

# Event Detection System (EDS)

## Installation, Operations and Maintenance Guide



*Control Module*



*Sensor Module*

Revision 6.0 – June 24<sup>th</sup>, 2016

### I – Functional Description

The Event Detection System (EDS) uses an array of “intelligent electronic sensors” that deploy on live wires without having to plan for outages. The sensors are electronic trip indication relays designed to detect DC targets from protection systems. When a target is detected, the sensors operate an appropriate set of relays to indicate event type and duration. The system also provides health monitoring functionality for determining system status.

The EDS is comprised of 4 sensors connected to a control module. The control module has five indicating LEDs. The top LED monitors the power supply while the bottom ones monitor communications to the 4 sensors. The EDS provides 4 alarm contacts (one for each sensor) called “sensor relays”. An additional alarm contact is also included for health indication and is called “health relay”. The sensor relays are designed for connection to Disturbance Monitoring Equipment (DME) such as a Digital Fault Recorder (DFR) or a Sequence of Events Recorder (SER). The health relay can connect to a DME or to a station alarm panel.

The EDS power supply, weatherability and withstand capabilities are:

- 125 VDC power supply (110 – 370 VDC, 3 Watts).
- The power supply is surge protected and uses a half amp slow blow fuse.
- The control module and all of the connectors and sensors are watertight.
- The surge withstand capability is compliant with C37.90-1-2.

- The operating temperature range is -20 to 65°C.
- The operating humidity range is 0 to 95% non-condensing.

## II – Basic Operation

The EDS sensors use Hall Effect transducers to measure current flow through conductors. The sensors are programmed for DC only. A microcontroller in each sensor is set at the factory to operate at a desired DC level.

The default settings are:

- **Pick-up Setting:** Above 1 Amp
- **Drop-out Setting:** Under 0.6 Amps
- **Response time:** Within 1 millisecond

The various states of the control module's LEDs and relay contacts are shown in Table 1.

| <i>Parameter</i> | <i>Condition</i>     | <i>LED</i>   | <i>LED State</i>  | <i>Sensor Relay</i> | <i>Health Relay</i> | <i>Close Time</i> |
|------------------|----------------------|--------------|-------------------|---------------------|---------------------|-------------------|
| <i>Current</i>   | <i>DC target</i>     | <i>Red</i>   | <i>Slow Blink</i> | <i>Closed</i>       | <i>Open</i>         | <i>Duration</i>   |
|                  | <i>Normal</i>        |              | <i>Slow Blink</i> | <i>Open</i>         | <i>Open</i>         | <i>NA</i>         |
| <i>Sensors</i>   | <i>Nonfunctional</i> |              | <i>On</i>         | <i>Closed</i>       | <i>Closed</i>       | <i>Duration</i>   |
|                  | <i>Normal</i>        |              | <i>Slow Blink</i> | <i>Open</i>         | <i>Open</i>         | <i>NA</i>         |
| <i>Power</i>     | <i>Off</i>           | <i>Green</i> | <i>Off</i>        | <i>All Closed</i>   | <i>Closed</i>       | <i>Duration</i>   |
|                  | <i>On</i>            |              | <i>On</i>         | <i>Open</i>         | <i>Open</i>         | <i>NA</i>         |

**Table 1: Control Module Alarm Matrix and LED Indications**

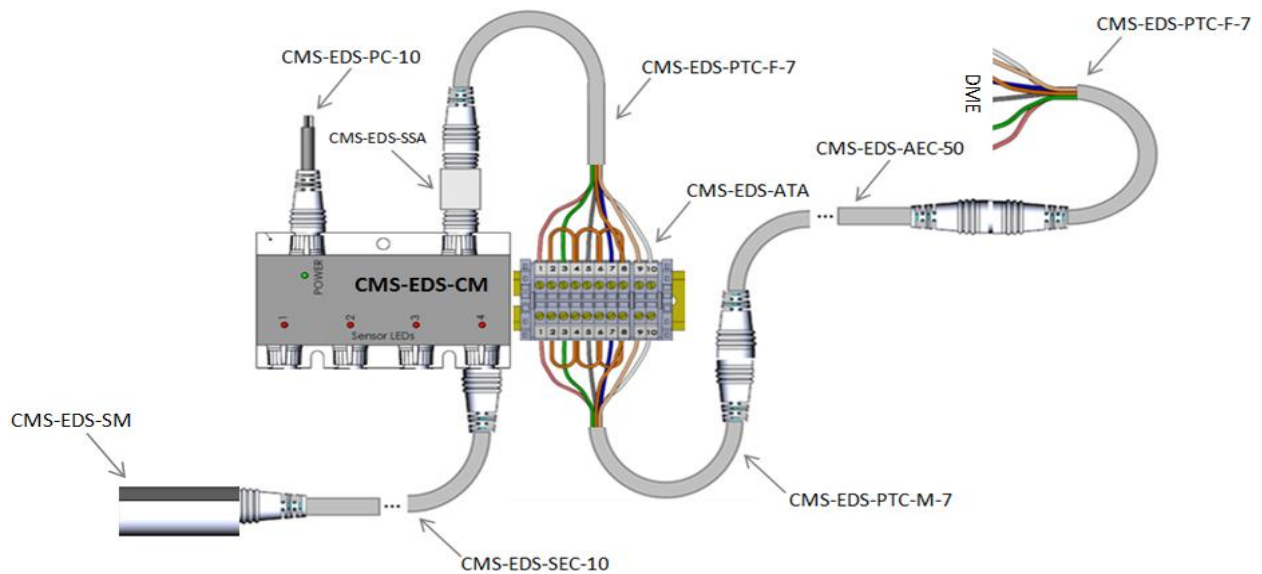
The basic operation modes are:

