



PG-914, PG-214 Pistol-Grip Remote Control User Manual

**U045.5-SmaRT_PG-X14_HH
March 2013**

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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

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 pistol-grip remote controllers.

SmaRT Remote Control System

SmaRT system consisting of one or more SmaRT base units and from one to eight SmaRT remote control units. The system operates in the 900MHz or 2.4GHz range and has inputs/outputs or data communications.

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

Note to the Manual User

✓ **Note:** The standard SmaRT pistol grip is available to operate at 900MHz or 2.4GHz using Direct Sequence Spread Spectrum (DSSS) wireless technology. To avoid repetition and possible confusion, the pistol-grip remote control unit will be referred to as the PG-X14 remote throughout this document where X represents either 900MHz as 9—for PG-914, or 2.4GHz as 2—for PG-214.

Similarly, SmaRT base units will also be referred to using an X in the base unit name to represent both 900MHz and 2.4GHz broadcast frequencies.

Related Documents

System related Cervis, Inc. Engineered System Approval document.

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

1.0 Safety Instructions

CAUTION



These instructions **must** be read carefully in order to use the SmaRT PG-X14 properly, to keep it in safe working condition, and to reduce the risks of misuse.

Do not use the system in potentially explosive atmospheres.

Any use other than that specified in this manual is **DANGEROUS**.

Strict adherence to the following instructions is a **MUST**.

✓ **Note:** To comply with FCC RF exposure compliance requirements, this device and its antenna must not be co-located or operating in conjunction with any other antenna or transmitter.

CAUTION



Certain adjustments may need to be made while the controlled machinery is active. All personnel must be at a safe distance from the machine during these adjustments to avoid risk of injury or accidental death.

1.1 What You MUST Do

- **Strictly adhere** to system installation instructions.
- Make sure that professional and competent personnel carry out the installation.
- Make sure that all site and prevailing safety regulations are fully followed.
- Make sure that this manual is **permanently available** to the operator and maintenance personnel.
- Keep the transmitter out of reach of **unauthorized personnel**.
- At the beginning of each work day, check to make sure that the **Stop button** and other safety measures are working.
- When in doubt, press the **Stop button**.
- Whenever several systems have been installed, make sure the transmitter you are about to use is the right one. **Identify** the machine controlled by the transmitter on the transmitter label (customer supplied).
- An **audible or visual warning device** indicating the machine is electrically active and that the transmitter has control should be installed on the machine.
- **Service** the equipment periodically.
- When carrying out repairs, only use parts supplied by Cervis dealers.

1.2 What You MUST NOT Do

- **Never** make changes to the system that have not been studied and approved by Cervis.
- **Never** power the equipment with anything other than with the specified power supply.
- **Never** allow unqualified personnel to operate the equipment.
- **Never** leave the equipment **ON** after use. Always use or the **Stop Button** to avoid accidental movements.
- **Never** use the system when visibility is limited.
- **Never** abuse the transmitter. Avoid dropping.
- **Never** use the system if failure is detected.

2.0 SmaRT PG-X14 Remote Control System

A standard SmaRT PG-X14 remote control system consists of a SmaRT PG-X14 pistol-grip remote control unit and one or more SmaRT base units. The system is capable of communicating in congested radio environments using Direct Sequence Spread Spectrum (DSSS) wireless technology at 900MHz or at 2.4GHz.

The communication link between the pistol-grip remote control and the base unit is established at the factory using a process known as Association. Situations in the field may arise where it becomes necessary to reestablish the system communications link. The wireless system can be seamlessly associated in the field without the need to open the enclosures of either unit by a series of switch operations which is detailed later in this manual.

SmaRT base units come in a variety of standard configurations for 900MHz or 2.4GHz operation among which are:

- BU-906F or BU-206F (six FET input/outputs)
- BU-916F or BU-216F (sixteen FET input/outputs)
- BU-906R or BU-206R (six solid state normally open/normally closed relays)

SmaRT base units can be standard or custom configured by Cervix Engineering.



