



Instruction Bulletin - 01.4IB.48110

EcoVisor® Plus

Environmental Monitoring System

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Signal Words

As stated in ANSI Z535.4-2023, the signal word is a word that calls attention to the safety sign and designates a degree or level of hazard seriousness. The signal words for product safety signs are “**Danger**”, “**Warning**”, “**Caution**” and “**Notice**”. These words are defined as:

DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE is used to address practices not related to physical injury.

Qualified Person

For the purposes of this manual, a qualified person, as stated in NFPA 70E®, is one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved. In addition to the above qualifications, one must also be:

1. trained and authorized to test, energize, deenergize, lock out, tag, clear, and ground circuits and equipment in accordance with established general site-specific safety practices.
2. trained in the proper selection, care and use of personal protective equipment (PPE) including but not limited to insulating gloves, hard hat, safety glasses or face shields, arc flash clothing, etc., in accordance with established general site-specific safety practices.
3. trained in rendering first aid if necessary.

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Ch 1 General Information

WARNING

The equipment described in this document may contain high voltages and currents which can cause death or serious injury.

The equipment is designed for use, installation, and maintenance by knowledgeable users of such equipment having experience and training in the field of high voltage electricity. This document and all other documentation shall be fully read, understood, and all warnings and cautions shall be abided by. If there are any discrepancies or questions, the user shall contact Powell immediately at 1.800.480.7273.

WARNING

This equipment is designed for use, installation, and maintenance by qualified persons who have demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazard and reduced the associated risk.

NOTICE

The information in this instruction bulletin is not intended to explain all details or variations of the Powell equipment, nor to provide for every possible contingency or hazard to be met in connection with installation, testing, operation, and maintenance of the equipment. For additional information and instructions for particular problems, which are not presented sufficiently for the user's purposes, contact Powell at 1.800.480.7273.

NOTICE

Powell reserves the right to discontinue and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

A. SCOPE

The information in this instruction bulletin describes the following environmental monitoring system:

- EcoVisor® Plus

B. PURPOSE

The information in this instruction bulletin is intended to provide details required to properly operate the EcoVisor Plus environmental monitoring system described in [Ch 1 General Information, A. Scope](#).

This instruction bulletin provides:

1. Safety guidelines
2. General descriptions on the operation of the EcoVisor Plus environmental monitoring system
3. Instructions for installation
4. Illustrations, photographs, and description described in [Ch 1 General Information, A. Scope](#).

The illustrations contained in this document may not represent the exact construction details of each EcoVisor Plus installation. The illustrations in this document are provided as general information to aid in showing component locations.

All illustrations and photos are shown using deenergized equipment.

C. APPROVAL AND CERTIFICATIONS

Refer to the following Tables:

- [Table G EMC Immunity](#)
- [Table H EMC Emission](#)
- [Table I Environmental Conditions](#)

D. INSTRUCTION BULLETINS AVAILABLE ELECTRONICALLY**NOTICE**

Changes to the instruction bulletin may be implemented at any time and without notice. Go to powellind.com to ensure use of the current instruction bulletin for Powell equipment.

For more information visit powellind.com.

To contact the Powell Service call

1.800.480.7273 or email

serviceinfo@powellind.com.

For specific questions or comments pertaining to this instruction bulletin email

documents@powellind.com with the IB number in the subject line.

E. ASSOCIATED BULLETINS

- 01.4IB.51000D PowlVac® Metal-Clad Switchgear 5kV & 15kV
- 01.4IB.51200D PowlVac-AR® Arc Resistant Switchgear 5kV & 15kV

⚠ WARNING

Follow the appropriate safety precautions while handling any of the equipment. Failure to do so could result in death or serious injury.



Ch 2 Safety

A. SAFE WORK CONDITION

The information in Section A is quoted from *NFPA 70E 2018 - Article 120, 120.5 Establishing an Electrically Safe Work Condition*.

NFPA is periodically updated. Refer to the latest version of any additional updates

120.5 Process for Establishing and Verifying an Electrically Safe Work Condition.

Establishing and verifying an electrically safe condition shall include all of the following steps, which shall be performed in the order presented, if feasible:

1. Determine all possible sources of electrical supply to the specific equipment. Check applicable up-to-date drawings, diagrams, and identification tags.
2. After properly interrupting the load current, open the disconnecting device(s) for each source.
3. Wherever possible, visually verify that all blades of the disconnecting devices are fully open or that drawout-type circuit breakers are withdrawn to the fully disconnected position.
4. Release stored electrical energy.
5. Release or block stored mechanical energy.
6. Apply lockout/tagout devices in accordance with a documented and established procedure.

7. Use an adequately rated portable test instrument to test each phase conductor or circuit part to verify it is de-energized. Test each phase conductor or circuit part both phase-to-phase and phase-to-ground. Before and after each test, determine that the test instrument is operating satisfactorily through verification on any known voltage source.

N *Exception No. 1: An adequately rated permanently mounted test device shall be permitted to be used to verify the absence of voltage of the conductors or circuit parts at the work location, provided it meets the all following requirements: (1) It is permanently mounted and installed in accordance with the manufacturer's instructions and tests the conductors and circuit parts at the point of work; (2) It is listed and labeled for the purpose of verifying the absence of voltage; (3) It tests each phase conductor or circuit part both phase-to-phase and phase-to-ground; (4) The test device is verified as operating satisfactorily on any known voltage source before and after verifying the absence of voltage.*

N *Exception No. 2: On electrical systems over 1000 volts, noncontact test instruments shall be permitted to be used to test each phase conductor.*

Informational Note No. 1: See UL 61010-1, *Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements*, for rating, overvoltage category, and design requirements for voltage measurement and test instruments intended for use on electrical system 1000 volts and below.

- N** Informational Note No. 2: For additional information on rating and design requirements for voltage detectors, refer to IEC 61243-1, *Live Working - Voltage Detectors - Part 1: Capacitive type to be used for voltages exceeding 1kV a.c.*, or IEC 61243-2, *Live Working - Voltage Detectors - Part 2: Resistive type to be used for voltages of 1kV to 36kV a.c.*, or IEC 61243-3, *Live Working - Voltage Detectors - Part 3: Two-pole voltage type*.
8. Where the possibility of induced voltages or stored electrical energy exists, ground the phase conductors or circuit parts before touching them. Where it could be reasonably anticipated that the conductors or circuit parts being de-energized could contact other exposed energized conductors or circuit parts, apply temporary protective grounding equipment in accordance with the following:
- Placement.** Temporary protective grounding equipment shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to a shock hazard (i.e., hazardous differences in electrical potential). The location, sizing, and application of temporary protective grounding equipment shall be identified as part of the employer's job planning.
 - Capacity.** Temporary protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault.
- N** Informational Note: ATSM F855, *Standard Specification for Temporary Protective Grounds to be Used on De-energized Electric Power Lines and Equipment*, is an example of a standard that contains information on capacity of temporary protective grounding equipment.
- Impedance.** Temporary protective grounding equipment and connections shall have an impedance low enough to cause immediate operation of protective devices in case of unintentional energizing of the electric conductors or circuit parts.
- B. SAFETY GUIDELINES**
- Study this instruction bulletin and all other associated documentation before installing the EcoVisor® Plus environmental monitoring system.
- Each user has the responsibility to instruct and supervise all personnel associated with usage, installation, operation, and maintenance of this equipment on all safety procedures.
- Furthermore, each user has the responsibility of establishing a safety program for each type of equipment encountered.
- The safety rules in this instruction bulletin are not intended to be a complete safety program. The rules are intended to cover only some of the important aspects of personnel safety related to the EcoVisor Plus.*

**C. GENERAL**

1. Only supervised and qualified personnel trained in the usage, installation, operation, and maintenance of a circuit breaker shall be allowed to work on this equipment. It is mandatory that the appropriate instruction bulletins, supplements, and service advisories be studied, understood, and followed.
2. Maintenance programs must be consistent with both customer experience and manufacturer's recommendations, including service advisories and instruction bulletin(s). A well planned and executed routine maintenance program is essential for circuit breaker's reliability and safety.
3. Service conditions and circuit breaker applications shall also be considered in the development of safety programs. Variables include ambient temperature; humidity; actual continuous current; thermal cycling; number of operations; interrupting duty; and any adverse local conditions including excessive dust, ash, corrosive atmosphere, vermin and insect infestations.

D. SPECIFIC

1. **OBSERVE ALL SAFETY PRECAUTIONS FOR ANY ASSOCIATED, ADJACENT OR ANCILLARY EQUIPMENT.**
2. **DO NOT WORK ON ENERGIZED EQUIPMENT.** If work must be performed on a circuit breaker, remove it from service and remove it from the switchgear.
3. **DO NOT WORK ON EQUIPMENT WITH THE CONTROL CIRCUIT ENERGIZED.**
4. **ALL ELECTRICAL COMPONENTS SHALL BE DISCONNECTED BY MEANS OF A VISIBLE BREAK AND SECURELY GROUNDED FOR SAFETY OF PERSONNEL PERFORMING MAINTENANCE OPERATIONS ON THE EQUIPMENT.**

5. Interlocks are provided to ensure the proper operating sequences of the equipment and for the safety of the user. If for any reason an interlock does not function as described, do not make any adjustments, modification, or deform the parts. **DO NOT FORCE THE PARTS INTO POSITION. CONTACT POWELL FOR INSTRUCTIONS.**

E. SAFETY LABELS

The equipment described in this document has **DANGER, WARNING, CAUTION**, and instruction labels attached to various locations. All equipment **DANGER, WARNING, CAUTION**, and instruction labels shall be observed when the circuit breaker is handled, operated, or maintained.

NOTICE

Danger, Warning and Caution labels are located in various places. Do not remove or deface any of these warning/caution labels.

Ch 3 Equipment Description

A. OVERVIEW

NOTICE

Powell is committed to continuous product improvement.

It is possible that improvements occurred between revisions to this document and therefore, may not be described in these instructions. If the equipment does not resemble the photographs and descriptions contained herein, contact Powell before attempting to perform any actions.

