WiSI™

Product Reference

RUGID COMPUTER, INC.
9730-F1 Lathrop Industrial Dr. SW
Olympia, WA 98512
USA

Support@RugidComputer.com

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1 Overview

A WiSI™ unit comes standard with a processor, 2.4GHz radio, 4 analog inputs, 4 digital inputs, 4 digital outputs, sensor supply capable of sourcing up to 25 mA for powering sensors or a single 4-20 mA loop, and a current source for powering RTDs.

WiSI™ units come in four different package types; two power options, Externally Powered (EP) and Solar Powered (SP) and two antenna options, Embedded Antenna (EA) and reverse polarity SMA (SMA). Externally Powered nodes are available to perform any of the roles defined for network elements; Coordinator, Router or End-node. Solar Powered nodes are only available for End-node applications.

The input and output capability of a WiSI unit is the same for all four package types. Solar powered units can also be powered from an external source; the externally powered units contain an energy efficient switching supply with an increased operating voltage range making them ideally suited for low power installations.

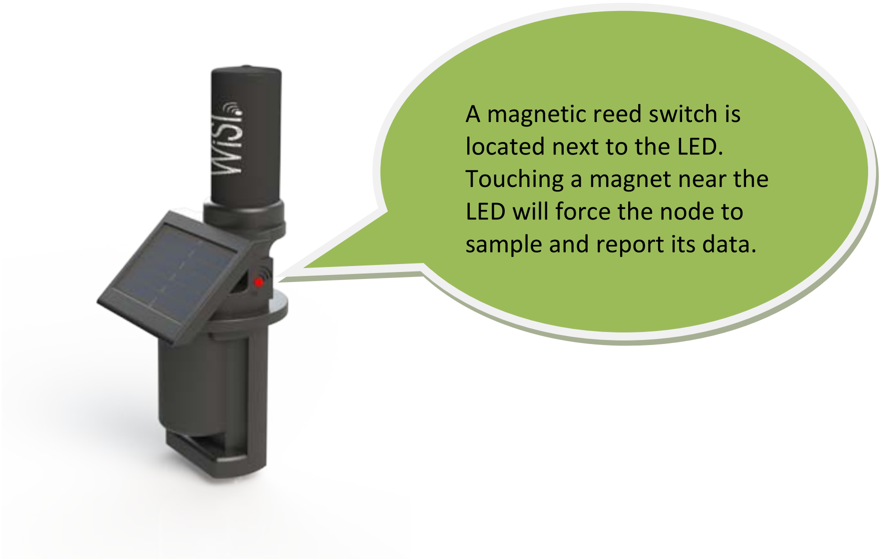
Each WiSI unit requires software configuration to specify its desired operation and network parameters. Configuration is done through free configuration software. All the inputs and outputs are sampled or controlled based on the sample period specified in the unit's configuration. Even though the coordinator and routing units are always awake, their inputs and outputs are sampled based on the sample period similar to the sleeping End-nodes. For analog inputs, a minimum of four samples is taken and their average value is reported. The onboard sensor supplies are switched on prior to sampling the inputs. A warm-up time is user adjustable and allows for a specified period of time between the supplies turning on and the first sample to allow the sensor's output to stabilize before a measurement is taken. For sensors requiring constant power, an external power source is required.

A digital input configured as an event or pulse is handled independent of the sample period. A specified status change, rising or falling edge, on a digital input configured as an event will immediately cause the unit to sample its IO and report their values. When monitoring a pulse output the pulses are counted independent of the sample period but reported every sample period.

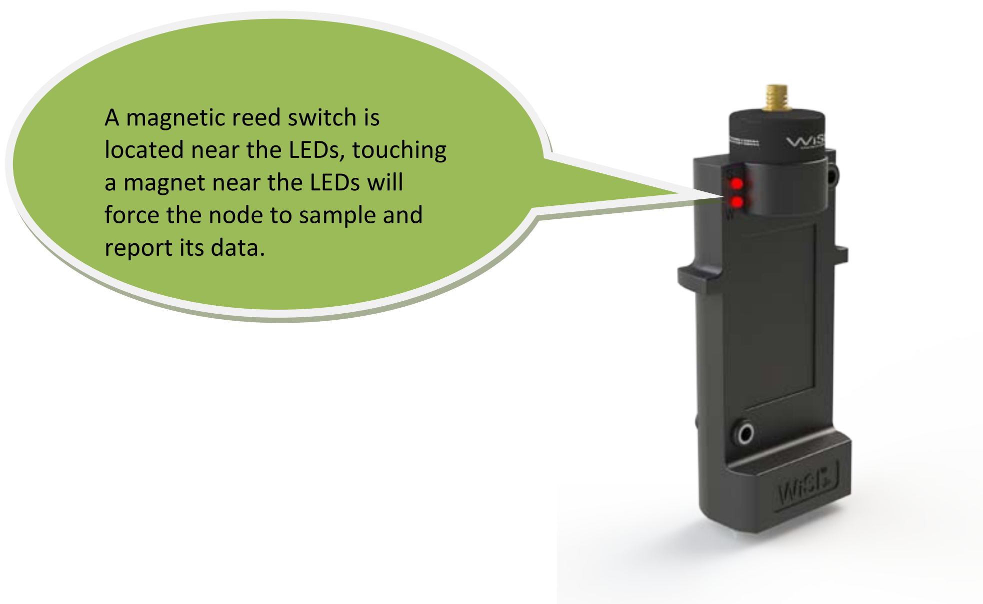
The connection to the WiSI is a single high-density DB26 connector. The connector is housed in an IP67 rated back shell. A gasket seals against the WiSI body and a liquid tight fitting is used to seal against the cable exiting the back shell. In most applications only a small number of the signals will be used.

