Series 3 System Manual

Rev 05112022

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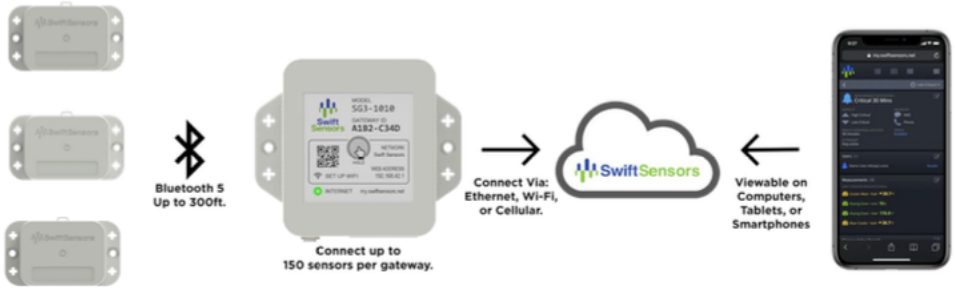
2. General

System Overview

Congratulations on your purchase of a Swift Sensors Wireless Monitoring and Notification System. The introduction of wireless sensors and the industrial internet of things (IIOT) are revolutionizing measurement and monitoring applications across many different industries – including foodservices, manufacturing, laboratory and pharmaceutical, facilities management, and agriculture. Across all these industries, our users are applying wireless sensors to protect their valuable inventory, equipment and facilities to prevent catastrophic losses and optimize their business processes. We appreciate your business and look forward to helping you get up and running successfully with our innovative products and systems.

The Swift Sensors system is made up of four primary components:

1. Wireless Sensors: battery-powered sensors that perform a variety of measurements
2. Gateways: dedicated, Swift Sensors-specific wireless access points that receive measurement values from Swift Sensors wireless sensors and transmit them to the cloud.
3. Cloud: Servers which handle and negotiate all customer data.
4. Console: the configuration and monitoring software for setting up your sensors, viewing the data, and sending notifications when specific alarm conditions occur.



Sensors *Gateway* *Cloud* *Console*

This manual provides general instructions for proper installation and operating guidelines of Swift Sensors gateways and wireless sensors. Additional notes and information are provided for specific sensors as well. We recommend you read this manually carefully to understand the broad measurement capabilities of the system and how best to take advantage of the system.

Please read this manual fully before deployment of your Swift Sensors system. This manual and linked supplemental media should be used to gain understanding in all aspects of Swift Sensors Series 3 sensors and gateways.

Use of product outside of recommended environments, ratings, and specifications will result in impairment or degradation of protection mechanisms. This may ultimately result in a partial or complete failure due to mishandling.

3. Intended Use 3.1 Operating Environment

3.1.1 Gateway

3.1.1.1 Deployment Environment

The SG3-1010 (Shown in *Figure 3.1*) and SG3-1012 gateways are designed for indoor use only in a dry environment, away from water. Gateways used outdoors without proper protection may void their guarantee.

While Series 3 gateways currently do not carry an IP-Rating, Swift Sensors offers IP67-rated NEMA enclosures as optional accessories for outdoor use and for use in an indoor wash down environment.

The small NEMA enclosure (Model SG3-NEMA-1010-Kit) shown in *Figure 3.2* can accommodate the gateway SG3-1010. Larger NEMA enclosures can accommodate the gateway SG3-1012 with the external RF antenna (Model SG3-NEMA-1012) or the cellular network module (Model SG3-NEMA-1012-C1).

Figure 3.1: Model SG3-1010 Series 3 Gateway

Figure 3.2:
Model SG3-NEMA-1010-Kit

3.1.1.2 Operating Temperature and Flammability

According to the gateway's internal circuitry, the operating environment shall not exceed +50°C or go below -20°C. The gateway has a flammability rating of UL94-V0.

3.1.2 Sensor

3.1.2.1 Deployment Environment

Series 3 sensors without an IP-rating are suggested to be used indoors, in a dry environment only. Most Series 3 sensors carry an IP-Rating of IP66, making them suitable for use in any environment, including wash down. Please check the data sheet for your sensor in Appendix A: Data Sheets to confirm its IP-Rating.

3.1.2.2 Probe Environmental Limits

If the sensor has an external probe, the probe may be fully submerged in any non-volatile medium unless otherwise specified on its datasheet. Please refer to the relevant sensor data sheet in Appendix A: Data Sheets for additional environmental limits specific to sensor models with probes.

3.2 Hazards / Failure Conditions

3.2.1 Gateway and Sensor

3.2.1.1 Exposure and Mechanical Damage

Whenever possible, ensure that sensors and gateways are in environments away from their critical temp + humidity boundaries. Exposure to heat, humidity, and liquid outside the datasheet indicated ranges may cause a partial or total failure in gateway or sensor operation.

- Persistent exposure to borderline environmental elements may affect certain readings, and potentially cause faster degradation of the system over time.
    - For example, installing Sensor Enclosures in a +60C or -40C environment will affect battery voltage readings, although it will not have a large impact on battery life.
    - Borderline environments also risk occasional exposure outside the specification threshold, which may truncate the system life. Using a +60C environment again for a Sensor enclosure will risk exposure to temperatures >60C, risking unexpected behavior and potential damage.
- Physical Damage may also occur resulting in partial or total failure in gateway operation if the equipment is dropped repeatedly, or from a height higher than 3-meters (~10’). Gateways are at greater risk of damage from falls.

3.3 Warnings

3.3.1 Gateway

3.3.1.1 Disassembly and Risk of Electrical Shock

Disassembling the gateway should never be necessary. If it is deemed necessary for any reason by Swift Sensors qualified support resources, ensure complete removal from power before disassembly to avoid risk of electrical shock.

4. Mounting and Deployment

4.1 Operating Environment Indications

4.1.1 Gateway

4.1.1.1 Optimal Orientation

For optimal wireless sensor communication, the Series 3 gateway should be mounted in the correct orientation, with the power and communication ports facing down (as shown in *Figures 4.1-4.3* below).

4.1.1.2 Mounting Options

Several mounting options are available for the gateway, depending on environmental factors. Mounting on the wall or placing in the gateway stand is recommended to prevent movement or damage to the gateway if the power cord is accidentally pulled or kicked. The power cable provided with any gateway has a thread-locking mechanism, which provides protection against accidental removal from power.

- The gateway can be mounted indoors to a drywall or a similar material using drywall mounting anchors that are provided with each gateway. See *Figure 4.1.*
- An optional gateway stand (model SG3-Stand) is available for placing the gateway indoors on a flat surface in the correct orientation. See *Figure 4.2.*
- Optional IP67-rated enclosures (models SG3-NEMA-1010-Kit, SG3-NEMA-1012, or SG3-NEMA-1012-C1) are available to protect the gateway from water in outdoor or wash down environments. The gateway is screwed to the interior of the enclosure, and the enclosure is designed to be mounted to a wall using screws. See *Figure 4.3- More information about NEMA IP-Rated Gateway Enclosures (Mounting, Assembly, and Use) can be found in the Accessories section 6.1.1.2.*

Figure 4.1:
Drywall-mounted indoors

Figure 4.2:
Mounted in stand indoors

Figure 4.3:
Mounted in enclosure indoors or outdoors

4.1.2 Sensor

4.1.2.1 Optimal Orientation

The Series 3 sensor has optimal wireless sensor communication when mounted in the correct orientation, with an upright, readable Swift Sensors logo. See *Figure 4.4* below:

Figure 4.4

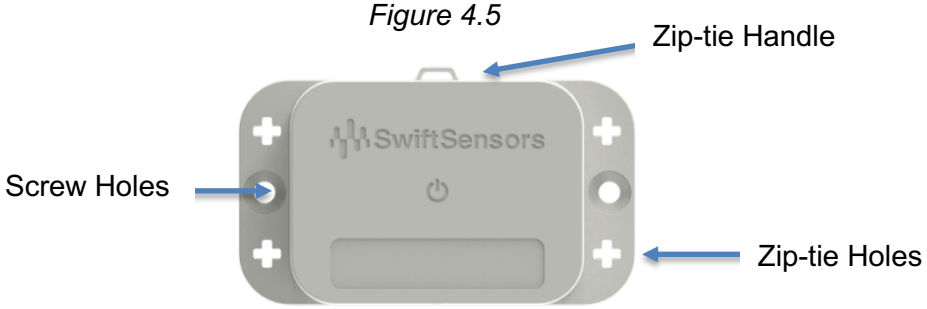
4.1.2.2 General Mounting Options

There are multiple ways to mount Series 3 sensors, please reference *Figure 4.*5 below for mounting all Series 3 sensor enclosures. Section 4.1.2.4 includes additional mounting guidance for specific sensor models:

- Zip-ties: Sensors may be mounted from a rack in a refrigeration unit from the “zip-tie handle” on top to the enclosure that ensures the correct sensor orientation. You can also securely mount the sensors against a pipe or round object using the zip-tie holes on each corner of the sensor. Zip-tie sizes vary from 6” to 11” in length, with a width up to 0.187” to properly fit in the holes.
- Screws: Sensors may be wall-mounted using #6 x ¾” screws. Recommended screw size is #6 X ¾”.
- Adhesive: Sensors may be wall-mounted with adhesive affixed to the back of the sensor.

