CERVIS INC.™

Warrior 32

System Manual

U100.1.3

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-310) 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-310) 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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Definitions/Notes

Association: When you program a handheld with a receiver's ID during the Association process.

Pairing: When a handheld takes control of a receiver for operation.

DSSS: Direct sequence spread spectrum; an advanced wireless communications technology.

Warrior Receiver: "Receiver" mounted to the crane or machine.

Line of Sight (aka Direct Line of Sight): Term used to describe RF communication where the pathway between units is clear of physical obstacles such as walls, earth, and other obstructions.

TX/RX: Wireless transmission and reception of data..

CAN TX/RX: Transmit and receive data over Control Area Network (CAN).

Transmitter: Handheld or portable unit.

Receiver: Machine mounted unit.

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 machine unit 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 machine unit enclosures. Do not use high pressure equipment to clean the handheld remote or machine unit.***
- ✓ ***Disconnect the radio machine unit before welding on the machine. Failure to disconnect the base unit may result in destruction of or damage to the machine unit.***
- ✓ ***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 32 System

The Warrior 32 System consists of a Warrior 32 receiver (MU-9X15) and one or more Warrior 32 handheld remotes (HH2S-9XL10).

1.1 Warrior 32 MU-9X15 Receiver

An MU-9X15 is capable of communicating with one handheld at a time (first come first serve). The MU-9X15 is able to connect to any handheld that has the receiver ID stored in its memory. The rugged construction and relay output configurability allows Warrior 32 systems to be used in a wide variety of typical crane control applications.

Standard (DIP Switch Set) Configurations include:

- 3 motion 2 Speed control with A/B Select configurations
- 3 motion 2 speed control with momentary or latching AUX functions
- 3 motion 2 speed control with “4 wire” hoist set up
- 4 motion 2 speed control

Figure 1. Warrior 32 System Receiver and Handheld Remote

Warrior 32 MU-9X15 Features

- 16 Form A relays
- Rugged compact design
- 900 MHz license free operation
- Designed to ICS 8 NEMA Crane Specification
- Eight DIP switches allow for configurability
- High VAC, Low VAC, and DC input ranges available
- Operating temperature of -40°C to +70°C (-40°F to +158°F)
- Storage temperature of -40°C to +80°C (-40°F to +176°F)

1.2 Warrior 32 HH2S-9XL10 Handheld Remote

A Warrior 32 HH2S-9XL10 handheld has eight 2-stage buttons plus STOP and HORN/START. The handheld is powered by two 1.5V AAA batteries. Once associated to a receiver, the handheld stores **one** receiver ID in its memory. One or more handhelds are associated to the receiver at Cervis before it is shipped. The user can use the Association process described in Heading 4.0 to to change the ID in a handheld memory. Refer to section 4.4 (Factory Reset) to clear the handheld memory so that it will not control any receiver.

The Warrior 32 HH2S-9XL10 has four LEDs that are used to identify system status and provide diagnostics. LEDs as shown in Figure 2 are: **Transmit/Receive** (TX/RX); **Battery Status**; **A Selection**; and **B Selection**.

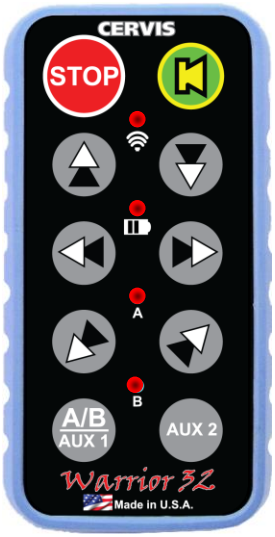

Figure 2. Warrior 32 HH2S-9XL10 Handheld Remote

Warrior 32 HH2S-9XL10 Handheld Remote Features

- Powered by two 1.5V AAA batteries
- Low Battery Warning and Low Battery Auto-Shutdown
- 900MHz license free operation @ 100mW
- Rugged compact design
- Protective rubber bumper and detachable wrist lanyard
- Four Diagnostic LED indicators
- Ten two-step actuators
- Operating temperature of -40°C to +60°C (-40°F to +140°F)
- Storage temperature of -40°C to +85°C (-40°F to +185°F)

2.0 Warrior 32 MU-9X15

The MU-9X15 receiver features 16 Form A relays arranged in four banks of four. Each bank of four relays is fused at 5A. The MU-9X15 features a redundant MLC (Main Line Contactor) safety circuit consisting of two series Form A relays (K14, K15) and a watchdog IC (integrated circuit) controlling one of the relays (see Appendix C for details).

Depending on the model, the MU-9X15 accepts the following input voltages:

- 110 to 220VAC at 50-60 Hz (High VAC)
- 10 to 28VAC at 50-60Hz, and (Low VAC)
- 7-36VDC

2.1 MU-9X15 Diagnostic LEDs

The MU-9X15 has three system status LEDs, 16-relay status LEDs, and four power LEDs that can be used as diagnostics tools (see Table 1). The MU-9X15 has one external LED indicator visible from outside the enclosure that is used for association and health status.

