RELM COMMUNICATIONS, INC.
1 YEAR LIMITED WARRANTY

MS200 MOBILE AM/FM SCANNER

INSTRUCTION MANUAL

RELM Communications, Inc.
7505 Technology Drive
West Melbourne, FL 32904

7001-20157-000   7-97

RELM: The Choice of Professionals

Welcome to the RELM Communications family of professional monitors, two-way radios and systems, and thank you for purchasing one of our fine products. We are confident that you will be pleased with this product and that it will provide you many years of dependable, trouble-free communications.

About Our Company

Formerly known as Regency Electronics, Inc., RELM Communications, Inc., is a U.S. manufacturer of one-way (monitors) and two-way FM radio products. We are backed by more than 40 years of experience in the electronic communications industry and have earned a worldwide reputation for providing dependable, hard working products at a fair price.

You may remember us as Symmetrics, or Wilson, or as Regency Land Mobile. Your first experience with us may have been with crystal based mobile and portable radios. We were pioneers in the development of synthesized radios, incorporating built-in tone signalling options such as CTCSS, DCS and Two-Tone Sequential and a host of user friendly operational features, like scanning and keyboard control. Our innovation in commercial radio continues today with the introduction of an *Instant Priority*™ button, a reversible display and area grouping of channels.

We are truly a commercial communications company with a dedicated commitment to monitors and two-way radio design, manufacturing, sales and service. We have selected a new name — a name which bolsters our position as a communications company and symbolizes our steadfast commitment to the land mobile industry.

RELM

COMMUNICATIONS

QUALITY PRODUCTS • SERVICE • DELIVERY

Our nationwide network of authorized dealers assures that you will receive prompt, high quality service for all your RELM products. For more information about our products or how we can meet your special applications, please call us at 1-800-821-2900.

"Seeking Excellence in Communications"

This device complies with part 15 of the 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.

PACKING LIST

1 — MS200 Scanner Unit
1 — TAMS Telescopic Antenna w/BNC Connector
1 — ACMS AC Adapter
1 — DCMS DC Power Cord
1 — MMBMS Mobile Mounting Bracket w/Hardware
1 — Instruction Manual (P/N 7001-20157-000)

IMPORTANT
Please read all instructions thoroughly before operating the Unit.

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INTRODUCTION

The MS200 is a programmable, 200 channel, multi-band AM/FM scanning monitor receiver that can be used as a mobile or desktop unit. It is a double-conversion, superheterodyne type receiver that is microprocessor controlled and designed to cover: Aircraft Communications band; 10M, 6M, 2M and 70 cm Amateur (Ham) bands; Low and High VHF, Standard and Extended UHF public safety and business bands; High VHF and UHF Government bands; 800 MHz band (Cellular telephone frequencies are not included).

The Aircraft Communications band uses Amplitude Modulation (AM) while the other bands covered use Frequency Modulation (FM). The Unit automatically recognizes the proper type of modulation used based upon the frequency selected.

Any combination of two to 20 channels within a bank and up to 10 banks of channels can be scanned automatically. In the Manual Mode, any single channel can be monitored continuously. In addition, all of the Weather channels can be monitored by the press of a single button (key).

A search function helps locate unknown frequencies within any of the included bands. Search Hold or Delay can be selected for holding or delaying the resumption of searching after an active frequency is found.

Other features include: Priority Channel per Bank, Scan Delay, Channel Lockout, Birdie Lockout, Program Lock, Tone (CTCSS and DCS) Decode, Weather Scan, Weather Alert and Direct Channel Access.

A Liquid Crystal Display (LCD) provides useful information such as Mode, Channel Number, Channel Frequency, Channel Identifier (alphanumeric) Tone Codes, Bank(s) selected for scanning, etc. See page 8 for details.

Illumination or backlighting of the display and the keypad is provided for night time viewing.

For desktop use, a built-in stand can be pulled down that elevates the front of the Unit. This helps in viewing the display and providing easier access to the keypad.

The Scanner can be operated on 12 VDC (mobile installation), or on 120 VAC using the wall-mounted AC Adapter. The Unit has a non-volatile memory that does not require a battery to maintain the information that is programmed by the user.

> NOTE: In this Manual, the words Scanner, Radio and Unit are used interchangeably.

SPECIFICATIONS (Subject to change without notice)

Number of Channels	200
Number of Banks	10; 20 Channels per Bank
Band's Frequency Range	
10 M Amateur	29.000 – 29.700 MHz
Low VHF	29.700 – 50.000 MHz
6 M Amateur	50.000 – 54.000 MHz
Aircraft Communications (AM)	118.000 – 136.000 MHz
Government (Military)	136.005 – 144.000 MHz
2 M Amateur	144.000 – 148.000 MHz
High VHF	148.000 – 174.000 MHz
UHF Government	406.000 – 420.000 MHz
70 cm Amateur	420.000 – 450.000 MHz
UHF – Standard	450.000 – 470.000 MHz
UHF – Extended	470.000 – 520.000 MHz
800 MHz	806.000 – 824.0375 MHz
	848.975 – 869.0375 MHz
	893.975 – 960.0000 MHz
Sensitivity (12 dB SINAD)	
29.0 – 54.0 MHz	0.4 µV, Max.
118.0 – 136.0 MHz	0.7 µV, Max. (10 dB S/N)
136.0 – 174.0 MHz	0.5 µV, Max.
406.0 – 520.0 MHz	0.5 µV, Max.
806.0 – 960.0 MHz	0.5 µV, Max.
Selectivity (Adjacent Channel)	-50 dB, Min.
Audio Output @ 10% THD	
Internal or External	2.0 W, Min.; @ 13.8 VDC or 120 VAC
Scan Speed	Up to 100 Chan./Sec.
Search Speed	100 Increments/Sec.
Search Lockouts	100 Frequencies
Priority Sampling Rate	Once every two seconds
Antenna Impedance	50 Ohms; BNC Connector
Internal Speaker Impedance	8 Ohms
External Speaker Impedance	8 Ohms, Min.
Tape Out – Audio Level	360 mV_{RMS}, Max.
– Impedance	600 Ohms
Power Requirements	
AC Adapter	120 VAC , ± 10%; 60 Hz
External DC	13.8 VDC ± 15%
Current – Squelched and Scanning	185 mA; Typically
– Max. Audio	490 mA; Typically
FCC Certified	Part 15

