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**FCC Statements**

15.19 – Two Part Warning

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.

15.21 – Unauthorized Modification

NOTICE: The manufacturer is not responsible for any unauthorized modifications to this equipment made by the user. Such modifications could void the user’s authority to operate the equipment.

15.27 – Special Accessories

This device is supplied with special accessories that include an RF adapter cable and antenna. These special accessories must be used with the device. It is the responsibility of the user to use the needed special accessories supplied with the equipment.

15.105(b) – Note:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**Industry Canada Statement**


**Industry Canada Statement**

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes : (1) l’appareil ne doit pas produire de brouillage, et (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

**Industry Canada Unlicensed Devices EIRP Statements for Removable Antennas**

Part 1: Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that necessary for successful communication.

Part 1: Conformément à la réglementation d’Industrie Canada, cet émetteur radio ne peut fonctionner qu’avec une antenne dont le type et le gain maximal (ou inférieur) sont approuvés par Industrie Canada. Pour réduire les interférences radioélectriques potentielles avec d’autres utilisateurs, le type d’antenne et son gain doivent être choisis de telle sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne soit pas supérieure à celle nécessaire pour une communication réussie.

Part 2: This radio transmitter 7955A-MRF450 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Part 2: Le présent émetteur radio 7955A-MRF450 a été approuvé par Industrie Canada pour fonctionner avec les types d’antenne énumérés ci-dessous et ayant un gain admissible maximal et l’impédance requise pour chaque type d’antenne. Les types d’antenne non inclus dans cette liste, ou dont le gain est supérieure au gain maximal indiqué, sont strictement interdits pour l’exploitation de l’émetteur.

<table>
<thead>
<tr>
<th>Approved Antenna List / Liste Antenne Approuvée</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>Cervis, Inc.</td>
</tr>
</tbody>
</table>

**RSS-GEN 7.1.3 – Notice / Délai**

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes: (1) l’appareil ne doit pas produire de brouillage, et (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.
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Cervis, Inc. Safety Precautions

✓ Read and follow all instructions.

✓ Failure to abide by Safety Precautions may cause equipment failure, loss of authority to operate the equipment, and personal injury.

✓ Use and maintain proper wiring. Follow equipment manufacturer instructions. Improper, loose, and frayed wiring can cause intermittent operation, equipment damage, and system failure.

✓ Changes or modifications made to equipment not expressly approved by the manufacturer will void the warranty.

✓ Equipment owner/operators must abide by all applicable Federal, State, and Local laws concerning equipment installation and operation. Failure to comply could result in penalties and could void user authority to operate the equipment.

✓ Make sure that the machinery and surrounding area is clear before operating. Do not activate the transmitter control system until you are certain that it is safe to do so.

✓ Turn off the transmitter and disconnect power from the receiver before attempting any maintenance. This will prevent accidental operation of the controlled machinery.

✓ Disconnect power from the receiver by either detaching the cable from the receiver or removing the source power from the receiver.

✓ Use a damp cloth to keep units clean. Remove mud, concrete, dirt, etc. after use to prevent obstructing or clogging the buttons, levers, joysticks, wiring, and switches.

✓ Do not allow liquid to enter the transmitter or receiver enclosures. Do not use high-pressure equipment to clean the transmitter or receiver.

✓ Disconnect the receiver before welding on the connected machinery. Failure to disconnect the receiver may cause destruction of or damage to the receiver.

✓ Operate and store units only within the specified operating and storage temperatures defined in this document's specifications.

✓ Keep high-energy radio frequency (RF) devices away from transmitters. Activating high-power communication radios, for instance, close to transmitters can cause interference and “false” circuit activation.

✓ Do not key two-way radios while using the console box transmitter.

✓ Note: Refer to the custom drawing package provided with each job for specific details not included in this manual!
1.0 Warrior Locomotive Remote Control (LRC) Console Box Transmitter Introduction

The Warrior locomotive remote control (LRC) console box (CB) transmitter works in conjunction with the MU-x6E Warrior receiver to remotely control locomotives. Housed in an extremely durable, sealed, glass-filled nylon enclosure, the Warrior LRC transmitter is ready for duty in harsh environments, including outdoor applications.

Warrior systems operate in the 450 MHz United States Federal Communications Commission (FCC) Part 90 licensed radio band. The system uses continuously monitored bi-directional radio transmissions, where the receiver acknowledges each message the transmitter sends via its own acknowledge message. Four transmitter diagnostic light-emitting diodes (LEDs) indicate:

- Radio transmission integrity
- Battery life
- Radio Active (RA) relay (main line contactor [MLC]) status
- Safety Stop (SS) relay status

1.1 Features

- 450 MHz @ 100 mW FCC Part 90 licensed operation
- 12 system status/diagnostic LEDs (see Table 3)
- Operates using two type “C” cell batteries
- Pull-up Stop switch
- On/off keyswitch
- Neck/shoulder harness standard; optional belt mounting available
- Eight-character LED display
- Unsurpassed durability and environmental sealing
2.0 Warrior LRC Transmitters

2.1 Warrior LRC Diagnostic/Status LEDs

Warrior LRC transmitters have four red diagnostic/status LEDs.

