



SmaRT 918, 218
Remote Control System
User Manual

U053.4-SmaRT_OO-x18_Sys

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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.

15.105(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.

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Definitions/Notes

Associate/Association

Mode where by SmaRT handhelds and base units are paired for operation (ID's exchanged). This mode is used to commission spare handhelds or base units.

DSSS

Direct sequence spread spectrum; an advance wireless communication technology.

Disassociation

The process of decommissioning a handheld from a base units ID memory.

PTO

Push-to-Operate: Command broadcast only while a button is depressed. The command ends when the button is released.

Latch

Command broadcast while a switch is placed in position or when a button is pressed. The command ends when switch is repositioned or when the button is released, or in some cases when the button is pressed again.

SmaRT Base Unit

I/O unit to which the controlled machine is connected. SmaRT base units communicate with each other and SmaRT handheld, console, and 18-Button Handheld remote controllers.

SmaRT x18 Remote Control System

SmaRT wireless remote control system consisting of one or more SmaRT base units and a SmaRT 18-button remote control unit that controls the base unit input and output functions. The system operates either in the 900MHz or 2.4GHz range.

Line of Sight (aka Direct-Line-of-Sight)

Term used to describe RF communication where the pathway between the units is clear of physical obstacles such as walls, earth, and other obstructions.

TX/RX

Transmit/Receive

Contact us with questions during installation or troubleshooting at (724) 741-9000

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 base unit before attempting any maintenance. This will prevent accidental operation of the controlled machinery.***
- ✓ ***Power can be removed from the Base Unit by detaching the 12-pin cables from the base unit connectors P1 and P2, or by removing the source power from the circuit.***
- ✓ ***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 base unit enclosures. Do not use high pressure equipment to clean the handheld remote or base unit.***
- ✓ ***Disconnect the radio base unit before welding on the machine. Failure to disconnect the base unit may result in destruction of or damage to the base unit.***
- ✓ ***Operate and store units only within the specified operation and storage temperatures defined in 6.0 Specifications of this document.***

The following applies only to SmaRT 218 18-Button Handheld remote control systems.

RoHS Compliance Statement

Cervis, Inc. complies with the requirements of **Restriction of Hazardous Substances (RoHS/WEEE) Specification** based on in-house practice and declaration of compliance from our vendors. For additional information concerning RoHS compliance, please contact Cervis, Inc. at:

CERVIS, Inc.

170 Thorn Hill Road
Warrendale, PA 15086
Phone: 724.741.9000
Fax: 724.741.9001



This product may contain material that may be hazardous to human health and the environment. In compliance with EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE):

- ✓ Do not dispose of the product as unsorted municipal waste.
- ✓ This product should be recycled in accordance with local regulations. Contact local authorities for detailed information.
- ✓ This product may be returnable to the distributor for recycling. Contact your distributor for details.

1.0 SmaRT 218, 918 Remote Control System

✓ **Note:** Frequency of operation for a SmaRT system will be either in the 900MHz or 2.4GHz range. The first number in the name of the system or device indicates the frequency of operation. For instance, a SmaRT 18-button handheld remote with an ON button and an OFF button will either be OO-218 or OO-918, where a 2 indicates 2.4GHz and 9 indicates 900MHz. As such, reference to the system, handheld remote, and base unit in this manual will use x in the name (rather than a 2 or 9) to indicate the frequency of operation.

A standard SmaRT x18 Remote Control System consists of a SmaRT OO-x18 18-button handheld remote control unit and a BU-x16F base unit. A SmaRT system is capable of communicating in congested radio environments using Direct Sequence Spread Spectrum (DSSS) wireless technology at a system dependant 900MHz or 2.4GHz range. The system communication link between the handheld remote control and the base unit is established at the factory using a process known as Association. The system can also be seamlessly associated in the field without the need to open the enclosures of either unit by a wireless process described later in this manual.

The OO-x18 handheld remote has a dedicated ON button and an OFF button. The remaining sixteen buttons are assigned to and used to control the base unit outputs. The BU-x16F base unit has sixteen solid state FET channels. System configuration is extended as the I/O can also be custom configured by Cervis Engineering to be inputs or outputs.



Figure 1. Standard SmaRT x18 System

2.0 SmaRT x18 18-Button Handheld Remote Control

The SmaRT™ x18 18-Button Handheld Remote is designed for traditional and non-traditional mobile applications capable of activating and deactivating the input/outputs of SmaRT base units. The handheld remote is capable of providing single-handed operation in a comfortable ergonomic layout.

