Solutions for Advancing Communications

M2115 OWNERS MANUAL

Model M2115

Airport Ground Support Radios

VHF Voice Radio Frequency Band: (118.025-136.975 MHz)

This document supports the following models:

M2115M	Mobile Receiver/Transmitter - 10 Watt
M2115B	Base Station Receiver/Transmitter - 10 Watt
M2115B-25	Base Station Receiver/Transmitter - 25 Watt
M2115B-50	Base Station Receiver/Transmitter - 50 Watt

CONTENTS

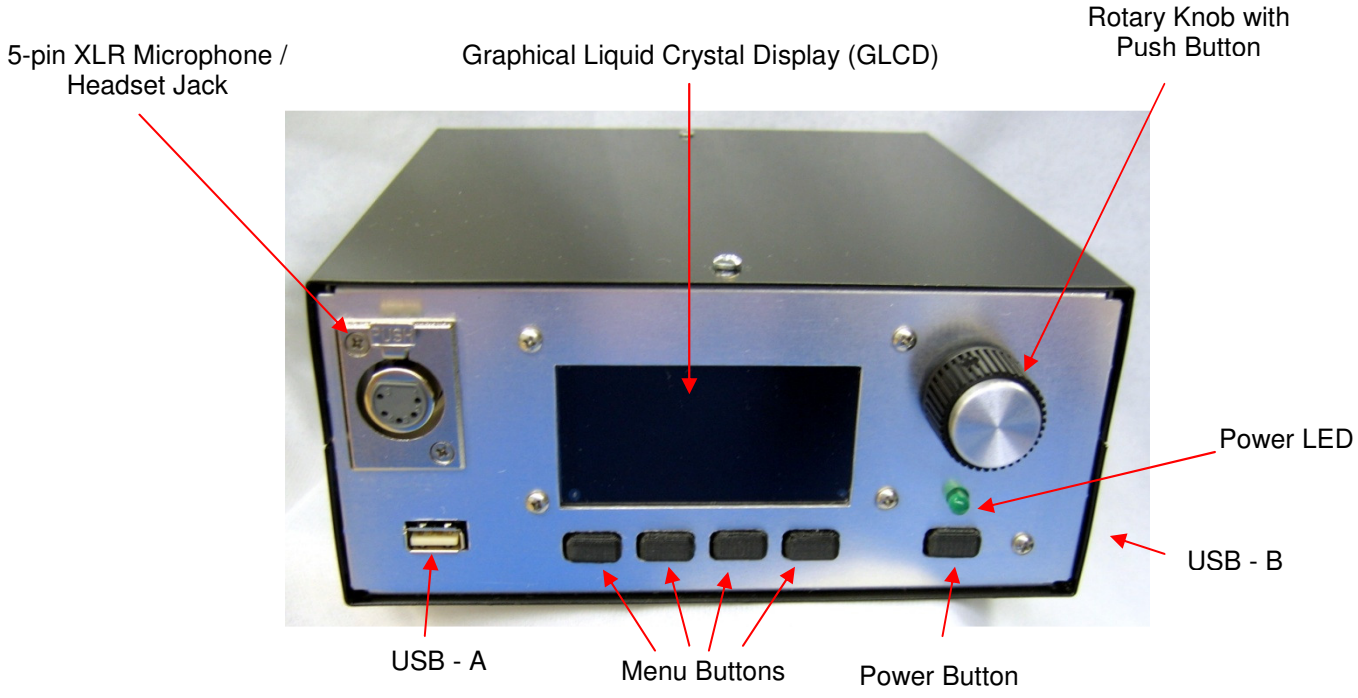
Safety Notices [1]

The following safety precautions are meant to prevent personal injury and damage to the equipment.

1.) Do not connect the unit to any voltage source other than to the source provided/recommended for the unit. Verify correct polarity of the mobile unit power leads during installation.
2.) Do not operate the unit within the vicinity of lightning.
3.) Under normal conditions, **DO NOT TRANSMIT WHEN THE VSWR ENUNCIATOR IS DISPLAYED. OVERRIDING THE TRANSMITTER'S AUTOMATIC SHUTDOWN IS FOR EMERGENCY USE ONLY AND WILL VOID THE WARRANTY IF DAMAGE OCCURS AS A RESULT.**
4.) Do not operate the unit when wet.
5.) Do not operate the unit if there is an indication of a malfunction (i.e. LCD shows "ERROR").
6.) Do not perform internal maintenance on the unit. Only qualified technicians should perform maintenance on this product.

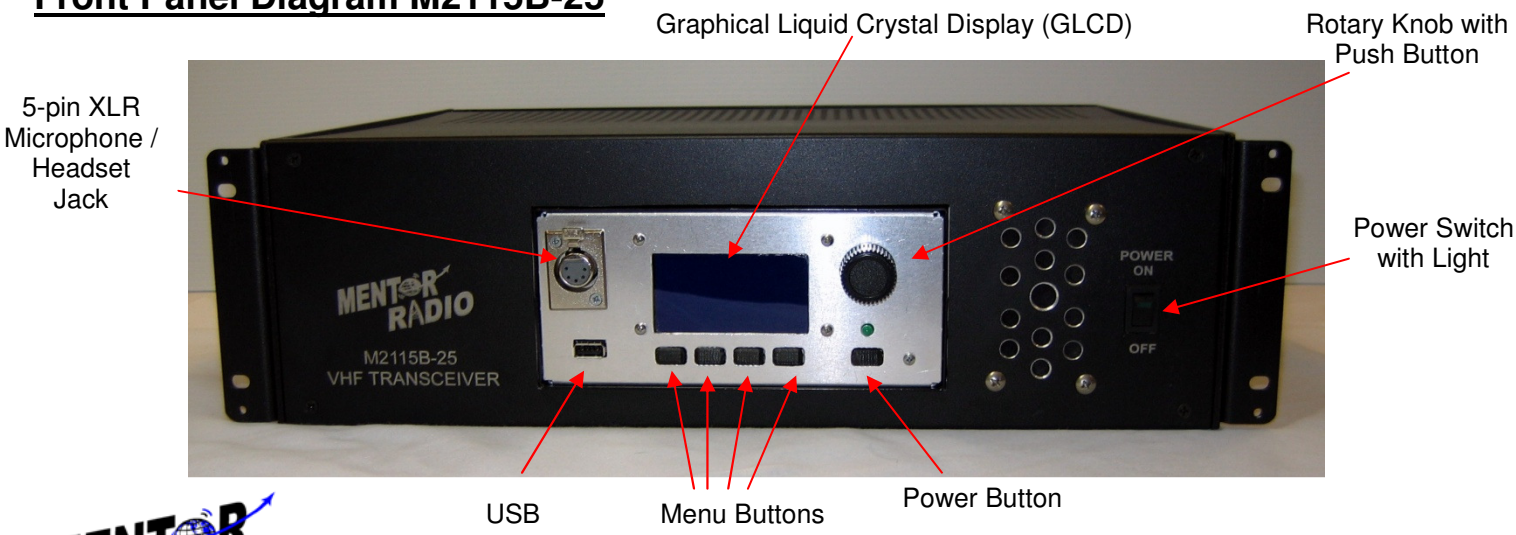
Mechanical Diagrams [2]