Different measurement types will see best results with optimal mounting. For example, a vibration sensor should always use a rigid mount with adhesive or screws. If mounting with adhesive, ensure the adhesive has the corresponding strength and resilience for the operating environment.

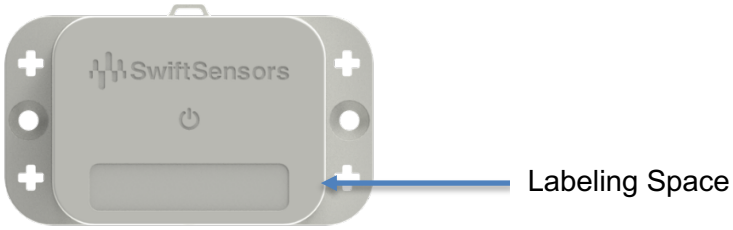
Figure 4.5



4.1.2.3 Labeling the Sensor

The front of the sensor has a rectangular space provided just below the button icon to place a label or write a sensor name or ID. Use the same name or ID when configuring the sensor in the Swift Sensors console so the sensor can be easily identified after it is deployed. Labeling space specified in *Figure 4.6 below:*

Figure 4.6



4.1.2.4 Sensor-Specific Installation Guidance

Below is sensor-specific mounting and installation guidance that discusses unique considerations for each sensor model. As explained in Section 4.1.2.2, all sensor enclosures share the same basic mounting options, but guidance is needed for external probes and special features of unique sensor models. All sensor models below carry an IP-rating of IP66 unless otherwise specified.

SS3-101

The SS3-101 Temperature and Humidity sensor is easily mounted or placed in the desired location to monitor ambient conditions. Because there is no probe on the SS3-101, excessive temperature or humidity beyond the Operating Temperature specification listed on the datasheet will degrade performance. While the SS3-101 carries an IP66 rating, please avoid persistent, excessive water exposure to the Humidity filter shown below in *Figure 4.7:*

Figure 4.7: S3-101 Filter

SS3-102

The SS3-102 Water Resistant Temperature sensor is easily mounted or placed in the desired location to monitor ambient conditions. Since there is no probe on the SS3-102, excessive temperature or humidity beyond the Operating Temperature specification listed on the datasheet will degrade performance. The sensor is water and dust resistant with an IP 66 rating.

SS3-103

The SS3-103 Ring Lug Temperature sensor is typically used to monitor temperature inside equipment such as a refrigerator. The temperature sensor is located at the end of the wire inside the ring lug. Mount the sensor enclosure on the side of the equipment or on a nearby wall with two mounting screws (optimal) and place the ring lug in the desired location. SS3-103 Leads are discrete enough to allow door gaskets to close on them without obstruction. The deflection of the gasket on the door will not affect temperature readings or cause a consequential leak. Ensure that the gasket does not close on the wire splices, shown below in *Figures 4.8-4.9.* Ring lug dimensions are shown for mounting assistance in *Figure 4.10.* Sensor is IP66-rated.

Figure 4.8: Incorrect Gasket Insertion

Figure 4.9: Correct Gasket Insertion

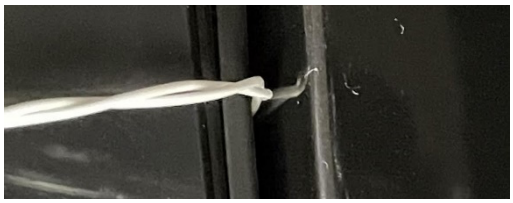
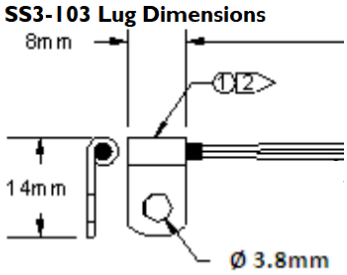


Figure 4.10: Ring Lug Dimensions



SS3-105

The SS3-105 Remote Temperature sensor is typically used to monitor temperature inside equipment such as a walk-in cooler, refrigerator, or freezer. The temperature measurement is made from the capsule at the end of a 1-meter (3.25') probe. Mount the sensor enclosure on the side of the equipment or on a nearby wall with two mounting screws (optimal) and place the metal temperature sensing element at the end of the probe in the desired location. When used on a walk-in refrigeration system, drill a 6.35mm (¼") hole through the walk-in exterior, insert the end of the probe through the hole and pull the lead to the desired location inside the refrigerated environment. The lead is typically "twist tied" or "zip-tied" to a shelf in a place where the tip and the wire will not be disturbed (Shown in *Figure 4.11*). Please note the temperature inside a large walk-in may vary several degrees depending on the vertical placement and proximity to the door. An offset calibration is available on the configuration panel of the sensor in the Swift Sensors console if needed. 10(~30') and 15-meter (~50') lead lengths are available if extra length is required for the application. Sensor is IP66-rated.

Figure 4.11: SS3-105 Capsule tied to Cooler

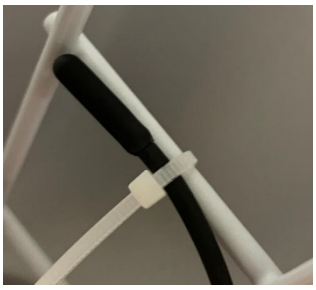


Figure 4.12 shows a dimensional drawing of the SS3-105 Probe, *Figure 4.13* shows a dimensional drawing of the SS3-105-10/15 Probe. These drawings may be used for drilling + placement guidance. 6.35mm (1/4") hole suggested as SS3-105-10/15 capsule sizes are 6mm.

Figure 4.12

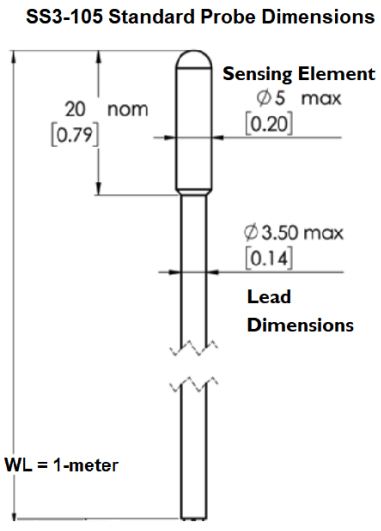
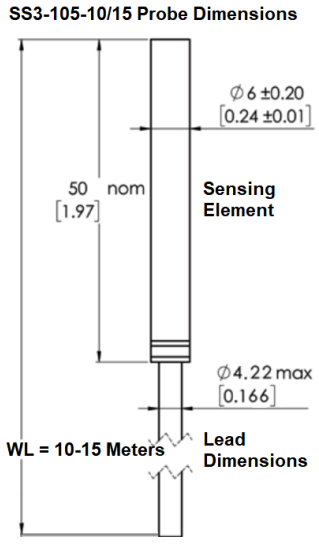


Figure 4.13

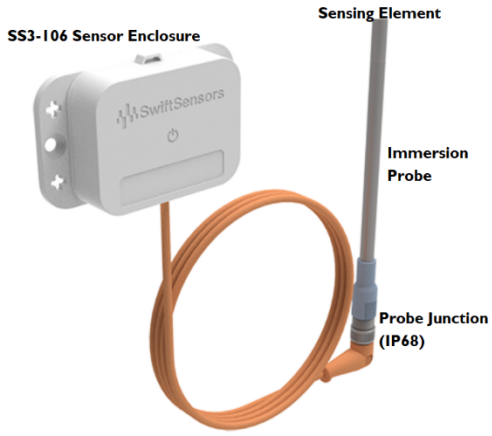


SS3-106

The SS3-106 sensor has a 1.5-meter (~5') lead from the sensor enclosure to a right-angle M12 probe junction (Junction rated IP68). This M12 Probe Junction creates a thread-locking, IP68 connection between the sensor

lead and the provided rigid, Stainless Steel Immersion probe which contains the sensing element. These probes are available in different lengths (100 / 150 / 750 / 1000mm). Probe diameter is 3mm (<1/8”) for probe lengths < 500mm (1.6’), and is a 6mm (<1/4”) diameter for probe lengths >500mm (1.6’). Immersion probes are generally placed into the measurement medium and left alone, but mounting may be supported with zip-ties as needed. It’s best to place any supporting mounts at the right-angle probe junction. *Figure 4.14* identifies the probe junction, sensing element, and sensor enclosure. Sensor is IP66-rated.

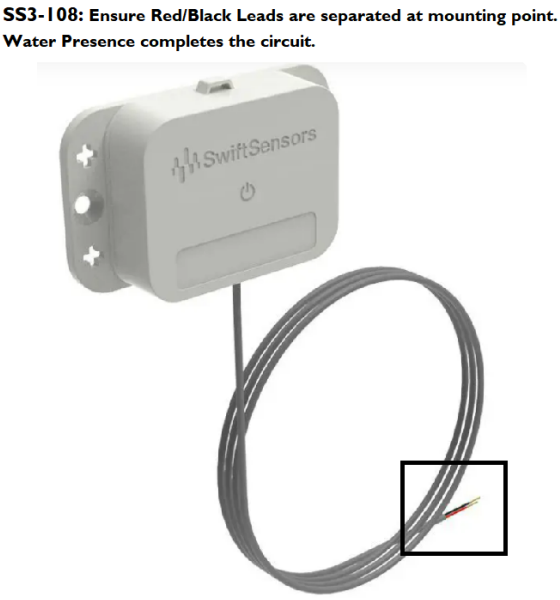
Figure 4.14



SS3-108

SS3-108 is a Water Detection sensor that may be used for small spot-leaks and flood detection. There is a simple 1-meter (3.25’) cable length attached to the sensor enclosure, with Red + Black Leads emerging from the end of the cable length. The presence of water completes the circuit between the Red + Black Leads. Therefore, these leads may be mounted in any style, as long as the leads are not actively touching each other. *Figure 4.15* shows the SS3-108 and indicates where these leads are located. Sensor is IP66-rated.

