Power Connector

Pin No	Pin Name	Description	Specification	I/O
Red	DC+13.6V	DC Power Output	13.6 ±15%	-
Black	GND	Ground	Ground	-

Antenna Connector
Impedance is 50

5. Controls & Operation

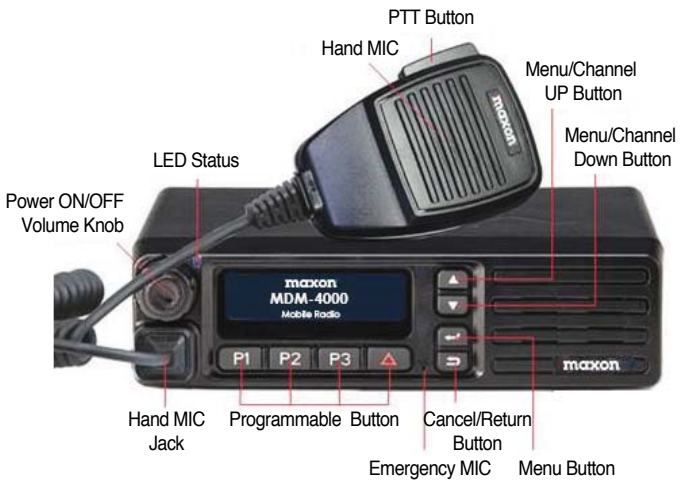


Figure 5-1) Controls, Knobs and Buttons

5.1 Power ON/OFF Volume Knob

Press and hold in the Power On/Off knob to power on the radio. Display screen will start with a Maxon screen and a power-up tone. Press and hold the power on/off knob to power off. Display screen will power off and you will hear a voice notification stating “Good-bye”

Audio volume level can be adjusted by rotating the Power On/Off volume knob clockwise/counter-clockwise.

5.2 PTT Button

Press & hold the PTT button to transmit voice and release the PTT button to receive voice. It is recommended to talk 2~4 inches from the microphone.

5.3 Menu Button

To enter the menu tree as displayed in Figure 5-3a, press the MENU button. Press the ▲ to move to the right and press ▼ to move to the left. To enter the submenu, press the MENU button one more time.

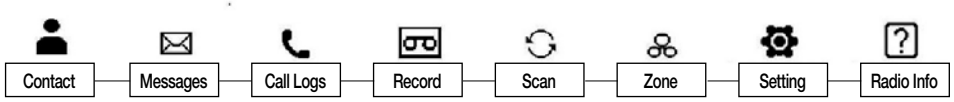


Figure 5-3a) MDM Series Digital Menu

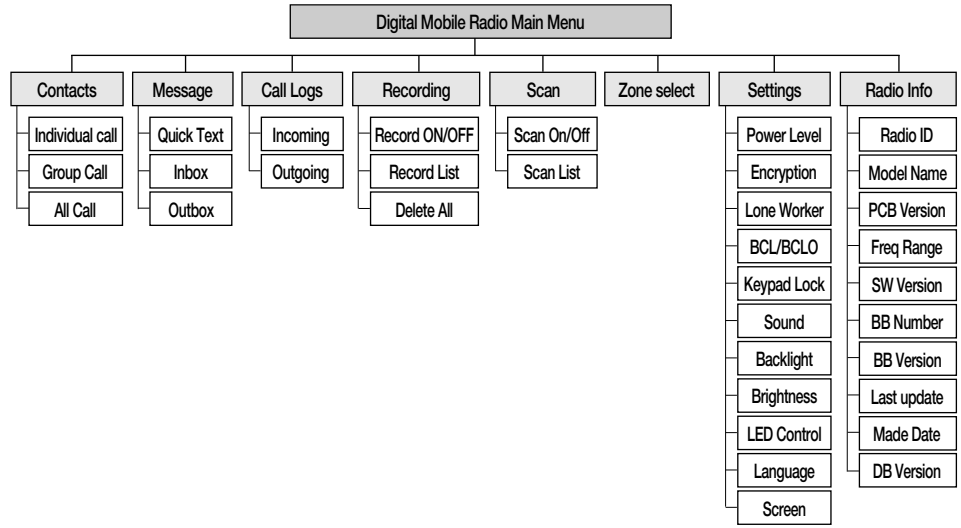


Figure 5-3b) MDM Series Full Menu Tree (Digital Channel)

5.4 Menu Button and Channel ▲/▼ Buttons

Press the MENU button to enter menu and press ▲/▼ button to highlight selection within the menu list. Press the Menu button again to select. Pressing ▲/▼ button when not in a menu will move UP / DOWN through the channels programmed into the radio.

