Instruction Bulletin - 01.4IB.48080
EcoVisor™

Environmental Monitoring System
Contact Information

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Signal Words

As stated in ANSI Z535.4-2007, 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** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

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

- **CAUTION**, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

- **CAUTION**, used without the safety alert symbol, is used to address practices not related to personal injury.

- **NOTICE** is used to address practices not related to personal 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 energize, deenergize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
2. trained in the proper care and use of personal protective equipment (PPE) such as rubber gloves, hard hat, safety glasses or face shields, flash clothing, etc., in accordance with established 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**

Prior to adjustments, servicing, maintenance, or any act requiring the operator to make physical contact with the equipment, the power source must be disconnected and the equipment grounded. Failure to do so may result in death or serious injury.

**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™

B. **Purpose**

The information in this instruction bulletin is intended to provide details required to properly operate and maintain the environmental monitoring system described in *Ch 1 General Information, A. Scope*.

This instruction bulletin provides:

1. Safety guidelines
2. General descriptions of the operation and maintenance of the EcoVisor environmental monitoring system
3. Information for ordering renewal parts
4. Illustrations, photographs, and description of the EcoVisor environmental monitoring system

The illustrations contained in this document may not represent the exact construction details of each EcoVisor 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**

The EcoVisor is another addition to the BriteSpot® Plus sensing platform with the capability of operating as a standalone device. The EcoVisor provides continuous real-time monitoring of temperature, relative humidity, and settled dust. This instruction bulletin covers the installation and usage of the EcoVisor and details the installation and standalone operation with Modbus RTU.

D. **Instruction Bulletins Available Electronically**

*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 Division call 1.800.480.7273 or email info@powellservice.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

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**WARNING**

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

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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.

120.5 Process or 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:

   a. **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.

   b. **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.

   c. **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™ 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.

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. **DO NOT WORK ON AN ENERGIZED CIRCUIT BREAKER.** If work must be performed on a circuit breaker, remove it from service and remove it from the metal-clad switchgear.

2. **DO NOT WORK ON A CIRCUIT BREAKER WITH THE CONTROL CIRCUIT ENERGIZED.**

3. **ALL COMPONENTS SHALL BE DISCONNECTED BY MEANS OF A VISIBLE BREAK AND SECURELY GROUNDED FOR SAFETY OF PERSONNEL PERFORMING MAINTENANCE OPERATIONS ON THE EQUIPMENT.**

7. 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**

*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. General

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™ environmental monitoring device is intended for use in environments with high voltages and currents, where environmental factors pose a risk of equipment failure, for example accumulated dust deposits combined with high humidity can lead to tracking and flashovers. The EcoVisor measures settled dust optically as well as the ambient temperature and relative humidity. These readings may be logged and used to generate warnings and alarms by connecting the EcoVisor to a BriteSpot® Plus unit via RS-485. Alternatively, the EcoVisor may be used as a standalone device connected to a Modbus RTU, allowing the collection, logging and interpretation of the data via other equipment.

B. Device Overview

The EcoVisor incorporates three environmental sensors: settled dust, relative humidity, and temperature. The location of the sensors is shown in Figure 1. The environmental data is made available to other equipment via Modbus RTU over RS-485. The device has two identical 6 conductor modular jacks which incorporate both DC power input and RS-485 communications to allow easy installation and daisy chaining of multiple units.

Figure 1 EcoVisor™ Environmental Monitor

![Figure 1 EcoVisor™ Environmental Monitor]

a. Settled Dust Sensor
b. Relative Humidity and Temperature Sensor

The EcoVisor may be connected to a BriteSpot Plus unit allowing data logging and remote access via an Ethernet or RS-485 connection as shown in Figure 2.
Figure 2  **EcoVisor™ Connected via BriteSpot® Plus**

Alternatively, the EcoVisor may be incorporated as a client device into an existing RS-485 network and its data collected by a connected HMI or other control system as shown in **Figure 3**.