Table 1. Warrior LRC Transmitter Status/Diagnostic LEDs

<table>
<thead>
<tr>
<th>LED</th>
<th>Icon</th>
<th>Function</th>
<th>Receiver Communication</th>
<th>Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td><img src="wifi.png" alt="WiFi Icon" /></td>
<td>Radio Frequency (RF) Transmit and Receive indication</td>
<td>Flashes when message is sent or received</td>
<td>Used for Maintenance Mode (MM) indication</td>
</tr>
<tr>
<td>L2</td>
<td><img src="battery.png" alt="Battery Icon" /></td>
<td>Battery Status indication</td>
<td>Low battery warning when on (&lt;2.2 V)</td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td><img src="radio.png" alt="Radio Icon" /></td>
<td>Radio Active</td>
<td>Solid when “Radio Active” (MLC) relays are energized</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td><img src="safety.png" alt="Safety Icon" /></td>
<td>Safety Stop</td>
<td>Solid when safety stop relay is pulled in</td>
<td></td>
</tr>
</tbody>
</table>
Additionally, they have eight functional LEDs located beneath the display.

**Table 2. Warrior LRC Transmitter Display LEDs**

<table>
<thead>
<tr>
<th>LED</th>
<th>Icon</th>
<th>Color</th>
<th>Function</th>
<th>Receiver Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>FWD</td>
<td>Green</td>
<td>Forward</td>
<td>Solid when forward direction selected</td>
</tr>
<tr>
<td>L2</td>
<td>REV</td>
<td>Amber</td>
<td>Reverse</td>
<td>Solid when reverse direction selected</td>
</tr>
<tr>
<td>L3</td>
<td></td>
<td>Red</td>
<td>Spare</td>
<td></td>
</tr>
<tr>
<td>L4</td>
<td>PKD</td>
<td>Green</td>
<td>Throttle Enable</td>
<td>Solid when brake released/throttle enabled</td>
</tr>
<tr>
<td>L5</td>
<td>D-EN</td>
<td>Red</td>
<td>Direction Enable</td>
<td>Solid when brake is applied</td>
</tr>
<tr>
<td>L6</td>
<td>MRP</td>
<td>Red</td>
<td>Main Reservoir Pressure</td>
<td>Solid when main reservoir pressure is OK</td>
</tr>
<tr>
<td>L7</td>
<td>TL2</td>
<td>Red</td>
<td>Trainline Fault</td>
<td>Solid when fault detected on locomotive</td>
</tr>
<tr>
<td>L8</td>
<td>WS</td>
<td>Red</td>
<td>Wheel Slip</td>
<td>Solid when a wheel slip condition is present</td>
</tr>
</tbody>
</table>

**Table 3. Advanced LED Diagnostics**

<table>
<thead>
<tr>
<th>Indication</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="BLINKING" alt="Blinking" /> ![Lit Solid](LIT SOLID) <img src="UNLIT" alt="Unlit" /></td>
<td>1. Signal to receiver inactive. 2. Command being selected and confirmed.</td>
</tr>
<tr>
<td><img src="BLINKING" alt="Blinking" /> ![Lit Solid](LIT SOLID) <img src="UNLIT" alt="Unlit" /></td>
<td>1. Signal to receiver active. 2. Loss of messages. (Inconsistent flashing.)</td>
</tr>
<tr>
<td><img src="Alternating" alt="Alternating" /></td>
<td>Alternating: Stop Check, Cycle Stop.</td>
</tr>
<tr>
<td><img src="Alternating" alt="Alternating" /></td>
<td>Alternating: Stuck Switch. Check switches/proportional not neutral.</td>
</tr>
<tr>
<td><img src="Scrolling" alt="Scrolling" /></td>
<td>Scrolling: Indicates Maintenance Mode. (See Section 2.6.)</td>
</tr>
<tr>
<td><img src="Scrolling" alt="Scrolling" /></td>
<td>Scrolling: Tilt Switch Active in Maintenance Mode. (See Section Error! Reference source not found..)</td>
</tr>
<tr>
<td><img src="Alternating" alt="Alternating" /></td>
<td>Alternating: Tilt Switch Inactive in Maintenance Mode. (See Section Error! Reference source not found..)</td>
</tr>
<tr>
<td>Indication</td>
<td>Definition</td>
</tr>
<tr>
<td>------------</td>
<td>------------</td>
</tr>
<tr>
<td>![Image]</td>
<td>Batteries low; replace with fresh batteries soon. (Receiver also warns of low transmitter battery. See respective Warrior receiver manual for more information.)</td>
</tr>
<tr>
<td>![Image]</td>
<td>Power Off: All four LEDs simultaneously light solid for a moment, then go out.</td>
</tr>
<tr>
<td>![Image]</td>
<td>Shutting Off: Batteries below normal operating level (replace batteries with fresh set.)</td>
</tr>
</tbody>
</table>

### 2.2 LED Display Standard Messages

**Figure 2. Warrior LRC Transmitter LED Display**

**Table 4. Warrior LRC Transmitter LED Display Standard Messages**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Start Prompts</strong></td>
<td></td>
</tr>
<tr>
<td>NO KEY</td>
<td>Key switch is in the OFF position.</td>
</tr>
<tr>
<td>STOP ↓</td>
<td>Cycle the STOP switch. Push the STOP switch down.</td>
</tr>
<tr>
<td>STOP ↑</td>
<td>Pull the STOP switch up.</td>
</tr>
<tr>
<td>MM WAIT</td>
<td>Indicates that the operator has two seconds to enter Maintenance Mode. Message briefly displays, then automatically clears.</td>
</tr>
<tr>
<td>PAIR</td>
<td>Displayed briefly while RF link is being established and when the CB is searching for a receiver to link with.</td>
</tr>
<tr>
<td>L# XXXX</td>
<td>When the locomotive number displays, all conditions are met to establish an RF link, and the “Radio Active” relay in the receiver will be pulled in when the START button is pressed.</td>
</tr>
</tbody>
</table>