Figure 1. Standard SmaRT X14 System Pistol-Grip Remote and Base Unit

3.0 SmaRT X14 Pistol-Grip Remote Control

The SmaRT™ PG-X14 pistol-grip remote is designed for traditional and non-traditional mobile applications. The PG-X14 is capable of activating digital and trigger-controlled proportional pulse-width-modulated outputs of SmaRT base units. The PG-X14 Pistol-Grip Remote provides single-handed operation in a comfortable ergonomic layout.

Using direct sequence spread spectrum (DSSS) wireless technology at 900MHz or 2.4GHz, the SmaRT Pistol-Grip Remote provides a robust link with a receiver in congested radio environments.

The SmaRT PG-X14 pistol-grip remote features seamless association to a SmaRT base unit without the need to open the case of either unit. The rugged weatherproof pistol-grip enclosure allows the unit to operate worry free in harsh weather conditions.



Figure 2. SmaRT PG-X14 Pistol-Grip Remote Control

3.1 Features

- 900MHz or 2.4GHz Direct Spread Spectrum Technology
- Controls a variety of SmaRT base units
- Controls accessible while wearing gloves
- Oversized Machine Stop button
- Seven three position, bi-direction toggle switches
- Four diagnostic LEDs
- Comfortable weatherproof pistol-grip design
- Umbilical connection capable option
- Magnet-embedded handle (attach to machine surfaces to avoid loss)
- Powered by four AA batteries (+3.0VDC nominal)

4.0 SmaRT PG-X14 Pistol-Grip Battery Installation

This SmaRT handheld unit is powered by four size AA batteries. When installing batteries, be sure to observe proper polarity as marked on the inside of the compartment to avoid damaging the unit. To replace or install batteries in the handheld:

1. Loosen the four Phillips battery compartment cover screws on the rear of the remote and lift the cover from the handheld.
2. Install (or replace with) four (4) fresh size AA batteries. Observe the proper polarity by positioning the batteries as shown in Figure 3.
3. Replace the compartment cover and tighten the four Phillips screws. These screws should not be over-tightened, *but they must be tight enough to insure the gasket provides a proper seal.*

CAUTION



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

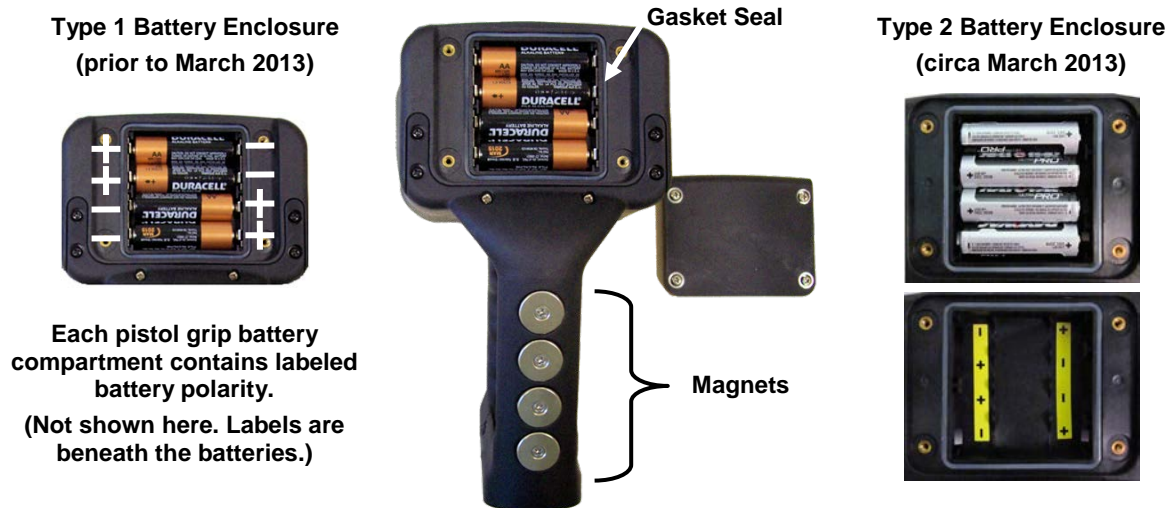


Figure 3. SmaRT PG-X14 Pistol-Grip Battery Installation

✓ **Note:** Cover screws must be tightened enough to insure the sealing gasket is compressed. Do not over-tighten the screws.

