

# Rain gauge

## Model PRGEN-RG

SMARTREK Datasheet Rain gauge

## 1 Overview

Monitoring rainfall in real time offers valuable benefits across various applications. For instance, cities facing inflow and infiltration (I&I) issues can deploy real-time rain gauge monitors in order to ensure accurate measurements. These measurements are used in I&I studies that will guide costly sewer system rehabilitation decisions. Rainfall-derived I&I prediction requires precise precipitation data that can be easily collected with the Rain Gauge Atrax A-link. Furthermore, the A-Link rain gauge stands out for its ease of installation and maintenance, as well as its compatibility with most tipping bucket available on the market.



### 1.1 Features

The Rain Gauge A-link is a 1 channel, long range, wireless tipping bucket rain gauge monitor. It can be connected to most tipping buckets with a pulse output on the market. Additionally, the sensor shows the rain rate by averaging the total number of tips over a rain event. It also stores the total number of tips in its internal memory, therefore keeping track of the totalizer value even after losing power. A total of 3 resettable totalizers are provided with the option to select one of the following 3 modes of operations: 1) generic totalizer, 2) total rain in the current rain event and 3) the total rain in the last X hours.

### 1.2 Applications

- Dewatering
- Agriculture and irrigation
- Weather monitoring
- Engineering & Urban planning
- Environmental studies
- Aquifer monitoring

## 1.3 Sensors

TECHNOLOGY  
**HOLYKELL**



### HRS10(H) from Holykell

The HRS10 is a special tool used in hydrology and meteorology. Its main purpose is to measure natural rainfall and convert that information into a digital format for easy transmission, processing, recording, and display. The instrument is made up of several parts including a 200 mm diameter rainfall receiver and a measuring component. The measuring component is a tipping bucket type mechanism that converts the depth of rainfall into a digital signal output. This mechanism works by tipping over when a certain amount of rain has been collected, signaling a specific amount of rainfall. Additionally, the HRS10H is equipped with a heating unit that can be activated by connecting it to a 120/220V power source. This heating unit is particularly useful in cold weather conditions like snow, ensuring the instrument functions properly even in harsh environments. Contact us for the device datasheet.



### TR-525MM from Texas Electronics

The TR-525MM, manufactured by Texas Electronics, is a high precision tipping bucket rain gauge that monitors rainfall. It measures in 0.1 mm increments and has a 24.5 cm funnel. This tipping bucket is widely used in environmental monitoring applications. When required it can also come with bird spikes and an electric heater to quantify precipitation even in winter conditions. You can download the datasheet from Texas Electronics [here](#)

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## 2 Data

A tipping bucket rain gauge is a simple yet effective tool for measuring precipitation. It consists of a funnel that collects rainwater and directs it into a small bucket with a narrow opening at the bottom. As water fills the bucket, it becomes heavier, causing it to tip and empty its contents. This tipping action triggers a switch, indicating a certain amount of rainfall, typically set at 0.1 mm. The PRGEN-RG A-Link records these activations of the switch, keeping track of the total count in its built-in totalizer. It also has signal processing capabilities to calculate the rain rate. Additionally, it offers three resettable totalizers to help with data analysis and alarm setup.

Various configuration fields are available for the PRGEN-RG. There are three different modes where you can independently configure the totalizer: miscellaneous totalizer, total in the current rain event, and total from a fixed period of time. Since the PRGEN-RG is compatible with most tipping buckets on the market, it is also possible to specify the resolution of the tipping bucket. This allows the end user to connect the PRGEN-RG to any existing tipping bucket with a pulse output. Another configuration available to the end user is controlling the way the rain rate is computed. The rain rate can be computed under three different modes: rain rate computed from a fixed period of time, rain rate computed from a fixed rain height, and rain rate from the current rain event.

Table 1: Configuration options available for the PRGEN-RG

Name	Unit	Default	Description
TOTALAMODE		0	Totalizer A mode: 0: Miscellaneous totalizer 1: Total in the current rain event 2: Total from a fixed amount of time
TOTALARST		0	Reset signal of the totalizer A
TOTALBMODE		0	Totalizer B mode: 0: Miscellaneous totalizer 1: Total in the current rain event 2: Total from a fixed amount of time
TOTALBRST		0	Reset signal of the totalizer B
TOTALCMODE		0	Totalizer C mode: 0: Miscellaneous totalizer 1: Total in the current rain event