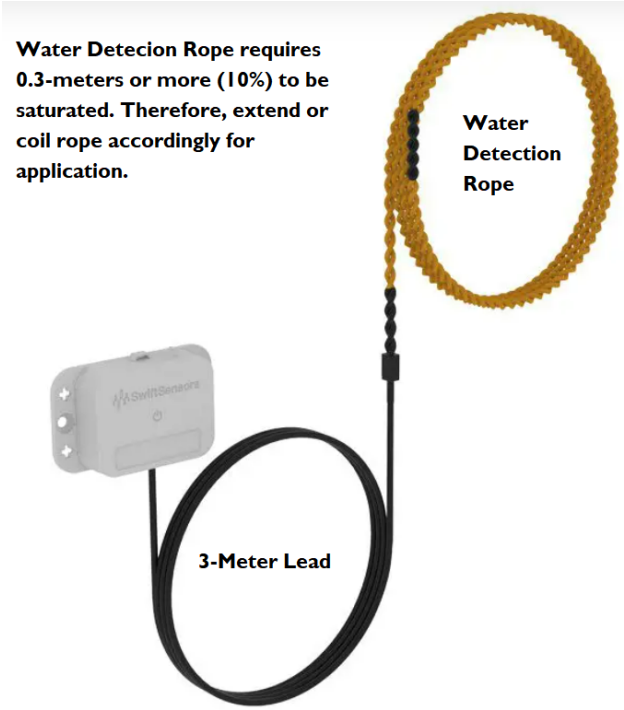
Figure 4.15



SS3-109

SS3-109 is a Water Detection Rope sensor. A 3-meter (~10') lead comes attached to the sensor enclosure, with a 3-meter orange water detection rope which connects to the 3-meter lead with a waterproof connector. The 3-meter lead allows for more placement options of the actual water detection rope. For water presence to be detected, the water detection rope must see at least 10% or 0.3 meters (1'+) of saturation. Therefore, the SS3-109 is most useful for flood detection, or larger leak detection. The rope may be coiled or extended for specific applications to optimize performance. For example, water leaking from above would benefit most from a coiled rope placed on the ground. This gives a smaller point of water detection. However, if water is leaking up through the ground, an extended rope may perform better, as a coiled rope would require a higher water-level threshold to trigger detection (or will detect water falling onto it). *Figure 4.16* shows this sensor with the crucial parts identified. Twist ties may be used for any necessary suspension of the water detection rope. Sensor is IP66-rated.

Figure 4.16

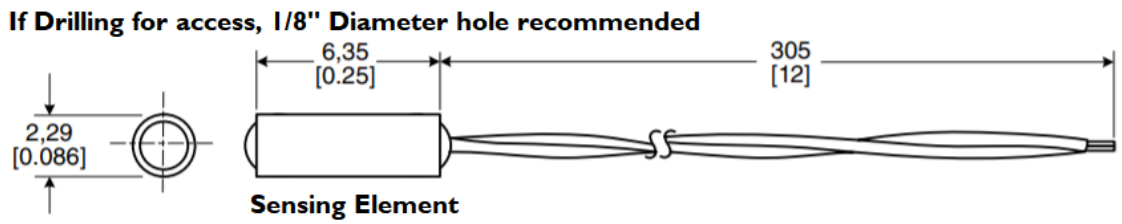


SS3-110

Mounting of the SS3-110 Sub-Zero Temperature Sensor is similar to SS3-105, however, SS3-110 has a 30AWG 1-meter (3.25') lead that may be placed between any gaskets, if necessary, without negative effects (similar to SS3-103), and is a free-hanging probe. Depending on the specific application, the probe may be left "free-hanging" inside of the sensing environment or may be anchored with zip-ties against any part of the sensing environment. Please Reference *Figures 4.8, 4.9* under "SS3-103" and *Figure 4.11* under "SS3-105" for photo-guidance. *Figure 4.17* below shows the SS3-110 probe dimensions, with guidance for drilling if placement in a gasket is not possible. Sensor is IP66-rated.

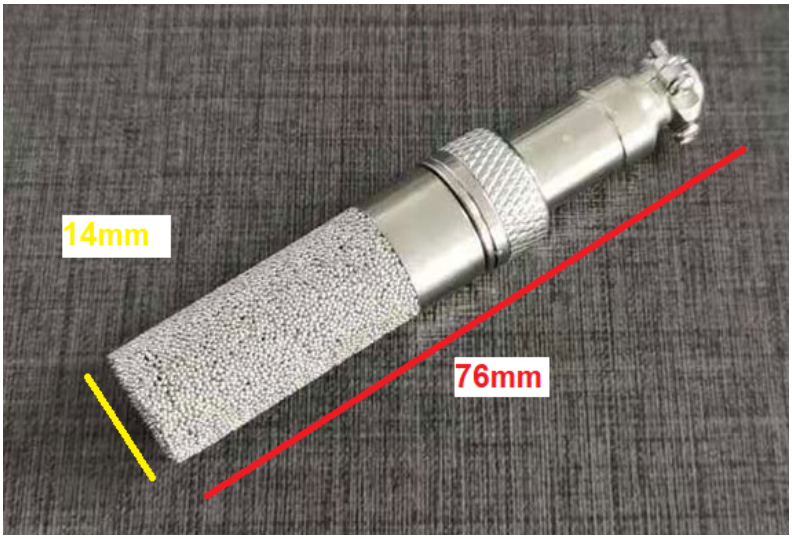
Figure 4.1

SS3-114



The SS3-1 -40C to +125C) and asheet for Accuracies l at the end. This g the

location of the desired measurement, and mount the sensor in a safe environment (-40C to +60C) as advised in *Section 4.1.2.2*. Although the gland can withstand +125C, the sensor enclosure is limited to +60C due to the use of batteries. Stainless steel gland is shown below with dimensions for placement strategy (*Figure 4.18*).



SS3-116

The SS3-116 High Temp has a 1-meter (3.25') stainless steel-braided cable for holistic exposure to high-temperatures, such as BBQ pits, fire pits, and any situation where the cable may also be exposed to extreme temperature. The probe has a penetrating tip. Common use applications involve penetration with the probe, ultimately leaving it "free-hanging." The sensor enclosure itself must be mounted externally, away from heat. An optional grill mount is included. *Figure 4.19* identifies the aforementioned parts; *Figure 4.20* is the Grill Mount. Sensor is IP66-rated.

Figure 4.19

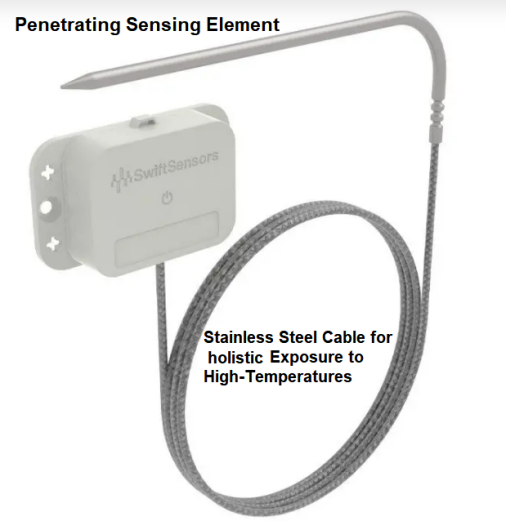
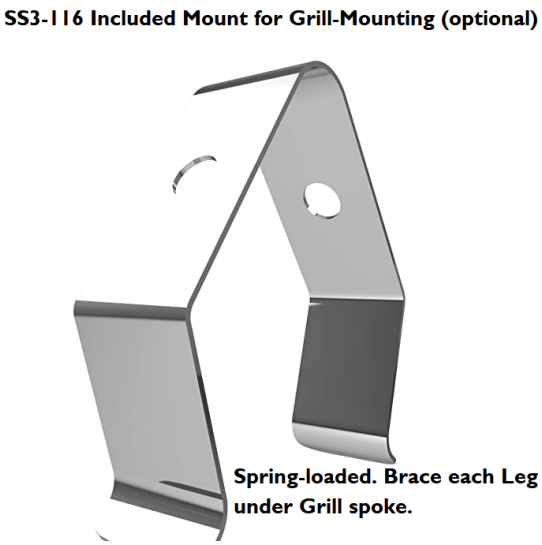


Figure 4.20



SS3-301

The SS3-301 Door Sensor operates using a remote magnet, which trips the attached switch capsule to determine the door's state (open/closed). The sensor enclosure is mounted on a wall near the door being monitored. Both switch and magnet capsules have adhesive for easy mounting on the door frame and door. Sensor is IP66-rated. (*Figure 4.21* shows magnet/switch capsule dimensions)

1. Mount the contact with the wire leads above the door or window on the frame. For doors, ensure that the mounting is farthest from the hinged side of the door.

