



## **IEEE 802.3at and Pre-802.3bt PSE's**

End-Spans

Mid-Spans

PoE/PoE+ Connectors

Injectors

## **Fully Automated 802.3at PSE Conformance Test**

Comprehensive Hardware /  
Firmware DV Testing

Device Qualification

LLDP Protocol Analysis

Interoperability Analysis

Quality Assurance

## **Fully Automated PSE System Power Management Test**

PSE System and Power  
Management Verification

System Stability Analysis  
including PoE LLDP

PSE Administrative  
Responses up to 192\*  
802.3at PD's or 96\* 4-Pair  
PD's

## **High Throughput QA, Manufacturing**

Multi-Port Automation

Ready-to-Use, High  
Throughput Test Scripts

High Defect Coverage

## **Overview**

Power-over-Ethernet (PoE) challenges design and test engineers to evaluate multi-channel, "intelligent" DC power sources that are activated and deactivated through signaling protocols operating over several power delivery and polarity configurations. The application and management of DC power over multiple local area network connections must be completely transparent and non-disruptive to the traditional data transmission functions of those network connections.

### **One Box Solution**

Sifos Technologies provides a **one-box solution** to facilitate complete testing and analysis of Power Sourcing Equipment (PSE) behaviors including overall compliance to the **IEEE 802.3at** and future **802.3bt** specifications. Each test port inside a PowerSync Analyzer is an autonomous and fully isolated instrument offering a rich set of stimulus and measurement resources for 2-Pair PSE testing. Each test port pair (*or test blade*) can configure as an autonomous and fully isolated instrument for testing both **pre-802.3bt** and future **802.3bt** 4-Pair PSE's.

### **Automated PSE Conformance Testing**

The PSA-3248 may be optioned via a license key to run the world's most advanced **PSE Conformance Test Suite**. This fully automated application applies the PowerSync Analyzer's diverse resources to assess over 70 IEEE 802.3at specification parameters per port, presented in easily readable spreadsheet reports with multi-port statistics and clearly notated pass/fail limit analysis.

### **Automated PSE System Testing**

PSA-3248's may also be optioned via a license key to run the one-of-a-kind **PSE Multi-Port Suite**. This software offers flexible, programmable, simultaneous **Live PD Emulation** of up to 192 independent Powered Devices including 802.3at Type-2, LLDP capable devices and also supports live emulation of up to 96 pre-802.3bt (or proprietary) 4-Pair PD's. A fully automated second generation **Multi-Port Test Suite for 802.3at** evaluates PSE power allocation decisions and power management behaviors in response to multi-port PD loads including Type-2 PD's that negotiate power using PoE LLDP. Results are presented in colorful graphical reports.

### **LLDP Emulation**

The IEEE 802.3at specification describes a new generation of PSE's and Powered Devices (PD's) that communicate highly resolved power needs and power allocations using Ethernet layer 2 (LLDP) link protocols. The PSA-3248 may be optioned via a license key to flexibly emulate PD's and fully analyze the power negotiation protocols between PSE's and PD's.

### **Getting Ready for 4-Pair PoE (802.3bt)**

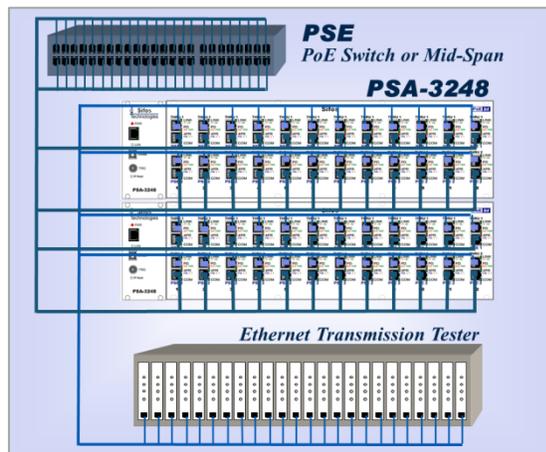
The PSA-3248 offers capability to fully emulate future 802.3bt compliant PD's. Under PowerShell Wish, users may configure and observe signaling during 802.3bt compliant 4-pair power-up sequences while connected to either test port. Emulations include single and dual signatures, multi-event classes, and flexible 4-pair loading to over 99 watts per test slot. A rich set of 4-pair load control and metering commands enable early generation 802.3bt PSE analysis today. The PSA-3248 also supports PD emulation and analysis of a variety of pre-standard 4-Pair PSE formats from PSA Interactive (GUI) and PowerShell PSA software environments.

\* Assumes up to 4 PSA-3248's combined  
into single Multi-Port Resource Configuration.