Figure 3  **EcoVisor™ Connected Directly to RS-485 Network**
### C. Specifications

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<th>Parameter</th>
<th>Detection Range</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Refresh Rate</th>
<th>Response Time*</th>
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<td><strong>Sensors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust</td>
<td>0-1 mm</td>
<td>±0.05 mm</td>
<td>0.01 mm</td>
<td>50 ms</td>
<td>15s</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>20% to 95% RH</td>
<td>See Figure 4 Relative Humidity Sensor Accuracy</td>
<td>0.1% RH</td>
<td>1s</td>
<td>90s</td>
</tr>
<tr>
<td>Temperature</td>
<td>-40°C to +85°C</td>
<td>±1.5°C</td>
<td>0.1°C</td>
<td>1s</td>
<td>9min</td>
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<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
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<tr>
<td>Approximate Dimensions</td>
<td>3.25” x 3.75” max</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Enclosure Material</td>
<td>Injection molded PC/ABS blend (UL 94 V-0 rated)</td>
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<tr>
<td>Mounting</td>
<td>2 x 1/4” (6.25mm) holes on 3.9” (99mm) center, see Ch 4 Installation, A. Mounting for details</td>
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<td></td>
<td></td>
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<tr>
<td>Interface</td>
<td>1 button</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Power Requirements</strong></td>
<td></td>
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<td>Voltage Range</td>
<td>10 - 24 VDC</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Max Current</td>
<td>0.1A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Power</td>
<td>1W</td>
<td></td>
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<td>Operating Temperature &amp; Storage Temperature</td>
<td>-40°C to 85°C</td>
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<tr>
<td>Humidity</td>
<td>20% - 95%RH</td>
<td></td>
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<td><strong>Communication Interface</strong></td>
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<td>RS-485</td>
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<td>Standalone Modbus</td>
<td>RS-485</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Supported Baud Rates</td>
<td>9600, 19200, 38400, 57600, 115200</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Maximum Polling Rate</td>
<td>1 Modbus RTU request per second</td>
<td></td>
<td></td>
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<td><strong>Indicators</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>COM LED</td>
<td>Bi-color LED for indication of communication status - see Table B, EcoVisor™ LED Indicators for definitions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEALTH LED</td>
<td>Bi-color LED for indication of power and environmental conditions - see Table B, EcoVisor LED Indicators for definitions</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Figure 4  Relative Humidity Sensor Accuracy

![Relative Humidity Accuracy Graph](image-url)
D. **Hardware Description**

Refer to **Figure 5** for the location of the EcoVisor™ physical features.

**Figure 5  EcoVisor™ Overall Views**

- a. Optical Dust Sensing Window
- b. Communication Status Indicator LED
- c. Power and Environmental Condition Indicator LED
- d. Mounting Holes (x2)
- e. Power and RS-485 Connection Ports (x2)
  
  **Note:** This is not an RJ12 telephone jack, the EcoVisor does not communicate using telephone lines.

- f. Replaceable Humidity and Temperature Sensor
- g. Clip/Release for Humidity and Temperature Sensor
## Table B  EcoVisor™ LED Indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Color</th>
<th>Description</th>
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<tbody>
<tr>
<td>Health</td>
<td>Solid GREEN</td>
<td>Low dust level</td>
</tr>
<tr>
<td></td>
<td>Solid AMBER</td>
<td>Moderate dust level</td>
</tr>
<tr>
<td></td>
<td>Solid RED</td>
<td>Extreme dust level</td>
</tr>
<tr>
<td></td>
<td>Flashing GREEN for 3 seconds</td>
<td>Dust zero point has been set</td>
</tr>
<tr>
<td>COM</td>
<td>Flickering GREEN (may appear dim during intermittent communication)</td>
<td>Traffic on the RS-485 network</td>
</tr>
<tr>
<td></td>
<td>OFF</td>
<td>No traffic on the RS-485 network</td>
</tr>
<tr>
<td></td>
<td>Flashing AMBER continuously</td>
<td>The EcoVisor™ is in bootloader mode</td>
</tr>
</tbody>
</table>

**Note:** COM solid RED and HEALTH flashing RED for three seconds then GREEN for three seconds indicates a return to defaults.
Ch 4 Installation

A. Mounting

The mounting of the EcoVisor™ is intended to be in any high voltage compartment including bus compartment, rear cable compartment, or circuit breaker compartment. The EcoVisor 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 6 (NOT TO SCALE). Refer to Appendix A Mechanical Drawings for a 1:1 drawing.