1.1 Indicator LEDs

Solar powered nodes have one LED. The LED flashes every time the node transmits data once it has joined a network. When the node is out of the network the LED will not flash even though the node may be transmitting. Once the node has joined the network the LED will flash with every message sent from the node over the air. A magnetic reed switch is located near the LED and touching a magnet to the unit below the LED will force the node to sample and report its data.



Externally powered nodes have 2 LEDs. The top LED will flash every time the unit transmits data over the serial port and the bottom LED will flash every time the node transmits data over the air once it has successfully joined the network. When the node is out of the network the LED will not flash even though the node may be transmitting. A magnetic reed switch is located near the LEDs, touching a magnet near the LEDs will force the node to sample and report its data.



2 Analog Inputs

Each WiSI has four non-isolated 12-bit analog inputs along with the ability to measure internal temperature and internal supply voltage. In addition, solar powered (SP) nodes monitor charging status of the solar panel and the level of the internal super capacitor used to store energy. Externally powered nodes monitor the status of the input voltage.

2.1 Analog Input Type

There are currently 4 possible hardware configurations for each of the analog inputs. Any combination of the four channel types is possible but only a few are stocked. Please contact Rugid Computer or your sales representative to inquire about currently stocked models or a specific configuration requirement.

2.1.1 0-5 Volt

When an analog input is configured to measure 0 to 5 volts the input impedance is 2.2 MΩ.

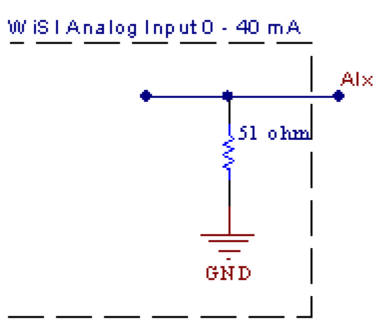
2.1.2 -1.8 Volt to +1.8 Volt

This input type allows the unit to measure a sensor output that swings below ground. Sensors used for cathodic detection typically output a signal below ground.

2.1.3 0-2.2 Volt / RTD interface

Low voltage input type is designed to measure lower voltage sensors across the full range of the ADC.

2.1.4 0-40 mA



The typical current output of a sensor is 4 – 20 mA. A WiSI analog input configured to measure current can measure from 0 to 40 mA. A precision 51 ohm resistor is used to measure the current. The low resistance value is used to reduce the overhead required by the channel from the loop supply powering the current loop. This allows for a lower loop voltage such as 12 volts to be used in solar applications running off of standard 12VDC battery systems. The current measurement is referenced to ground/DC common, requiring the WiSI's analog input to be inserted at the return of the loop. Only connect the output of a sensor to the analog channel.

2.2 Internal Temperature

Each WiSI can monitor its internal temperature. The temperature is calibrated at the factory for room temperature. The temperature measurement is an approximation and should only be used as a rough measurement. Applications requiring accurate and consistent temperature measurements should not rely on the internal temperature measurement.

2.3 Internal Voltage

Each WiSI can monitor the supply voltage for the internal electronics. This value should always be a nominal 3.3 volts. It is primarily used for a diagnostic value if a unit is not operating properly. For solar powered nodes that have almost completely discharged their internal energy storage, the internal voltage will fall below the regulated 3.3 volts and the analog measurements will no longer be accurate. This is only for the last few reported samples before the unit will no longer report. After the internal capacitor is charged the internal supply will again be the regulated 3.3 volts and analogs will once again report accurately.

2.4 Capacitor Voltage

Solar powered nodes store energy in an internal super capacitor. The capacitor voltage range is 0.7 to 2.4 volts. If the capacitor is discharged below 0.7 volts the unit will no longer be able to measure and report data. Other than a loss of data, there will be no damage to the unit if the capacitor is fully discharged no matter the duration or the number of times. The solar powered unit will begin reporting again after the capacitor is charged above 1.1 volts. If the capacitor is frequently discharged, it is recommended to decrease the sample frequency to prevent the loss of data.

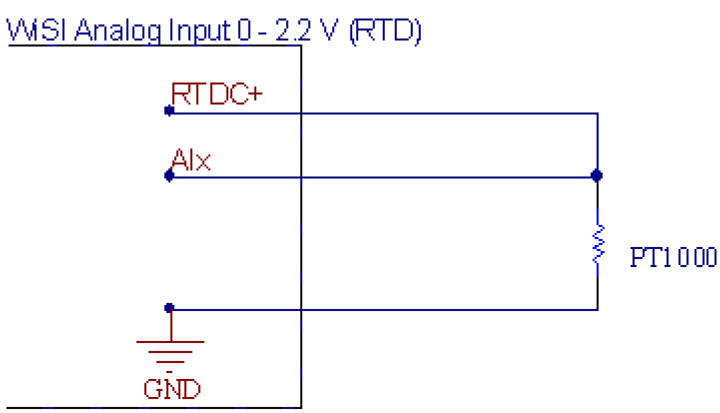
2.5 External Voltage Monitor

Externally powered nodes monitor the external voltage level and compare it to a nominal threshold of 12.0 volts. The unit will report a software status bit of 1 if the external supply voltage falls below the threshold.

