Safety information

Important information

Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of either symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>WARNING</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>NOTICE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTICE is used to address practices not related to physical injury.</td>
</tr>
</tbody>
</table>

Please note

Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by ASCO Power Technologies for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.
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8.0 Troubleshooting ......................................................................................................... 30
ASCO Power Technologies makes it easy to monitor your electrical system by integrating its Active Surge Monitor package within its SPDs. The web-based device allows the end-user real time power quality measurements, logged events, statistical summaries and premium power protection.

The installer should perform the following steps to assure a quality installation. Please read all instructions before starting the installation of this product. These instructions do not replace national or local electrical codes — check applicable codes to ensure compliance.

This manual provides information pertaining to the installation & operation of the SPD’s Active Surge Monitor. For general SPD installation instructions, please refer to the installation manual provided with your SPD.

1.0 Introduction

1.1 Overview

The ASCO Active Surge Monitor system measures, displays, & logs the following parameters/events:

**Measured & Displayed**
- RMS Voltages
- Surge Count (& IEEE category)
- Voltage Sag Count
- Voltage Swell Count
- Frequency
- Crest Factor
- VTHD
- Voltage Unbalance
- MOV Health

**Logged System Events**
- Power On
- Settings Change
- Firmware Update
- Communication Error Detection
- Software Reset
- Factory Reset
- Frequency Lock Lost/Enabled
- Surge Monitoring Disabled

**Logged Power Quality Events**
- Surge/Transient
- Sag
- Swell
- Voltage Harmonics (VTHD)
- Neutral Bond
- Over/Under Frequency
- Loss of protection
- Phase Loss/Outage
- Voltage Interruption/ Dropout
- Overvoltage
- Temporary Overvoltage (TOV)

The ASCO Active Surge Monitor system measures, displays, & logs the following parameters/events:

- RMS Voltages
- Surge Count (& IEEE category)
- Voltage Sag Count
- Voltage Swell Count
- Frequency
- Crest Factor
- VTHD
- Voltage Unbalance
- MOV Health

1.2 Device Ratings – Active Surge Monitor (ASM)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Inputs</td>
<td>0-600 VAC Nominal*</td>
</tr>
<tr>
<td>Frequency</td>
<td>45 – 67 Hz</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>- 20°C to + 70°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0% to 95% Non-Condensing</td>
</tr>
<tr>
<td>Relay Outputs</td>
<td>Form C dry contact rating: Class 2, 24 VAC/VDC at 2 Amps</td>
</tr>
<tr>
<td>RS485 Interface</td>
<td>Isolated RS485 communications interface</td>
</tr>
</tbody>
</table>

*The Active Surge Monitor is configured to operate at the SPD voltage & configuration input ratings prior to shipment.

1.3 Measurement Specifications

<table>
<thead>
<tr>
<th>Feature</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMS Voltage Monitoring</td>
<td>±1%</td>
</tr>
<tr>
<td>Frequency</td>
<td>±1%</td>
</tr>
<tr>
<td>Voltage Harmonics (THD)</td>
<td>±5%</td>
</tr>
</tbody>
</table>
1.4 FCC Class B Part 15 Statement

This device complies with Part 15 of the Federal Communications Commission (FCC) Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the manufacturer's instructions, may cause interference harmful to radio communications.

There is no guarantee, however, that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.
- This digital apparatus complies with CAN ICES-3 (B) /NMB-3(B).

NOTICE:
Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user’s authority to operate this equipment.

2.0 Installation

⚠️ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

NOTICE

LOSS OF BRANCH CIRCUIT POWER / LOSS OF SURGE SUPPRESSION

- Perform periodic inspection of the surge protective device status indicator lights as part of the preventative maintenance schedule.
- Promptly replace the surge protective device when an alarm state exists.
- Use dry contacts to signal an alarm state to the central supervisory system for unmanned, inaccessible, or critical installations.
- Use multiple surge protective devices to achieve redundancy for critical applications.

Failure to follow these instructions can result in equipment damage.

At end-of-life conditions, Surge Protective Devices (SPDs) can lose their ability to suppress power system transient voltage spikes and attempt to draw excessive current from the line. This SPD is equipped with overcurrent and overtemperature components that will automatically disconnect the surge suppression elements from the mains should the surge suppression elements reach end of life. Tripping of the branch circuit breaker or fuse feeding the SPD can occur.
2.1 Communication Connections

(Typically located on ASM’s printed circuit board - behind SPDs front door/cover)

Communications wiring should be installed in dedicated conduit wherever possible. When installed without conduit, wiring should be contained within the building/structure wherever possible. If the wire exits the building/structure and is not contained within conduit, the length shall not exceed 140 feet. (per UL 60950). Ensure that status/communication and power wires are physically not touching. See figure 2.1 below for suggested routing of the ethernet cabling.

Relay 1 — 1 set (TB2) of Form C relay contacts; 
Rated: Class 2, 24 VAC/VDC; 2A max. “NC” (Normally Closed), “COM” (Common), and “NO” (Normally Open). Designations are with AC applied.

Rating:
Class 2,
24 VAC/VDC @ 2 A

Range:
#24-#14

Torque:
3 in/lbs (0.339Nm)

Both relays will change state if there is an active event (Sag, Swell, etc) or if the SPD has a suppression component which has reached end of life and needs service. If the event is corrected, the relays will automatically change back to their original state.

RS-485 Communication - one 3-position terminal block (TB1), 2 wire compatible.

Wire Size:
#24-#14

Torque:
3 in/lbs (0.339Nm)

External or Internal RJ-45 Ethernet Port - x1
female RJ-45 Ethernet connection port (J6 / J20)

Ethernet LED’s – Active Ethernet connection is indicated by solid green LED. Data activity is indicated by an Amber LED.

The Ethernet port may be located on the interior or the exterior of the SPD depending on the options selected.

To insert internal RJ-45 connection:
• Remove main SPD cover
• Remove the snap-in Ethernet cover to access the connector
• After connecting the cable, reinstall the snap-in cover
• Reinstall the main SPD cover.

Figure 2.1 ASM 460/465 Ethernet Installation

Typical Communication Cable Installation
For proper operation there must be separation of the power and communication cables. Ensure that the communication cables utilize a separate entry point that power cabling. Secure the communication cables to the supplied self-locking cable clamps inside the enclosure and door to assure they are separated from power cables.
Figure 2.2   ASM 440/445 Ethernet Installation

To insert internal RJ-45 connection:
- Turn off all power supplying this equipment before working on or inside any enclosure containing this equipment.
- Remove each of the phase monitoring wires & communication cable J16.
- Remove the snap-in Ethernet cover to access the connector.
- To remove the cover apply downward pressure on the horizontal edge of the cover.
- Route data communications cables through J2 conduit nipple.
- Install the RJ-45.
- After connecting the cable, reinstall the snap-in cover.
- Reattach each of the phase wires and J16 connector.
- Replace all devices, doors, and covers before turning on power to the equipment.
3.0 Operation

3.1 Applying Power

Once all physical connections are made to the ASM, apply the appropriate AC power to the device and the LCD display screen will illuminate.

