Warrior ZZ

MU-X9 Receiver Manual

U108.0.0

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.

15.105(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. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular 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.

Industry Canada Statement

This device complies with Canadian RSS-210.
The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc-ca/rpb.

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 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.

IC 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 (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Part 2: This radio transmitter (LOBSRF-305) has been approved by Industry Canada to operate with the antenna type 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.

Le présent émetteur radio (LOBSRF-305) 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 supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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Cervis Inc. Safety Precautions

- ✓ ***Read and follow all instructions.***
- ✓ ***Failure to abide by Safety Precautions may result in 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 system failure, equipment damage, and intermittent operation.***
- ✓ ***Changes or modifications made to equipment not expressly approved by the manufacturer will void the warranty.***
- ✓ ***Owner/operators of the equipment must abide by all applicable Federal, State, and Local laws concerning installation and operation of the equipment. 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 remote control system until certain that it is safe to do so.***
- ✓ ***Turn off the handheld remote and remove power from the receiver before attempting any maintenance. This will prevent accidental operation of the controlled machinery.***
- ✓ ***Use a damp cloth to keep units clean. Remove mud, concrete, dirt, etc. after use to prevent obstructing or clogging the buttons, levers, wiring, and switches.***
- ✓ ***Do not allow liquid to enter the handheld or receiver enclosures. Do not use high pressure equipment to clean the handheld remote or receiver.***
- ✓ ***Disconnect the radio receiver before welding on the machine. Failure to disconnect the base unit may result in destruction of or damage to the receiver.***
- ✓ ***Operate and store units only within the specified operation and storage temperatures defined in the specifications of this document.***
- ✓ ***Keep high-energy RF devices away from handheld remotes. Activation of high-power communication radios, for instance, in close proximity to handheld remotes can result in interference and “false” circuit activation.***
- ✓ ***Do not key 2-way radios while using the handheld remote.***

1.0 Warrior 22 MU-X9 Receiver

The Warrior 22 MU-X9 is a low cost machine-mounted receiver intended for use on industrial systems. Available in 900MHz for maximum flexibility, the standard MU-X9 is self-contained and preconfigured providing a no-touch solution. The pigtail harness flying leads are marked for easy identification when wiring. When desired, custom harness field wiring can easily be done using the fourteen board-mounted Phoenix screw terminals. The MU-X9 accepts control commands from the HH2S handheld transmitter as part of a Warrior 22 system and it can also be used with other Warrior handheld transmitters.

Figure 1. Warrior 22 MU-X9 Receiver and 900MHz External Antenna

Warrior 22 MU-X9 Receiver Features

- ✓ **Two Motion, Two Speed Control**
- ✓ **Two Series MLC (Main Line Contact) Safety Relays**
- ✓ **Dedicated Horn/Light and Start Relays**
- ✓ **Compact Designed to IP65/IP67 Standards**
- ✓ **900MHz @ 100mW No License Required Operation**
- ✓ **Designed to ICS 8 NEMA Crane Specification**
- ✓ **External Antenna**
- ✓ **Self-Contained, Factory Pre-Configured Terminal Wiring with Single Pigtail Harness**
- ✓ **Fourteen Screw Terminals for Optional Custom User Wiring**

2.0 MU-X9 Receiver Mounting

The MU-X9 can be mounted using the molded enclosure mounting flanges that provides the option of using the four pre-drilled 0.20” holes with bolts or screws, or by using the two 0.425” holes with the 0.225” x 1.00” shank-slides. The sturdy enclosure allows the MU to operate worry free in harsh weather conditions and factory environments.