Front Panel Diagram M2115 [2.1]



The front panel control allows a user to program, operate, and monitor the state of the M2115 radio; a noise cancelling handheld microphone (sold separately) plugs into the Microphone/Headset jack. A headset may also be used for high noise environments. See Front Panel Control for descriptions of how the front panel control operates and Screen Control for specific screen functionality.

Front Panel Diagram M2115B-25



Rear Panel Diagrams [2.2]

Fig. 1 – M2115M (See Rear Panel for specific component functionality)

Fig 2 – M2115B (See Rear Panel for specific component functionality)

Fig 3 - M2115B-25 (See Rear Panel for specific component functionality)

Introduction [3]

Mentor Radio Model M2115 refers to a family of VHF Band aviation transceiver radios. Model M2115M refers to the vehicle mounted mobile version of the transceiver, while models M2115B and M2115B-xx refer to the 10W and 'xx' watt base station versions, respectively. Both the mobile and base station radios use the same core radio. However, there are several differences between them, which are as follows:

1.) ***Input power required***: The M2115M requires 12-14 VDC, whereas the M2115B and M2115B-xx versions both operate off of an AC power source (115 VAC or 230 VAC). There are three versions of base station radios available: M2115B (rack mount style case is available), M2115B-25 and M2115B-50.
2.) ***External radio frequency (RF) power amplifiers***: The M2115 when used with a PA25 or a PA50 power amplifier can provide closed loop power control for up to 25 watts and 50 watts respectively in three power steps. The M2115B-25 uses the PA25 and the M2115B-50 uses the PA50.
3.) ***Microphone signals***: The 500 ohm audio output signal is factory configurable. For mobiles, it is connected to the microphone jack for headset use. On the base unit, it may be connected to the rear panel for remote control connections.
4.) ***Remote interface***: All base radios have remote control capability. The 12-pin rear power plug includes discrete signals for connecting to a variety of remote controls. 5 signal lines (F1 through F5 are available to allow remote frequency selection. Any one of up to 16 channels may be selected. Two of these 5 lines serve multiple purposes, which makes it so that only 3 frequency selection lines may be used when an external PA is being used.

On the M2115B base station unit, a rocker style power switch is on the rear of the base power supply and controls the AC input power to the unit. On M2115B-XX style base station units, the rocker style power switch is located on the front panel. . The unit is provisioned with a D-shaped AC power plug to allow low cost international power cords to be connected to local AC power. The power-plug on all base station units has a built-in fuse providing circuit overload protection and a spare fuse is included in the power plug.

Physical Component Descriptions [4]

Radio Cards [4.1]

A M2115 may contain one or two radio cards, while the radio system's main controller is housed only on the VHF voice radio card operating in the 118.025 MHz – 136.975 MHz VHF band. Therefore, all M2115's must have this radio card installed. Expanded functionality may be given to the radio by adding a second radio card. Each radio will have its own separate antenna connector on the rear panel which allows for simultaneous dual band operation.

The second radio card may operate in one of several bands planned for integration into the M2115 unit. The first radio card to be introduced will be a UHF FM LMR radio operating in the 450-470MHz band for voice and low speed data. As technology progresses, radios in different frequency bands offering diverse functionality will be developed and made available for the second card slot.

USB-A and USB-B Ports [4.2]

There are two USB ports available for connecting various devices to the M2115 mobile and most base units. There is a USB-A style connector on the front panel of the radio that will allow the connection of a flash memory stick to either read/write configuration information, save audio in a base station application, or save GPS data when used in mobile applications. There is also a USB-B style connector on the right side of the radio that allows an M2115 to connect to a PC. Users may configure an M2115 remotely through the use of a PC program. Configuration information is either entered into a simple-to-use graphical interface, or is read in from a file that contains configuration information downloaded to a PC from an M2115. Once the information is loaded into the graphical interface, the user may then load the configuration information into the M2115 over the USB-B port. This makes configuring the radio quick and easy as no front panel operation is needed to program the M2115. Another use of the USB-B port is for when two radio boards are installed in the M2115. When used in tandem with an LMR radio PC application data may be sent over the UHF radio link to the base station for Business-to-Business (B2B) applications. Live ("real time") GPS data may also be sent to a dispatcher for vehicle tracking purposes (e.g.: optimal resource scheduling, etc…). *The LMR and GPS applications are future implementations.*

Rear Panel [4.3]

The rear panel includes a 12-pin power connector, two UHF style antenna connectors for radio cards 1 and 2, and an optional GPS module. The radio includes a cover plate for the GPS interface when the GPS module is not in use. The 12-pin power connecter may also have wires for an external power amplifier, remote frequency control, external microphone input, and/or external speaker output for base stations. If an external power amplifier is used, the number of frequencies made available by remote selection goes from a maximum of 16 to a maximum of 7 channels as the power amplifier uses two of the remote frequency selection lines. The 12-pin power connector implements functions that are dependent on the type of M2115. The available options are as follows:

