User Manual

RUGGEDIZED, FULL-FEATURED GPS SOLUTION

IX-101

Combining a GPS receiver and a 4G LTE cellular radio for an easy-to-use and effective method to capture and utilize data for various types of assets.

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Introduction

The IX-101 is a ruggedized, reliable asset management device. It combines a GPS receiver and a 4G LTE cellular radio for an easy-to-use and effective method to capture and transfer location and utilization data for various types of assets. The system provides out-of-the-box, Internet-based reporting along with an advanced data-export interface to integrate with existing asset management solutions. You can access the information about your equipment on PreCise's secure website (https://myfleet.precisemrm.com).

Features

The PreCise IX-101 has the following features:

- Gathers information about where a vehicle has been and when it was there
    - Position (latitude/longitude)
    - Speed
    - Heading
    - Time
- Automatically logs engine hours (ignition on time)
- Monitors two discrete inputs and tracks when and where they change
- Stores data when not in-network coverage
- Wirelessly downloads data using the GSM/GPRS network
- Ruggedized design
- 12V/24V operation

Warnings & Cautions

Read and follow all safety rules and instructions before installing or operating this equipment.

- Never operate a vehicle within a closed area. Always ensure proper ventilation before starting the engine.
- Always use eye protection. Use goggles that are ANSI-approved against impacts and shattering.
- Before wiring, disconnect the negative cable from the battery terminal. Failure to do so may result in electric shock or injury due to electrical shorts. Batteries can generate explosive gases. Keep sparks, flames, and smoking materials away from batteries. Always wear eye protection around batteries.
- Do not damage pipe or wiring when drilling holes. When drilling holes in the chassis for installation, take precautions so as not to contact, damage, or obstruct pipes, fuel lines, tanks, or electrical wiring. Failure to take such precautions may result in a fire.
- Do not use bolts or nuts in the brake or steering systems to make ground connections. Bolts or nuts used for the brake or steering systems (or any other safety-related system) or tanks should NEVER be used for installations or ground connections. Using such parts could disable control of the vehicle and cause fire.
- Arrange the wiring so that it is not crimped or pinched by a sharp edge. Route the cables and wiring away from moving parts (like the seat rails) or sharp or pointed edges. This will prevent crimping and damage to the wiring. If wiring passes through a hole in metal, use a rubber grommet to prevent the wire insulation from being cut by the metal edge of the hole.

- When making connections to the vehicle's electrical system, be aware of the factory-installed components (e.g. on-board computer). Do not tap into these leads to provide power for this unit. When connecting the unit to the fuse box, make sure the fuse for the intended circuit has the appropriate amperage. Failure to do so may result in damage to the unit and/or the vehicle.
- Be sure to connect the color-coded leads according to the diagram provided. Incorrect connections may cause the unit to malfunction or damage the vehicle's electrical system.
- To avoid property damage, personal injury, or death, park the vehicle on a flat, level surface, set the parking brake, turn the engine off, and chock the wheels before beginning installation.
- Do not mount the module in a location that could interfere with the proper operation of the vehicle, such as behind the gas or brake pedals.
- Avoid any circuits associated with the airbag system. Inadvertent airbag deployment may cause personal injury or death.
- While the system is in operation, a separation distance of at least 20 centimeters (approximately 8 inches) must be maintained between the antenna and the body of all persons to meet FCC RF exposure guidelines.

Installation Instructions

Before You Start

Prior to installing a PreCise IX-101 module, take time to familiarize yourself with the installation instructions, theory of operation, and system components. Check the contents of the shipping package and verify the following items are included:

Included Items

Item	Supply
1	PreCise IX-101 module
2	Power harness
3	Installation guide
4	Combination antenna – GPRS & GPS