5.0 Operation

5.1 Turn ON the Unit

The SmaRT PG-X14 Pistol-Grip Remote is powered **ON** releasing the large Red mushroom-style button by twisting clockwise until it springs UP, and then activating a toggle switch. Prior to activation of the toggle switch, the unit is not transmitting or receiving.

✓ **Note:** *Power to the handheld is available when the mushroom-style Machine Stop button is twisted clockwise until it springs UP, but the transceiver is not yet enabled. The unit does not transmit or receive until the unit transceiver is enabled.*

The unit transceiver is enabled by initial operation of any of the toggle switches (either UP or DOWN) following the release of the Stop button. Initial operation of a toggle switch following power-up of the handheld does not send a command to the base unit.

✓ **Note:** *If a switch is held prior to release of the Stop button (turning ON the remote), the red ERR LED begins to flash.*

5.2 Enable the Transceiver

The transceiver is enabled upon the initial operation of any of the toggle switches after the unit is turned ON.

5.3 Turn OFF the Unit

The SmaRT PG-X14 Pistol-Grip Remote is turned **OFF** by pushing the large Red mushroom-style button **IN** or by allowing the unit to “time out”.

CAUTION



A stuck switch is indicated if the remote Stop button is depressed and the red ERR LED lights and remains lit. Check all switches before use. If the LED remains lit, the remote will need to be serviced before it can be safely used. Contact Cervis Support at (724) 741-9000.

5.4 Proportional Control Trigger

The SmaRT PG-X14 spring-loaded trigger is used to control a digital output or for proportional output control.

5.5 Toggle Switches SW1 through SW7

Toggle switches SW1 through SW7 (see Figure 5) are 3-position, return-to-center; Up or Down with a return to center detent. These switches are used for digital control and for various setup and adjustment functions described later in this manual.