The EcoVisor® Plus environmental monitoring device is intended for use in environments with high voltages and currents, where environmental factors pose a risk of equipment failure. The EcoVisor Plus measures settled dust optically, ambient temperature & humidity and also the primary conductor temperature using the integrated 3 channel BriteSpot® Plus module. The location of the sensors is shown in [Figure 1](#). These readings may be logged and used to generate warnings and alarms by connecting the EcoVisor Plus to a BriteSpot® Plus unit via RS-485. Alternatively, the EcoVisor Plus may be used as a standalone device connected to a Modbus RTU, allowing the collection, logging and interpretation of the data via other equipment.

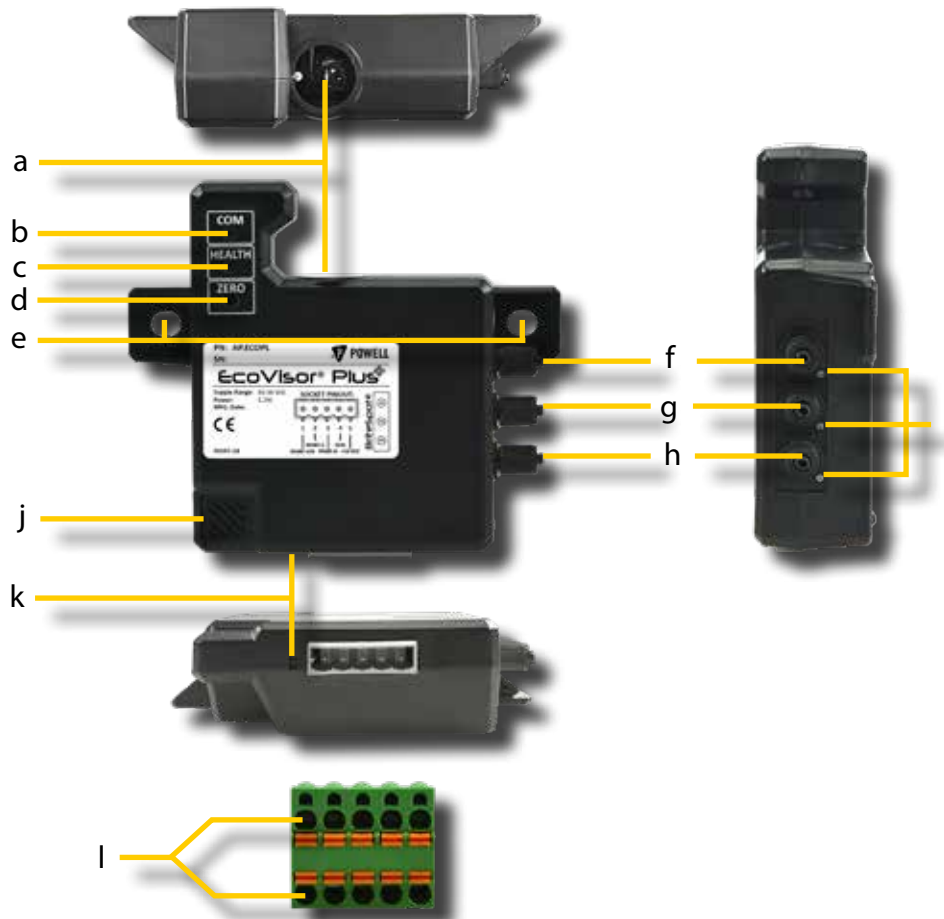
The device has an included two row push-in terminal plug ([Figure 1, k](#)) which incorporates both DC power input and RS-485 serial communication to allow easy installation and daisy chaining of multiple units. A key feature of this plug is that the circuit between other devices is not interrupted when the EcoVisor Plus is disconnected.

B. HARDWARE DESCRIPTION

Refer to [Figure 1](#) for the location of the EcoVisor® Plus physical features.



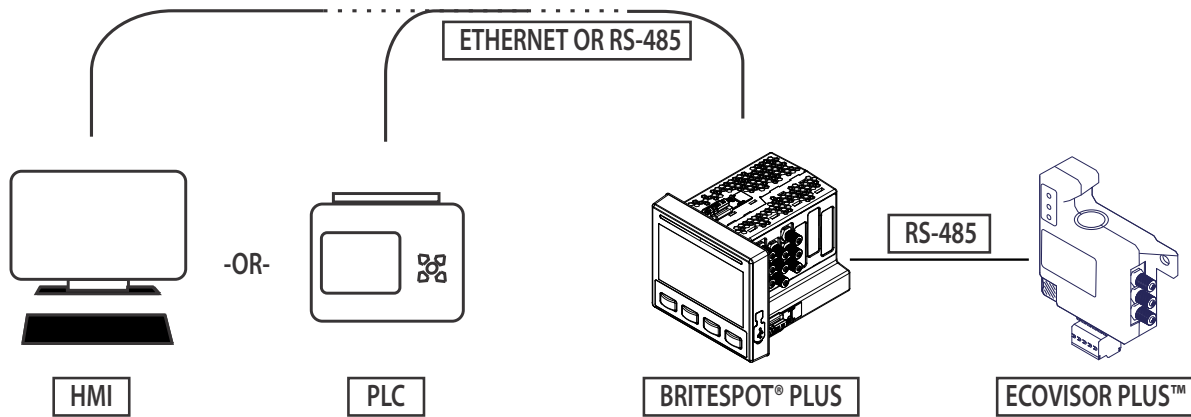
Figure 1 EcoVisor® Plus Environmental Monitor



- a. Optical Dust Sensing Window
- b. Communication Status Indicator LED
- c. Power and Environmental Condition Indicator LED
- d. Zero Button
- e. Mounting Holes (x2)
- f. BriteSpot® Temperature Sensor Channel 1
- g. BriteSpot® Temperature Sensor Channel 2
- h. BriteSpot® Temperature Sensor Channel 3
- i. BriteSpot® Status LEDs
- j. Replaceable Humidity and Temperature Sensor
- k. Clip/Release for Humidity and Temperature Sensor
- l. Two row push-in terminal plug for power and RS-485 communication

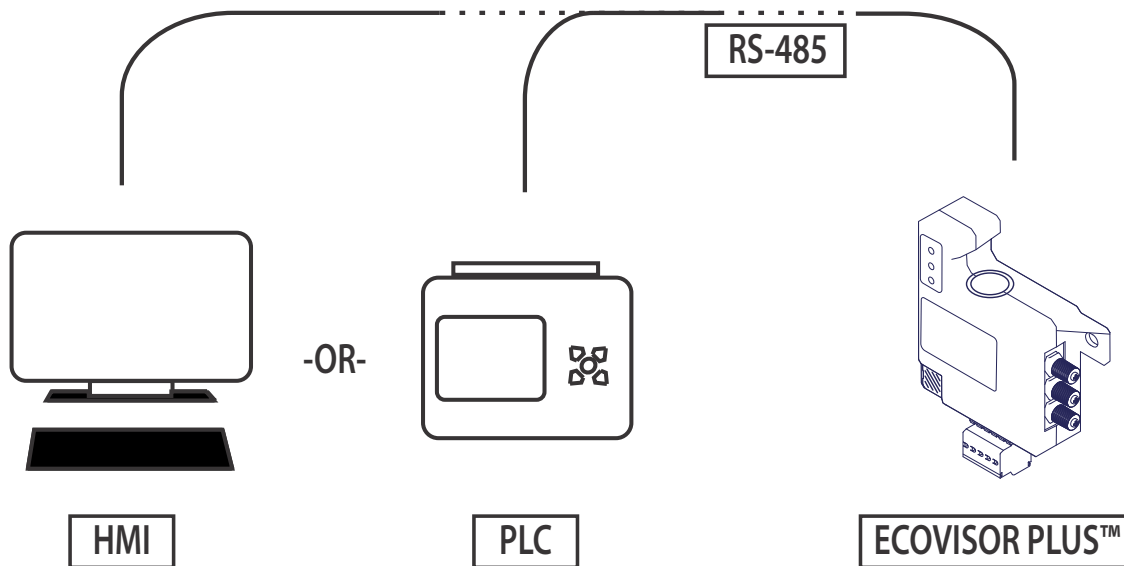
The EcoVisor® Plus may be connected to a BriteSpot® Plus unit allowing data logging and remote access as shown in [Figure 2](#).

Figure 2 EcoVisor® Plus Connected via BriteSpot® Plus



Alternatively, the EcoVisor Plus may be incorporated as a slave device into an existing RS-485 Modbus RTU network and its data collected by a connected HMI or other control system as shown in [Figure 3](#).

Figure 3 EcoVisor® Plus Connected Directly to RS-485 Network





Ch 4 Installation

A. RECEIVING

When the EcoVisor® Plus environmental monitoring system is received, check for any sign of damage. If damage is found or suspected, file all claims immediately with the transportation company and notify the nearest Powell representative.

Estimated size and weight for shipping the EcoVisor Plus assembly:

- Size: 5.25" long x 4.5" height x 1.375" width
- Weight: 0.4 lbs

B. HANDLING

NOTICE

Do not handle the device by the inputs as damage may occur.

NOTICE

Do not drop the device as damage may occur.

C. STORAGE

Shipping and storage of electrical equipment requires specific measures to prevent the deterioration of the apparatus over a long unused period. The equipment is designed for use in a variety of environments. When the equipment is in transit and storage, these design considerations are not functional. In general, the following measures must be considered. The warranty of the equipment is not valid if proper handling and storage practices are not implemented. If equipment shipment is prolonged, such as ocean transit, these storage measures also apply to shipment.