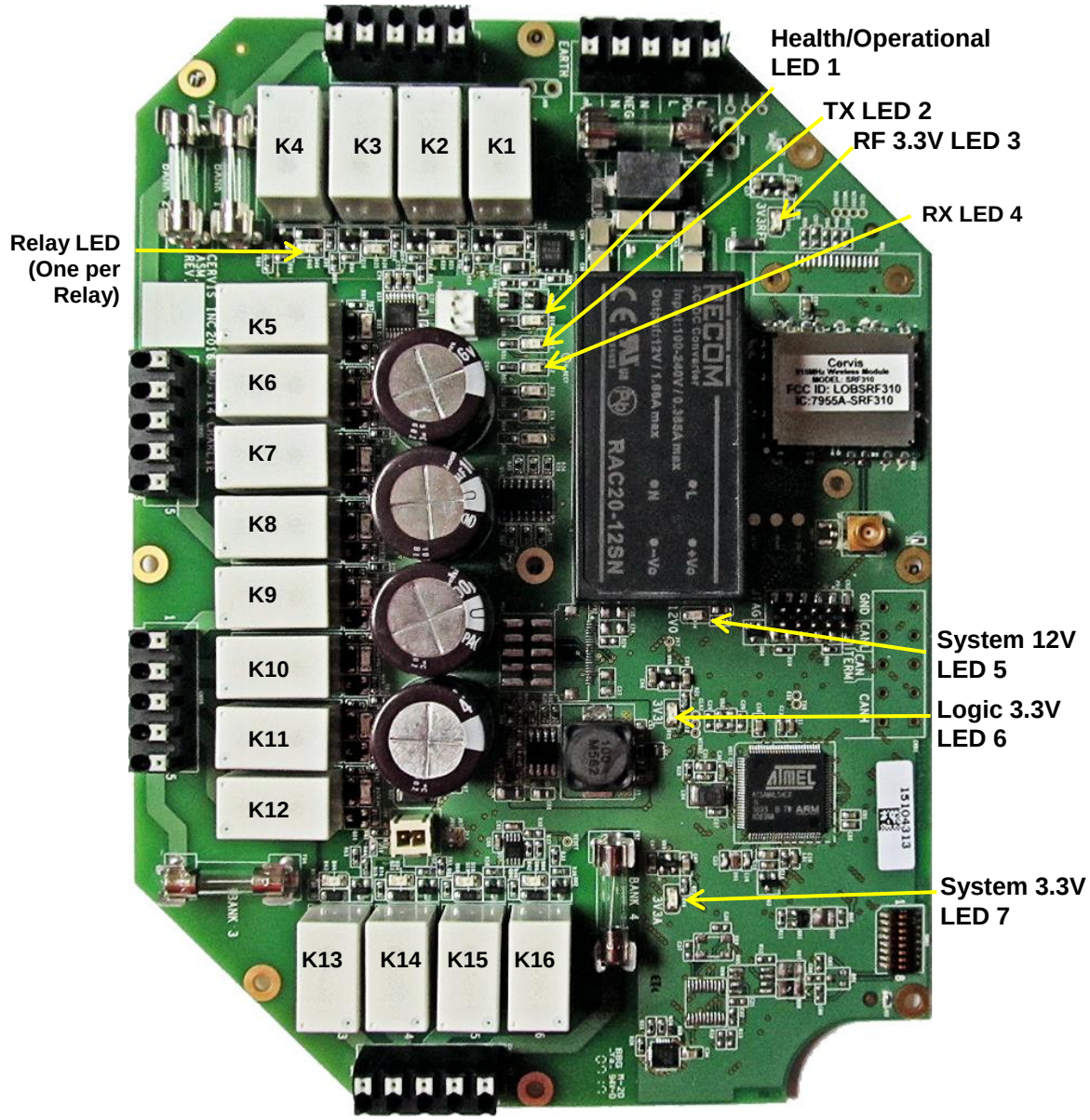

Figure 3. MU-9X15 LED Indicators & Relay Locations

Table 1. MU-9X15 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	RF 3.3V	Steady Lit	Indicates RF 3.3V bus OK
4	RX (Receive)	Fast Blinking	Indicates RF Messages received from handheld
5	System 12V	Steady Lit	Indicates System 12V bus OK
6	Logic 3.3V	Steady Lit	Indicates Logic 3.3V bus OK
7	System 3.3V	Steady Lit	Indicates System bus 3.3V OK
LED per Relay (16)	Relay State	Steady Lit	Relay Active

Each of the 16 relays has its own LED. When commanded the relay LED illuminates.

2.2 MU-9X15 Mounting

Caution!	**Disable the machine on which the receiver is to be attached before installation to avoid injury.**

Use the configuration diagrams supplied by Cervis to guide you in mounting the receiver and connecting your wire harness. Mounting of the receiver is left much to your discretion with the following guidelines:

- Make sure that the configuration diagrams supplied with the system are available. Keep them where they can be easily accessed when needed.
- Mount the receiver away from any intense radio or electric disturbance sources.
- Mount the receiver where there is enough room to make wiring harness terminations.
- Make sure the mount is secure.
- The external antenna must be connected only as recommended by Cervis with parts recommended by Cervis. ***Under no circumstances can a signal amplifier be used.***
- Mount such that the unit antenna is in view of the operator. Apply an antenna extension cable if needed. Cervis optional extension cables are 3ft. (J5-07), 10ft. (J5-02), or 25ft. (J5-13). See Figure 5.