PREPARATION FOR USE

Before operating the Unit, read the following directions carefully.

UNPACKING

Unpack the Unit from the carton and check for damage. If the Unit is damaged, contact the place of purchase as required by the Warranty.

> CAUTION: Do NOT operate a damaged Unit.

AC ADAPTER USE

The supplied ACMS AC Adapter provides the necessary 12 VDC with a coaxial type DC power plug that properly mates with the Unit's external power jack located on the right side (rear view). Plug the cable end of the Adapter into the Unit. Then plug the Adapter into a 120 VAC, 60 Hz receptacle.

ANTENNA CONNECTION

To install the supplied TAMS telescopic antenna, place it on the Unit's BNC antenna connector and turn its base clockwise until it locks in place. Pull the antenna out to its maximum length for best reception on all bands.

The telescopic antenna will be more than adequate in areas of moderate to low signal strength. In areas of very low signal strength, it may be necessary to use a better antenna system for proper operation. An external antenna mounted as far above ground as practical will greatly increase the signal strength. It is suggested that a monitor type antenna that covers the VHF (29-50 MHz and 118-174 MHz), UHF (406-512 MHz) and "800" MHz (806-960 MHz) be used. For proper matching, 50 Ohm cable should be used to run from the antenna to the Scanner.

> CAUTION: If an outside (external) antenna is used, be sure it is located away from power lines. The antenna should also be suitably grounded. Follow the antenna manufacturer's instructions on proper grounding, if provided. See also the example of antenna grounding on page 28.

MOBILE INSTALLATION

> NOTE: Mobile operation of a Scanner by unauthorized personnel is illegal in some areas. It is the responsibility of the person making the installation to be sure that the User of this Unit is properly authorized. Under no conditions can RELM Communications, Inc. be held responsible for its unauthorized installation or use.

The Scanner can be used in any vehicle (car, truck, etc.) that has a 12 Volt, negative ground system. Install the mounting bracket in a convenient location that does not interfere with the operation of the vehicle. Use either the two #8 metal screws, or the two #8 machine screws, and the two #8 lockwashers and securely fasten the bracket in the desired location.

Attach the Radio to the bracket, using two #6 screws and two black fiber washers per side. Position the Radio to the desired angle before fully tightening the four #6 screws.

Connect the DC Power Cord's positive lead (black with white stripe) to the positive terminal of the vehicle's battery or to the nearest fuse block. If the Unit is to be turned off with the ignition switch, connect the positive lead to the Accessory terminal block. Connect the negative lead (black only) to the battery's negative terminal or to the nearest vehicle ground.

A mobile type antenna, such as a magnet-mount or glass-mount provides good reception. The telescopic antenna could be used (if the Unit is not mounted), but its reception is poor compared to a proper externally mounted antenna. If the mobile antenna does not have the BNC connector, an adapter can be used.

An external speaker, such as RELM's RSMS, can be used if it is desired to have the Unit's audio closer to or directed more to the driver. The RSMS is supplied with a mounting bracket and the necessary hardware. Do not use a speaker with an impedance that is less than 8 Ohms.
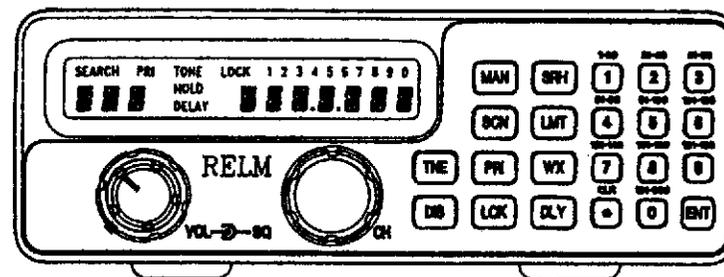
Front View
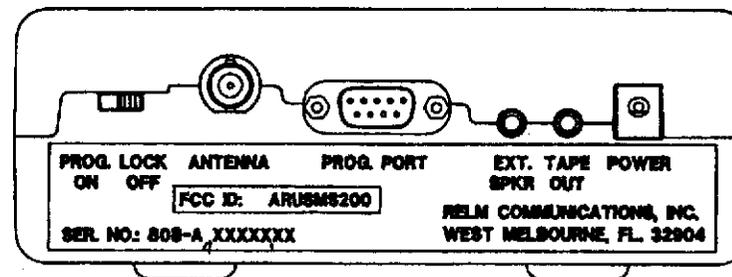
Rear View