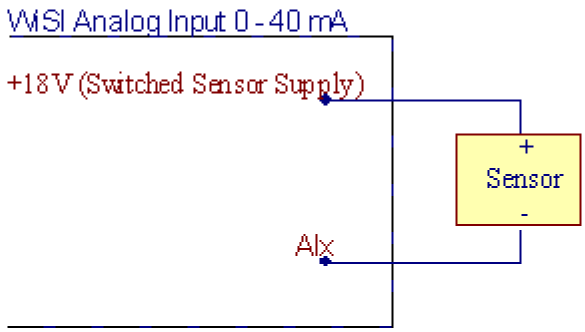
2.6 Solar Charge Monitor

Solar powered nodes monitor whether the solar panel is producing enough voltage to charge the internal super capacitor. If the solar panel is charging the capacitor, a status bit of 1 is reported. If the capacitor is fully charged, the status bit will be a zero even if the solar panel is in direct sun light.

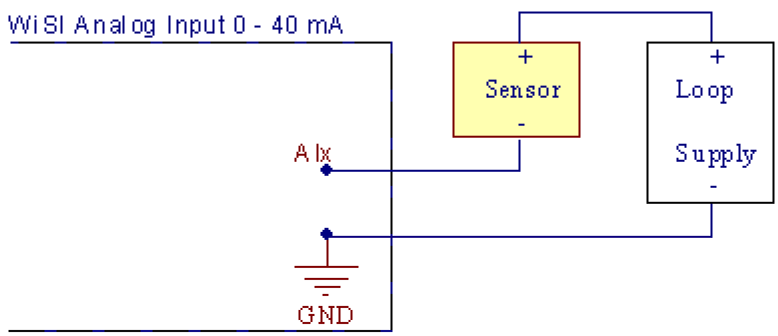
2.7 Typical Wiring Diagrams for Analog Inputs



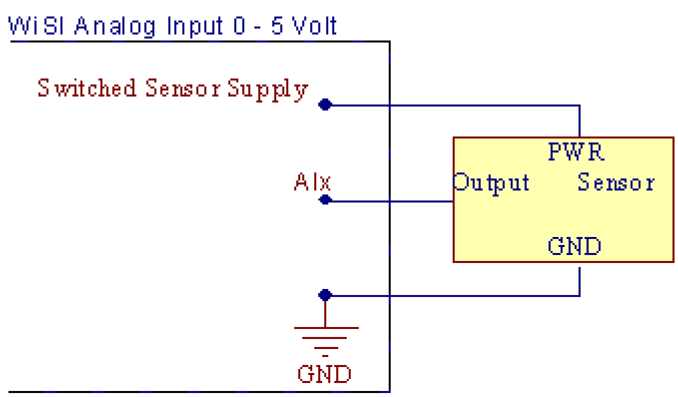
The wire diagram above uses the quarter milliamp current source on the WiSI to power the PT1000 RTD and is sensed with a low voltage input on the WiSI.



The above wiring diagram shows connecting a 4-20 mA sensor powered from the switched onboard supply.



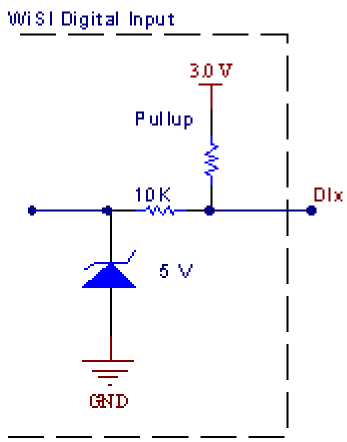
The above wiring diagram demonstrates connecting an externally powered 4-20 mA sensor.



The above wiring diagram shows connecting a 3 wire sensor to the WiSI using an onboard switched supply to power the sensor. The supply could be either the regulated 5 volts in the case of precision potentiometers and weather vanes or the 18 volt supply for sensors requiring higher power voltage than the output voltage. The output of the sensor is measured with a 0-5 volt input.

3 Digital Inputs

Each WiSI has four non-isolated digital inputs. Each digital input can be independently configured to sense/monitor a status, event, or pulse. Any combination of status, event and pulse is possible. When connecting powered digital inputs to a WiSI, the grounds for both the power source and the WiSI must be the same. Please see the specification table for minimum and maximum voltage required for ON and OFF condition.



The above diagram represents the internal hardware for each digital input. The digital inputs are wetted with a pull-up to 3.0 volts. A clamping diode allows voltages up to 24 volts to be applied to each digital input. To reduce the power draw when a digital input is pulled to ground, a very large pull-up resistor is used. Please refer to the wiring diagrams below for typical connections to the WiSI's digital inputs.

3.1 Channel Type

3.1.1 Status

A status input is sampled based on the sample rate. The input status is reported every time the WiSI unit reports.

3.1.2 Event

A digital input event is a change in state, either low to high, or high to low causing the WiSI to sample and report its data immediately.