**Possible Startup Prompt Faults**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STUCK SW</td>
<td>Maintained switch is in the wrong position during CB power-up.</td>
</tr>
<tr>
<td>SE FAULT</td>
<td>Check locomotive E-Stops. Press the START/RESET button.</td>
</tr>
<tr>
<td>TL FAULT</td>
<td>Train Line fault. No reset allowed.</td>
</tr>
</tbody>
</table>

**Initiating Locomotive Control**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLE</td>
<td>Move the “Enable” switch up.</td>
</tr>
<tr>
<td>SS START</td>
<td>Press START/RESET to pull in the SS relay.</td>
</tr>
</tbody>
</table>

**System Error Messages**

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRPFAULT</td>
<td>Low Main Reservoir Air Pressure.</td>
</tr>
<tr>
<td>&quot;TILT&quot;</td>
<td>The CB is tilted.</td>
</tr>
</tbody>
</table>
2.3 LRC Functionality Switch/Joystick Description

<table>
<thead>
<tr>
<th>Prompt</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>“VGLN”</td>
<td>Vigilance timeout about to occur.</td>
</tr>
</tbody>
</table>

**Run Time Message**

| TH0 IB6 | Current Throttle and Brake positions. |

**General Maintenance Messages**

| MM | Currently in Maintenance Mode. |
| ASOC | CB is trying to associate. |
| IDLE | Message displays when CB timeout occurs. |

---

**Table 5. Warrior LRC Controls Descriptions**

<table>
<thead>
<tr>
<th>Name</th>
<th>Switch Position</th>
<th>Function</th>
<th>Switch Type</th>
<th>Startup Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ditch Lights</td>
<td>S1+ S1–</td>
<td>On/Off</td>
<td>2-Position Maintained Toggle Switch</td>
<td>Any</td>
</tr>
<tr>
<td>Headlights</td>
<td>S2+ S2–</td>
<td>On/Off</td>
<td>2-Position Maintained Toggle Switch</td>
<td>Any</td>
</tr>
<tr>
<td>Display</td>
<td>S3</td>
<td>Display On/Off</td>
<td>Pushbutton</td>
<td>Any</td>
</tr>
<tr>
<td>Start/Reset</td>
<td>S4</td>
<td>System Start</td>
<td>Pushbutton</td>
<td>Any</td>
</tr>
<tr>
<td>Directional</td>
<td>S5+ S5–</td>
<td>Forward/Neutral/Reverse</td>
<td>3-Position Maintained Toggle Switch</td>
<td>Center (Neutral)</td>
</tr>
<tr>
<td>Horn/Bell</td>
<td>S6+ S6–</td>
<td>Horn/Bell</td>
<td>3-Position Momentary/Off/Maintained Toggle Switch</td>
<td>Center (Neutral)</td>
</tr>
<tr>
<td>Enable/Disable†</td>
<td>S7+ S7–</td>
<td>Enable/Disable</td>
<td>2-Position Maintained LTO</td>
<td>Center (Neutral)</td>
</tr>
</tbody>
</table>

---

![Figure 3. Warrior LRC Control Layout](image-url)
<table>
<thead>
<tr>
<th>Name</th>
<th>Switch Position</th>
<th>Function</th>
<th>Switch Type</th>
<th>Startup Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>UP DOWN</td>
<td>Enable Console Box</td>
<td>Pull Up</td>
<td>Up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disable Console Box</td>
<td>Push Down</td>
<td></td>
</tr>
<tr>
<td>Throttle/Brake</td>
<td>JS1Y+ JS1Y– JS1X+ JS1X–</td>
<td>Throttle Increase Throttle Decrease Brake Apply Brake Release</td>
<td>Single-step Joystick</td>
<td>Center (Neutral)</td>
</tr>
</tbody>
</table>

† – This switch toggles between normal operating mode (Enable) and allowing users to "Disable" the vigilance feature. The switch can be set to “disable” when the operator needs to perform maintenance. When in “disable” mode, the brake is fully applied, and the throttle is disabled. The locomotive cannot move. The display reads “ENABLE”, reminding users to move the switch to that position when they are ready to operate the locomotive again.

- The vigilance timer is shut off while in Disable mode.
- To re-start the system, move the switch to Enable mode, and hit the Start/Reset button (S4), making sure the joystick is in the center position.

<table>
<thead>
<tr>
<th>Console Box Left Side</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switch</strong></td>
</tr>
<tr>
<td>S21+ (UP) S21– (DOWN)</td>
</tr>
<tr>
<td>S22+ (UP) S22– (DOWN)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Console Box Right Side</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Switch</strong></td>
</tr>
<tr>
<td>Off+ (UP) On– (RIGHT)</td>
</tr>
</tbody>
</table>
2.4 Turn LRC Transmitter On

Turn the LRC transmitter on and make it ready for use as follows:

1. Turn the keyswitch 90° to the ON position.

![Keyswitch Image]

**Notes:**

- If you attempt to start the CB without turning the keyswitch, the LED display reads “NO KEY.”
- The Warrior LRC transmitter has a keyswitch on the right-hand side. Typically, this keyswitch enables/disables transmitter power.