Mobile and Base Station Radios:

- External speaker wire
- 12V-14V DC power supply

Base Station Radios (only):

- External RF power amplifier monitoring wires (25W and 50W BS's)
- Remote frequency selection, remote PTT, and microphone input wires

Global Positioning System (GPS) [4.4]

Note: The GPS unit is a future option.
The Global Positioning System (GPS) is a satellite based system that allows an M2115 to know it's location with an error in horizontal distance of only 10.5 meters. The GPS module updates its position once every second and main controller polls this data and uses it for reporting the position of the radio. Some users may want to know where their vehicles are in real time (resource scheduling applications), while others may want to review their vehicles' locations periodically. Depending on whether the radio is a mobile, base station, or dual card radio determines what implementation may be used with any given M2115. Mentor Radio's live tracking system requires using the UHF LMR radio to send location data in real time. Users with less stringent time requirements may have the radio set up to access the data by manually extracting it with a flash memory stick (sold separately). The radio may store up to a week's worth of GPS information. The GPS module is sold separately from an M2115, and customers may install it themselves (See Installation).

Receiver [4.5]

The M2115 receiver is a dual conversion super heterodyne with frequency synthesized local oscillators. The first local oscillator (LO1) is 400 MHz above the carrier frequency and the second local oscillator (LO2) is set to 800 MHz. The process for receiving a signal is as follows:

- The received signal is mixed with LO1 where only the ~400 MHz mixing product is kept. All other frequencies including those from other channels are filtered out except for the adjacent channels. The resulting signal will henceforth be called MIX1.
- LO2 is divided by two inside an IQ modulator and mixed with MIX1 to yield two different signals. These two signals are the I and Q baseband components of the received RF signal. All other unwanted frequencies from adjacent channels are filtered out during this process.
- The I and Q baseband signals go through separate analog-to-digital conversions (ADC) inside a Digital Signal Processor (DSP) and the voice/data is then fully demodulated inside the DSP.
    - If the radio card is a VHF/UHF voice radio, then the DSP passes the voice information to the radio's main microcontroller. The voice audio is then sent to the local speaker and/or to an external speaker by way of filtered ~9-bit pulse-width modulation (PWM). The audio level may be adjusted from the front panel, and may even be shut off completely if desired. The squelch level and channel frequency may also be adjusted from the front panel.
    - If the radio card is a UHF data radio, then the data may sent to a PC over the USB-B port and/or saved to a flash memory stick.

While receiving, the radio cannot be transmitting as well. Since transmitting supersedes receiving, pressing the PTT will cause any signal that is being received on the current channel to be cut off from being sent to the M2115's speaker. By default, the radio is in receive mode and will send audio to the speaker at all times when not in transmit mode, so long as the squelch level is set to 0%. Setting the squelch level above 0% will always cut out noise being sent to the speaker when there is no audio being received. Each saved channel has its own squelch setting, so make sure to set each channel to the squelch level desired. To see how to adjust the squelch level to get rid of noise or unwanted distant signals, see Screen Control.

Transmitter [4.6]

General Operation [4.6.1]

There are multiple power output levels for the transmitter, where each channel has a unique power setting. There are 0W, 1W, 5W, and 10W output power settings that may be set using the front panel for the M2115M. For the 25W and 50W base stations, the power setting selection changes accordingly, but still implements different settings. The 0W setting disables the transmitter and so the M2115 functions as a receive-only device in this case. When the microphone push-to-talk switch is pressed from the remote controller or front panel the microprocessor detects it, shuts down the receiver, and then enters transmit mode. It does not matter what screen on the display a user is on in order to go into transmit mode, but the user will have the message "TRANSMIT" appear on the upper left side of the screen if on the main screen. Also note that all front panel operations are disabled when in transmit mode.

Hot Microphone Detection [4.6.2]

There is a hot-microphone, automatic shut down function that kicks in after 30 seconds of continuous transmitter on time. This function is useful especially when a user accidentally has the PTT in a pressed state while they are not present.

Base Station PTT Operation [4.6.3]
For base station radios, the audio input that is used depends on which PTT is pressed when a remote interface is installed. The remote audio input is used when the remote PTT is pressed, and the local audio input is used when the local PTT is pressed. If the PTT is pressed from the remote controller AFTER the PTT has been pressed from the local controller, the PTT from the remote controller is ignored by the main processor. Any audio put on the remote controller audio line is also ignored. If the remote controller's PTT was pressed first, the same procedure holds true.

High Voltage Standing Wave Ratio (VSWR) Detection [4.6.4]
While in transmit mode, the M2115's transmitter output is applied to forward and reverse power detector circuits. This allows the radio to keep the power output stable while transmitting. The radio card's processor can also detect if the PA breaks or prevents the PA from breaking by shutting it off when the reflected power voltage reads too high (VSWR) when transmitting. The front panel display shows "VSWR" on the main screen when a high reflected power is detected to let the user know that the transmitter has been turned off due to high VSWR. A user may disable this feature altogether, although it is not recommended (see VSWR).

AM Modulation Control [4.6.5]
For voice radio's, the AM modulation index can be as high as 95% and will never go over 100% due to processor monitoring and control while under normal operation. The M2115M, M2115B-25, and M2115B-50 are all capable of operating at 100% duty cycle.

Front Panel Control [4.7]

Overview [4.7.1]
The M2115 front panel control consists of a power on/off momentary button, a power status LED, four menu buttons, an optical rotary encoder with a built-in push button, a USB-A port, a USB-B port, a graphical liquid crystal display (GLCD), and a 5-pin XLR locking microphone/headset jack (microphone sold separately).

5-Pin XLR Locking Microphone/Headset Connector [4.7.2]
The M2115 can be configured to operate with a headset using a headset adapter which may be purchased through Mentor Radio. A Bluetooth adapter, also sold through Mentor Radio, may be connected to this plug as well and allows a user to use nearly any off-the-shelf Bluetooth headset on the market. The adapter comes with a wireless PTT so that the user needs to buy only the Bluetooth headset from a third-party vendor.