Recommended Supplies

Item	Quantity/Vehicle
18-22 awg 4 conductor wire	50ft (varies)
18 awg stranded wire	30ft (varies)
Butt splice	10
Cable ties	25
3A to 5A in-line fuse holder	1 – 2
5A fuse	2
Wire loom	25ft (varies)
Silicone	0.1 tube
1/4" x 1.25" bolts	2
1/4" washer	4
1/4" lock nuts	2
Electrical tape	
1/4" self-tapping screws	2
3/8" grommet	1
5/16" ring lug terminals (18awg)	5
#10 ring lug terminals (18awg)	3

Recommended Tools

Item	Tool
1	Electric drill
2	Terminal crimping tool
3	Strippers
4	Drill bit sets
5	Screwdrivers
6	Socket sets
7	Needle-nose pliers
8	Pliers
9	Big channel-locks
10	1/4" drill bit
11	1/2" drill bit - mounting holes
12	Spring-loaded center punch
13	Tape measure
14	Wrench set
15	7/16" open end wrench
16	Volt-Ohm meter

Mounting Locations

Antennas

Selecting a good mounting location for the antennas is important for proper system operation. You should consider a few points prior to selecting a location:

- Do not mount the antenna within 20cm (~8”) of other antennas or within 20cm (~8”) of the vehicle operator.
- The combination antenna should have a clear view of the sky. For the GPS receiver to calculate position, it needs to “see” several satellites. These satellites are constantly moving overhead in different orbits, so the wider the field of view, the better. It may be possible to place the antenna on a dashboard or similar location with a partial view of the sky; however, this could result in degraded performance. In these cases, there may be times when the IX-403 will not be able to calculate its position.
- Consider where the IX-101 module will be mounted to ensure the antenna cables will reach it. Keep in mind that depending on how the cables are routed, the actual distance between the antenna and the IX-101 module may have to be much closer than the overall length of the cables.
    - **NOTE:** Do not cut the antenna cables to shorten them. Carefully coil the extra cabling and tie wrap in a safe, out-of-the-way area to prevent damage.
- Make sure the magnet-mount antenna (when needed) will stick to the mounting surface. The magnet will work with steel, but it won’t stick to a surface like aluminum or fiberglass. If you mount the IX-101 module on aluminum or fiberglass, a small amount of silicone can be used to adhere the magnetic base to these surfaces.

Module

Before you mount the IX-101 module, be sure to write down the module's ICC ID, the activation code, and the identifier for the equipment on which you are installing it. This information is necessary to identify which data belongs to a particular piece of equipment, especially if you are installing multiple IX-101 modules. The ICC ID and activation code can be found printed on the PreCise label attached to the IX-101 module. The ICC ID is a 19 or 20-digit identifier. The equipment identifier can be a combination of letters and/or numbers that you use to uniquely identify your equipment. Examples include the Vehicle Identification Number (VIN), the license plate number, or the driver's name (i.e., "Joe's Truck").

While the IX-101 module is designed to operate from –30°C to +60°C (-22°F to +140°F) and is water-resistant, it should be mounted where it's not directly exposed to the weather. This ensures reliable operation in adverse conditions. Mounting the module in the engine compartment is not recommended due to the high temperatures. Examples of good mounting locations might be under or behind a seat, under the dashboard, or in a utility box.

The IX-101 module has integral mounting flanges that you can use to fasten it to a flat surface. You can use the module itself as a template to mark the hole locations, or you can use the dimensions shown in Figure 1. Be sure to allow enough room to make the necessary connections to the antenna cables as well as the power harness. You should consider a few points prior to selecting a location:

- Consider the wire routing for the antenna and power.
- Consider the protection of connections from weather and items stored nearby.
- Consider if the unit needs to be tamper-proof.