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Name	Unit	Default	Description
			2: Total from a fixed amount of time
TOTALCRST		0	Reset signal of the totalizer C
TOTALIZERTIME	min	360	Time used to compute Total from a fixed amount of time
RAINEVENTTIMEOUT	min	360	Time without new pulse before declaring a rain event as over
MM_TIP	mm	0.1	Rain height corresponding to a bucket tip
RAINRATEMODE		0	Rain rate computation algorithm 0: Rain rate from a fixed time 1: Rain rate from a fixed rain height 2: Rain rate from the current rain event
RAINRATETIMEFRAME	min	60	Time frame to compute rain rate in rain rate from a fixed time mode
MM_TIP	mm	0.1	Rain height corresponding to a bucket tip
ENABLETOTALA		1	Enable totalizer A functionality
ENABLETOTALB		1	Enable totalizer B functionality
ENABLETOTALC		1	Enable totalizer C functionality

Table 2: Values available from the PRGEN-RG

Name	Unit	Resolution	Description
RSSI		1	Strength of the RF signal at the node.
VOLTAGE	V	0.05	Voltage of the battery pack.
TOTALA	pulse	1	Pulses counted by the totalizer A
TOTALB	pulse	1	Pulses counted by the totalizer B
TOTALC	pulse	1	Pulses counted by the totalizer C
RAINRATE	mm/h	0.01	Computed rain rate
ISRAINING			Flag is raised during a rain event
mTotalAComputed	mm	MM_TIP	Computed value of the totalizer A
mTotalBComputed	mm	MM_TIP	Computed value of the totalizer B
mTotalCComputed	mm	MM_TIP	Computed value of the totalizer C

## 2.1 Modbus

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

Table 3: Modbus holding register list for the PRGEN-RG

Offset	Register	Encoding	Format
0	MM_TIP	0.001 mm/tip	u16
1	TOTALAMODE	0, 1 or 2	u16
2	TOTALARST	0 or 1	u16
3	TOTALBMODE	0, 1 or 2	u16
4	TOTALBRST	0 or 1	u16
5	TOTALCMODE	0, 1 or 2	u16
6	TOTALCRST	0 or 1	u16
7	TOTALIZERTIME	1 min	u16
8	RAINEVENTTIMEOUT	1 min (max = 4069)	u16
9	RAINRATEMODE	0, 1 or 2	u16
10	RAINRATETIMEFRAME	1 min (max = 4069)	u16
11	RAINRATEHEIGHTFRAME	0.01 mm	u16

Table 4: Modbus input register list for the PRGEN-RG

Offset	Register	Encoding	Format
0	RSSI	1	i16
1	VOLTAGE	0.05 V	u16
2	mPowerCorrected	1 %	u16
3	RAINRATE	0.01 mm/h	u16
4	ISRAINING	0 or 1	u16
5	mTotalAComputed	mm	float
7	mTotalBComputed	mm	float
9	mTotalCComputed	mm	float

## 2.2 Local Storage

When the node receives a pulse, it immediately stores it along with its timestamp in a circular buffer. This buffer serves a dual purpose: it helps in calculating both the rain rate and the total rainfall accumulation within a fixed time frame. When powered-off, the node ensures data persistence by saving the total rainfall accumulation value in its memory. Simultaneously, it clears the circular buffer, which can hold up to 1024 pulses, preparing it for new data collection when powered back on.

## 2.3 Data poll timing

This sensor requires up to 500 ms to transmit the data from its internal memory. Every time this node is polled it responds with the most recent data it has in its memory. As such, the usage of this sensor requires a DYN period equal or slower than **500 ms**. Refer to the documentation of your SpiderMesh Gateway for more details on how to set the DYN period of your network.

# 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 5: 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-RG 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-RG 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 gateway. The PRGEN-RG is compatible with the following Smartrek Gateway:

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

## 4 Power

The ATRAX node is powered with three D-cell alkaline batteries. Figure 1 shows the expected battery life depending on the mesh configuration. Every ATRAX node is sold with high quality batteries. User replacements, which may be of lower capacity, might provide a lower duration. In addition, SpiderMesh nodes, similar to many other wireless protocols, draw much more power while trying to find a network. In such cases, batteries can be depleted in a few weeks. Ensure that the network and connectivity are appropriate by following the suggested installation procedures.