Using direct sequence spread spectrum (DSSS) wireless technology at the 900MHz or 2.4GHz (system dependant) range to communicate, the SmaRT 18-button handheld remote provides a robust link with a base unit in congested radio environments. The handheld remote allows seamless association to a SmaRT base unit without the need to open the case of either unit. The rugged weatherproof handheld enclosure allows the unit to operate worry free in harsh weather conditions.



Figure 2. SmaRT x18 18-Button Handheld Remote Control Unit

2.1 Features

- Uses direct sequence spread spectrum technology (DSSS) at 900MHz or 2.4GHz
- Direct-line-of-sight operation
- Individual On and Off buttons with 16-button function control
- Three LED indicators
- Low voltage warning LED indication
- Critical low voltage auto-shutdown
- Rugged high-impact polymer/polycarbonate/stainless steel enclosure
- Optional removable protective bumper and lanyard
- Weatherproof design
- Operates at 1.6 – 3.2VDC (uses four AA batteries)

2.2 SmaRT OO-x18 Handheld Battery Installation

The handheld remote operates between 1.6 to 3.2VDC powered by four factory installed 1.5V AA alkaline batteries. Cervis, Inc. recommends that fresh spare batteries be at hand at all times that the system is in use.

✓ **Note:** *The battery cover is designed so that the four screws holding the battery cover in place are 'captive' to the cover. Although not easily removed from the cover itself, be aware that if the screws are over-loosened while opening the battery compartment, they can be completely removed increasing the risk of loss. All four screws must be installed to maintain a tight seal.*

1. Place the remote face down and remove the four screws holding the battery cover in place. Remove the battery cover.
2. Remove the discharged batteries and properly dispose in accordance with local regulations.
3. Plug each fresh battery into a terminal cradle observing proper polarity. The interior of the cradle shows polarity markings for each terminal. Make sure the batteries are firmly seated in the cradle.
4. Replace the battery cover. Secure the cover with the four screws. Make sure they are tightened enough to compress the seal, but be careful not to over-tighten.

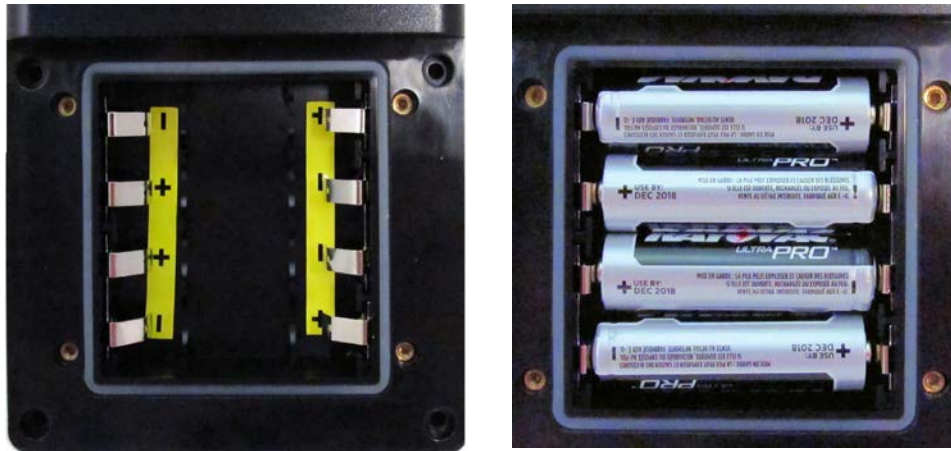


Figure 3. OO-x18 Handheld Battery Compartment

CAUTION



Observe proper polarity when placing batteries into the cradle. Improper battery placement can result in excessive heat, battery explosion, injury to the operator, and damage to the remote.

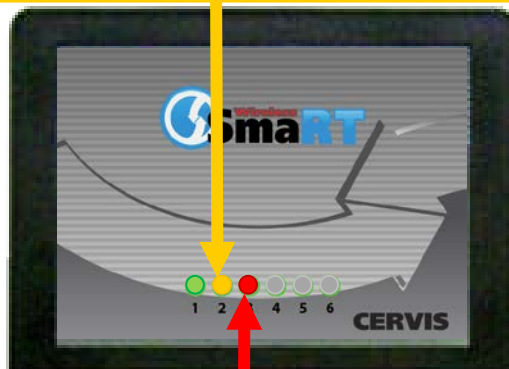
✓ **Note:** *Cervis, Inc. recommends that the batteries be removed from the handheld remote when the remote is going to be stored for any extended length of time.*

2.3 Low Battery Warning

When low voltage is sensed—approximately 1.7V—the AMBER RX LED will no longer indicate that there is an incoming message. Instead, the LED will begin to flash approximately once per second indicating a Low Battery Warning. Messages are still being received, and the handheld can still be used, but it is recommended that a fresh set of four AA batteries should be installed as soon as possible.