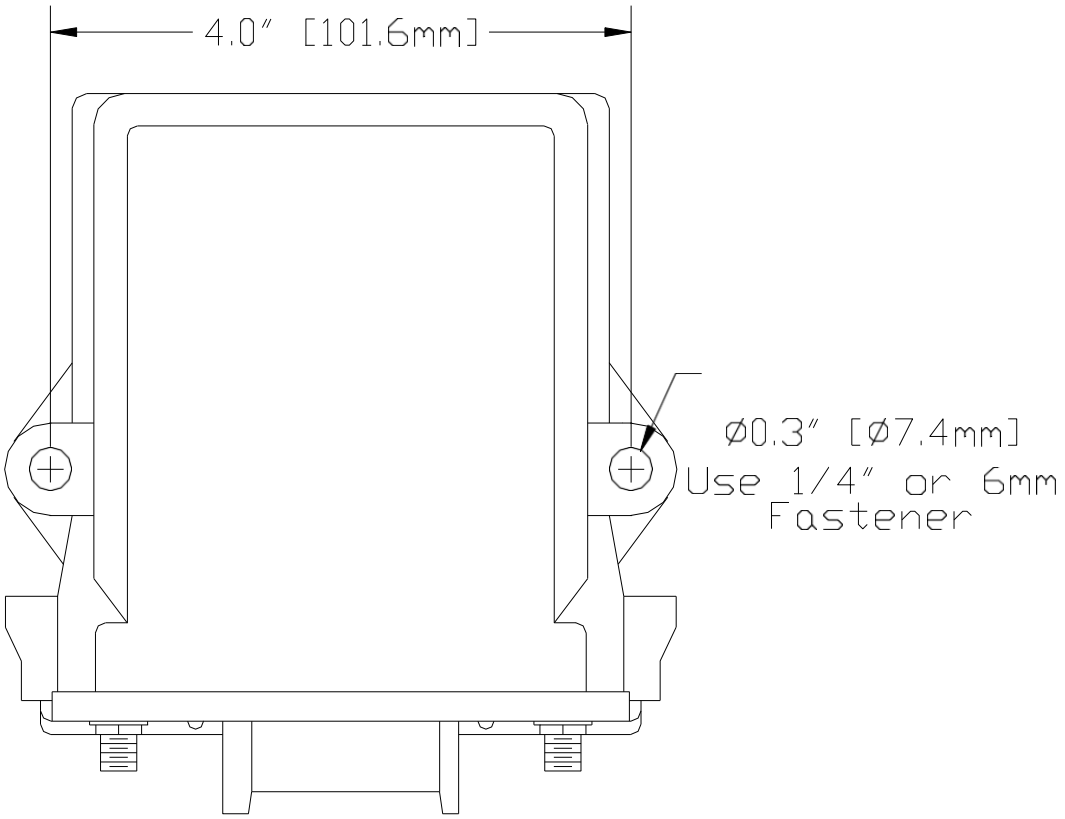

Figure 1: Mounting Hole Dimension

Electrical Connections

The IX-101 modules are designed to operate from a continuous voltage source and a switched voltage source (ignition signal). To track and report total operating hours, as well as allow the unit to manage its shut-down sequence, you must connect the green ignition wires properly. One of the green ignition wires should be connected to a line on the vehicle that supplies between 7 and 32 volts during operation only. This could be a signal from the engine-hour meter, an input from the ignition key switch, or a similar connection. If the green ignition wire is connected to the alternator for the switched power source, you will need to confirm that the voltage remains at a minimum of 7 volts, even when the battery is fully charged, to avoid the following: false ignition off signals, increased data usage due to more frequent ignition off reports, and skewed ignition times. The other green wire should be connected to ground. On equipment with a master disconnect switch, the green wire should be connected to chassis ground, not to battery negative. It does not matter which green wire is connected to the ignition signal and which one is connected to ground.

When determining where you should make your connections, you should use a volt-ohm meter or digital multimeter to verify proper voltage levels and determine whether the voltage is constant or switched, as required by the connection. (**NOTE:** If the vehicle is equipped with a master disconnect switch for the battery this does not qualify as a “switched” power source. An example of a properly switched power source would be something that only comes on when the ignition has been turned on, such as an engine-hour meter).

The threaded antenna connectors on the IX-101 modules should be connected only finger-tight. Do not use a wrench or pliers to make these connections, as you may cause damage. Figure 2 shows all available connections.

