Safe Remote Control

Rugged Remote Control System with Six Analog Axes, Eight Programmable Buttons, Status LCD, Emergency Stop, and Simple Integration Interface

FORT's Safe Remote Control is a medium to long-range wireless controller designed from the ground up to enable the safe operation of remote and automated systems. It provides a rugged, ergonomic, and easy to understand controller with a flexible receiver that both implement FORT's proprietary SafetySense™ technolog y to ensure both consistent and reliable control.

1. Applications

- Control of remote, tele-operated, semi- or fully autonomous robotic systems where safety and usability are critical.
- Monitoring of fixed or mobile industrial systems requiring sophisticated control and reliable wireless emergency stop capabilities.
- Pan & tilt controls for security and surveillance.

2. Key Features (Safe Remote Control – SRC)

- SafetySense™ Secure wireless communications with AES128 encryption and range of 1000+ ft
  - Frequency bands include 900 MHz, 2.4 GHz (other bands available)
  - AES256 encryption available upon request
- Direct USB interface for easy integration into existing systems
  - Support for USB HID and FORT proprietary interface
- Six fully proportional analog control axes using hall effect, non-contact controls for rugged and reliable performance
- Very low-latency control response (< 40ms)
- Guaranteed low latency emergency stop response (250ms absolute worst case)
- Eight programmable buttons
- SafetySense™ Active User Sensing for enhanced operator safety
  - Free-fall/drop detection
  - Orientation detection
  - Idle controller detection – automatic pause for unattended controls
- Sunlight-readable graphic LCD display
- Dual vibration functions for non-visual directional feedback
- 1000+ unique system addresses

- 12 hour battery life for continuous use
- Independent pause (graceful stop) and emergency stop (immediate stop) modes
- Flexible USB charging interface
- Protocol enforced remote takeover sequence to prevent accidental control of remote or non-line-of-sight systems
- Real-time status display as well as extensive system information display in menu
- USB/Serial configuration options for programmable systems
- RP-SMA antenna connector
- IP67 (NEMA 4X) rated enclosure
- Designed to meet MIL-STD-810 for ruggedness
- -20°C to 60°C operation
- Dual lanyard attachments for flexible harnessing options

3. SafetySense™ Technology

SafetySense™ Technology consists of major system-level technologies that work together to provide the integrator the ability to design systems with consistent and reliable remote operations.

The Safe Remote Control constantly monitors its motion and orientation to determine if the controls are in a safe operating state. The system will be put into a safe state (Pause) if the remote detects free-fall (e.g. remote is dropped), orientation faults (e.g. remote is moved to the user's side), or a lack of motion (e.g. user places the remote on a table). This active detection eliminates the need for traditional operator safety mechanisms such as dead-man switches, which are often defeated by the user.

While the system is constantly monitoring its health, the remote also provides the operator with the ability to intervene. The SRC has a dedicated emergency stop button, which causes the receiver to indicate an emergency stop in a maximum of 250ms (absolute worst case). This, along with wired emergency stop buttons, gives the system designer significant flexibility in implementation of a safety system.

4. Specifications (Safe Remote Control – SRC)

The Safe Remote Control (SRC) is game-style remote robotic controller that delivers superior ergonomics, unparalleled safety, and flexible controls in a ruggedized and reliable package. It combines active emergency stop reporting with passive fault detection to ensure that the SRCS prevents all unintended motion.

4.1. Specifications

Parameter	Minimum	Typical	Maximum	Unit
Operating Temperature	-20		+60	°C
Charging Voltage	4.5	5	5.5	V
Charging Current			1.5	A
Battery Life		12		Hours
Ingress Protection	IP67 (NEMA 4X)			
Ruggedness	Designed to meet MIL-STD-810			

Weight		1.1		lbs
Radio Connector		RP-SMA		
Charging/Programming Connector		Lemo 4P -> USB		
RF Transmit Power* (900MHz)			140	mW
RF Transmit Power* (2.4GHz)			100	mW
RF Receive Sensitivity*	-101			dBm
RF Spread Spectrum*		FHSS		
Data Security*		AES 128		optional
**Wireless version only*				

Table 1 - Safe Remote Control Specifications

4.2. Control Layout

The SRC offers a wide varity of control options that are available to the system integrator. The basic control layout is shown below for the standard system with two thumbsticks, two fingersticks, and 8 digital buttons.

Figure 1 - SRC-001 Control Locations

Parameter	Minimum	Typical	Maximum	Unit
Thumb/finger stick precision		+/- 256		Counts
Thumb/finger stick endurance	10^6 (all directions)			Cycles
Button Endurance	10^6			Cycles

Table 2 - SRC Control Specifications

4.3. User Sensing

One of the most powerful features of the SRC are its motion and orientation sensors. This implementation of FORT's SafetySense™ technologies eliminates the need for traditional user safety systems such as large control guards and deadman switches.