If the display LEDs and/or audible alarm remain in alarm mode after a few seconds, verify source voltages & mechanical connections. If the alarm condition persists, call ASCO Power Technologies at 800-237-4567 or 727-535-6339.

3.2 Status Interface

Protection Status LED’s
Red, Green, & Amber LED indication is provided for each phase, neutral, and service.

LINE-1, LINE-2, LINE-3, & NEUTRAL LEDS

Green LED = Normal Operation - Source voltage is within tolerance, and surge components are fully functional

Amber LED = Unit has reduced protection (67% or less) in a protection mode associated with this phase. (L-N or L-G...or N-G mode if "NEUTRAL" is amber)

Red LED (Steady) = Unit protection has reached end of life in a protection mode associated with this phase. (L-N or L-G...or N-G mode if NEUTRAL is red)

SERVICE LED

Green LED = Normal Operation - Source voltages to unit are within tolerance, and all surge components are fully functional.

Amber LED = Unit has an active power quality event. (See section 7.3)

Red LED (Steady) = Unit protection has reached end of life. (See section 8.0 Troubleshooting)

LCD Display Screen

The Active Surge Monitor system provides several informational Display Screens. Each screen provides real-time information concerning the existing power quality, past recorded events, & networking. See section 3.3 Display Screen Descriptions for more information.

1. SPD/TVSS (Home Screen)
2. L-L Voltages
3. L-N Voltages
4. Status
5. Surge Counts
6. L-N or L-L Surge Counts
7. L-N or L-L Crest Factor
8. L-N or L-L VTHD
9. Harmonics L-N or L-L (3rd-7th)
10. Harmonics L-N or L-L (9th-13th)
11. Average L-L Values
12. Average L-N Values
13. L-N MOV Health
14. L-G MOV Health
15. L-L MOV Health
16. Recorded Events
17. Networking
18. Overvoltage Settings
19. Undervoltage Settings
20. Miscellaneous Settings
21. Display Settings
22. MODBUS Settings
23. About

After a short time without interaction, the LCD Display will automatically switch to energy saving mode. The backlight will turn off first, followed shortly after by the text. Touching any of the navigation buttons on the front cover will reactivate the display backlight and text.

Failure to follow these instructions will result in death or serious injury.

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices. See NFPA 70E, NOM-029-STPS or CSA Z462.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Turn off all power supplying this equipment before working on or inside equipment.
- Always use a properly rated voltage sensing device to confirm power is off.
- Replace all devices, doors and covers before turning on power to this equipment.
- This equipment must be effectively grounded per all applicable codes. Use an equipment-grounding conductor to connect this equipment to the power system ground.

Failure to follow these instructions will result in death or serious injury.

DANGER

LCD Display Screen

The Active Surge Monitor system provides several informational Display Screens. Each screen provides real-time information concerning the existing power quality, past recorded events, & networking. See section 3.3 Display Screen Descriptions for more information.

Various screens are not available with some configurations.

Example: A unit will not have the screens referencing L-N if the SPD is configured for a 3 Phases + Ground (no Neutral) source.

The display screen Update time, Turn-Off time, and Backlight Turn-Off time can be modified at the password protected Display Settings screen (#26).
3. Display Navigation Buttons
The LCD display provides numerous screens. Push buttons are utilized to maneuver from screen to screen.

BACK – Pressing the BACK button at any time during navigation will take you back to the HOME screen.

UP & DOWN – The UP and DOWN buttons are used to toggle between the “PrevP” (Previous Page) and “NextP” (Next Page) commands.

ENTER – Used to select the highlighted action on the LCD display. Pressing the ENTER button repeatedly will cycle the display through each of the display screens.

Pressing UP and DOWN at the same time will silence the audible alarm.
Pressing BACK and ENTER at the same time will jump directly to the About Display Screen.

Display Navigation Buttons may not function properly if they are being touched while the system is powered up. Each time the unit is powered up, the buttons will re-calibrate under the assumption that they are NOT being touched.

3.3 Display Screen Descriptions

The example Display Screens shown below represent a Three Phase WYE, 4W+G 10-mode source configuration. Other configurations may vary.

1. Home (Start-Up/Home Screen)
Displays the average L-N or L-L voltage, the total Surge Count of IEEE Category A, B, & C surges recorded since last reset, the current system IP Address, and the number of active Alarms.

2. L-L Voltages
- Displays L-L RMS voltages with ±1% accuracy at nominal
- RMS values calculated for each phase every 100ms

3. L-N Voltages
- Displays L-N & N-G RMS voltages with ±1% accuracy at nominal
- RMS values calculated for each phase every 100ms

4. Status
- Provides a total Surge Count of IEEE Category A, B, & C surges recorded on all Line-to-Ground modes.
- Provides a total Swell Count detected on all Line-to-Neutral & Line-to-Line modes.
- Provides a total Sag Count detected on all Line-to-Neutral & Line-to-Line modes.
- Indicates number of Alarms counted since last reset. (Sag, Swell, MOV FAIL, or MOV Reduced)
5. Surge Counts
   • Provides a breakdown of the ANSI/IEEE Category A, B, & C surges recorded.
   - New = number since last reset
   - Total = number since SPD start-up

   See Section 7.5 Category A, B, & C Surge Events for Category A, B, & C definition

<table>
<thead>
<tr>
<th>Surge Counts</th>
<th>New</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT C</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>CAT B</td>
<td>11</td>
<td>66</td>
</tr>
<tr>
<td>CAT A</td>
<td>46</td>
<td>958</td>
</tr>
</tbody>
</table>

Counters can be reset by selecting the password protected Reset Counts feature on the “Status” screen. See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding passwords.

6. L-N or L-L Counts
   • Provides the total SAG Count and SWELL Count events recorded for each Line-to-Neutral mode. If the source configuration doesn't include a neutral, the Line-to-Line modes are displayed.

<table>
<thead>
<tr>
<th>L-N Counts</th>
<th>Sag</th>
<th>Swell</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-N</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>L2-N</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>L3-N</td>
<td>5</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L-L Counts</th>
<th>Sag</th>
<th>Swell</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-L2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>L2-L3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>L3-L1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Counters can be reset by selecting the password protected Reset Counts feature on the “Status” screen. See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding passwords.