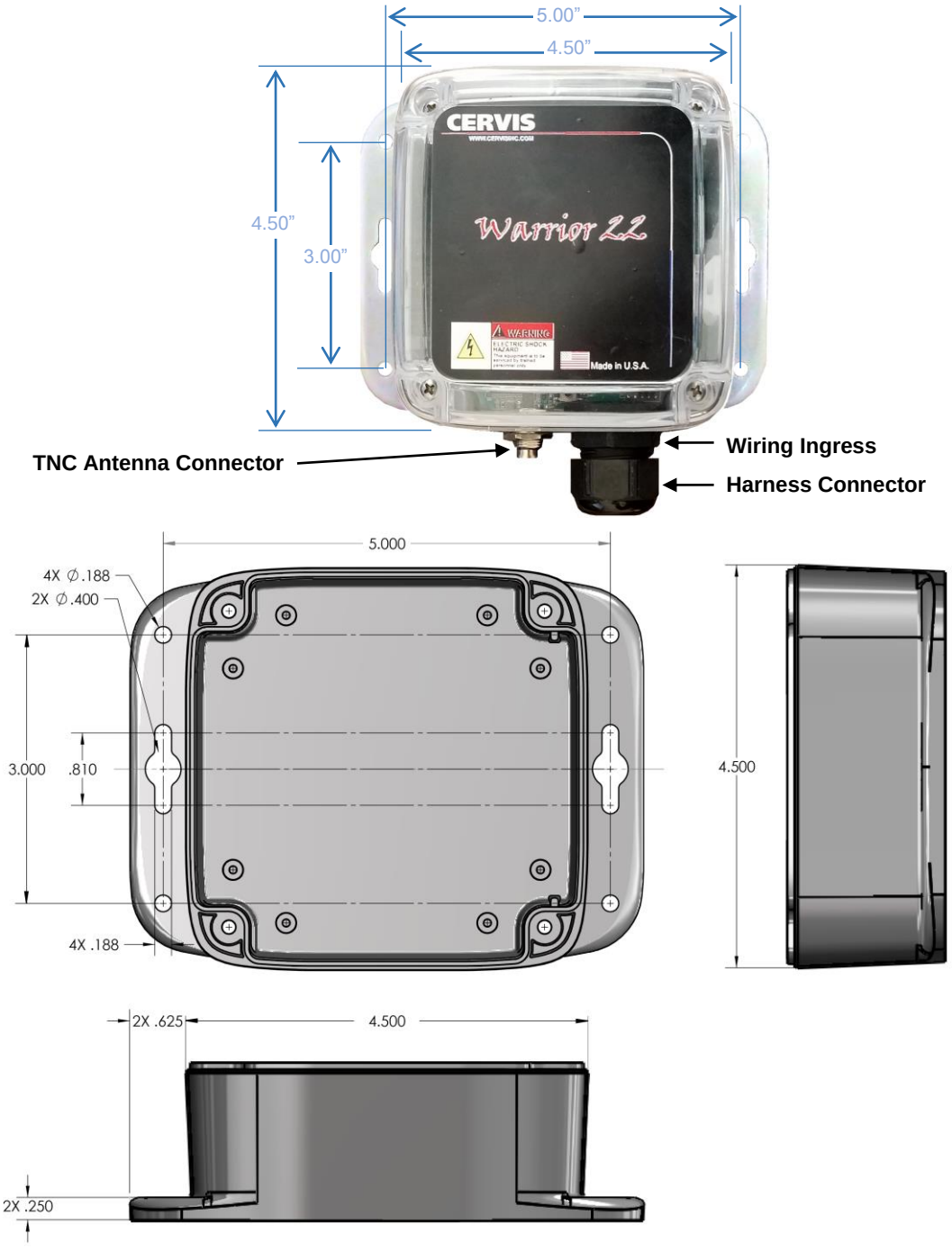