Figure 1. Scanner Views.

```
   A      B    C   D  E               F
   |      |    |   |  |     _____|_____
SEARCH  PRI  TONE   LOCK  1 2 3 4 5 6 7 8 9 0
               HOLD
               DELAY
   |           |          |
   I           H          G
```
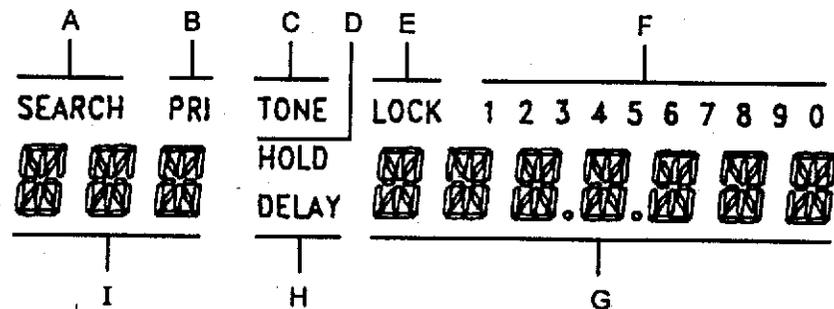
A. Displayed when SEARCH (SRH) has been selected or when Limit (LMT) key is pressed.

B. Displayed when PRIORITY Feature (PRI) is enabled.

C. Displayed when TONE (CTCSS or DCS) Decode (TNE) is selected.

D. Displayed when SEARCH Hold (DLY) is selected.

E. Indicates (in MANUAL Mode) the channel being displayed is Locked Out from SCAN Mode.

F. Indicates what Bank(s) is activated in SCAN Mode.

G. Displays Frequencies (Channel or Search), Channel Alphanumeric designators, Tone Frequencies or DCS Codes and various messages such as SCAN, PSCAN, ALERT, etc.

H. Displayed when SCAN Delay (DLY) or SEARCH Delay is selected.

I. Indicates a Channel Number (1-200), a Search Limit (Lo or Hi), Tone Code or that Weather Mode (WX) is selected.

```
                        1-20    21-40   41-60
   MAN   SRH             1       2       3

                        61-80   81-100  101-120
   SCN   LMT             4       5       6

                       121-140 141-160 161-180
TNE  PRI  WX             7       8       9

                        CLR    181-200
DIS  LCK  DLY            •       0      ENT
```
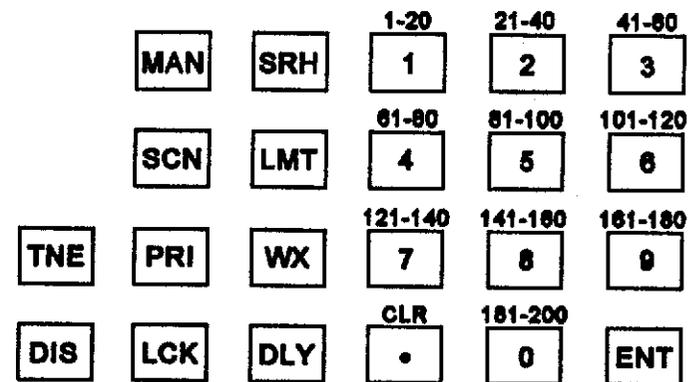
Mode Keys — MAN (Manual), SCN (Scan), SRH (Search) and WX (Weather Scan)

Feature Keys — PRI (Priority), TNE (Tone) and DIS (Display Frequency or Alphanumeric, Alphanumeric Programming)

Function Keys — LCK (Channel Lockout) and DLY (Delay/Hold)

Program Keys — ENT (Enter) and LMT (Low/High Search Limits)

Number Keys — Channel Number (001-200), Bank Number (1-9, 0), Frequency (29.0000-960.0000 MHz) and Tone Code (000-154).

Other Key — •/CLR (Decimal Point/Clear)

NOTE: The small numbers (such as 1-20, 21-40, etc.) just above the Number Keys refer to the channels included in the Bank that the respective Number Key selects. For example, the Number Key 4 selects Bank 4, which includes Channels 61 through 80.

CONTROLS AND CONNECTORS

OFF/VOLUME CONTROL (VOL ──●)
Turning this control clockwise turns the Unit ON and increases the audio's volume level at the internal speaker or external speaker jack.

SQUELCH CONTROL ( )── SQ)
This control is used to eliminate background noise while not receiving a signal. The unit must be squelched (turn control counter-clockwise until no noise is heard) for proper SCAN, WX SCAN or SEARCH operation. Turning the control fully counter-clockwise will help eliminate very weak or intermittently received signals.

CHANNEL SELECTOR (CH)
This rotary control can be used to manually select Channels. If turned while the Unit is in the SCAN, WX SCAN or SEARCH Mode, it puts the Unit in the MANUAL Mode. It is also used to select alphanumeric characters when programming a Channel Identifier.

12 VDC JACK (POWER)
This coaxial DC power jack can be used with the supplied AC Adapter or any external 12 VDC source capable of supplying 500 milliamperes. Since the polarity of the mating connector must be properly observed or damage to the Unit will probably occur, the supplied DC Power Cord should be used. The jack's inner conductor is positive (+) and the outer conductor is negative (–).