- **Pick-up Logic:** If the measured current exceeds the pick-up setting at a given sensor then the control module will operate the relay associated with that sensor providing a contact closure to the DME.
- **Drop-out Logic:** If the measured current falls below the drop-out setting at a given sensor then the control module will operate the relay providing an open contact to the DME.
- **Loss of Heartbeat:** If communications between the control module and a sensor are lost due to a damaged or unplugged cable or due to a problem with the sensor then the control

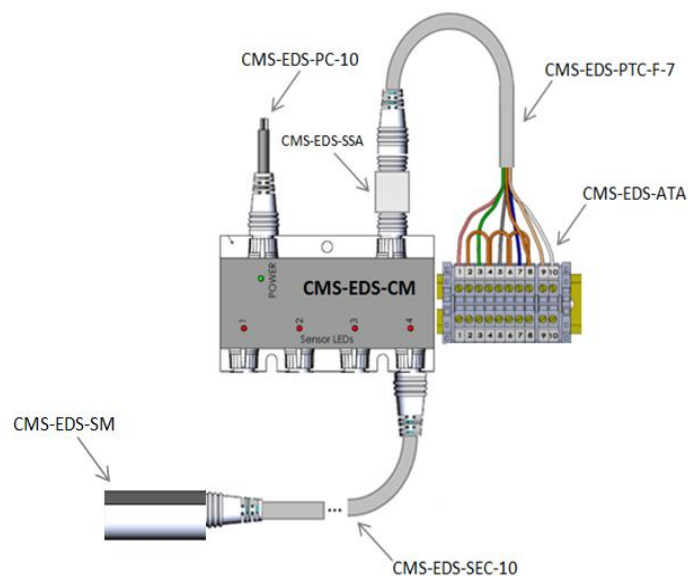
module will operate the relay associated with that sensor along with the health relay providing two contact closures for as long as the condition persists.

- **Loss of Power:** If power is lost then the control module will operate all of the sensors and health relays providing contact closures for as long as the condition persists.

### III – Components and Installation



**Figure 1: Overall Depiction of System Assembly (with Cables to DME)**



**Figure 2: Overall Depiction of System Assembly (without Cables to DME)**

| <b>Component</b>       | <b>Definition</b>   |
|------------------------|---|
| <i>CMS-EDS-CM</i>      | <i>Control Module with Brackets and 1' Din Rail</i>               |
| <i>CMS-EDS-ATA</i>     | <i>Alarm Terminal Block – 10 I/O Terminals</i>                    |
| <i>CMS-EDS-SM</i>      | <i>Sensor Module with 10' Cable (connector to Control Module)</i> |
| <i>CMS-EDS-SEC-x</i>   | <i>Sensor Extension Cable (x=length, 10' Standard – 50' Max)</i>  |
| <i>CMS-EDS-PC-x</i>    | <i>Power Cable (x=length, 10' Standard – 50' Max)</i>             |
| <i>CMS-EDS-PTC-g-w</i> | <i>Alarm Cable, Pig tail (g=Gender M or F, w=Wires 7 or 10)</i>   |
| <i>CMS-EDS-AEC-x</i>   | <i>Alarm Extension Cable (x=length, 50' Standard – 150' Max)</i>  |
| <i>CMS-EDS-SSA</i>     | <i>Surge Suppression Adapter</i>                                  |

**Table 2: List of EDS Components and their Definitions**

**1) Control Module and Cables:** The control module has mounting holes and brackets on the rear plate and is pre-mounted on a din rail as shown in Figure 3. The module is equipped with 6 connectors to simplify installation and maintenance. The connectors connect 4 sensors, 1 power cable, and 1 alarm cable. The power cable is un-terminated at the customer end. The alarm cable is pre-terminated on the terminal block. The system connections are shown in Figures 1 and 2 and the system components are listed in Table 2.