3.1.3 Pulse

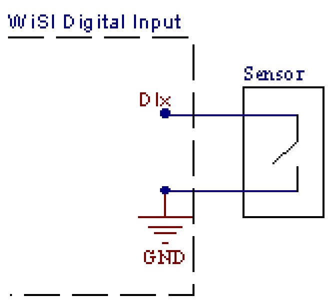
Each digital input configured to monitor a pulse can be set to count on either the rising edge or falling edge of the pulse. In most applications the pulse input is simply a contact closure. Since each digital input is internally pulled-up, a simple contact closure will pull the digital input to ground.

Model	Max Pulse Frequency	Minimum Pulse Width
End Nodes	150 Hz*	50µs
Coordinators and Routers	150 Hz**	50µs
*Limited by the wakeup time required for sleeping end nodes		
**Factory adjustable, please contact sales representative for faster frequency.		

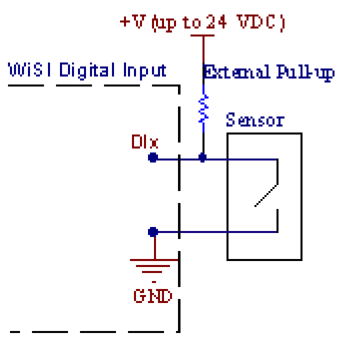
3.2 Reed Switch

A sealed magnetic reed switch is embedded in each WiSI unit. Using a magnet to engage the reed switch will immediately force the WiSI unit to sample its configured IO and report the values. There are many possible uses for the embedded switch such as time stamping an operator or worker entering or leaving, patrol route verification or verifying communication during setup and test.

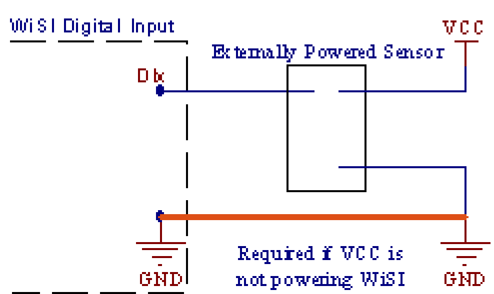
3.3 Typical Wiring Diagrams for Digital Inputs



The above wiring diagram demonstrates the most common digital input connection. This will also be the lowest power option.



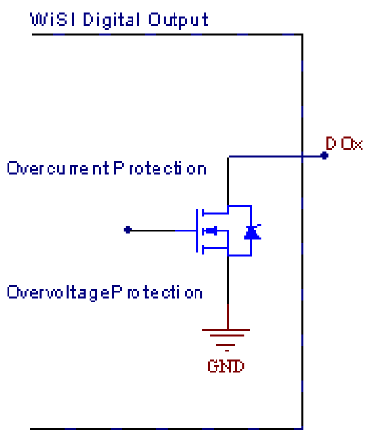
The above wiring diagram demonstrates the use of an external pull-up resistor and voltage source for increased noise immunity. This configuration is only applicable to applications with extreme amounts of digital noise or applications utilizing very long wire runs.



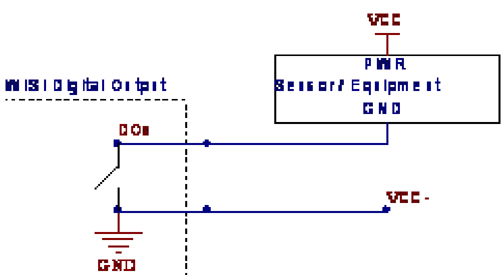
The above wiring diagram demonstrates connecting an externally powered sensor. If the sensor supply is also powering the WiSI, then only a single wire needs to be connected to the digital input. If a separate power supply is used to power the sensor, then an additional wire will be required to common the grounds.

4 Digital Outputs

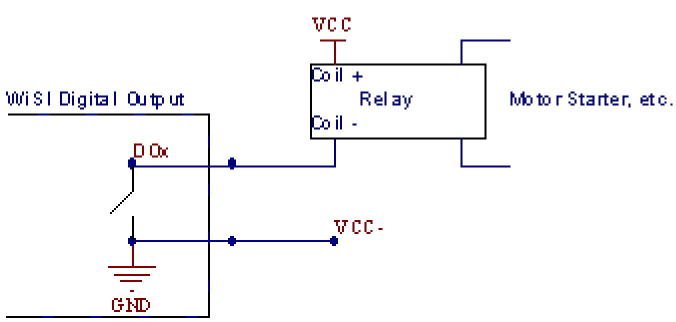
Each WiSI unit has 4 FET outputs capable of sinking 2 amps. In some cases the digital output will control an interposing relay. An interposing relay is generally used for isolation, switching higher voltage or current levels, or to meet a specific certification. When switching high currents, it is required that all 4 of the WiSI's ground pins be connected to input ground with the appropriate gauge wire.



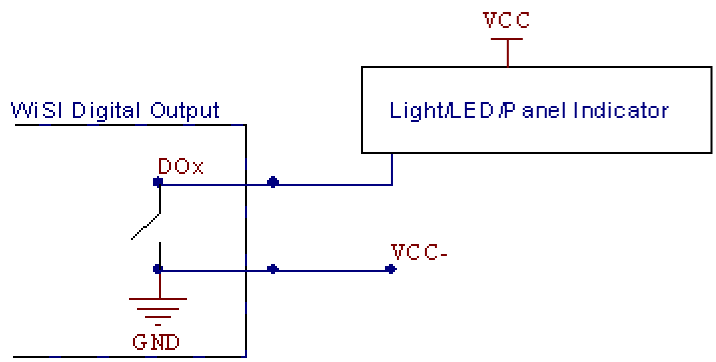
4.1 Connecting Digital Outputs



The above wiring diagram utilizes the digital outputs to control the power supply to a sensor or piece of equipment where continuous power might cause a drain on the power system.