2. Pull the STOP button UP to the ON position.

![STOP Button Image]

If the STOP button is not up – nothing will happen. If the STOP button is already up, the display reads “STOP ↓”, indicating to push the STOP button down. The display then reads “STOP ↑”, indicating to pull the STOP button up.

All four LEDS light solid for 0.5 second:

![All LEDs Solid]

Then, LED SS lights solid for 1.5 seconds:

![LED SS Solid]

And the display reads “PAIR.”

3. When the RF LED begins blinking rapidly:

![RF LED Blinking]

The transmitter has established a communications link with the receiver. (This entire process takes approximately five seconds.)

4. Press the green START/RESET pushbutton to energize the receiver’s Main Line Contact (MLC) relays.
2.5 Turn LRC Transmitter Off

Two methods are available to turn the transmitter off:

1. To immediately stop all operations, push the STOP button down.

2. Turn the keyswitch to the OFF position.

All outputs deactivate after the communications link is lost.

✓ Note: The transmitter will also shut off automatically if you do not activate any switch within the transmitter’s built-in Switch Inactivity Timeout (standard time=ten minutes) period. The display reads “IDLE.”
2.6 LRC Maintenance Mode

Maintenance mode is the gateway to the LRC transmitter's various adjustable operating functions – including association (Section 2.7), tilt switch activation/deactivation (Section Error! Reference source not found.), and switch test mode (Section 2.9.1).

To Enter Maintenance Mode:
1. Turn the transmitter on. (See Section 2.3, steps 1–2).
2. When the SS LED lights steadily:

   ![Select and Next Switches](image)

   Quickly move both the SELECT and NEXT switches on the left-hand side of the transmitter DOWN for approximately one second. The display reads “MM WAIT”.

   ✓ Note: If you wait too long to perform this operation, restart the process from Step 1.

3. The LEDs scroll from right to left:

   ![LEDs Scroll](image)

   And the display reads “MM.”

   The unit is now in Maintenance Mode. Release the switches to perform further operations.

To Exit Maintenance Mode:
1. Press the STOP switch DOWN.

   ![Stop Switch](image)

   This also shuts the transmitter down. Pull it up again to begin operations. (Section 2.3).

2.7 Associate LRC with the System Receiver

Before you can use the Warrior remote control system, system transmitter(s) must establish a communications link—or be “associated”—with the system receiver. The LRC stores the target receiver identity (ID) in its core memory following successful association with the chosen
receiver. Systems are pre-associated at Cervis, Inc. before leaving the factory; but there may be times when it is necessary to associate transmitters and receivers while in the field.

Use the process outlined in the following steps to associate a receiver with the LRC transmitter when needed.

**To Associate with Receiver:**

1. Turn the transmitter on. (See steps 1–2 in Section 2.3).
2. Enter **Maintenance Mode**. (See steps 1–3 in Section 2.6).
3. While in Maintenance Mode, simultaneously lift and hold the **SELECT** and **NEXT** switches on the transmitter's left side UP for five seconds.

Release both switches when LED RA starts blinking:

![LED RA and SS](image)

And the Display reads “ASOC.”

You are now in **Association Mode**.

4. While in Association Mode, the **SS** and **RF** LEDs light steadily:

![LED SS and RF](image)

This indicates that the transmitter is attempting to locate any available receivers to **Link** to. The transmitter builds a list of all possible receiver identities (IDs) that are in range (usually only one).

5. When the **RA** and **RF** LEDs light steadily:

![LED RA, SS, and RF](image)

The transmitter has completed its search for available receivers. You can now pick which receiver to link to.

6. The Association Relay on a found receiver starts pulsing. (During the process, an LED on the bottom of the MU’s enclosure blinks when the receiver is selected.)
To select the indicated receiver, momentarily lift the SELECT switch UP.

To bypass that receiver and move to the next one in the transmitter’s memory, momentarily lift the NEXT switch UP.

7. When you have found the receiver you want to control, press the green START/RESET pushbutton again to pull in the “Radio Active” (MLC) relays.
Note: Once you have selected a receiver and energized the MLC relays, the Locomotive CB transmitter and receiver are linked (associated). The display reads “L# XXXX”—where “XXXX” is the locomotive ID number.

Notes:
- If you purchase a spare transmitter after the original system ships, you will need to associate it yourself before it will work with that system.
- Each transmitter must be associated one time. Once associated with a receiver, that transmitter will work with that receiver until the receiver ID is cleared (see Section 2.8). The transmitter will work in a first-come/first-serve fashion, where only one transmitter can ever be linked to a receiver unit at a time.

2.8 Clearing LRC Stored Receiver ID (Factory Reset)

The LRC transmitter stores its associated receiver ID in its internal memory. During instances of severe interference—or perhaps when troubleshooting—it may become necessary to break the established communications link between the transmitter and the system receiver. This is called “clearing the stored ID” or “Factory Reset.”