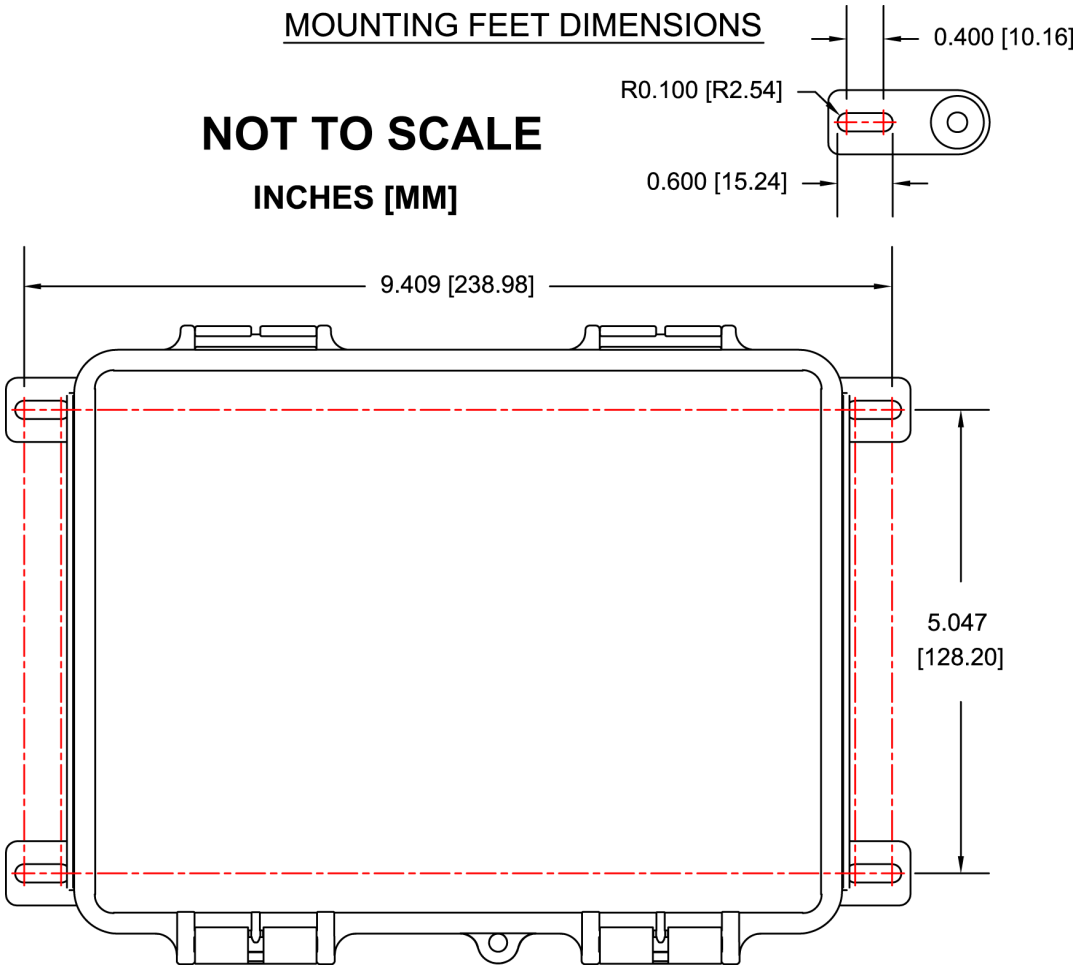

Figure 4. MU-9X15 Mounting Dimensions

2.3 MU-9X15 Power

Power is provided to the unit through the control cable. The cable is part of the final assembly and comes attached to the receiver. MU-9X15 is available in the following input power configurations:

Table 2. MU-9X15 Power Configurations

Model	Input Voltage	Range	Frequency
MU-9X15-HVA	High Voltage AC	115-230 Vrms	50-60 Hz
MU-9X15-LVA	Low Voltage AC	10-28 Vrms	50-60 Hz
MU-9X15-LVD	DC	7-36 V	—

2.4 MU-9X15 External Antenna

Warrior 32 comes with a 900MHz external antenna that attaches to the receiver using the external unit connector. Antenna extensions are available in 3, 10 and 25 foot lengths.

Figure 5. MU-9X15 900MHz External Antenna and Optional Extension Cables

2.5 MU-9X15 Cable and Field Wiring

✓***Note:*** *The control cable is individually marked on the insulation of each wire.*

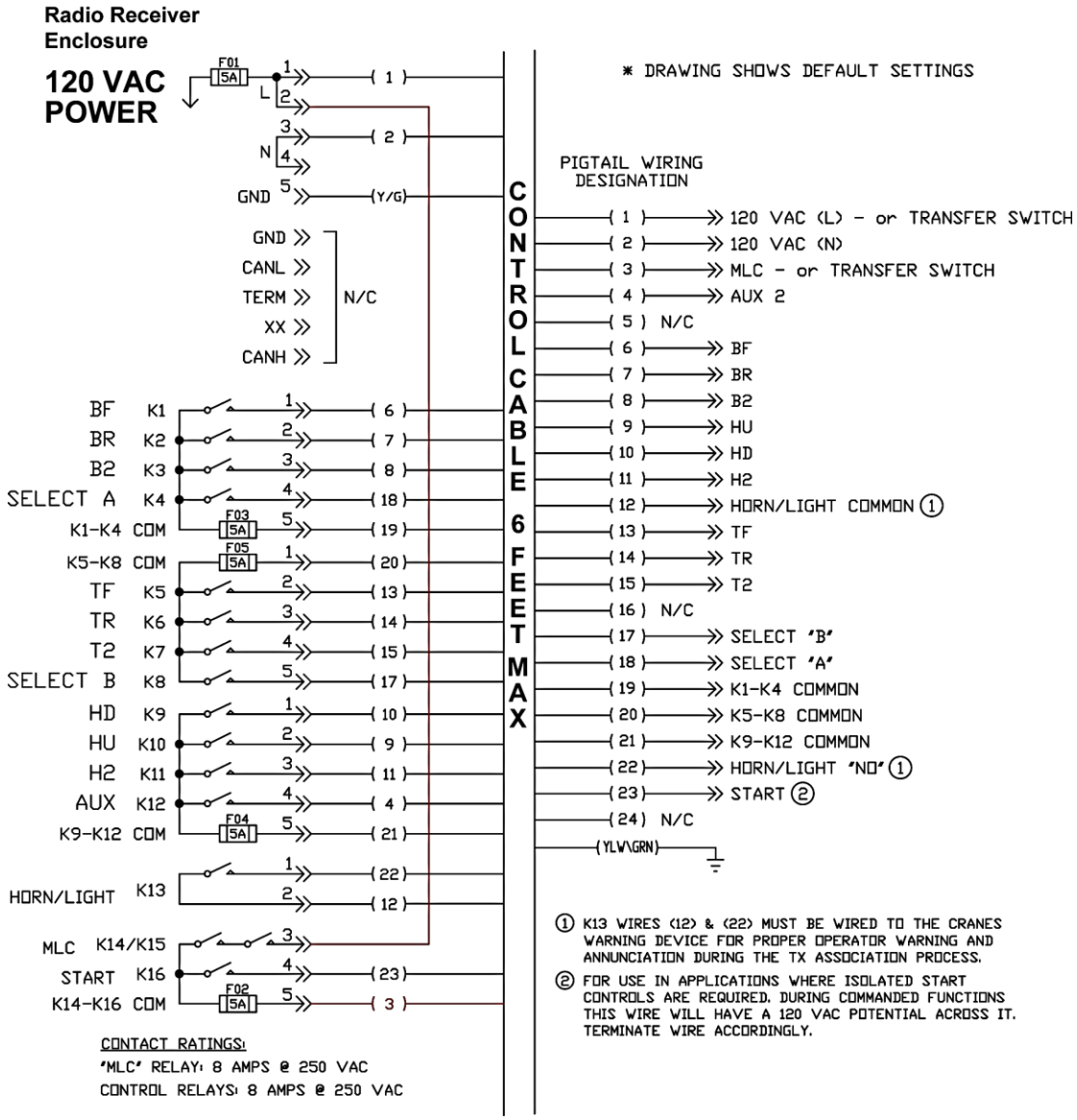

Figure 6. MU-9X15 Wiring Diagram

2.6 MU-9X15 Fuse Information

Use Table 3 to find replacement fuse part numbers based on the rated input voltage rating for your system.

