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A horizontal banner image composed of four panels: a yellow mining truck, a blue semi-truck on a road, a rocket launch, and a red shipping container. A white network diagram with nodes and lines is overlaid on the image.

CONNECTING THE
WORLD'S ASSETS

ST2102

USER MANUAL

Version 1.0

Nov 2023

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ABOUT THIS GUIDE

Purpose

This document provides an overview of the hardware characteristics and specifications for the ST2102.

Notation

Hardware components and hardware stickers in this document might not be exactly as shown and are subject to change without notice.

CAUTION: This safety symbol warns of possible hazards to personnel, equipment, or both. It includes hazards that will or can cause personal injury, property damage, or death if the hazard is not avoided.

Note: A note indicates information with no potential hazard. A note indicates points of interest or provides supplementary information about a feature or task.

Numbered lists indicate a series of steps required to complete a task or function.

Bulleted lists highlight information where order or sequence is not crucial.

Reference

The content of the following documents may be useful in conjunction with this guide. These documents are available from the ORBCOMM Developer Toolkit or customer support.

[N200]	IsatData Pro Network Services Overview
[R403]	ST2102 Development Kit User Guide
[T405]	IsatData Pro Services API Reference for
[T411]	FW v3.x ST2102 Installation Guide



1 OVERVIEW

Each ST2102, also referred to as a smart antenna, consists of a single environmentally sealed mechanical enclosure containing an integral antenna, a satellite modem for communicating with the satellite, its own power supply circuitry, an integral GPS subsystem, three digital output and one digital input port, and an RS-232 port. A supercapacitor provides last gasp capability and brown out protection.

Figure 1: ST2102




1.1 ST2102

The ST2102 (Table 1) operates on the IsatData Pro network and is self-contained, environmentally sealed, compact, and provides low power consumption.

The built-in programmability allows it to work as a standalone device with built-in I/O data collection and processing capabilities. Each model is suitable for both mobile and fixed installations.

Feature-rich software tools make scripting easy and shorten the script design and testing time.

Table1:ST2102Models

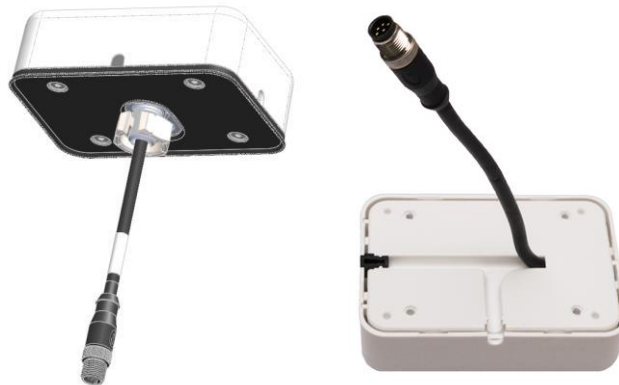
Model	Pins	Configuration
ST2102	8-pin	side or bottom mount 

The ST2102 offers two configurations: bottom mount or side mount (see figures below)

Figure 2: ST2101as a Side Mount (Surface Mount)




Figure 3: ST2101as a Bottom Mount (Cab Mount)



1.2 Key Features and Benefits

The ST2102 has the following key features and benefits:

- Designed to be incorporated into a Solution Provider's (SP) solution
- Built-in multi-GNSS receiver to calculate position, speed and heading with SP-preferred constellation
- Quick and easy installation reduces labor time and costs
- Very low power consumption enables a wide variety of autonomous applications
- Ships with installed firmware that is over-the-air upgradeable for significant cost and schedule savings, and convenience
- Wide operational temperature range to support a very broad range of applications and geographies
- Rugged construction to support applications in the harshest environments
- Two-way satellite service: Global and IsatData Pro
- Up to 6,400 bytes from-mobile messages 
- Up to 10,000 bytes to-mobile messages

2 COMPLIANCE

ST2102s are compliant with the following regulation and standards:

Inmarsat Type Approval

FCC: 47 CFR Part 25 and Part 15

FCC ID: OGX-ST2102

FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment

In order to comply with FCC RF Exposure requirements, this device must be installed to provide at least 25 cm separation from the human body at all times

IC: ICES-003 and RSS-170

IC: 11881A-ST2102

CAN ICES-3 (A)/NMB-3(A)

Innovation, Science and Economic Development Canada Compliance Statement

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device. L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- (1) L'appareil ne doit pas produire de brouillage;
- (2) L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

ICES-003 Issue 7, October 2020, Interference-Causing Equipment Standard, Information Technology Equipment (including Digital Apparatus)

RSS-102 Issue 5, March 2015, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

RSS-247 Issue 2, February 2017, Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

This equipment complies with ISSED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 35 cm (13.8 inches) between the radiator and any part of your body. This transmitter must

not be co-located or operating in conjunction with any other antenna or transmitter.