**Figure 6  EcoVisor™ Mounting Pattern**

B. Electrical Connection

The EcoVisor has two 6 conductor modular jacks which are connected internally to provide easy daisy chaining of several devices. Pre-terminated cables are available from Powell, refer to Table C, Part Numbers for RJ12 Cables. The RJ12 breakout adapter listed in Table C is used to provide discrete wire terminations connected to the RJ12 wiring. The pinout of the jack is shown on the front label of the EcoVisor as shown in Figure 7.
**Figure 7**  EcoVisor™ Pinout

**EcoVisor™ LOOKING INTO CONNECTOR**

1 - GND  
2 - NC  
3 - NC  
4 - RS-485 B  
5 - RS-485 A  
6 - $+V_{IN}$

**Note:**  Pins 1 & 6 are used to supply power (10-24VDC) to the EcoVisor.

Pins 4, 5, & 1 are used to connect to the RS-485 interface. Pin 1 should be connected to the shield line.

**Table C Part Numbers for RJ12 Cables**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Length (mm)/Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>60047</td>
<td>250</td>
</tr>
<tr>
<td>60048</td>
<td>750</td>
</tr>
<tr>
<td>60049</td>
<td>1200</td>
</tr>
<tr>
<td>60050</td>
<td>2000</td>
</tr>
<tr>
<td>60051</td>
<td>175</td>
</tr>
<tr>
<td>APRS6595</td>
<td>RJ25 to RJ12 Breakout adapter to screw terminals with DIN rail clips (See Figure 8)</td>
</tr>
</tbody>
</table>

**Figure 8**  RJ12 Breakout Adapter
Ch 5  Operation

A. STANDALONE

This section describes how to communicate with the EcoVisor™ using the Modbus RTU protocol. Should it be necessary to reset the communication settings to default, refer to Ch 6 Maintenance, C. Factory Reset.

<table>
<thead>
<tr>
<th>Table D Default Communication Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
</tr>
<tr>
<td>Default Baud Rate</td>
</tr>
<tr>
<td>Data Bits</td>
</tr>
<tr>
<td>Parity</td>
</tr>
<tr>
<td>Stop Bits</td>
</tr>
<tr>
<td>Default Slave ID</td>
</tr>
<tr>
<td>Max Number of Input Registers</td>
</tr>
<tr>
<td>Max Number of Holding Registers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table E EcoVisor™ Holding Registers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Register Name</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>MB Slave ID</td>
</tr>
<tr>
<td>MB Baud Rate</td>
</tr>
</tbody>
</table>
## Table F EcoVisor™ Input Registers