Power Control Button [4.7.3]
The power for the M2115 is controlled by a front panel momentary power on-off button. This is the button that is directly underneath the green LED on the front panel. Pressing the power on-off button while the radio is off will turn the radio on which will be apparent by the illumination of the green LED. Of course, the radio must have a power supply connected or nothing will happen. Also, if the radio turns off instantly, then the button was not held down long enough. To turn the radio off, it is highly recommended to only use the method that uses the power on-off button. This is done by holding the power on-off button down for about 3 seconds while the radio is in receive mode. The green LED will turn off to indicate the main processor is trying to shut the radio down. The radio will only fully turn off after the button is released. If the radio is non-responsive to the button press, then the radio may need to be shut down by turning the power supply off. This method should only be used if absolutely necessary as configuration data may be lost.

Menu Buttons [4.7.4]

Pressing a menu button changes either some value on the screen or changes what screen a user is viewing entirely. Menu buttons are referred to menu buttons 1 - 4, going from left to right when looking at the front panel head on (see the front panel diagram for visuals). Text above each button describes what each button will do on any given screen, while the high VSWR override functionality is accessible from every screen and only requires that a user is not in transmit mode to change the state.

Rotary Knob [4.7.5]

The rotary knob serves several purposes on some screens and none on others. Most uses are for increasing or decreasing the value of a selected field on a screen, but that is not all it is used for. When there is a screen that includes an "Enter" and/or "Exit" menu option, users may press the rotary knob once for "Enter" and twice for "Exit". Each screen uses the rotary knob differently. See the individual screens for rotary knob functionality in its entirety.

Internal Speaker [4.7.6]

A 2" x 2" speaker is mounted on the bottom panel on the M2115M for mobile applications. A 3.5" x 2" speaker is mounted on the front panel of the power supply for base station units. The M2115B-XX also includes an interface for a variety of remote control connections.

VSWR [5]

VSWR is an acronym for Voltage Standing Wave Ratio. VSWR is a measure of the ability of the transmitter to radiate RF power through the antenna and into open space compared to the signal that is reflected back into the transmitter. The more reflected power that does not leave the antenna, the higher the chance that there is excess energy that may damage the transmitter components. Therefore, it is very important to shut down the transmitter when there is a high reflected power to help prevent damage to the transmitter.

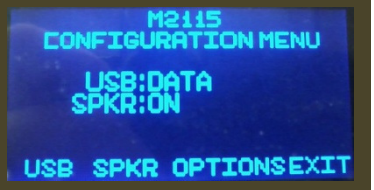
Under normal operating conditions, the transmitter is shut down when a high VSWR is read. Recognizing that there are times in the aviation industry where communications capability may be the difference of life and death, Mentor Radio has provided the ability of the M2115 to override the high VSWR transmitter shut down function. To disable the high VSWR transmitter shut down function, a user needs only to hold down menu buttons 1 and 3 for around 3 seconds while the radio is powered up and in receive mode. **Realize that if the PA blows up when VSWR control is overridden, then any warranty is instantly void.** To re-enable the high VSWR control function hold down buttons 1 and 3 for another 3 seconds. It does not matter what screen that a user is on to enable or disable the override, but the main screen shows that the control is disabled by displaying "OV" on the upper left of the screen. When a high VSWR is encountered, a user should cut the power to the radio and inspect/repair the transmission line as soon as possible.

Screen Control [6]

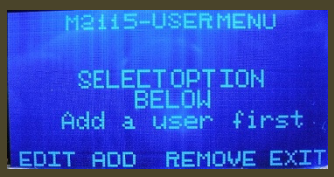
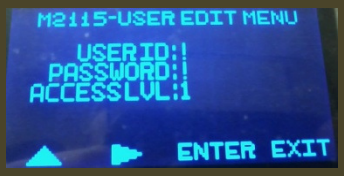
The table below describes what each function menu does for each individual screen. Note that rotating the rotary knob in a clockwise direction will increase the value of a field that has focus, and rotating the rotary knob in a counter clockwise direction will decrease the value of the field on the screen that has focus.

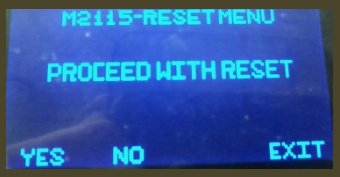
Screen Name	Actions	Screen Shot
Main	**Button 1:** Opens the Channel Select screen. **Button 2:** Opens the Basic Settings screen. **Button 3:** Opens the Configuration Main screen. **Button 4:** Opens the Reset screen. **Rotary Knob Rotate:** Increases and decreases **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Channel Select	**Description:** While toggling through channels the radio is tuned to, the current channel is displayed on the screen. However, the change is not permanent. If the user exits the screen, the channel that the radio was tuned to before entering this screen is restored. **Button 1:** Toggles through channels in the up direction. **Button 2:** Toggles through channels in the downward direction. **Button 3:** If the channel shown on the screen is different from the channel that the radio is currently tuned to, then the radio is tuned to the channel currently shown on the screen. When the screen is exited, the selected channel will remain the current channel. **Button 4:** Opens the Main screen. **Rotary Knob Rotate:** Clockwise goes up through the channels and counter clockwise goes down. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	
Basic Settings	**Button 1:** Opens the Power Adjust screen. **Button 2:** Opens the Squelch Adjust screen. **Button 3:** Opens the Backlight Adjust screen. **Button 4:** Opens the Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	