2. Mount the magnet on the door/window so that it will face the contact. Be sure that the gap between the contact and magnet does not exceed 3/4" (19mm)

3. Contact and magnet must be installed on the protected side of the door or window. Spacers are included for difficult or misaligned installations.

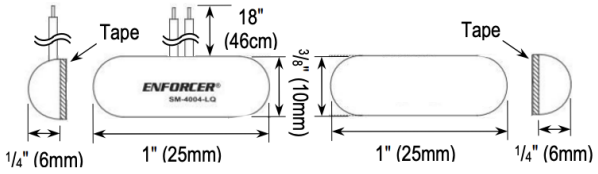
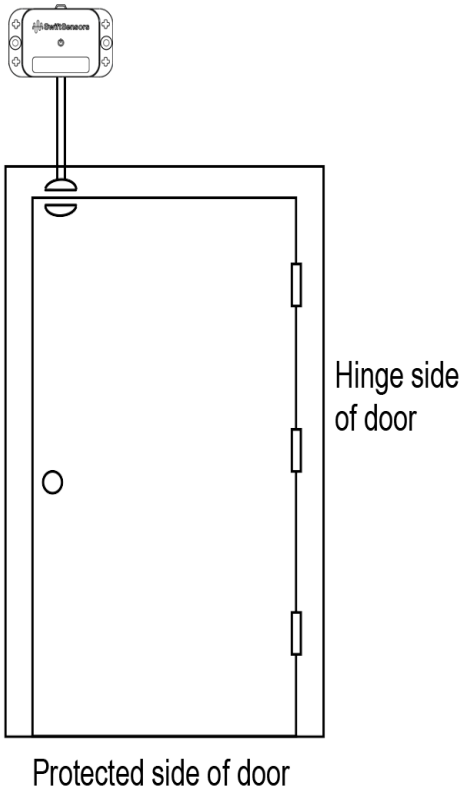


Figure 4.21



SS3-202

The SS3-202 Vibration Amplitude sensor performs best with secure, rigid mounting to ensure vibration activity is accurately conducted to the sensing element. To obtain an optimal measurement of vibration amplitude, direct screw mounting, or epoxy mounting is strongly recommended. Zip-tie mounting, or any mounting with a single point of contact will greatly reduce the integrity of the measurement.

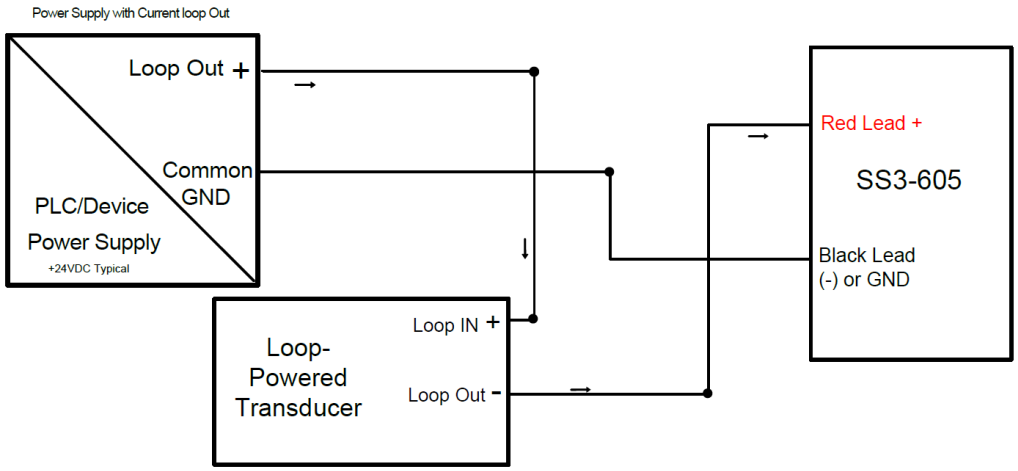
1. Direct Screw Mounting: Clean the measurement surface and sensor underside with alcohol to remove debris. Install two #6 Countersunk/Countersunk Raised screws into the sensor's Screw Mounting Holes, directly into the measurement surface. See section 4.1.2.2 for screw hole location if needed.
2. Adhesive Mounting (Epoxy/Loctite): It's best to use the most rigid epoxy available for best results. Loctite 454 has become a standard for accelerometers, but any rigid-curing epoxy will do well.

SS3-203, SS3-501, SS3-502

Please reference the mounting guidance above for SS3-202 in application for SS3-203, SS3-501, SS3-502. As accelerometer measurements, they require the same requirements for mounting and performance.

SS3-605

The SS3-605 4-20mA Current Sensor has a 1-meter (3.25') cable connected to the sensor enclosure, terminating with red and black leads. The red lead connects to a terminal block, or any preferred method of connection to the current loop Positive (+). The black lead connects to a terminal block, or any preferred method of connection to the current loop Negative (-). Please reference the Transducer/Object of measurement to ensure Loop Positive (+) and Loop Negative (-) connections are made properly. *Below is an example of using the SS3-605 in a 4-20mA current Loop, with a Loop-Powered Transducer.*



Making a 4-20mA Loop Measurement with SS3-605

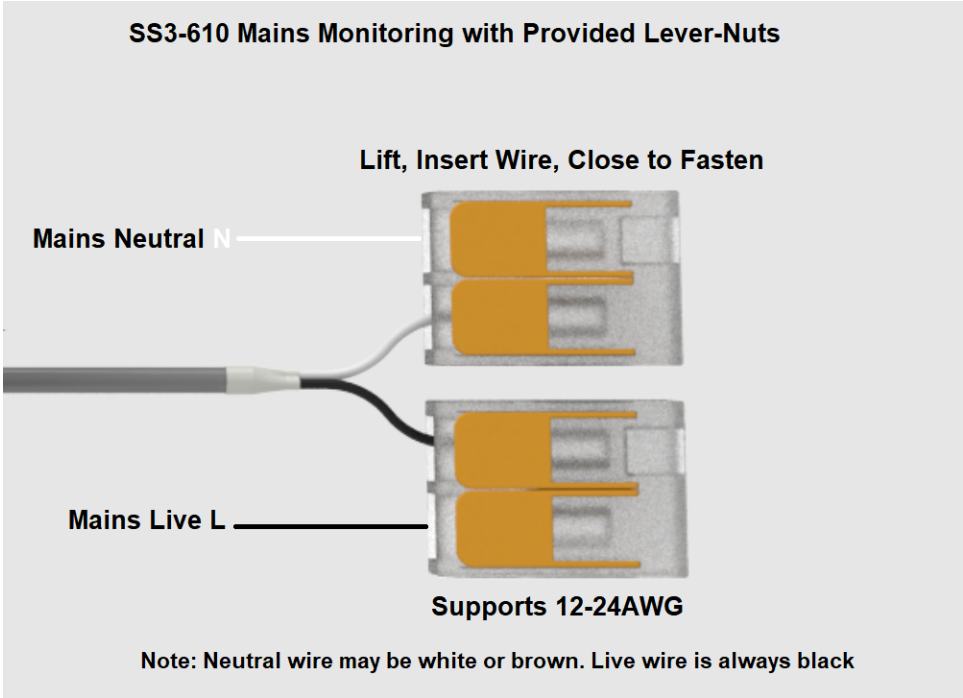
SS3-610

The SS3-610 0-500VACrms Voltage Meter has a 0.5-Meter (1.6') length of cable connected to the sensor enclosure, terminating with white and black leads. The black lead connects to "Live" (+), and the white/brown lead connects to the "Neutral" ("N") wire if monitoring Mains voltage. If monitoring a signal generator, the white lead connects to "negative" (-).

If wire leads are desired to directly enter a terminal block, the sensor enclosure must be mounted within 0.5-meters of the terminals. Connect the black and white leads correspondingly inside the receiving terminals to "Live" (+), and "Neutral" ("N")

Lever-Nuts are provided with each sensor to create fast and easy wire-to-wire connections. *Figure 4.22* shows a typical Mains monitoring application with the SS3-610, and how the Lever-Nuts are used to connect the proper wires.

Figure 4.22



SS3-612

The SS3-612 0-10Vdc Sensor has a 1-meter (3.25') cable connected to the sensor enclosure, terminating with red and black leads. The red lead connects to positive (+), and the black lead connects to negative (-) or GND.

The two most typical applications for this sensor are DC Voltage Monitoring and Industrial/Transducer Monitoring. For DC voltage monitoring, connect the red lead to Vdc+, and the black lead to GND/V-/Vss.

For Industrial/Transducer monitoring, the "0-10V Output signal" connects to the red lead, positive (+). The black lead connects to GND/Common.

Wire connections, similarly to the SS3-605, will be made directly to provided terminals on an object of measurement, or can be connected "wire-to-wire" if necessary for the application. Leads may also be soldered into place for permanent installations if needed.

SS3-611, SS3-613

The SS3-611 0-50VDC Meter and SS3-613 0-30VDC Meter has a 1-meter (3.25') length cable connected to the sensor enclosure, terminating with red and black leads. The red lead connects to positive (+), and the black lead connects to negative (-) or GND.

These sensors may be used for any DC Voltage measurement application such as; Logic Level Monitoring (3.3/5/12/24VDC), 12/24VDC power system monitoring, and even PoE Monitoring (48VDC - SS3-611 only)

For Industrial/Transducer 0-5/0-10VDC output monitoring, SS3-612 is suggested for better accuracy and resolution.