7. L-N or L-L Crest Factor
   • Displays crest factor with ±1% accuracy for each Line-to-Neutral mode. If the source configuration doesn't include a neutral, the Line-to-Line modes are displayed.
   • Calculated for each phase every 100ms
   • Crest factor is the peak amplitude of the waveform divided by the RMS value of the waveform.

8. L-N or L-L Voltage THD
   • Displays VTHD with ±1% accuracy for each Line-to-Neutral mode. If the source configuration doesn't include a neutral, the Line-to-Line modes are displayed.
   • Expressed as a percentage
   • Calculated every 100ms
   • Bandwidth = 850Hz
9. Voltage Harmonics L-N or L-L (3rd-7th)
   - Displays L-N voltage THD for 3rd, 5th, and 7th harmonic with ±5% accuracy. If the source configuration doesn't include a neutral, the Line-to-Line modes are displayed.
   - Expressed as a percentage
   - Calculated every 1.5s
   - Bandwidth = 850Hz

<table>
<thead>
<tr>
<th>Harmonics L-N 3rd-7th</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
</tr>
<tr>
<td>L1-N</td>
</tr>
<tr>
<td>L2-N</td>
</tr>
<tr>
<td>L3-N</td>
</tr>
</tbody>
</table>

10. Voltage Harmonics L-N or L-L (9th-13th)
   - Displays L-N voltage THD for 9th, 11th, and 13th harmonic with ±5% accuracy. If the source configuration doesn't include a neutral, the Line-to-Line modes are displayed.
   - Expressed as a percentage.
   - Calculated every 1.5s
   - Bandwidth = 850Hz

<table>
<thead>
<tr>
<th>Harmonics L-L 3rd-7th</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
</tr>
<tr>
<td>L1-L2</td>
</tr>
<tr>
<td>L2-L3</td>
</tr>
<tr>
<td>L3-L1</td>
</tr>
</tbody>
</table>

11. AVG L-L Values
   - Frequency range of 45-67Hz with ±1Hz accuracy averaged over one second.
   - Displays average RMS Line-to-Line voltages calculated every 100ms.
   - Displays imbalance for Line-to-Line values calculated every 100ms.

<table>
<thead>
<tr>
<th>AVG L-L Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq</td>
</tr>
<tr>
<td>L-L Avg V</td>
</tr>
<tr>
<td>L-L Avg Imb</td>
</tr>
</tbody>
</table>

12. AVG L-N Values
   - Frequency range of 45-67Hz with ±1Hz accuracy averaged over one second.
   - Displays average RMS Line-to-Neutral voltages calculated every 100ms.
   - Displays imbalance for Line-to-Neutral values calculated every 100ms.

<table>
<thead>
<tr>
<th>AVG L-N Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq</td>
</tr>
<tr>
<td>L-N Avg V</td>
</tr>
<tr>
<td>L-N Avg Imb</td>
</tr>
</tbody>
</table>

13. L-N MOV Health
   - Provides current state of all MOV's in each Line-to-Neutral mode as well as the Neutral-to-Ground mode.
   - Expressed as a percentage.
14. L-G MOV Health
- Provides current state of all MOV's in each Line-to-Ground mode.
- Expressed as a percentage.

<table>
<thead>
<tr>
<th>L-N MOV Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-N MOV’s</td>
</tr>
<tr>
<td>L2-N MOV’s</td>
</tr>
<tr>
<td>L3-N MOV’s</td>
</tr>
<tr>
<td>N-G MOV’s</td>
</tr>
</tbody>
</table>

15. L-L MOV Health *(when included)*
- Provides current state of all MOV’s in each Line-to-Line mode.
- Expressed as a percentage.

<table>
<thead>
<tr>
<th>L-L MOV Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1-L2 MOV’s</td>
</tr>
<tr>
<td>L1-L3 MOV’s</td>
</tr>
<tr>
<td>L2-L3 MOV’s</td>
</tr>
</tbody>
</table>

16. Events
- Provides information on the last 2000+ recorded events.
- Date, Time, Type, & Duration of the event will be displayed.

<table>
<thead>
<tr>
<th>Event 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date- MM/DD/YEAR</td>
</tr>
<tr>
<td>Time- HH:MM:SS.SS</td>
</tr>
<tr>
<td>Type-</td>
</tr>
<tr>
<td>Dur - Dev-</td>
</tr>
</tbody>
</table>

Viewing Event Details – While at the event screen, selecting “PrE” (Previous Event) and “NxE” (Next Event) will navigate through the recorded events.

**System Events**
- Power On
- Settings Change
- Firmware Update
- Communication Error Detected
- Software Reset
- Factory Reset
- Frequency Lock Lost/Enabled
- Surge Monitoring Disabled

**System Events**
- Surge/Transient
- Sag
- Swell
- Phase Loss/Outage
- Voltage Interruption/Dropout
- Voltage Harmonics (VTHD)
- Neutral Bond
- Overvoltage
- Temporary Overvoltage (TOV)
- Over/Under Frequency
- Protection End of Life

See Section 7.0 - Definitions for System Event and Power Quality Event details.

17. Networking
- Systems networking IP address, Subnet Mask, and Gateway Address.
- Displays current Ethernet status.

See ENET Status Messages chart below

**Viewing Event Details** – While at the event screen, selecting “PrE” (Previous Event) and “NxE” (Next Event) will navigate through the recorded events.

**ENET** Status Messages

<table>
<thead>
<tr>
<th>Message</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting...</td>
<td>Attempting to locate a network server.</td>
</tr>
<tr>
<td>Acquiring IP...</td>
<td>Found a network connection; If DHCP mode enabled: Attempting to acquire an IP address from a DHCP network server. If DHCP mode disabled: Attempting to assign a static IP address.</td>
</tr>
<tr>
<td>DHCP Acquired...</td>
<td>IP address acquired from a DHCP network Server, and ASM is ready to communicate.</td>
</tr>
<tr>
<td>Static Acquired...</td>
<td>The static IP address has been assigned, and ASM is ready to communicate.</td>
</tr>
<tr>
<td>Static Fallback...</td>
<td>DHCP Service is not available; system fell back to last saved IP address.</td>
</tr>
</tbody>
</table>
18. Overvoltage Settings*
   - Provides system Swell, Overvoltage (OV), & Temporary Overvoltage (TOV) event thresholds.
   - Factory defaults are 10% (OV), 20% (Swell), & 40% (TOV).
   - User configurable thresholds

<table>
<thead>
<tr>
<th>Overvoltage Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swell Level</td>
</tr>
<tr>
<td>TOV Level</td>
</tr>
<tr>
<td>OV Level</td>
</tr>
</tbody>
</table>

