



SAFESTOP™ ES-200 WIRELESS EMERGENCY STOP

USER MANUAL



SAFESTOP™ TRANSMITTER



SAFESTOP™ RECEIVER

2200 Kraft Drive, Suite 1325
Blacksburg, VA 24060
(540) 443-9262
www.torcotech.com

Upon receiving your SafeStop™ system, please verify the information below with the numbers printed on the transmitter and receiver. This information will assist TORC Technologies in the support of your SafeStop™ system should you ever need assistance.

Transmitter Model Number: _____

Transmitter Serial Number: _____

Receiver Model Number: _____

Receiver Serial Number: _____

System ID / Key: _____

Date of Purchase: _____

Channel Number: _____

Timeout Action: _____

NOTE: Channel Number and Timeout Action can be changed by TORC Technologies upon request.

For technical assistance and repairs, please use the following contact information:

TORC Technologies
2200 Kraft Dr, Ste 1325
Blacksburg, VA 24060
540-443-9262
www.torcotech.com

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All information contained in this manual is believed to be accurate at the time of printing, however, TORC Technologies, LLC reserves the right to make modifications to the specifications and operation of this product without obligation to notify any person or entity of such revision.

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1 ASSIGNMENT OF LIABILITY

TORC Technologies, LLC does not assume any responsibility for the safe operation of any vehicle, machinery, or related equipment connected to the SafeStop™ system. This product has been tested for proper functionality and safe operation, however, it is the responsibility of the consumer to ensure the safe operation and testing of all connected components.

By using the SafeStop™ system, the customer agrees to accept full responsibility and legal liability for any systems connected to the device, and to indemnify, defend and hold harmless TORC Technologies, LLC from all associated legal liability and recourse.

Each operator should read the entire user manual prior to using the device. Failure to read, understand, and strictly follow these instructions could result in serious personal injury and/or property damage.

2 GENERAL SAFETY INFORMATION

The following symbols are used throughout the user manual to indicate a particularly hazardous condition.



WARNING: Indicates a hazardous condition that could result in serious injury or loss of life if not performed properly.



CAUTION: Indicates a hazardous condition or procedure that could result in damage to this product, or loss related to equipment malfunction.

Use Redundant Safety Measures

This product is not intended to be used as the only safety stop device. It is the user's responsibility to ensure that adequate and redundant safety measures are implemented for the system that this product is used in.

Use Proper Supplied Accessories

To prevent damage to the product, use only the recommended accessories, including power adapters, antennas, and cables.

Observe All Connector Ratings

To avoid shock hazard and/or damage to the product, do not exceed any voltage or current specifications on any of the connectors.

Do Not Charge Unattended

To avoid fire hazard and/or damage to the product, monitor the SafeStop™ transmitter when connected to an external power supply.

Do Not Operate With Suspected Failures

If you suspect there is damage to the product, contact TORC Technologies to have it inspected before further use.

Do Not Modify or Disassemble

To avoid shock hazard and/or damage to the product, do not attempt to open the case, make modifications, or repair the device. Opening, modifying or repairing this device will void any applicable warranty and could prevent the device from operating properly.

Do Not Operate in Wet/Damp Conditions

To avoid shock hazard and/or product malfunction, do not operate in a wet or damp environment.

Do Not Operate in Explosive Atmosphere

To avoid a fire hazard, do not operate in an explosive atmosphere, such as in the presence of flammable liquids or gases.

Use Within Range

To prevent unreliable operation, do not use this product outside of its specified range. A range check should be performed at the before using the SafeStop™ system.

Maintain Minimum Separation Distance

To prevent receiver overload (possibly causing loss of link), and to ensure operator safety, maintain a minimum operating distance of 10 feet between the antennas of the SafeStop™ system.

3 PACKAGE CONTENTS

After unpacking the contents of the SafeStop™ ES-200 System, please verify the contents of the package includes the following items:

- | | |
|----------------------------------|---|
| <input type="checkbox"/> ES-200T | SafeStop™ Transmitter unit |
| <input type="checkbox"/> ES-200R | SafeStop™ Receiver unit |
| <input type="checkbox"/> ESA-001 | Rubber Duck Antenna for ES-200T Transmitter |
| <input type="checkbox"/> ESA-002 | AC Power Adapter/Charger for ES-200T Transmitter |
| <input type="checkbox"/> ESA-003 | Automotive Power Adapter/Charger for ES-200T Transmitter |
| <input type="checkbox"/> ESA-004 | Antenna for ES-200R Receiver w/Magnetic Mount and 6' Cable |
| <input type="checkbox"/> ESA-005 | 6' Power and Serial Cable for ES-200R Receiver (Red/Black/Serial) |
| <input type="checkbox"/> ESA-006 | 6' Relay Cable for ES-200R Receiver (Yellow/Blue/White/Green) |



SafeStop™ Transmitter
(rubber duck antenna installed)



SafeStop™ Receiver



Transmitter Rubber Duck Antenna
ESA-001



AC Power Adapter
ESA-002



Automotive Power Adapter
ESA-003



Receiver Magnetic Mount Antenna
ESA-004



Receiver Power and Serial Cable
ESA-005



Receiver Relay Cable
ESA-006

4 SAFESTOP™ SYSTEM OVERVIEW

The SafeStop™ ES-200 multi-level wireless emergency stop system consists of the ES-200T transmitter and the ES-200R receiver. The SafeStop™ system provides the ability to safely disable an unmanned or autonomous vehicle from a remote location up to 6 miles away. The compact lightweight transmitter contains an internal rechargeable battery that allows the SafeStop™ system to operate up to 30 hours on a single charge. Two independently controlled contacts allow a vehicle to be placed in a paused state as well as disable power to actuators, fuel valves, etc. An audible alarm and indicator lights provide user feedback of contact position, link status, and battery life. Additionally, a serial port is provided for interfacing to an onboard computer, and a bypass switch allows for manual override of the system.