Wire connections, similarly to the SS3-612, will be made directly to provided terminals on an object of measurement, or can be connected “wire-to-wire” if necessary for the application. Leads may also be soldered into place for permanent installations if needed.

SS3-617-30/100/200

The SS3-617 family are Sensors with 1-meter cables (2-meters for SS3-617-200) which connect to high-quality current transformer clamps (“CTs”), which arrive pre-calibrated. The Sensor bodies themselves are IP66 rated, but please keep CT latches closed whenever possible to delay/prevent corrosion.

The CTs are “split-core” meaning they can be opened and latched around a single wire lead, without needing to cut or re-install wire leads.

These sensors measure current consumption, and can approximate power consumption as well. Sensor enclosures shall mount with standard guidance, with more detailed information mentioned below.

There is a complete User Guide + Application Note (AN617), which gives detailed information about the transformers being used, getting the most accurate measurements, and approximating power consumption. If using any SS3-617 sensor, please view this User Guide + Application Note here: <Insert Link to AN617>

4.1.2.5 SS3-615: Wireless Universal Analog Sensor Adaptor

Important: *Please read the SS3-615 Datasheet before use. For SS3-615 Setup, Configuration, Wiring, and Use-Case Examples, Please Refer to the SS3-615 Configuration Guide Here: <Insert Link to SS3-615 Configuration Guide>*

4.1.2.5.1: SS3-615 Overview and Capabilities

Mounting and External Connector:

The SS3-615 is mounted using standard mounting guidance from **Section 4.1.2.2,** Using #6 Screws or Zip-ties. Since the SS3-615 has an external connector plug (shown inf *Figure 4.23)* that is removable, stable mounting is important. SS3-615 should be mounted in an orientation with the external connector facing the ground, ensuring the Bluetooth antenna is parallel to the gateway antenna. If SS3-615 is mounted with the antenna 90-degrees (orthogonal) from the gateway, up to 30% of range may be lost. The best range performance will always occur with the antenna from SS3-615 being parallel to the gateway antenna.

SS3-615 has an 8-position external connector with Pins Numbered 1-8. The Pinout is available on the datasheet and may be viewed in the Swift Sensors Cloud Console. The external connector may only be inserted only one way, and proper insertion occurs when the external connector (plug) is flush with the on-

board receptacle (*Figure 4.24)*. It may also be removed using a thumb and index finger, applying a pulling force. It may help to add lateral force to the pulling force to "wiggle" the connector out gently. (*Figure 4.25)*

Note: When the external connector is removed, Hardware Alerts may be triggered on an existing measurement, due to loss of connection. Similarly, if SS3-615 is set into any mode (Voltage, Current, or Resistance), there will be a Hardware Alert if no connections are made to the external connector, due to the absence of connection. In both situations, the sensor will continue transmitting all other data (Battery %, RSSI) to the Swift Sensors Console, and any Hardware Alert will restore itself once a connection is restored or the connector is re-inserted.

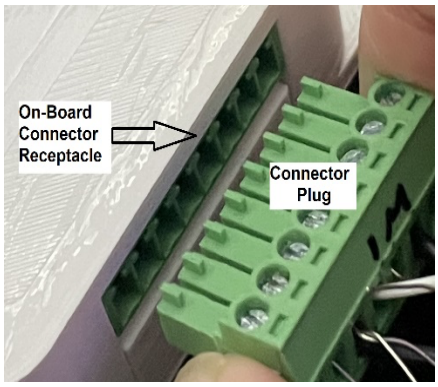


Figure 4.23

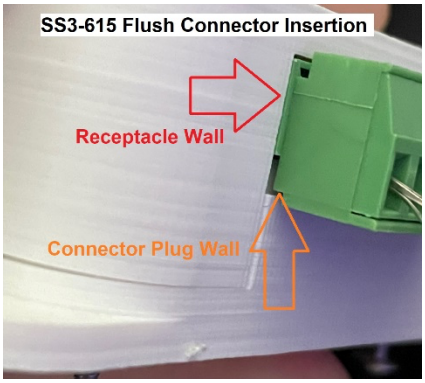


Figure 4.24

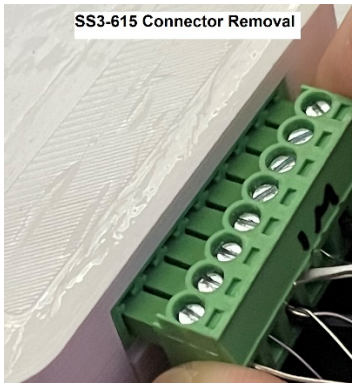


Figure 4.25

Making a Connection: Insert wires into the terminal slots and tighten with a flathead screwdriver until connection is secure and will not be removed accidentally. For all connection Diagrams, reference "SS3-615 Typical Connection Diagrams" available here: <Insert Link to SS3-615 Typical Connection Diagrams>

Powering SS3-615:

SS3-615 Can be Powered Externally by any 5-24Vdc Source, or by its Internal 2xAAA Energizer "Ultimate Lithium" L92 Batteries. Average Battery life is 6-8yrs in almost all scenarios except those defined in ***Section 4.1.2.5.2*** as power consumption only increases when SS3-615 is using the Digital Out Trigger switch.

Below in Section ***4.1.2.5.2*** are also Lifetime tables, showing the effects of DOUT usage in "Automatic Mode," and what lifetimes to expect when these scenarios occur in *Tables 4-1 to 4-3.*

SS3-615 Measurements:

SS3-615 Has the capabilities to add wireless data monitoring to nearly any instrument or transducer that has an analog output of the following types:

- **Voltage:** Linear 0-10V DC Output
- **Current:** Linear Current Output up to 20mA
- **Resistance:** Linear or Logarithmic Resistance up to 3Mohm

Measurement Notes:

1. *Only one measurement mode is possible at a time (as stated in the SS3-615 configuration guide) but may be switched at any time.*

2. *Having multiple measurements connected at once will not harm the SS3-615, although data may only be gathered for one single measurement at a time.*
3. *Any Measurement mode may include a Digital Out Switch Mode, configurable by the customer.*

4.1.2.5.2 SS3-615 Digital Out Switch: Information on connections, indications, and typical usage of the Digital Out Switch (DOUT) is available on the previously referenced "SS3-615 Configuration Guide" and "SS3-615 Typical Connection Diagrams."

Overview and Purpose: The Purpose of the Digital Out Switch is to enable reliable control of a logic signal, toggle device modes, and acts as an agent to "complete the circuit," that can act independently of the Swift Sensors Console, resulting in a "real-time" hardware response. Conditions may be set in "Automatic Mode" with a control loop time. This control loop time applied uses an internal control loop to make hardware decisions every loop period to toggle the Digital out switch ON or OFF. DOUT is protected by a fuse and Diode to prevent any damage done to Pin 7 if Voltage >+24Vdc is applied, or a current >300mA is conducting through the DOUT circuit.

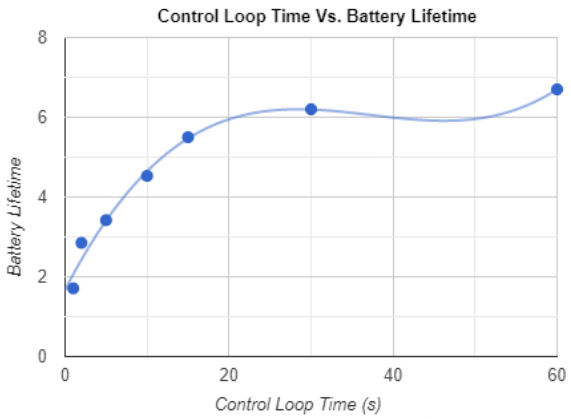
Effects on Product Battery Lifetime:

1. Typical Battery Lifetime is 6-8yrs in most situations, and Sensors using External Power may last up to 20yrs. The Digital Out Switch may significantly affect battery lifetime in certain situations described below due to increased power consumption. Using External power and the Digital Out Switch has no effect on Product Lifetime.
2. **DOUT "Automatic Mode":** Power consumption will only increase when DOUT is in "Automatic" mode and the "Control Loop Rate" is <= 60s. Disabled, ON, or OFF modes have no effect on power consumption, nor does "Measurement Averaging." Below is a Table (*Table 4-1),* which documents Control Loop Time effects on "Automatic" mode power consumption vs Battery Lifetime. *Figure 4.25* also shows a graph of Control Loop Time vs. Battery Life in "Automatic Mode" with any measurement. For Low Resistance Measurement effects on Battery Life, see *Figures 4.27-4.33* below.

Table 4-1

Control Loop Time	Current Consumption	Exp. Battery Lifetime
60s	22uA	6.5-7yrs
30s	25uA	6-6.5yrs
15s	28uA	5-6yrs
10s	34uA	4-5yrs
5s	45uA	3-4yrs
2s	54uA	2.5-3yrs
1s	90uA	1.5-2yrs

Figure 4.26



3. Swift Sensors uses a proprietary technology that adapts to resistance measurements to provide high accuracy across a broad range of Resistance (0-3MΩ). There are no power consumption consequences of this technology when resistance measurements are being made with DOUT modes; Disabled, OFF, or ON. Power Consumption and therefore, shorter battery lifetimes occur only when Resistance falls below 10kΩ (See Datasheet for Resistance Ranges if necessary).

a. *Figures 4.27-4.33* show the effects on battery lifetime as resistance decreases while using Control Loop Times <=60s in “Automatic Mode.” Power Consumption for Resistance Measurements 10kΩ+, *Table 4-1* and *Figure 2.25* may be referenced. The tables below are relevant to “Resistance Mode,” and no other measurements.