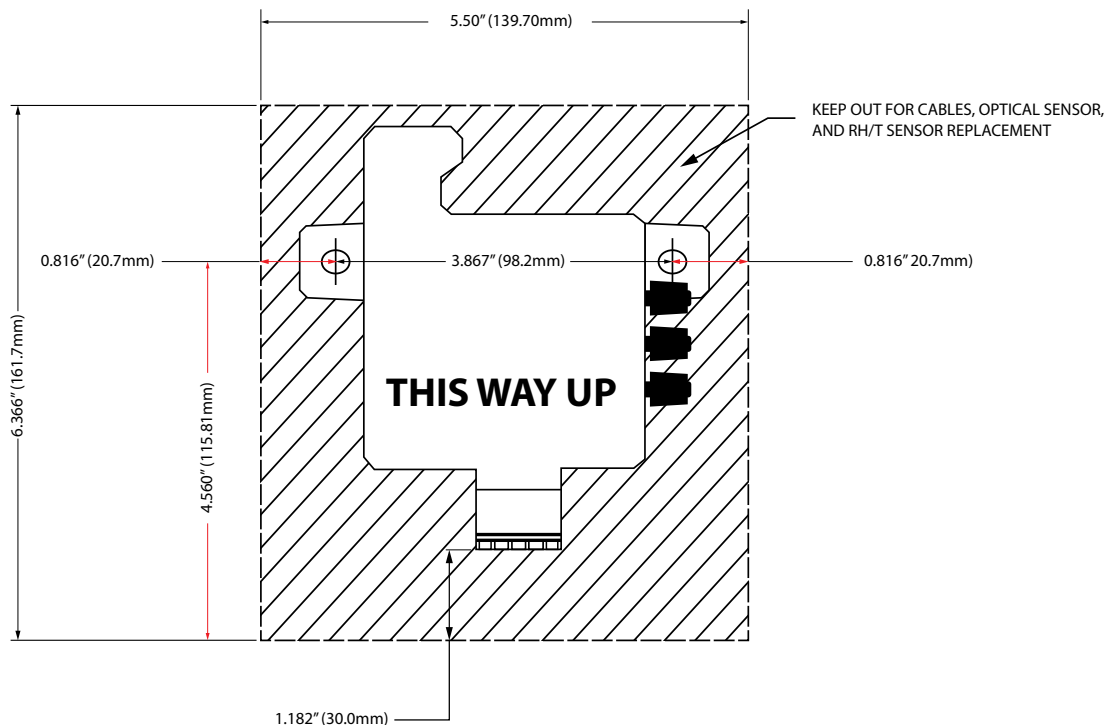
Equipment designed for indoor installation must be stored indoors in a climate controlled environment to prevent condensation of moisture. Exposure to rain and the elements, even for a short period, can permanently damage the equipment. The temperature should be kept above -40°F (-40°C) and below 185°F (85°C). The relative humidity should be between 20% to 95%. If prolonged storage is anticipated, humidity controlling desiccant materials should be applied to switchgear.

D. MOUNTING

1) EcoVisor® Plus

The mounting of the EcoVisor Plus is intended to be in any high voltage compartment including bus compartment, rear cable compartment, or circuit breaker compartment. The EcoVisor Plus can be mounted with two plastic rivets (PN: PDM-ANT-RIVET) or on 0.25" PEM studs. Dimensions for the mounting holes are shown in [Figure 4](#).

Figure 4 EcoVisor® Plus Mounting Pattern



Note: Figure 4 is not to scale and dimensions are in inches (millimeters).

2) BriteSpot® Probe

The BriteSpot fiber optic probe can be independently installed from the EcoVisor® Plus. Many of the installations are at user's discretion. The images used in this section are installed in medium voltage switchgear as a sample. The principle of installation can be carried over to many other applications where temperature monitoring is needed. Other examples include but not limited to; wiring splices, circuit breakers, motor control centers, bus duct, dry-type transformers, and cable compartments.

a) Selection of Location of Interest

BriteSpot can measure temperatures on any equipment within its operational range. The start of the process is to select a Location of Interest, LOI. The tip of the fiber shall eventually be placed at this location and secured via the fixture.

Here are some recommended principles to follow when selecting the LOI:

1. The LOI should ideally be as close to a potential source of failure. For example, if a splice or bolted connection is present and critical, consider mounting the fiber sensing tip right at, or adjacent to, the connection point.



2. The probe can measure temperatures in locations that are not visible, therefore consider locations where infrared monitoring will not be effective. In many situations, important connections are hidden behind ducting, and sheet metal. Main Bus compartments are an ideal example as they cannot be viewed in operation.
3. There must be a method for affixing one of the various fixture options to the LOI. Each fixture type has specific requirements for proper attachment.
4. There must be a continuous path between the LOI to the mounting location of the EcoVisor® Plus which can be followed by the fiber. This will be termed "Fiber Path".
4. No point on the fiber path (in contact with the fiber) shall exceed 212°F (100°C). This excludes the LOI where the fiber is attached to the mounting fixture.

There are additional aspects that need to be considered before proceeding with installation.

1. The LOI and mounting location of the EcoVisor Plus must not be farther apart than the length of the fiber. In practice, they must be even closer as the fiber will frequently not take a direct path, following the surface features instead.
2. Provide continuous low-voltage, 10-30VDC, power to the EcoVisor Plus. In addition, RS-485 ports are used for real-time communication. The associated wire for both power and RS-485 ports must be capable of being routed to the EcoVisor Plus.
3. Temperature at the LOI must not exceed the maximum rated temperature of the fiber for an extended period.

b) Secure Probe to LOI

The most common probe mounting fixture for use with the BriteSpot® is based on industry standard ring-style cable termination lugs. These lugs have proven to be reliable, easy to install, and virtually maintenance free. In addition, if installed at locations with existing hardware, no modification to hardware length or specification are needed. The fiber probe has a special feature, called probe-lock which secures the probe to the lug without crimping, allowing lugs to be installed first, then the attachment of the probe (*Figure 5*).

1. Select the proper lug of the application based on the existing hardware, if present, or planned hardware. Any #6 AWG Tyco/Amp Solistrand™ ring-style lug should be compatible, however not all have been tested. If purchase in kit form, three standard lug sizes (*Figure 6*) have been included, and are specified in Installation Sequence of Lug with Standard Washers (*Figure 7*). When selecting the lug for a given location, ensure that the lug with the tightest fit around the hardware is selected – this aids in proper thermal conduction and will result in more accurate readings.

Figure 5 Fiber - Optical Probe with Probe Lock

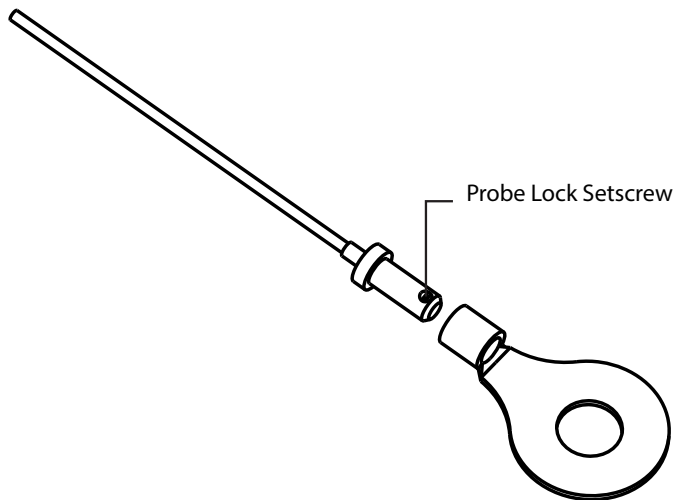
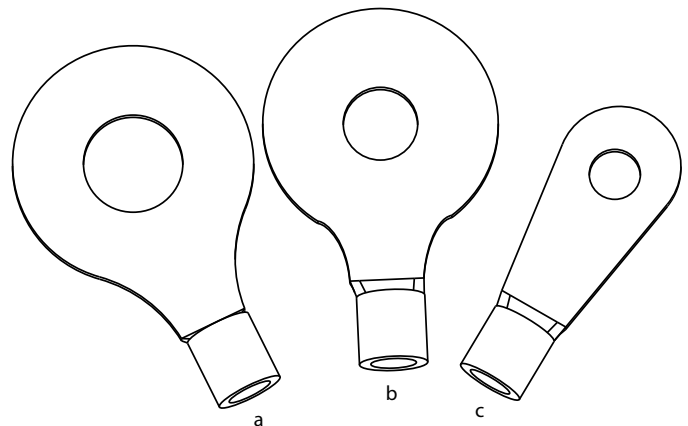


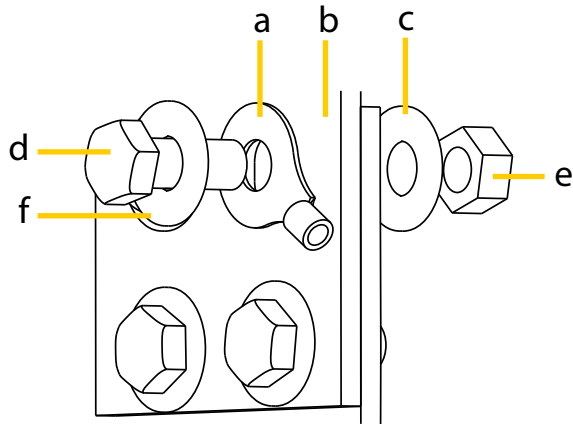
Figure 6 Tyco/Amp Ring-Style Lugs



- $\frac{1}{2}$ " Hardware (Tyco/Amp PN 36808)
- $\frac{3}{8}$ " Hardware (Tyco/Amp PN 36807)
- $\frac{1}{4}$ " Hardware (Tyco Amp PN 33465)



Figure 7 Installation Sequence of Lug with Standard Washers



- a. Lug
- b. Measurement Surface
- c. Washer
- d. Bolt
- e. Nut
- f. Washer

2. To make probe installation easier, consideration must be first given to the rotational orientation of the lug before it is mounted. When the probe is eventually installed, the fiber will need to have a relatively unobstructed path to be inserted into the lug. For example, in some situations protective boots are placed over bolted connections, posing an inconvenience when routing the fiber. Align the fixture to allow the fiber to be threaded through existing seams in the dielectric boot. The lug must also be placed such that the probe-lock is accessible to an Allen Key for tightening.

3. Mount the lug so that it is directly contacting the surface to be measured. Washers should not be placed between the lug and the surface to be measured, instead they should be placed on the other side of the lug, as shown in (Figure 7). Figure 8 shows the proper installation when Belleville washers are used. Absolutely no greases and/or pastes should be used between the lug and the surface it is contacting. Ensure the orientation of the lug is such that the probe and fiber run parallel to the bus.