The SRC senses both its movement and orientation in three dimensions at a rate of 100 Hz. The following table describes the default limits and conditions sensed:

Condition	Limit	Description
Drop/Freefall	2 ft	Detects a drop of the SRC
Orientation	20 degrees beyond vertical	Detects rotation of the SRC beyond vertical in any direction
No Controller Activity	60 seconds without activity or detectable motion	Detects an idle controller. This prevents the possibility of unintentional control input on an unattended controller if it has not been used for a specific amount of time. This value is adjustable from the SRC Menu.

Table 3 - SRC Active User Sensing Description and Limits

All of these conditions result in the SRCS entering the “Pause” state. This is typically implemented as a controlled stop, versus an emergency stop. All parameters of these features are available for factory customization.

4.4. Mechanical

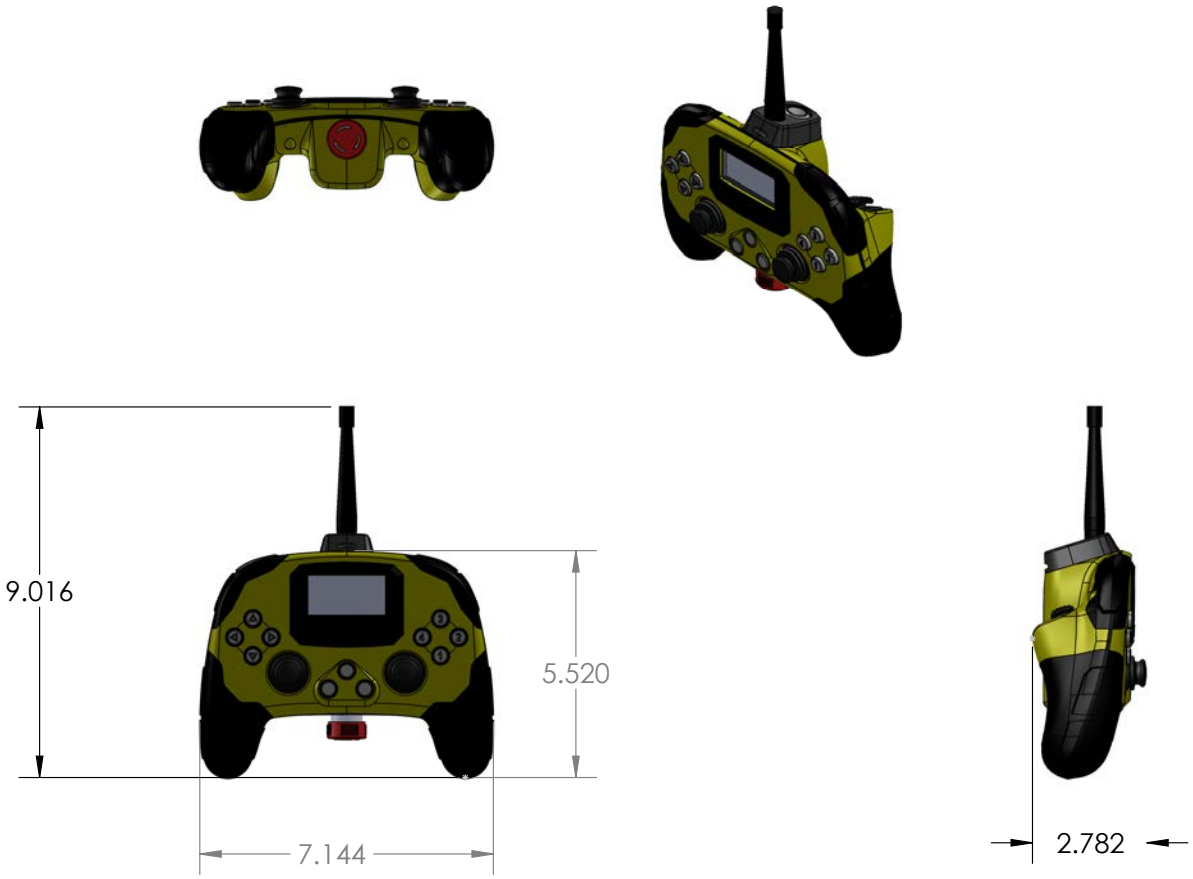

Figure 2 - SRC Mechanical Drawing

5. Installation

5.1. SRC Wireless Integration

The wireless version of the SRC is designed to be paired with any of FORT's Vehicle Safety Controllers (VSC) . The VSC receiver functions primarily as a bridge between the remote and the integrator's control computer. An example of this type of integration is shown below.