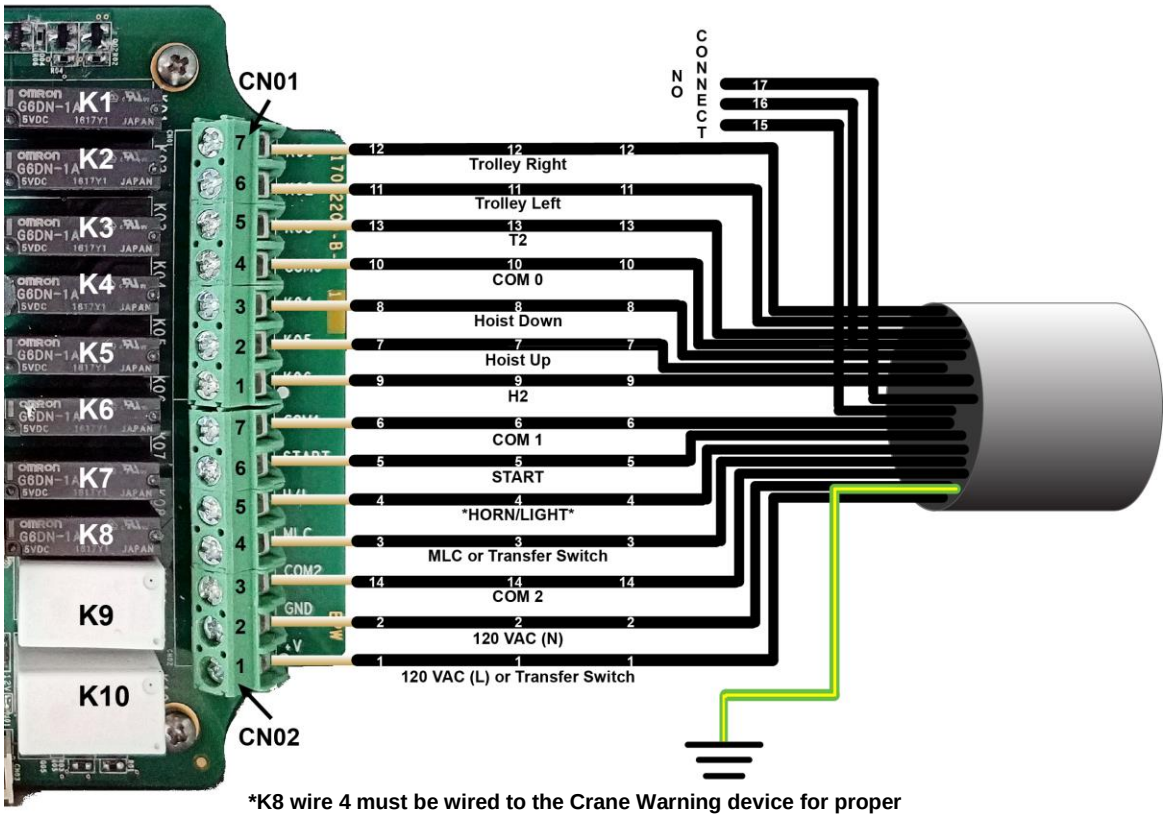