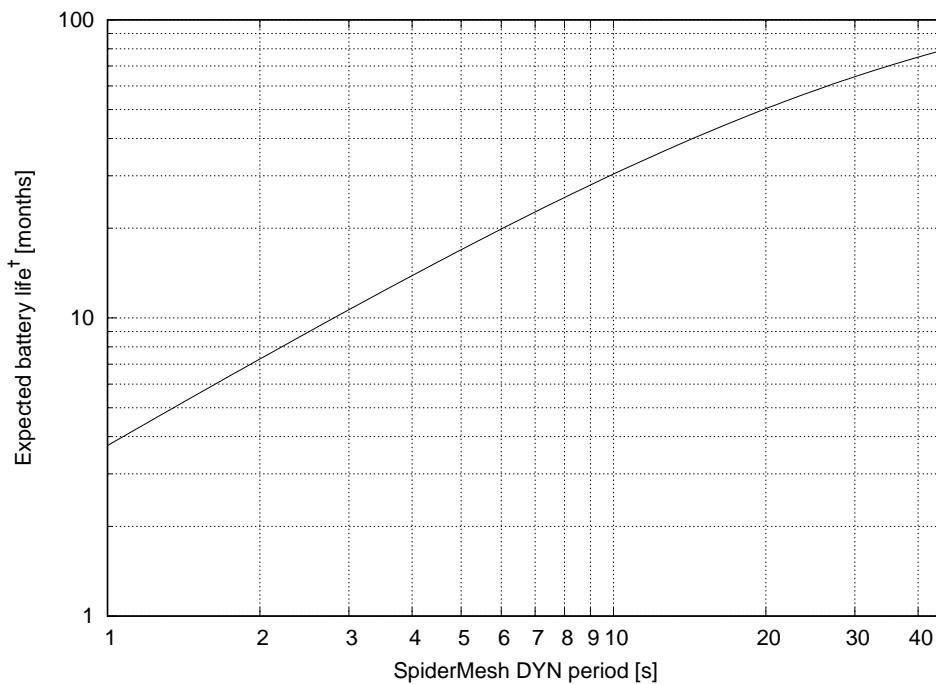


Figure 1: Battery Life Expectancy

† Battery life depends on the network configuration as well as other parameters, such as loss of connectivity and others.

