



**SmaRT DO-918, DO-218  
Handheld Remote Control  
User Manual**

**U055.3-SmaRT\_DO-x18\_HHR**

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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](http://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 4.0 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 DO-x18 18-Button Handheld Remote Control

✓ **Note:** Frequency of operation for a SmaRT handheld remote will be 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 a single button serving as the ON and OFF button will either be DO-218 or DO-918, where a 2 indicates 2.4GHz and 9 indicates 900MHz. As such, reference to the, handheld remote, base unit, or system in this manual will use x rather than a 2 or 9 in the name to indicate the frequency of operation.

The SmaRT DO-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 ergonomic layout of the handheld remote provides for comfortable remote operation of the SmaRT system.

Using direct sequence spread spectrum (DSSS) wireless technology at the 900MHz or 2.4GHz (system dependant) range to communicate, the SmaRT DO-x18 eighteen 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 1. SmaRT DO-x18 18-Button Handheld Remote Control Unit*

### 1.1 Handheld Features

- Uses direct sequence spread spectrum technology (DSSS) at 900MHz or 2.4GHz
- Direct-line-of-sight operation
- Single On and Off button with 17-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)

## 1.2 SmaRT DO-x18 Remote Control System

A standard SmaRT DO-x18 Remote Control System consists of a SmaRT DO-x18 eighteen 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 DO-x18 handheld remote has a single button with which the unit is switched ON and OFF. The remaining seventeen buttons are assigned and used to control the sixteen base unit outputs, or custom programmed to serve a special function. Custom program options are available through the Cervis Engineering Department.



**Figure 2. Standard SmaRT DO-x18 System**

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 the Cervis Engineering Department to be inputs or outputs.



### 1.3 Smart DO-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.

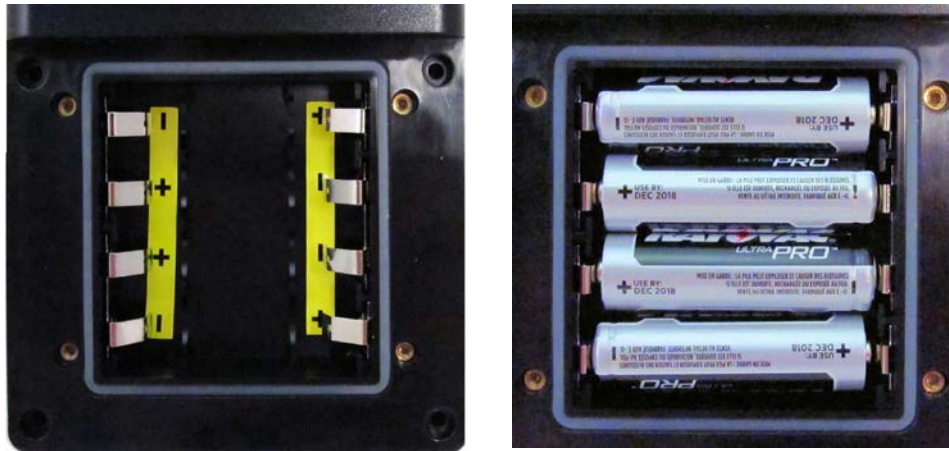


Figure 3. DO-x18 Handheld Battery Compartment

**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.**

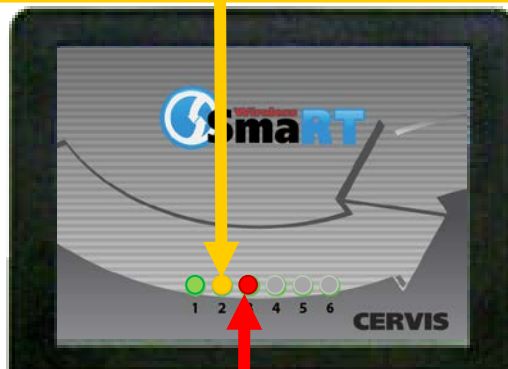
✓ **Note:** *Cervis, Inc. recommends that the batteries be removed from the handheld remote when the remote is going to be stored for any extended length of time.*

## 1.4 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*

## 1.5 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.

## 2.0 Smart DO-x18 Operation

### Turn ON the Unit

When the unit is off, the remote is **turned ON** by pressing the **ON/OFF** button .

