

4-20mA Receiver Model PRGEN-420R

SMARTREK Datasheet 4-20mA Receiver

1 Overview

The Atrax 4-20mA receiver node is a single-channel, long-range wireless 4-20 mA receiver that leverages SpiderMesh network architecture for reliable data transmission in industrial and environmental applications. The 4-20 mA standard is a simple yet noise-resistant protocol, making it ideal for industrial processes, environmental monitoring, and water and wastewater applications.

Designed for seamless integration, the Atrax 4-20R is compatible with any 4-20 mA transmitter probe or sensor, including pressure transducers, temperature probes, and level transmitters. Its rugged construction ensures durability in harsh environments, while its wired power supply guarantees continuous operation without battery limitations. The SpiderMesh self-healing network further enhances reliability, allowing for stable and efficient data communication even in complex industrial settings.



1.1 Features

Targeting industrial environments, the PRGEN-420R includes overcurrent and reverse polarity protection, to safeguard the device from potential damage due to incorrect connections or excessive current.

The PRGEN-420R features a 24VDC built-in power supply, capable of powering the current loop for continuous operation. The configuration supports both passive and active modes, depending on the wiring. In passive mode, the node only monitors the current, while in active mode, it monitors the current and provides power to the connected probe. This flexibility ensures compatibility with a wide range of industrial sensors.

1.2 Applications

- Lift station
- Automation
- Agriculture
- Sensor and instrumentation
- Scientific studies
- Environmental monitoring

1.3 Sensors

The 4-20 mA current loop is a simple and reliable method used for transmitting analog signals from sensors to monitoring equipment. The name refers to the range of electrical currents used to represent the value of the signal. The current starts at 4 mA, representing the lowest value (such as zero or minimum), and increases to 20 mA, representing the highest value (such as full scale or maximum).

The current loop changes linearly with the measured value, simplifying signal interpretation for the PRGEN-420R. For example, 4 mA could represent 0°C, and 20 mA could represent 100°C, with the current varying smoothly between those points as the temperature changes.

The Atrax 4-20 receiver node is designed to be highly versatile and compatible with nearly any 4-20 mA sensor. The 4-20 mA protocol is an industry standard, and a wide variety of industrial sensors support this protocol.

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2 Data

The Atrax 4-20R Receiver Node contains a shunt resistor that measures the current flowing through the 4-20 mA loop. This loop operates continuously. The node samples the current within the loop when polled to provide an updated reading each time.

The configuration settings affect how data is displayed on the gateway but do not influence node operation. Users can adjust the display settings, including selecting the appropriate unit of measurement, setting the offset, and determining the maximum value for the readings. These settings allow for customization of the data presentation to match the sensor used.

Table 1: Configuration options available for the PRGEN-420R

Name	Unit	Default	Description
CURRENTLO	%	0	Low current threshold for custom alarm
CURRENTHI	%	100	High current threshold for custom alarm
OFFSET	UNITID	0	Value corresponding to 4 mA
UNITID	-	0	0. % 1. psi 2. bar 3. inHg 4. kPa 5. mH ₂ O 6. °C 7. °F 8. m 9. A 10. gal/s 11. gal/min 12. gal/hr 13. gal UK/s 14. gal UK/min 15. gal UK/hr 16. L/s

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Name	Unit	Default	Description
			17. L/min
			18. L/hr
			19. L
			20. gal
			21. gal UK
			22. Hz
			23. N•m
			24. lbf
			25. rpm
			26. ton/hr
			27. ton/min
			28. ton UK/hr
			29. ton UK/min
			30. kg/hr
			31. kg/min
			32. lb/hr
			33. lb/min
			34. NTU
			35. in
			36. ft
			37. lb
			38. ton
			39. ton UK
			40. kg
MAXRANGE	UNITID	100	Value corresponding to 20 mA

Table 2: Values available from the PRGEN-420R

Name	Unit	Resolution	Description
RSSI		1	Strength of the RF signal at the node.
VOLTAGE	V	0.05	Voltage of the battery pack.
CURRENTPERCENTAGE	%	0.01	Current value in percent 0% is 4 mA, 100% is 20 mA and -25% is 0 mA

2.1 Modbus

When used with a Modbus gateway, the data and configuration for the PRGEN-420R are mapped to input registers and holding registers respectively. The offset at which the information is mapped depends on the Gateway used and its configuration. As such, refer to the manual of your SpiderMesh Gateway for more details.