ANTENNA CONNECTOR (ANTENNA)
Although the supplied telescopic antenna is normally used, other antennas, external perhaps, may be used as long as they are 50 ohms and have a BNC type connector. The other antenna(s) should cover all of the bands of interest.

EXTERNAL SPEAKER JACK (EXT. SPKR)
This 3.5mm jack can be used for connecting to an external speaker. The impedance of the external speaker should be 8 ohms or greater. When this jack is used, the Radio's internal speaker is disconnected.

AUDIO OUT JACK (TAPE OUT)
This 3.5mm jack can be used for providing the Scanner's audio output at an impedance (600 Ohms) and level suitable for connecting to a voice-activated tape recorder. The Volume Control adjusts the overall level at this jack.

PROGRAMMING CONNECTOR (PROG. PORT)
This DB-9 connector can be used for programming the Unit's frequencies, decode tones (CTCSS and DCS) and alphanumeric channel identifiers. An IBM® PC-compatible computer with a serial port, Windows 95® and RELM's MS200 Programming software MSPCKIT are required for this purpose.

PROGRAM LOCK SWITCH (PROG. LOCK)
This switch, when set to the ON position, prevents any changes being made to channel frequencies, channel identifiers (alphanumeric), decode tones and Search Limits. Thus, it locks the Unit's memory from being accidentally, inadvertently or purposefully reprogrammed.

PROGRAMMING
The MS200 has 200 channels available for your personal choice of frequencies. The microprocessor-controlled circuitry eliminates the need for crystals and allows easy touch entry of all frequency data. Programming is done while in the MANUAL Mode. The Unit will emit a tone (referred to as a "Beep") each time a key is pressed, indicating proper key operation.

The blank form on page 25 may be used (or copied) to plan and/or record the Unit's channel information.

CHANNEL FREQUENCY AND TONE CODE
1. Press **MAN** if the Unit is not already in the MANUAL Mode.

2. Press the number keys corresponding to the desired frequency. For example, press **465.75** for the frequency of 465.7500 MHz.
   a. The decimal point does not have to be pressed if 3 digits have already been selected before it is required.
   b. If the frequency is not within one of the specified band ranges (see Specifications on page 4), it will be forced to the nearest band's lowest frequency.
   c. If an error has been made while entering the frequency, press **CLR** once or twice and start over.

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3. Press **ENT** (Enter). A small segment (bar) in lower left end will be blinking, which indicates a channel number is to be selected.

> **NOTE:** If a Channel number is displayed, the frequency has already been programmed for that channel.

4. Press 1, 2 or 3 number keys to select the desired Channel (1-200).

> **NOTE:** The first Channel in all Banks is a Priority Channel. Channel 1 (of Bank 1) is the highest Priority Channel. See page 17 for more details.

5. Press **ENT**. The keyed in frequency is now entered into the selected channel and it can receive a signal at this time.

6. a. If a Tone Code is to be selected, go to Step 7 below.
   b. If the channel does not require a CTCSS (Continuous Tone Coded Squelch System) or DCS (Digital Coded Squelch) Tone Code, go to Step 10 below. Tone Code 000, which means "no tone", is already pre-programmed into the channel.

7. Press **ENT** again. A small digit (usually 0) will be blinking in the display's left end.

> **NOTE:** See Tables 1 and 2 starting on page 22 for Tone Codes versus Tone Frequencies and DCS Codes.

8. Press 1, 2 or 3 number keys to select the Tone Code (1-154).
   a. The Channel Selector also can be used to select the Tone Code. Rotate it clockwise (or counter-clockwise) until the desired Code and/or Tone Frequency or DCS Code is displayed.
   b. Your local RELM Dealer can assist you in finding what Tone Frequencies or DCS Codes may be used on the various frequencies active in the area.

9. Press **ENT**. The keyed in frequency and its associated Tone Code is now entered into the selected channel.

10. To program another channel's frequency and Tone Code, go to Step 2 on page 11.

It is recommended that frequencies with the same purpose, such as police or fire, be entered into channels that are in the same Bank. For example: Channels 1 through 20 (Bank 1) may be used for police frequencies; Channels 21 through 40 (Bank 2) may be used for emergency or fire frequencies. Thus, a group (Bank) of related frequencies can readily be scanned by itself.

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CHANNEL IDENTIFIER

Up to 7 alphanumeric (usually just referred to as alpha) characters can be assigned to each channel to help identify its purpose, location and so forth. The characters can be selected to make a name, such as POLICE, FIRE 1, EMGCY (Emergency), etc. The characters available for use are:

- All 26 letters of the alphabet — upper case (capital)
- 13 lower case letters — a, b, c, d, e, h, i, m, n, o, r, t, u
- 14 special symbols — --, ?, =, __, *, /, \, >, <, ', $, ↗, ↘, ▓
- 10 numbers — 0 through 9
- 1 blank (space)

> **NOTE:** These same characters are also available when the Unit is programmed by means of a computer.

To manually program a channel's identifier, the procedure is as follows:

1. Press **MAN** if the Radio is not already in the MANUAL Mode.

2. Select the Channel to be programmed:
   a. Turn the Channel Selector knob until the desired channel is reached, or
   b. Repeatedly press MAN until the desired channel is shown, or
   c. Press the desired Channel's number (01–200) and then press **MAN**.

3. a. If the Alpha Display mode is not activated, go to Step 4 below.
   b. If the Unit is in the Alpha Display mode, press DIS and a Boop (low tone) should be heard, signifying that the Alpha Display mode is now deactivated.