**Figure 3: Control Module with Terminal Block and Alarm Cable**

A schematic drawing for the alarm cables, surge suppression adapter, and the sensor relays is shown in Figure 4. The designations for the wire colors for the power and alarm cables are shown in Table 3.

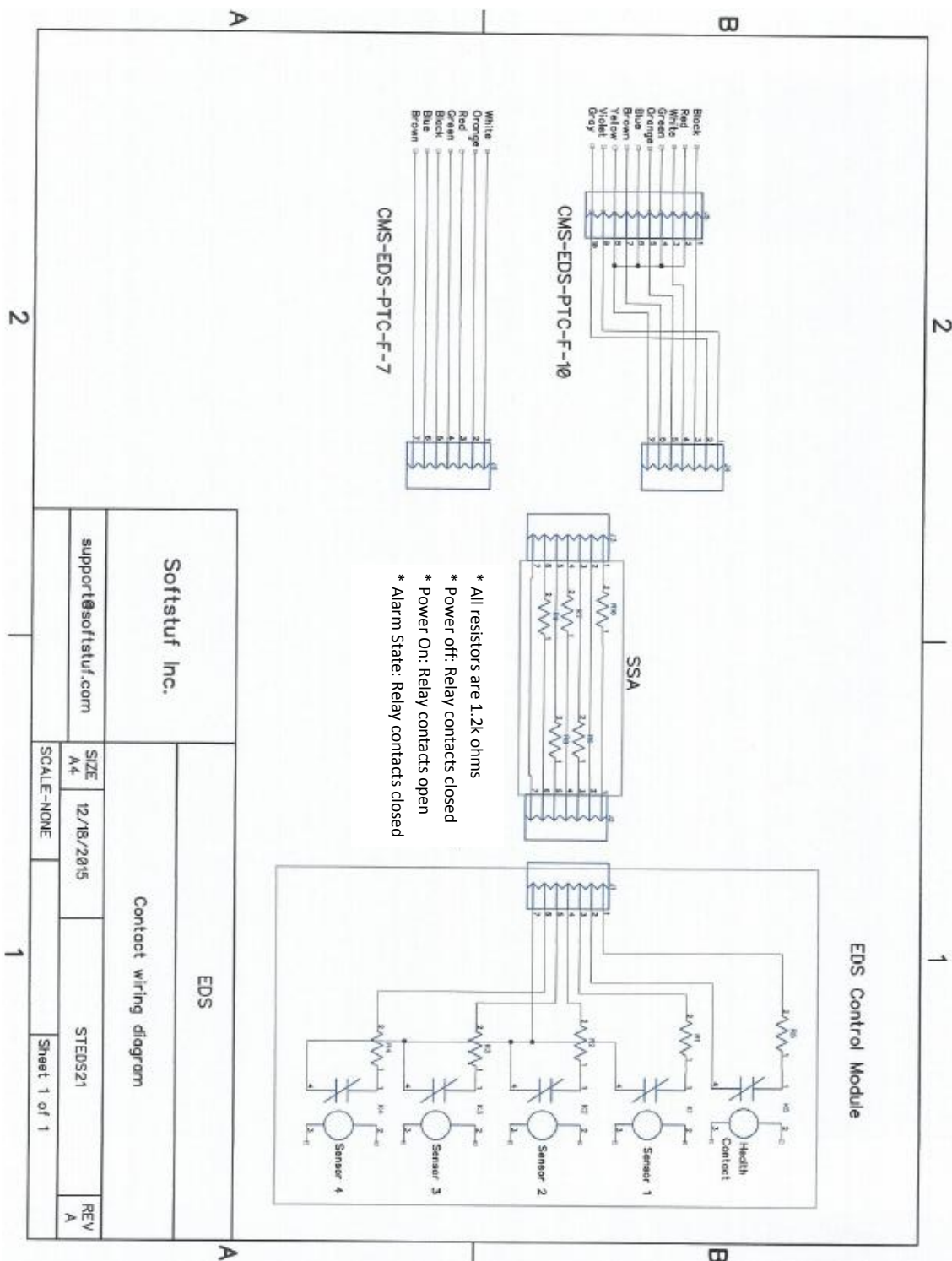


Figure 4: Alarm Cables and Surge Suppression Adapter Schematic

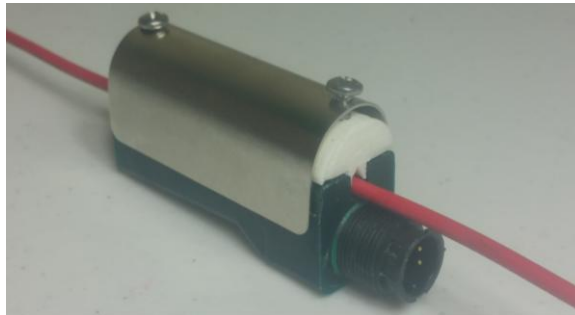
| <b>Wires</b>                      | <b>Colors</b> | <b>Designations</b>             |
|-----------------------------------|---------------|---------------------------------|
| <i>Alarm cable<br/>(7 wires)</i>  | <i>Red</i>    | <i>Sensor 1 Relay Alarm</i>     |
|                                   | <i>Green</i>  | <i>Sensor 2 Relay Alarm</i>     |
|                                   | <i>Black</i>  | <i>Sensor 3 Relay Alarm</i>     |
|                                   | <i>Blue</i>   | <i>Sensor 4 Relay Alarm</i>     |
|                                   | <i>Brown</i>  | <i>Common for Sensor Relays</i> |
|                                   | <i>Orange</i> | <i>Health Relay Alarm</i>       |
|                                   | <i>White</i>  | <i>Common for Health Relay</i>  |
| <b>Wires</b>                      | <b>Colors</b> | <b>Designations</b>             |
| <i>Alarm cable<br/>(10 wires)</i> | <i>Black</i>  | <i>Sensor 1 Relay Alarm</i>     |
|                                   | <i>Red</i>    | <i>Common for Sensor Relays</i> |
|                                   | <i>White</i>  | <i>Sensor 2 Relay Alarm</i>     |
|                                   | <i>Green</i>  | <i>Common for Sensor Relays</i> |
|                                   | <i>Orange</i> | <i>Sensor 3 Relay Alarm</i>     |
|                                   | <i>Blue</i>   | <i>Common for Sensor Relays</i> |
|                                   | <i>Brown</i>  | <i>Sensor 4 Relay Alarm</i>     |
|                                   | <i>Yellow</i> | <i>Common for Sensor Relays</i> |
|                                   | <i>Purple</i> | <i>Health Relay Alarm</i>       |
|                                   | <i>Gray</i>   | <i>Common for Health Relay</i>  |