Table 3: Modbus input register list for the PRGEN-420R

Offset	Register	Encoding	Format
0	RSSI	1	i16
1	VOLTAGE	0.05 V	u16
2	CURRENTPERCENTAGE	0.01 %	u16

No configuration is mapped by default for the PRGEN-420R, as such there is no holding register list.

2.2 Local Storage

The 4-20R Receiver node does not store data locally. Upon polling, the node immediately reads the current state of the input and returns the latest value. This ensures that the data transmitted is always up to date, with no reliance on internal memory.

2.3 Data poll timing

The node requires a polling interval (DYN) of at least 500 ms. When polled, it directly reads the current analog value and returns the live data. No data is stored locally, so the response always reflects the actual analog input at the time of the poll.

3 SpiderMesh

SpiderMesh is a Low Power Wide Area Network (LPWAN) protocol, from concept to reality, it is a Machine-to-Machine (M2M) wireless technology built from the ground up.

The first truly cooperative mesh technology, featuring bit synchronized communication, we make it possible to counter the well known effect of packet collision as the network increases in size. A true differentiation between SpiderMesh and other mesh protocols.

While standard protocols re-transmit data in a nondeterministic fashion in the event of a packet collision, SpiderMesh makes it possible to avoid these collisions. Thus, unrivaled and unmatched performance in terms of power consumption, network size and reliability in maintaining M2M communication.

Table 4: General network specifications

Specifications	Performance
Frequency Band	North America: 902-928MHz Europe, Australia/NZ: 860MHz Japan: 925MHz
Wireless Technology	SpiderMesh
Encryption	AES-128
Range	Up to 10km/7Miles (LOS*) 500m average (NOLS**) 300m (deciduous forest)
Max hop count	30 (total range is 30x node-to-node range)
Max number of A-Link on network	Unlimited

*LOS: line of sight

**NLOS: near line of sight

3.1 Portia

The PRGEN-420R as well as all the other Atrax products are powered by the SpiderMesh Portia module. Portia radio transceivers provide an extremely high wireless network range. To achieve this, radios use the proprietary SpiderMesh technology, a cooperative mesh wireless protocol developed by Smartrek Technologies. This protocol provides synchronous communication between the links to mitigate network contention issues. This strategy allows Portia radios to offer a connectivity solution

for the most challenging applications.

The nodes act as repeaters within the linked networks. Data transfer is bidirectional, and thus, nodes allow for controlling, reading, or both, of either digital or analog external module, therefore connecting them to the mesh network. Activating a link in the field only requires the node to be on the same radio frequency channel as the network during deployment. This considerably reduces installation complexity as there is no technical knowledge required for its use.

For more details about the Portia radio module, refer to the [Portia module datasheet](#).

3.2 Node Register Configuration

The Portia radio module provides hardware registers that can be tuned to change its configuration. The SpiderMesh network allows remote reading and writing of these registers and as such, the Portia within the PRGEN-420R can be configured through its registers to better suit the system to your application. Registers can be used to configure the RF channels and other mesh parameters, access internal memory and much more. Public available registers are documented within the [Portia module datasheet](#).

3.3 Gateway Requirement

In order to fetch the data from the node, the node must be connected to one of the compatible Smartrek gateways. The PRGEN-420R is compatible with the following Smartrek gateways:

- Smartrek Modbus Gateway
- Smartrek Smart Gateway V1
- Smartrek SG+

4 Power

The 4-20R receiver node is not battery-operated, because the 4-20 mA current loop is always active and requires a continuous power supply. Typically, the node is powered by an external 120V AC to 24V DC switch-mode power supply. To ensure continuous operation, it is recommended to pair the node with an uninterruptible power supply (UPS), ensuring consistent performance even during power outages.

5 Technical Specifications

5.1 Performance

Table 5: Specifications of the PRGEN-420R

Specifications	unit	Performance
Enclosure Protection	-	Weatherproof enclosure for outdoor use
Resolution	μA	20
Accuracy	μA	80
Measuring Range	mA	4 to 20
Supply Voltage Range	V	9 to 25
Nominal Power Supply Voltage	V	24
Power Consumption (standalone)	W	0.4 W
Voltage Drop @ 20 mA	V	1.7
Voltage Drop @ 4 mA	V	1.3
Number of Channels	-	1
Connector Type	-	M12

5.2 Pinout

Pin number	Name	Purpose
1	24V+	24V coming from A-Link power source.
2	Sense	Analog Input. The current flowing between Sense and GND is measured by the internal circuitry.
3	GND	The negative terminal of the A-Link power source
4	N.C.	This pin is not internally connected.