19. Undervoltage Settings*
   - Provides system Sag, Dropout & Outage event thresholds.
   - Factory defaults are -10% (Sag & Outage), & -20% (Dropout)
   - User configurable thresholds

<table>
<thead>
<tr>
<th>Undervoltage Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAG Level</td>
</tr>
<tr>
<td>Dropout Level</td>
</tr>
<tr>
<td>Outage Level</td>
</tr>
</tbody>
</table>

20. Miscellaneous Settings*
   - Provides system Frequency Deviation, Total Harmonic Distortion (THD) & Neutral Bond (NB) event thresholds.
   - Factory defaults are 1% (Frequency), 5% (VTHD), & 10V (Neut Bond).
   - User configurable thresholds

<table>
<thead>
<tr>
<th>Misc Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freq Dev</td>
</tr>
<tr>
<td>THD Level</td>
</tr>
<tr>
<td>NB Level</td>
</tr>
</tbody>
</table>

21. Display Settings*
   - Provides system Update Time, Display Turn-Off time, & display screen Backlight Turn-Off time.
   - User configurable

<table>
<thead>
<tr>
<th>Display Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Update Time</td>
</tr>
<tr>
<td>Display TO</td>
</tr>
<tr>
<td>Backlight TO</td>
</tr>
</tbody>
</table>

22. MODBUS Settings*
   - Provides MODBUS TCP Port, RTU Port, & RTU Baud rate.
   - User configurable

<table>
<thead>
<tr>
<th>MODBUS Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCP Node</td>
</tr>
<tr>
<td>RTU Node</td>
</tr>
<tr>
<td>RTU Baudrate</td>
</tr>
</tbody>
</table>

23. About
   - Provides the units model number, type of MOV technology utilized, and the current software revision number & software revision date.

<table>
<thead>
<tr>
<th>About</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Model Number</td>
</tr>
<tr>
<td>MOV Tech:</td>
</tr>
<tr>
<td>SW Rev:</td>
</tr>
<tr>
<td>Date:</td>
</tr>
</tbody>
</table>

ENTER and BACK pressed together will switch the display screen directly to the About screen.

See section 7.1 Field Definitions for additional Display Screen information.

*The systems event trigger thresholds, Update Time, Display Turn-Off and display screen Backlight Turn-Off time, and MODBUS TCP Port, RTU Port, & RTU Baud rate can be modified by selecting the password protected Modify feature.

See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding passwords.
4.0 Webpage

4.1 Introduction

The Active Surge Monitor system webpage contains all of the information available on the LCD display as well as some additional features.

Various settings, thresholds, and functions can be modified, enabled, disabled, using the systems webpage/Ethernet function.

4.2 Connection Method

To view the Active Surge Monitor’s webpage, a connection can be made in one of two methods.

1. **Network Connection** - Connection from RJ-45 Ethernet port to a network
2. **LAN Connection** - Connection from RJ-45 Ethernet port directly to a PC

If changing from a Network connection to a LAN (direct to PC) connection and vice-versa, power to the system may need to be cycled off and back on.

### 4.2.1 Network Connection

Connection from Ethernet port to a Network

Connecting the system to a network may be the simplest method of connection. The ASM will automatically attempt to locate an available network IP address.

The IP address acquired by the system is provided on the units LCD display at the “HOME” and “NETWORKING” screens. (examples shown below)

---

**To open the ASM’s webpage**

Open a web browser and enter the system IP address into the address bar and press Enter. This will open the Active Surge Monitor system webpage.

---
4.2.2 LAN Connection

Connection from Ethernet port directly to a PC (LAN)

To view the system webpage, the IP address for the PC must be different from the IP address of the ASM. To verify/set the PC’s IP address follow the instructions below:

To verify or set the PC’s IP address, follow these instructions:

1. Go to the CONTROL PANEL, and select NETWORK & INTERNET.
2. Under NETWORK AND SHARING CENTER, select VIEW NETWORK STATUS AND TASKS.
3. Select ETHERNET under “No Internet Access”.
4. Select PROPERTIES
5. Select and highlight INTERNET PROTOCOL VERSION 4 (TCP/IPv4). Select PROPERTIES.
6. Select USE THE FOLLOWING IP ADDRESS, and enter an IP address with a number that ends different from the ASM’s IP address. See example below.

<table>
<thead>
<tr>
<th>ASM’s IP Address</th>
<th>Example IP address to enter into PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>192.168.1.10</td>
<td>192.168.1.1</td>
</tr>
</tbody>
</table>
7. Enter the same SUBNET MASK as the ASM. Enter a DEFAULT GATEWAY value (may be same as the ASM’s system but doesn’t need to be). Select OK.

8. Open a web browser and enter the ASM’s IP address into the address bar and hit Enter. This will open the Active Surge Monitor system webpage.

4.3 Webpage Navigation

Menu Bar
The Active Surge Monitor system default home page is the Measurements page.
4.4 IP Settings

Default Settings - Locate the system IP settings on the “Home” and “Networking” screens.

The factory default IP configurations are as follows:
- IP Address: 192.168.1.10
- Subnet Mask: 255.255.255.0
- Gateway: 192.168.1.1
- ENET: DHCP Acquired

In most cases, the user will need settings other than this. If so, please follow instructions detailed below (Manually Assigning IP Settings). If more than one Active Surge Monitor system is on a network, each unit will need a unique IP address. Fixed IP addresses for each unit in a network should be obtained from the network administrator. Each unit should have the same Mask and Gateway as the network server.

4.5 Password Protection

Password - Assorted features of the system will require an alpha numeric password for modification. The unit is shipped from the factory with a default password of “1234”. User is required to change the password upon first log-in.

Changing Password - This system password can be changed. Refer to Section 5.4.1 Configuration for information on changing the system password.

5.0 Web Pages

5.1 Introduction

The Active Surge Monitor system comes equipped with numerous on board web pages. The system web pages provide system, power, & event information in a user-friendly format. Various functions & settings of the system can be turned on, off, or modified using the webpage tool. Device, Company, and Contact information is also conveniently accessible when accessing the system webpage.

5.2 Measurements Pages

[IP ADDRESS/main.html]

Hover the curser over the “Measurements” tab to activate a pull-down menu where various measurement & counts web pages can be selected. Selecting “Voltages/Counts Summary” will open the Measurements home page.

5.2.1 Measurements - Voltages/Counts Summary

[IP ADDRESS/DeviceSettings.html]

The system default home page is the Measurements- Voltages/Counts Summary web page. The current measured voltages, VTHD, Crest Factor, & Frequency, as well as various resettable event counters, and SPD MOV health levels are all located here allowing for a quick efficient method to verify or troubleshoot the locations power quality, as well as the health of the SPD.