Upon detecting a lost link, the ES-200R can be programmed by TORC Technologies, LLC to either activate the Pause contact, or both the Pause and Stop contacts. This functionality can only be changed by TORC Technologies, LLC and should be specified at the time of order.

5 SAFESTOP™ SYSTEM SPECIFICATIONS

Performance

Operating Distance: 6 mi. (line-of-sight)
Update Rate: 25 Hz

Wireless Link

Frequency Band: 902 - 928 MHz
Transmit Power: 1W
Modulation: FHSS FSK
Channels: 32
Encryption: 56-bit DES Key
FCC Approved: Yes

Electrical

ES-200T Battery Life: 30 hours
ES-200R Input Voltage: 12 VDC +/- 20%
ES-200R Input Current: 0.5 A

Vehicle Interface / Contact Ratings

Digital Communications: RS-232
Data Rate: 9600 baud
Run/Stop Contact Rating: 24VDC, 5A
Run/Pause Contact Rating: 24VDC, 5A

Visual Indicators

Power: Bicolor LED
Link Status: Bicolor LED
Pause Relay: Bicolor LED
Stop Relay: Bicolor LED
Charging (Transmitter Only): Bicolor LED

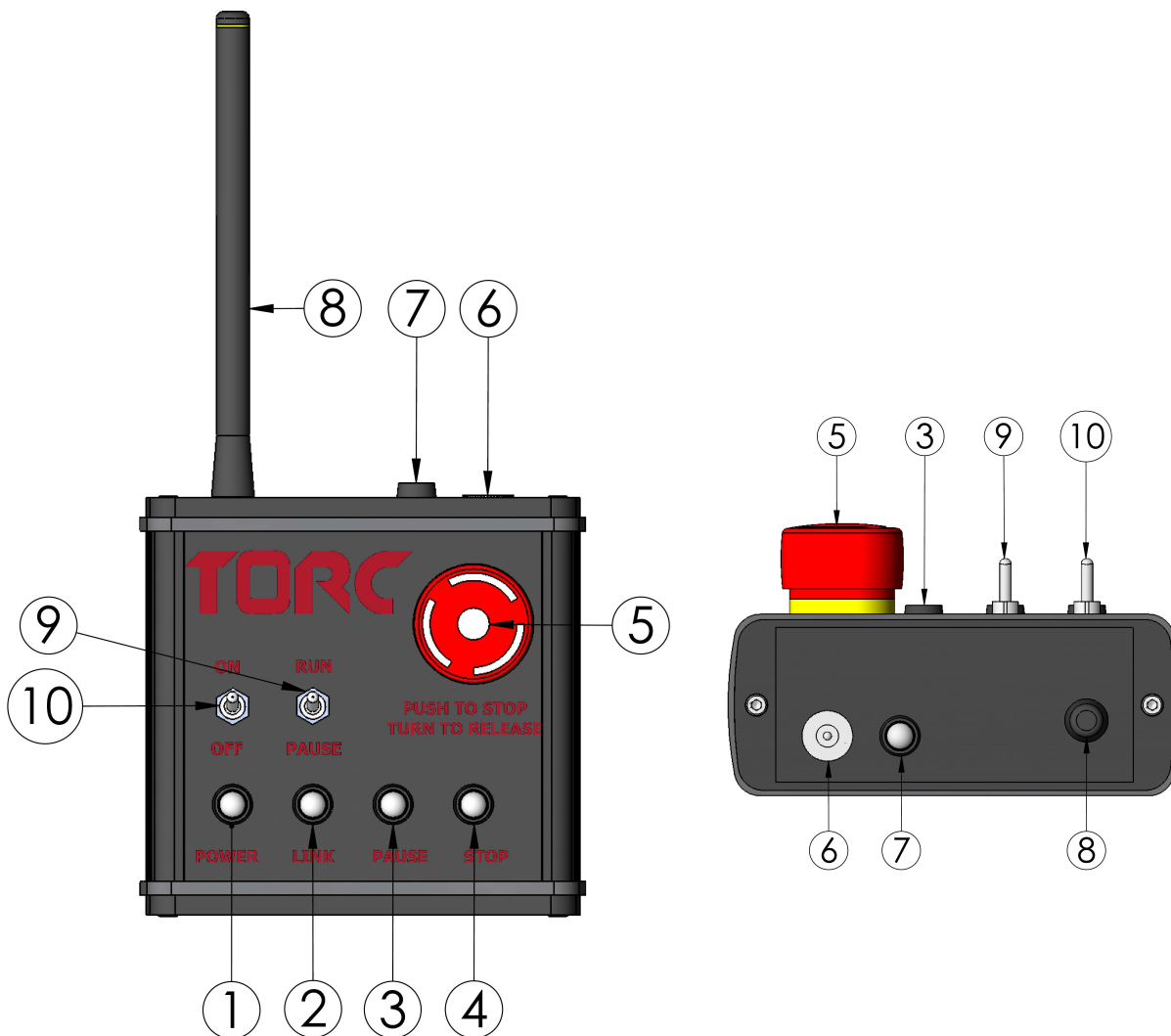
Audible Alarm (Transmitter Only)