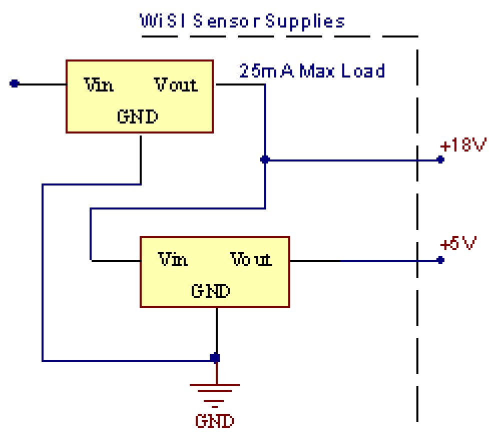
The above wiring diagram incorporates an interposing relay and a digital output to control a motor starter. Small motors could be directly controlled with the digital output, but using an interposing relay is a recommend practice to reduce possible back EMF from the motor starter.



The above wiring diagram uses the digital output to control a light.

5 Sensor Supplies

Each WiSI has an onboard sensor supply capable of supplying 25 mA for powering external sensors. A regulated 5 volt linear supply is powered from the sensor supply and can be used to power lower voltage sensors or equipment requiring a regulated voltage. Other regulated voltage values are possible; please contact a sales representative for more information.



An onboard quarter milliamp current supply is available to power RTDs.

6 Maintenance

The WiSI units are completely sealed in a UV resistant thermoplastic and are designed for continuous outdoor exposure to the elements. There should be no maintenance required for the units. Depending on the exposure of the gasket on the connector, a periodic check may be prudent in order to prevent the ingress of water into the connector back shell.

7 FCC Certification

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 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.
- Consult the dealer or an experienced radio/TV technician for help.

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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

WARNING!

FCC Radiation Exposure Statement:

This portable equipment with its antenna complies with FCC’s RF radiation exposure limits set forth for an uncontrolled environment. To maintain compliance follow the instructions below;

1. To comply with FCC’s RF radiation exposure requirements, the antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2. Avoid direct contact to the antenna, or keep it to a minimum while using this equipment.

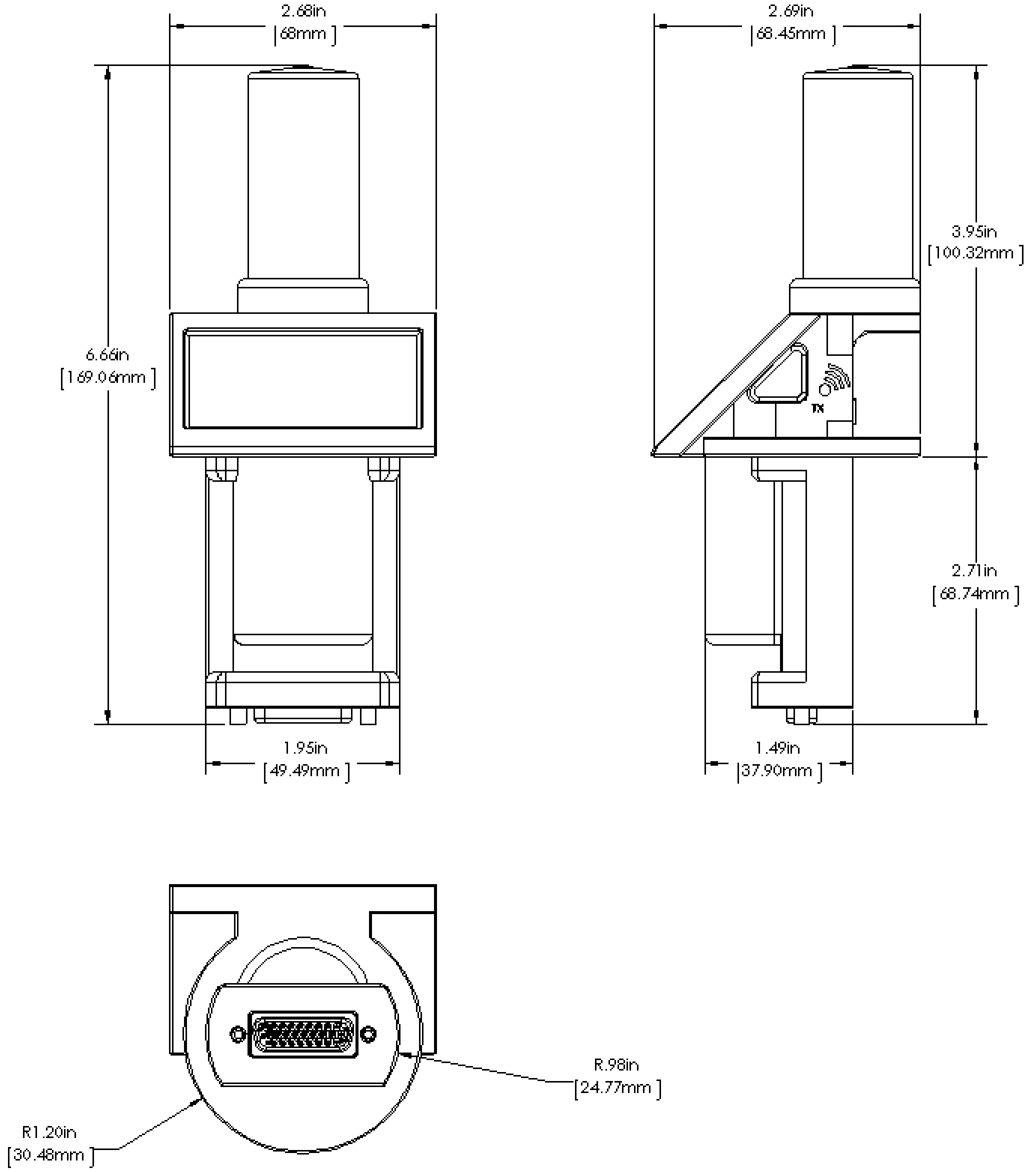
3. These units are classified as ‘mobile’ device pursuant with FCC § 2.1091 and **must not** be used at a distance of < 20 cm (8”) from any nearby people.