5.2.2 Measurements - Counts

[IP ADDRESS/Counts.html]

The Measurements- Counts page provides the number of new surges since last reset, as well as the total number of surges detected. All recorded Surge events are also categorized in accordance with the ANSI/IEEE C62.41 categories. New Surge counts can be reset here using the password protected “Reset” feature. Source voltage SAG and SWELL counts are also provided on this page for each individual L-N and/or L-L mode.

5.2.3 Measurements - Harmonics

[IP ADDRESS/Harmonics.html]

The Measurements- Harmonics page provides a quick view of each individual L-N and/or L-L voltage THD percentage for the 3rd, 5th, 7th, 9th, 11th, and 13th harmonic with ±5% accuracy.

See Section 7.0 Definitions for additional information/details on measurements, counts, health, harmonics, etc.
### 5.2.1 Measurements - Voltages/Counts Summary

#### L-N Voltages

<table>
<thead>
<tr>
<th></th>
<th>RMS</th>
<th>Crest</th>
<th>VTID</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 - N</td>
<td>119 V</td>
<td>1.426</td>
<td>1.2</td>
<td>60 Hz</td>
</tr>
<tr>
<td>L2 - N</td>
<td>120 V</td>
<td>1.427</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>L3 - N</td>
<td>120 V</td>
<td>1.428</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>N - G</td>
<td>6 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L - N (AVG)</td>
<td>119 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### L-L Voltages

<table>
<thead>
<tr>
<th></th>
<th>RMS</th>
<th>Crest</th>
<th>VTID</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 - L2</td>
<td>206</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2 - L3</td>
<td>207</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3 - L1</td>
<td>205</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L-L (AVG)</td>
<td>119 V</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Disruptions

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge</td>
<td>0</td>
</tr>
<tr>
<td>Swell</td>
<td>0</td>
</tr>
<tr>
<td>Sag</td>
<td>0</td>
</tr>
<tr>
<td>Alarms</td>
<td>PASS</td>
</tr>
</tbody>
</table>

#### SPD Health

<table>
<thead>
<tr>
<th>Module</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 - N Module</td>
<td>100 %</td>
</tr>
<tr>
<td>L2 - N Module</td>
<td>100 %</td>
</tr>
<tr>
<td>L3 - N Module</td>
<td>100 %</td>
</tr>
<tr>
<td>L1 - G Module</td>
<td>100 %</td>
</tr>
<tr>
<td>L2 - G Module</td>
<td>100 %</td>
</tr>
<tr>
<td>L3 - G Module</td>
<td>100 %</td>
</tr>
<tr>
<td>N - G Module</td>
<td>100 %</td>
</tr>
</tbody>
</table>

### 5.2.2 Measurements – Counts

#### Surge Counts

<table>
<thead>
<tr>
<th>Severity</th>
<th>New</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAT C</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAT B</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>CAT A</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### LN Sag/Swell Counts

<table>
<thead>
<tr>
<th>Mode</th>
<th>SAG Count</th>
<th>SWELL Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 - N</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>L2 - N</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>L3 - N</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 5.2.3 Measurements – Harmonics

#### Harmonics Quick View

<table>
<thead>
<tr>
<th></th>
<th>3rd</th>
<th>5th</th>
<th>7th</th>
<th>9th</th>
<th>11th</th>
<th>13th</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 - N</td>
<td>0.93</td>
<td>0.39</td>
<td>0.60</td>
<td>0.23</td>
<td>0.24</td>
<td>0.25</td>
</tr>
<tr>
<td>L2 - N</td>
<td>1.2</td>
<td>0.73</td>
<td>0.59</td>
<td>0.36</td>
<td>0.17</td>
<td>0.11</td>
</tr>
<tr>
<td>L3 - N</td>
<td>0.51</td>
<td>0.37</td>
<td>0.50</td>
<td>0.71</td>
<td>0.49</td>
<td>0.38</td>
</tr>
</tbody>
</table>
5.3 Events Page

The Events webpage provides detailed information for approximately 2000 recorded events. A Time/Date stamp of the recorded event, the specific modes affected, as well as the event duration & severity are detailed here, making it an ideal troubleshooting tool.

5.4 Configuration Pages

Hover the cursor over the “Configuration” tab to activate a pull-down menu where various configuration web pages can be selected. Selecting “Configuration” will open the Configuration home page.

5.4.1 Configuration – “Configuration”

See Section 7.2 - System Events and Section 7.3 - Power Quality Events for detailed descriptions of system & power quality events.
5.4.2 Configuration – “Event Settings”  
[//IP ADDRESS/EventSettings.html]

The Event Settings page allows the user to establish or modify the trigger levels that the system identifies as an “Event”. All event settings can be modified using a login password.

See Section 7.3 Power Quality Events for detailed information regarding event definitions, event thresholds, factory default levels, etc.

See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding login passwords.

5.4.3 Configuration – “Network Settings”  
[//IP ADDRESS/NetworkSettings.html]

The Network Settings web page can be used to Disable DHCP mode and manually enter an IP address, Subnet Mask, & Gateway Address. To modify settings on this page, a login password must be entered.

See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding login passwords.

5.4.4 Configuration – “MODBUS Settings”  
[//IP ADDRESS/ModbusSettings.html]

The MODBUS Settings web page can be used to configure Node Address, TCP & RTU RS485 settings. To modify settings on this page, a login password must be entered. See Section 6.0 MODBUS for additional information.

See Section 4.5 Password Protection & 5.4.1 Configuration for information regarding login passwords.
5.4.5 “Email Settings”  
[[/IP ADDRESS/EmailSettings.html]]

To modify email settings, a login password must be entered. Up to three email addresses may be entered for users to be notified of selected power quality events. See section 7.3 for definitions for the measured events.

1. Enter the login password at the bottom of the screen. See Section 4.5 for Password Protection information.
2. Select the radio button to enable email notifications at the top of the screen.
3. Enable Authentication using the radio button if SMTP mail server requires Account Authentication and enter SMTP account Username and Password.
4. Enter SMTP and IP address information as necessary.
5. Enter the email address that will be sending the notifications and up to 3 individuals who which to receive the automated email notifications.
6. Select the Power Quality or System events that will generate email notifications. See section 7.3 for a description of each of the power quality events. Each person receiving emails will receive an email for each of these events. There is no way to customize who may receive an email for specific events.
7. Select the “Set” button at the bottom of the page to save the changes.
8. Log out.