<table>
<thead>
<tr>
<th>Register Name</th>
<th>Description</th>
<th>Default</th>
<th>Range, format:</th>
<th>UOM:</th>
<th>Register</th>
<th>Modbus Offset</th>
<th>Interpretations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General Parameters - 300001 to 300009</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW P/N</td>
<td>PCB Part Number</td>
<td>10230</td>
<td>0-65535</td>
<td>N/A</td>
<td>30001</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>FW Rev</td>
<td>Firmware Revision</td>
<td>N/A</td>
<td>0-65535</td>
<td>N/A</td>
<td>30002</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Day</td>
<td>Day of Manufacture</td>
<td>N/A</td>
<td>1-31</td>
<td>N/A</td>
<td>30003</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Month</td>
<td>Month of Manufacture</td>
<td>N/A</td>
<td>1-12</td>
<td>N/A</td>
<td>30004</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Year</td>
<td>Year of Manufacture</td>
<td>N/A</td>
<td>2019-65535</td>
<td>N/A</td>
<td>30005</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Serial Number Low Word</td>
<td>LSW of Serial Number in Hexadecimal</td>
<td>N/A</td>
<td>0-65535</td>
<td>N/A</td>
<td>30006</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Serial Number High Word</td>
<td>MSW of Serial Number in Hexadecimal</td>
<td>N/A</td>
<td>0-65535</td>
<td>N/A</td>
<td>30007</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Sensor Serial Number Low Word</td>
<td>LSW of RH/T Sensor Serial Number in Hexadecimal</td>
<td>65535</td>
<td>0-65535</td>
<td>N/A</td>
<td>30008</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Sensor Serial Number of High Word</td>
<td>MSW of RH/T Sensor Serial Number in Hexadecimal</td>
<td>65535</td>
<td>0-65535</td>
<td>N/A</td>
<td>30009</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td><strong>Communication Parameters - 30010 to 30011</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MB Slave ID</td>
<td>Modbus Slave ID</td>
<td>1</td>
<td>1-247</td>
<td>N/A</td>
<td>30010</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>MB Baud Rate</td>
<td>MODBUS</td>
<td>1</td>
<td>0-4</td>
<td>N/A</td>
<td>30011</td>
<td>10</td>
<td>0 = 9600, 1 = 19200, 2 = 38400, 3 = 57600, 4 = 115200</td>
</tr>
<tr>
<td><strong>Measurement Registers - 30012 to 30016</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature (C)</td>
<td>Temperature in C</td>
<td>N/A</td>
<td>-40-85</td>
<td>°C</td>
<td>30012</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Temperature (F)</td>
<td>Temperature in F</td>
<td>N/A</td>
<td>-40-185</td>
<td>°F</td>
<td>30013</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Relative Humidity %</td>
<td>Relative Humidity in %</td>
<td>N/A</td>
<td>5-95</td>
<td>%</td>
<td>30014</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Dust Thickness</td>
<td>Dust Thickness in μm</td>
<td>N/A</td>
<td>0-2000</td>
<td>μm</td>
<td>30015</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Reserved</td>
<td>Register Reserved for Future Use</td>
<td>65535</td>
<td>N/A</td>
<td>N/A</td>
<td>30016</td>
<td>15</td>
<td>Register reserved for future use.</td>
</tr>
<tr>
<td><strong>System Status Registers - 30017</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OS Tick</td>
<td>OS Tick</td>
<td>N/A</td>
<td>0-65535</td>
<td>N/A</td>
<td>30017</td>
<td>16</td>
<td>This value is updated internally within the EcoVisor and can be used as an indicator that the device is operating correctly when each subsequent read returns a different value from the previous.</td>
</tr>
</tbody>
</table>
B. Operation with BriteSpot® Plus

1) Electrical Connection

For connection to the BriteSpot Plus, a 6p6c modular cable must be terminated to match the client port pinout described in the BriteSpot Plus instruction bulletin and connections made as directed.

2) Setup

Refer to the most recent version of the BriteSpot Plus instruction bulletin for information on Web Interface to set up the EcoVisor™ connection.

C. Quick Start Guide

1) Establishing Connection to the EcoVisor

**Note:** This procedure assumes that the EcoVisor is in its default state. Should it be necessary to return to this state refer to Ch 6 Maintenance, C. Factory Reset.


b. Power EcoVisor with 10 – 30VDC.

c. Connect the EcoVisor to a computer using a suitable RS-485 converter, see connection diagram in Figure 9.

d. Use the Modbus RTU communication tool and the information provided in Ch 5 Operation, A. Standalone to configure communication with the EcoVisor.

e. Set up connection as shown in Figure 10 (select the appropriate COM port and other settings in the “serial settings” panel of the software).

---

**Figure 9** Connection Diagram

**Figure 10** Initial Connection Setup
2) **Changing the Slave ID**

   a. Double click on the value for the slave ID in the Modbus Poll window for the holding register, the following dialogue will appear shown in Figure 11.