LOW BATTERY WARNING

At Low Voltage, the AMBER RX LED stops flashing as messages are received by the handheld remote from the base unit. Messages are still being received, but they are not indicated by the LED. The RX LED begins flashing once per second indicating a LOW BATTERY situation is present. The batteries should be replaced with four fresh AA batteries 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 the level where Auto-Shutdown occurs.



LOW BATTERY AUTO-SHUTDOWN

As the critical Auto-Shutdown voltage is sensed, the AMBER LED stops flashing. The RED LED flashes for approximately 30 seconds indicating the handheld remote is automatically shutting down. The four AA batteries must be replaced before the handheld can be used again.

Figure 4. Low Battery Warning and Auto-Shutdown

2.4 Low Battery Auto-Shutdown

When the critical Auto-Shutdown voltage is sensed (approximately 1.6VDC), the AMBER RX LED will stop pulsing, the handheld will no longer communicate with the base unit, the RED LED will pulse for approximately 30 seconds indicating the handheld remote is about to completely shut down. The four AA batteries must be replaced before the handheld remote can be used.

3.0 SmaRT x18 Operation

Turn ON the Unit

The remote is powered ON by pressing the Green and White **ON** button .

Turn OFF the Unit

The remote is turned OFF by pressing the Red and White **OFF** button .

Buttons 1 through 16

Buttons 1 through 16 are used for control of the base unit. These buttons are typically mapped to specific base unit outputs/inputs M1 through M16 as shown below.



Buttons 1 (M1) through 16 (M16) are used for function control.

Button	BU Map M#	I/O Channel	BU Connector P# and Pin #
1	M1	Ch1	P2-9
2	M2	Ch2	P2-10
3	M3	Ch3	P2-11
4	M4	Ch4	P2-12
5	M5	Ch5	P2-1
6	M6	Ch6	P2-2
7	M7	Ch7	P2-3
8	M8	Ch8	P2-4
9	M9	Ch9	P1-3
10	M10	Ch10	P1-4
11	M11	Ch11	P1-5
12	M12	Ch12	P1-6
13	M13	Ch13	P1-7
14	M14	Ch14	P1-8
15	M15	Ch15	P1-9
16	M16	Ch16	P1-10

Table 1. Handheld Button to BU I/O Mapping

Figure 5. Handheld Buttons

4.0 Associate Mode

The Associate Mode is used to establish the communications link between the 18-button handheld remote and base unit on a 1-to-1 basis. There must be a clear line of sight between the handheld and the base to associate, and both units must be OFF (powered down). The 18-Button Handheld is turned off by pressing the OFF button. The SmaRT base unit is safely powered down by removing the power source from the unit.

CAUTION *To prevent inadvertent movement of the machine, be sure to remove power from the Base Unit before attempting to enter Associate Mode.*


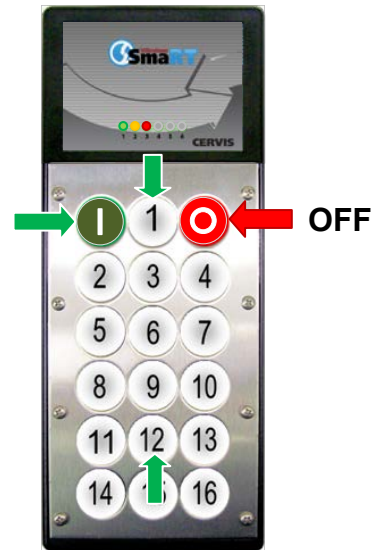



Figure 6. Associate Mode

Observe LED states while performing the following Association:

1. Remove power from the base unit and turn off the handheld.
2. Stand near the base unit with the handheld in clear line-of-sight.
3. Press and hold **button 12**, then press and hold the **ON** button. LEDs #1 (green), #2 (amber), and #3 (red) light solid.
4. Continue to hold both buttons until the **Amber LED (#2)** goes **OUT**. Immediately release both the **ON** and **12** buttons. You have approximately 2 seconds to perform the next step. If you miss this window of opportunity, you must restart this procedure starting at Step 3.
5. Press and **hold** button **1**. Wait until the Amber LED #2 goes out.
6. Turn the base unit **ON** while holding button 1. LEDs illuminate.
7. When the **Red LED #3** goes out, release button 1.