Pour se conformer aux exigences de conformité ISSED RSS-102 RF exposition, une distance de séparation d'au moins 35 cm doit être maintenue entre l'antenne de cet appareil et toutes les personnes. Lanceurs ou ne peuvent pas coexister cette antenne ou capteurs avec d'autres.

CE Mark : RED 2014/53/EU

Declaration of Conformity

Hereby, ORBCOMM declares that the radio equipment type CT1000 is in compliance with Directive 2014/53/EU. The DOC (Declaration of Conformity) is either included in the packaging or can be found at the following link: The full text of the EU declaration of conformity is available from <http://www2.orbcomm.com/eudoc>.

Ingress Protection: IP67

RoHS : RoHS 3 Directive 2015/863/EU

Countries' Approval: USA, Canada, Europe, Brazil, Australia...

CAUTION: Mount the the device at least 25 cm (10 in.) away from human body.



3 SPECIFICATIONS

3.1 Temperature

Parameter	Value
Operating Temperature	-40° to +85°C (-40° to +185°F)
Storage Temperature	-40° to +85°C (-40° to +185°F)

3.2 Temperature Sensor

The temperature sensor monitors the ambient temperature of the device.

The sensor can measure an internal temperature over the range of -40 to +85°C (-40° to +185°F), to an accuracy of $\pm 0.3^{\circ}\text{C}$ ($\pm 37^{\circ}\text{F}$).

3.3 Connector

The smart antenna uses a circular 8-pin connector.

3.3.1 Connector Pin Assignment

Figure 4: Smart Antenna Connector Pin Assignment (Female)

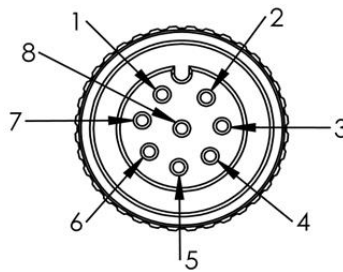
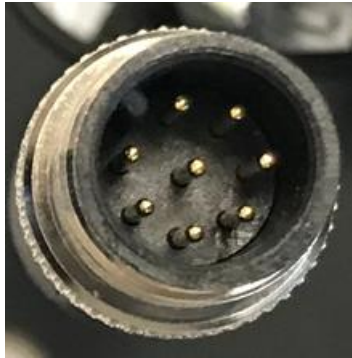


Table 3: Electrical Pin Assignment (ST 2102)

Pin	Functionality
1	External Reset Input
2	Ground
3	RS-232 Rx (Output)
4	RS-232 Tx (Output)
5	VEXT
6	1PPS Output
7	Event_Notification Output
8	External Reset Output

Figure 5: View of Smart Antenna Male Connector



3.4 Power

3.4.1 Input Range

Parameter	Value
Power Supply Voltage	9 to 32 V DC
Reverse Polarity Protection	-40 V maximum
Minimum External Operating Voltage	6.5 V

3.4.2 Load Dump Protection

The ST2102's power supply input voltage range is 9 to 32 V. Above this range the load dump protection circuitry disconnects external power so that the smart antenna is not damaged. The cut-off threshold is ± 34 V. External power is disconnected during the load dump pulse.

3.4.3 Fuse/Over Current Protection

The smart antenna has an internal 5 A fast acting fuse, which provides protection in the event of an internal short on the device.

3.4.4 Supercapacitor

This section only applies to an ST2102 with a supercapacitor.

An Electric Double Layer Capacitor provides last gasp capability and brown out protection. When external power drops due to a brown out condition or if the external power is turned off the supercapacitor allows the device to

¹Only applies to an ST2102 with a supercapacitor.