## 5 Technical Specifications

### 5.1 Performance

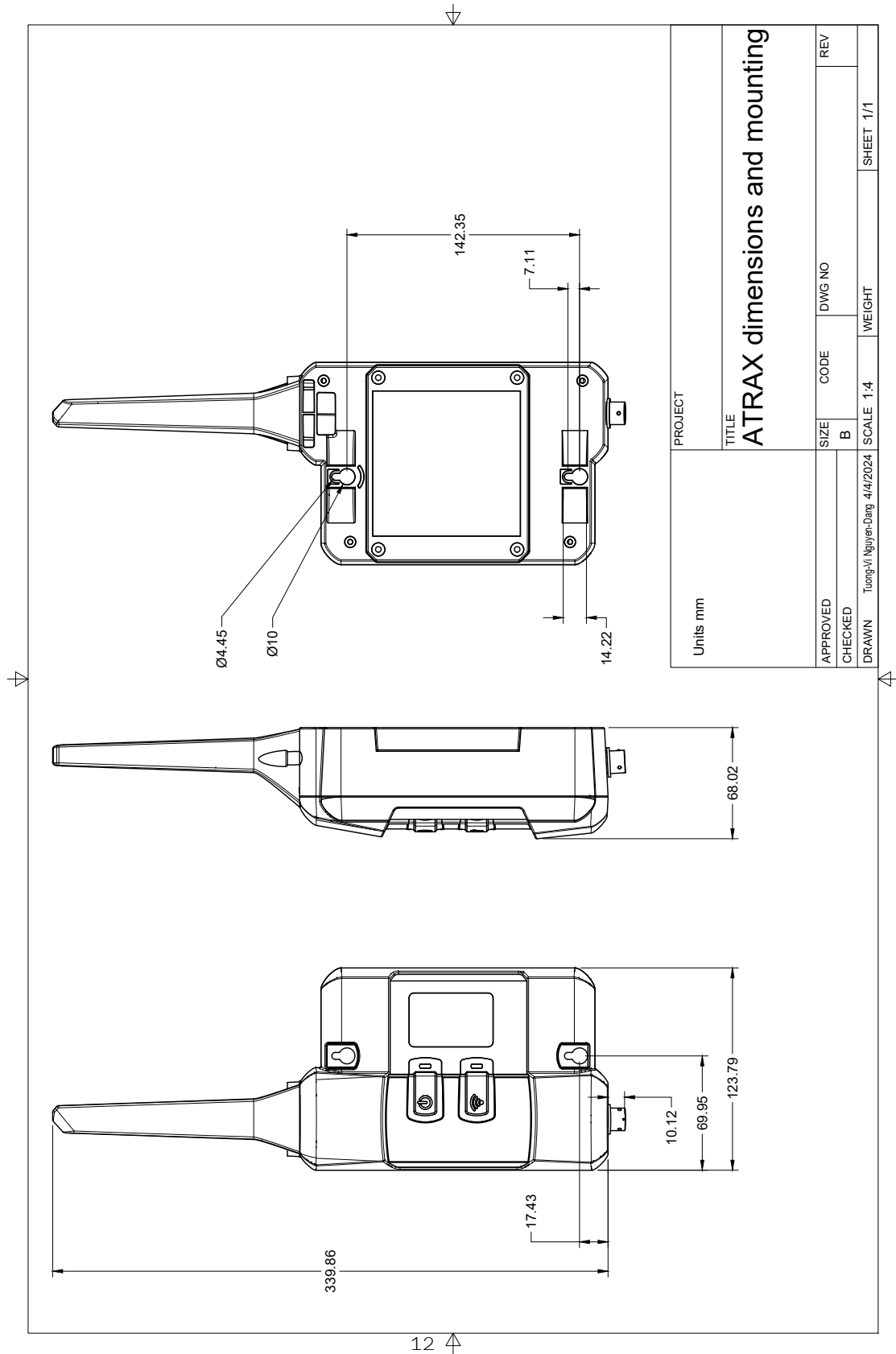
Table 6: General Network Specifications

Specifications	unit	Performance
Enclosure protection		Weatherproof enclosure for outdoor use
Nb of input channel		1
Maximum totalizer tip count		A: 4,924,967,296 B, C: 16,777,216
Max voltage at input	V	5.5
Pull-up voltage at input	V	33.3
Pull-up resistor value	k $\Omega$	2.2
Max rain event timeout	min	4096
Debouncing filter	ms	9.98
Weight	kg	0.930
Dimension	mm	339 x 124 x 68

### 5.2 Pinout

Pin number	Name	Purpose
1	Pulse +	Positive pulse input
2	Pulse -	Negative pulse input

### 5.3 Technical Drawing



## 6 Installation and Configuration

This guide will walk you through the necessary steps to properly install and configure your PRGEN-RG 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 Installation of the tipping bucket

The tipping bucket can be mounted in 2 different ways. The first one is to directly mount it to a pole using a hose clamp. With this strategy, it is important to verify that the pole is solidly installed. The pole or pipe can be attached to a concrete foundation using J-bolts or placed directly into a concrete foundation. A concrete pad is recommended, but it should not be installed over a large paved or concrete surface. The second method consists of pouring a 15" square concrete pad with three anchor bolts. Then, you will be able to install and level the rain gauge.