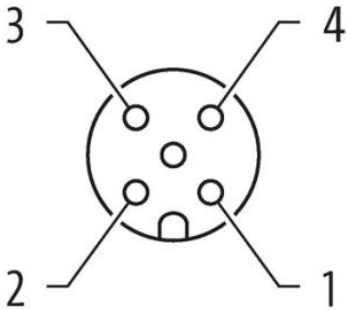


Figure 1: M12 connector diagram

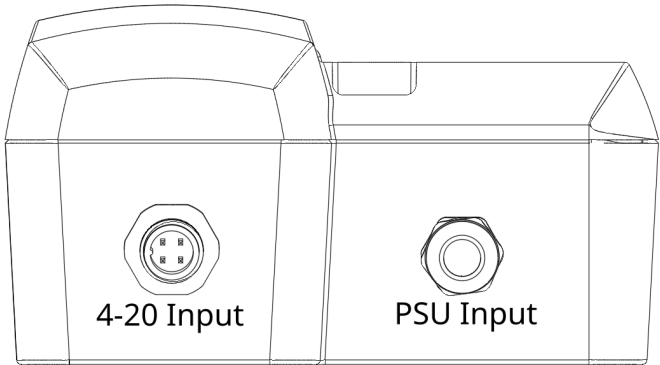
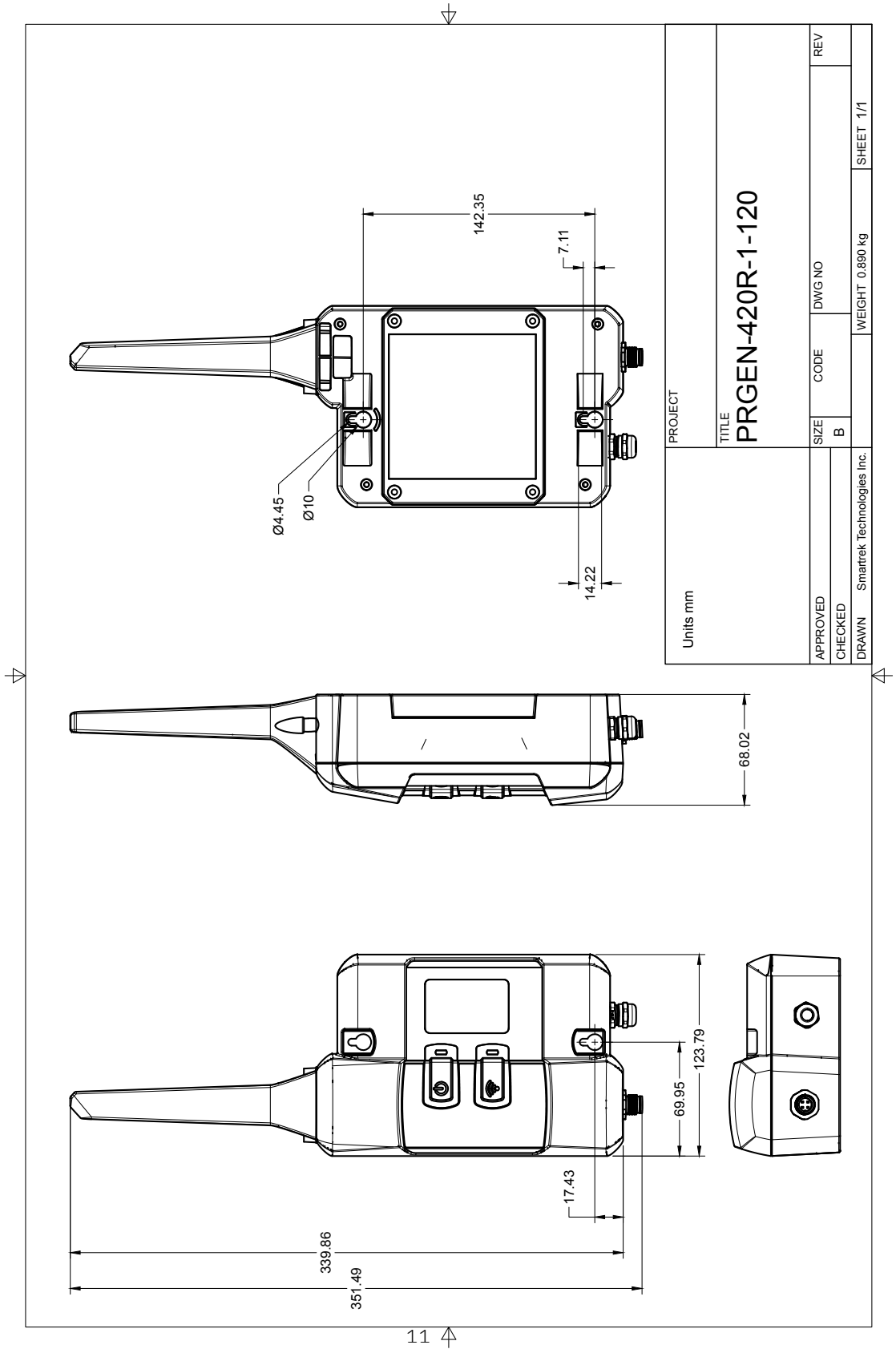