3.5 Input/Output

The ST2102 has one digital input and three digital output ports:

- Reset Input
 - The Reset Input allows an external controller to reset the ST2102. Reset is a CMOS/TTL input.
- 1 PPS Output
 - The 1 PPS Output is available from the GNSS module. It outputs a pulse every second, providing a valid fix is present. If the GNSS signal is blocked, the 1 PPS stops.
 - By default, the GNSS is only on when requested by the application or the network. For constant time updates, the GNSS must be on at all times (GNSS Continuous Mode). Refer to [\[T403\]](#) for further details. 1 PPS is a CMOS/TTL output.
- External Reset Output
 - The External Reset Output allows the ST2102 to reset an external circuit. This allows users to send a to-mobile message to reset their external controller remotely. External Reset is a CMOS/TTL output.
- Event Notification Output
 - The Event Notification Output indicates that one or more events have occurred. Example events include incoming satellite messages, modem reset, new GPS position, and transmit compete. Event Notification is a CMOS/TTL output.

The inputs and outputs are protected against transients with a 36 V TVS.

3.5.1 Reset Input

[Figure 6](#) shows a schematic for the I/O when configured as a digital input.

The following table describes the input specifications.

Parameter	Min.	Max.	Units
Input low range	-10	0.85	V
Input high range	1.5	32	V
Input current, $V_{in} = 3.3$ V	-	5	μ A
Input bandwidth	1	1000	Hz

3.5.2 Digital Outputs

[Figure 7](#) shows the digital outputs for the ST2102.

The following table describes the output specifications.

Parameter	Min.	Typ.	Max.	Units
Output high voltage - open circuit	3.14	3.3	3.46	V
Output high voltage (sourcing 25 μ A)	3.24	-	-	V
Output high voltage (sinking 25 μ A)	-	-	0.05	V
Voltage limits (survivability)	-10	-	32	V

3.6 Serial Interface

3.6.1 RS-232

The half duplex RS-232 port has the following settings: 9600 bit/s (8 data, no parity, 1 stop bit). The baud rate is configurable up to 115,200 bps.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Serial Rx Input High Voltage Threshold	-	1.5	2.4	V
Serial Rx Input Low Voltage Threshold	0.6	1.2	-	V
Serial Tx Output Voltage Swing	±5.0	±5.4	-	V

3.6.1.1 Auto RS-232 Power On/Off

The ST2102 uses the input voltage to turn the RS-232 driver on/off.

Parameter	Value
Valid Rx Input Threshold	$Rx > 2.7\text{ V}$ or $Rx < -2.7\text{ V}$
Invalid Rx	$-0.3\text{ V} < Rx < 0.3\text{ V}$

3.7 RF Specifications

Parameter	Value
Receive	
Frequency Band	1525 to 1559 MHz
Modulation	OQPSK
Symbol Rate	IDP: 300; OGx: 2000,8000, & 16000 symbol/second
Polarization	RHCP
Transmit	
Frequency Band	1626.5 to 1660.5 MHz
Modulation	OQPSK
Symbol Rate	IDP: 900 ; OGx: 800,1600,3200,6400,12800 symbols/second
Polarization	RHCP

Parameter	Value
Maximum Typical EIRP	7 dBW
Minimum Operation Elevation Angle	20 degrees
Maximum Transmit Antenna Gain	5.6 dBi

3.8 GNSS

The manufacturer's specifications are shown in the table below.

Table 8: Multi-GNSS Specifications

Parameter	GPS	GLONASS	BeiDou	GPS/GLONASS
Time to First Fix¹				
Cold Start	29 s	30 s	34 s	26 s
Hot Start	1 s	1 s	1 s	1 s
Sensitivity				
Tracking	-166 dBm	-166 dBm	-160 dBm	-167 dBm
Reacquisition	-160 dBm	-156 dBm	-157 dBm	-160 dBm
Hot Start	-157 dBm	-156 dBm	-155 dBm	-157 dBm
Cold Start	-148 dBm	-145 dBm	-143 dBm	-148 dBm
Horizontal Position (CEP)¹	2.5 m	4.0 m	3.0 m	2.5 m
Accuracy				
Velocity	0.05 m/s			
Heading	0.3 degrees			

3.9 Mechanical

The ST2102 mechanical enclosure is a rugged, impact, and chemical resistant plastic material.