5.5 Cancel / Menu Exit

A single press of the Cancel/Return button takes you back one step. A press and hold will exit all menus.

5.6 Programmable Buttons (P1, P2, P3, ▲)

Programmable buttons are available for user convenience. These buttons can be set via the radio’s programming software

Once the radio is on, you can use a quick press of the P1 button to change zones. Selectable Zones are displayed in order based on your radio’s programming.

5.7 Emergency Microphone
You can program one of the programmable buttons on your mobile as an Emergency microphone PTT switch if ever the mobile's palm microphone is unavailable. Emergency Microphone PTT button can be set via radio programming software.

5.8 15 Pin Accessory Jack
The accessory jack as several functions such as connecting a horn relay, external speaker, external microphone and GPIO pins. Pinout is shown in section 4.2.

5.9 LED Display
LED next to the display indicates the operational status of the radio.

① LED will illuminate RED color when transmitting
② LED will illuminate GREEN color when receiving
③ If the LED blinks GREEN, the frequency is correct, but the color code, CTCSS or DCS does not match

6. Functionality

6.1 Menu selection
Press Menu Button to enter the menu mode. Figure 6-1 shows the radio menu when you are on a digital channel. Full Digital Mode menu tree was previously displayed in figure 5-3b. Figure 6-2 shows the radio menu when you are on an analog channel

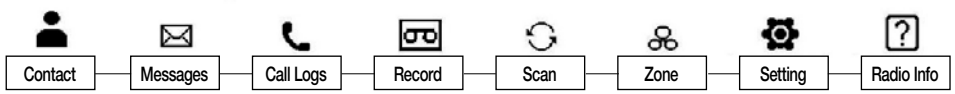


Figure 6-1) MDM Series Digital Mode Menu

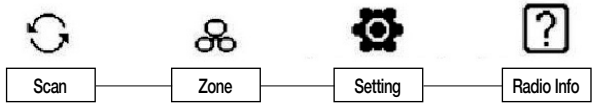


Figure 6-2) MDM Series Analog Mode menu

☞Note) Radio will exit Menu mode and go into Standby mode if no selections are made within 30 seconds.

6.1.1 Contact (Digital Mode Only)
The Contact List provides a list of individuals, groups or all calls of which you can make a direct call. To initiate a call, select the Contacts section from the menu (or press the contact button for direct access), press the menu/enter button to see the list of contacts, press ▲/▼ buttons to the desired contact and press the PTT button to initiate the call. You can set up a list of contacts within the radio by the radio's programming software.

The Contact Menu displays "Individual", "Group", and "All Call" contacts using the following icons:

- : Individual contact list (individual calls, individual messages can be sent)
  * Stun Radio, Revive Radio, Check Radio, & Monitor Radio functionality is in this menu. "Stun" will disable the desired radio's ability to Tx. "Revive" will restore the functionality. "Check Radio" checks to see if the target radio in your contact list is receiving. "Monitor Radio" turns on the mic of the target radio to listen to the surrounding sound.
- : Group contact list (group call, group message can be sent)
- : All contact lists (terminals with the same channel and color code are available)

6.1.2 Text Messages (Digital Mode Only)
When a new message arrives and the radio is in receive mode, the message contents are displayed on the OLED display and the radio's message menu appears. When a new message arrives during a different radio operation, it will be displayed as a message icon.

The Message menu provides three additional menu functions: Quick Message, Inbox, and Outbox.

1) Quick Text message
The radio holds 40 software programmable messages (each up to 40 characters) that the radio sends via SMS in digital mode as a "Quick Message" To get into the Quick Message menu, use your radio to enter the Main Menu and then select Messages. This will bring you to the Messages menu. Select "Quick Message" to see the available messages to send. Highlight the message you want to send and press the menu button to view the message contents. Press the menu/select button again and highlight the recipient from your contacts list. Press select button to select the recipient and send the message. To cancel the message, press and hold the Cancel/Return button.

2) Inbox
Inbox stores up to 10 received text messages; After 10 messages are received in your inbox, the oldest message is overwritten as a new message is received. When a new message arrives, the contents will be displayed on the LCD screen. When you choose messages stored in the inbox, you can view the received messages and the caller ID that initiated the call. You cannot delete a received message one at a time. If you want to delete a message, you will need to select "Delete All" from the message menu and delete all the messages in your inbox.