To Clear the Stored Receiver ID (Factory Reset):
1. Turn the transmitter on. (See steps 1–2 in Section 2.3).
2. Enter Maintenance Mode. (See steps 1–3 in Section 2.6).
3. To reset the transmitter, simultaneously hold the SELECT and NEXT switches on the transmitter’s left side UP and push the green START/RESET pushbutton.
4. Release the SELECT and NEXT switches and green START/RESET pushbutton to return to Maintenance Mode.
Notes:

- When a transmitter is not associated with a receiver, the transmitter will illuminate all the LEDs and then power down shortly after it is turned on.
- The receiver does not need to be on when clearing a receiver ID from the transmitter.

2.9 Maintenance Mode Special Features

2.9.1 Switch Test Mode

Switch Test Mode allows you to diagnose the Warrior LRC transmitter when troubleshooting a potential problem.

While in switch test mode, you can test the transmitter switches, levers, and joysticks without energizing the relays in the receiver (and consequently, unnecessarily manipulating the attached machinery). As you manipulate the controls, the LEDs will light to let you know that the transmitter’s printed circuit board (PCB) recognizes that switch movement.

✓ Note: You can test all switches except for the SELECT switch UP. (This switch allows you to enter Switch Test Mode).

In switch test mode, the Battery, RA, and SS LEDs are used.

<table>
<thead>
<tr>
<th>LED</th>
<th>Analog Input</th>
<th>Digital Input</th>
<th>Mode Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To Enter Switch Test Mode:

Before beginning, make sure the transmitter off.

1. Turn the transmitter on. (See steps 1–2 in Section 2.3).
2. Enter Maintenance Mode. (See steps 1–3 in Section 2.6).
3. While in maintenance mode, hold the SELECT switch UP for five seconds.

4. After five seconds, LED SS starts blinking:

![LED SS blinking](image)

Indicating that the transmitter is in Switch Test Mode.

✓ Note: LED SS will continue blinking for as long as you are in Switch Test Mode.
When you move a switch on the transmitter (all switches are digital inputs), LED RA lights solid for 0.5 second then goes out.

When you move a lever or joystick (these are analog devices with a digital input), LED RA will again turn on momentarily:

Then the Battery LED comes on and stays on solid:

Indicating that there is a positive connection to one of the analog inputs.

**To Exit Switch Test Mode**

Either:

1. Press the STOP button DOWN.

2. Turn the keyswitch to the OFF position.
3.0 Warrior LRC Battery Installation and Replacement

The Warrior LRC transmitter operates between 2.0 VDC to 3.2 VDC, powered by two 1.5-V type “C” cell batteries (included when shipped). Nominal battery life expectancy is approximately 70 to 100 operating hours\(^1\) before it becomes necessary to replace the batteries.

To Replace Batteries:

Observe proper polarity when placing batteries into the battery compartment. Improper battery placement can cause excessive heat, battery explosion, operator injury, and transmitter damage.

1. Before proceeding, press the **STOP** button DOWN to cut transmitter power.

2. Remove the battery cover by twisting it counter-clockwise.

3. Remove the discharged batteries and properly dispose according to local regulations.

\(^1\) At room temperature. Usage alone does not affect battery life; so does operating or storing the battery in too-high or too-low ambient temperatures. For instance, the longer you expose batteries to extreme cold or hot temperatures, the more likely it will negatively affect battery life. Factors such as battery age and initial quality may also come into play.
4. Place two new “C” cell batteries in the terminal cavity. Observe proper polarity, with the negative side (–) down and each positive battery terminal up. The battery cap interior has the positive polarity marking (+) cut into it, as illustrated in Figure 4.

![Two "C" Cell Batteries]

Figure 4. Warrior LRC Battery Installation

Replace the battery cover by threading it clockwise onto the cavity. You will feel tension as you tighten the cap. Hand-tighten the cap to compress the compartment O-ring gasket seal embedded in the cap.

чки

Notes:

- Do not overtighten the battery cap or you could damage it.
- To ensure continued reliable operation, change batteries soon after the first low battery warning. Cervis, Inc. recommends having fresh spare batteries on hand at all times that the system is in use. The transmitter senses when the voltage is at the low-power threshold—approximately 2.2 V—at which time, the red Battery LED periodically flashes to warn you to change the batteries soon. The warning flashes while the unit is in use either until you replace the batteries or the voltage drops below 2.0 V—after which, the unit automatically powers down (auto-shutdown). The unit will not power-up and operate until you replace the depleted batteries. Cervis, Inc. recommends replacing them with two fresh batteries.

3.1 Neck/Shoulder Harness

The 1¾" wide neck/shoulder harness lets you conveniently and comfortably strap the Locomotive CB around your neck or shoulder for easy access and operation. Adjustable to lengths up to 60 inches (~1.5 m), the harness conforms to most body lengths; and its rugged, heavy-duty construction and quick-release fasteners keep a single LRC securely against your body. Plus, its polypropylene webbing resists wear, and its bright orange color gives it high visibility against even the lightest colored garments.

3.1.1 Adjusting the Harness

Before you attach the harness to your LRC, adjust the blue strap to the most comfortable operating length for your individual body type.
The harness' left strap features a 6” (152 mm) long quick release hook-and-loop Nylon rip cord. Connect the two parts of the rip cord together, and press down to secure the connection.

3.1.2 Attaching the Harness to the Locomotive CB

Both ends of the high-visibility orange straps feature a pair of heavy-duty metal button snaps at the ends.
To attach the harness to your LRC, locate either the two T-shaped harness clips on the front of your CB—one is on the left side; the other is on the right—or the orange bar across the top of it.