Figure 4.27

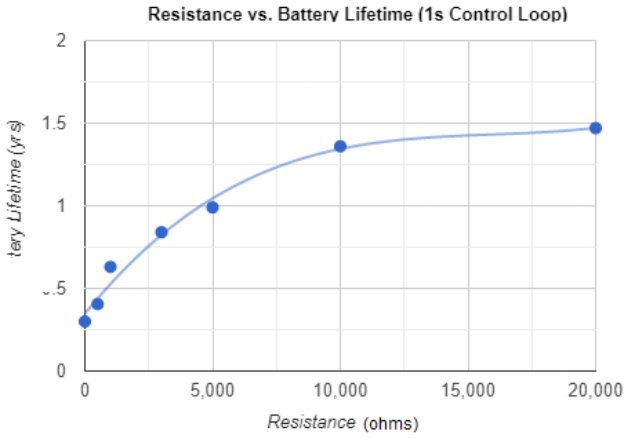


Figure 4.28

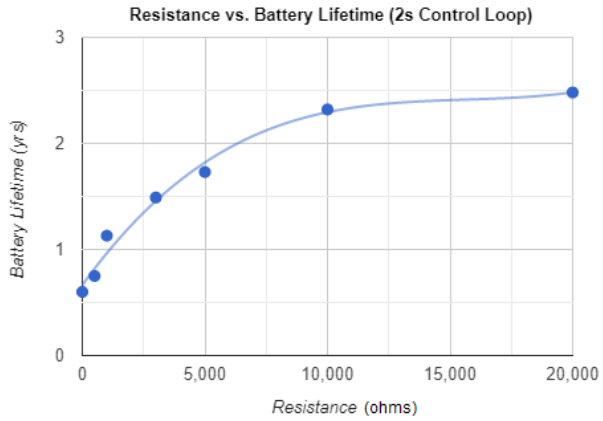


Figure 4.29

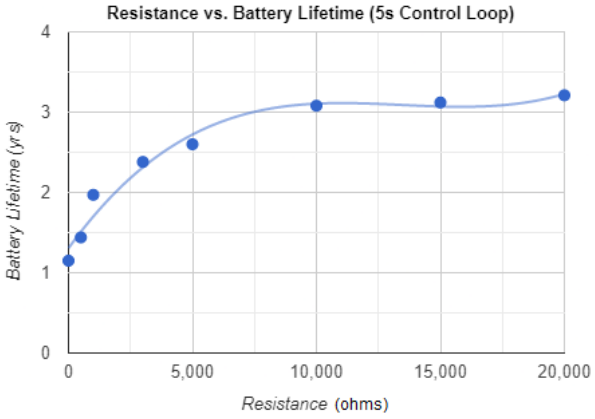


Figure 4.30

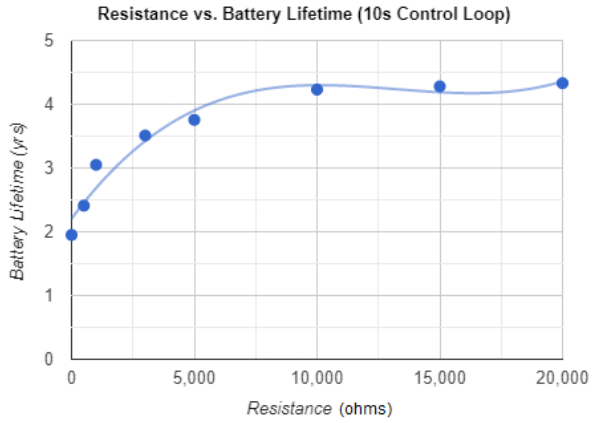


Figure 4.31

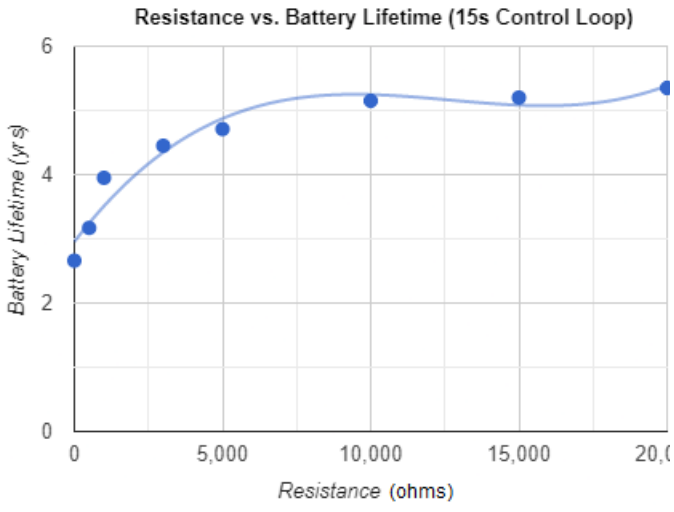


Figure 4.32

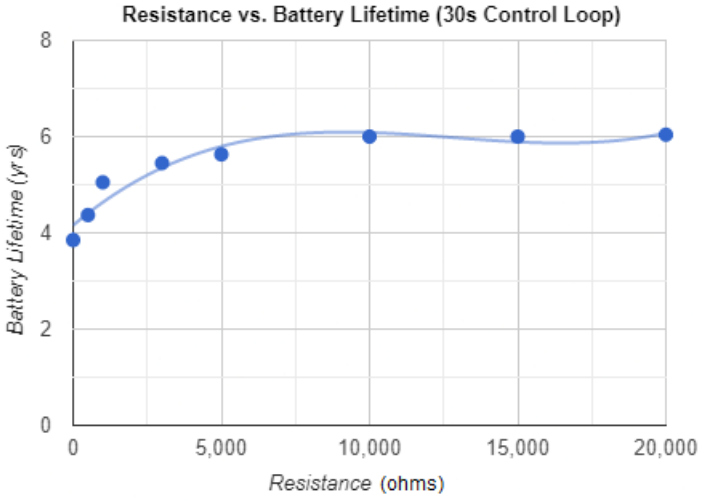
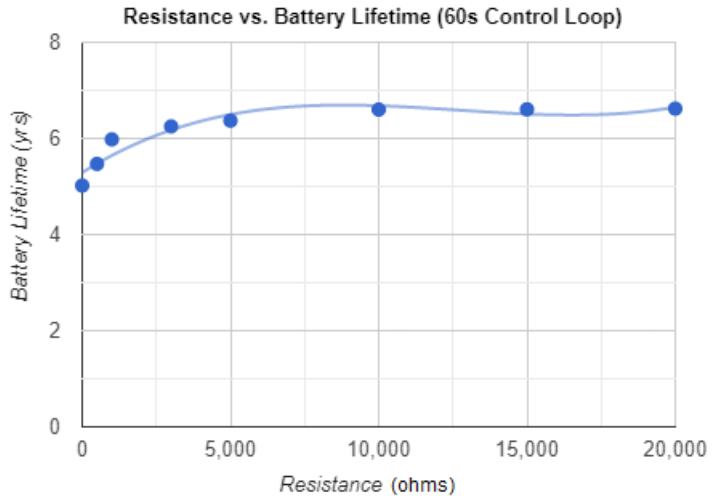


Figure 4.33


Resistance vs. Battery Lifetime (60s Control Loop)
Battery Lifetime (yrs)
8
6
4
2
0
0
5,000
10,000
15,000
20,000
Resistance (ohms)

5. Technical Specification

5.1 Electrical Specification

Electrical specification data for each Series 3 gateway and sensor model is located in Appendix A: Data Sheets.

5.2 Equipment Ratings

Equipment ratings data for each Series 3 gateway and sensor model is located in Appendix A: Data Sheets

6. Equipment Operation

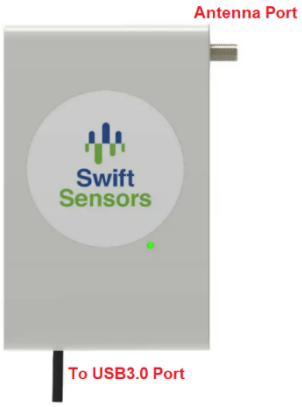
6.1 Accessories / Interconnects

6.1.1 Gateway Accessories

6.1.1.1 USB3.0 Ports and Cellular Modem

The Series 3 gateway has two operational USB3.0 ports. These USB3.0 ports may provide 5V @ 0.9A (4.5W) total for general use. Swift Sensors offers an optional cellular modem which may be used on either of the two USB3.0 ports, with “plug-and-play” operation. The modem does come with an antenna which can easily be screwed on. Modem without antenna shown below in *Figure 6.1.*

Figure 6.1



6.1.1.2 Optional Gateway Enclosures (NEMA, IP Ratings)

Recommended for outdoor use, or a harsher indoor environment, Swift Sensors offers an optional water-resistant (IP67) enclosure for Series 3 gateway use in harsh environments. These IP67 enclosures can be used with all Series 3 gateway models and the optional cellular modems. Two sizes are offered; one for SG3-1010 Gateway only which is smaller, and one that can accommodate SG3-1010 (or SG3-1012) with a cellular modem. They may be purchased as “kits” to apply to existing gateways or may be purchased with gateways installed. Both enclosures are explained below- crucial parts for mounting, assembly, and deployment.