The ends of the wires in the supplied power harness are terminated with butt-splice connectors designed for 18-22 AWG wire. Strip approximately ¼” (7mm) of insulation from the wire that will connect to the harness and be sure to use the proper crimping tool. A slight tug on the wire after crimping is recommended to ensure a firm connection.

The input connections usually consist of one wire connected to the measurement point, and the other wire connected to either ground or power, depending on the state of the signal when the switch is on. If the signal measures low voltage (< 1.8 V) when the switch is on, the second wire should be connected to power. If the signal measures high voltage (> 5V) when the switch is on, the second wire should be connected to ground. Figure 3 shows examples of input connections.

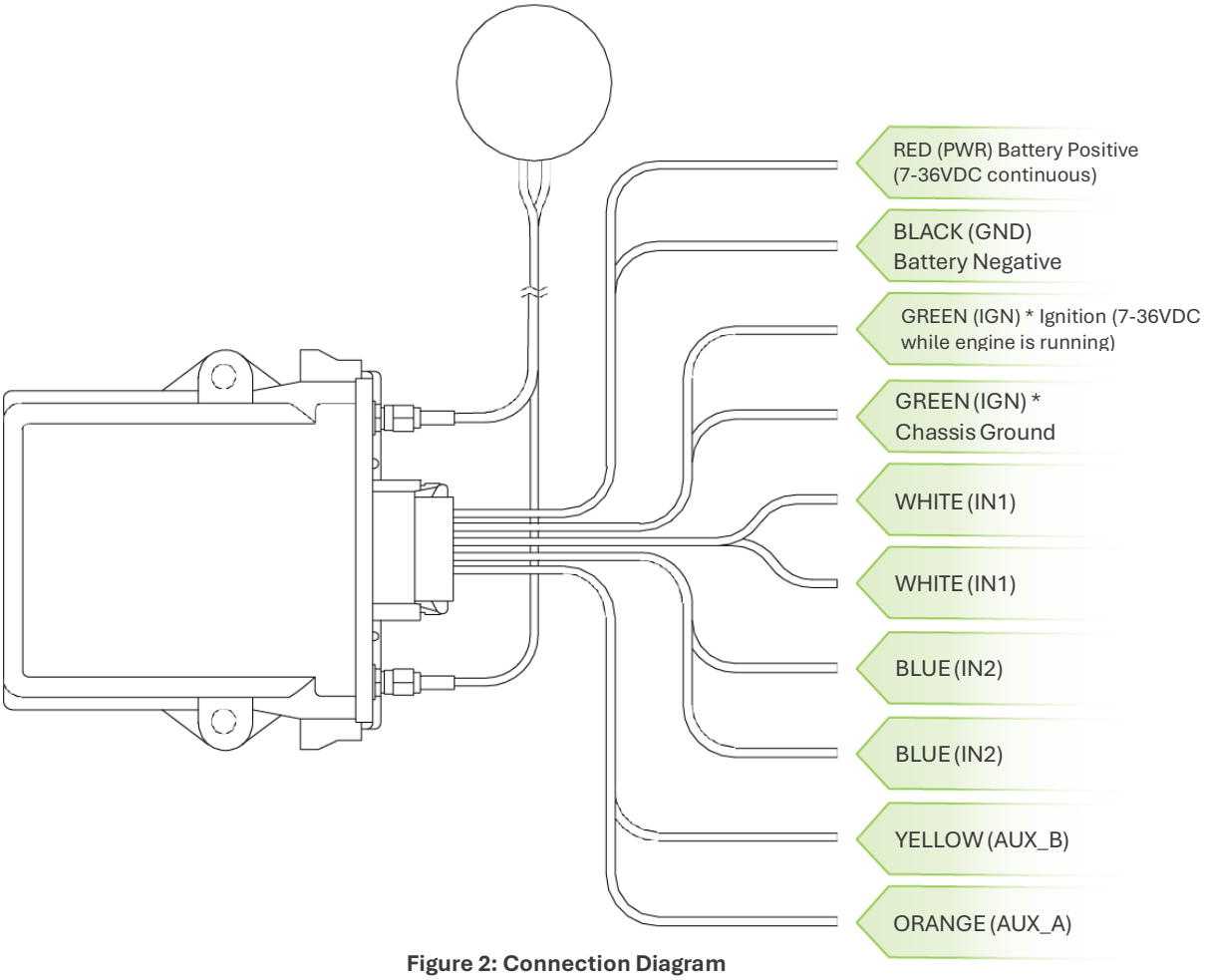

Figure 2: Connection Diagram

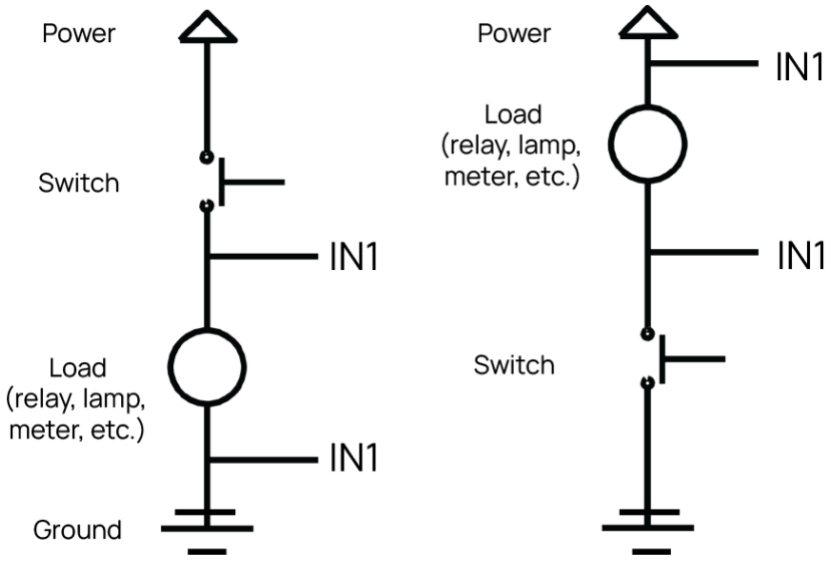

Figure 3: Input Connections

Post-Install Checklist

Perform the following tasks upon successful completion of the IX-101 module installation:

- Ensure the vehicle has a clear view of the sky for obtaining a GPS lock on at least 4 satellites and registering on a cellular tower for wireless communications.
- Start the vehicle and visually inspect the LED status lights on the IX-101 module (refer to Appendix A).
    - **NOTE:** The IX-101 module may take a few minutes to acquire a GPS lock on the first startup. Subsequent startups will acquire a GPS lock quickly.
- Confirm the device is reporting either by watching for the Cellular LED to turn solid green (not blinking) or by checking the asset's status on the PreCise website (myfleet.precisemrm.com).
    - **NOTE:** This step assumes that the asset has already been configured on the PreCise website. For information regarding the initial setup and configuration of devices and assets in the PreCise website please refer to the online tutorials.
- Confirm the meter readings have been configured and are correct on the PreCise website.
- Confirm the settings on the Cellular tab are configured and correct on the PreCise website.
- Confirm the location of the asset on the map on the PreCise website.
- Confirm that the inputs are working by running a Raw Data Report on the PreCise website.