Screen Name	Actions	Screen Shot
Squelch Adjust	**Description:** The value that is displayed when the screen is first loaded is the current channel's squelch level. If the screen is exited before button 3 is pressed, the last saved squelch value is what the current channel has and not the value that is shown on the screen (unless the two values are in fact identical). **Button 1:** Increases the squelch value by 5% each press, up to a maximum value of 100% for the channel that the radio is currently tuned to. **Button 2:** Decreases the squelch value by 5% to a minimum value of 0% for the channel that the radio is currently tuned to. **Button 3:** Saves the currently selected squelch value as the current channels squelch value. **Button 4:** Opens the Basic Settings screen. **Rotary Knob Rotate:** Increases and decreases the squelch value in 5% intervals. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	
Backlight Adjust	**Description:** The backlight intensity changes as the value shown on the screen changes, but unless button 3 is pressed before exiting the backlight intensity will revert back to the last saved value. **Button 1:** Increases the backlight value in 4% intervals up to a maximum of 100%. **Button 2:** Decreases the backlight value in 4% intervals down to a minimum of 0%. **Button 3:** Saves the backlight value that is currently displayed. **Button 4:** Opens the Basic Settings screen. **Rotary Knob Rotate:** Increases and decreases the backlight value in 4% increments. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	
Power Adjust	**Description:** Allows a user to alter the transmit output power for the currently selected channel. Unless button 3 is pressed before exiting, the transmit output power will revert back to the last saved value. **Button 1:** Increases the current transmit output power. The interval and maximum value are dependent on the model of M2115. **Button 2:** Decreases the current transmit output power. The interval and minimum value are dependent on the model of M2115. **Button 3:** Save the value for the transmit output power as the power value on the screen. **Button 4:** Opens the Basic Settings screen. **Rotary Knob Rotate:** Increases and decreases the power value. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	

Screen Name	Actions	Screen Shot
Configuration Main	**Button 1:** Opens the USB screen. **Button 2:** Opens the Speaker screen. **Button 3:** If there are users entered into the system, then the Log In screen is opened. Otherwise, the Channel and User Configuration Main screen is opened. **Button 4:** Opens the Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
USB	**Button 1:** DO NOT USE. (Soon this screen will not exist.) **Button 2:** DO NOT USE. (Soon this screen will not exist.) **Button 3:** Nothing **Button 4:** Opens Configuration Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Speaker	**Button 1:** The radio will send received audio signals to connected radio speakers. **Button 2:** The radio will not send received audio signals to connected radio speakers. **Button 3:** Nothing **Button 4:** Opens Configuration Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Channel and User Configuration Main	**Button 1:** Opens Add or Delete Channel screen. **Button 2:** Opens Channel Edit screen **Button 3:** Opens Add Channel screen. **Button 4:** Opens Configuration Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	

Screen Name	Actions	Screen Shot
Add or Delete Channel	**Button 1:** Opens Add Channel screen. **Button 2:** Opens Delete Channel screen. **Button 3:** Nothing **Button 4:** Opens Channel and User Configuration Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Delete Channel	**Button 1:** Goes through currently saved channels in an upward direction. **Button 2:** Goes through currently saved channels in a downward direction. **Button 3:** Deletes the currently selected channel. **Button 4:** Opens the Add or Delete Channel screen. **Rotary Knob Rotate:** Go up and down through the currently saved channels. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	
Edit Channel	**Description:** There are two different focus groups for this screen. The first group is the line marked “CH” and the second includes the “FREQ” and “PWR” lines. Enter and Exit buttons control which group the user is navigating. The current field that is in the group that has focus will be blinking at a rate of one second. **Button 1:** If in Group 1, does nothing. If in Group 2, selects between the “FREQ” and “PWR” fields. No matter what the position was in the “FREQ” field, the position will always start at the 100 MHz place holder. **Button 2:** If in group 1, does nothing. If in group 2, the position in “FREQ” is moved to the right one place holder. When at the 0.001 MHz place holder, the position wraps around to the 100 MHz place holder. **Button 3:** When in group 1, changes the focus to group 2 and places the curser to the 100 MHz place holder position in the “FREQ” field. When in group 2, the information displayed on the screen is saved for the current channel displayed. **Button 4:** When in group 1, opens Channel and User Configuration Main screen. When in group 2, sets focus to group 1. **Rotary Knob Rotate:** When in group 1, selects the channel whose frequency and/or transmit power output is desired to be altered. When in group 2, increases and decreases the value of the currently selected field. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	

Screen Name	Actions	Screen Shot
User Main	**Button 1:** Opens the Edit User screen. **Button 2:** Opens the Add User screen. **Button 3:** Opens the Delete User screen. **Button 4:** Opens the Channel and User Configuration Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Edit User	**Description:** There are two different focus groups for this screen. The first group is the line marked "USER ID" and the second includes the "PASSWORD" and "ACCESS LVL" lines. Enter and Exit controls which group the user is navigating. The current field in the group that has focus will be blinking at a rate of one second. If a user name is desired to be changed, the user must be re-added. **Button 1:** If in group 1, does nothing. If in group 2, selects between the "PASSWORD" and "ACCESS LVL" fields. No matter what the position of the cursor is in the "PASSWORD" field, the position will always start at the far left place holder. **Button 2:** If in group 1, does nothing. If in group 2, the position in "PASSWORD" is moved to the right one place holder. When at the 10 place holders out, the position wraps around to the far left place holder. **Button 3:** When in group 1, the focus changes to group 2 and places the curser to the far left place holder in the "PASSWORD" field. When in group 2, the information displayed on the screen is saved for the current user displayed on the screen and the focus shifts back to group 1. **Button 4:** When in group 1, opens User Main screen. When in group 2, focus is set to group 1. **Rotary Knob Rotate:** Increases and decreases the value in the selected field at the cursor position. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	

Screen Name	Actions	Screen Shot
Delete User	**Button 1:** Shuffles through users in an upward direction. **Button 2:** Shuffles through users in a downward direction. **Button 3:** Deletes the currently selected user. **Button 4:** Opens the User Main screen. **Rotary Knob Rotate:** Shuffles through users in an upward and downward direction. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	
Reset	**Button 1:** Opens Reset Confirm screen, where the squelch value for the currently selected channel will be reset to factory default. **Button 2:** Opens Reset Confirm screen, where the backlight intensity value will be reset to factory default. **Button 3:** Opens Reset Confirm screen, where the radio is reset to factory default settings and all channel and user information is deleted. If users are in the system, the log in screen is opened instead or Reset Confirm. **Button 4:** Opens the Main screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Reset Confirm	**Button 1:** Resets whichever option brought the user to this screen. **Button 2:** Opens the Reset screen. **Button 3:** Nothing **Button 4:** Opens the Reset screen. **Rotary Knob Rotate:** Nothing **Rotary Knob 1 Press:** Nothing **Rotary Knob 2 Presses:** Nothing	
Log In	**Description:** A blinking cursor indicates what data the user is currently manipulating. **Button 1:** Changes the cursor focus to the field that is directly above the current field. If the current field is “USER ID”, then the field changes to “PASSWORD”. **Button 2:** The cursor moves one place holder to the right in the selected field. If the cursor is at the last place holder, then the cursor moves to the far left place holder in the selected field. **Button 3:** Opens the security protected screen that the user tried getting to prior to the Log In screen being shown. **Button 4:** Opens the screen that was displayed directly before this one. **Rotary Knob Rotate:** Increases and decreases the value in the selected field at the cursor position. **Rotary Knob 1 Press:** Performs the same function as button 3. **Rotary Knob 2 Presses:** Performs the same function as button 4.	