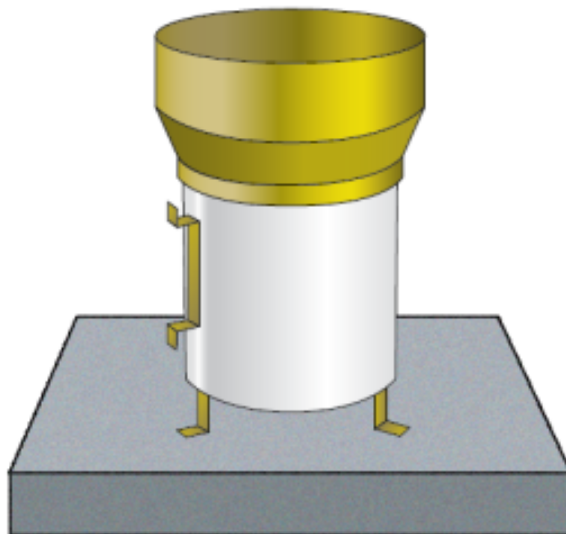


Figure 2: Rain gauge installation directly on a concrete pad

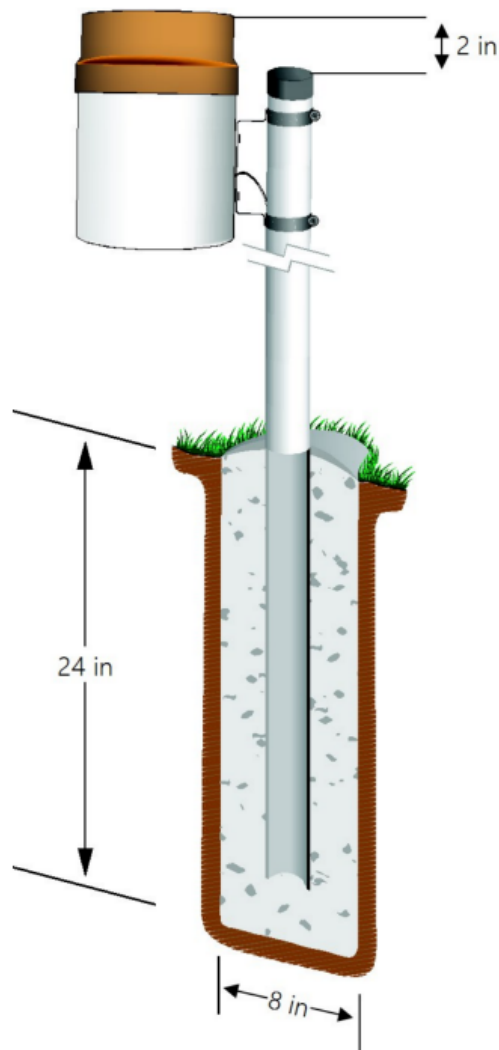


Figure 3: Rain gauge installation on a pipe

## 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.

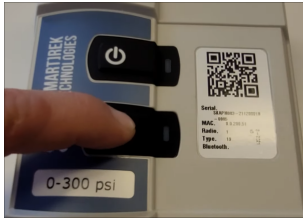
With the correct configuration, the node will automatically sync to the network upon powering on, eliminating the need for manual intervention.

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.

For configuring 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. If it's still on, hold down the power button for at least ten seconds until it turns 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. **Press the power button** once.



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 Maintenance and Troubleshooting

### 7.1 Maintenance

Ensure the cleanliness of the funnel and bucket mechanism by regularly inspecting and clearing away any debris, such as leaves, dust, or insects.

### 7.2 Calibration procedure

Here is the calibration procedure issued from the manual of the TR-525MM.

1. Secure a can or bottle that will hold at least 16 oz of water.
2. Punch a very small hole in the bottom of the can or bottle. If it takes less than 45 minutes for 16 oz of water to run out, the hole in the can is too large.
3. Place the can in the top funnel of the rain gauge and pour 16 fluid ounces of water into the can. (A 16 oz soft drink bottle filled to 2.5 inches from the top may be used for a rough field calibration. An exact volume will allow for a more precise calibration.)
4. The following number of tips should occur for the TR-525MM:  $100 \pm 3$
5. Adjusting screws are located on the bottom, adjacent to the large center drain hole. Adjust both screws the same number of turns. Rotation clockwise increases the number of tips per 16 oz. of water; counter clockwise rotation decreases the number of tips per 16 oz. of water. One half turn of both screws causes a 2% to 3% change.
6. Check and re-level the rain gauge

## 7.3 Troubleshooting

Issue	The bucket is tipping when it is raining, but the counter do not increment.
Causes	1. The signal wire is disconnected or damaged.
Actions	<ol style="list-style-type: none"> <li>1. Validate the integrity of the connector.</li> <li>2. Unplug and plug the connector back again.</li> <li>3. Pour some water in the rain gauge until it tips a few times.</li> <li>4. Wait for the data to come in.</li> <li>5. If the problem persist the connector might be damaged, contact Smartrek support department for further assistance</li> </ol>

Issue	There is some data but it appears to be inaccurate.
Causes	<ol style="list-style-type: none"> <li>1. There is some dirt, a branch, or something else that is creating an obstruction on the rain gauge.</li> <li>2. The rain gauge is not properly calibrated</li> </ol>
Actions	<ol style="list-style-type: none"> <li>1. Clean the rain gauge from any visible debris</li> <li>2. Calibrate the rain gauge</li> </ol>

Issue	The node is not connecting to the gateway
Causes	<ol style="list-style-type: none"> <li>1. The Node is turned off.</li> <li>2. The Node does not have the same encryption as the gateway.</li> <li>3. The Node is not on the same channel as the gateway.</li> </ol>
Actions	<ol style="list-style-type: none"> <li>1. Hold the power button down for at least 5 seconds to power off the node.</li> <li>2. Press the power button once for 0.5 second to power on the node.</li> <li>3. Count the number of times the bottom LED will pulse at boot, it corresponds to your channel number. <b>Beware at boot the top led always blinks 3 times to indicate the start up of the radio module.</b> <b>Beware while in network seek mode the bottom led will blink 3 times once every 8 seconds.</b></li> <li>4. Validate that the node is on the same channel as the gateway.</li> </ol>

## 8 Ordering Information

Table 11: Product number of the PRGEN-RG

Part number	Description	Country
PRGEN-RG	Atrax node	North america

Table 12: Product number for the accessories of PRGEN-RG

Part number	Description
PRB-RG-HRS10	Rain gauge Holykell
PRB-RG-HRS10-H	Rain gauge Holykell with heating element
PRG-RB-TE25M	Rain Gauge Texas Electronics