5.4.6 Configuration – “Firmware Update”  
[[/IP ADDRESS/FirmwareUpdate.html]]

The Firmware Update page allows the ASM’s firmware to be updated as new versions become available. Firmware updates can be obtained from the “Software Downloads” section of the ASCO website, or by contacting the factory. See Section 5.5.2 About – Contact Us for contact information.

1. Use the “Browse…” function to locate & select the desired Firmware file.
2. Press the “Upload file” and the system will ask for you to Confirm or Cancel…Select “OK”. This is the last user action required in the process.
3. Wait. The system will quickly automatically update the firmware while retaining all user settings, counts, etc. The upload percentage status is displayed in the lower left corner of the screen. (may take a few minutes)

Once the file is uploaded, the system will automatically reboot the unit, and return you to the MEASUREMENTS page.
5.5 About Pages

Hovering the cursor over the About tab will activate a pull-down menu where device information and company/contact information web pages can be selected.

5.5.1 About – “Device”

The Device page details the units model number, serial number, as well as the version/date of the Bootloader & Firmware the system is currently utilizing. The Units Location and Name/Title also appear if they have been entered. (See 5.4.1 Configuration)

5.5.2 About – “Contact Us”

The Contact Us page displays our company name, address, & phone numbers. Hotlinks to the company website and a contact email are also easily accessible on this webpage.
6.0 MODBUS

For full instruction including Supported Function Codes and Register Map, please refer to IO-70110 - ASM MODBUS Installation Manual.

6.1 Introduction
This design specification describes the Modbus communications protocol as supported by the monitoring/metering system. For packet details and examples, refer to Appendix I of this document. The TCP or RS485 communication port must be active and configured properly.

6.2 Supported Protocol Parameters

Implementation Basics
- Operates as slave device only
- The maximum number of bytes contained within one packet of communications is 255. This equates to supporting a read request for 125 registers.

Transmission Format
Only Modbus ASCII mode is not supported. The RS485 controller only supports the following format:
- 8 data bits
- No parity
- 1 stop bit
- Refer to register map for baud rate supported
- Device address 1 - 247

Packet Framing and Timing
Three timing intervals as follows:
- Maximum time between two consecutive bytes within a packet < 3.5 character times
- Minimum time between two consecutive packets is > 3.5 character times
- Maximum response time from a Master request to a slave response is < 50 milliseconds

7.0 Definitions

7.1 Field Definitions

- **Alarms** – The number of active alarms. This indicates the unit is currently experiencing an active event (Phase Loss, Overvoltage, etc) or the protection has reached end of life. Refer to the Events screen and/or webpage for further information on the existing events/alarms.
- **Backlight TO** – The length of time the display screen backlight remains lit without interaction before returning to energy saving/sleep mode.

**CAT A - Surge Count (New)** – The number of IEEE Category A transients the Active Surge Monitor has recorded since the last time the “reset” feature was activated.

**CAT A - Surge Count (Total)** – The number of IEEE Category A transients the Active Surge Monitor has recorded since first activated.

**CAT B - Surge Count (New)** – The number of IEEE Category B transients the Active Surge Monitor has recorded since the last time the “reset” feature was activated.

**CAT B - Surge Count (Total)** – The number of IEEE Category B transients the Active Surge Monitor has recorded since first activated.

**CAT C - Surge Count (New)** – The number of IEEE Category C transients the Active Surge Monitor has recorded since the last time the “reset” feature was activated.

**CAT C - Surge Count (Total)** – The number of IEEE Category C transients the Active Surge Monitor has recorded since first activated.

**Display TO** – The length of time the display screen information remains viewable before returning to energy saving/sleep mode.

**Dropout Level** – The percentage (20%-30%) below the nominal voltage at which the Active Surge Monitor will trigger a Voltage Interruption/Dropout event.
*Example: A 208V L-L source voltage with a 20% dropout level (41.6V) will trigger a Dropout event at approximately 166V L-L.*

**ENET** – The Active Surge Monitors current Ethernet connection status.

**Event #** – The saved information for each recorded event. The event type, time/date stamp, duration, severity (deviation), and the mode where the event was detected are displayed.

**Freq (Frequency)** – The AC frequency. The allowable range is 45-66Hz with a ±1 Hz accuracy averaged over 1 second.

**Freq Dev** – The percentage (1%-10%) of deviation at which the ASM will trigger an Over/Under Frequency event.
*Example: A 60Hz frequency with a 10% deviation level (6Hz) will trigger an event at approximately 54Hz (Low) or 66Hz (High).*

**Message** **Definition**

| Connecting... | Attempting to locate a network server. |
| Acquiring IP.. | Found a network connection; If DHCP mode enabled: Attempting to acquire an IP address from a DHCP network server. If DHCP mode disabled: Attempting to assign a static IP address. |
| DHCP Acquired... | IP address acquired from a DHCP network Server, and ASM is ready to communicate. |
| Static Acquired... | The static IP address has been assigned, and ASM is ready to communicate. |
| Static Fallback... | DHCP Service is not available; system fell back to last saved IP address. |

For full instruction including Supported Function Codes and Register Map, please refer to IO-70110 - ASM MODBUS Installation Manual.
- **GWay** – The ASM’s current Gateway Address.

- **Harmonics L-L 3rd-7th** – Display screen providing 3rd, 5th, & 7th voltage THD for each line-to-line mode, expressed as a percentage, calculated every 100ms, Bandwidth = 850Hz, ±5% accuracy.

- **Harmonics L-L 9th-13th** – Display screen providing 9th, 11th, & 13th voltage THD for each line-to-neutral mode, expressed as a percentage, calculated every 100ms, Bandwidth = 850Hz, ±5% accuracy.

- **Harmonics L-N 3rd-7th** – Display screen providing 3rd, 5th, & 7th voltage THD for each line-to-neutral mode, expressed as a percentage, calculated every 100ms, Bandwidth = 850Hz, ±5% accuracy.

- **Harmonics L-N 9th-13th** – Display screen providing 9th, 11th, & 13th voltage THD for each line-to-neutral mode, expressed as a percentage, calculated every 100ms, Bandwidth = 850Hz, ±5% accuracy.

- **L-G MOV Health** – The current condition of all surge components (MOVs) between each line/phase and ground (L1-G, L2-G, L3-G if applicable)

- **L-L Avg Imb** – The Average Voltage Imbalance of all possible L-L voltages. Voltage Imbalance is calculated as (Current L-L RMS voltage – Average L-L RMS voltage) / Current L-L RMS voltage.

- **L-L Avg V** – The average of all available Line-to-Line voltages. In a 3 Phase system, this field displays the average of the L1-L2, L1-L3, & L2-L3 voltages.

- **L-L Counts** – The number of Sag & Swell events the system has recorded on each Line-to-Line mode since the last time the “reset” feature was activated.