Figure 8 Installation Sequence of Lug with Belleville Washer

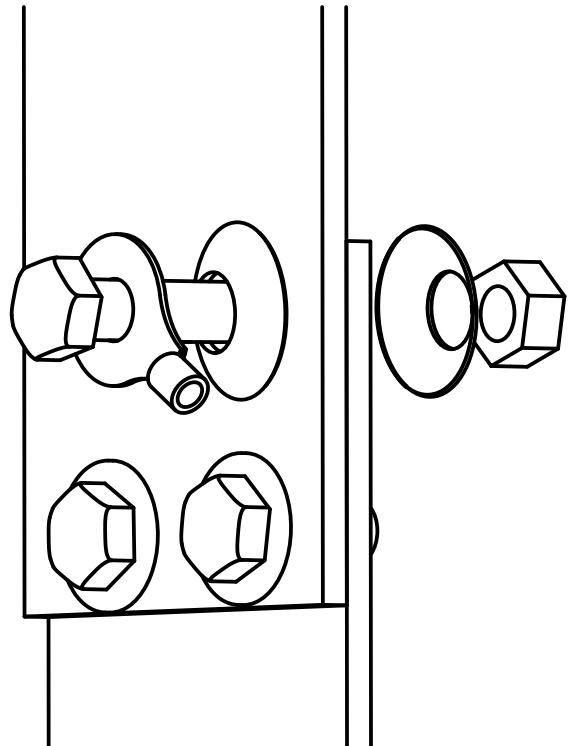


Figure 9 Mounting Lug



Figure 10 Secure Probe Tightening Allen Key



6. Validate that the probe is properly secured into the lug by giving a gentle tug ([Figure 11](#)). At this point the joint can be carefully dressed, if required, while ensuring the probe is not abused.

Figure 11 Correctly Installed Probe and Lug

4. Once the lug is mounted, the probe can be installed. This is simply done by inserting the probe tip into the end of the lug. Ensure that the head of the probe-lock set screw is visible and easily accessible to allow it to be secured.
5. With the probe installed, fasten the head of the Allen setscrew. This is performed with a 0.05" (1.5mm) Allen Key ([Figure 10](#)). The setscrew is designed to bite in the lug and is retained by military grade friction patch to ensure immunity to vibration. The setscrew should be torqued to approximately 5 in-lbs.



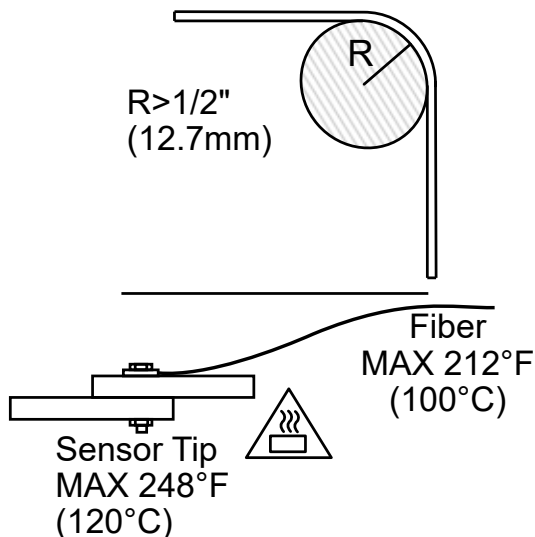


c) Route Fiber-Optic Probe

Proper routing of the probe is important to facilitate proper installation of the BriteSpot®. The optical fiber has some general guidelines that must be followed during installation.

1. Ensure that the bend radii are greater than 1/2" (1.3cm) bend. Smaller than this will cause a loss of optical signal (Figure 12).

Figure 12 Fiber Limitations



2. Keep exposed sections of the fiber away from excessive temperatures up to 248°F (120°C) and the fiber for temperatures up to 212°F (100°C). Temperatures in excess of these could cause premature failure of the fiber.
3. Secure the fiber along its routing path is best done with non-conductive tie-wraps at even intervals every 3 - 6 ft (1 - 2m) depending on the types of features that must be navigated. Use electrical tape as

temporary attachment to assist in installation as indicated in (Figure 13). When securing tie-wraps, ensure that the fiber is not pinched excessively as this can degrade the optical signal. Cables can be bundled together and routed for ease of installation whenever possible. Ensure to clip all extra length from tie-wraps once they have been secured.

Figure 13 Electrical Tape Installation



Figure 14 Tie-Wrap Being Secured Over Fiber



Figure 15 Completed Fiber Installation



NOTICE

Do not fasten or attached ANY mounting hardware (tie-wraps, etc.) to at least 12" (30cm) length of fiber in between the portion of the probe at high voltage point of contact and the fiber's first non-energized point of contact. This section of suspended fiber provides an increase in dielectric strength to the probe and therefore must be left unsecured and ungrounded. It is good practice to maintain more than 12" (30cm) of suspended fiber, but not required.

Figure 16 Safe Dielectric Routing Practices

11.81"
(30cm)



Note: *Ensure that at least 12" (30cm) of fiber is suspended prior to fastening.*



4. Do not straddle phases with the fiber. The fiber must go from the LOI to a non-energized contact point and then to the EcoVisor® Plus.
5. Mark each end of the Fiber with a means to identify each fiber when finalizing the installation location. If this is not done, it can be very challenging to correlate installation location with the fiber. Black marker and tape are acceptable, as are approved wire markers (preferred). Ensure to make all markings a safe distance from the energized end, typically this is 2 - 3 ft. (60 -100cm).

d) Fiber Connection/Termination at EcoVisor® Plus

1. Determine trim location. Once the fibers have been secured along their length, they can be prepared for the final installation. Determine where the fibers must be trimmed to remove the excess fiber and still reach the EcoVisor Plus. Once a section of the fiber has been cut, it can only be cut shorter, therefore be careful to ensure that enough length has been allocated to reach the EcoVisor Plus. It is best to leave at least 1 - 2" (25 - 50mm) of extra fiber as a precautionary measure.
2. Trim the Fiber. Slide the fiber through either of the two holes label "2.2" on the provided guillotine trimmer (*Figure 17*). Once the location is set, push down briskly on the trimmer to complete the cut. Each location on the trimmer should be only be used maximum 10 times, so keep track of the locations that have already been used.

Figure 17 Fiber Trimmer



Figure 18 Fiber Trimmed



NOTICE

Once the fiber is cut, it is imperative to ensure that the cut end is kept clean and free from debris. If the end becomes contaminated, trim off several millimeters.

3. Connect the Fiber to the EcoVisor® Plus. Ensure that the cut surface of the fiber is clean. Fully disengage the fiber retention nuts on each sensor. This is done by turning them counter-clockwise several turns (*Figure 19, a*). They are designed to stay in place once disengaged, if they are inadvertently removed, they can be put back simply by pushing them back on. Insert the fibers into the proper optical connector (*Figure 19, b*). If the fibers have not been marked to identify installation location already, see *Ch 8 Troubleshooting, Table J* for the method of identifying fibers that are not labeled. Insert the fibers individually into the optical connectors until they come to a hard stop (*Figure 19, b*). The stop will be very noticeable and does not require excessive force. Secure the fiber retention nut with moderate force by turning it in clockwise (*Figure 19, c*). Do not over tighten the nut, as it is plastic and can be broken if too much force is applied.



Figure 19 Fiber Installation



- a. Turn counter-clockwise (Channel 3)
- b. Insert fiber to optical connector (Channel 3)
- c. Turn clockwise (Channel 3)

4. Ensure that the optical signal is adequate once all the fibers are installed and connected. They must be checked to ensure that the optical signal is strong enough for proper operation of the device.
 - i. Apply power to the device and wait several minutes for all probes to stabilize.
 - ii. For each probe, look at the color of the BriteSpot® status LED ([Figure 1, h](#)) and follow the action recommended in [Table A BriteSpot® LED Colors](#).

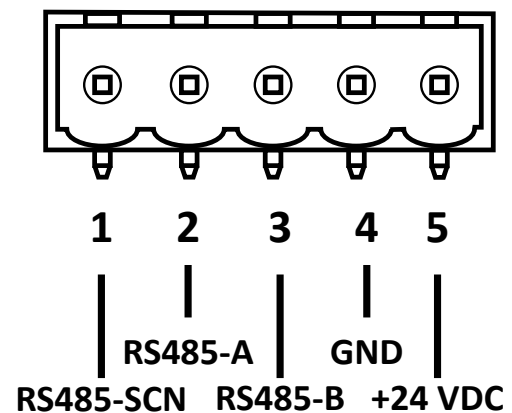
Table A BriteSpot® LED Colors		
Status LED Color	Status	Action
Green	OK	No Action
Red	Not ready	Cut several mm off the fiber end and reinsert

- iii. Complete the procedure by checking the fiber power for the probes. Read the fiber power registers in [Table C EcoVisor® Plus Modbus RTU Registers Supported](#). Fiber power should be 7, 8, 9, or 10 (strongest signal).
- iv. If any of the probes do not stabilize, please see [Ch 8 Troubleshooting](#) for remedial actions.

E. ELECTRICAL CONNECTIONS

The EcoVisor® Plus has a two row terminal plug which is connected internally to provide easy daisy chaining of several devices. The pinout of the connection is shown on the front label of the EcoVisor Plus and in [Figure 20](#).

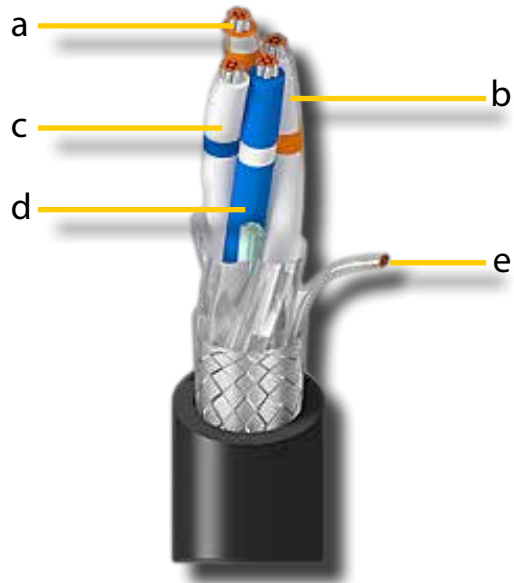
Figure 20 EcoVisor® Plus Pinout



It is recommended to use a Belden 3107 cable to wire the EcoVisor Plus. See [Figure 21](#) for the proper connection.