Link Lost: Continuous Tone
Low Battery: Three Beeps

Environmental

Dust / Water Resistance: IP50
Operational Temperature: 0°C - 70°C
Operational Humidity: 10% - 90%, non-condensing
Operational Shock Rating: 10 g

6 TRANSMITTER UNIT



Item	Description
1	Power Status Indicator
2	Link Status Indicator
3	Pause Contact Indicator
4	Stop Contact Indicator
5	Run/Stop Push-to-stop, turn-to-release button
6	Charging Plug
7	Charge Status Indicator
8	Dipole Antenna
9	Run/Pause toggle switch
10	Power toggle switch

6.1 Transmitter Switch Detail

There are three switches located on the transmitter: the power toggle switch, the Pause/Run toggle switch, and the push-to-stop/turn-to-release Stop/Run button.

When the power toggle switch is in the up or “ON” position, the transmitter is powered. With the switch in the “OFF” or down position, the transmitter is shut down, and will no longer receive or transmit data.

The Pause/Run toggle switch is used to activate or deactivate the Pause relay on the receiver. With the switch in the “PAUSE” or down position on the transmitter, the Pause contact is deactivated on the receiver. When deactivated, the Pause GND contact (Pin: 6) and the Pause OUT contact (PIN: 5) are connected. When the switch is in the up or “RUN” position, Pause VIN contact (PIN: 4) and the Pause OUT contact (PIN: 5) are connected.

The push-to-stop/turn-to-release red Stop button controls the Stop relay on the ES-200R receiver. When pushed, the button is in the Stop position, and deactivates the Stop contact on the receiver. When the Stop contact is deactivated, the Stop GND contact (PIN: 3) is connected to the Stop OUT contact (PIN: 2). When the button is turned, or released, the Stop VIN contact (PIN: 1) and the Stop OUT contact (PIN: 2) are connected.

6.2 Transmitter Power Connector

The transmitter Power Connector is used for charging the internal rechargeable transmitter battery and powering the transmitter off of external power. The Power Connector is a 2.1mm center positive DC power plug.



WARNING: Do not leave the ES-200T unattended while charging the battery.



WARNING: Only charge battery with one of the supplied adapters (P/N: ESA-002 or ESA-003).

6.3 Transmitter LED Indicator Detail

Indicator	Status	Meaning
Power	Off	Unit power is off
	Red	Less than 20% battery life remaining
	Green	Unit power is on
Link	Off	Bypass mode activated
	Red	Communications link has been lost
	Green	Communications link is active
Pause	Off	State of Pause contact is unknown due to lost link
	Red	Pause ('Pause OUT' connected to 'Pause GND')
	Green	Run ('Pause OUT' connected to 'Pause VIN')
Stop	Off	State of Stop contact is unknown due to lost link
	Red	Stop ('Stop OUT' connected to 'Stop GND')
	Green	Release ('Stop OUT' connected to 'Stop VIN')
Charge Status	Off	External Power Not Connected
	Red	Battery Charging
	Green	Battery Fully Charged