Table 3. MU-9X15 Fuse Identification

Model	Fuse Package	Bank 1-4 Fuse P/N	F01 Fuse P/N
MU-9X15-HVA	5x20 MM Glass	0218005.HXP	0217002.H
MU-9X15-LVA	5x20 MM Glass	0218005.HXP	0217002.H
MU-9X15-LVD	5x20 MM Glass	0218005.HXP	0217002.H

2.7 MU-9X15 DIP Switch Configurations

The MU-9X15 utilizes eight DIP switches to allow for relay configuration of A/B cycling sequences, configuring relays for 3 or 4-wire hoist control systems, configuration of Aux Relay A, and configuration of Aux Relay B for momentary or latching control.

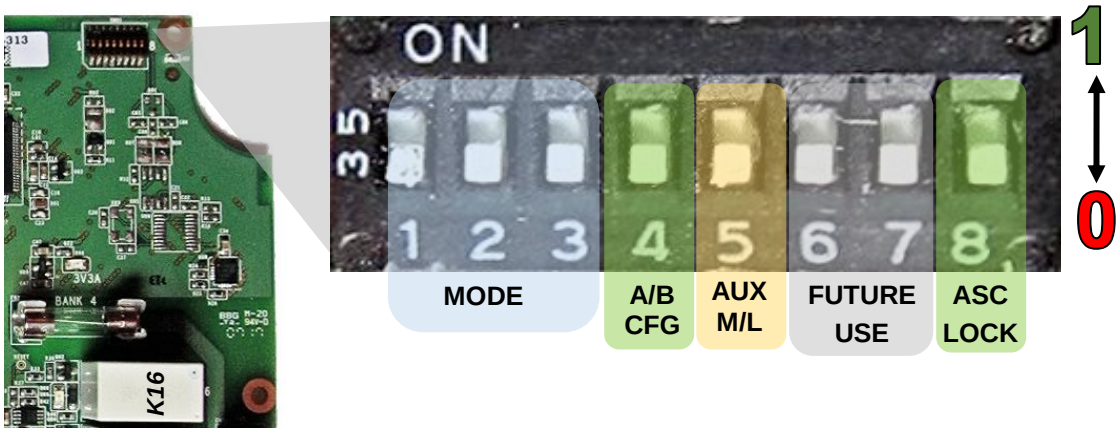

Figure 7. MU-9X15 SW01 DIP Switch Assignments

2.8 MU-9X15 Mode Definitions

Table 4. MU-9X15 DIP Switch Configurations

Example: In the table below setting 010 equals DIP switch 1 in the OFF position, DIP Switch 2 in the ON position and DIP Switch 3 in the OFF position. “0” equals OFF and a “1” equals ON.

Mode Configurations Using DIP Switches 1, 2, and 3

Mode	Definition
000	3-Motion. BR TR Hoist (3-Wire). A/B/Both cycling with A/B/AUX 1 button. Default
001	3-Motion. BR TR Hoist (3-Wire). A select with A/B/AUX 1 button / B select with AUX 2 button
010	3-Motion. BR TR (3-Wire) Hoist (4-Wire). A/B cycling. No AUX
011	3--Motion. BR TR (3-Wire) Hoist (4-Wire). A select with A/B/AUX 1 button / B select with AUX 2 button

Mode	Definition
100	3-Motion. BR TR Hoist (4-Wire). No A/B AUX
101	4-Motion. BR TR Hoist 1, Hoist 2 (3-Wire). Hoist 2 controlled by A/B/AUX and AUX 2 buttons.
110	Reserved
111	Reserved

A/B Configuration (DIP Switch 4) when Mode = 000 or 010

Mode	Definition
0	A / B relays cycle in the following way with pressing of A/B/AUX 1 button: **A, B, Both, A, B, Both ….**
1	A / B relays cycle in the following way with pressing of A/B/AUX 1 button: **A, B, OFF, A, B, OFF ….**

A/B Configuration (DIP Switch 4) when Mode = 001 or 011

Mode	Definition
0	A / B relays are momentary closures when commanding button is pressed
1	A / B relays are latching closures when commanding button is pressed

Aux M/L Mode = 000 (DIP Switch 5)

Mode	Definition
0	AUX relays is a momentary closure when button AUX 2 is pressed
1	AUX relays is a latching closures when button AUX 2 is pressed

ASC Lock (DIP Switch 8, applies to all modes)

Mode	Definition
0	Association is disabled. The unit will not accept association requests. The unit will not accept association requests unless virtually unlocked: see section 4.2.2
1	Association is enabled

✓***Note:*** *DIP switches may be changed at any time. However, changes will only be applied when there is no active RF connection.*

2.9 MU-9X15 Relay-to-Mode Output Assignments

Table 5. MU-9X15 Relay Output Assignments

Relay Wire	K1 06	K2 07	K3 08	K4 18	K5 13	K6 14	K7 15	K8 17	K9 10	K10 09	K11 11	K12 04	K13 12/23	K14 03	K15 03	K16 23
Mode 000	BF	BR	B2	A	TF	TR	T2	B	HD	HU	H2	AUX	H/L	MLC	MLC	ST
Mode 001	BF	BR	B2	A	TF	TR	T2	B	HD	HU	H2	X	H/L	MLC	MLC	ST
Mode 010	BF	BR	B2	A	TF	TR	T2	B	HD	HU	HD2	HU2	H/L	MLC	MLC	ST
Mode 011	BF	BR	B2	A	TF	TR	T2	B	HD	HU	HD2	HU2	H/L	MLC	MLC	ST
Mode 100	BF	BR	BF2	BR2	TF	TR	TF2	TR2	HD	HU	HD2	HU2	H/L	MLC	MLC	ST
Mode 101	BF	BR	B2	4^{th}R	TF	TR	T2	4^{th}F	HD	HU	H2	4^{th}2	H/L	MLC	MLC	ST
Mode 110	***Don't care, future use, position can be 1 or 0***															
Mode 111	***Don't care, future use, position can be 1 or 0***															