If the Association is successful, green LED #1 and amber LED #2 will continually flash (TX and RX respectively) indicating that the handheld and the base unit are communicating.

✓ **Note:** *The label on early versions of the OO-x18 handheld remote indicated eight LED places numbered left-to-right as 1 through 8 respectively as opposed to the current six LED places shown throughout this manual, which are numbered from left-to-right as 1 through 6.*

LED numbers 2 (green), 3 (amber), and 4 (red) were the active LEDs on the eight-place units, which respectively relate to active LED numbers 1 (green), 2 (amber), and 3 (red) in the current version shown in this manual.

5.0 BU-X16F Base Unit

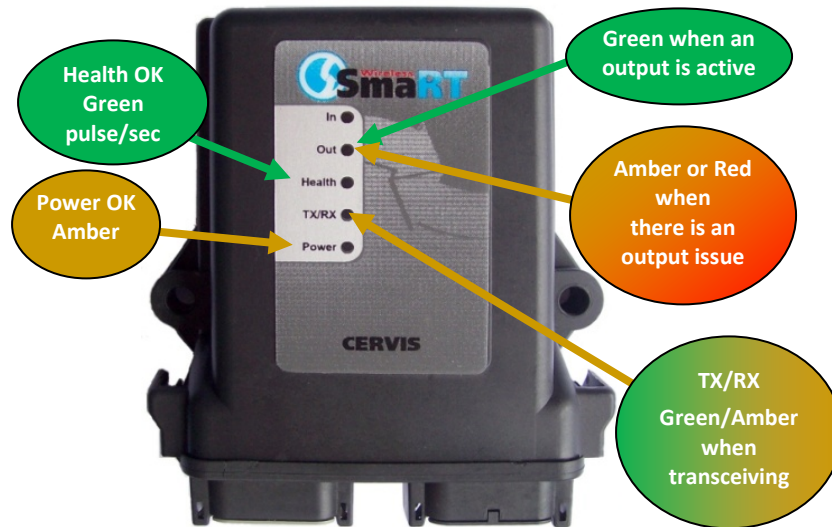


Figure 7. SmaRT BU-X16F LEDs

The SmaRT™ BU-x16F features sixteen FET, high side switching outputs or switch-to-ground digital inputs. The versatile, programmable digital inputs can be customized by Cervis to fit specific user applications. The BU-X16F accepts a broad range of input power with operating voltages ranging from 7VDC to 32VDC. The rugged weatherproof enclosure allows the unit to operate worry free in harsh weather conditions. Two models of connecting cables are available for P1 and P2 of the base unit.

SmaRT™ base units feature seamless association to a SmaRT™ hand-held unit without the need to open the case. Using Direct Sequence Spread Spectrum (DSSS) wireless technology at a system dependant 900MHz or 2.4GHz, the base unit provides a robust link in congested radio environments.

Features

- Uses 900MHz or 2.4GHz direct sequence spread spectrum technology
- Sixteen FET outputs/inputs
- +7 to +32VDC power
- Dual connector interface for ease of wiring
- Diagnostic LEDs
- Compact design
- Rugged, weatherproof construction

5.1 BU-X16F Base Unit Installation

CAUTION



Make sure the machine that the base unit is to be installed is disabled during installation.

Use the configuration diagrams supplied by Cervis as a guide when mounting the base unit and connecting the wiring harnesses. Dimensions for drilling mounting holes are shown in Figure 8. Wiring harness connections are shown in Figure 9 below.