| <b>Wires</b>                      | <b>Colors</b> | <b>Designations</b>             |
| <i>Power cable<br/>(2 wires)</i>  | <i>Red</i>    | <i>Line 125 VDC Source</i>      |
|                                   | <i>Black</i>  | <i>Neutral 125 VDC Source</i>   |

**Table 3: Wire Designations for the Alarm and Power Cables**

**2) Sensor Module:** Each module is comprised of a molded sensor enclosure, a conductor stabilizer, and a curved metallic shield as shown in Figures 5 and 6. The conductor stabilizer is used to wedge the monitored conductor against the surface of the sensing chip. The curved metallic shield is used to amplify internal magnetic fields, to protect against external magnetic fields, and to hold the conductor stabilizer in place.



**Figure 5: Sensor Module Components**



**Figure 6: Sensor Module Assembly**

**3) Relay Contacts:** The sensor and health relay contacts are rated for 10 Watts. The maximum voltage rating is 200 VDC and the maximum current rating is 0.5 Amps. The contacts are protected with an internal 1.2k Ohm resistor each. These ratings are sufficient protection when wetting from a clean source such as SER or DFR equipment because digital inputs on such equipment provide additional resistance and surge protection. However, care must be taken when wetting from an external source (see Caution note below).

**4) Caution:** Applying the full force of a 125 VDC source directly across a relay contact without the added protection from DME digital inputs will cause 0.125 Amps to flow through the circuit providing a total wattage of 15.625 which exceeds the rating of the contact and will therefore weld the contact shut. For such cases, the surge suppression adapter should be used.

#### **IV – Installation Procedure**

The below steps should be followed in numerical order:

1. Mount the EDS control module assembly in the desired relay panel.
2. Mount the sensor modules on the conductors to be monitored utilizing the conductor stabilizer and shield. The conductor should be in the **quiescent state** (in the event that the

sensors are installed on de-energized conductors, cycle the control module power after the conductor is energized).