8 Specifications

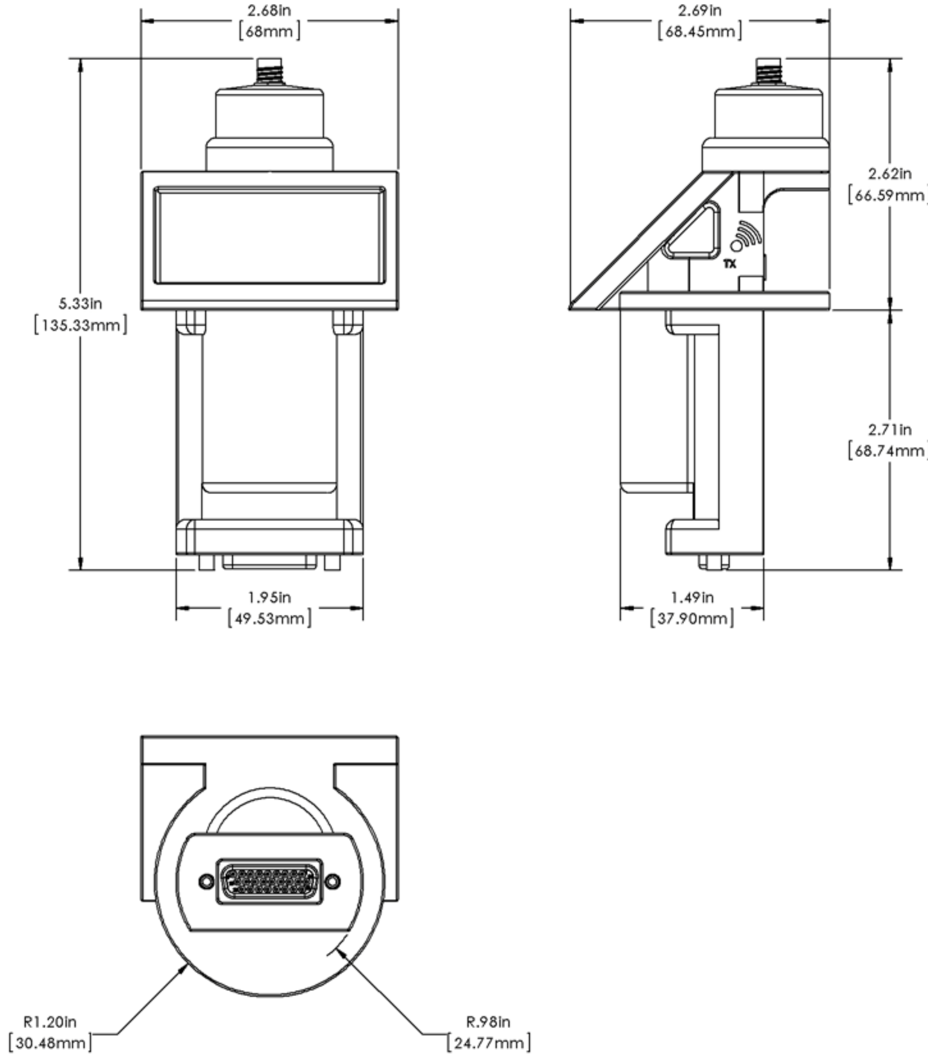
Radio: 2.4 GHz IEEE 802.15.4	
Range	Up to 4 KM / 2.5 miles
Transmit Power	+19 dBm, (79 mW)
Receiver Sensitivity	-100 dBm
Antenna Connector	Reverse Polarity SMA, 50 ohms
Antenna Tightening Torque	
Encryption	128-Bit AES, User Selectable Key
Data Rate	250 kbps
RSSI (Receive Signal Strength Indicator)	Operational between 60 and 255
Networking:	
Star	Up to 17 nodes
Tree *min of 1 routing node required for every 16 nodes	Up to 200 nodes*
General:	
Power – External Powered (EP) unit	+5 – 30 VDC
Power – Solar Powered (SP) Unit	+5 – 15 VDC
Average Power Draw (12 / 24 VDC)	19 mA / 9.5 mA
Operating Temperature	-20 to 70° C
Weight	0.24 kg (0.52 lb) – SP nodes 0.17 kg (0.36 lb) – EP nodes
Mounting *EP package only	2 inch ID pipe 2 x 8-32 screws*
Connector	High Density DB26
Connector Tightening Torque	0.34 – 0.49 N*m (3.00 - 4.34 in*lbf)
Sensor Supplies:	3 non-isolated, switched
+18 Volt Supply +5 Volt regulated	25 mA max combined load
Rise Time from switch ON	100 ms
0.25 mA current supply	