Table 7 Abbreviations Key

K	BR	BF	TF	TR	HD	HU	x2
Relay	Bridge Reverse	Bridge Forward	Trolley Forward	Trolley Reverse	Hoist Down	Hoist Up	Second Speed
MLC	**ST**	**A**	**B**	**AUX**	**4^{th} R**	**4^{th} F**	**H/L**
Main Line Contact	Start/HORN	A Control	B Control	Auxiliary	4^{th} Wire Relay Option Reverse	4^{th} Wire Relay Option Forward	Horn/Light Relay

3.0 Warrior 32 Handheld Remote (HH2S-9XL10)

The HH2S-9XL10 handheld is a small, compact handheld remote control that interfaces with Warrior 32 MU-9X15 receiver. The HH2S-9XL10 is made up of ten two step actuators. The HH2S-9XL10 utilizes two AAA batteries for power. The handheld remote enclosure is constructed of rugged polycarbonate designed to meet an ingress protection rating of IP55 according to IEC 60529. The HH2S-9XL10 has four LEDs used for diagnostics that indicate wireless link, Battery, and AB selection.

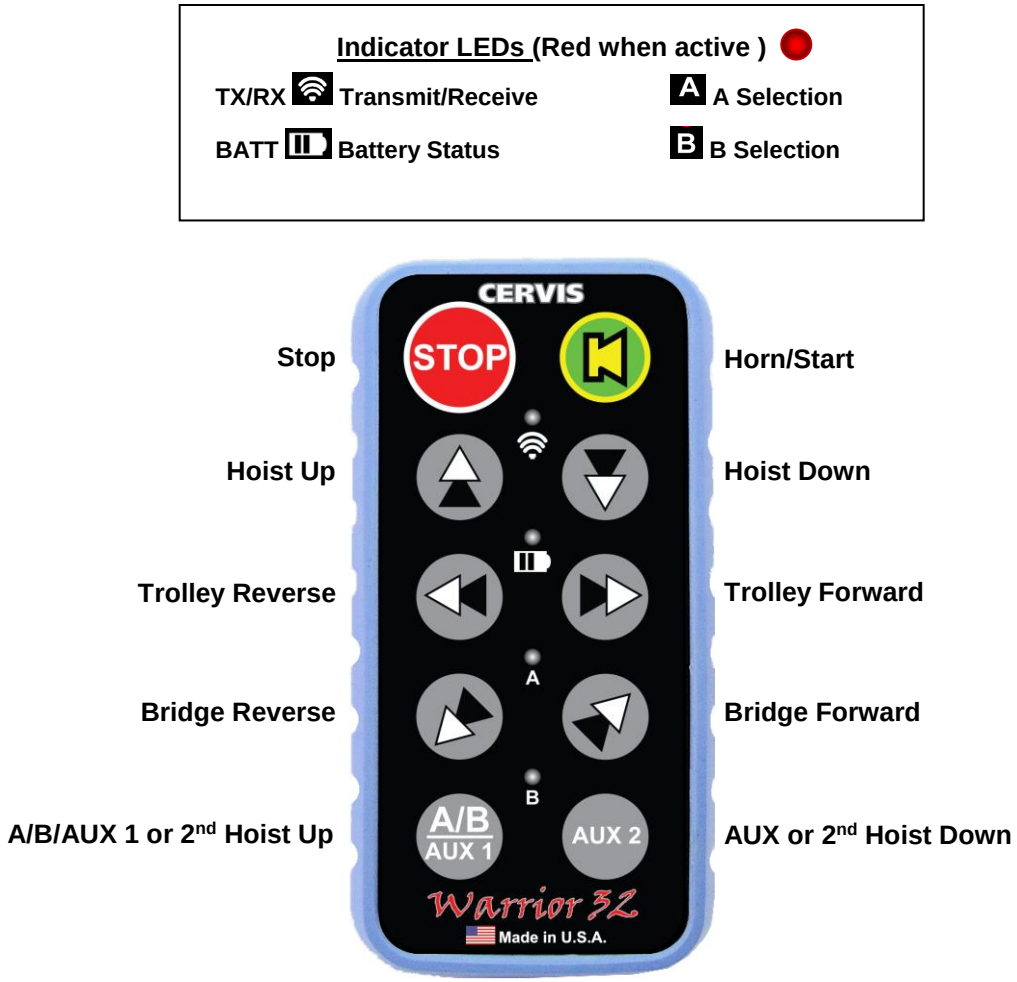

Figure 8. HH2S-9XL10 and LED Descriptions

The HH2S-9XL10 handheld remote button functions are configured by manipulating the MU-9X15 DIP Switch Mode settings . These configurations and the button functions are shown in Table 5.

3.1 HH2S-9XL10 Battery Installation

HH2S-9XL10 handheld units are powered by two AAA alkaline batteries. When installing batteries, be sure to observe proper polarity as marker on the inside of the compartment to avoid damaging the unit. To replace or install batteries in the handheld:

1. Loosen the four small Philips screws from the battery compartment cover and lift the cover from the handheld. The screws remain attached to the cover. Make sure the compartment sealing gasket stays in place on the handheld.
2. Install two fresh size AAA batteries. Be sure to position batteries as shown in Figure 9.
3. Replace the compartment cover and tighten the four Philips screws. These screws should not be over tightened, but they should be tight enough to ensure the gasket provides a proper seal.