- **L-L Crest Factor** – The Line-to-Line crest factor calculated every 100 milliseconds with ±1% accuracy.

- **L-L MOVs (L-N MOV Health)** – The current condition of all surge components (MOVs) between each line/phase and neutral (L1-N, L2-N, L3-N if applicable)

- **L-N Avg Imb** – The Average Voltage Imbalance of all possible L-N voltages. Voltage Imbalance is calculated as (Current L-N RMS voltage – Average L-N RMS voltage) / Current L-N RMS voltage.

- **L-N Avg V** – The average of all available Line-to-Neutral voltages. In a 3 Phase system, this field displays the average of the L1-N, L2-N, & L3-N voltages.

- **L-N Counts** – The number of Sag & Swell events the system has recorded on each Line-to-Neutral mode since the last time the “reset” feature was activated.

- **L-N Crest Factor** – The Line-to-Neutral crest factor calculated every 100 milliseconds with ±1% accuracy.

- **L-N MOVs (L-N MOV Health)** – The current condition of all surge components (MOVs) between each line/phase and neutral (L1-N, L2-N, L3-N if applicable)

- **L-N Voltages** – All possible Line-to-Neutral and Neutral-to-Ground measured voltages. In a 3 Phase system L1-N, L2-N, L3-N, & N-G voltages are displayed.

- **L-N VTTHD** – The Line-to-Neutral Voltage THD calculated every 100 milliseconds with ±1% accuracy. Bandwidth to 850Hz.

- **Mask** – The system/network Subnet Mask.

- **NB Level** – The Neutral-to-Ground voltage (10V-30V) at which the ASM will trigger a Neutral Bond event.

- **N-G MOV’s (L-N MOV Health)** – The current condition of all surge components (MOVs) between neutral and ground.

- **N-G** – Voltage measured between Neutral and Ground.

- **Outage Level** – The percentage (10%-30%) below the nominal voltage at which the ASM will trigger a Phase Loss/Outage event.

  Example: A 208V L-L source voltage with a 20% outage level (41.6V) will trigger an Outage event at approximately 166V L-L.

- **OV Level** – The percentage (10%-30%) above the nominal voltage at which the ASM will trigger an Overvoltage event.

  Example: A 208V L-L source voltage with a 20% overvoltage level (41.6V) will trigger an Overvoltage event at approximately 250V L-L.

- **RTU Baud Rate** – Modbus RTU Baud Rate – 9600bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, or 115.2 kbps.

- **RTU Port** – RS/TIA/EIA-485 remote terminal unit (RTU) port number (1-239)

- **Sag Count** – The number of Line-to-Neutral and Line-to-Line Sag events the ASM has recorded since the last time the “reset” feature was activated.

- **Sag Level** – The percentage below the nominal voltage at which the ASM will trigger a Sag event. The allowable range is 10% (default) to 5% below the Dropout event trigger setting.

  Example: A 208V L-L source voltage with a 10% Sag level (20.8V) will trigger a Sag event at approximately 187V L-L.

- **Surge Count** – The number of Line-to-Ground Surge/Transient events the ASM has recorded since the last time the “reset” feature was activated.

- **Swell Count** – The number of Line-to-Neutral and Line-to-Line Swell events the ASM has recorded since the last time the “reset” feature was activated.
• **Swell Level** – The percentage (20%-40%) above the nominal voltage at which the ASM will trigger a Swell event.  
*Example: A 208V L-L source voltage with a 20% Swell level (41.6V) will trigger a Swell event at approximately 250V L-L.*

• **TCP Port** – RS/TIA/EIA-485 Transmission Control Protocol/Internet Protocol (TCP/IP) port number (1-239)

• **THD Level** – The percentage (50%-25%) above the nominal voltage at which the ASM will trigger a Voltage Harmonics (VTHD) event.  
*Example: A 208V L-L source voltage with a 20% THD level (41.6V) will trigger a Voltage Harmonics event at approximately 250V L-L.*

• **TOV Level** – The percentage (40%-80%) above the nominal voltage at which the ASM will trigger a Temporary Overvoltage event.  
*Example: A 208V L-L source voltage with a 50% temporary overvoltage level (104V) will trigger a Temporary Overvoltage event at approximately 312V L-L.*

• **Update Time** – The length of time before the unit refreshing the display screen. A longer duration Update Time can lessen the burden to the system memory increasing the overall system performance.

7.2 System Events

• **Communication Error Detected** – The ASM has detected an internal communication issue. Power to the unit must be cycled off and back on to resume all monitoring functions.

• **Factory Reset** – All of the ASM’s configurable settings, thresholds, etc. have been reset and returned to the factory default settings.

• **Frequency Lock Enabled** – The frequency has returned to an acceptable level within the ASM rating (45-67Hz). All Power Quality Event detection & recording capabilities have been restored.

• **Frequency Lock Lost** – The frequency has been detected outside of the ASM rating (45-67Hz). Power Quality Event detection capabilities are disabled during this event. Surge/Transient events continue to be detected & recorded during this event.

• **Firmware Update** – The ASM’s Firmware has been updated. Date, time, and New Firmware version are recorded.

• **Power On** – Indicates the date and time power was applied to the unit.

• **Settings Change** – A password protected ASM setting has been changed.

• **Software Reset** – Indicates that the Metering system software has been reset or updated. The software reset can happen automatically as well as manually.

• **Surge Disabled** – The ASM’s surge/transient detection & recording capabilities have been temporarily disabled. This event/action is typically due to long duration nominal voltage swells that would otherwise appear as numerous surges/transients.  
*Note: The units surge protection capabilities are not affected by this event.*
7.3 Power Quality Events

**Protection end of life** – A component critical to the surge protection performance has been damaged and the surge protection capabilities of the SPD have been reduced or eliminated.

Contact the factory to initiate the warranty & troubleshooting process.

**Email:** CustomerCare@ASCO.com  **Phone:** 800-237-4567 or 727-535-6339
Voltage Harmonics (VTHD) – Voltage event where a voltage harmonic RMS value is above the voltage harmonic user configurable threshold (5% - 25%). Factory default is 5% above Nominal voltage. The event log shall specify the event duration (100 milliseconds – approximately 50 days), the maximum recorded voltage, phase effected, and harmonic number (3rd-13th). User can disable this function by selecting OFF as the lower trigger.
**Neutral Bond** – Neutral-to-Ground voltage swell that exceeds a user configurable voltage (10 Volts – 30 Volts). Factory default setting is 10 Volts. The Neutral Bond event duration (8 milliseconds – approximately 50 days), and the maximum recorded voltage are also provided.