Figure 21 Belden 3107A Cable Connection



- a. RS485-A to Orange with White Stripes
- b. RS485-B to White with Orange Stripes
- c. +24 VDC to White with Blue Stripes
- d. GND to Blue with White Stripes
- e. RS485-SCN to Shield

Ch 5 Operation

A. INTEGRATION WITH THIRD PARTY SYSTEMS

Table B lists the default configuration of the ModBus RTU Interface and *Table C* lists the Modbus RTU registers supported by EcoVisor® Plus using the Modbus RTU protocol. Should it be necessary to reset the communication settings to default, refer to *Ch 7 Maintenance, B. Factory Reset*.

Table B EcoVisor® Plus Modbus RTU Interface Default Settings

Parameter	Value
Baud Rate	19200
Data Bits	8
Parity	None
Stop Bits	1
Device ID	1

Table C EcoVisor® Plus Modbus RTU Registers Supported

Register Name	Name	Default Value	Min. Value	Max. Value	UOM	Register Address	Offset
<i>General Parameters - 30001 to 30009</i>							
Hardware Part Number	PCB Part Number	10372	NA	NA	NA	30001	0
Firmware Revision	Firmware Revision Number	NA	0	65535	NA	30002	1
Manufacturing Day	Day of Manufacture	NA	1	31	DD	30003	2
Manufacturing Month	Month of Manufacture	NA	1	12	MM	30004	3
Manufacturing Year	Year of Manufacture	NA	2024	65535	YYYY	30005	4
Device Serial Number (Low)	LSW of Serial Number in Hexadecimal	NA	0	65535	-	30006	5
Device Serial Number (High)	MSW of Serial Number in Hexadecimal	NA	0	65535	-	30007	6
RHT Sensor Serial Number (Low)	LSW of Serial Number in Hexadecimal	NA	0	65535	-	30008	7
RHT Sensor Serial Number (High)	MSW of Serial Number in Hexadecimal	NA	0	65535	-	30009	8
<i>Modbus Communication Parameters - 30010 to 30011</i>							
Modbus Device ID	Modbus Slave ID	1	1	247	1-247	30010	9
Modbus Baud Rate	Modbus Baud Rate	1	0	4	0-9600, 1-19200, 2-38400, 3-57600, 4-115200	30011	10


Table C EcoVisor® Plus Modbus RTU Registers Supported (Cont.)

Register Name	Name	Default Value	Min. Value	Max. Value	UOM	Register Address	Offset
<i>Measurement Ambient Parameters - 30012 to 30014</i>							
Ambient Temperature in °C	Ambient Temperature in °C	NA	-40	85	°C	30012	11
Ambient Temperature in °F	Ambient Temperature in °F	NA	-40	185	°F	30013	12
Relative Humidity in %	Relative Humidity in %	NA	5	95	%	30014	13
<i>Measurement Dust Thickness - 30015 to 30016</i>							
Dust Thickness	Dust Thickness in µm	NA	0	2000	µm	30015	14
Reserved	Reserved for future use	NA	NA	NA	NA	30016	15
<i>System Status Registers - 30017 to 30037</i>							
OS Tick	OS Tick	NA	0	65535	NA	30017	16
Reserved	Reserved for future use	NA	NA	NA	NA	30018	17
Reserved	Reserved for future use	NA	NA	NA	NA	30019	18
Reserved	Reserved for future use	NA	NA	NA	NA	30020	19
Reserved	Reserved for future use	NA	NA	NA	NA	30021	20
Reserved	Reserved for future use	NA	NA	NA	NA	30022	21
Reserved	Reserved for future use	NA	NA	NA	NA	30023	22
Reserved	Reserved for future use	NA	NA	NA	NA	30024	23
Reserved	Reserved for future use	NA	NA	NA	NA	30025	24
Reserved	Reserved for future use	NA	NA	NA	NA	30026	25
Reserved	Reserved for future use	NA	NA	NA	NA	30027	26
Reserved	Reserved for future use	NA	NA	NA	NA	30028	27
Reserved	Reserved for future use	NA	NA	NA	NA	30029	28
Reserved	Reserved for future use	NA	NA	NA	NA	30030	29
Reserved	Reserved for future use	NA	NA	NA	NA	30031	30
Reserved	Reserved for future use	NA	NA	NA	NA	30032	31
Reserved	Reserved for future use	NA	NA	NA	NA	30033	32
Reserved	Reserved for future use	NA	NA	NA	NA	30034	33
Reserved	Reserved for future use	NA	NA	NA	NA	30035	34
Reserved	Reserved for future use	NA	NA	NA	NA	30036	35
Reserved	Reserved for future use	NA	NA	NA	NA	30037	36
<i>Calculated Dew Point - 30038 to 30043</i>							
Dew Point in °C	Calculated Dew Point in °C	NA	-40	85	°C	30038	37
Reserved	Reserved for future use	NA	NA	NA	NA	30039	38
Dew Point in °F	Calculated Dew Point in °F	NA	-40	185	°F	30040	39
Reserved	Reserved for future use	NA	NA	NA	NA	30041	40
Reserved	Reserved for future use	NA	NA	NA	NA	30042	41
Reserved	Reserved for future use	NA	NA	NA	NA	30043	42

Table C EcoVisor® Plus Modbus RTU Registers Supported(Cont.)

Register Name	Name	Default Value	Min. Value	Max. Value	UOM	Register Address	Offset
<i>BriteSpot® Registers - 30044 to 30063</i>							
BriteSpot G2.1 Serial Number (Low)	LSW of serial number in hexadecimal	NA	0	65535	-	30044	43
BriteSpot G2.1 Serial Number (High)	MSW of serial number in hexadecimal	NA	0	65535	-	30045	44
BriteSpot G2.1 Channel 1 Status	Channel 1 status	NA	0	7FFF	0 - Good 1 - Probe not detected 2 - Signal too weak 4 - Temperature out of range 8 - Initializing error-0x7FFF	30046	45
BriteSpot G2.1 Channel 2 Status	Channel 2 status	NA	0	7FFF	0 - Good 1 - Probe not detected 2 - Signal too weak 4 - Temperature out of range 8 - Initializing error-0x7FFF	30047	46
BriteSpot G2.1 Channel 3 Status	Channel 2 status	NA	0	7FFF	0 - Good 1 - Probe not detected 2 - Signal too weak 4 - Temperature out of range 8 - Initializing error-0x7FFF	30048	47
BriteSpot G2.1 Channel 1 Temperature in °C	Channel 1 temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30049	48
BriteSpot G2.1 Channel 2 Temperature in °C	Channel 2 temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30050	49
BriteSpot G2.1 Channel 3 Temperature in °C	Channel 3 temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30051	50
BriteSpot G2.1 Channel 1 Temperature in °F	Channel 1 temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30052	51


Table C EcoVisor® Plus Modbus RTU Registers Supported (Cont.)

Register Name	Name	Default Value	Min. Value	Max. Value	UOM	Register Address	Offset
BriteSpot® G2.1 Channel 2 Temperature in °F	Channel 2 temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30053	52
BriteSpot G2.1 Channel 3 Temperature in °F	Channel 3 temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30054	53
BriteSpot G2.1 Channel 1 Fiber Power	Channel 1 fiber power	NA	0	10	0 - 10 (8 - 10 is acceptable)	30055	54
BriteSpot G2.1 Channel 2 Fiber Power	Channel 2 fiber power	NA	0	10	0 - 10 (8 - 10 is acceptable)	30056	55
BriteSpot G2.1 Channel 3 Fiber Power	Channel 3 fiber power	NA	0	10	0 - 10 (8 - 10 is acceptable)	30057	56
BriteSpot G2.1 Channel 1 Delta vs Ambient Temperature in °C	Channel 1 delta vs ambient temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30058	57
BriteSpot G2.1 Channel 2 Delta vs Ambient Temperature in °C	Channel 2 delta vs ambient temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30059	58
BriteSpot G2.1 Channel 3 Delta vs Ambient Temperature in °C	Channel 3 delta vs ambient temperature in °C	NA	-50	200	°C -999 is invalid Temperature 0x7FFF is channel error	30060	59
BriteSpot G2.1 Channel 1 Delta vs Ambient Temperature in °F	Channel 1 delta vs ambient temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30061	60
BriteSpot G2.1 Channel 2 Delta vs Ambient Temperature in °F	Channel 2 delta vs ambient temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30062	61
BriteSpot G2.1 Channel 3 Delta vs Ambient Temperature in °F	Channel 3 delta vs ambient temperature in °F	NA	-58	392	°C -999 is invalid Temperature 0x7FFF is channel error	30063	62

Table D EcoVisor® Plus Modbus Holding Registers

Register Name	Name	Default Value	Min. Value	Max. Value	UOM	Register Address	Offset
<i>Modbus Communication Parameters - 40001 to 40002</i>							
Modbus Device ID	Device ID	1	1	247	1 - 247	40001	0
Modbus Baud Rate	Baud Rate	1	0	4	0 - 9600 1 - 19200 2 - 38400 3 - 57600 4 - 115200	40002	1

B. OPERATION WITH BRITESPOT® PLUS

1) Electrical Connection

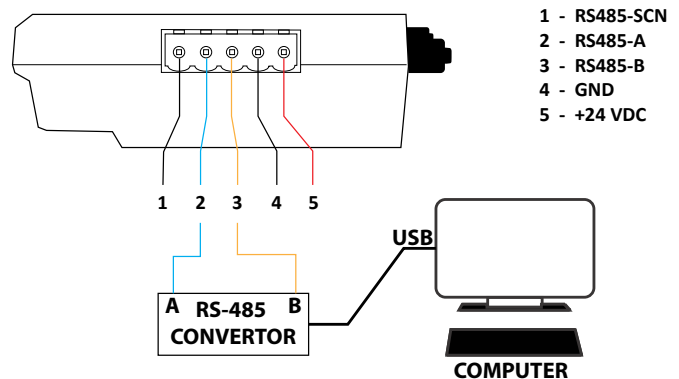
For connection to the BriteSpot Plus, a 5 pin module cable must be terminated to match the client port pinout described in the BriteSpot Plus instruction bulletin and connections made as directed. The EcoVisor® Plus is treated as a regular EcoVisor device when connected to the BriteSpot Plus.