Installation [7]

Notice [7.1]

The first consideration for installation is to choose a suitable location. For both mobile and base installations, installation of the M2115 radio requires connecting the radio to a suitable antenna and a suitable power source.

NOTICE: For geographic locations where lightning is prevalent, Mentor Radio recommends installing a lightning protector on the antenna coax. If used as a base station radio, another lightning protector on the AC line is recommended.

M2115M [7.2]

The M2115M is intended to be installed into a vehicle. A suitable location should be selected to allow viewing of the GLCD and access to the front panel controls. A mounting bracket is provided to allow mounting the M2115M under the dash or on any flat surface. The bracket may be installed above or below the radio. Mobile antennas are available in two versions; a thru-hole type and a magnetic mount type. Installing a thru-hole antenna requires drilling a hole in the vehicle or mounting on a hood or roof of a vehicle. Magnetic mount antennas require routing the coax through the vehicle door where water may leak in or where the coax may be pinched. This may shorten the life of the antenna. Therefore, it is recommended to use a magnetic mount antenna for short term applications where the antenna may be removed and a thru-hole type antenna for a permanently long term applications. Install the antenna and connect to the antenna connector on the rear panel. Some antennas for aviation band frequencies come with a UHF connector.

The M2115M includes a built-in speaker. However, an external speaker may be used with or instead of the internal speaker. If an external speaker is to be used, install 18 AWG wires to the power plug as follows: Green wire to pin 12 (Speaker audio out signal) and a black wire to pin 2 (GND). A power cable is available which includes a 6 foot speaker cable. External speakers and cables are sold separately.

Verify that the vehicle power is not greater than 14VDC. Connect the power cable to the vehicle power or battery (Red to “+”, Black to “-”). Connect the 12-pin connector to the rear of the M2115M radio.

M2115B-xx [7.3]

The M2115B can rest on a shelf or a desk when ordered as the standard tower mechanical configuration, or installed in a rack mount when ordered in the rack mount mechanical configuration (M2115B-RM). Since this unit contains a cooling fan, when located on a desk or shelf, do not place equipment, papers, magazines, etc. near where they would restrict air flow through the left and right side vent ports thereby reducing its cooling capability.

Install a suitable power cord for local power used. A line replaceable fuse is inside the power plug. To remove the fuse, the cord must be removed first which is done with lightly prying pressure. The exposed fuse is the operating fuse and a spare fuse is located inside the fuse holder tray.

The antenna connector is a UHF style connector. If the antenna coax does not mate with this type, adapters are available from Mentor Radio or from many electronic distributors.

The antenna should be either a wideband type (118-137 MHz) or a narrow band type tuned to single channel or a very narrow range of frequencies. If a 3 or 6 dB gain antenna is used, communications range can be increased, because gain antennas effectively increase both receiver sensitivity and transmitter power. Care should be taken using gain antennas as many specify gain in a specific direction only. A directional antenna may reduce range in other directions in order to increase gain in a single direction. Depending upon your application, this may be acceptable. Low loss coaxial cable is also recommended, especially if the cable length exceeds 30 feet (10 meters).

Connections for remote operation for the M2115B-XX, when needed, are made via the 25 pin connector (type DB25) on the rear of the cabinet. Theses cables must be custom made by Mentor Radio to fit the needs of the customer. The cable is not standard, so please ask Mentor Radio to supply the cable with the radio. To install the interface cable, plug the green housing into the back of the TTP (tone termination panel) and plug the DB25 connector into M2115B-xx. If there is a custom interface that does not involve the TTP, then follow the instructions that Mentor Radio provides over the phone or through e-mail for the custom configuration. Refer to Remote Control Installation [7.5] for installation/planning of a remote control interface to work with the M2115B.

Plug a microphone into the microphone jack on the front panel of the M2115. Be sure the plug is pushed all the way into the jack before turning the radio on.

Global Positioning System (GPS) Module [7.4] Future feature, not currently available.

** To install the GPS module, a #2 Philips Head screwdriver is required.

1.) Remove the rear panel GPS module cover plate by unscrewing the two screws that hold the plate on.
2.) Press the GPS module connector onto the mating connector on the rear panel. Press firmly to ensure the connector is fully seated.
3.) Install cover plate over module and fasten the two screws removed from step 1.
4.) Install GPS antenna in a suitable location. Route antenna cable to radio. Connect to the GPS module mating connector (SMA style connector). NOTE: The GPS antenna must be exposed to the sky although placing it on a dashboard may be acceptable. For optimal sky view an externally mounted antenna is better. Review user requirements before deciding on antenna installation location.
5.) To enable the GPS feature of the radio, see the screen controls. ** This feature is not currently available.

Remote Control [7.5]

Planning [7.5.1]

As a general guide for basic system design planning purposes, the following may help you in your equipment requirement and selection process. Review Figure 1 for a summary of the pros and cons of each system.