Thread the high visibility orange straps through the harness mounts or bar—snap side up—past the first two (female) snaps.

Fold the strap over onto itself, and fasten the female snaps to their male counterparts.
✓ Note: You’ll know the snaps are secured when you hear a clicking sound.
When you have the harness securely together, hang it around your neck—or drape it over your shoulder—and begin operating your LRC.
4.0 Locomotive Interface Cabinets

4.1 Electrical Interface Cabinet

Table 6. Electrical Interface

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure</td>
<td>NEMA 12 24” H x 30” W x 10” D</td>
</tr>
<tr>
<td>Power</td>
<td>From locomotive 64-volt system as specified DC to DC converter</td>
</tr>
</tbody>
</table>
### Item Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate Relays</td>
<td></td>
</tr>
<tr>
<td>Excitation Throttle Control</td>
<td>– Contact closure for Throttle control</td>
</tr>
<tr>
<td>Headlight</td>
<td>– Contact closures for Headlight Bright outputs</td>
</tr>
<tr>
<td>FWD/REV/NEUTRAL</td>
<td>– Contact closures for Forward and Reverse reverser commands; Neutral state MyClass</td>
</tr>
<tr>
<td>Ditch Light</td>
<td>– Lights</td>
</tr>
<tr>
<td>Light Interface</td>
<td>– Relays/contacts that wire brake fwd/rev to locomotive lanterns</td>
</tr>
<tr>
<td>Association</td>
<td>– Provides audible indication of the process</td>
</tr>
<tr>
<td>Safety Stop</td>
<td>– Enables locomotive control</td>
</tr>
<tr>
<td>Train E-Stop</td>
<td>– Enables locomotive control</td>
</tr>
<tr>
<td>Reset</td>
<td>– Not used</td>
</tr>
<tr>
<td>System Enable</td>
<td>– Monitors locomotive’s external E-Stops</td>
</tr>
<tr>
<td>Inhibit</td>
<td>– Interface to “Smart Start” Circuitry</td>
</tr>
</tbody>
</table>

### 4.1.1 Changeover Switch
Located on the right side panel of electrical interface cabinet, this switch permits either manual (1) or remote (2) locomotive operation. Switch handle is located at the top-right side of the Receiver Decoder enclosure. (See Figure 6.)

### 4.1.2 System Enable Fault Indicator and Reset Button
The electrical cabinet contains a “system enable” relay that must be energized before radio operation can begin. Do this by pressing the green **RESET** button on the front of the enclosure.

![SE FAULT RESET](image)

A red LED—labeled **SE FAULT**—next to the green **RESET** pushbutton indicates the locomotive’s external E-stops’ status. When power is first applied to the radio enclosure (by moving the transfer switch to “radio”), the LED lights. When you press the **RESET** pushbutton, the **SE** relay energizes and the **LED** goes OFF — as long as the external E-stops have not been activated. This indicates that the radio is now ready for operation. If that LED does not go off, one of the external locomotive E-stops was pressed, and the radio cannot be used. You must then investigate and correct the problem.

If no external locomotive E-stops are being used, a jumper is installed in the radio electrical panel.

If the “SE” input is not satisfied—the receiver mounted in the electrical panel monitors this input—the locomotive cannot be controlled using the remote control console box, and its display reads “**SE FAULT**”.

An **SE FAULT** requires a reset on the enclosure in the locomotive cab.
### Table 7. Locomotive Output Details