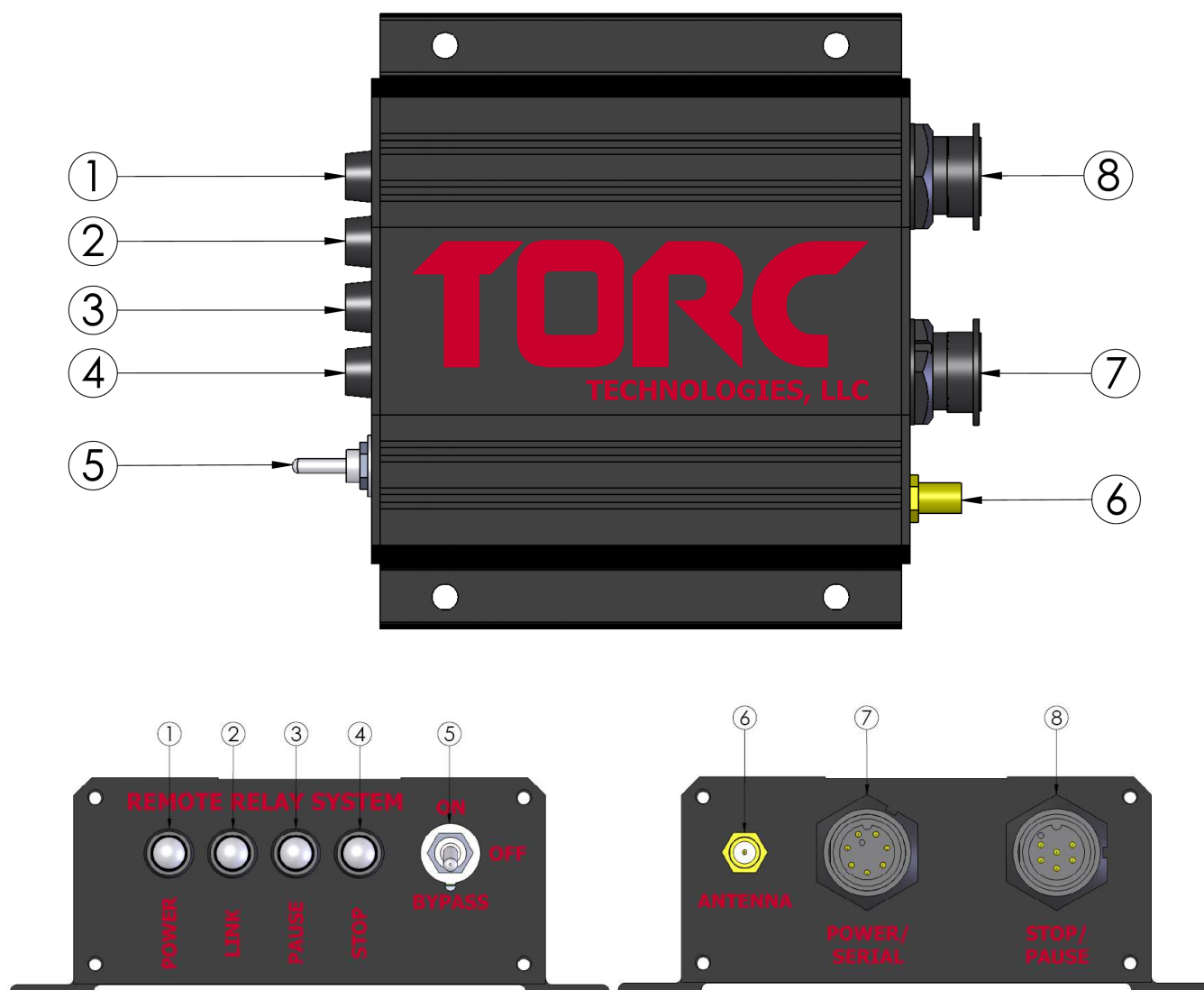
6.4 Transmitter Audible Alarm Detail

The ES-200T transmitter features an audible alarm to indicate an error condition that requires immediate user intervention. If the communication link is lost, the ES-200T is no longer in communication with the receiver, and the transmitter emits a constant tone. The ES-200T transmitter needs to be brought back within range of the receiver before operation can resume.

If the battery drops to approximately 20% of its total capacity, the audible alarm will start to sound 3 short tones every 10 seconds. If this occurs, power the transmitter off external power with either the supplied AC adapter (P/N: ESA-002), or automotive adapter (P/N: ESA-003).

Alarm	Meaning
Continuous	Communication link with receiver has been lost
3 Short Beeps	Low battery

7 RECEIVER UNIT

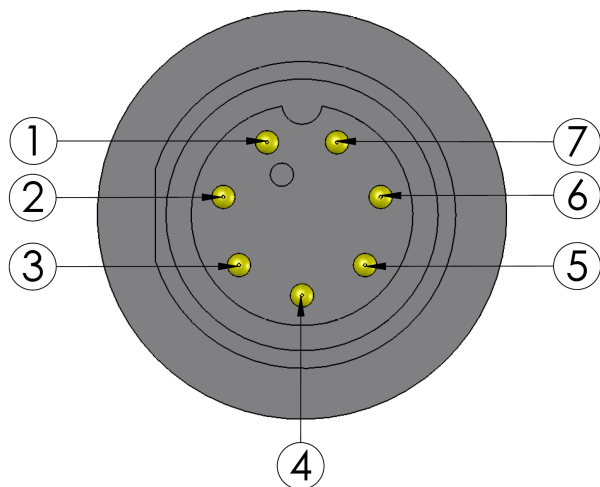


Item	Description
1	Power Status Indicator
2	Link Status Indicator
3	Pause Contact Indicator
4	Stop Contact Indicator
5	Power/Bypass Switch
6	RP-SMA Antenna Connection
7	Power/Serial Connector
8	Stop/Pause Connector

7.1 POWER/SERIAL Connector Detail

The POWER/SERIAL connector is used to supply power to the ES-200R receiver and for RS-232 communications.

Mating connector: Switchcraft EN3C7F

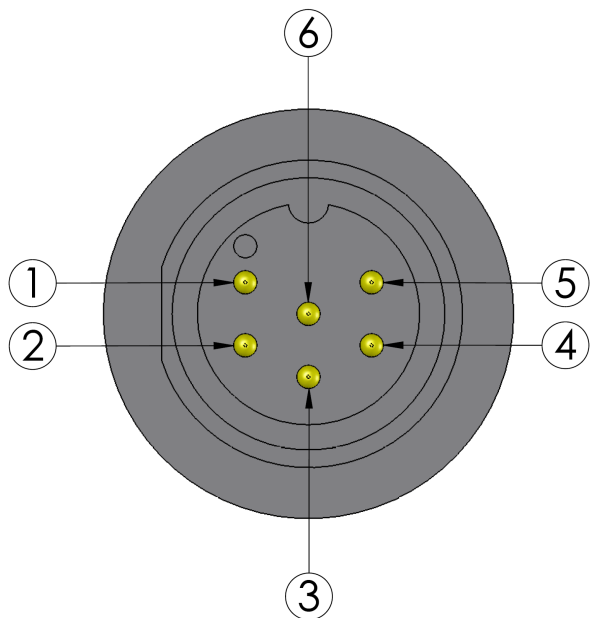


Item	Description
1	+12V (Red)
2	Power GND (Black)
3	Tx (DB9 Pin 2)
4	Rx (factory use only)
5	DTR (factory use only)
6	Signal GND (DB9 Pin 5)
7	RTS (factory use only)

7.2 STOP/PAUSE Connector Detail

The STOP/PAUSE connector is used for the contact connections of both the Run/Pause, and Release/Stop contacts.