   **Figure 11  Slave ID Change**

   ![Image of Write Single Register dialog](image)

   **Use Function**
   - 06: Write single register
   - 16: Write multiple registers

   **Result**
   - N/A
   - Close dialog on "Response ok"

   **Address:**
   - 1
   - 4
   - Value:
     - 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 dialogue (**Figure 12**).

   **Figure 12  Modbus Poll Read/Write Definition**

   ![Image of Read/Write Definition dialog](image)

   **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 3 and 4 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 for the holding register. The following dialogue will appear shown in Figure 13.

![Figure 13 Baud Rate Change](image)

b. Enter the enumerator of the desired baud rate (0-4, described in Table D, Default Communications Settings) 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 F4 key to disconnect, or click on “Connection” → “Disconnect”.

d. Press the F3 key or click on “Connection” → “Connect”, to open the connection dialogue shown in Figure 14.

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

![Figure 14 Modbus Poll Connection Setup](image)
Ch 6 Maintenance

A. HUMIDITY AND TEMPERATURE SENSOR

1) Expected Life Span

The expected life span of the relative humidity and temperature sensor used in the EcoVisor™ 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 replacement humidity and temperature sensor: Powell part number AP.ECO-RH

   ii. 2.5mm x 50mm slotted screwdriver: Wiha part number: 26025 or similar.

b. Sensor Removal

   i. Disconnect power to the EcoVisor.
   ii. Using a slotted screwdriver, pull the sensor module straight out.
c. Sensor Installation

i. Disconnect the power to the Ecovisor™.

ii. Slide sensor module in as shown in Figure 19. DO NOT FORCE.

Figure 19 Inserting Sensor Module

iii. Ensure sensor is fully inserted and the retaining clip is engaged.

Figure 20 Sensor Inserted

a. Retaining Clip

d. Apply power to the Ecovisor.

B. Dust Sensor Cleaning and Zeroing

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

1) Cleaning

a. Remove excessive amounts of dust from the unit.

b. Using a Kimtech wipe or other optically safe tissue and a small amount of Isopropyl alcohol, wipe the window (Figure 21, b) until it is completely clean. Take care not to use excessive isopropyl alcohol, as ingress could damage the unit. Inspect the optical receiver (Figure 21, a) to ensure it is clean and unobstructed.
Figure 21  Clean Window

2) Zeroing

a. Ensure dust sensor window and optical receiver are clean and unobstructed, see Figure 21 for locations.
b. Press the “ZERO” button for no more than 4 seconds, longer than this will reset the device to defaults. Refer to Ch 6 Maintenance, C. Factory Reset, 1) Required Tools for the recommended tool for this operation.
c. The “HEALTH” LED will blink GREEN for three seconds to indicate that the zero level has been stored.

Table G Factory Reset Defaults

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave ID</td>
<td>1</td>
</tr>
<tr>
<td>Baud Rate</td>
<td>19200</td>
</tr>
</tbody>
</table>

C. Factory Reset

In certain circumstances it may be necessary to restore the EcoVisor™ to the default settings. This will return the Modbus settings to the values shown below, as well as zeroing the dust level.

Figure 22  Precision Hex Screwdriver 2mm

1) Required Tools

A small screwdriver, preferably 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.
2) **Factory Reset Procedure**

a. Clean dust sensor window. Refer to *Ch 6 Maintenance, B. Dust Sensor Cleaning and Zeroing*.

b. While unit is powered, press and hold the zero button for five seconds and release (*Figure 23*).

**Figure 23  Factory Reset**

![Image of Factory Reset](image)

c. The COM LED will be solid RED and the HEALTH LED will flash RED for three seconds then GREEN for three seconds to indicate a return to defaults.

D. **Firmware Update**

For information on EcoVisor™ firmware and software updates contact Powell Service at 1.800.480.7273 or email info@powellind.com.