4. Press **DIS** and a Beep should be heard. Continue to hold in the DIS key for approximately 2 seconds until 2 short Beeps are heard. The Scanner is now in the Alpha Programming mode.

> **IMPORTANT:** The Alpha Programming mode can be activated for only one channel at a time. In other words, for each channel to be programmed with alpha, the procedure must be followed starting with Step 2.

5. If the channel has not been previously programmed with alpha, the frequency (right) end of the display will be blank. If the channel already has been programmed with alpha, the display will now show the current alpha, with the first character (left end) slowly blinking.
   a. Rotate the Channel Selector knob *clockwise* to select one of the 29 alphabetical or 14 special characters.

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b. Rotate the Channel Selector knob *counter-clockwise* to select one of the 10 numbers (9 through 0).

> NOTE: The blank (or space) is the first character shown if the channel was not previously programmed with alpha. Otherwise, the blank character is located between 9 and A.

6. After the desired character is displayed, press **DIS** to enter it and advance to the next character to be selected. A Beep will signify this entry. If a selection error has been made and **DIS** has been pressed, press **CLR** and go to Step 2 on page 13.

7. Repeat Steps 5.a, or 5.b, and 6 until the desired Identifier (1 to 7 characters) is programmed.

8. Press **ENT** to store the Identifier into the Channel's alpha memory. This key press will also remove the Unit from the Alpha Programming mode. Go to Step 2 on page 13 if another channel is to be programmed with alpha.

OPERATION

GENERAL

After you have programmed the channels with frequencies of your choice, the Unit is ready for operation in one of its two major Modes, MANUAL or SCAN.

Adjust the audio's volume by turning the OFF/VOLUME Control knob clockwise to increase the audio output. Turn the knob counter-clockwise to decrease it. If necessary, first turn the SQUELCH Control knob clockwise until "noise" is heard. Then set the VOLUME Control to the desired listening level.

Turn the SQUELCH Control knob counter-clockwise until "noise" is no longer heard. The Unit is now squelched. While in the SCAN or SEARCH Mode, the SQUELCH Control may require being turned slightly more counter-clockwise to a setting that permits proper scanning or searching operation.

Tone Decoder

To enable the built-in CTCSS and DCS Decoder, press **TNE**. A small TONE will appear in the display when the Decoder is enabled. The Tone Decoder is operational only in MANUAL, SCAN and Weather Alert Modes.

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> NOTE: Weather Alert uses a pre-programmed (built-in) tone, but for MANUAL and SCAN Modes, channel tones have to be programmed in by the keypad or by use of RELM's computer software MSPCKIT.

When the Unit has Tone Decode enabled, audio will not be heard if a signal with a non-matching or improper tone (CTCSS or DCS) is received. In other words, no audio will be heard unless the correct tone is on the signal. To hear the audio, regardless if the tone is correct or not, press the **TNE** key again to disable the Tone Decoder. A channel with Tone Code 000 (or 0) does not require a tone for proper reception at any time.

In SCAN Mode, the Unit will not stop on the frequency (or channel) unless the proper tone is on the signal.

Program Lock Function

Set the Program Lock Switch, located on the rear panel, to the ON position to prevent accidental or inadvertent changes to the Unit's programmed data. Thus, its channel frequencies, channel tones, channel identifiers and Search Limits can not be changed via the keypad. Also, these items can not be changed even with a computer. The display will show *LOCKED* if changes are attempted.

MANUAL MODE
General

If at any time you want to monitor one channel continuously, press **MAN**. The desired channel can then be selected by: (1) repeatedly pressing **MAN**, (2) by turning the Channel Selector until the channel's Number (and frequency) appears in the display, or (3) by entering the channel's Number and then pressing **MAN** again.

A channel selected in MANUAL Mode that had been previously locked out during SCAN operation will show a small LOCK in the display. If desired, press **LCK** to change its status for later SCAN operation.

Delete a Channel

To delete (remove or erase from memory) a channel, select the channel while in the MANUAL Mode and then press **CLR**. The display will show "*dEL. ch?*" for approximately one (1) second. During this time, press **ENT** (YES) and the channel will then be deleted from the Unit's memory. A Priority channel can not be deleted if the Priority Feature is enabled.

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Review a Channel's Tone Code

To review the Tone Code (CTCSS or DCS) programmed for a channel, select the desired channel while in the MANUAL Mode. Press **ENT** and the channel's Tone Code and actual CTCSS Tone or DCS Code will be displayed. Press **ENT** again, or **MAN**, to return the display to showing the channel's Number and Frequency or Identifier.

> **REMINDER:** For a channel not programmed with a Tone Code, the display will show "0 00.0", which means a tone is not required even if the Tone Decoder has been enabled.

Priority Feature Enabled

To enable the Priority Feature, press **PRI**. The display should show a small PRI. When a channel other than a Priority Channel is manually selected (in MANUAL Mode), the Unit will sample the Priority Channel approximately every two (2) seconds. If any activity is found on the Priority Channel, the Radio will stay on that channel and monitor its transmission. After the transmission is completed, the Unit will remain on the Priority Channel for approximately 2 seconds and then return to the non-priority channel.