Figure 2. MU-X9 Receiver Mounting Dimensions

3.0 MU-X9 Receiver Wiring

The standard MU-X9 receiver is pre-wired for crane operation. Figure 3 illustrates which of the bundled wiring harness wires connect to particular screw terminals.

✓ **Note:** *Flying leads that are not connected on the jobsite must be insulated at the wire end or the wire must be disconnected from the appropriate terminal.*



***K8 wire 4 must be wired to the Crane Warning device for proper warning and annunciation during the Transmitter Associate process.**

Figure 3. MU-X9 Receiver Terminals Standard Wiring

4.0 MU-X9 Receiver Relays Schematic

The ten Form A system relays of the MU-X9 are divided into two groups of three relays — K1 through K3, and K4 through K6, and one group of four relays — K7 though K10.

- Group 1 and 2 perform related motion functions.
- Group 3 contains the MLC (Main Line Contact) redundant-contact safety circuit, the Start, and the Horn/Light relays.

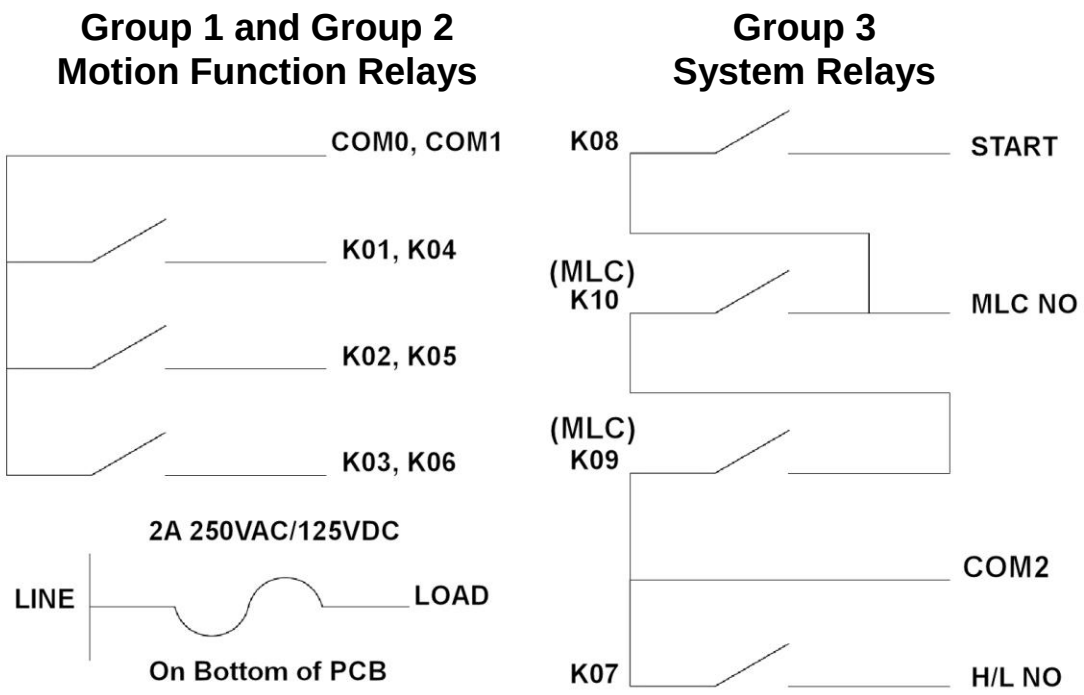


Figure 4. MU-X9 Receiver Relay Schematic

5.0 MU-X9 Receiver Diagnostic LEDs and Relay Locations

5.1 MU-X9 Internal Diagnostic/Status LEDs (Five)

The MU-9X receiver has five board-mounted system status LEDs that can be used as diagnostics tools to verify operation. Removing the MU-X9 cover allows access to the LEDs. These LEDs as shown in Figure 5 are LED1 Health; LED2 TX; LED3 RX; LED4 Output; and LED5 System 12V. See Table 1.

Table 1. MU-X9 Diagnostic LEDs

LED	Name	LED State	Description
1	Health	Blinking	Unit OK, normal processor operation
2	TX (Transmit)	Fast Blinking	Indicates RF Messages sent to handheld
3	RX (Receive)	Fast Blinking	Indicates RF Messages received from handheld
4	Output	Steady Lit	Indicate any relay is being commanded to close
5	System 12V	Steady Lit	Indicates System 12V bus OK

5.2 MU-X9 Strobe LED

Caution!

The Strobe LED is extremely bright. Caution should be used when removing the MU-X9 cover for troubleshooting while the unit is powered. Avoid looking directly at the Strobe. Cervis advises pressing the Strobe Shut Off Switch immediately after removing the cover when the unit is powered.

The Strobe LED (Figure 5, Table 2) illuminates the MU-X9 enclosure when active by flashing at a rate of ¼ second per second. It is active:

- When a Warrior transmitter attempts to Associate (link communications) with the receiver
- When the MLC initially activates
- While the MLC is active.

Table 2. MU-X9 Strobe LED

LED	Name	LED State	Description
6	Strobe	Blinking	Slow blink when alive, fast blink when linked

5.3 MU-X9 Strobe Stop Switch

The primary use of the Strobe Shut Off Switch (Figure 5) is to turn off the strobe when the MU-X9 cover is removed for troubleshooting. When pressed, the strobe will remain off for an hour. The strobe while off will become active anytime a Warrior transmitter attempts to associate with the receiver.

✓***Note:*** ***The Strobe LED will begin to flash an hour after it is pressed if the MLC is engaged, or anytime that a Warrior transmitter attempts to associate with the MU-X9.***