Mating connector: Switchcraft EN3C6F



Item	Description
1	Stop VIN (Yellow)
2	Stop OUT (Blue)
3	Stop GND (not cabled)
4	Pause VIN (White)
5	Pause OUT (Green)
6	Pause GND (not cabled)

7.3 Receiver Switch Detail

The Power/Bypass switch is a three position toggle switch used to power the receiver and for placing the unit in Bypass mode. With the switch in the up or “ON” position, the receiver is in normal operation, and accepts commands from the transmitter. The center, or “OFF” position, of the switch cuts power to the receiver. With the switch in the down or “BYPASS” position, the receiver will activate the relays, placing both the Stop and Pause relays in a run state, and turn off the “LINK” indicator.



WARNING: While in Bypass Mode, the receiver will not accept Stop or Pause commands from the transmitter.

7.4 Receiver LED Indicator Detail

Indicator	Status	Meaning
Power	Off	Unit power is off
	Green	Unit is powered on
Link	Off	Bypass mode activated
	Red	Communications link to transmitter has been lost
	Green	Communications link to transmitter is active
Pause	Red	Pause (Pause OUT connected to Pause GND)
	Green	Run (Pause OUT connected to Pause VIN)
Stop	Red	Stop (Stop OUT connected to Stop GND)
	Green	Release (Stop OUT connected to Stop VIN)

7.5 Receiver RS-232 Communications Format

The ES-200R continuously monitors the status of the relay outputs and communication link. This information is sent serially over RS-232 communications. The data bit format is set to communicate at 9600bps, 8 data bits, 1 stop bit, no parity, and no flow control.

The serial protocol consists of 3 data bytes followed by a carriage return and line feed for a total of 5 bytes updated at a frequency of 25 Hz in the following format:

<Link Status><Run/Pause Status><Release/Stop Status><CR><LF>

Byte	Value	Description
<Link Status>	X	Link Lost
	B	Bypass Mode
	L	Link Active
<Run/Pause Status>	R	Run
	P	Pause
<Release/Stop Status>	R	Release
	S	Stop

Upon startup, the ES-200R will perform a diagnostic check and transmit the results over the RS-232 communications link. An example startup screen can be seen below. After the initial diagnostic outputs, the standard serial output protocol will be continuously displayed.

```

SafeStop RS-232 Output - HyperTerminal
File Edit View Call Transfer Help

TORC Technologies SafeStop(TM)
ES-200 System Receiver

Firmware Version 1.3 Loading...

Hardware Self Test...
  Version: 1.0
  Serial Number: RSB00001
  Temperature: 25 C

Radio Configuration...
  MAC Address: 00-50-67-27-98-62
  System ID: 0x80
  Key: TORC
  Channel: 0
  Mode: Server

Restoring Settings...
  Timeout Delay: 600 ms
  Timeout Action: Pause Only

XPS
XPS
XPS
-

Connected 0:00:51  Auto detect  9600 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo

```

Example RS-232 Output Terminal

8 SYSTEM INTEGRATION

Before your remote relay system can be used, you need to perform the following steps: fully charge the transmitter battery, install the antennas, install the receiver cables, and verify proper system operation.

8.1 Charging the Transmitter Battery

Before using the Remote Relay System, the transmitter battery must be fully charged for 5 hours. The transmitter can be charged using the supplied AC adapter (P/N: ESA-002), or the 12VDC automotive power adapter (P/N: ESA-003). To charge the battery, plug one of the supplied power supplies into the charging plug. When connected to an external power supply, the Charge Indicator LED should be red while the battery is charging and green when the battery is fully charged. Operating the SafeStop™ system while connected to external power will not drain the battery or reduce the charge time as long as the power adapter is properly connected.



WARNING: Do not leave the ES-200T transmitter unattended while charging the battery.



WARNING: Only charge battery with one of the supplied adapters (P/N: ESA-002 or ESA-003).

8.2 Installing the Antennas

Before turning power to either the ES-200T transmitter or ES-200R receiver on, the device antennas must be connected. The supplied antenna with magnetic mount and 6' coaxial cable (P/N: ESA-004) installs on the receiver's antenna connector. Install the antennas by threading it clockwise onto the corresponding antenna jacks.



CAUTION: Do not over tighten antenna connectors.



CAUTION: Antennas must be installed before applying power to the SafeStop™ system.

The receiver antenna is connected to a magnetic base that may be attached to a ferrous object. The antenna should be mounted to the highest point possible, away from any other communications antennas and sources of electro-magnetic interference, such as engines and electric motors. Care should be taken when routing the coaxial cable to avoid tight bends smaller than 1" radius.