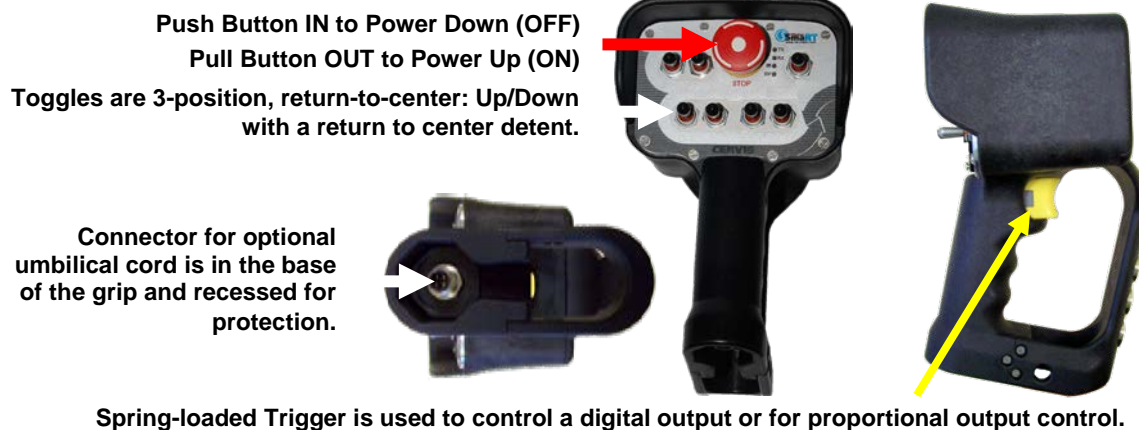


Figure 4. Button, Switch, and Trigger Operation

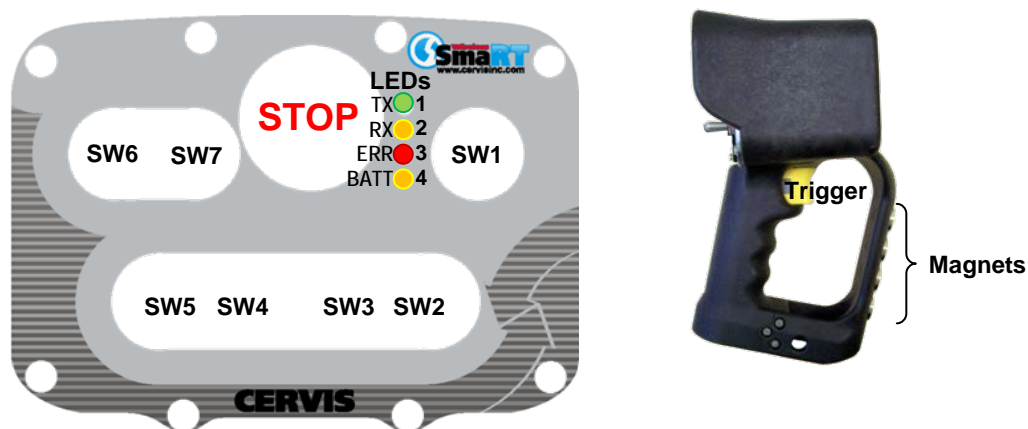


Figure 5. SmaRT PG-X14 Pistol-Grip Button, Switch, LED, and Trigger Layout

5.6 Standard LED Indications

Table 1. Standard LED Indications

LED	Action	Indication
TX Transmit – Green LED 1	Steady lit	Switch active
	Blink	Transmitting
RX Receive – Amber LED 2	Blink	Receiving
ERR Error – Red LED 3	Steady lit when Stop is pushed in or released	Stuck switch, contact Cervis Support
	Flashing while Stop is released (unit turned on)	Switch conflict; switch is being held by the user
BATT Battery – Amber LED 4	Blink	Intensity is relative to battery voltage when an a single active switch is operated. Bright – Full battery Dim – Less full battery
	Cycle on/off	Change batteries

6.0 Associate Mode

The Associate Mode is used to establish the communications link between the pistol-grip remote and base unit. The X14 Pistol-Grip remote allows association to a base unit. To associate there must be a clear line of sight between the handheld remote and the base unit, and both units must be OFF (powered down). The X14 Pistol-Grip is immediately turned off by pushing in the oversized mushroom STOP button, which removes power from the unit. The pistol-grip can also turn off if the auto-shutdown time limit is exceeded. A 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.

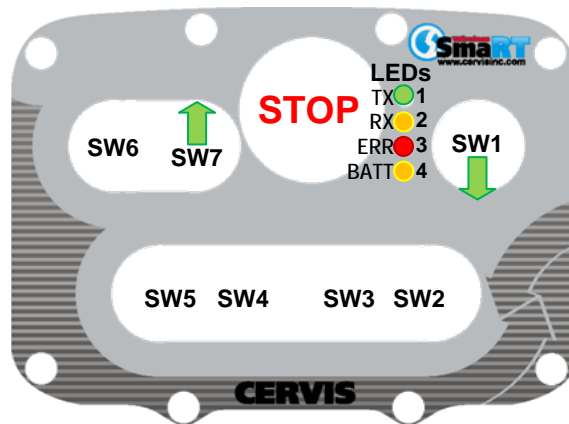


Figure 6. Associate Mode Switches

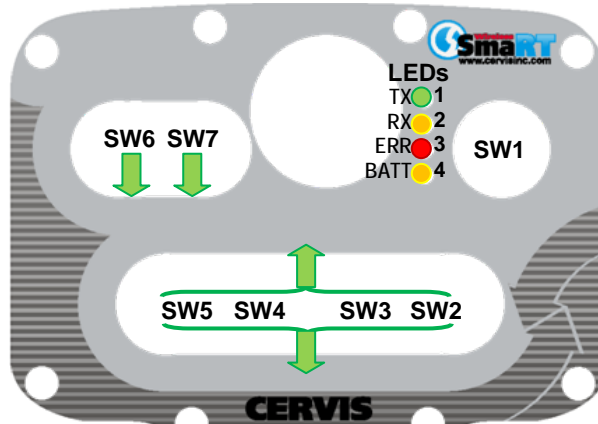
1. Stand near to the base unit with the PG-X14. Make sure the remote **STOP** button is depressed.
2. Remove **power** from the base unit.
3. Release the depressed STOP button by pulling it **OUT**. This powers the PG-X14.
4. Push and hold **SW7 UP** (Associate position) and then immediately push and hold **SW1 DOWN**. Both switches must be held in these positions for the entire time it takes to Associate—establish the communications link—between the handheld and base unit.
5. Watch the LEDs. Associate Mode is indicated when all four handheld LEDs illuminate for approximately **two (2) seconds**.
6. After the initial 2-seconds, **LED2** and **LED4** momentarily deactivate. LED 4 then lights solid. During this time **LED1** and **LED3** remain lit. Time to connect power to the base unit is indicated when LEDs 1, 3, and 4 light solid.
7. Apply power to the base unit.
8. Successful Association (link established) is indicated when all four handheld LEDs light again for approximately two (2) seconds. LEDs 1 (TX) and 2 (RX) then begin to flash indicating that communications between the PG-X14 and base unit are established.