3) Outbox

The message "Outbox" holds a maximum of 10 sent messages. View your outbox by selecting "Outbox" from your Messages menu and then select the message you want to read from the contents listed. After 10 sent messages are stored in your outbox, the oldest message is overwritten as a new message is created. You cannot delete a sent message one at a time. If you want to delete a message, you will need to select "Delete All" from the message menu and delete all the messages in your outbox.

6.1.3 Call Logs (Digital Mode Only)

Call Logs menu stores only the history of your individual calls. Group Calls and All Call radio calls are not saved. The messages are managed by your Message Inbox and Outbox.

1) Inbox

Your radio can store 10 IDs of radios who have called you in your call history Inbox. If more than 10 IDs are received, the oldest IDs are overwritten by the new ones. The Delete menu in your inbox is used to delete your entire call history.

2) Outbox

Your radio can store 10 IDs of radios you have called in your call history Outbox. If more than 10 IDs are stored, the oldest IDs are overwritten by the new ones. The Delete menu in your outbox is used to delete your entire call history.

6.1.4 Voice Recording (Digital Mode Only)

You can record your incoming and outgoing radio calls with the "Voice Record" feature located in the Main Menu when on a digital channel. Once it is turned on, all incoming audio received through the radio and every outgoing audio transmission will be recorded in separate files. Save up to 63 calls (Max Length 1 minutes and 45 seconds). You have the ability to turn the Voice Record feature ON or OFF in the Settings Menu. If you want to purposefully remove a recording you will need to "Delete All" messages. Numbering for your oldest recordings start at #1 and are automatically deleted as new recordings are captured

When the encryption mode is selected, audio is recorded on the transmitting radio and also the receiving radio if the other radios also have encryption turned on. Transmitted audio will not be heard and voice recordings will be silent on the receiving radios if they do not have encryption turned on as well.

6.1.5 Scan

Scanning allows you to check a list of channels for activity. A button can be assigned to start and stop scan or it can be accessed through the menu.

Scan lists are predefined using the programming software. There can be up to 10 scan list. These lists can be selected in the menu by Scan/Scan List.

A scan list can also have one priority channel. If priority is selected and the radio is in scan mode, transmit will be on the priority channel. If reception is on a non-priority channel, transmit is allowed on that channel within the scan hang time.

1) Scan ON/OFF

On/Off setting can be set in the Scan Menu

2) Scan List

Scan list can be set via the radio's software programmer

6.1.6 ZONE

You can organize and expand the number of available channels by moving your channels into groups called "Zones". Your MDM Series mobile radio supports up to, 5000 total channels using any combination of 64 zones, with a maximum of 1,024 channels per zone. Contact your radio dealer to program your radio's zones.

6.1.7 Radio Settings

Radio Settings from the Main menu: Power Level (Tx), Voice Encryption, Lone Worker, Busy Channel Lock (BCL)/Busy Channel Lock Override (BCLO), Button (Keypad) Lock, Sound, LCD Backlight, LCD Brightness, LED Control, Screen and Language.

1) Power Level

There are 6 power levels with 1 being the lowest and 6 being the highest. The higher the level the farther the transmission range. The power level can be changed by a programmed button or by accessing the menu.

2) Voice Encryption

Your radio's Voice Encryption feature is used to encrypt incoming and outgoing voice communications. Menu setting on radio turns encryption ON or OFF. Encryption settings are adjustable using your radio dealer's programming software. Encryption can be set for each digital channel. Key length is itself is created automatically according to key length. You can create up to 40 selectable receiving radios if they do not have encryption turned on as well. The radio will show reception, but there will be no audio.

3) Lone Worker (Digital Mode Only)

When turned on, the "Lone Worker" feature will automatically send out an emergency call to the rest of your fleet through your radio when there is no radio activity within the time set in the menu. To activate, select "On" after you enter the Lone Worker menu. Press up or left on the circle button to get to the timer (Set Times). Choose between 1-100 minutes for Lone Worker to activate and press the select button to make the selection. "Set Success" will appear on the screen when activated.

4) BCL/BCLO

The BCL/BCLO function is used to prevent the radio from transmitting while the channel is busy to avoid interruption of a conversation in progress. The default setting is OFF.
(Busy Channel Lockout): Prohibits transmission on the same RF frequency.
BCLO (Busy Channel Lockout Override): Allows transmit only if the CTCSS/DCS or Color Code match.