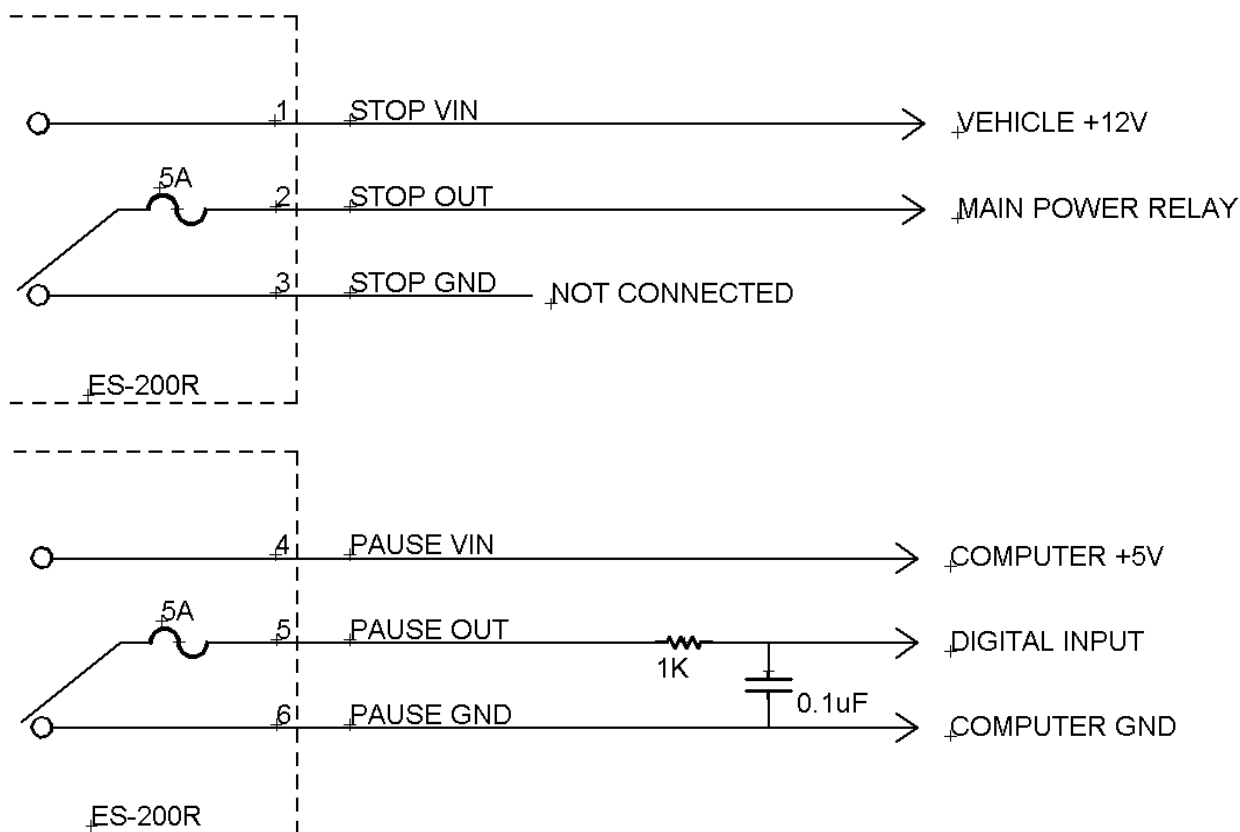
8.3 Installing the Receiver Cables into the Vehicle System

The installation of the receiver consists of properly wiring the “POWER/SERIAL” connector and the “STOP/PAUSE” connector. Using the supplied power cable (P/N: ESA-005), power the receiver using a constant 12V power source (not included) capable of 0.5 amps. The power cable’s (P/N: ESA-005) red wire should be connected to a positive 12 volts DC, and the black wire should be connected to ground. If using the RS-232 output, the DB9 serial connector on the power cable should be connected to a computer’s line level serial port.



CAUTION: Reversing the polarity may cause damage to the ES-200R.

8.4 Example STOP/PAUSE Wiring Schematic



8.5 Verify Proper Operation of the System

After connecting the power cable to the ES-200R receiver, turn the power to the receiver on by switching the power switch to the up or “ON” position (the transmitter should not be powered at this time). Once power to the receiver is

turned on, the “POWER” indicator should turn green after a brief self-test, indicating that this unit is powered on. The “LINK” indicator should turn red, indicating that there is no signal from the transmitter. The “PAUSE” and “STOP” indicators should also be red, indicating that both the Pause and Stop contacts are deactivated.

To verify the operation of the receiver and transmitter working together, turn the ES-200T transmitter power on while the receiver is still powered. Once power to the transmitter is turned on, the “POWER” indicator should be green signifying that it is powered on. The “LINK” indicator should turn green indicating that a communications link has been established between the transmitter and receiver. The “PAUSE” and “STOP” indicators should depict the state of the Pause switch and Stop button respectively. Changing the state of the Pause switch on the transmitter will change the state of the Pause contact on the receiver, which will switch the “PAUSE” indicator accordingly. Likewise, pushing or releasing the Stop button will change the state of the Stop contact and update the “STOP” indicator.

Turning off power to the transmitter while the receiver is still powered will result in a loss of communications between the receiver and transmitter, resulting in the “LINK” indicator on the receiver to turn red, and the “PAUSE” and or “STOP” indicators to turn red depending on the preset timeout action.

Turning off power to the receiver while the transmitter is still powered will also result in a lost communications link and turn the “LINK” led on the transmitter red. Since there is no feedback from the receiver about the state of the contacts, both the “PAUSE” indicator and the “STOP” indicator will turn off. Upon a loss of link, the transmitter will also emit a constant tone indicating that the link to the receiver has been lost.