Appendix A: LED/Pinout Definitions

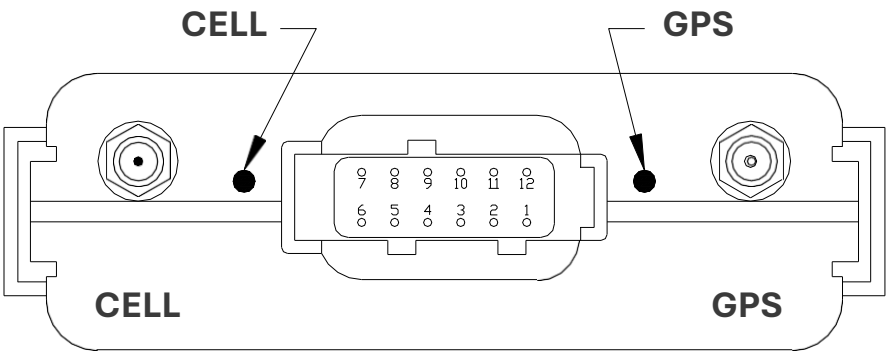

Figure 4: Faceplate

GPS & Time/Date Status LED

- **SHORT RED BLINK:** GPS receiver is not communicating.
- **LONG RED BLINK:** GPS antenna short- or open-circuit detected.
- **SHORT GREEN BLINK:** GPS is searching for current position.
- **LONG GREEN BLINK:** A position fix has been acquired.

GSM Cell Phone Status

- **SHORT RED BLINK:** Cellular radio is not communicating.
- **LONG RED BLINK:** Cellular radio is not detecting network service.
- **SHORT GREEN BLINK:** Cellular radio is detecting network service.
- **LONG GREEN BLINK:** Cellular radio is transferring data.
- **SOLID GREEN:** Cellular radio has transferred a data file. (This status indication remains for one minute and then reverts to the status existing at the end of the minute)

Pin Number	Pin Label	Description
1	GND	Ground
2	IGN_B	Switched power input (active above 7V)
3	IN1_B	Input 1 connection B
4	IN2_B	Input 2 connection B
5	AUX_B	IX101C: CAN_L, IX101: RS232 RXD
6	DIAG_RX	Diagnostics RS232 RXD
7	DIAG_TX	Diagnostics RS232 TXD
8	AUX_A	IX101C: CAN_H, IX101: RS232 TXD
9	IN2_A	Input 2 connection A
10	IN1_A	Input 1 connection A
11	IGN_A	Switched power input (active above 7V)
12	PWR	12/24VDC constant power

Appendix B: IX-101 Electrical Installation

Antenna Connections:

Two antenna cables must be connected to the IX-101. The GPS cable is connected to the small gold (SMA) connector on the right side of the front panel. The LTE antenna cable with the second small (SMA) connector must be connected to the small gold connector on the left side of the front panel.

Power Connections:

There are four wires that must be connected for a minimally configured IX-101 module can function. The supplied cables are color-coded to aid in proper installation.

The BLACK wire is the ground and should be connected to the negative battery voltage. This is normally, but not always, the chassis of the equipment. If the equipment has a master disconnect switch on the negative side, this ground connection should be between the battery and that switch.

The RED wire is the continuous power wire. It should be connected to the positive side of the battery power through a 3- to 5-amp fuse. It must not be switched by the ignition, a master disconnect switch, or any other switched apparatus. This power is used to run the real-time clock, enabling the unit to wake at scheduled intervals. It also maintains the GPS data, allowing for quicker position determination when the equipment starts.

The GREEN wires provide the switched power ("ignition") signal. They are used to indicate that the equipment has started operation (or is running). One of the GREEN wires should be connected to a signal that is grounded (or open circuit) when the equipment is "OFF", and it should be at the battery voltage (greater than 7 volts) when the equipment is running. The other GREEN wire should be connected to chassis ground.

Digital Inputs:

Both digital inputs on the IX-101 module are electrically identical. The IX-101 module reports the input as "OFF" if the input is switched to below approximately one volt. It reports "ON" when it is switched above about five volts.