2) Setup

Refer to the latest version of the BriteSpot instruction bulletin for information on Web Interface to set up the EcoVisor® Plus connection. The EcoVisor Plus is treated as a regular EcoVisor device when connected to the BriteSpot Plus. The 3 BriteSpot channels featured by the EcoVisor Plus are not displayed or recorded by the BriteSpot Plus.

- Download and install any Modbus master simulator. In this case Modbus Poll is used.
<http://www.modbustools.com/download.html>.
- Power EcoVisor Plus with 10 – 30VDC.
- Connect the EcoVisor Plus to a computer using a suitable RS-485 converter, see connection diagram in [Figure 22](#).

Figure 22 Connection Diagram



C. QUICK START GUIDE

1) Establishing Connection to the EcoVisor Plus

Note: This procedure assumes that the EcoVisor Plus is in its default state. Should it be necessary to return to this state refer to [Ch 7 Maintenance, B. Factory Reset](#).

- Use the Modbus master simulation software and information provided in [Ch 5 Operation, A. Integration with Third Party Systems](#) to configure communication with the EcoVisor Plus.
- Set up connection as shown in [Figure 23](#) (select the appropriate COM port and other settings in the “Serial Settings” panel of the software).



Figure 23 Initial Connection Setup

Figure 25 Slave ID Change

2) Changing the Slave ID

- a. Double click on the value for the slave ID in the Modbus Poll window (Figure 24) for the holding register. The following pop-up window will appear shown in Figure 25.

Figure 24 Modbus Poll - Slave ID

	Name	Value
0	HR_MB_SLAVE_ID	1
1	HR_MB_RATE	1

- b. Enter the desired slave ID in the box labeled "value" and press the enter key or click "Send". Connection to the device will temporarily be lost until the next steps in this process have been performed.
- c. Press the F8 key to open the Read/Write Definition pop-up window (Figure 26).

Figure 26 Modbus Poll Read/Write Definition

Figure 28 Baud Rate Change

- d. Enter the new slave ID into the box labeled "Slave ID" and press the enter key or click "OK". Connection will be reestablished.
- e. Repeat steps a to d for the Input register window.

3) Changing the Baud Rate

- a. Double click on the value for the baud rate in the Modbus Poll window (Figure 27) for the holding register. The following pop-up window will appear shown in Figure 28.

- b. Enter the enumerator of the desired baud rate (0-4, described in [Table D EcoVisor® Plus Modbus Holding Registers](#)) in the box labeled "Value" and press the enter key or click "Send". Connection to the device will be lost until the next steps in this process have been performed.
- c. Press the F4 key to disconnect, or click on "Connection" → "Disconnect".
- d. Press the F3 key or click on "Connection" → "Connect", to open the connection pop-up window shown in [Figure 29](#).

Figure 27 Modbus Poll - Baud Rate

Doc

Ecovisor_plus_holdi...

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✕

Tx = 0: Err = 0: ID = 1: F = 03: SR =

	Name	00000
0	HR_MB_SLAVE_ID	1
1	HR_MB_RATE	1



Figure 29 Modbus Poll Connection Setup

- e. Select the new baud rate from the dropdown menu and press the enter key or click "OK". Connection will be reestablished.

Ch 6 Specifications

Table E System Sensor Specification

Parameter	Detection Range	Accuracy	Resolution	Refresh Rate	Response Time
Sensors					
Dust	0-1 mm	±0.05 mm	0.01 mm	50 ms	15s
Relative Humidity and Temperature	20% to 95% RH	See Figure 30	0.1% RH	1s	10s
	-40°F to 185°F (-40°C to +85°C)	±34.7°F (±1.5°C)	32.18°F (0.1°C)	1s	9 min
BriteSpot® Plus Temperature Channels.	-40°F to 320°F (-40°C to +160°C) (probe dependent)	±35.6°F (±2°C)	33.8°F (1°C)	3s	-
Physical					
Approximate Dimensions	Height: 4.89" (124.20mm) Including Plug Width: 4.77" (121.16mm) (Edge to Edge of Mounting Flanges) Depth: 1.21" (30.73mm); 1.22" (30.98mm) Including Plug				
Enclosure Material	Injection molded PC/ABS blend (UL 94 V-0 rated)				
Mounting	2 x 1/4" (6.25mm) holes on 3.867" (98.2mm) center, see Ch 4 Installation, D. Mounting for details				
Interface	1 button				
Power Requirements					
Voltage Range	10 - 30 VDC				
Max Current	0.1A				
Max Power	1.2W				
Environmental Operating Conditions					
Operating Temperature	-40°C to 85°C				
Storage Temperature	-40°C to 85°C				
Communication Interface					
Interface to BriteSpot Plus	RS-485				
Standalone Modbus	RS-485				
Supported Baud Rates	9600, 19200, 57600, 115200				
Supported Modbus RTU Device ID	1 - 247 (Default is 1)				
Recommended Maximum Polling Rate	1 Modbus RTU request per second				
Indicators					
COM LED	Bi-color LED for indication of communication status. See Table F EcoVisor® Plus LED Indicators for definitions				
HEALTH LED	Bi-color LED for indication of power and dust level conditions. See Table F EcoVisor® Plus LED Indicators for definitions				


Table E System Sensor Specification (Cont.)

Parameter	Detection Range	Accuracy	Resolution	Refresh Rate	Response Time
Push Button Operations					
Bootloader Mode	Button held pushed while power is applied, the device will enter bootloader mode and remain there until new firmware is loaded or power is cycled. COMM LED will flash amber continuously at 1 Hz. HEALTH LED will be off.				
Dust Zero Level Reset	Button pushed for between 0.5 and 4 seconds and then released, dust zero level reset. On release of the button, HEALTH LED will flash green at 1 Hz for 3-12 seconds. Intended to be used after cleaning the dust sensor window.				
Factory Default	Button pushed for more than 4 seconds, when release, the device will be returned to factory defaults. COMM LED will be solid red while the HEALTH LED will flash 1 Hz red for 3 seconds then followed by green at 1 Hz for 3-10 seconds before both LEDs return to normal operation.				
Standard BriteSpot® Probe (BSL007, BSL010, BSL015)					
Material	Nylon				
Minimum Bend Radius	½" (12mm)				
Probe Length	21, 30, 45ft (7, 10, 15m)				
Operating Temp. Range	-40°F to 248°F (-40°C to 120°C)				
High Voltage Characteristics	38kV, over 8" gap				
BriteSpot® Probe High Temperature (BSP-HT)					
Material	Fluoropolymer				
Minimum Bend Radius	½" (12mm)				
Probe Length	Detachable probe 10" (0.25m), max. Fiber extension 393.70" (10m).				
Operating Temp. Range	-40°C to +160°C (-40°F to +320°F)				
High Voltage Characteristics	38kV, over 8" gap				
Probe Mounting Fixture					
Material	Tin-Plated Copper				
Manufacturer	Tyco/Amp				
Approvals	UL/CSA				
Part Numbers	i. ¼" Hardware (Tyco/Amp PN 33465) ii. ⅜" Hardware (Tyco/Amp PN 36807) iii. ½" Hardware (Tyco/Amp PN 36808)				

Figure 30 Relative Humidity Sensor Accuracy

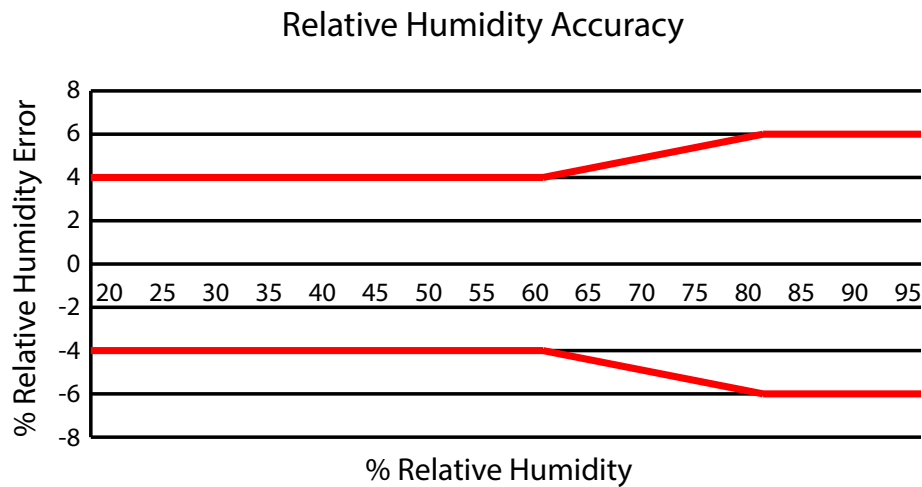


Table F EcoVisor® Plus LED Indicators

Indicator	Color	Description
COMM LED	Off	No traffic on RS-485 network
	Flickering GREEN (may appear dim during intermittent communication)	Traffic on the RS-485 network
	Flashing AMBER continuously	The EcoVisor Plus is in bootloader mode (firmware flashing mode)
HEALTH LED	Solid Green	Low dust level
	Solid Amber	Moderate dust level
	Solid Red	Extreme dust level
	Flashing Green	Dust zero point being set

Table G EMC Immunity

Phenomena	Basic Standard	Range	Level
Electrostatic Discharge	IEC 61000-4-2:2008	±6 kV Contact ± kV Air	Level 3
Radiated RF Immunity	IEC 61000-4-3:2010	80 - 3000MHz, 10V/m	Level 3
Electrical Fast Transient (EFT)	IEC 61000-4-4:2004	±4kV	Level 4
Conducted RF Immunity	IEC 61000-4-6:2008	0.15 - 80MHz	10Vrms. 140db(uV)
Voltage dips and interruptions	IEC 61000-4-29	30% & 60% for 0.1s, 100% 0.05s	-