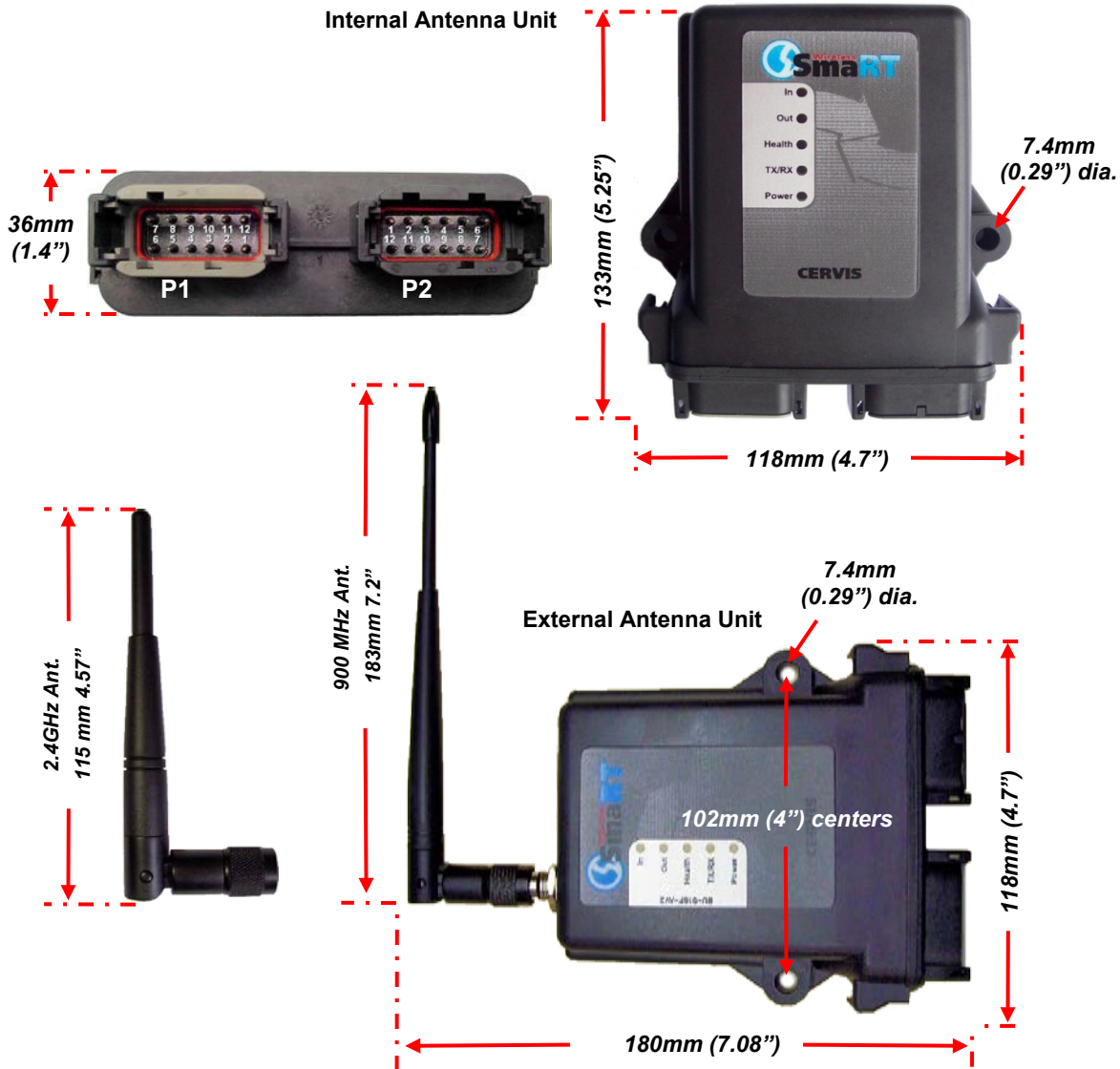
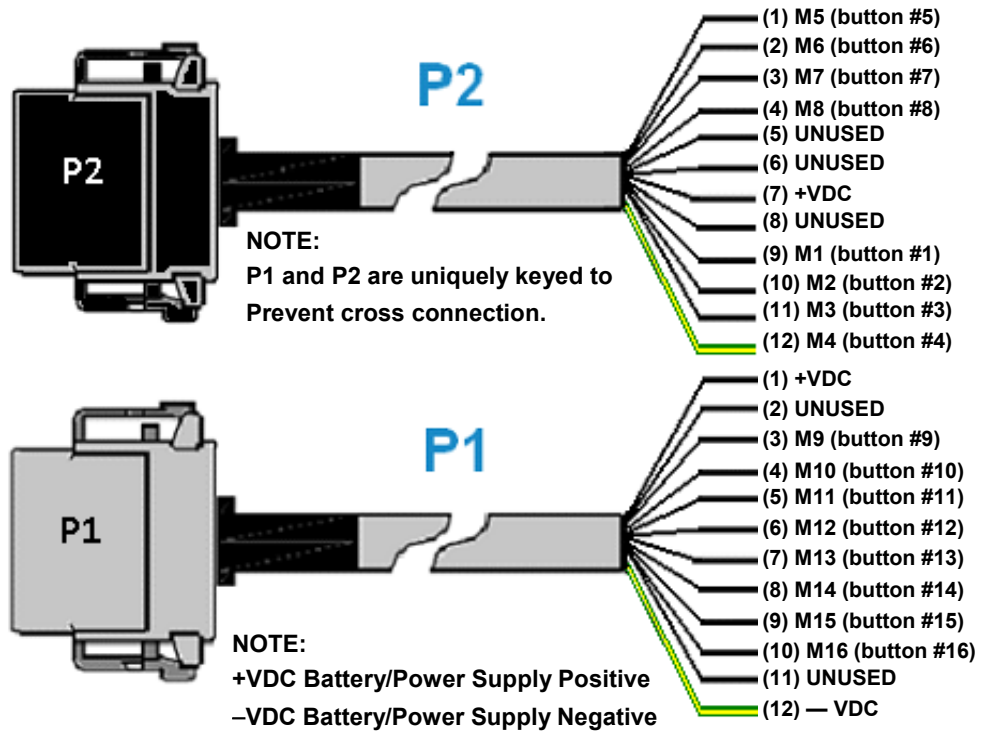