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Additional Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASSOCIATION</td>
<td>Relay turns on/off during association process. Contacts are included if the customer wants to connect an indicating device (not provided).</td>
<td></td>
</tr>
</tbody>
</table>
| FWD      | Locomotive Forward output    | Terminal connections included to interface with the locomotive.  
- Once direction is selected, the input confirms the selection, and the operator can start to operate the locomotive.  
- If the switch is moved (after throttle is selected), throttle returns to idle, and the brake is applied.  
- The operator can change direction at any time but should use caution. If the direction changes, the brakes are fully applied, and the throttle returns to idle. This condition causes the locomotive to stop abruptly. |
<p>| REV      | Locomotive Reverse output    | Same as FWD                                                                                                                                           |
| FHB      | Front Headlight Bright       | Output is on when the locomotive is moving forward and the headlight switch (S2) is &quot;on.&quot; When the headlight bright switch (S2) is turned off, the light is no longer bright. It is dim. |
| RHB      | Rear Headlight Bright        | Output is on when the locomotive is moving in reverse and the headlight switch (S2) is &quot;on.&quot; When the headlight bright switch (S2) is turned off, the light is no longer bright. It is dim. |
| BL       | Brake Light                 | Relay comes on to indicate brake pressure &gt;20 PSI. Terminal connections are included to interface with the locomotive’s lantern.                       |
| FL       | Forward Light               | Relay comes on when the locomotive is moving forward. Terminal connections are included to interface with the locomotive’s lantern.                      |
| RL       | Reverse Light               | Relay comes on when the locomotive is moving in reverse. Terminal connections are included to interface with the locomotive’s lantern.                     |
| DLF      | Ditch Light Forward light    | Relay comes on when the switch is on (S1) and the locomotive is moving forward. Terminal connections are included to interface with the locomotive’s lantern. |
| DLR      | Ditch Light Reverse light    | Relay comes on when the switch is on (S1) and the locomotive is moving in reverse. Terminal connections are included to interface with the locomotive.                  |
| INH      | Smart Start Inhibit relay    | Output mimics the “Radio Active” relay in the receiver. The relay energizes when the LRC and the MU-6E (receiver) establish an RF link. Terminal connections to interface with the locomotive are included; so, the smart start system knows the radio connection is established and the locomotive is being controlled via the remote control. |
| NEU      | Neutral                     | Relay is on when the directional switch is in the neutral position.                                                                                   |</p>
<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Additional Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>TA – TB, EX</td>
<td>The throttle relays and terminal connections are included to interface with the remote control [TH1, TH2, TH3, TH4, TH5, TH6, TH7, TH8].</td>
<td></td>
</tr>
<tr>
<td>WS, TL2, &amp; AUX</td>
<td>These relays are included to indicate alarm conditions. Signals from the locomotive (72 VDC) control these relays that are wired to the terminal strip in the electrical panel. When the relays are properly wired and energized, they transmit inputs to the radio system that are used to turn on LEDs on the LRC that the operator will see.</td>
<td></td>
</tr>
<tr>
<td>INDEPENDENT BRAKE VALVE (PAR15)</td>
<td>Radio relay outputs control the valve, which delivers air to the brake line in pre-determined steps. [IB0 = 0 PSI, IB1 = 4 PSI, IB2 = 10 PSI, IB3 = 22 PSI, IB4 = 32 PSI, IB5 = 42 PSI, IB6 = 45 PSI].</td>
<td></td>
</tr>
<tr>
<td>IBES VALVE</td>
<td>Valve comes on when the radio is active and stays on during operation. This valve is de-energized with an emergency fault condition.</td>
<td></td>
</tr>
<tr>
<td>HORN VALVE</td>
<td>Turns on to blow the horn on the locomotive</td>
<td></td>
</tr>
<tr>
<td>BELL VALVE</td>
<td>Turns on to ring the bell on the locomotive</td>
<td></td>
</tr>
</tbody>
</table>
4.1.3 Advanced Features

4.1.3.1 Brake Operation

Six brake steps range from 0–45 PSI.

- Independent brake – what the brakes on the locomotive are called.
- Automatic brake – train car brakes (does not apply to Nucor locomotives).

Emergency brake

LCB initiates functionality (red stop switch).

- The IBES and IBA valves deactivate and apply two levels of air pressure to the independent brake valve and release pipe via shuttle valve.
- Emergency command occurs anytime the system is active (SS and ES relays on) and the red stop button is pressed. An emergency condition could also occur with various faults.

Normal brake

Joystick (JS1) initiates functionality.

- Apply brake levels one step at a time by moving JS1 to apply, then back to the center position.
• **Quick Apply**: Move JS1 to the right, and hold it in the “apply” position. The brake steps up one level at a time in 0.5-second increments.
• Brake releases to “0 PSI” anytime throttle is commanded and a direction is selected.
• The brake is fully applied anytime the select switch (S5) moves to the neutral position.
• “One-shot” brake release when JS1 moves from REL then back to the joystick center position.

4.1.3.2 **Selecting a Direction (FWD/REV/NEU)**
- Select a direction while the brakes are applied and before using the throttle lever.
- Any time the directional switch (S5) moves from one position to another while the locomotive is moving: the brake will be fully applied, and the throttle will reduce to idle.
- Two LEDs are on the LCB for “FWD” and “REV.” Once a valid direction change is made the LED will light to show the operator what direction was selected.

✓ **Note**: The electrical panel has an input circuit that provides feedback based on the actual direction that the locomotive.

4.1.3.3 **Throttle Operation**
- A throttle input (PKD) becomes active when the brake pressure is <15 PSI (there is a pressure switch that can be adjusted to turn on at the desired level). When this happens, a green LED on the LCB turns on.
- When JS1 is activated (then released), eight throttle steps are indexed one step at a time based on a programming sequence. Five relays on the electrical panel are associated with throttle: EX, TA, TB, TC, and TD.
- Decrease the throttle by moving JS1 to “decrease” then back to the center. The operator can either decrease the throttle one step at a time or can hold the joystick in the decrease position and it automatically steps down at 0.5-second intervals until it reaches idle.
- If the directional switch is in neutral, the operator can throttle up to the third step (“TH3” on display). This can be done with the brake released or applied.
- The throttle automatically returns to idle anytime the brake is applied with a direction selected (under normal operating conditions).
- The throttle reduces to idle anytime the directional switch is moved from one position to another (under normal operating conditions).

4.1.3.4 **Vigilance**
- A vigilance timer is implemented anytime the brake cylinder pressure is <40 PSI (IB5). If there is no switch/joystick activity for 20 seconds, a 10-second audible warning is heard (30 seconds total), then a fault occurs. The brake is fully applied, and the throttle returns to idle.
- The vigilance timer is disabled if the brakes are applied at a level >40 PSI (IB5/IB6). This is because if the brakes are applied, the throttle is idle, and the locomotive is not moving.
- The operator can also disable the vigilance feature by moving switch S7 to “disable.” This sets the brake (with no throttle) so the operator can perform any maintenance that might be required without having to worry about the vigilance timer.