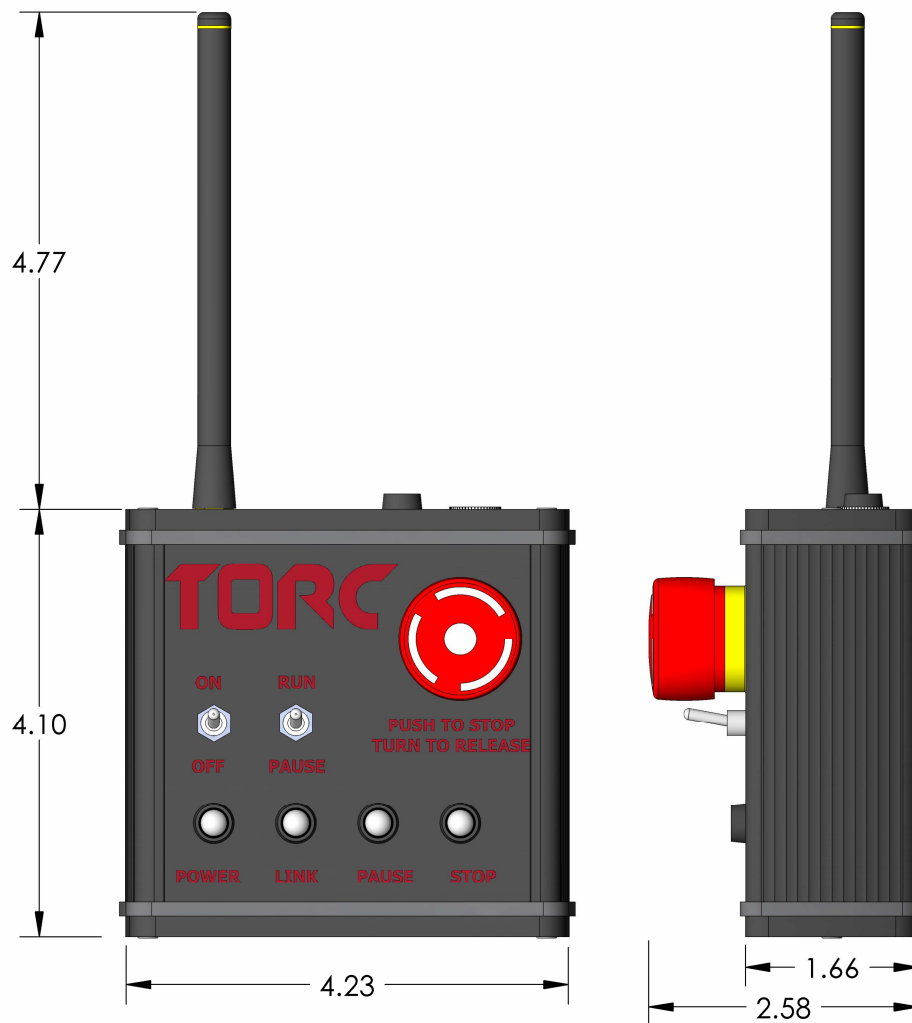
Switching the receiver Power/Bypass switch to the down or “BYPASS” position, overrides any signals being sent by the transmitter. In Bypass mode, the receiver “LINK” indicator will turn off to signify that the receiver is in Bypass mode. Also, both the Pause and Stop contacts will be activated, resulting in the “PAUSE” and “STOP” indicators to turn green. In Bypass mode, the receiver ignores all commands sent from the transmitter, and it is not possible to Stop or Pause a vehicle from the transmitter.



WARNING: It is not possible to stop or pause a vehicle from the transmitter when the receiver is placed in Bypass mode.