7.0 Proportional Output Adjust Mode

Proportional Output Adjust Mode allows adjustment of the proportional output deadband and gain settings as well as selection of the desired trigger response curve.

7.1 Deadband Adjust

Deadband may vary from machine to machine. Deadband Adjust allows field adjustment of the level of output that the base unit will immediately jump to upon actuation of the trigger.



Any one mode switch SW2 through SW5 can be held, UP or DOWN, to enter Deadband Adjust Mode

Figure 7. Proportional Adjust Mode

To enter the Proportional Output Adjust Mode



The controlled machinery is active for this adjustment. All personal must be at a safe distance from the machine during these adjustments to avoid risk of injury or accidental death.

1. Make sure that the PG-X14 remote is active (TX LED will be flashing).
2. Release the trigger and hold **SW6** and **SW7** pushed **Down** along with any **one** of the mode switches (**SW2**, **SW3**, **SW4**, or **SW5**) held either **Up** or **Down** at the same time. In approximately four (4) seconds, the system will enter Proportional Output Adjust Mode. Proportional Output Adjust Mode is indicated on the handheld by slow, in-synch blinking of **LED3** and **LED4**. **LED1** will be steady-lit as it lights for any switch action.
3. Once in Proportional Output Adjust Mode, release SW6 and SW7, but continue to hold the chosen mode switch (**SW2**, **SW3**, **SW4**, or **SW5**).
4. Operate the trigger slowly until the machine just begins to operate.
5. Push **SW7 Down** again (this is the **STORE** position) while holding the trigger steady at the desired signal. Continue to hold **SW7 Down** until all four LEDs flash for approximately one (1) second. The trigger signal in effect at the time SW7 is held down will be written into the EEPROM non-volatile memory.

The Deadband Adjust Mode will be exited anytime the selected mode switch (**SW2**, **SW3**, **SW4**, or **SW5**) is released.

Once the deadband is set, the base unit will immediately jump to the stored PWM signal value as soon as the trigger is pressed. Proportional control will vary from this point to maximum output as the trigger is operated.

7.2 Gain Adjust

CAUTION



Unexpected movement of the controlled machinery can occur if power is not removed from it or the base unit. All personal must be at a safe distance from the machine during these adjustments to avoid risk of injury or accidental death.

The proportional outputs maximum setting can be adjusted between 56% and 100% while in the Proportional Output Adjust Mode. Adjustments are made in 0.4% increments or decrements. Each UP movement of SW1 from center increases the signal by 0.4%. Each DOWN movement of SW1 from center decreases the signal by 0.4% .

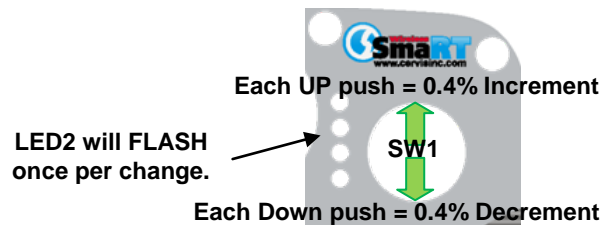


Figure 8. Gain Adjustment

LED2 will flash each time the signal is incremented or decremented. It will stop flashing when either the maximum Gain setting of 100% or the minimum Gain signal setting of 56% is reached.