4.1.3.5 **Tilt**
- A tilt condition occurs when S7 is in the “enable” position and the LRC is tilted more than 60 degrees. The transmitter can be tilted for three seconds without penalty. If it remains
tilted after three seconds, an audible alarm is heard for an additional seven seconds (ten seconds total). After this time, the brakes are fully applied, and the throttle returns to idle. To clear the tilt penalty, return the LRC to the correct position, and hit the start/reset pushbutton (S4).

- The tilt feature is disabled if S7 is in the “disable” position.

4.1.3.6 Alarms

- TL2 – A red LED on the LRC illuminates anytime TL2 is active. No change to the locomotive controls occurs. Operators will know to return to the locomotive cab to correct the problem when they see the LED.
- WS – Wheel slip. Again, a red LED on the LRC indicates the fault. The operator will make manual adjustments to correct the problem.

4.2 Pneumatic Interface Cabinet

![Pneumatic Interface Cabinet Image](image_url)

*Figure 7. Pneumatics Enclosure Essential Decoder*
### Table 8. Pneumatic Interface

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enclosure</strong></td>
<td>NEMA 12</td>
</tr>
<tr>
<td></td>
<td>24&quot; H x 30&quot; W x 10&quot; D</td>
</tr>
<tr>
<td><strong>Air System</strong></td>
<td>Arranged from locomotive main reservoir supply</td>
</tr>
<tr>
<td></td>
<td>40 micron filter</td>
</tr>
<tr>
<td></td>
<td>Coalescing, Grade 6 filter and Shutoff Valve</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td><strong>Emergency Brake</strong> – Solenoid valve with internal regulator. Activated by portable remoter</td>
</tr>
<tr>
<td></td>
<td>controller STOP Switch.</td>
</tr>
<tr>
<td></td>
<td><strong>Independent Braking</strong> – Digital to pressure stepped regulator. Allows independent setting</td>
</tr>
<tr>
<td></td>
<td>of five-step Braking and Release.</td>
</tr>
<tr>
<td></td>
<td><strong>Bell</strong> – Solenoid valve</td>
</tr>
<tr>
<td></td>
<td><strong>Horn</strong> – Solenoid valve</td>
</tr>
<tr>
<td><strong>Monitored Pressures</strong></td>
<td><strong>Main Reservoir</strong> – (MRPS) Disables systems if inadequate</td>
</tr>
<tr>
<td></td>
<td><strong>Independent Brake Cylinder</strong> – Two pressures monitored:</td>
</tr>
<tr>
<td></td>
<td>✓ (BPS) Monitors brake cylinder pressure.</td>
</tr>
<tr>
<td></td>
<td>✓ (PKDS) Knockdown excitation above a specified brake cylinder pressure; enables throttle.</td>
</tr>
</tbody>
</table>

### 4.3 Miscellaneous Items

- Receiver antenna with 10 feet of feed cable
- Shuttle valves required to tie-in pneumatic outputs to locomotive system: ½" and ¾"
- ½" ball valve with locking handle and relief port
- Battery charger for 120 VAC mains operation
- 10’ enclosure interconnect cable
Figure 8. System Controls
5.0 Locomotive Remote Control System Receiver

The LRC system uses a Warrior MU-x6E receiver.

Figure 9. MU-x6E Receiver Inside the Electrical Cabinet

For more information, please consult the following manual:

### 6.0 Warrior LRC Console Box Specifications

#### Table 9. Warrior LRC Console Box Specifications

<table>
<thead>
<tr>
<th>Warren LRC Console Box Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power</strong></td>
</tr>
<tr>
<td><strong>Radio</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Enclosure</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Appendix A: Exposure to Radio Frequency Energy

Warrior system transmitter and receiver units contain radio transceivers. When active, transmitters/receivers send out radio frequency (RF) energy through an internal (or external) antenna. The Warrior Locomotive CB transmitter complies with limits set by the FCC for operating distance from human tissue.

Appendix B: RF Exposure Considerations

Radio modules may be used in a variety of host applications falling into two general categories:

1. **Mobile** applications: Any operating locations where the transmitting equipment is not on a human body. In mobile applications, the host application is typically fixed to mobile equipment, with either an internal or external antenna.

2. **Portable** applications: Any operating locations where the transmitting equipment is located on the hand, arm, or other part of the human body. In portable applications, the equipment is either held in the hands of an operator or affixed to either a belt or harness on the torso.

Equipment containing the radio module was evaluated for RF exposure hazards by two approaches:

1. **Maximum Permissible Exposure (MPE)** for mobile applications.
2. **Specific Absorption Rate (SAR)** for portable applications.

Required separation distances are measured from the actual location of the radiating part of the antenna. An antenna may be inside the host application, affixed to the host application enclosure, or at the end of an optional extension coaxial cable.

**Mobile Applications**

Equipment must be located at least 20 cm away from areas likely to be occupied by an unaware person.

**Transmitter Applications**

All operators of transmitter equipment with any type of antenna require proper equipment operation training, and such training must include RF exposure safety instructions. Once training is completed, they are then considered “aware” persons.

If the portable operating position is on the hand or arm, a 5-mm separation is required between the radiating part of the antenna and nearby human tissue.

**Required Training**

All installers and operators of host applications that include an MRF450 FT module must be trained to use proper RF safety precautions as presented in this Appendix.
Appendix C: Agency Identification Label Location

Note: The Agency ID label for all CB transmitters can be found in the position shown.

Figure 10. Agency Identification Label Locations