Digital Inputs:	4 non-isolated, sinking, wetted 3.0V
Input Voltage Rating	0 – 24 VDC
Input Current	2 mA max at 24 VDC
Input ON Level	0.89 VDC max
Input OFF Level	2.31 VDC min
Pulse Frequency *Factory adjustable	150 Hz max– sleeping nodes 150 Hz max*- non-sleeping
Pulse Width	50 µs
Digital Outputs:	4 FET, sinking
Voltage Rating	42 V max
Current Rating * Each connector pin is rated for 2.5 A. 4 ground pins are provided and must all be connected when switching high currents on multiple outputs.	2 A max*
Analog Inputs:	4 non-isolated 12 bit, single ended
0 – 40 mA	0.04 mA min, 45 mA max
0 – 5 Volts	0.025 V min, +5.15 V max
-1.8 Volts to +1.8 Volts	-1.8 V min, +1.8 V max
0 – 2.2 Volts	0.02 V min, +2.30 V max
Accuracy	0.25% of full scale
Serial Port:	Single RS232
Baud Rates	4800, 9600, 38,400, 76,800, 115,200
Parity	None, odd or even
Stop Bits	1 or 2
Data Bits	5, 6, 7, 8
Inner character Timeout	
Compliance	2.4 GHz
FCC	FCC ID TYOJN5139M4
Industry Canada	IC:7438A-CYO5139M4
ETSI EN	EN 300 328V1.7.1 (2006/05)