To Adjust the Gain Setting

1. Turn the handheld remote **ON**.
2. Enter **Proportional Output Adjust Mode** by **holding SW6** and **SW7 DOWN**, and any one switch from switches **SW2** through **SW5** in the **UP** or **Down** position for approximately 4 seconds. After 4 seconds, **Proportional Output Adjust Mode** is indicated by slow, in synch blinking of the **LED3** and **LED4**. **LED1** will be steady-lit as it lights for any switch action.
3. Once the handheld is in Proportional Output Adjust Mode, continue to **hold the single switch chosen from SW2 through SW5 either UP or Down**, but **release SW6** and **SW7**.
4. To increase the output signal, push **SW1 UP** as shown in Figure 8. **LED2** will flash indicating a **+0.4%** change. Each subsequent push of SW1 from center-set position UP results in a +0.4% change and a flash of the LED2 until the maximum limit of a 100% output signal is reached. The LED2 will not flash once 100% limit is obtained.
5. To decrease the output signal, push **SW1 DOWN** as shown in Figure 8. **LED2** will flash indicating a change of **- 0.4%**. Each subsequent down push of SW1 from center position results in a - 0.4% change and a flash of LED2 until the minimum 56% output lower limit is reached. LED2 will not flash once the 56% limit is obtained.
6. Once the desired output signal is achieved, move **SW7 Down**. This stores the Maximum Output value to the EEPROM non-volatile memory.
7. Release both SW7 and the chosen mode switch.

7.3 Trigger Response Curve Options

The three different trigger response curves shown in Figure 9 are available for use. Curve 1 (default) is a linear curve. Curve 2 suppresses the command in the initial (Low End) regions of trigger movement and then emphasizes the command toward the end of the trigger movement. Curve 3 is similar to Curve 2, except its Low End skew is more substantial.

The default Trigger Curve is Curve 1, but the current curve type can be changed by using **SW6** in the **DOWN** position (UP is not used) *while in Proportional Output Adjust Mode*. Each time that SW6 is pushed to the DOWN position and held there for approximately five (5) seconds, the curve changes from its current setting to the subsequent curve setting. For instance, Curve 1 to Curve 2; Curve 2 to Curve 3; Curve 3 to Curve 1; etc.