REMOTE	BENEFITS	DOWNSIDE
Local Extension Control:	• Less expensive controllers	• Distance limited (<1K ft) • Hard to add controllers • Requires special expensive cable between each controller and radio. • NO remote frequency selection • Requires tools and technical skill to connect wires to a terminal board.
Tone Remote Control:	• Not distance limited • Easy to add controllers • Uses low cost phone wire to connect between adapter and radios. • Allows remote frequency selection • No tools required to install units.	• More expensive controllers • Requires a tone remote adapter

Figure 1 - Comparison between Remote Control Systems

NOTE: As the engineering work for the Local Extension Controllers has not been completed, it is recommended that the tone remote is selected if at all possible as the remote interface option. If a Local Extension Controller is desired for cost reasons, the engineering work will be completed at that time but please be aware that the radio will take longer to get out the door.

Installation [7.5.2]

The M2115B and M211B-XX have two different styles of connectors for remote interfaces: The M2115B provides the connections necessary at the rear panel 12-pin power plug using a custom connector for connecting/disconnecting from the remote interface, while the M2115B-XX series radios have a 25-pin connector on the back of the radio that the tone remote interface connects to directly. This plugs for each radio contains all the connections needed for connecting various types of remote controllers to allow remote users to operate the M2115B base station radio.

Each basic remote control type requires a different adapter cable to connect between the radio and the controllers. There are four basic styles of controllers available for connecting to the M2115B, they are:

1. Telephone style handset
2. Desktop style with a pedestal style desktop microphone
3. Hands free voice operated transmit (vox) box
4. Dispatch style controller with a gooseneck microphone

These 4 styles are available for both the local extension and tone remote controllers. Further, it is also possible to interface the M2115B to a dispatch console. Most consoles allow interfacing many different types of radios, so make sure the M2115B is configured as an analog radio.

M2115 PIN	DB-25 PIN	FUNCTION	COLOR
10	1	Mic PTT	Gray
8	2	Mic Audio	Violet
2	3	Ground	Black
2	4	Ground	Black
2	5	Ground	Black
2	6	Ground	Black
12	7	4 Ohm RCVR out	Green
12	8	4 ohm RCVR out	Green
3	9	500/600 Ohm RCVR out	Green
9	25	+12 VDC Switched	Yellow
7	11	F1	Orange
1	12	F2 (No External PA)	White-Blue
4	13	F3 (No External PA)	White-Blue
5	14	F4	White-Yellow
6	15	F5	White-Red
1	N/A	FWD PWR DET (External PA)	White-Orange
4	N/A	REV PWR DET (External PA)	White-Blue

Figure 2 - M2115 Power Plug / Remote Cable (DB-25 plug)

Figure 2 shows the functions of the remote connector pins using a 25 pin D-subminiature type connector cable.

Connections to the mating connector may use #22 AWG. **Note:** There are four ground terminals and two terminals for the 4 ohm receiver audio output. The ground terminals may be used as needed for various remote connections; in some circumstances it may be desirable to “double-up”, using two ground pins in parallel (Each pin is rated for 1 ampere). The 4 ohm audio receiver outputs can be used with one 4 ohm or two 8 ohm external speakers. The +14 VDC is available to operate external remote control equipment. The 500/600 ohm receiver audio output can be used for remote stations or for a tape recorder output.

The remote microphone audio input should be in the range -10 to -16dBm (0.3 to 0.15 V RMS). If this voltage is too high the modulation may be distorted when transmitting—that is, the voice transmissions may not sound as clear.

From the table above it can be seen that the number of remotely selectable frequencies drops from 16 to 7 when an external PA is used for the 25W and 50W radios. Take this into account when selecting which system is best for your application.

User Security Notice [8]

Mentor Radio has incorporated security into the the family of M2115 radios to help prevent inadvertent frequency changes that may result in unauthorized emissions. However, they may be programmed without enabling security. Operating the M2115 radio without enabling security allows faster configuration changes, but cannot help prevent unauthorized users from making inadvertent frequency changes that may potentially result in transmissions on unauthorized frequencies. ***NOTE: It is up to the licensee or responsible person to determine if security is required for the M2115 radio. If more than one user is to operate the radio, Mentor Radio recommends that security be enabled.***

Enabling security requires adding at least one user to the radio. Once one or more users are entered into the configuration, no changes to the configuration are allowed until a user "logs in". A prompt requests that a user to enter their user identification (displayed on the LCD as USER ID) and password.

Maintenance [9]

No routine maintenance is necessary, other than to remove accumulated dust. If the equipment is accidentally impacted or dropped, operation should be fully checked and an internal inspection made for loose or broken parts.

Servicing and Repair [10]

Should the M2115 require servicing, return it to us with a description of the problem. ***SERVICE SHOULD ONLY BE ATTEMPTED BY TECHNICIANS EXPERIENCED WITH THIS TYPE OF EQUIPMENT AND WHO HAVE AVAILABLE THE APPROPRIATE TEST EQUIPMENT. CALL OUR OFFICE FOR SERVICE.***

Trouble Shooting and User Repair Guide [11]

In the event of a malfunction, the following information may help isolate the malfunction to a line replaceable component. If you are unable to troubleshoot your problem; call us before sending your unit in for repair.

1.) Unit will not turn on after pressing the power button.
- For a mobile installation check that the power connections are secure and verify the polarity is correct.
- For a base unit, verify that the fuse has not blown. A spare fuse is inside the fuse holder tray.

2.) LCD is hard to read in day light.
- Adjust the backlight setting to a more suitable level for your existing lighting conditions. See screen.

3.) Radio has continuous noise when in receive mode.
- Adjust squelch level. Increase level until the noise stops. This is the point of maximum sensitivity squelched. It will be necessary to set this level for each operating channel.
- You may need to adjust to a lower setting if you are trying to receive very weak signals.

4.) The receiver volume level is set to low.
- In normal operate mode the volume may be adjusted by rotating the front panel rotary knob while on the main screen.

5.) The unit tries to transmit then stops and the VSWR enunciator illuminates on the LCD.
- This is an indication that there is a malfunction in the transmission line (coax cable) or antenna. If this happens, a qualified technician should check the cabling and antenna installation for the problem.

6.) The base unit is connected to a tone remote adapter, and remote operations fail to operate the radio properly.
- Try disconnecting the remote control and operate the M2115 locally. If the unit operates properly, replace the tone remote adapter.