SCAN MODE
General

To put the Unit in the SCAN Mode, press **SCN**. The display should show "$SCAN$" until an active channel is found. If ALL channels in All Banks are locked out, the display will momentarily show "no CHn" and then the last channel selected in MANUAL Mode. The Unit will NOT scan unless at least one channel is enabled (not locked out).

To select the Bank(s) to be scanned, press its respective number key after **SCN** is pressed. A Bank may also be de-selected at this time. It should be noted that if all Banks are de-selected, Bank 1 will automatically remain enabled (selected).

A channel may be locked out while the Unit is in the SCAN Mode whenever a signal is found on the channel and scanning has stopped. Press **LCK** and the Radio will instantly resume scanning and bypass the channel thereafter.

To unlock or restore a channel into the scanning sequence, press **MAN**. Either repeatedly press **MAN** or turn the Channel Selector until the desired channel is in the display, or enter the channel's Number and press **MAN** again. Press **LCK** to restore the channel and then **SCN** to return to the SCAN Mode.

The SCAN List (Channels programmed and not locked out) can be reviewed by two methods. One method is to turn the Channel Selector slowly and observe if a small LOCK is displayed or not. Another method is to open squelch (turn SQUELCH Control fully clockwise) and observe what channels are displayed as **SCN** is repeatedly pressed.

Delay

When a proper signal is received on a channel, the scanning will stop and the channel's audio will be heard. After activity ceases (signal no longer present) on the channel, the Unit will delay (stay) on that channel for approximately 1/2 second, or 2 seconds if Delay is selected, and then resume scanning. Press **DLY** to enable SCAN Delay. The display should then show a small DELAY. To disable SCAN Delay, press **DLY** while the Unit is in the SCAN Mode.

Priority Feature Enabled

To enable the Priority Feature, press **PRI**. The display should show a small PRI. While scanning, "$PSCAN$" will be displayed.

Channel 1, even if locked out, will always be included in the SCAN List if Priority is enabled and will be sampled for a signal approximately every 2 seconds whenever the Scanner has stopped on another channel. The first channel in the other 9 Banks are also considered as a Priority Channel, but only as a lower priority. In other words, Channel 1 is the highest priority and will override the other Priority Channels (21, 41, 61, 81, etc.) if it becomes active (signal present).

The other Priority Channels can be locked out from the SCAN List and thus also from Priority Sampling. In addition, if their respective Bank is not selected for scanning, they will not be sampled even though not locked out as a channel. Thus, they are to be considered only as a secondary type priority channel. Therefore, if there is a Channel (frequency) that must be checked periodically for a signal, use Channel 1 and enable Priority by pressing **PRI**.

The sequence of sampling the Priority Channels always starts with Channel 1. If there is no signal there, then Channel 21 is checked for a signal. If none is on Channel 21, then Channel 41 is checked and so on, providing their Banks are being scanned. This sequence continues until the current Bank's first channel is checked. At this time, if no signals are found, the Scanner returns to the non-priority channel it had stopped on.

WEATHER (WX) SCAN MODE
General
The National Weather Service (NWS) provides a continuous or 24-hour broadcast of local and area weather conditions. These weather messages are repeated until the next updated report is issued. The NWS has broadcast facilities in most areas of the country, especially around metropolitan areas.

The Radio has a set of 8 pre-programmed channels (frequencies) reserved exclusively for scanning for these weather messages. The Canadian Weather frequency (161.650 MHz) is also included. To have the Unit automatically scan the National Weather Service's frequencies, press **WX**. The display will show "*WX*" and "*SCAN*".

The Scanning action will stop at every WX frequency that is strong enough in your area. In some areas of the country, perhaps 2 of the 8 possible frequencies may be received. Press **WX** again to see if the Scanner stops on a different frequency. In this case, you should try to determine which frequency is the closest to your location.

> **NOTE:** The frequencies in WX Scan can not be locked out, which is why it is important to note the frequency of the nearest facility if more than one can be received. If you are still uncertain as to which frequency covers or relates to your area, the local RELM Dealer should be able to provide the information.

Priority Feature Enabled
To enable the Priority Feature, press **PRI**. The display should show a small PRI. The Radio will sample the Priority Channel approximately every 2 seconds. If activity (signal present) is found, the Radio will stay on the Priority Channel until 2 seconds after the activity ceases and then return to WX SCAN.

Weather Alert
The MS200 has been pre-programmed with a 1050 Hz tone, which is used by the National Weather Service to activate any weather receiving radio that has tone decoding capabilities. This tone is transmitted by the NWS to warn (Alert) of severe weather conditions in the area.

To activate the Weather Alert Feature press **WX**, if the Unit is not already in WX SCAN Mode. Then press **TNE**. No audio will be heard until the weather channel being monitored (assuming WX SCAN was stopped on a frequency) transmits its Alert Tone (1050 Hz). Audio will be heard and

at this time, the display will alternately show *WX ALERT* and *WX 162.5500* (for example). To deactivate the Alert Feature, press **TNE** and weather audio should be heard.

SEARCH MODE
General
The Unit includes a SEARCH function that enables the user to find new frequencies in addition to those already known. It can locate active frequencies anywhere within a band. These active frequencies, if desired, can then be readily assigned to a regular channel for MANUAL or SCAN operation.

The frequency increments (steps) used in SEARCH Mode are: 5 kHz for 29.0 to 54.0 MHz; 25 kHz for 118.0 to 136.0 MHz; 5 kHz and 12.5 kHz for 136.0 to 174.0 MHz; 12.5 kHz for 406.0 to 520.0 MHz and for 806.0 to 960.0 MHz.