Figure 8: ST2102Top View - Side Connector Dimensions

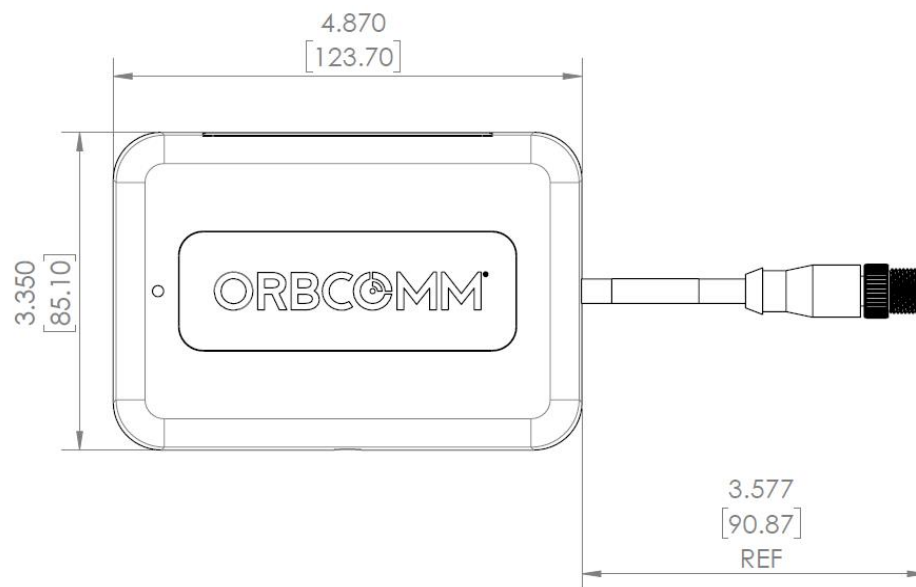


Figure 9: ST2101Side View Dimensions

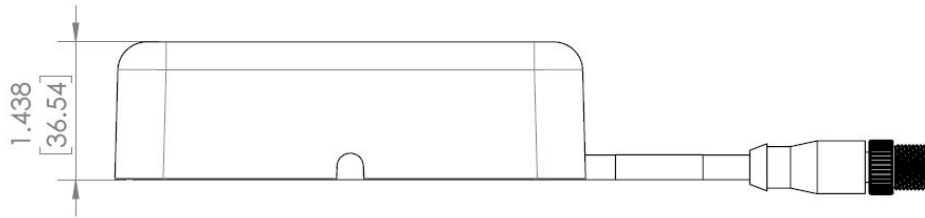


Figure 10: ST 2102 Bottom Connector Cable Length

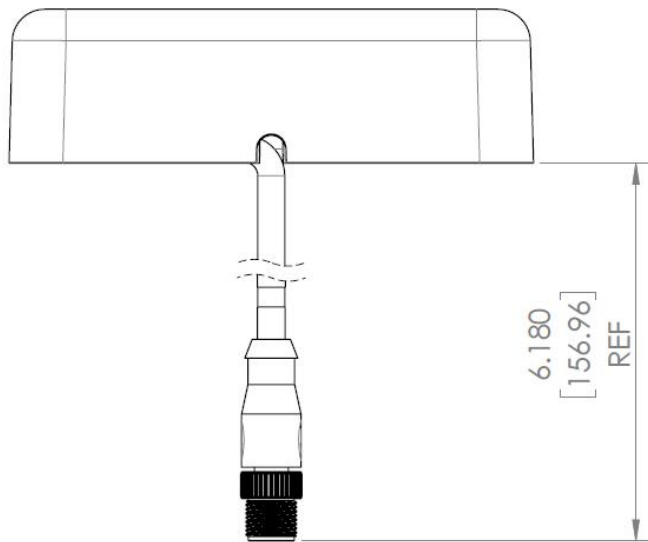


Table 9: Mass and Materials

Parameter	Value
ST2102 mass	245 g (0.54 lbs)
Enclosure Material	Lexan EXL9330 Resin

3.10 LED

The ST2102 has an integral LED to indicate that the smart antenna has successfully powered on, otherwise it is off.