1) **Required Tools**

1. The most current version of the Powell Bootloader Utility:
   - 60092-sw-bootloader-rev-x.xx.xx. x64 (64 bit)
   - 60092-sw-bootloader-rev-x.xx.xx. x86 (32 bit)

2. A suitable RS-485 converter, refer to the connection diagram as shown in *Figure 9*.

3. 10V – 24V DC power supply

4. Most current release firmware image in .hex format:
   - 60083-fw-ecovisor-rev-xxxxxx-bl.hex

5. Computer

2) **Firmware Upload Procedure**

a. Install the appropriate version of the bootloader software on the computer (60092-sw-bootloader-rev-x.xx.xx. x64 for 64 bit Windows and 60092-sw-bootloader-rev-x.xx.xx.x86 for 32 bit Windows).

b. Connect the RS-485 converter between the EcoVisor and the computer.

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

c. Connect the power supply to the EcoVisor.

d. Place the EcoVisor into bootloader mode:
   i. Disconnect power to the unit
   ii. Hold the zero button
   iii. Apply power to the unit
   iv. Release the zero button
   v. The “COM” led will flash orange indicating the unit has entered bootloader mode

e. Start the Powell Bootloader Utility.
f. Browse to the location of the firmware hex file and select it.

Figure 25  Select Hex File

- Using the dropdown menu, select the com port the EcoVisor™ is connected to.

Figure 26  Select Com Port

h. Click “Program”, the device will be programmed with the selected firmware.

Figure 27  Firmware Programming Sequence
Once the programming completes successfully, the software displays “Done” and the unit will reboot. At this point, the USB cable may be disconnected from the unit.

If there has been a communication error, or the power has been interrupted during boot loading the following errors will appear. Cycle power to the EcoVisor™ and attempt programming again.

**Figure 28  Bootloader Errors**
## Ch 7 Troubleshooting

### Table H Troubleshooting

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Likely Cause(s)</th>
<th>Possible Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>EcoVisor™ LED’s not illuminated</td>
<td>Power connected incorrectly</td>
<td>Verify connections to unit, see Ch 4 Installation, B. Electrical Connection</td>
</tr>
<tr>
<td>COM LED flashing amber, unit not responding</td>
<td>Firmware corrupt or no firmware present</td>
<td>Upload most current firmware, see Ch 6 Maintenance, D. Firmware Update for procedure</td>
</tr>
<tr>
<td>Dust level not zero after cleaning</td>
<td>Unit not zeroed after cleaning</td>
<td>Ensure window is clean and zero the dust level, see Ch 6 Maintenance, B. Dust Sensor Cleaning and Zeroing</td>
</tr>
<tr>
<td>No relative humidity or temperature readings</td>
<td>RH/T sensor not fully inserted</td>
<td>Remove and reinsert the sensor, ensuring retaining clip is engaged. See Ch 6 Maintenance, A. Humidity and Temperature Sensor, 2) Sensor Replacement</td>
</tr>
<tr>
<td></td>
<td>RH/T sensor damaged</td>
<td>Replace sensor, see Ch 6 Maintenance, A. Humidity and Temperature Sensor, 2) Sensor Replacement</td>
</tr>
<tr>
<td>Unable to communicate with the EcoVisor</td>
<td>Cable improperly connected</td>
<td>Disconnect and reconnect the cable</td>
</tr>
<tr>
<td></td>
<td>Incorrect baud rate and/or slave ID</td>
<td>Verify that communications settings are correct. If problem persists, restore device to defaults as per Ch 6 Maintenance, C. Factory Reset. Then follow Ch 5 Operation, C. Quick Start Guide to restore the desired communications settings.</td>
</tr>
<tr>
<td>Sudden large jump in dust measurement</td>
<td>Physical object obstructing optical path</td>
<td>Inspect the unit to see if something has fallen into the optical path, if so, remove it and take steps to prevent similar problems in the future.</td>
</tr>
</tbody>
</table>
Appendix A Mechanical Drawings - Mounting Pattern

KEEP OUT FOR CABLES, OPTICAL SENSOR, AND RH/T SENSOR REPLACEMENT

THIS WAY UP

140.1 [5.516 in]
98.8 [3.889 in]
126.7 [4.987 in]
20.7 [0.814 in]
300 [11.81 in]
01.4IB.48080
EcoVisor™

Environmental Monitoring System

June 2020