Programming Search Limits
Two frequencies are used in the SEARCH Mode. One frequency is called the Low (or start) Search Limit. The other frequency is the High (or end) Search Limit. The Unit "searches" for any active frequency within these two Limits. The search automatically starts over again after the High Limit is reached. The Limits do not have to be in the same band, but it is highly recommended that they are, so as to reduce the overall search time.

To program the Limits, press **LMT**. The Unit can be in MANUAL, SCAN, WX SCAN or SEARCH Mode. The display will show "*Lo*" in the left corner. In addition, the display will show a frequency (if previously programmed) or "_ _ _ . _ _ _ _" with the first bar blinking. Key in the Low Limit frequency and press **ENT**, which will store the Low Limit in memory.

Press **LMT** again. This time, "*Hi*" will appear in the left corner of the display. Key in the High Limit frequency and press **ENT**, to store the High Limit in memory.

> **NOTE:** If the High Limit is lower in frequency than the Low Limit, "*Error*" will appear in the display when **SRH** is pressed. If this happens, press **LMT** *once* and key in a new Low Limit, or press **LMT** *twice* and key in a new High Limit. Press **ENT**, after either one of these actions, to store the new Limit.

Searching

After the Search Limits have been properly programmed, press **SRH** and SEARCH (small letters) will appear in the display. The Unit will start to search for any active frequencies within the defined Limits. When an active frequency is found, the Unit will stop searching, display the frequency and reproduce any audio associated with it.

After finding an active frequency, the Unit will resume searching:

1. Any time **SRH** is pressed again.

2. Approximately 2 seconds after the frequency's activity stops when DELAY (small letters) is in the display.

3. Only after **SRH** is pressed when HOLD (small letters) is in the display.

The Delay/Hold selection can be made anytime while in the SEARCH Mode, except when programming the Limits. Press **DLY** to toggle from Delay to Hold or vice versa.

While the Unit has stopped on an active signal, its frequency can be assigned to any one of the 200 possible channels. Press **ENT** and the display will prompt (a blinking bar in upper left corner of the display) for a channel assignment.

> **NOTE:** If a channel number is displayed, the frequency has already been assigned to the channel shown.

Key in the desired channel and press **ENT** again. The Unit will then immediately resume searching, starting with the next frequency in sequence.

Birdies

During Search operation, the Unit may stop on a frequency that does not have any audio, but is almost always present. In most cases, this frequency may be what is commonly referred to as a "birdie". A birdie can be the result of internally generated signals and/or externally generated signals that mix and appear to be a proper signal (but without any modulation). Some sources of externally generated signals are TV stations, TV receivers, home computers and other nearby radios. These frequencies will usually vary from location to location and are therefore impossible to list or predict.

Birdie Lockout

To reduce or eliminate the effect that birdie frequencies have, a special lockout function is provided for the SEARCH Mode. Whenever one of these frequencies is encountered while the Unit is searching, press **LCK** and that frequency will no longer be part of the current Search sequence. Up to 100 frequencies may be locked out. When the Birdie List or memory is full (100 frequencies locked out), the display will show "*Full*" and no more frequencies can be locked out.

It should be noted that proper signals can also be locked out. This can be helpful, for example, if some highly active frequencies keep stopping the search operation, but you have already assigned them to a normal channel or they have been duly noted.

To clear the Birdie List, re-program one of the Search Limits. This will also allow you to perhaps choose a different segment of the Band that does not require locking out very many frequencies.

Priority Feature Enabled

To enable the Priority Feature, press **PRI** and a small PRI should appear in the display. The Priority Channel will be sampled approximately every 2 seconds for a signal. If activity is found, the Unit will stay on the Priority Channel until 2 seconds after the activity ceases and then it will resume searching.

Table 1. Tone Codes *vs.* CTCSS* Tones.

Code #	TONE (Hz)	Code #	TONE (Hz)	Code #	TONE (Hz)
000	No Tone	017	118.8	034	218.1
001	67.0	018	123.0	035	225.7
002	71.9	019	127.3	036	233.6
003	74.4	020	131.8	037	241.8
004	77.0	021	136.5	038	250.3
005	79.7	022	141.3	039	69.4
006	82.5	023	146.2	040	159.8
007	85.4	024	151.4	041	165.5
008	88.5	025	156.7	042	171.3
009	91.5	026	162.2	043	177.3
010	94.8	027	167.9	044	183.5
011	97.4	028	173.8	045	189.9
012	100.0	029	179.9	046	196.6
013	103.5	030	186.2	047	199.5
014	107.2	031	192.8	048	206.5
015	110.9	032	203.5	049	229.1
016	114.8	033	210.7	050	254.1

*CTCSS stands for Continuous Tone Coded Squelch System.

Table 2. Tone Codes *vs.* DCS* Codes.

STD Tone Code	DCS Code		INV Tone Code
	STD	INV	
051	023	047	058
052	025	244	090
053	026	464	127
054	031	627	141
055	032	051	059
056	036	172	082
057	043	445	121
058	047	023	051
059	051	032	055
060	053	452	123
061	054	413	117
062	065	271	100
063	071	306	102
064	072	245	091
065	073	506	131

*DCS stands for Digital Coded Squelch. The frequency may use a Standard (STD) or Inverted (INV) DCS code. Select the appropriate Tone Code as indicated. Table 2 is continued on next page.