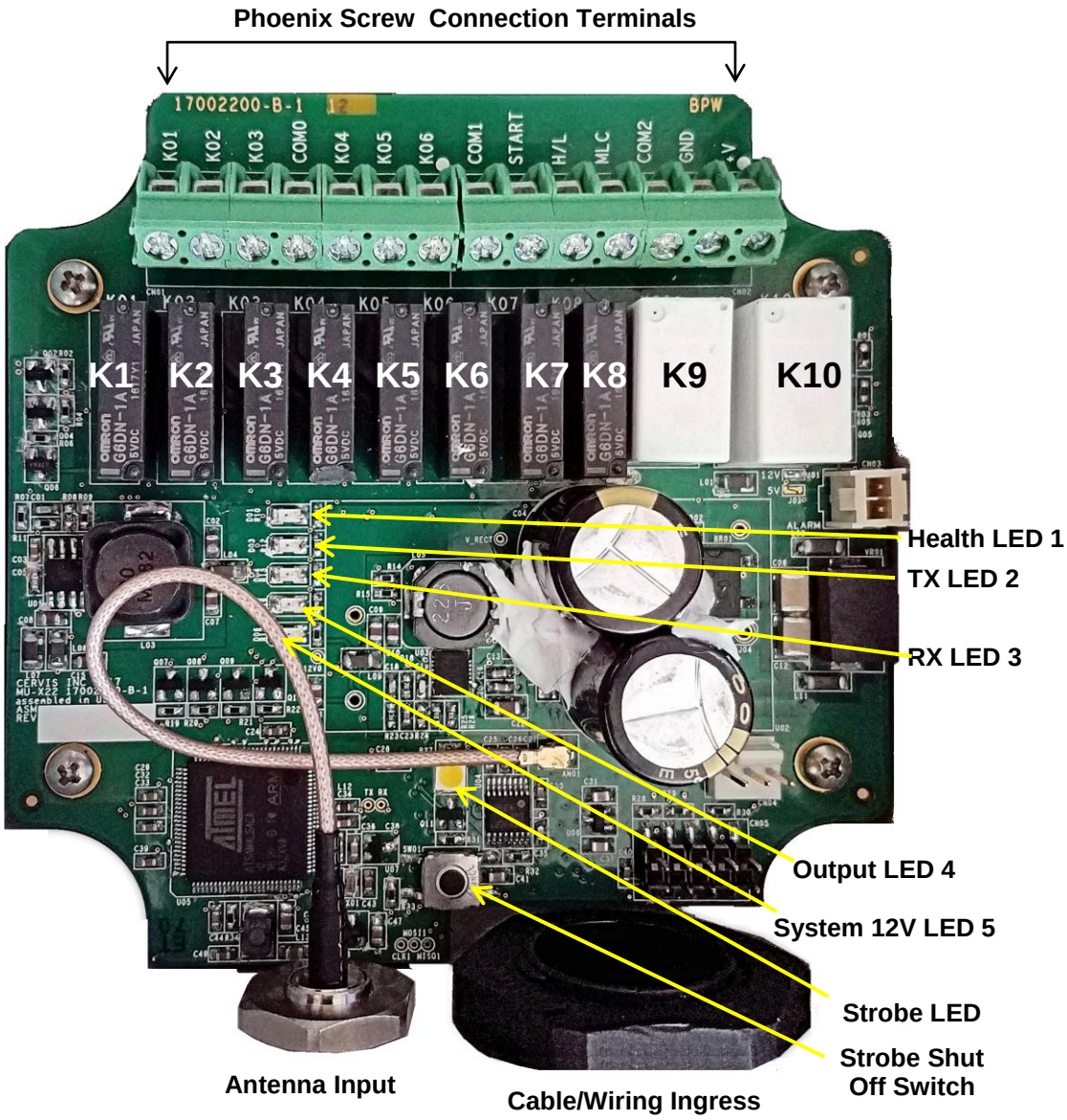


Figure 5. MU-X9 LED Indicators and Relay Locations

5.4 Low Battery Mode

When the transmitter battery voltage drops to or below 2.2V (Low Battery Warning Mode), the handheld LED 2 ( ) begins flashing and the MU-X9 Horn/Light relay K7 energizes four times per minute to alert the operator that the transmitter batteries need to be replaced with a fresh set. K7 will continue to activate four times per minute until the handheld batteries are replaced.

Caution!	Transmitter batteries should be replaced as soon as possible after the Low Battery Warning begins. If the transmitter battery voltage drops to 2.0V, the transmitter will shut down and cannot be used until fresh batteries are installed.

6.0 HH2S-9XL10 Communications: Associate with MU-X9

The Associate process is used when necessary to establish or re-establish the communication link with the MU-X9 receiver.

✓***Note:*** *MU-X9 association can only occur during the first 2-minutes following power-up of the unit. If this 2-minute window of opportunity is exceeded before attempting to Associate with the HH2S-9X10, the attempt will be rejected and the MU-X9 must be powered-off and then turned on again allowing for the 2-minute window to activate.*

✓***Note:*** *A receiver that is in use with another handheld cannot be associated.*

The MU-X9 must be turned on prior to attempting to Associate using the handheld.