Parameter	Value
Color	Red

3.11 Environmental

Parameter	Description
Vibration	The smart antenna meets all its specifications during exposure to random vehicular vibration levels per SAE J1455, section 4.9.4.2 and MIL-STD-810G, section 514.6, fig 514.6C-1.
Mechanical Shock	The smart antenna meets all its specifications after exposure to positive and negative saw tooth shock pulses with peaks of 20G and durations of 11 ms as specified in MIL-STD-810G, section 516.6, Procedure I, section 2.3.2c, 3/axis/(positive and negative direction).
Altitude	The smart antenna meets all its specifications after a nonoperating 12.2 km altitude test as detailed in SAE J1455, section 4.9.3, except with an ambient temperature of -40°C.
Thermal Shock	The smart antenna meets all its specifications after a thermal shock test as detailed in SAE J1455, section 4.1.3.2
Drop Test	The smart antenna meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1.
ESD	The smart antenna meets all its specifications after exposure of the enclosure to 2 kV ESD contact discharge per IEC 60945 and IEC61000-4-2, level 3. All the connections on the 8-pin harness connection except for the VEXT power rail are ESD protected to ± 30 kV contact discharge per IEC 61000-4-2 far exceeding level 4.

Appendix: ST2102 Volvo variant mechanics

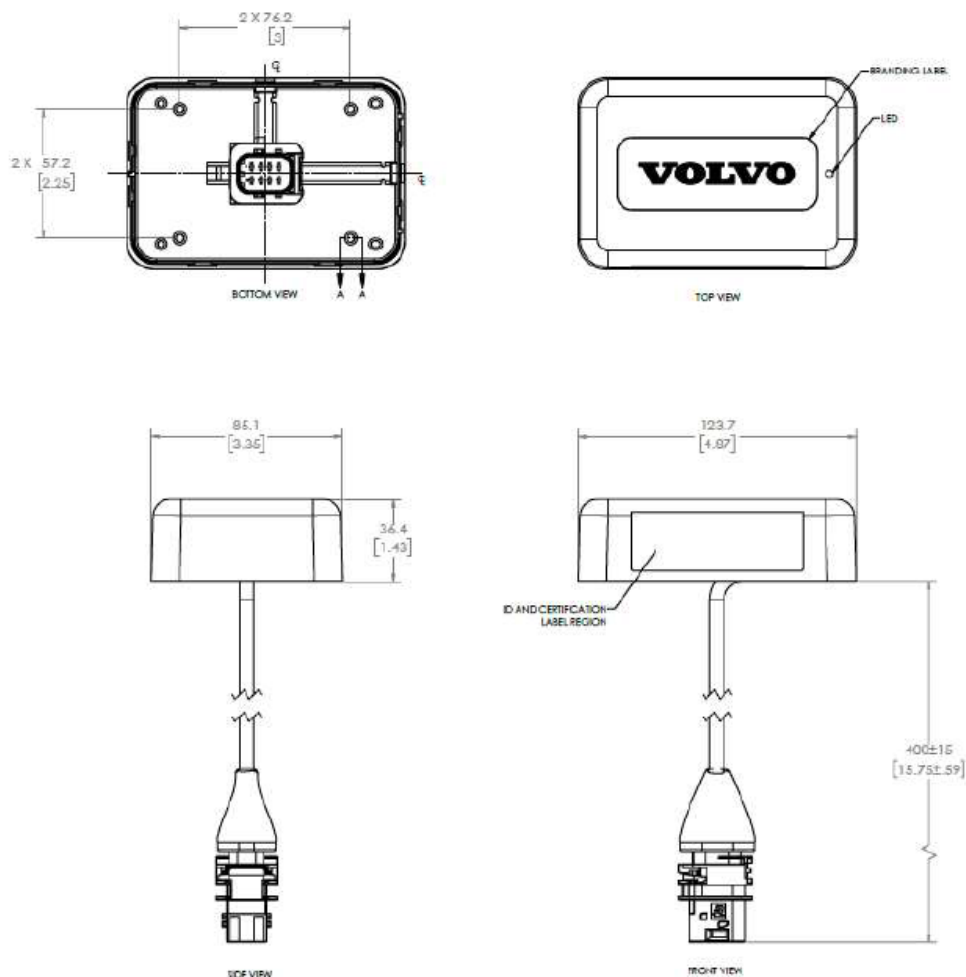


FIGURE 1: ALL DIMENSIONS IN MILLIMETERS [INCHES]