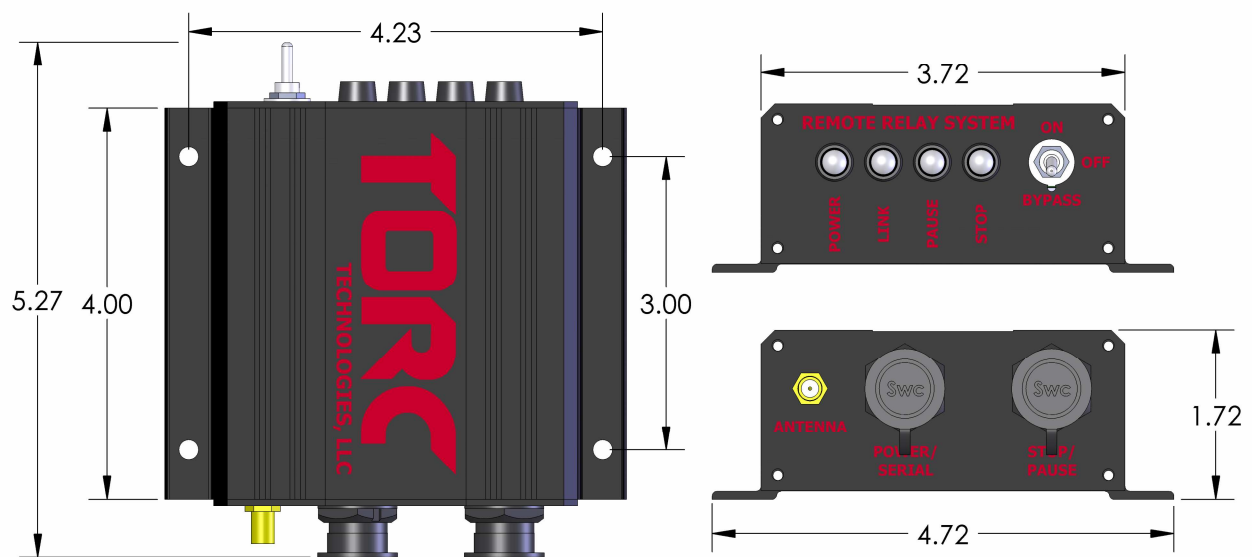
9 PHYSICAL DIMENSIONS

9.1 ES-200T Transmitter Dimensions



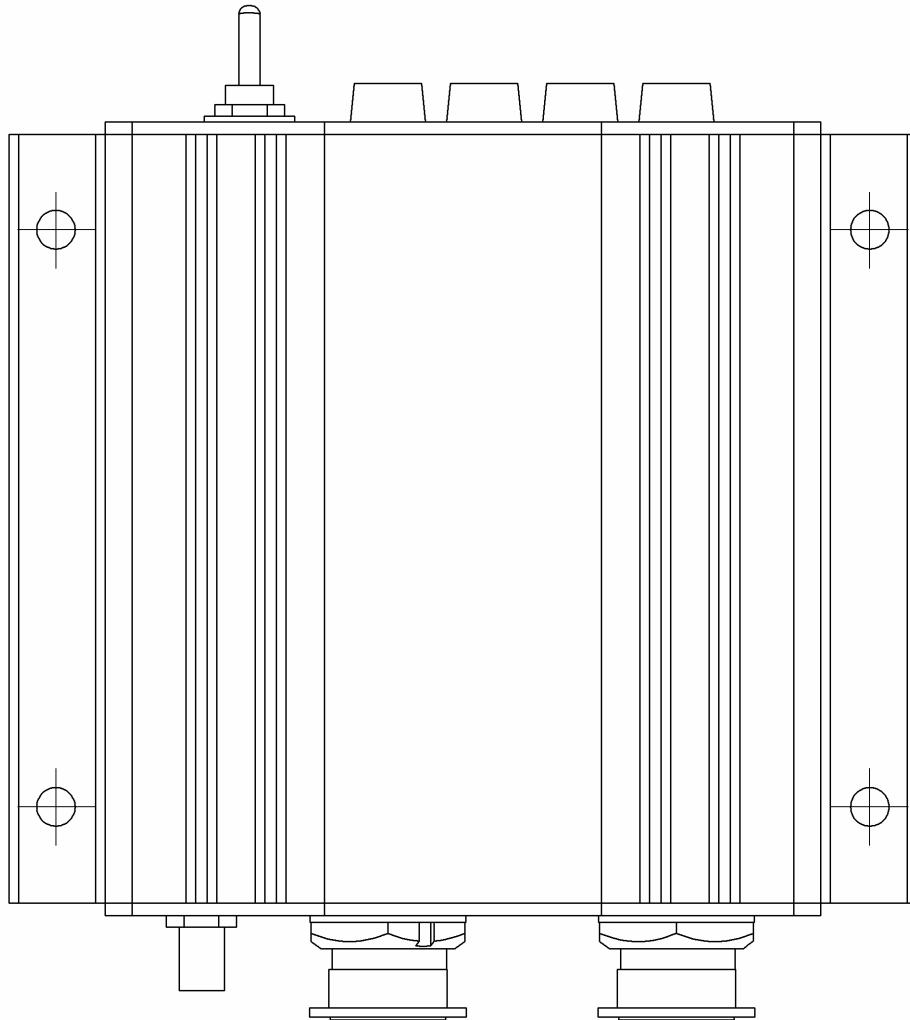
All units in inches.

9.2 ES-200R Receiver Dimensions



All units in inches.

9.3 Receiver Mounting Template



Scale 1:1 Use for mounting hole location

10 FCC COMPLIANCE

This equipment has been approved for mobile applications where the equipment should be used at distances greater than 20cm from the human body (with the exception of hands, wrists, feet, and ankles). Operation at distances less than 20 cm is strictly prohibited.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following 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.

FCC ID: KQL-AC4490.

11 LIMITED WARRANTY

TORC Technologies, LLC (herein referred to as TORC) guarantees that the product(s) you have purchased from TORC are free from defects in materials or workmanship for a period of one year from the original date of purchase. Within this period TORC will, at its sole discretion, repair or replace any components which fail under normal use. This warranty does not cover failures due to abuse, misuse, accident, or unauthorized alterations or repairs.

There are no other warranties, expressed or implied, which extend beyond the description contained herein including the implied warranty of merchantability and fitness for a particular purpose. TORC expressly excludes all other warranties

TORC's liability is limited to the cost of repair or replacement of the product. Such remedy shall be the sole and exclusive remedy for any breach of warranty.

TORC shall not be liable for:

1. Damage to other property caused by any defects in the product, damages based upon inconvenience, loss of use of the product, loss of time, loss of profits, loss of business opportunity, loss of goodwill, interference with business relationships, or other commercial loss, even if advised of the possibility of such damages.
2. Any indirect or other damages, whether incidental, consequential, or otherwise.
3. Any claim against the customer by any other party.