3. Connect the sensor modules to the connectors on the control module.
4. Terminate the alarm cable's sensor relays to the desired DME digital inputs.
5. Terminate the alarm cable's health relay to the desired DME input or station alarm panel.
6. Terminate the power cable to the 125VDC source (the connection is fused using a half amp slow blow fuse as noted in section I).
7. Connect the power cable to the control module and wait for one second.
8. Observe that the power LED on the control module is illuminated (steady on) and that the sensor LEDs are blinking (slow blink).
9. Observe that the sensors and health relay contacts have energized to the open state.

## **V – Sensor Calibration, Triggers and Polarity**

The EDS sensors automatically self calibrate upon power up. The calibration process is quick (within one second from power up, or from reconnecting a sensor module). Customized settings are available. Please contact the manufacturer for further information. The default calibration process includes:

- Measuring zero upon power up,
- Setting the pick-up triggers at 1 Amp above zero, and
- Setting the drop-out triggers at 0.6 Amps to zero.

These settings are based on a resolution of 50 milliamps per digital bit and provide for noise tolerance of up to 100 milliamps (hysteresis). The EDS is polarity independent.

## **VI – System Testing (Maintenance)**

System testing is used to confirm that the EDS system is providing the proper indications to the DME. To test the system, use the following procedures:

### ***Procedure 1 – DC Level Testing:***

- Apply the desired direct current to a selected set of sensors.
- Observe that the correct DME points were asserted and recorded.
- Remove the applied current.



- Observe that the correct DME points were de-asserted.

**Procedure 2 – DC Trip Testing:**

- Playback the desired trip signature to a selected set of sensors (such as an LOR operation).
- Confirm that the correct DME points were recorded (asserted and then de-asserted).
- Measure the trip duration by subtracting the time tags from the recorded DME points.

**Procedure 3 – Health Testing:**

- Unplug the sensor to be tested from the control module.
- Observe that the correct LED on the control module is illuminated (steady on).
- Observe that the correct sensor relay has operated (closed).
- Observe that the health relay has operated (closed).
- Reconnect the sensor module to the control module.
- Observe that the state of the sensor LED on the control module has changed (slow blink).
- Observe that the state of the sensor relay has changed (open).
- Observe that the state of the health relay has changed (open).
- Repeat for all 4 sensors.

**VII – Terms and Ordering Information**

- **Procurement:** All materials will be procured upon receipt of PO.
- **Deliveries:** Within 12 weeks of receipt of PO.
- **Production Rate:** Up to 100 EDS units per month.
- **Discounts:** Prices are discounted based on quoted volumes.
- **Payments:** Payments are for materials delivered.
- **Warranty:** 2 years from initial date of delivery.
- **Training:** Training services are available. Please contact us for further information.

| <b>Item</b> | <b>Part Number</b> | <b>Description</b>   |
|-------------|--------------------|--|
| 1           | CMS-EDS-04         | <p><b><u>Complete Package /w:</u></b></p> <p>1 CMS-EDS-CM (Control Module with Brackets and 1' Din Rail)<br/> 4 CMS-EDS-SM (Sensor Module with 10' Cable)<br/> 1 CMS-EDS-PC-10 (Power Cable – 10' – 2 Wire)<br/> 1 CMS-EDS-PTC-F-7 (Alarm Cable – Pig Tail – Female – 7 Wire)<br/> 1 CMS-EDS-ATA (Alarm Terminal Block – 10 I/O Terminals)</p> |
| 2           | CMS-EDS-SEC-x      | Accessory, Sensor Extension Cable (x=length, 10' Standard – 50' Max)   |
| 3           | CMS-EDS-AEC-x      | Accessory, Alarm Extension Cable (x=length, 50' Standard – 150' Max)   |
| 4           | CMS-EDS-PTC-g-m    | Accessory, Alarm Cable Pig Tail (g=Gender M or F, w=Wires 7 or 10)   |
| 6           | CMS-EDS-SSA        | Accessory (Alarm Cable – Surge Suppression Adapter)  |

**Table 4: EDS Parts List and Model Numbers**

## **VIII – Contact Information**

For further information, please contact our sales or support team at:

800.818.3463 (Sales)

[sales@wavegrid.net](mailto:sales@wavegrid.net)

215.922.6880 (Support)

[support@wavegrid.net](mailto:support@wavegrid.net)

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