IX-101 Specifications

4G LTE Radio

Parameter		Rating	Units
Frequency bands	LTE B2	1900	MHz
	LTE B4	1700	MHz
	LTE B5	850	MHz
	LTE B12	700	MHz
	LTE B13	700	MHz
	LTE B14	700	MHz
	LTE B71	600	MHz
Output power	LTE B2	23 ± 0.5	dBm (max)
	LTE B4	23 ± 0.5	dBm (max)
	LTE B5	23 ± 0.5	dBm (max)
	LTE B12	23 ± 0.5	dBm (max)
	LTE B13	23 ± 0.5	dBm (max)
	LTE B14	23 ± 0.5	dBm (max)
	LTE B71	23 ± 0.5	dBm (max)
Receiver Sensitivity	LTE	-102.0	dBm
Regulatory Certifications	FCC, PTCRB, IC, ROHS, REACH	FCC ID: RI7LE910CXNF IC ID: 5131A-LE910CXNF	

GPS

Parameter		Rating	Units
Satellite tracking		12	channels
Update rate		1	Hz
Acquisition time	Reacquisition	<2	s
	Hot start	<3	s
	Warm start	<35	s
	Cold start	<38	s
	Out of the Box	<41	s
Accuracy	Horizontal	<2.5 <5	m (50%) m (90%)
	Velocity	0.06	m/s
	Time	60	ns
Sensitivity	Tracking	-160	dBm
	Acquisition	-142	dBm

Power

Parameter		Rating	Units
Supply voltage	**Operating**	9.8 to 32.0	V
	Continuous	65.0	V (max)
Over-voltage protection threshold (Note 1)		40	V (min)
		48	V (max)
Input current (average)			
Vin=24V dc	**Sleep**	15	mA (typ)
	Operating	90	mA (typ)
Vin=12V dc	**Sleep**	20	mA (typ)
	Operating	160	mA (typ)

1. Above this threshold, the device will not operate until the voltage is within normal operating range.

Inputs

Parameter	Rating	Units
High-Level Input	5.0	V (min)
	36.0	V (max)
Low-Level Input	0.8	V (max)
	-0.8	V (min)

Physical

Parameter	Rating	Units
Dimensions	4.7 x 5.3 x 1.5	in
	120 x 135 x 38	mm
Weight	0.6	lbs
	0.3	kg

Environmental

Parameter	Rating
Operating Temperature:	-30° C to +60° C
Storage Temperature:	-40° C to +85° C
Humidity:	5% to 95% RH non-condensing at +40° C
Vibration:	SAE J1455 for chassis-mounted devices (4g, 20Hz-2kHz).
Shock:	±25g
Electrical Protection:	SAE 1455 (12V & 24V) ▪ load dump ▪ inductive switching ▪ mutual ±8kV ESD, human body model Reverse polarity Over-voltage shutdown

MANUFACTURER LIMITED WARRANTY AND LIMITATION OF LIABILITY

Manufacturer warrants that on the Date of Purchase, this Product will conform to Manufacturer's published specifications for the product, which are available from Manufacturer on request, and Manufacturer warrants that the product is free from defects in materials and workmanship. This Limited Warranty extends for twelve (12) months from the date of manufacture. Manufacturer will, at its option, repair or replace any product found by Manufacturer to be defective and subject to this Limited Warranty.

This Limited Warranty does not apply to parts or products that are misused; abused; modified; damaged by accident, fire, or other hazard; improperly installed or operated; or not maintained in accordance with the maintenance procedures set forth in Manufacturer's Installation and Operating Instructions.

To obtain warranty service, you must ship the product(s) to the specified Manufacturer location within thirty (30) days from expiration of the warranty period. Contact customer service to obtain an RMA number and write the number on the shipping container. You must prepay shipping charges and use the original shipping container or equivalent. Return shipping charges within the United States, Canada, and Puerto Rico, will be paid by Manufacturer. This Limited Warranty will apply only to a product purchased and located in the United States, Canada, or Puerto Rico.

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This Limited Warranty gives you specific legal rights, and you may also have other legal rights, which vary, from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion or limitation may not apply to you.

Any oral statements or representations about the product, which may have been made by salesmen or Manufacturer representatives, do not constitute warranties. This Limited Warranty may not be amended, modified, or enlarged, except by a written agreement signed by an authorized official of Manufacturer that expressly refers to this Limited Warranty.

Part 15 Notice:

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.