Figure 8. Internal and External Antenna Base Unit Dimensions



Handheld remote buttons #1 through #16 are typically mapped to base unit outputs/inputs M1 through M16 respectively.

Figure 9. Base Unit Field Wiring

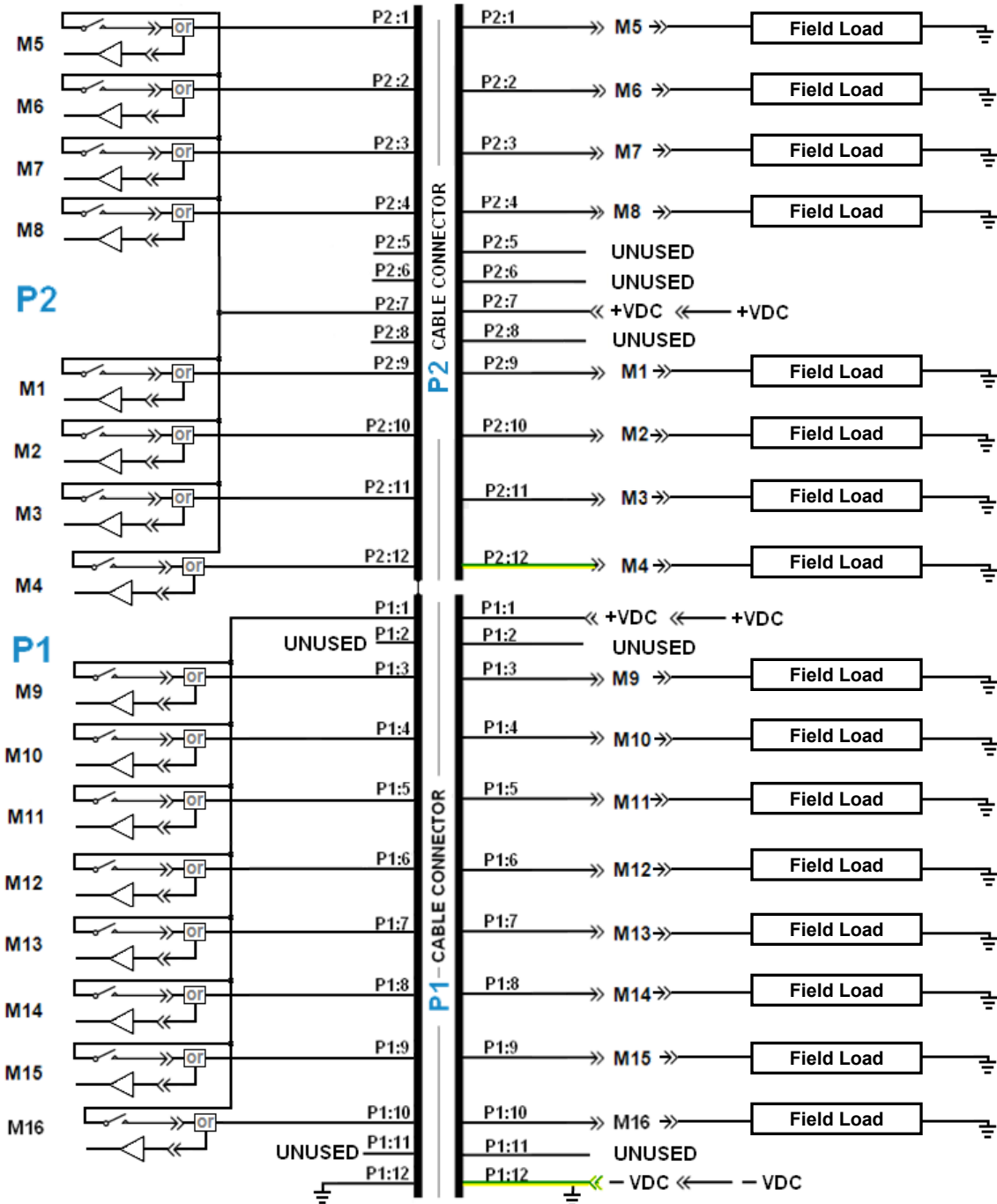


Figure 10. Field Wiring

6.0 Specifications

Table 2. SmaRT x18 18-Button Handheld Specifications

Item	Description	
Power	V_{in}	+1.6V to +3.2VDC
	Batteries	Four (4) AA
	Battery Life	175 to 200 hours
	Low V Warning	~1.7VDC
	Low V Shutdown	1.6VDC
	Auto-shutdown	15 min. of button inactivity
Environment	Operating Temp	-20°C to 55°C (-4°F to 131°F)
	Storage Temp	-40°C to 55°C (-40°F to 131°F)
	Humidity	0 to 100%
Radio	Frequency	906-924MHz 2405-2480MHz
	900MHz RF Power	1mW
	2.4GHz RF Power	2mW
	License	License free
	Modulation	DSSS
	Antenna	Internal
Enclosure	Dimensions	9 1/8" x 3 1/8" x 1 1/4" (231.8 mm x 79.4 mm x 31.8mm)
	Total Weight	15.2 oz. (430.9 gr.)
	Durability	High impact polymer case Polycarbonate faceplate Stainless steel faceplate
Indicators (4)	LEDs	
	TX (Green LED 2)	Blinking – transmitting, no switch active Solid – button press, switch active
	RX (Amber LED 3)	Blinking – receiving, no output of interest active Solid – base unit output of interest active 1 sec pulses – low battery indication
	LED 4 (Red)	Used for Association Pulses for 30 sec. – low voltage auto-shutdown indication
Pushbuttons	Green	ON