1. Turn on the handheld by pressing and releasing the STOP button.
2. Within 1 second, while the B Select LED is active, simultaneously press and release buttons **9** and **10**.

Figure 6. Associate Step 2 and Step 3

Handheld LEDs will begin cycling indicating the handheld is in maintenance mode.

3. Simultaneously press and hold buttons **3** (UP) and **4** (DOWN) for approximately 5-seconds.
4. Release the buttons when LED A starts to blink.
5. TX/RX LED and B Selection LED will become active indicating the handheld is attempting to locate all available Warrior receivers.
6. Once the handheld has completed its search and one or more receivers have been found, the TX/RX LED and A Selection LED become active.

If there are no receivers available, the handheld will stay in scan mode until the handheld times out or is turned off.

7. A detected receiver will start blinking the association LED indicator and the Horn/Light relay is engaged to sound the horn. In order to select this receiver press button AUX 2. TX/RX LED will start blinking rapidly indicating communication is established. The receivers ID is now stored in the handheld memory slot.
8. If the found receiver unit is **NOT** the receiver desired, press **Button 9** to scroll through detected receivers until the desired receiver is found and blinking its association LED indicator and pulsing the Horn/Light relay that is engaged to sound the horn. Press **Button 10** to select the receiver. The TX/RX LED will start blinking rapidly indicating communication is established. The selected receiver is stored in the handheld memory slot.

7.0 MU-X9 Receiver Antenna

The MU-X9 comes with a 900MHz external antenna (J5-01) that attaches to the receiver using the external unit connector. Antenna extensions are available in 3, 10 and 25 foot lengths.

Figure 7. MU-X9 900MHz External Antenna and Optional Extension Cables

Caution!	***Ensure that the metal ends DO NOT contact any other metal surface if using an extension cable.*** ***RF interference may result in poor performance.***