Figure 2: Port assignment for the 4-20 node

5.3 Technical Drawing



6 Installation and Configuration

This guide will walk you through the necessary steps to properly install and configure your PRGEN-420R to ensure optimal performance. It is important to follow these instructions carefully to avoid any potential issues or damage to the device. If you have any questions or encounter any problems during the installation process, please refer to the troubleshooting section of this guide or contact Smartrek Technologies support for further assistance.

6.1 Probe Installation

Current loop basic components

The 4-20 mA loop consists of three key elements: the power source, the transmitter, and the receiver.

The power source is the component that supplies the necessary voltage to the current loop, ensuring that the current can flow through the system. The power source provides the energy to drive the current, but it does not modulate the current based on measurements. In most setups, only one power source is used in the loop.

The transmitter measures a physical parameter such as pressure, temperature, or level and modulates the current accordingly. It adjusts the current from 4 mA, representing the minimum value, to 20 mA, representing the maximum value, based on the measurement. However, the transmitter does not supply the current; it only regulates the flow within the loop, which is powered by the power source. The loop must always have a single transmitter, as multiple transmitters would interfere with accurate current modulation.

The receiver monitors the current in the loop and interprets the current levels to provide meaningful data. While multiple receivers can be connected in series, each receiver adds a small voltage drop across its input terminals. If too many receivers are added, the total voltage drop may become too high, potentially reducing the available voltage for the transmitter and affecting proper loop operation.

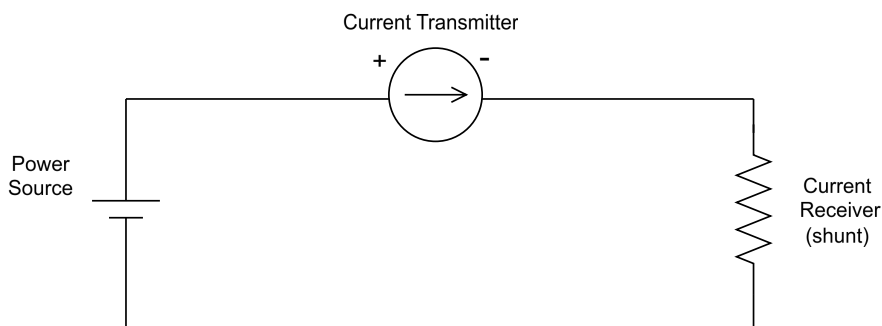


Figure 3: Electrical diagram for a standard 4-20 mA loop

Electrical model

The PRGEN-420R has a 24VDC power supply and a shunt resistor for current monitoring. The power supply is not directly connected to the shunt resistor, which allows for flexible wiring configurations. It can power the loop itself or other connected probes. The GND pin is connected to both the power supply and one pole of the shunt resistor, while the other pole of the shunt is available for user connection. The three-wire configuration is the most versatile but requires an understanding of the components in the current loop to ensure correct operation. To connect the probe to the appropriate pin, an M12 4 pin screw connector is provided with the node.

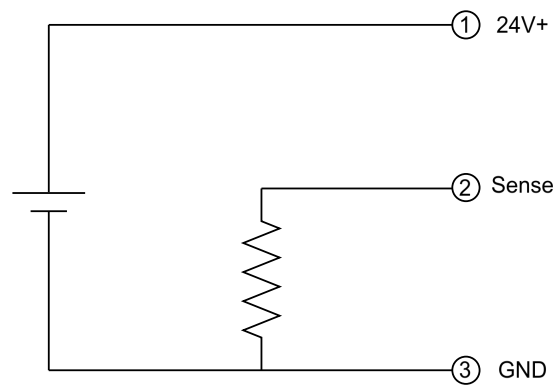


Figure 4: Simplified electrical diagram of the PRGEN-420R

Two wire configurations

In a two wire configuration, there are two possible wiring configurations for connecting the 4-20R node: passive and active.