	Red	OFF
	1 through 16	Function, output control
	Style	Latching or Momentary
	Button Life	5-million operations (typical)

Table 3. SmaRT BU-X16F Base Unit Specifications

SmaRT BU-x16F Base Unit Specs		
POWER	Vin	+7 to +32VDC
RADIO	Frequency	906 – 924MHz
	900MHz RF Power	1mW
	Frequency	2405 – 2480MHz
	2.4GHz RF Power	2mW
	License	License Free
	Modulation	DSSS
	Antenna	Internal
ENVIRONMENT	Operating Temp	-20°C to See Derating Curve chart for details (7.0, below) (-4°F to 158°F)
	Storage Temp	-40°C to 85°C (-40°F to 185°F)
	Humidity	0 to 100%
	Vibration/Shock	IEC60068-2-6 10Hz to 150Hz @ 1.0g peak acceleration 10.0g peak shock acceleration
INDICATORS (5)	In	Green – Input On
	Out	Green – Output On
	Health	Green – Pulse/sec. OK
	TX/RX	Green – Receive Red – Transmit
	Power	Amber – OK Red/Green – Fault
ENCLOSURE	Dimensions	119mm x 133mm x 36mm (5.24" x 4.69" x 1.42")
	Durability	High Impact Polymer
	Mounting Holes	7.4mm (0.29") dia. 102mm center-to-center (4" center-to-center)
OUTPUTS/INPUTS	Sixteen	FET—Open Drain
	Current	4A per channel 15A Max. total
	Input Active Low	Active <1V Inactive >3V
DIGITAL I/O	Assignments	M1 (Ch1) P2–9 M2 (Ch2) P2–10 M3 (Ch3) P2–11 M4 (Ch4) P2–12 M5 (Ch5) P2–1 M6 (Ch6) P2–2 M7 (Ch7) P2–3 M8 (Ch8) P2–4 M9 (Ch9) P1–3 M10 (Ch10) P1–4 M11 (Ch11) P1–5 M12 (Ch12) P1–6 M13 (Ch13) P1–7 M14 (Ch14) P1–8 M15 (Ch15) P1–9 M16 (Ch16) P1–10