Table H EMC Emission

Emission		Standard	Range	Level
RF Radiated Emissions	Enclosure	IEC 61000-6-4	-	Class 1 product, Class B limit
RF Conducted Emissions	LVDC	IEC 61000-6-4	-	Class 1 product, Class B limit
FCC Compliance	-	FCC Part 15 Subpart	30MHz - 1000MHz 1GHz - 6GHz	Class A limit

Table I Environmental Conditions

Test	Description	Standard	Exposure Level	
Ambient Temperature Storage and Operational	Change of Temperature	IEC 60068-2-14	-40°F (-40°C)	185°F (+85°C)
	Damp Heat Cyclic RH 95%, 6 cycles	IEC 60068-2-30	77°F (+25°C)	131°F (+55°C)
	Damp Heat Steady State, RH95%, 96h	IEC 60068-2-78	-	131°F (+55°C)
	Cold, 16h	IEC 60068-2-1:2007	-40°F (-40°C)	-
	Dry Heat, 16h	IEC 60068-2-2:2007		185°F (+85°C)
Mechanical	Operational	IEC 60068-2-6:2007	3G 10 - 150Hz	-
	Vibration	IEC 60255-21-1		Class 2
	Shock	IEC 60255-21-2		Class 2
Enclosure Protection	Terminals	IEC 60529:2009	-	IP20
	Enclosure			

Ch 7 Maintenance

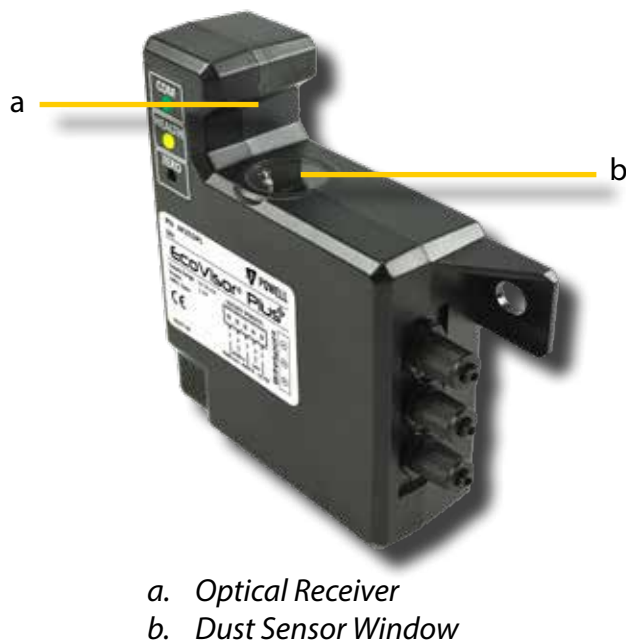
A. DUST SENSOR CLEANING AND ZEROING

Whenever the equipment the EcoVisor® Plus is monitoring is cleaned, the dust sensor should be cleaned and re-zeroed. The purpose of this is to ensure that the EcoVisor Plus window reflects the condition of the high voltage components in the environment that the EcoVisor Plus monitors.

1) Cleaning

- Remove excessive amounts of dust from the device.
- Using a Kimtech wipe or other optically safe tissue and a small amount of Isopropyl Alcohol, wipe the window (Figure 31, b) until it is completely clean. Take care not to use excessive Isopropyl Alcohol, as ingress could damage the device. Inspect the optical receiver (Figure 31, a) to ensure it is clean and unobstructed.

Figure 31 Clean Window



2) Zeroing

- Ensure dust sensor window and optical receiver are clean and unobstructed, see Figure 31 for locations.
- Press the “ZERO” button for no more than 4 seconds, longer than this will reset the device to factory defaults. Refer to Ch 7 Maintenance, B. Factory Reset, 1) Required Tools for the recommended tool for this operation.
- The “HEALTH” LED will flash GREEN for 3 to 12 seconds. After it finished, the zero level has been restored. Refer to Table F EcoVisor® Plus LED Indicators for definitions.

B. FACTORY RESET

In certain circumstances it may be necessary to restore the EcoVisor® Plus to the default settings. This will return the Modbus settings to the values shown in Table B EcoVisor® Plus Modbus RTU Interface Default Settings as well as zeroing the dust level.

1) Required Tools

A small screwdriver, preferably a 2mm hex drive, is required to push the zero/reset button as it is recessed. Any tool which is small enough to fit, that will not damage the button is acceptable.

Figure 32 Precision Hex Screwdriver



2) Factory Reset Procedure

- Clean the dust sensor window. Refer to Ch 7 Maintenance, A. Dust Sensor Cleaning and Zeroing.



- b. While device is powered, press and hold the zero button for five seconds and then release. See [Figure 33](#).

Figure 33 Factory Reset



- c. The COM LED will be solid RED and the HEALTH LED will flash RED for three seconds then GREEN for 3 to 12 seconds. WAIT for the HEALTH LED finish flashing. After it finished, the defaults has been restored. Refer to [Table F EcoVisor® Plus LED Indicators](#) for definitions.

C. BRITESPOT® TEMPERATURE MONITORING TROUBLESHOOTING

1) Sensor / LOI Mapping

The user is unsure which sensors are mapped to which location. This can happen if several wire tags falls off during the installation of the fibers.

- a. Identify the unknown fibers at their respective LOIs.
- b. Apply an indirect heat source to the vicinity of the LOI, heat guns are recommended for the task but should never be directly applied to the fiber or the sensing tip. Heat the adjacent area.

- c. Return to the EcoVisor® Plus information display and identify which unknown sensor has shown an increase in temperature due to the application of heat.
- d. Repeat the process until all fibers have been properly identified and marked.

2) BriteSpot® Module Indicator LEDs Remain Red (optical signal too low)

- a. Determine if there is a problem related to the BriteSpot fiber or the BriteSpot module input by moving the probe in question to another input that has already been determined to work. If the fiber functions in the test input, then the original input is likely the problem.
- b. Optical port related problem: Attempt to remove any contaminants off the surface of the LED inside the optical port with a clean compressed air. **DO NOT USE UNFILTERED, NON-INSTRUMENTATION TYPE COMPRESSED AIR.** This can introduce contamination into the BriteSpot channel causing permanent damage. Re-insert the fiber into connector and allow 30 seconds to stabilize. Proceed to the next step if BriteSpot indicator LED remains red.
- c. Probe related problems:
 - i. Trim $\frac{1}{8}$ " (~3mm) from the end of the fiber. Re-insert into the connector and allow 30 seconds to stabilize. Proceed to the next step of BriteSpot if indicator LED remains red.
 - ii. Replace the probe.

If the BriteSpot module indicator LED remains red after performing the steps above, contact Powell Service at 1.800.480.7273 or email serviceinfo@powellind.com.

D. RELATIVE HUMIDITY AND TEMPERATURE SENSOR REPLACEMENT

1) Expected Life Span

The expected life span of the relative humidity and temperature sensor used in the EcoVisor® Plus is typically in excess of 10 years under normal operating conditions. As such, it may become necessary to replace the sensor should spurious readings occur.

2) Sensor Replacement

a. Required Tools

- i. EcoVisor Plus replacement relative humidity and temperature sensor: Powell part number APECO-RH

Figure 34 EcoVisor® Plus Replacement Relative Humidity Sensor and Temperature Sensor



- ii. 0.09" x 1.96" (2.5mm x 50mm) slotted screwdriver: with part number: 26025 or similar.

Figure 35 Slotted Screwdriver



b. Sensor Removal

- i. Disconnect power to the EcoVisor Plus.
- ii. Insert a slotted screwdriver in the push release pin hole to release the sensor module.
- iii. Pull the sensor module straight out.

Figure 36 Remove RHT Sensor Module



- a. Insert Screwdriver
- b. Slide Sensor out of Module

Figure 37 RHT Sensor Module Removed





c. Sensor Installation

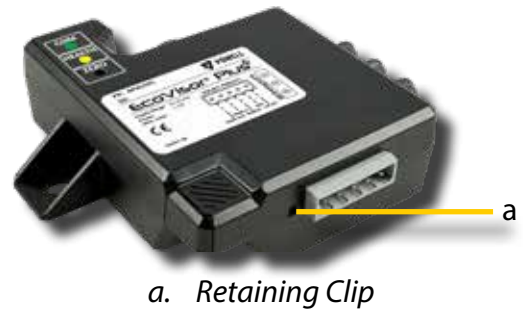
- i. Disconnect the power to the EcoVisor® Plus.
- ii. Slide sensor module in as shown in [Figure 38](#). DO NOT FORCE IT.

Figure 38 Inserting RHT Sensor Module



- iii. Ensure sensor is fully inserted and the retaining clip is engaged in the pin hole.

Figure 39 Sensor Inserted



- iv. Apply power to the EcoVisor Plus.

E. FIRMWARE UPDATE

For information on EcoVisor Plus firmware and software updates, contact Powell Service at 1.800.480.7273 or email serviceinfo@powellind.com.

1) Required Tools

- a. The latest version of the Powell Bootloader Utility software.
 - 60092-sw-bootloader-x.xx.xx.x86.msi (32 bit)
 - 60092-sw-bootloader-x.xx.xx.x64.msi (64 bit)
- b. A suitable RS-485 converter, refer to the connection diagram as shown in [Figure 22](#).
- c. 10V – 24VDC power supply
- d. Latest firmware image in *.hex format:
 - 60111-fw-eem-stm32-rev-xxxxx-bc-10372.hex
- e. Windows Computer

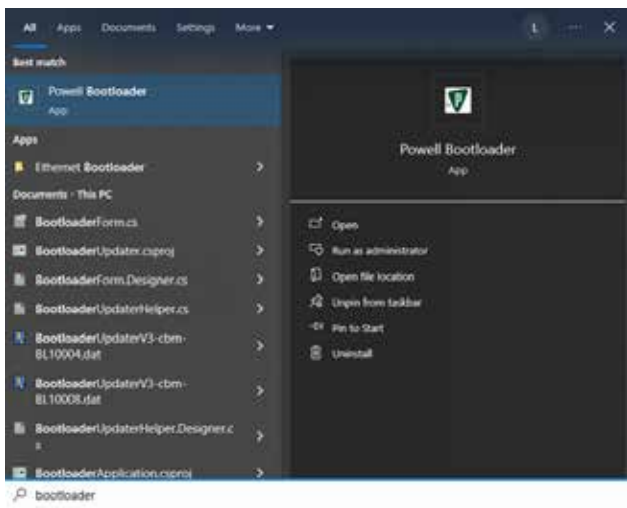
2) Firmware Upload Procedure

- a. Install the appropriate version of the Powell Bootloader Utility software on the computer.
- b. Connect the RS-485 converter between the EcoVisor® Plus and the computer.