### Turn OFF the Unit

When the unit is on, the remote is **turned OFF** by pressing the **ON/OFF** button .

### Buttons 1 through 16

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

### Button 17

Button 17 is typically unused.

*✓ Note: As an option provided by the Cervis Engineering Department, Button 17 (or any of the other buttons) can be custom programmed. Contact Cervis, Inc. for details.*



Buttons 1 (M1) through 16 (M16) are used for base unit output/input 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
17	Optional (through Cervis engineering)		

Table 1. Handheld Button to BU I/O Mapping

Figure 5. Handheld Buttons and Typical Button to Output/Input Mapping

### 3.0 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. Both units must be OFF (powered down), and the handheld must be close to the base unit with a clear line of sight between handheld and base to associate. The SmaRT base unit is safely powered down by disconnecting P1 and P2 or 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 the Associate Mode.



**Observe LED states while performing the following Association:**

1. Remove power from the base unit by disconnecting P1 and P2 and turn off the handheld.
2. Stand near the base unit with the handheld in clear line-of-sight.
3. Press and hold **button 13** and then press and hold the **ON/OFF 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 **13** 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 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 DO-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.*

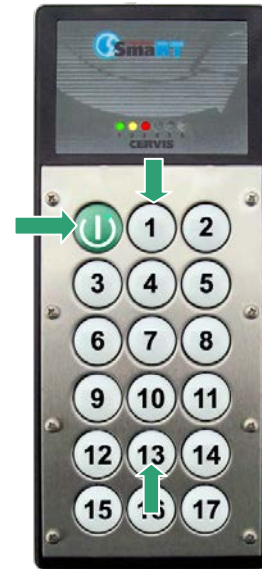


Figure 6. Associate Mode

## 4.0 Specifications

*Table 2. SmaRT DO-x18 18-Button Handheld Specifications*

Item	Description	
<b>Power</b>	<b>V<sub>in</sub></b>	+1.6V to +3.2VDC
	<b>Batteries</b>	Four (4) AA
	<b>Battery Life</b>	175 to 200 hours
	<b>Low V Warning</b>	~1.7VDC
	<b>Low V Shutdown</b>	1.6VDC
	<b>Auto-shutdown</b>	15 min. of button inactivity
<b>Environment</b>	<b>Operating Temp</b>	-20°C to 55°C (-4°F to 131°F)
	<b>Storage Temp</b>	-40°C to 55°C (-40°F to 131°F)
	<b>Humidity</b>	0 to 100%
<b>Radio</b>	<b>License</b>	License free
	<b>Modulation</b>	DSSS
	<b>Antenna</b>	Internal
	<b>DO-918 Freq.</b>	906-924MHz
	<b>900MHz RF Power</b>	1mW
	<b>DO-218 Freq.</b>	2405-2480MHz
	<b>2.4GHz RF Power</b>	2mW
<b>Enclosure</b>	<b>Dimensions</b>	9 1/8" x 3 1/8" x 1 1/4" (231.8 mm x 79.4 mm x 31.8mm)
	<b>Total Weight</b>	15.2 oz. (430.9 gr.)
	<b>Durability</b>	High impact polymer case Polycarbonate faceplate Stainless steel faceplate
<b>Indicators (4)</b>	<b>LEDs</b>	
	<b>TX (Green LED 1)</b>	Blinking – transmitting, no switch active Solid – button press, switch active
	<b>RX (Amber LED 2)</b>	Blinking – receiving, no output of interest active Solid – base unit output of interest active 1 sec pulses – low battery indication
	<b>LED 3 (Red)</b>	Used for Association Pulses for 30 sec. – low voltage auto-shutdown indication
<b>Pushbuttons</b>	<b>Green/White</b>	ON/OFF toggle
	<b>1 through 16</b>	Function, output control
	<b>17</b>	Optional through custom Cervis Engineering
	<b>Style</b>	Latching or Momentary
	<b>Button Life</b>	5-million operations (typical)

**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 being used.*

*Be aware that even if the diagnostic LEDs 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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