7.) The wrong frequency appears on the main menu screen for a previously programmed channel.
- This is an indication that there may have been an inadvertent change in the configuration of the radio. If security is not enabled, enable it by adding a user. After security is enabled, only a user with a password can gain access to change configuration data. It is also possible that there was a firmware malfunction that the configuration needs to be reloaded.

8.) The volume is different from when the unit was last turned off.
- This is because the unit was not turned off from the front panel on-off button.

9.) How do I reset the M2115 back to factory default user configuration settings?
- First make sure that the radio does not need to be used. This is because the radio must be restarted after the configuration reset. From the main screen on the front panel, open the “RESET” screen. Select the “RADIO” option. If there are any user’s stored for the current user configuration, then the user will be prompted to enter their user id and password. Once the reset confirm screen is visible, select the “YES” option and then restart the radio.

Licensing [12]

In the United States, all aviation band transmitters must be licensed by the Federal Communications Commission (FCC). Therefore, the radio equipment you have purchased requires FCC licensing. Applications can be found online at http://wireless.fcc.gov/uls/index.htm?job=home. This site provides instructions for the application, for payment of filing fees, as well as, online forms to complete and transmit electronically. Please call the FCC directly for help when filling out these forms. Their number is 1-877-480-3201, option #2.

The information in the table below provides Mentor Radio's FCC identification information on its products. This information may be needed when you make the online application and is provided below for your assistance.

The Mentor Radio model identification is not the same as the FCC Identification. The first table below gives the FCC Identification and the transmitter power for Mentor Radio models. For all Mentor Radio transmitters enter "6K00A3E" for "emission and bandwidth" ("0" is a numerical zero, not the letter following "N"). You may be asked for a "Class of Station". The second table below can help you select your Class. You must apply for a frequency that the FCC permits for your selected class. Some of the permissible frequencies are listed below.

For a complete listing of available frequencies, consult the FCC rules, Part 87.173 (available online at http://www./wireless.fcc.gov/rules.html). In the United States, all aviation band transmitters must be licensed by the Federal Communications Commission (FCC). The M2115-25 and M2115-50 each contains two different pieces of equipment which must be listed on the application. Do not list the M2115-25 or M2115-50; list the following:

Model	FCC Identification (Enter on Application)	Output
M2115M	QQTM2115	10 watts
M2115B	QQTM2115	10 watts
M2115B-25	QQTM2115 & QQTPA25	25 watts
M2115B-50	N/A	50 watts
M15 (Discontinued)	QQTM15	5 watts
MB (Discontinued)	QQTMB	10 watts
M15-25 (Discontinued)	QQTM15 and QQTPA25	25 watts

Class of Station	FCC Code	Mentor Radio Models	Typical Use	Frequencies Available
Aeronautical Advisory	FAU	M2115B, M2115B-25, M2115-50, M15	Unicom	No tower: 122.700, 122.800 Tower on field: 122.950 Heliport: 123.050, 123.075
Aeronautical Multi-com	MFL	M2115B, M2115B-25, M2115-50, M15	Air/Ground	Coordination 122.850, 122.900, 123.100
Search & Rescue	SAR	M2115B, M2115B-25, M2115-50, M15		123.100
Aviation Support	FAS	M2115B, M2115B-25, M2115-50, M15	Flight Schools, Soaring	123.300, 123.500, 121.950
Aero. Utility Mobile	MOU	M2115M	Airport vehicles Gnd. Cont. & tower frequencies	
Aeronautical En-route	FA	M2115B, M2115B-25, M2115-50, M15	ARINC, Corp.	128.825 to 132.000
Flight Test	FAT	M2115B, M2115B-25, M2115-50, M15	Manufacturers	123.200, 123.225
Control Tower	FAC	M2115B, M2115B-25, M2115-50, M15-25	numerous	118.000-136.975

These devices comply 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) these devices must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by Mentor Radio, LLC could void the user's authority to operate the equipment and voids the manufacturer's warranty. With each new M2115B, there are instructions included on how to complete Form 406 online at the FCC Internet web site. If the M2115B-25 or M2115B-50 is to be used on a channel in the frequency range of 128 to 132 MHz (the "en-route" channels), the license application is handled differently. Both the assignment of specific frequencies and the completion of Form 406 are done by Aeronautical Radio Incorporated

(ARINC), a private organization which contracts to the FCC to manage this part of the spectrum. For use of an aeronautical en-route frequency (128 to 132 Mhz), call the ARINC Call Center at 800-633-6882. ARINC (Aeronautical Radio, Inc.) coordinates frequency assignments with the FCC. Prior to assigning a frequency, your company will need to sign an ARINC contract. Your company must designate a Contract Officer and Station Representative who will be responsible for the establishment and operation of the radio station in accordance with the terms of the contract and the ARINC Ground Station Manual.

Once ARINC has received the necessary information from you, a license application will be sent to the FCC, who will in turn issue the station license. The original is sent to ARINC. ARINC will send you a copy. The entire process takes about 90 days. An interim temporary license, which is valid for 90 days, may be obtained from ARINC for a one-time charge. You pay the FCC license fee to ARINC, who in turn pays the FCC. Frequencies are assigned on a shared basis for air/ground operational control communications. Personal communications are not permitted. Please contact ARINC directly for current rates and applicable fees.

Limited Warranty [13]

Your Mentor Radio equipment is warranted to the original consumer purchaser only, for one full year, to be free from defects in materials and workmanship under normal use. This warranty does not include damage to the product resulting from accident or misuse. This warranty will not be effective unless you submit a Warranty Registration online at http://www.mentorradio.com.

If the equipment should become defective within the warranty period, we will elect to repair or replace it, without charge, if returned, postage prepaid, to the address shown on our website at http://www.mentorradio.com. We are not liable for defects or damages caused by the use of unauthorized replacement parts and/or service.

ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITTNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO ONE YEAR. Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you.

MENTOR RADIO, LLC., BECAUSE OF LACK OF CONTROL OVER THE CONDITIONS OF USE OF THIS EQUIPMENT, IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. ANY RECOVERY MAY NOT BE GREATER THAN THE PURCHASE PRICE PAID FOR THE EQUIPMENT. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.