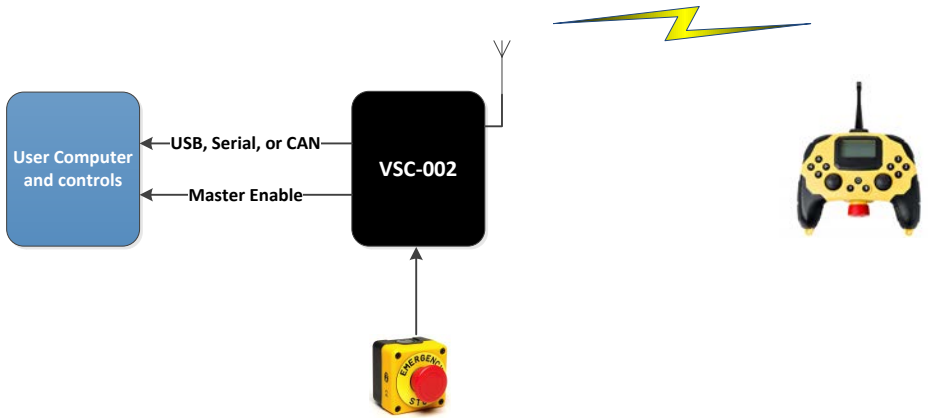

Figure 3 - Simple Receiver Integration

Integrating the SRCS as a safety-enabled remote control is the simplest way to achieve remote control capabilities. This configuration enables the user control computer with full access to all functions available on the SRC as well as its operator sensing safety features, both wireless (on the SRC) and wired emergency stops, and hardware and software monitoring of critical communications. Because the VSC does not have direct control over the drive and control system, this configuration relies on the User Computer to ensure that the system is put into a safe state whenever a stop condition is indicated by the VSC (either through a data interface or directly with the Master Enable signal). This integration option is best for cases where the SRCS is being added to an existing system where minimal changes are a design goal.

5.2. SRC Wired Integration

The wireless version of the SRC is designed to be directly connected to the integrator's control computer. All command and control communication over the USB interface is available in two options, the first is a USB HID Game Controller device, and the second is in the FORT Packet Protocol as described in the SRCS User's Manual. When using the HID Game Controller, the device is implemented as a USB HID device. On most operating systems it will show up as a standard Game Controller device and can be used the same as any off-the-shelf USB game controller including a Logitech or XBox Controller. When using the FORT Packet Protocol over the USB interface, the device is implemented as a CDC device. On most operating systems it will show up as a serial port (*/dev/tty.usbserial*, */dev/ttyACM0*, etc). An example C application is provided that uses the FORT Packet Protocol to communicate with the SRCS over a serial device.

6. Ordering Information

Part Number	Description
SRC-001-(F)-(C)	Wireless Safe Remote Control including case and charging cable (F) = Radio Selection 900 : 900MHz FHSS AES128 140mW max 240 : 2.4GHz FHSS AES128 100mW max ** Inquire about other frequency bands (C) = Color code (body color/overmould color) T : Tan/Black Y : Yellow/Black **Other colors available. Contact for details**
SRC-001-000-(C)-(I)	Wired Safe Remote Control including case and charging cable (C) = Color code (body color/overmould color) T : Tan/Black Y : Yellow/Black **Other colors available. Contact for details** (I) – Interface Selection HID: USB HID Device FORT: USB CDC Device (FORT packet protocol)
RIC-001	USB charging/programming cable for SRC

Table 4 - SRC Orderable Part Numbers

7. Limited Warranty

All products sold by Humanistic Robotics, Inc are subject to the warranty provisions of the Humanistic Robotics Order Confirmation terms and conditions and are warranted against defects in material and workmanship for a period of one (1) year from the date of shipment. If you believe any Humanistic Robotics, Inc product you have purchased has a defect in material or workmanship or has failed during normal use within the warranty period, please contact Humanistic Robotics, Inc for assistance. If product repair or replacement is necessary, the Customer will be solely responsible for all shipping charges, freight, insurance and proper packaging to prevent breakage in transit, whether or not the product is covered by this warranty.

This warranty does not apply to defects resulting from any Customer actions, such as mishandling, improper interfacing, operation outside of design limits, misapplication, improper repair, or unauthorized modification. No other warranties are expressed or implied. Humanistic Robotics, Inc specifically disclaims any implied warranties of merchantability or fitness for a specific purpose and all warranties arising from course of dealing and/or trade usage. Humanistic Robotics, Inc.'s liability shall be limited to the actual purchase price of any defective unit or units of equipment to which a claim is made, and shall in no event include the Customer's manufacturing costs, lost profits or goodwill, or any other direct, indirect, special, incidental, consequential or punitive damages whether based on contract, tort or other legal theory. Humanistic Robotics, Inc shall not be liable for normal manufacturing defects or customary variances from specifications.

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8. Revision History

Version	Date	Changes
-01	4/10/14	Initial Release