✓***Note:*** *Discard expired batteries in accordance with local regulations.*

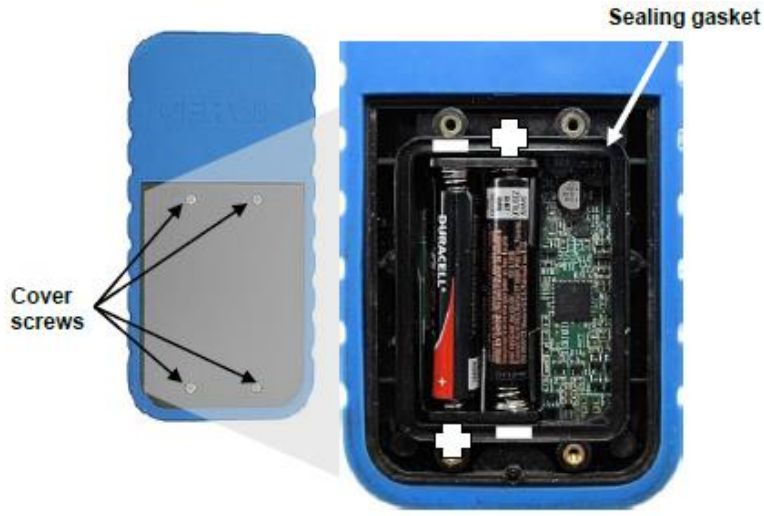

Figure 9. HH2S-9XL10 Battery Installation

Caution!	**Be sure to observe proper polarity when placing batteries in the handheld battery compartment.**

3.2 HH2S-9XL10 Battery Warning and Shutdown

HH2S-9XL10 will alert the user if the remaining battery life is getting low or is too low for normal operation.

LOW BATTERY

BATTERY LED flashes once per second indicating a LOW BATTERY (2.1V or less) situation is present. Two fresh AAA batteries should be replaced as soon as possible. The LED will continue to flash at one second intervals until the batteries are changed, or until the voltage level drops to 2.0V and Auto-Shutdown occurs.

AUTO-SHUTDOWN

At 2.0V, the BATTERY LED flashes briefly for approximately 1.25 seconds before the handheld remote automatically shuts down.

Two fresh AAA batteries must be installed before the handheld can be used again.

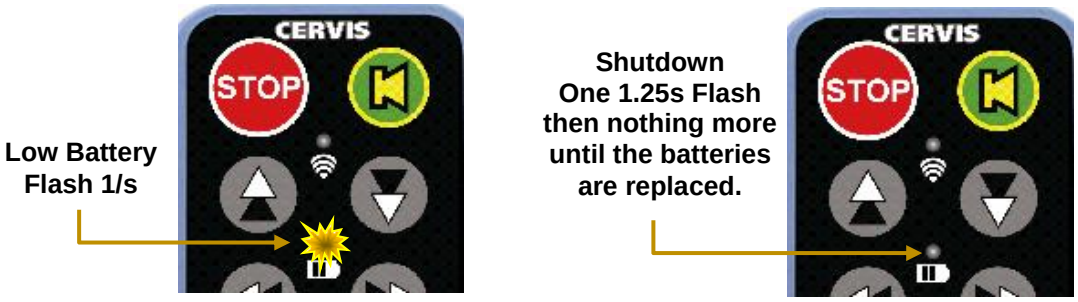

Figure 10. HH2S-9XL10 Remote Low Battery Warning and Auto-Shutdown

4.0 Warrior 32 System Operation

4.1 System Startup

The following assumes that power is applied to the Warrior 32 MU-9x15 receiver.

1. Press the handheld STOP button (B1).
2. Wait while the LEDs cycle and then the RX/TX begins to flash.
3. Press the Horn/Start button (B2). This energizes the MLC relays in the receiver.

The handheld is ready for normal functional operation.

4.2 Associating a Handheld with a Receiver

Warrior 32 system handhelds are associated to the receiver before the system is shipped and the Association process is locked by DIP switch 8 in the receiver being 0 (OFF). The receiver will only communicate with handhelds it is associated with. When necessary, other Warrior 32 handhelds can be associated to the receiver as additional spares or to replace damaged handhelds but the receiver's association ability must be unlocked first.

There are two methods to unlock association:

First is by manually changing the position of DIP switch 8 in the receiver. To unlock Association, DIP Switch 8 must be changed from its default position (0 (OFF)) to (1 (ON)). Unlocking with the DIP switch will unlock association until DIP switch 8 changed back to the 0 (OFF) or LOCKED position.

Second is by by using an already associated handheld and preforming a "virtual" UNLOCK. This process allows users to unlock the receiver from a distance without needing to access the receiver. A virtual unlock will allow the user to associate with the locked receiver for a limited time; after five minutes or after a successful handheld association the virtual unlock will expire and the receiver will become locked again.

4.2.1 Associating a Handheld Using the DIP Switch Unlock Option.

This process will unlock association of the receiver allowing the user to associate handhelds to the receiver until the DIP switch is set back to the locked position.

1. Set the receiver SW01 DIP Switch 8 ON (UP).
2. If the receiver is **Off**, the Horn/Light relay will activate when it is powered. If the receiver is **On**, the Horn/Light relay will immediately activate.
3. Go to section 4.3

Caution!	**It is not recommended to leave receivers in an UNLOCKED state. Move DIP switch 8 to the "0" (OFF) position once association is complete.**

4.2.2 Associating a Handheld Using the Virtual Unlock Process

✓***Note:*** ***Associating a new transmitter using Virtual Unlock can only be done from a transmitter that is already associated to the receiver.***

This process will unlock association for **five** minutes, allowing the user to associate another handheld to the receiver. Once association is complete or five minutes have passed, the RECEIVER will return to a locked state.

✓***Note:*** *The target receiver must be powered.*

1. Turn on the handheld by pressing the STOP button.
2. Wait for the RX/TX LED to begin blinking rapidly.
3. Press and hold buttons A/B Aux1, AUX2, and then STOP.

Receiver will sound the horn and activate the Association relay to confirm the receiver is now unlocked The handheld will then power down.

4. Go to section 4.3.

4.3 Associate a Handheld to a Receiver

This process is required when the handheld memory slot is either empty or the user wishes to associate to a different receiver.

✓***Note:*** *During this process, a receiver that is in use with another handheld cannot be associated.*

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 A/B and AUX 2.

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 receviers.
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 receiver ID is now stored in the handheld memory slot.
8. If the found receiver unit is **NOT** the receiver desired, press A/B AUX 1 button 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 AUX 2 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.

4.4 HH2S-9XL10 Handheld Factory Reset (Memory Clear)

The following steps will perform a factory reset on the handheld. Once this process is complete, the handheld memory slot is cleared and it will not communicate with any recievers.