<table>
<thead>
<tr>
<th>Nominal Voltage</th>
<th>0.5 ms</th>
<th>8 ms</th>
<th>1 Min.</th>
<th>50 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Max</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+45V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+40V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+35V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+30V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+25V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+20V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+15V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+10V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+5V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Event Trigger   |        |      |        |         |
| (±10V to ±30V)  |        |      |        |         |
| Default Setting | ±10V   |      |        |         |

<table>
<thead>
<tr>
<th>Event Duration</th>
<th>0.5 ms</th>
<th>8 ms</th>
<th>1 Min.</th>
<th>50 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral Bond</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Over/Under Frequency** – Voltage event where the frequency is above/below the nominal frequency by the frequency threshold. Factory default is 1 Hz deviation. Log shall specify the event duration and Hz deviation. User can disable this function by selecting OFF as the lower trigger.

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>0.5 ms</th>
<th>8 ms</th>
<th>1 Min.</th>
<th>50 Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>50Hz or 60Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±9%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±8%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±7%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±6%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±4%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±3%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>±1%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Event Trigger   |        |      |        |         |
| (±1% to ±10%)   |        |      |        |         |
| Default Setting | ±1%    |      |        |         |
### 7.4 Power Quality Event Threshold Table

<table>
<thead>
<tr>
<th>Event</th>
<th>Duration</th>
<th>% of Nominal Voltage Deviation</th>
<th>Event Trigger</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge/Transient</td>
<td>Minimum = 4us</td>
<td>Varies by unit (±15%±50%)</td>
<td>NA</td>
</tr>
<tr>
<td></td>
<td>Maximum = 0.5ms</td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Sag</td>
<td>Minimum = 8ms</td>
<td>Minimum = -10%</td>
<td>Default: -10%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 1 minute</td>
<td>Maximum = 5% below Voltage Interruption/Dropout event trigger</td>
<td>Configurable: -10% to 5% below Dropout trigger</td>
</tr>
<tr>
<td>Swell</td>
<td>Minimum = 8ms</td>
<td>Minimum = +20%</td>
<td>Default: +20%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 1 minute</td>
<td>Maximum = No Max</td>
<td>Configurable: +20% to +40%</td>
</tr>
<tr>
<td>Phase Loss/Outage</td>
<td>Minimum = 1 minute</td>
<td>Minimum = -10%</td>
<td>Default: -10%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 49.71 days</td>
<td>Maximum = -100%</td>
<td>Configurable: -10% to -30%</td>
</tr>
<tr>
<td>Voltage Interruption/Dropout</td>
<td>Minimum = 8ms</td>
<td>Minimum = -20%</td>
<td>Default: -20%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 1 minute</td>
<td>Maximum = -100%</td>
<td>Configurable: -20% to -30%</td>
</tr>
<tr>
<td>Voltage Harmonics (VTHD)</td>
<td>Minimum = 100ms</td>
<td>Minimum = +5%</td>
<td>Default: +5%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 49.71 days</td>
<td>Maximum = No Max</td>
<td>Configurable: +5% to +25%</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>Minimum = 1 minute</td>
<td>Minimum = +10%</td>
<td>Default: +10%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 49.71 days</td>
<td>Maximum = No Max</td>
<td>Configurable: +10% to +40%</td>
</tr>
<tr>
<td>Temporary Overvoltage (TOV)</td>
<td>Minimum = 0.5ms</td>
<td>Minimum = +40%</td>
<td>Default: +40%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 8ms</td>
<td>Maximum = No Max</td>
<td>Configurable: +40% to +80%</td>
</tr>
<tr>
<td>Over/Under Frequency</td>
<td>Minimum = 8ms</td>
<td>Minimum = +1%</td>
<td>Default: ±1%</td>
</tr>
<tr>
<td></td>
<td>Maximum = 49.71 days</td>
<td>Maximum = +10%</td>
<td>Configurable: ±1% to ±10%</td>
</tr>
<tr>
<td>Neutral Bond</td>
<td>Minimum = 8ms</td>
<td>Minimum = 10V</td>
<td>Default: 10V</td>
</tr>
<tr>
<td></td>
<td>Maximum = 49.71 days</td>
<td>Maximum = No Max</td>
<td>Configurable: 10V to 30V</td>
</tr>
</tbody>
</table>

### 7.5 Category A, B, & C Surge Events

When the SPD detects a surge/transient, the SPD’s Active Surge Monitor automatically records a new event and details the phase, the event duration, and the severity (the amount of let-through voltage after the SPD has performed its function).

The surge/transient event is categorized by the ASM as a Category A, B, or C surge event. Industry standard ANSI/IEEE C62.41 categories, the SPD source voltage, event let-through voltage, & SPD performance ratings are referenced when categorizing surge events.

<table>
<thead>
<tr>
<th>Category</th>
<th>Surge Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Surge events less than [6kV, 3kA]</td>
</tr>
<tr>
<td>B</td>
<td>Surge event between [6kV, 3kA] and [20kV, 10kA]</td>
</tr>
<tr>
<td>C</td>
<td>Surge event greater than [20kV, 10kA]</td>
</tr>
</tbody>
</table>
8.0 Troubleshooting

If any of the diagnostic indicators indicates a problem (i.e. red LED ON, and/or green LED OUT):
1. Navigate through the units display screens (or the Measurements webpage) to determine what event the system is indicating.
2. If a source voltage problem exists, check all wiring connections.
3. If the unit is indicating an existing “SAG” or “SWELL” condition, check the configurable trigger levels. See 5.4.2 – Event Settings.
4. If proper voltages are being supplied to all phases of the unit, remove all AC power and restart.
5. If problem persists after power-up, call ASCO Surge Protection, Inc at 727-535-6339.

If the unit display screen encounters a problem:
1. Remove all AC power and restart unit.
2. Install the current version of the system Firmware. See 5.4.6 – Firmware Update for more information.
3. If problem persists after power-up, call ASCO Surge Protection, Inc at 727-535-6339.

If the system web pages encounter a problem:
1. Refresh screen (F5). Try this step multiple times before moving to step 2.
2. Check all network wiring connections.
3. Go to the units Networking screen to verify the current “ENET” status - see section 3.3 (#22) of this manual for further information.
4. Check with your network administrator for initial assistance.
5. Install the current version of the system Firmware if possible. See 5.4.6 – Firmware Update for more information.
6. If the issue does not appear to be within your network, call ASCO Power Technologies Surge Protection, Inc at 727-535-6339.

Firmware updates can be obtained by contacting the factory.

Website: www.ascopower.com/ASM
Email: customercare@ascopower.com
Phone: 800-237-4567 or 727-535-6339