5) Keypad Lock

Keypad lock is used to lock the keypad from accidental keypresses. When the keypad lock function is on, all buttons are locked except the PTT button, the emergency button and power ON / OFF switch. If turned on from the Main Menu, the "Key Lock" feature is activated when there is no input information for 5-20 seconds (programmable through settings menu).

☞ Caution: A programmable key needs to be programmed for Keypad Lock before setting it from the main menu.

6) Sound

This function enables to setup and adjust volume and tones associated with Volume, Call Tone, Message Tone, Key Tone, Start-up Tone, Mic Input Set and Fixed Vol.
- Volume of the keypresses can be adjusted. (Off, Soft Medium, Loud)
- Call Tone. There are 4 types of calls. If it is selected to "off", all call tones are disabled.

Analog Call Tone: ☑
Digital Individual Call Tone: ☑
Digital Group Call Tone: ☑
Call End Tone: ☑

- Test Message Alert Tone can be enabled or disabled.
- Button Tone can be enabled or disabled.
- Starting Tone can be enabled or disabled.
- Microphone Input sound can be adjusted. (Soft, Default, Loud Mode, Louder Mode)
- Fixed Volume is used to prevent accidental volume change. If enabled and the volume control is rotated, the display will show "Fixed Volume Operation".

7) OLED LCD Backlight

OLED LCD Backlight function ON or TIMED the OLED LCD backlight.

8) OLED Contrast (Brightness)

OLED Contrast (Brightness) function adjusts the contrast/brightness of the LCD from 1 (dim) to 7 (brightest) levels

9) LED Control

LED Control function on or Timed disables the LED status display. Used to turn your LED status display ON or OFF. Your radio dealer can adjust detailed LED status behavior using the radio's programming software.

10) Language

Language is used to select the language displayed in the radio menus. Selection of Spanish or English.

11) Screen setting

Screen setting is used to select between 3 different screen modes (see fig 6-1).

Channel Numbers	Screen 1	Screen 2	Screen 3
1	D0001	01 D0001 DMRDigiCh1	D0001 TX:Mhz 01 RX:Mhz
2	A0001	01 A0001 Analog Ch1	A0001 TX:Mhz 01 RX:Mhz
	KEY D = Digital A = Analog "1"First analog and digital channels	**KEY** 01 = Zone D0001 same as Screen 1 Alias channel name	**KEY** D = Digital A = Analog "1"First analog and digital channels

Figure 6-1) Description of Display screen selections

6.1.8 Radio Information

Used to show the radio's information: Radio ID, Model Name, PCB Version, Freq Range, SW Version, BB Number, BB Version Last SW Update, Made Date, DB Version. Press the "Select" button to make a selection in this menu.

7. Single Frequency Repeater Function (MDM-4000 Series Only)

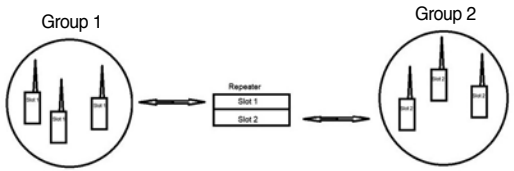
portable radios are out of range
in direct mode

What is it?

MDM Series mobile radios have a factory-optional feature called Single Frequency Repeater (SFR) that allows your mobile radio to be used as a repeater to help radios communicate that might fall out of normal communications range. SFR is different from traditional repeater mode in that the uplink and downlink frequencies of the repeater are the same. Your radio dealer will need to activate this feature in your MDM Series mobile radio.

How it works:

For DMR two-way radios, there are two “slots” at a single frequency, we call them “Slot 1” and “Slot 2”. Using interference cancellation technique, our DMR radio with SFR feature can use one slot to receive a call and the other slot to transmit the call on the same frequency at the same time.



Single Frequency Repeater (SFR) mode works as a very fast store and forward repeater. Radio 1 only transmits for 30 msec and then waits while the radio with SFR takes the voice data packets from radio 1 and sends them out on time slot 2 for 30 msec.

How do I use it?

Your radio dealer needs to program all your portable radios that you wish to use with the SFR feature to talk on the SAME FREQUENCY, but have one group talk on SLOT 1 and the other group that is out of reach to talk on SLOT 2. When turned on, the user of the MDM-4000 radio will only need to set the mobile radio to the channel where the SFR frequency is programmed and keep the mobile radio turned on. The radios you want to connect to the SFR channel to reach each other now just need to turn to the frequency & color code the SFR channel was programmed for and they will be able to communicate through the SFR repeater even though they are out of range when trying to reach each other directly on other channels (Simplex mode).