7.0 BU-x16F Output Current Derating Curve

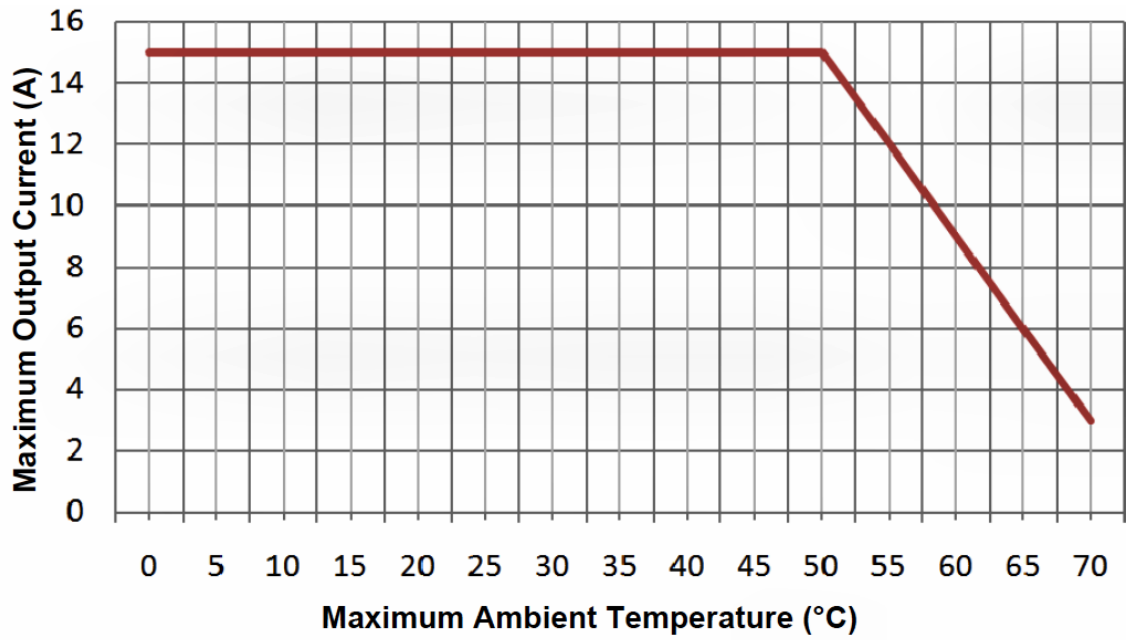


Figure 11. Base Unit Output Current Derating Curve

8.0 Base Unit Troubleshooting

Table 4. Base Unit LED Troubleshooting

Indication	Interpretation – Recommendation
Power LED not active	<ul style="list-style-type: none"> ✓ Is +7 to +32VDC input power present? ✓ Check input power polarity.
Power LED Red or Green	Indicates an internal component failure.
TX/RX not active	<ul style="list-style-type: none"> ✓ Check for obstructions preventing line-of-sight transmission. ✓ Check that the handheld remote is active. Re-associate the handheld remote to the base unit.
Health LED rapidly blinking Amber	Indicates an internal problem.
Health LED blinking Red	Over-temperature indicated.
Out LED not active	<ul style="list-style-type: none"> ✓ Check that the handheld LEDs are active when the appropriate buttons are pushed.
Out LED Amber	<ul style="list-style-type: none"> ✓ Check the outputs for loose wiring, etc. Over-temperature channel indication. Over-current channel indication. Active channel current consumption less than 1A typical. (This is not a problem in cases where less than 1A draw is a normal condition.)
Out LED pulsing Amber	Indicates an over-current condition.
Out LED slowly pulsing Amber	Over-temperature indication.
In LED not active	Check to make sure that voltage to channel is less than 1V.

CAUTION



Push-To-Operate means that the outputs under control should only change states when the appropriate button or switch of the handheld is pressed or positioned, and then only for the duration of time that particular output button is pressed. Any unexpected motion that occurs when pressing the output control buttons of the handheld must be investigated.

Should a jerkiness of motion occur while constantly pressing an output switch, immediately stop operation. Check the base unit diagnostic LEDs for any indication of a problem. Diagnostic descriptions are found in the manual of the particular SmaRT base unit.

Be aware that even if the diagnostic LEDs of the handheld and base unit do not indicate a problem, one may be present and further troubleshooting steps may be needed.

If a problem is found, do not operate the SmaRT System until the problem is resolved.



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