✓***Note:*** *The memory of spare handhelds from the factory will be clear upon arrival.*

1. Turn on the handheld by pressing and releasing button 1 (STOP).
2. Within 1s of activating the handheld, while only LED 4 is active, simultaneously press and release buttons 9 and 10. The LEDs will start scrolling indicating maintenance mode.
3. Simultaneously press and hold buttons 9 and 10.
4. Press and release button 1 (STOP).
5. The handheld will turn off indicating the factory reset was successful.

A handheld that has been cleared will power up and immediately shutdown indicating that it has no receiver in its memory.

Figure 11. HH2S-9XL10 with Numbered Buttons

5.0 Warrior 32 System Specifications

5.1 MU-9X15 Receiver Specifications

Table 6. MU-9X15 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°C to 70°C (-40°F to 158°F) -40°C to 80°C (-40°F to 176°F) 0-95% non-condensing
Radio	**Frequency** **License** **Modulation** **Antenna**	904-926 MHz @ 100mW No license required DSSS External (RP-TNC)
Enclosure	**Dimensions** **Weight** **Durability**	mm: 200 x 150 x 100 Inches: 7.87” x 5.9” x 3.93” 1.5 lbs. NEMA 1, 2, 4, 4X IP65/67
Indicators	**Power** **Diagnostic** **Relay Status** **Association**	3V3L - Lit when OK 3V3RF - Lit when OK 3V3A - Lit when OK 12V0 - Lit when OK Health - Slow blink when OK TX - Blinking when transmitting RX - Blinking when receiving (16) - Lit when Relay is ON Panel LED - Used during association
Outputs	**Fourteen**	Form A Relays
Main Line Contactor (MLC)	**Safety Circuit**	Comprised of two Form A Relays arranged in series

5.2 HH2S-9XL10 Handheld Specifications

Table 7. HH2S-9XL10 Handheld Specifications

Item	Description	
Power	**Vin**	+2.1V to +3.2V
	Source	Two (2) AAA alkaline batteries
	Low Battery Warning	~2.1V - batteries should be immediately replaced
	Low Battery Shutdown	<2.0V - batteries must be replaced to operate
Environment	**Operating Temp**	-40°C to 60°C (-40°F to 140°F)
	Storage Temp	-40°C to 85°C (-40°F to 185°F)
	Humidity	0-95% non-condensing
Radio	**Frequency**	904-926 MHz @ 100mW
	License	No license required
	Modulation	DSSS
	Antenna	Internal
Enclosure	**Dimensions**	mm: 136.38 x 68.96 x 28.42
		Inches: 5.37” x 2.68” x 0.92”
	Weight	200 gr. / 7.2 oz. (With lanyard or belt clip)
	Durability	High Impact Polymer case
		Polycarbonate faceplate
		Impact absorbing bumper
Indicators	**Wireless**	Indicates wireless communications
	Battery	Provides battery status
	A	Indicates A selected when lit
	B	Indicates B selected when lit
Buttons	**(10)**	Two-step pushbuttons

6.0 Trouble Shooting

Table 8. Trouble Shooting

Description	Possible Solutions
TX/RX LED and B do not illuminate	• Perform factory reset, see Heading 4.4Factory Reset. • Contact Cervis Inc.

Appendix A: Exposure to Radio Frequency Energy

Warrior 32 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 32** 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 as presented in this section.

Appendix C: MU-9X15 Safety Circuit

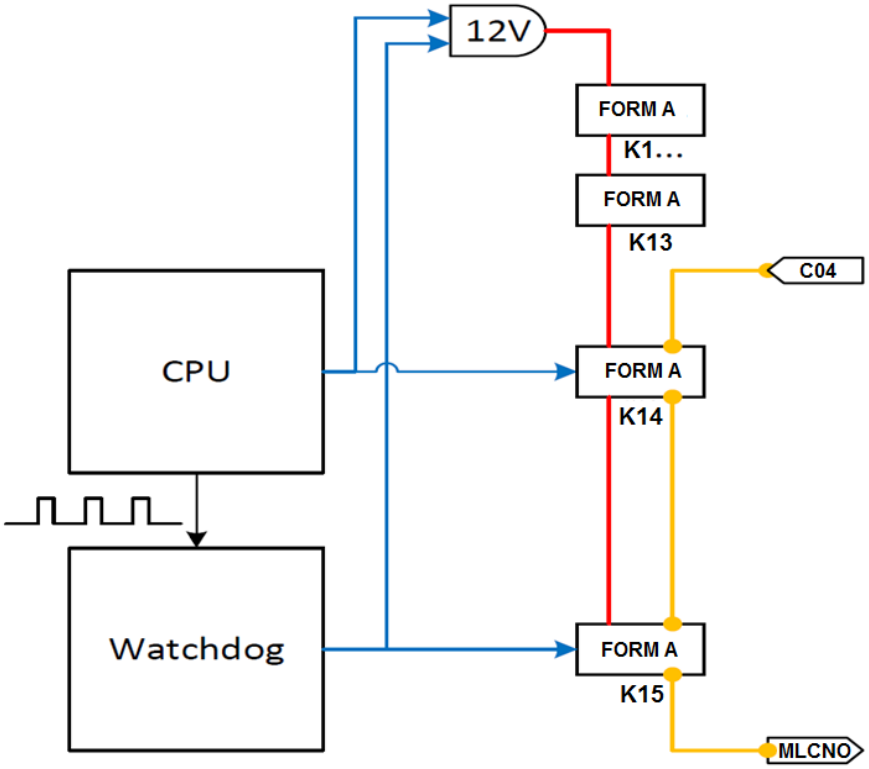

Figure 12. MU-9X15 MLC Safety Circuit Logic Diagram

Figure 12 illustrates a high-level view of the system's safety architecture. This architecture is based around redundant enable signals that are generated by separate hardware circuits. The microprocessor generates an enable signal to K14 when all conditions are met and the user activates the start sequence. The watchdog circuit generates an independent enable signal to K15 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 12V 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 K15 to open. Additionally, this will disable the internal 12V 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, the unit will be safe as the MLC path cannot close because K15 will be open and the internal 12V bus will be disabled. If the fault causes the watchdog circuit to never de-assert (perhaps the contacts on K15 weld closed), the system is still safe because the microprocessor has independent control of K14 that can break the MLC path and internal 12V bus.