Note: When the power jack is not in use, please keep the power jack protected with its attached cover to prevent ingress during washdown or harsh environments. Also, if the ethernet port is not in use, please keep the cable gland screwed onto the enclosure for extra protection when possible. Ethernet Cable Gland installation is explained in Section 6.1.1.2.3.

6.1.1.2.1 SG3-NEMA-1010-KIT

Guidance and instructions below illustrate proper preparation to the enclosures for mounting, as well as their assembly (if using a kit). *NOTE: When the main latch is closed (without sealing screws) IP Rating is IP65. To achieve IP67, sealing screws must be used in addition to the main latch.*

Assembly: The SG3-1010 NEMA enclosure is very simple to assemble if the kit is purchased. External ports are already installed (Power Jack, Ethernet Port) Shown in *Figure 6.2*, the Gateway is first mounted to provided black brackets with Screw + locking nuts, and those Brackets are then directly mounted to threaded holes inside the enclosure. Shown in *Figure 6.3,* if the SG3-NEMA-1010 (smaller enclosure) is being used, mount the gateway so that the gateway’s power and ethernet ports are facing 90-degrees away from the external enclosure power and ethernet ports. *Note: If using Ethernet, please see Ethernet cable gland installation section 6.1.1.2.3*

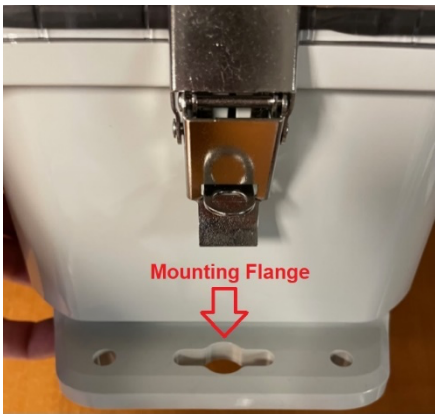
Figure 6.2

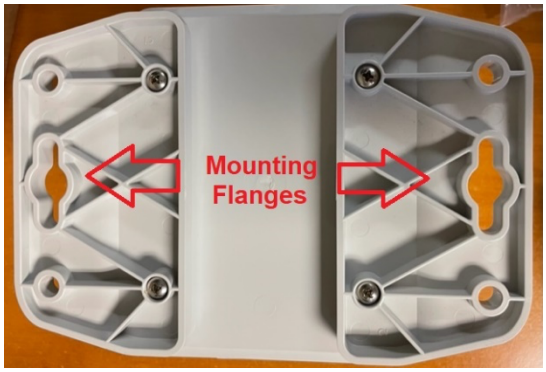
Figure 6.3

Mounting: *Figure 6.4* shows the included mounting brackets and screws included with the SG3-NEMA-1010 enclosure. There's also an included information packet that gives detailed mounting instruction. *Figures 6.5, 6.6* show the SG3-NEMA-1010 with mounting flanges installed. Please reference the included literature for desired mounting once flanges are installed.

Figure 6.4: Flanges, Screws, and Info Packet

Figures 6.5, 6.6: Mounting Flanges Installed





6.1.1.2.2 NEMA Enclosure for both Gateway + Cellular Modem (SG3-1010/1012 + SG3-CNM-01)

The larger size NEMA gateway enclosure can accommodate a Series 3 Gateway (SG3-1010 or 1012) and a cellular modem. Swift Sensors recommends this to be purchased with equipment already installed. *Figure 6.7, 6.8* shows all the different items inside the enclosure, and *Figure 6.9* shows the external components of this enclosure. This will assist with any disassembly, part replacement, or partial assembly. Assembly and Mounting are discussed below with all associated hardware.

Assembly Guidance:

Figure 6.7 shows all Internal Components and are named below.

1. Internal Power Jack (Connects to 5)
2. Internal Ethernet Jack (Connects to Gateway)
3. Cellular Antenna Mounts
4. RF Antenna Mounts (SG3-1012 only)
5. Power Jack Cable connecting (1) to Gateway
6. Ethernet Cable connecting jack to Gateway
7. Cellular Antenna (Provided Cable Attached)
8. RF Antenna (Provided Cable attached
9. *Cellular Modem Mounted on Provided Bracket*
10. *SG3-1010/1012 Gateway*
11. *Gateway Left-Side Mounting Bracket*
12. *Gateway Right-Side Mount (No Bracket)*
13. *RF Antenna cable connection on SG3-1012*
14. *Cellular Modem Antenna cable junction*

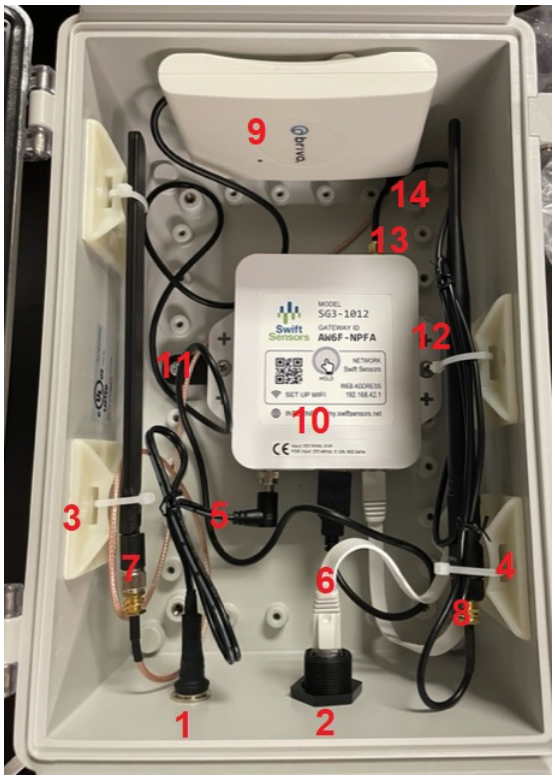


Figure 6.7

Figure 6.8

1. *Cellular Modem Mount*

NOTE: Cellular Modem Mount + Antenna Mounts come pre-installed even in the assembly kit.

Mounting: The Larger NEMA enclosure that can house the cellular modem accessory and a gateway comes with a hardware pack similar to the SG3-NEMA-1010 enclosure. Instead of mounting flanges, the hardware pack contains 4 brackets with 4 screws. These brackets should be attached to the enclosure as shown in *Figure 6.9*, and then may be mounted as desired to any surface. Screws must enter threaded holes on the enclosure exterior. Surface-mounting screws are not included.

Figure 6.9

Showing Bracket Placement and Threaded-Holes on Enclosure Exterior

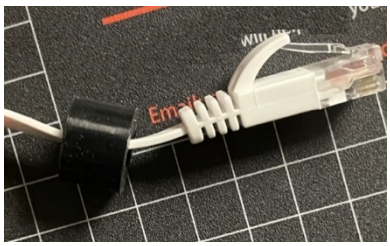
6.1.1.3 Ethernet Cable Gland Installation

If an optional NEMA enclosure is being used, an ethernet cable gland is included for water-resistant protection of the ethernet cable + port (as seen in *Figure 6.3*). Below is the process of how to install this cable gland when in-use. When not in-use, please leave the cable gland screwed onto the external port for extra protection.

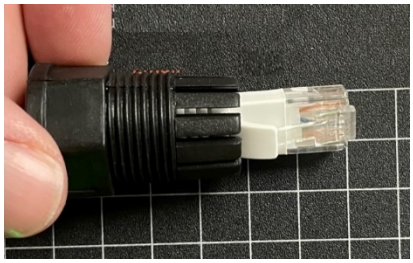
Overview: The Ethernet cable gland provided should not require the disassembly or cutting of the ethernet cable for access.

Step 1: Remove cable gland from external port, unthread the two outer-cuffs, and remove the inner-cuff.

Step 2: Place the small, rubber inner-cuff around ethernet cable. (*Figure 6.10)*

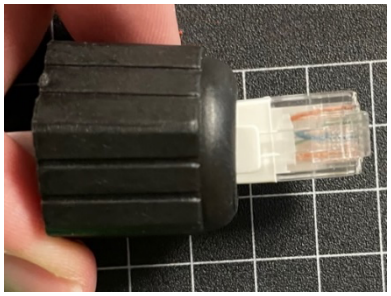


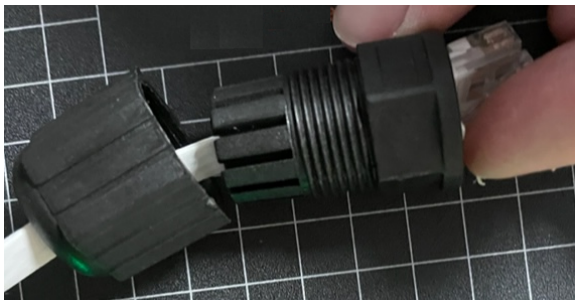
Step 3: Thread the ethernet cable through the first outer-cuff, so that outer-cuff threading will be facing in the correct direction on the proper end of the ethernet cable. (*Figure 6.11)*



Step 4: Match the Inner-cuff to be flush, inside the first outer-cuff, to prepare for the second outer-cuff.(*Figure 6.12). Label 1 is the Inner-Cuff, 2 is the first Outer-cuff.*

Step 5: Thread the ethernet cable through the second outer-cuff, in the same orientation as the first outer-cuff, so that the second outer-cuff can thread onto the first outer-cuff. (*Figures 6.13, 6.14)*





Step 6: Thread the two outer-cuffs together. The Ethernet cable may now be inserted into the ethernet jack, and the cable gland assembly can thread onto the external ethernet port. (*Figures 6.15, 6.16)*

6.1.2 Sensor Accessories

6.1.2.1 Thermal Buffer Bottles (Polyethylene Glycol/Glass Bead)

Thermal buffers are used on temperature sensors for two reasons; first is to avoid transient temperature swings and second is to have a uniform medium as a reference. This improves accuracy and keeps alerts toa minimum, without missing critical temperature swings. Swift Sensors offers PG (Polyethylene Glycol) or Fine Glass Beads in 120mL bottles. For Material Data Safety Sheets and Indications, access the appropriate literature here: <Insert Link to MSDS for PG>, <Insert MSDS for Glass Beads>

Overview of Indications: PG bottles may only be used on sensor probes in the range of -40C to +85C. The use of glass beads can be as low as -100C. All thermal buffer bottles come sealed and with an insert. Below is the insertion process for different sensor models, and which sensor models are appropriate for use with a thermal buffer.