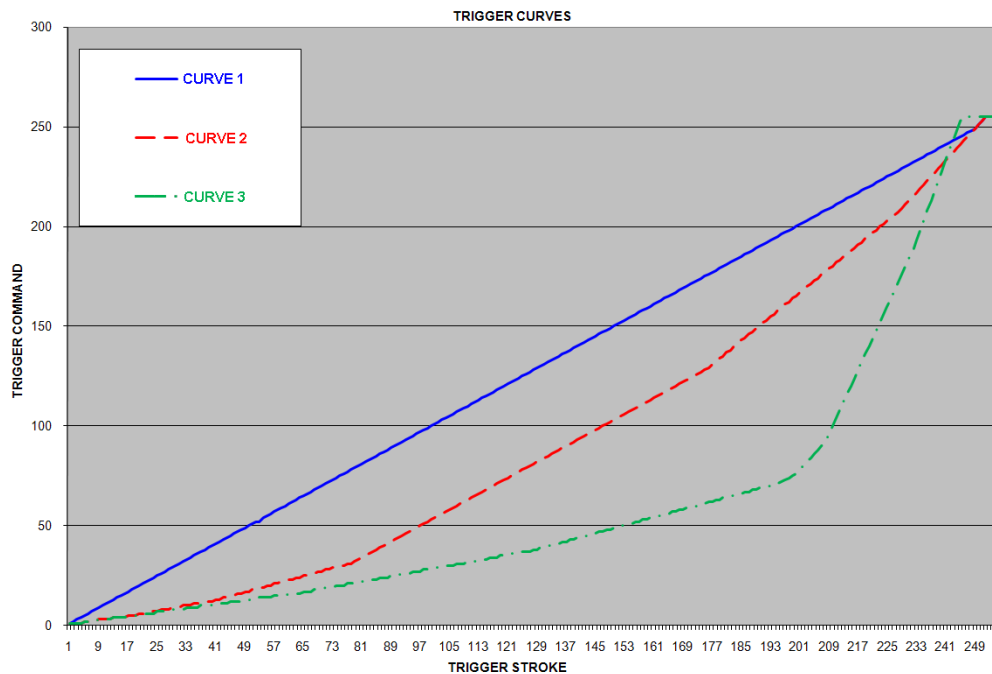


Figure 9. Trigger Response Curves

7.3.1 To Select or Change the Trigger Response Curve

Enter Proportional Output Adjust Mode

1. Make sure that the PG-X14 remote is activated (LED1 will be flashing).
2. Release the trigger and hold **SW6** and **SW7** pushed **Down** along with any **one** switch chosen from **SW2**, **SW3**, **SW4**, or **SW5** held either **Up** or **Down** at the same time. In approximately four (4) seconds, the system will enter Proportional Output Adjust Mode. Proportional Output Adjust Mode is indicated on the handheld by slow, in-synch blinking of **LED3** and **LED4**. **LED1** will be steady-lit as it lights for any switch action.
3. Once in Proportional Output Adjust Mode, continue to hold the chosen switch (**SW2**, **SW3**, **SW4**, or **SW5**), but *release* SW6 and SW7.
4. Push **SW6 DOWN** and hold it there for approximately **five (5) seconds**. All four LEDs will flash at $\frac{1}{2}$ **second intervals** for the first 5 seconds indicating the current curve type (see below), and then when the curve type changes the LEDs pulse to that of the next curve type. See 7.3.2 below for Trigger Curve Identification.

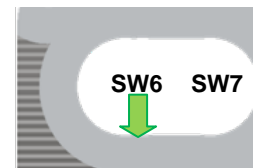


Figure 10. Change Trigger Response Curve

✓ **Note:** Curve type change will occur once per 5-second Down-hold position of SW6. To change to the next curve type, SW6 must be released and then pushed into the DOWN position again while in the adjustment mode.

7.3.2 Trigger Curve Identification

The current curve type can be determined without changing the curve type *while in the Proportional Output Adjust Mode* by pushing **SW6 DOWN** and holding for less than 5 seconds while watching the LED pulse responses. Three of the four LEDs will simultaneously flash at a $\frac{1}{2}$ second pulse rate while one LED is off. The LED that is **not** illuminated during the check indicates the current curve setting. If SW6 is held down for 5-seconds or longer, the Curve Type changes to the next type (from Curve 1 to Curve 2, etc.).

The LED curve patterns shown while holding **SW6** in the **DOWN** position are:

Curve 1 (Linear; default)

LED1, LED2, and LED3 simultaneously pulse; LED4 is out.

Curve 2 (Moderate Low End Skew)

LEDs 1, LED2, and LED4 simultaneously pulse; LED3 is out.

Curve 3 (Substantial Low End Skew)

LEDs 1, LED3, and LED4 simultaneously pulse; LED2 is out.

When changing the curve, the current curve pattern is indicated by the LED pulses for the first 5 seconds, and then the pattern changes when the new curve change takes place.

8.0 Specifications

Table 2. SmaRT PG-X14 Pistol-Grip Remote Specifications

Item	Description	
Power	V_{in}	+1.6V to +3.2VDC
	Batteries	Four (4) AA
	Battery Life	175 to 200 hours
	Low V Shutdown	1.6VDC
	Auto-shutdown	30 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 @ 1mW 2405-2480MHz @ 4.3mW
	RF Signal	1mW (PG-914) 4.3mW (PG-214)
	License	License free
	Modulation	DSSS
	Antenna	Internal
Enclosure	Dimensions	mm: 230.6x133.9x146.9 inch: 9.1 x 5.3 x 5.8
	Total Weight	3lbs
	Durability	High Impact Polymer case
	Faceplate	Aluminum or Polycarbonate
Indicators (4)	LED	Determined by Application
Control Switches	Toggle	Seven 3-position, center-detent push-to-operate or latch toggle switches
	Trigger	Proportional controller
	Mushroom	Oversized Machine-Stop

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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