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

*Except the K13 H/L relay because it is necessary to operate the H/L when the MLC is open.

Appendix D: MU-9X15 Control Cable Internal Wiring Diagram

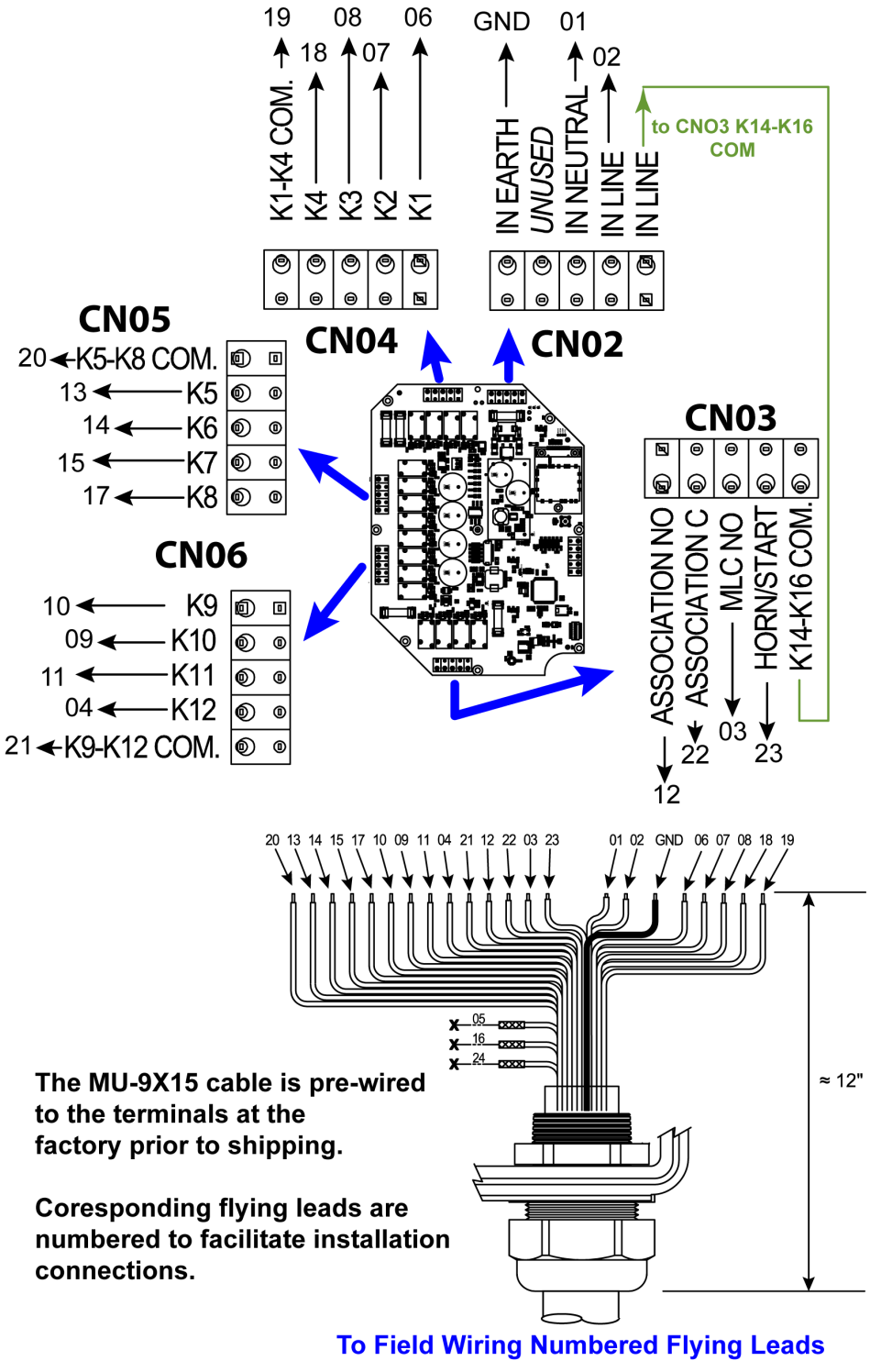

Figure 13. MU-9X15 Control Cable Internal Wiring Description

Appendix E: Warrior System Options

The following tables lists available system and aftermarket support and spare parts options.

Table 9. Warrior System Options

Item	Description
J5-07	3 ft. antenna extension cable
EXT-ANT10-1	10 ft. antenna cable extension kit. Includes J5-02 extension cable & J5-12 antenna bracket w/ isolation washers
EXT-ANT25-1	25 ft. antenna cable extension kit. Includes J5-13 extension cable & J5-12 antenna bracket w/ isolation washers
CONFIG	Factory set up DIP switch configuration for relay control(s)
15114311	HORN Mini 12VDC Onboard 90db Horn / Buzzer installed
15104112	Two Point mounting plate for receiver
VIB	Handheld haptic feedback vibratory motor
WOPT K24	Add Prewired 24 pin connector to the receiver pigtail
TS2L	2 pole Transfer Switch only. Includes (G4-02A & 2 ea. G4-02B)
TS6P	Pre-wired external Transfer Switch Assy. (up to 6 circuits)

Table 10. Aftermarket Support & Spare Parts

Item	Description
HH2S-9XL10	Spare transmitter
HH2S-9XL10M	Spare transmitter with vibratory feedback
L152	Warrior 32 alternative button label sheet
L154	Warrior 32 15100403 replacement handheld overlay
L159	Handheld Warning Tag
15100110	Handheld “Work Safe” orange wrist breakaway lanyard
07127150	Warrior handheld boot
07100376	Handheld battery door
AA8-015A	Handheld battery compartment sealing gasket
AA5-05	Handheld lanyard mounting pin
BB3-06	Receiver antenna
1708006	NiMH Battery Charger (for AA / AAA batteries only)
1708005	NiMH AAA Battery (2 per handheld)
L147	Laminated “Quick Reference” safety card

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