Suggested Sensor Model Usage: Swift Sensors suggests the use of PG bottles with the SS3-105 model family. SS3-106-100 may also use a PG bottle. Suggested use of glass bead thermal buffers is best with SS3-110 for lower temperature monitoring.

Thermal Buffer Installation: Pictured below in *Figure 6.17* is a 120mL thermal Buffer bottle with the Insert that will be used with SS3-105 and SS3-110. *Figure 6.17*

Step 1: Remove seal from the thermal buffer bottle.

Step 2 (Model SS3-105): Bottle insert can be pushed into the bottle after removing the seal, holding the bottle with one hand. Bottle insert orientation as shown in *Figure 6.17.*

Step 2 (SS3-110, Method 2): Method 2 is recommended for both sensor models. This involves pushing the sensor probe through the bottle insert (2” length) before installing the bottle insert into the thermal buffer bottle itself. *Figures 6.18, 6.19* shows an SS3-110 probe pushed through a bottle insert, and *Figure 6.20* shows an SS3-105 probe pushed through a bottle insert, before installation into the thermal buffer bottle. SS3-110 probe is not very rigid, so the capsule may be pushed through the insert top, and once the probe capsule is through the top, pliers or another hand tool may be used on the other side of the insert for guidance (shown in *Figure 6.18).*

Figure 6.18: Capsule may be grabbed with Pliers

Figure 6.19

Figure 6.20

Step 3 (SS3-105): If bottle insert was placed into thermal buffer bottle, and SS3-105 probe is pushed into thermal buffer, make sure the probe capsule is centered in the bottle, and installation is complete. The bottle may be placed where desired.

Step 3 (SS3-110): The bottle insert with probe extruding 2” may now be placed into the glass bead thermal buffer bottle. As shown in *Figure 6.19*, it’s best to tilt the bottle after insertion to ensure the glass beads do not obstruct the probe capsule from reaching the middle of the bottle. When the bottle insert has been installed into the thermal buffer bottle, shake the buffer bottle lightly until the probe capsule is approximately in the center of the buffer bottle. Installation is now complete and should look similar to *Figure 6.21.*

Figure 6.21

6.2 Battery Replacement

6.2.1 Sensor

6.2.1.1 Battery Specifications

Each Series 3 sensor contains two Energizer "L92" Lithium Polymer AAA Batteries. These batteries provide a minimum 6-8yr lifespan for most sensors. Sensors with optional external power may last up to 20 years, and binary sensors (such as SS3-301, 108, 603) may only last 4 years. Specific effects on battery life are addressed in sections 4.1.2.4 and 4.1.2.5.

6.2.1.2 Battery Replacement Procedure

If the batteries must be replaced, please follow these instructions.

1. Replacement with L92 "Ultimate Lithium" AAA is recommended. Traditional alkaline AAA's will function with a slightly shorter lifetime (30% less) and will result in incorrect Battery % readings in the Swift Console.
2. Remove the four mounting Screws on the bottom of the sensor.
3. Remove the sensor bottom
4. Remove the old batteries
5. Replace with new batteries. Battery polarity is drawn on the sensor PCBA to ensure correct insertion of the two batteries. Shown in *Figure 6.1* Below:

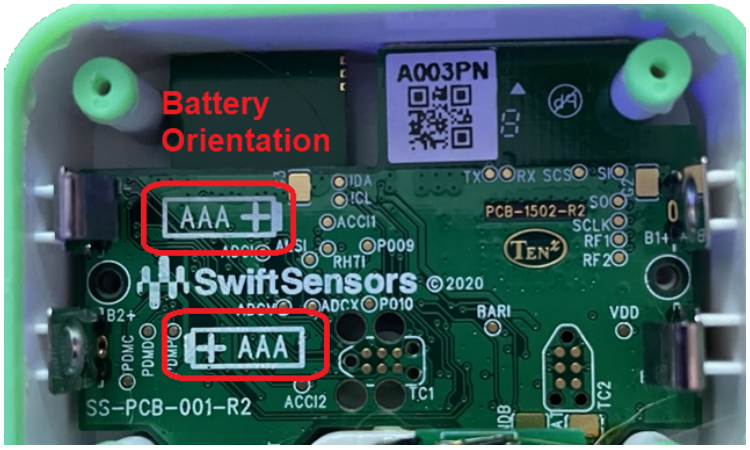


Figure 6.1

6. When new batteries are inserted, the onboard green LED will blink 5-6 times, indicating the batteries have been replaced correctly.
7. Replace the sensor bottom and tighten with the four mounting screws. Tighten in a star pattern.
8. Confirm proper battery replacement by clicking the top of the sensor. You should feel and hear the click. The green LED just below the power button icon on the enclosure will blink 6 times.

Appendix A: Data Sheets

A. Gateway

SG3-1010 - Gateway for Series 3 Sensors

SG3-1012 - Gateway for Series 3 Sensors and Series 2 RF Sensors

B. Sensor

SS3-101 - Wireless Temperature, Humidity, and Dew Point Sensor

SS3-102 - Wireless Water Resistant Temperature Sensor

SS3-103 - Wireless Ring Lug Temperature Sensor

SS3-104 - Wireless Medical Grade Temperature Sensor

SS3-105 - Wireless Remote Temperature Sensor

SS3-106 - Wireless High Temperature Probe

SS3-108 – Wireless Water Presence Sensor

SS3-109 - Wireless Water Detection Rope Sensor

SS3-110 - Wireless Sub-Zero Temperature Sensor

SS3-114 – Wireless Remote Temperature and Humidity Probe

SS3-116 – Wireless Stainless Steel High Temperature Probe

SS3-202 - Wireless Vibration Amplitude Sensor

SS3-203 - Wireless Predictive Vibration Amplitude Sensor

SS3-301 - Wireless Door Sensor

SS3-501 - Wireless Tilt Sensor

SS3-502 - Wireless Activity Sensor

SS3-603 – Wireless Dry Contact Sensor

SS3-605 - Wireless 4-20mA Current Sensor

SS3-610 – Wireless 0-500VACrms Voltage Meter

SS3-611 – Wireless 0-50VDC Voltage Meter

SS3-612 - Wireless 0-10VDC Voltage Meter

SS3-613 – Wireless 0-30VDC Voltage Meter

SS3-615 – Wireless Universal Analog Sensor Adaptor

SS3-617-30 – Wireless 0-30Arms Current Transformer Meter

SS3-617-100 – Wireless 0-100Arms Current Transformer Meter

SS3-617-200 – Wireless 0-200Arms Current Transformer Meter

C. Accessories

SG3-NEMA-1010-KIT - NEMA + IP67 Rated Enclosure for SG3-1010 Gateway Only

SG3-NEMA-CNM1-KIT - NEMA + IP67 Rated Enclosure for SG3-1010/1012 Gateways and Cellular Modem

SG3-CNM-1 - USB Cellular Modem Accessory for Series 3 Gateways

SS-TB1-120 - 120mL Polyethylene Glycol Thermal Buffer Medium Bottle with Insert

SS-TB2-200 - 200g Fine Glass Bead Thermal Buffer Medium Bottle with Insert

Appendix B: Compliance Notices

A. FCC Compliance Notice

This device complies with part 15 of FCC rules. Operation is subject to the following two conditions:
1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.
Change or modifications that are not expressly approved by the manufacturer could void the user's authority to operate the equipment.

RF Exposure Information:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm during normal operation.

B. Industry Canada (IC) Compliance Notice

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

This Class B digital apparatus complies with Canadian ICES-003.

RF Exposure Statement:
This equipment complies with IC RSS-102 radiation exposure limits set forth for an uncontrolled environment. This transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be collocated or operating in conjunction with any other antenna or transmitter.

Warning: Changes or modifications not expressly approved by Swift Sensors, Inc. could void the user's authority to operate the equipment.

C. CE Compliance Notice

All devices mentioned in this document carry the CE mark, and have full-compliance with CE guidelines.

Swift Sensors has a Declaration of Conformity available here: View Declaration of Conformity (Add live Link?)

Swift Sensors also has a complete CE Technical File available upon request. This is only accessible for legitimate inquiries.