Table 2. Tone Codes *vs.* DCS Codes (Continued).

STD Tone Code	DCS Code		INV Tone Code	STD Tone Code	DCS Code		INV Tone Code
	STD	INV			STD	INV	
066	074	174	083	111	356	212	085
067	114	712	148	112	364	131	072
068	115	152	077	113	365	125	071
069	116	754	154	114	371	734	152
070	122	225	087	115	411	226	088
071	125	365	113	116	412	143	075
072	131	364	112	117	413	054	061
073	132	546	136	118	423	315	104
074	134	223	086	119	431	723	149
075	143	412	116	120	432	516	132
076	145	274	101	121	445	043	057
077	152	115	068	122	446	255	095
078	155	731	050	123	452	053	060
079	156	265	098	124	454	266	099
080	162	503	130	125	455	332	107
081	165	251	093	126	462	252	094
082	172	036	056	127	464	026	053
083	174	074	066	128	465	331	106
084	205	263	097	129	466	662	145
085	212	356	111	130	503	162	080
086	223	134	074	131	506	073	065
087	225	122	070	132	516	432	120
088	226	411	115	133	523	246	092
089	243	351	110	134	526	325	105
090	244	025	052	135	532	343	108
091	245	072	064	136	546	132	073
092	246	523	133	137	565	703	147
093	251	165	081	138	606	631	142
094	252	462	126	139	612	346	109
095	255	446	122	140	624	632	143
096	261	732	151	141	627	031	054
097	263	205	084	142	631	606	138
098	265	156	079	143	632	624	140
099	266	454	124	144	654	743	153
100	271	065	062	145	662	466	129
101	274	145	076	146	664	311	103
102	306	071	063	147	703	565	137
103	311	664	146	148	712	114	067
104	315	423	118	149	723	431	119
105	325	526	134	150	731	155	078
106	331	465	128	151	732	261	096
107	332	455	125	152	734	371	114
108	343	532	135	153	743	654	144
109	346	612	139	154	754	116	069
110	351	243	089				

TROUBLESHOOTING GUIDE

> **NOTE:** Please perform the simple checks indicated for improper operation before returning the Unit for service.

TROUBLE	CHECK
No display, no sound	POWER/VOLUME Control should be turned clockwise. Check fuse in DC Power Cord. AC Adapter not plugged in properly.
Display OK, no sound	Volume Control setting — turn clockwise.
No reception (no stations heard)	Check antenna connection. Stations too far away. Incorrect frequencies entered.
Weak or poor reception	Squelch Control setting — turn fully clockwise and then counter-clockwise until the "noise" just disappears. Stations too far away.
Does not SCAN	Squelch Control setting — turn fully clockwise and then counter-clockwise until " SCAN " appears in the display. All channels are locked out? See page 16.
Does not SEARCH	Squelch Control setting — turn fully clockwise and then counter-clockwise until displayed frequency rapidly increments. Search Limits are incorrect? See page 19.
SEARCH stops on frequencies without stations	Birdies — See page 20.
Can't program frequencies	Set Program Lock switch to OFF — See page 15.

For service, in or out of Warranty, send Unit to:
Customer Service Department
RELM Communications, Inc.
7505 Technology Drive
West Melbourne, FL 32904

For information, contact: 1-800-422-6281

> **NOTE:** For in-Warranty service information, read the Warranty Statement on the back cover of this manual.

For future reference, please record:

Serial No. _____ Date Purchased _____

Dealer _____

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Use this form to plan or record the Unit's programmed information.

NOTE: This page only may be copied without violating copyright.

Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____
Ch. ____	Frequency ____ Identifier ____ Tone or Code ____	Ch. ____	Frequency ____ Identifier ____ Tone or Code ____

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OWNER'S FREQUENCY LIST

NOTE: This space is for the user to make his or her own frequency list.

FREQUENCY	SERVICE	FREQUENCY	SERVICE

Example of antenna grounding as per National Electrical Code Instructions

1. Use No. 10 AWG (5.3 mm²) copper, No. 8 AWG (8.4 mm²) aluminum, No. 17 AWG (1.0 mm²) copper-clad steel or bronze wire, or larger, as a ground wire.

2. Secure antenna lead-in and ground wires to house with stand-off insulators spaced from 4–6 feed (1.22–1.83 m) apart.

3. Mount antenna discharge unit as close as possible to where lead-in enters house.

4. Use jumper wire not smaller than No. 6 AWG (13.3 mm²) copper, or the equivalent, when a separate antenna-grounding electrode is used. See NEC Section 810-21(j).

SERVICE ENTRANCE CONDUCTORS

GROUND CLAMP

STANDOFF INSULATORS

MAST

ANTENNA LEAD-IN WIRE

SERVICE ENTRANCE EQUIPMENT

GROUND WIRE

GROUND CLAMPS

ANTENNA DISCHARGE UNIT

POWER SERVICE GROUNDING ELECTRODE SYSTEM (e.g. interior metal water pipe)

TO EXTERNAL ANTENNA TERMINALS OF PRODUCT

GROUND WIRE

GROUND CLAMPS

BONDING JUMPER

OPTIONAL ANTENNA GROUNDING ELECTRODE DRIVEN 8 FEET (2.44m) INTO THE EARTH IF REQUIRED BY LOCAL CODES. SEE NEC 810-21(f).