1. Passive configuration:

In the passive configuration, the node only uses its shunt resistor to monitor the current flowing through it. This configuration is useful when the loop already has a power source and transmitter in place. The receiver only monitors the current and does not provide any power to the loop. This setup works when the transmitter or another device in the loop has a built-in power source.

- **Use Case:** You can hook up the node to an existing loop that already has a power source, or connect to equipment with an integrated power source.

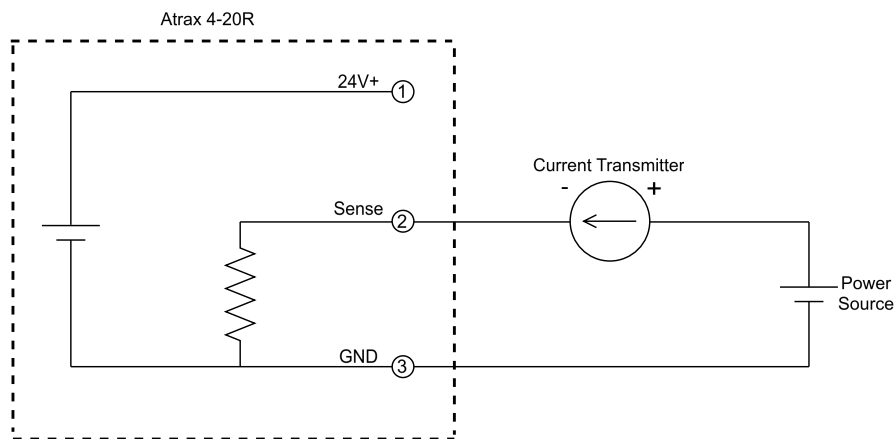


Figure 5: 4-20mA Receiver connected as a passive configuration

1. Active configuration:

In the active configuration, the node provides a 24VDC power source to the loop. This configuration is typically used for probes or sensors that are powered through the loop. The node powers the connected device using the loop current and provides the necessary voltage for proper operation.

- **Use Case:** This is ideal for sensors or probes that require to be powered through the loop. The node supplies both the monitoring capability and the required power.

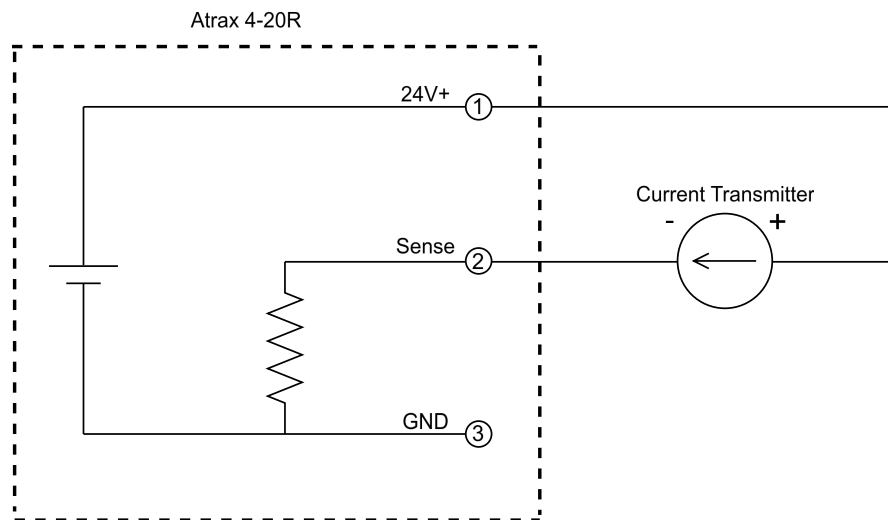


Figure 6: 4-20mA Receiver connected as an active configuration

Understand the device you connect to the node

Before wiring the node, it is crucial to fully understand the specifications of the device you are connecting. Incorrect wiring can lead to malfunction, inaccurate readings, or even damage to the equipment. Proper identification of all components ensures a reliable and safe installation.