8.0 MU-X9 Safety Circuit

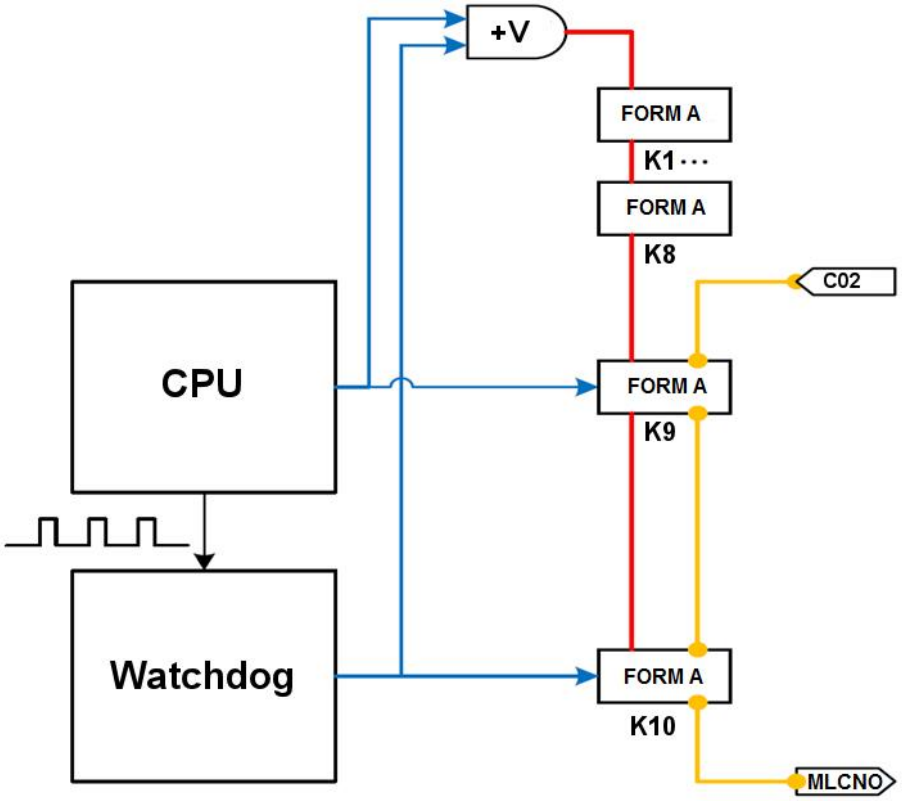


Figure 8. MU-X9 MLC Safety Circuit Logic Diagram

Figure 8 illustrates a high-level view of the system safety architecture. This architecture is based around redundant enable signals that are generated by separate hardware circuits. The microprocessor generates an enable signal to K09 when all conditions are met and the user activates the start sequence. The watchdog circuit generates an independent enable signal to K10 as long as the microprocessor generates the proper signaling to the watchdog. Additionally, these two independent enable signals are ANDed together to enable an internal +V bus that provides coil power to all relays*. The system is not capable of any relay closures until both watchdog and microprocessor enables are asserted. The loss of either signal immediately causes the MLC path to open and all output relays to de-energize.

If there is a software fault in the microprocessor, the watchdog will not assert its enable output, which will cause K10 to open. Additionally, this will disable the internal +V bus resulting in all relay outputs returning to their non-active state regardless of what the microprocessor is commanding.

If there is a fault in the watchdog circuit that causes its output to never assert (set to active state), the unit will be safe as the MLC (Main Line Contact) path cannot close because K10 will be open and the internal +V bus will be disabled. If the fault causes the watchdog circuit to never de-assert (set to the inactive state—perhaps the contacts on K10 weld closed), the system is still safe because the microprocessor has independent control of K9 that can break the MLC path and internal +V bus.

This architecture has been devised such that any one fault will not cause loss of control of the MLC path.

*Except the K07 H/L relay because it is necessary to operate the H/L when the MLC is open.

9.0 Warrior 22 MU-X9 Receiver Specifications

Table 3. MU-X9 Receiver Specifications

Item	Description	
Power	**Vin**	7 to 36 VDC 110 to 220 VAC @ 50-60 Hz 10 to 28 VAC @ 50-60 Hz
Environment	**Operating Temp** **Storage Temp** **Humidity**	-40° F to 158°F (-40°C to 70°C) -40°F to 176°F (-40°C to 80°C) 0-95% non-condensing
Radio	**Frequency** **License** **Modulation** **Antenna**	906-924 MHz @ 100mW None required, license free DSSS External (RP-TNC)
Enclosure	**Dimensions** **Weight** **Durability**	Inches: 4.5” x 61.89” x 5.75” mm: 114.3 x 61.89 x 146.05 1.5 lbs. NEMA 4, 4X, 6, 6P IP65/67
Indicators	**Power** **Diagnostic** **Association**	120V - Lit when OK Health - Slow blink when OK TX - Blinking when transmitting RX - Blinking when receiving Strobe LED - Used during association
Outputs	**Six Function** **Three System**	6-Form A Relays 4-Form A Relays (Two in series for MLC)
Main Line Contactor (MLC)	**Safety Circuit**	Comprised of two System Form A Relays arranged in series

Appendix A: Exposure to Radio Frequency Energy

Warrior handheld remote units and receivers contain radio transceivers. When active, a handheld remote sends out radio frequency (RF) energy through its internal antenna. The Warrior handheld remote complies with limits set by the FCC for operating distance from human tissue.

Appendix B: RF Exposure Considerations

The radio module may be used in a variety of host application that fall into two general categories: mobile or portable. Mobile applications are any operating locations that are **not** on a human body. Portable applications are those where the transmitting equipment **is** located on the hand, arm, or other part of the human body. In mobile application the host application is typically fixed to mobile equipment, with either an internal or external antenna. In portable applications the equipment is typically held in the hand of an operator or affixed to either a belt of harness on the torso.

Equipment containing the radio module has been evaluated for FR exposure hazards by two approaches: Maximum Permissible Exposure (MPE) for “mobile” applications and SAR for portable applications. Mobile applications are any operating locations that are not on a human body.

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

Mobile Applications

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

Handheld Applications

All operators of the handheld equipment with any type of antenna require training in the proper operation of the equipment and such training must include RF exposure safety instructions. Once training is completed they are considered to be aware persons.

If the portable operating pose in on the hand or arm it is required that a 5mm separation between the radiating part of the antenna and nearby human tissue.

Required Training

All installers and operators of host applications that include an SRF310 FT module **must** be trained to use proper RF safety precautions

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