Note: The EcoVisor Plus should be disconnected from all other devices or networks during this procedure.

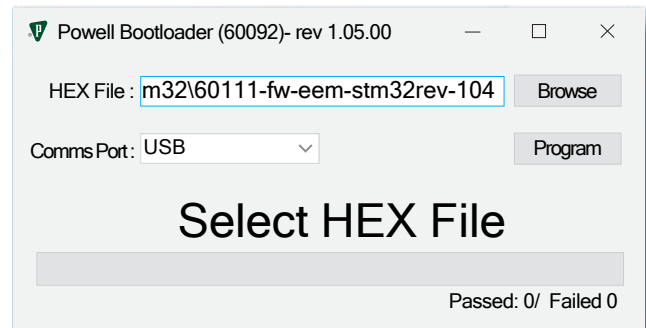
- c. Connect the power supply to the EcoVisor Plus.
- d. Start the Powell Bootloader Utility software (Figure 40).

Figure 40 Start Powell Bootloader Utility



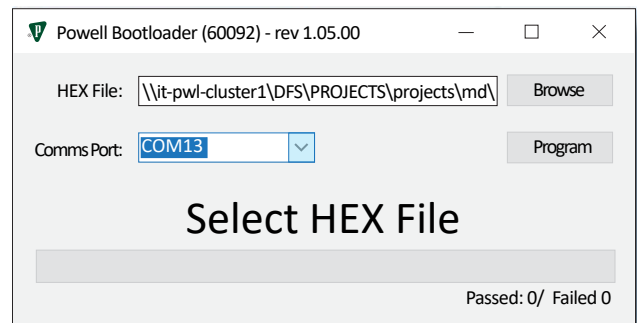
- e. Browse to the location of the firmware hex file and select it (Figure 41).

Figure 41 Select Hex File



- f. Using the drop down menu, select the com port (Figure 42) the EcoVisor Plus is connected to.

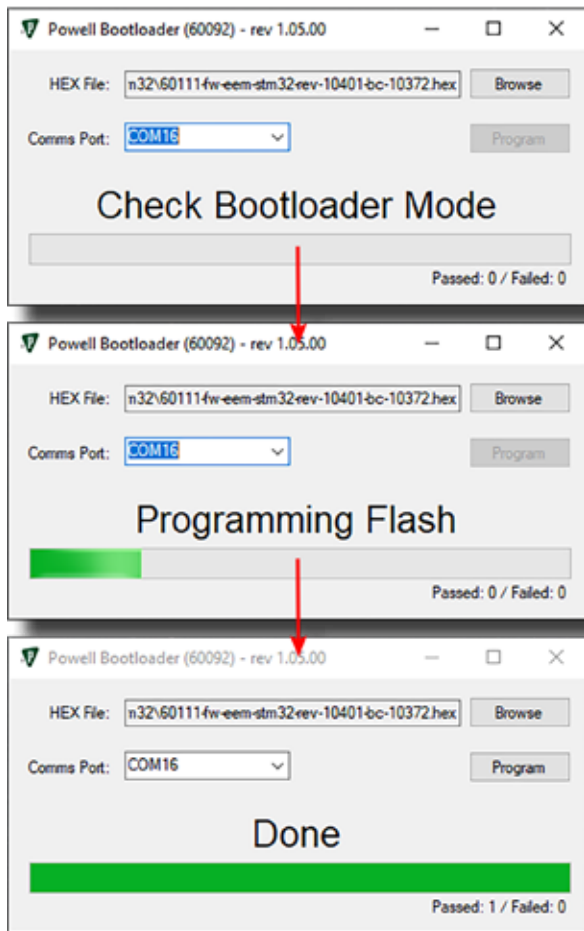
Figure 42 Select Com Port



- g. Click "Program", the software will program the selected firmware to the device.



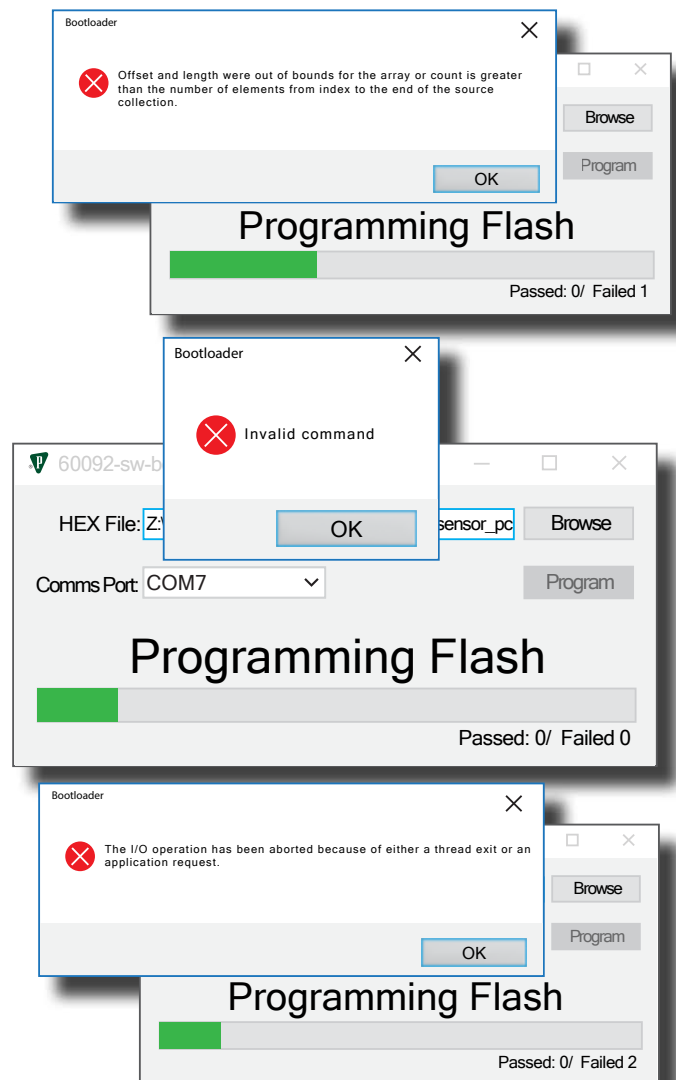
Figure 43 Firmware Programming Sequence



- h. Once the programming completes successfully, the software will display "Done" and the device will reboot. At this point, the USB cable may be disconnected from the device.
- i. If there has been a communication error, or the power has been interrupted during programming, the following errors will appear. Cycle power the EcoVisor® Plus and attempt programming again.

- j. Before re-connecting the EcoVisor Plus to the target network, please verify the previous communication settings of the device, see [Ch 5, A. Integration with Third Party Systems, Table B](#). If previous settings are unknown, revert to default settings ([Ch 7 Maintenance, B. Factory Reset](#)), then set the target settings using Modbus RTU interface, see [Ch 5, A. Integration with Third Party Systems, Table C](#).

Figure 44 Powell Bootloader Utility Software Errors



Ch 8 Troubleshooting

Table J Troubleshooting

Symptom	Likely Cause(s)	Possible Solutions
EcoVisor® Plus LED's do not illuminate	Power connected incorrectly or supply voltage not correct	Verify connections to the device, see Ch 4 Installation, E. Electrical Connections .
COM LED flashing amber, device not responding to Modbus interface or button presses	Firmware corrupt or no firmware present	Upload latest firmware, see Ch 7 Maintenance, E. Firmware Update for procedure.
Dust level not zero after cleaning	Device not zeroed after cleaning	Ensure window is clean and zero dust level, see Ch 7 Maintenance, A. Dust Sensor Cleaning and Zeroing .
No relative humidity or ambient temperature readings	RHT sensor module not fully inserted	Remove and reinsert the RHT sensor module, ensuring the retaining clip is engaged. See Ch 7 Maintenance, D. Humidity and Temperature Sensor Replacement, 2) Sensor Replacement .
	RHT sensor module damaged	Replace sensor, see Ch 7 Maintenance, D. Humidity and Temperature Sensor Replacement, 2) Sensor Replacement .
Unable to communicate with the EcoVisor Plus	Cable improperly connected	Disconnect and reconnect the cable
	Incorrect baud rate and/or slave ID	Verify that communications settings are correct. If problem persists, restore device to defaults as per Ch 7 Maintenance, B. Factory Reset . Then follow Ch 5 Operation, C. Quick Start Guide to restore the desired communications settings.
Sudden large jump in dust measurement	Physical object or material obstructing optical path	Inspect the device to see if something has fallen into the optical path, if so, remove it and take steps to prevent similar problems in the future.
BriteSpot® Module Indicator LEDs remain red	Loose connection or contact on the fiber optic probes	Reinsert and re-tighten fiber optic probes. See Ch 7, C. BriteSpot Temperature Monitoring, 2) BriteSpot Module Indicator LEDs Remain Red .



Ch 9 Recommended Renewal Parts

Table K Part List	
Part Number	Description
APECO.PLUS	EcoVisor Environmental Monitoring Device Measuring Temp, RH, and Settled Dust. Modbus Comms & Power Over Dinkle Connector.
APECO.PLUS.4M	EcoVisor Environmental Monitoring Device Measuring Temp, RH, and Settled Dust. Modbus Comms & Power Over Dinkle Connector, (3) Sets 4M Fiber Probes, (3) Sets 0.25IN Lugs, Probe Tool, Disposable Trimmer.
APECO.RH	Relative Humidity and Temperature Sensor Module.



01.4IB.48110 **EcoVisor® Plus**

Environmental Monitoring System

October 2025