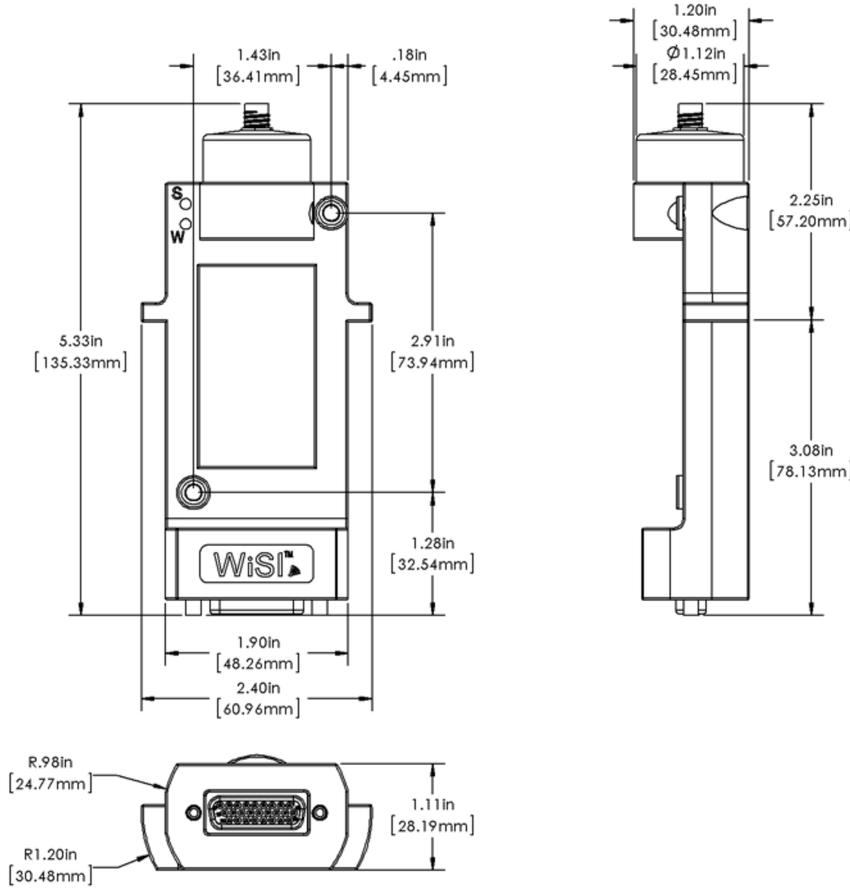
9 Dimensions



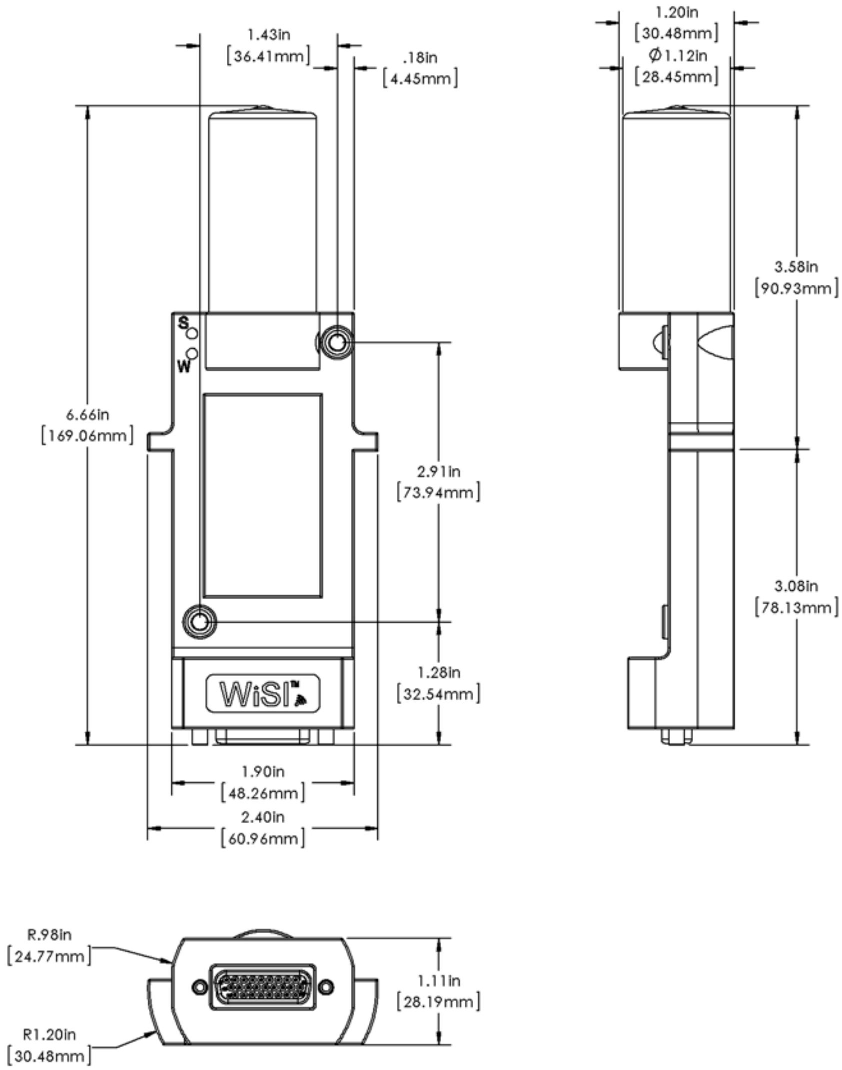
Dimensions of solar powered node with embedded antenna.



Dimensions of solar powered node with reverse polarity SMA.

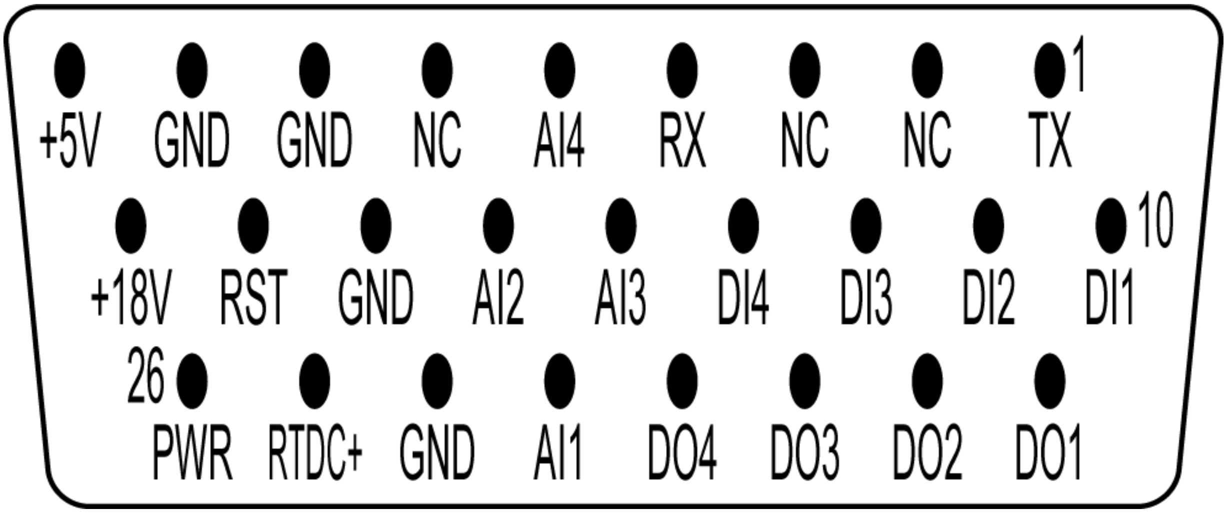


Dimensions of externally powered node with reverse polarity SMA.



Dimensions of externally powered node with embedded antenna.

10 Connector Pin Out



11 Warranty

Rugid Computer, Inc. warrants its products to be free from defects for one year. Under this warranty, Rugid Computer's obligation is limited to repairing or replacing, at our option, any equipment or parts returned, shipping prepaid and properly packed, to our plant and proving to be defective by our inspection within one year after sale to the original purchaser. This warranty shall not apply to equipment or parts thereof which are normally consumed in operation, or to any equipment which shall have been repaired or altered in any way outside our plant, so as to, in the judgment of Rugid Computer, Inc., effect its stability, accuracy, or reliability, nor which has been operated in a manner or environment exceeding its specifications, nor which has been damaged, altered, defaced, or has had its serial number removed or altered.

12 Disclaimers

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13 Contact

Rugid Computer Inc.
9730 Lathrop Industrial Dr SW, Suite F1
Olympia WA, 98512
P: 360-866-4492
F: 360-866-8074
info@rugidcomputer.com
www.rugidcomputer.com

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