Key elements to verify:

- **Probe power requirements:** Verify whether the probe requires an external power supply or if it is powered through the loop.
- **Loop power source:** Determine whether the probe supplies power to the loop or if an external source is required.
- **Pinout of the current transmitter:** Identify the correct terminals for power and signal connections.
- **Polarity of the current output:** Identify from which pin the current enters and from which pin the current exit from to ensure proper flow direction.

Choose the right configuration

Now that you are familiar with both the probe and the node, you should be ready to correctly connect your 4-20 mA probe to the PRGEN-420R. The most challenging part is usually determining how the loop should be powered. Here are some helpful guidelines to assist you in choosing the right configuration for wiring your probe:

- **2-wire device with no built-in battery:** This device is powered through the loop. Use an active connection.
- **Powered loop:** If the loop is externally powered, opt for a passive connection.
- **Monitoring an existing loop:** In this case the loop is already powered, a passive connection is recommended.
- **Externally powered device:** If the device has a built-in battery pack or an external power supply, check its datasheet to confirm if it powers the loop. If it does, choose a passive connection; if not, use an active connection.

Connect the probe to the node

1. Ensure the node is unplugged before wiring.
2. Use the M12 connector provided with the node and wire it according to your selected configuration and your probe's pinout. Refer to the [5.2](#) section for details.
3. Once everything is connected, power up the node by plugging it into the power outlet.

6.2 Connect the node to a network

To establish a connection with a Smartrek gateway, the following conditions must be met:

- The node must be on the same channel as the gateway.
- The node must have the same encryption as the gateway.
- The node must be within range of the gateway or any other node that is connected to it.

Once the node begins searching for a network, the channel LED will blink three times every 8 seconds, indicating the search process.

With the correct configuration, the node will automatically sync to the network upon powering on, eliminating the need for manual intervention.

However, after successful connection, please ensure that the node is manually added to the node list of the gateway. Otherwise, the gateway will not recognize the device as connected.

To configure the channel and encryption settings, kindly refer to the user guide of your gateway.

6.3 Change SpiderMesh channel

[A video guide is available for this step](#)



First, make sure the sensor is powered off. Once the sensor is off, locate the channel button. While **keeping the channel button held down**, proceed to the next steps.



While keeping the channel button held down. **Plug-in the power supply.**



Once you have pressed the power button while holding down the channel button, the power LED on the sensor will start blinking to indicate that it is booting up. You must wait until the power LED stops blinking **and the channel LED stays lit up solid** before **releasing the channel button**. This indicates that the channel change process is starting.



Slowly press the channel button a number of times that corresponds to the desired channel.

To clarify, “slowly” means that you should wait for a brief moment between each press. This will ensure that the sensor can register each press correctly and prevent any accidental multiple presses from being registered as a single press. The number of times you need to press the button corresponds to the desired channel number, so if you want to set the sensor to channel 5, you would press the channel button slowly five times. Each time you press the button, the channel LED on the sensor will light up to indicate that it has registered the press.



Once you have finished pressing the channel button the desired number of times, **hold down the channel button** one last time while waiting for the channel LED to turn off. This indicates that the sensor has successfully completed the channel change process. Once the channel LED turns off, release the channel button. The channel LED will then flash the number of times corresponding to the new channel to confirm the successful channel change.



Power cycle the node (turn it off and on again) and the node will connect to the newly selected channel.

7 Troubleshooting

Issue	The node returns a negative value
Causes	<ol style="list-style-type: none"> 1. The current loop is interrupted 2. The current is below 4 mA
Actions	<ol style="list-style-type: none"> 1. Validate the chosen wiring configuration 2. Inspect and rewire the connections if necessary 3. If possible, measure the current at the Sense pin with a multimeter 4. Inspect both the probe and the node

Issue	The node is not connecting to the gateway
Causes	<ol style="list-style-type: none"> 1. The Node is turned off. 2. The Node does not have the same encryption as the gateway. 3. The Node is not on the same channel as the gateway.
Actions	<ol style="list-style-type: none"> 1. Unplugged the power supply and wait 10 sec for the capacitor to drain. 2. Plug back the power supply. 3. Count the number of times the bottom LED will pulse at boot, it corresponds to your channel number. Beware at boot the top led blink always 3 times to indicate the start up of the radio module. Beware while in network seek mode the bottom led will blink 3 times once every 8 seconds. 4. Validate that the node is on the same channel as the gateway.

8 Ordering Information

Table 9: Product number of the PRGEN-420R

Part number	Description	Country
PRGEN-420R-1-120	Atrax node with an external 120AC to 24VDC power supply	North America