Why It is Used

1. In simplex mode, your signal coverage can be extended, especially in closed or isolated small areas of a signal’s dead zone or a weak signal zone.
2. Saves frequency resources. A single frequency point can set up a complete repeater system.

8. Precautions

7.1 Precautions for Safe Operation of this equipment.

Warning — Be careful when removing your antenna from the Radio and don't transform your antenna or make any changes to your antenna. Strong electronic waves emitted from the Radio can have an effect on the performance of the Radio if the antenna is modified and can cause the Radio to have a defect not covered under warranty.

Caution — Don't use other manufacturer's accessories (such as power adaptor, microphone, external speaker microphone and earphone, etc.). Unknown or unauthorized accessories may damage the radio and void the warranty.

Warning — Don't disassemble or reorganize the Radio. The disassembly or reorganization of your radio is punishable by law and can cause damage to the radio that will not be covered by the warranty

Warning — Don't use frequencies you do not have a permit for.

Caution — Avoid excessive shock to the Radio. Don't place the Radio where the direct sunlight and/or the high temperature occurs,

7.2 Do not use the radio where prohibited

Your radio emits a strong electronic wave which may have an effect on the operation of other equipment and can also be affected by those other devices.

Warning — If using radio in an area where medical equipment is being used, please get permission from relevant staff to prevent interference issues.

Caution — Be careful when using your radio in a place where computers or other electronic devices are being used because the strong electronic waves from the radio can affect this equipment.

9. Safety Notes & FCC

Warning

- Please keep the radio away at least 1 inch from the body.
- Do not touch antenna if it is damaged. Risk of skin burn can occur if the outside surface of antenna gets stripped out.
- Please don't listen to the radio at a high-volume level when using earphones. Loud volume may have a lasting bad effect on your hearing.
- It is recommended to adjust the volume step by step to the level you want after you set the radio volume of the radio at a low level.
- Turn off the radio in areas where there is a strong electromagnetic force

FCC RF EXPOSURE COMPLIANCE REQUIREMENTS FOR OCCUPATIONAL USE ONLY

The Federal Communications Commission (FCC), with its action in General Docket 93-62, November 7, 1997, has adopted a safety standard for human exposure to Radio Frequency (RF) electromagnetic energy emitted by FCC regulated equipment. Proper operation of this radio will result in user exposure far below the Occupational Safety and Health Act (OSHA) and Federal Communications Commission limits.

- DO NOT transmit for more than 50% of total radio use time (50% duty cycle). Transmitting more than 50% of the time can cause FCC RF exposure compliance requirements to be exceeded.
- This radio is NOT approved for use by the general population in an uncontrolled environment. This radio is restricted to occupational use, work related operations only where radio operator must have the knowledge to control the user's exposure conditions for satisfying the higher exposure limit allowed for occupational use.
- When transmitting, hold the mic 2″ to 4″ from your mouth when speaking.
- The radio is transmitting when the red LED on the front of the radio is illuminated. You can cause the radio to transmit by pressing the PTT bar on the microphone.
- These are required operating configurations for meeting FCC RF exposure compliance. Failure to observe these restrictions means violation.

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions:(1) This device may not cause harmful interference and (2) This device must accept any interference received, including interference that may cause undesired operation.

WARRANTY CARD

Thank you for purchasing MDM Series.

1. This product has passed strict quality control and testing process.

2. Warranty is three years from original date of purchase unless an extended warranty has been purchased.
   Failure of the product under normal operating conditions, during the warranty period may be repaired by Maxon America, Inc or our authorized service organization free of charge.

3. For the following cases, some service fees will be charged.
   - When repair occurs after the warranty period has passed.
   - When the product is damaged due to user's mishandling, abuse or improper operation.
   - When the product is damaged due to user's modification, attempted repair or otherwise access to sealed/non-user serviceable items.
   - When the product is damaged due to fire, pollution, earthquakes and any other natural or unnatural conditions, accidents, etc.

4. Product and personal information

PRODUCT NAME		MDM SERIES
SERIAL NUMBER		
PURCHASE DATE		
PURCHASER	NAME	
	ADDRESS	

※ Please contact Maxon America, Inc below for Return Merchandise Authorization (RMA) number before you send your radio back for service.

MAXON AMERICA, INC

11535 W. 83rd Terrace, Lenexa, KS 66214

Toll-Free: 800-456-2071/ Phone: 913-859-9515

Website: www.maxonamerica.com

Email: maxon@maxonamerica.com