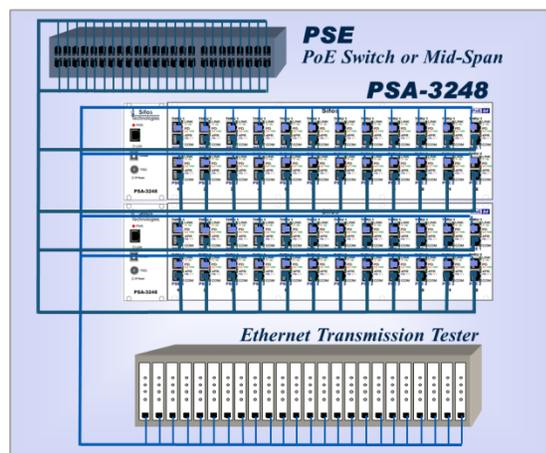
**Verification, Simplified.**

## PowerSync Analyzer Test Equipment Setups

### PSE DV, System, Mfg. Test



### Large PSE System QA



\* Available as an optional feature to the PSA-3248. See feature-specific data sheet.

### Per-Port PSE Test Resources

- Flexible 2-Pair & 4-Pair PD Detection & Class Emulation
- Flexible Loads and Load Transients
- Event or Edge Triggering of Load Transients & Measurements
- Average, Peak (Min/Max), and Trace Measurements of Port Voltage and Load Current with Flexible Sampling Apertures
- Standard One-Button Waveform Library for Rapid PSE Analysis and Conformance Troubleshooting (including 4-Pair PSE's)
- Flexibly Triggered, Noise-Immune Time Intervals / Slews
- O-Scope Graphical Waveforms (802.3at and 4-Pair PSE's)
- LAN Termination, LLDP Protocol Emulation and Tracing
- Concurrent Packet Transmission and PoE Load Testing
- External Trigger Input/Output
- 4-Pair PoE Loading and Analysis (per Test Slot)

### PSE System & Multi-Port Testing\*

- Fully Automated Multi-Port Test Suite for Type-1 and Type-2, including Type-2 LLDP PSE's up to 192 PSE Ports Covering:
  - Power Administration by PD Class and Port Group Subsets
  - Group Power-Up, Power Negotiation, and Disconnect Timing
  - Static Power Capacity by PD Type
  - Transient Reserve Capacity by PD Type
  - PD Power Budget Uncertainty by PD Class
  - Group Overload Response and Timing
  - Power Stress Tolerance
- Programmable Live PD Emulation Up to 192 Simultaneous 802.3at PD's (Type-1, Type-2, with or without LLDP) drawing up to 34 watts each
- Programmable Live PD Emulation Up to 96 Simultaneous 4-Pair PD's (with or without UPoE LLDP) drawing up to 95 watts each

### LLDP\*, PHY, Transmission Test Support

- Flexible, Per-Port, Programmable PD LLDP Emulation for PoE with Payload, Timing, & Synchronization Control
- Fully Automated LLDP Protocol Traces and Analysis
- PSE Side LLDP Emulation and Protocol Traces
- Cisco UPoE PD LLDP Support (PD Emulation)
- Test Port "Through" Channel for 10/100/1000 PHY Testing (using the Sifos PVA-3000) and Packet Transmission Testing
- Negligible Thru-Channel Impairment (10/100/1000/2.5GBase-T)

### PSE Conformance Suite\*

- High Coverage, Fully Automated IEEE 802.3at PSE Compliance Testing and Analysis (including LLDP)
- 23 PSE Tests Producing Over 70 802.3at Parameters / Port
- Automated Test and Port Sequencing with Comprehensive, Colorful Spreadsheet Reporting
- Automatically Adapts to PSE Device Technologies
- > 95% 802.3at PSE PICS Coverage
- Regularly Updated with Sifos Tracking Service Agreements

### Powerful Software

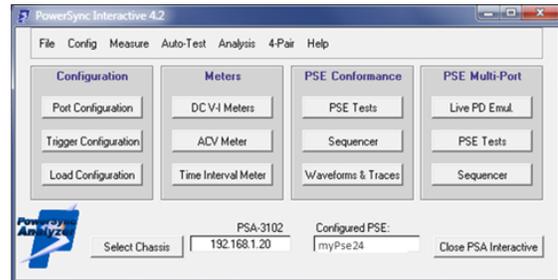
- PowerShell PSA Script Automation
- PSA Interactive Graphical User Interface\*
- Sample High Throughput, Multi-Port PSE Test Script

## PSA Interactive Graphical User Interface

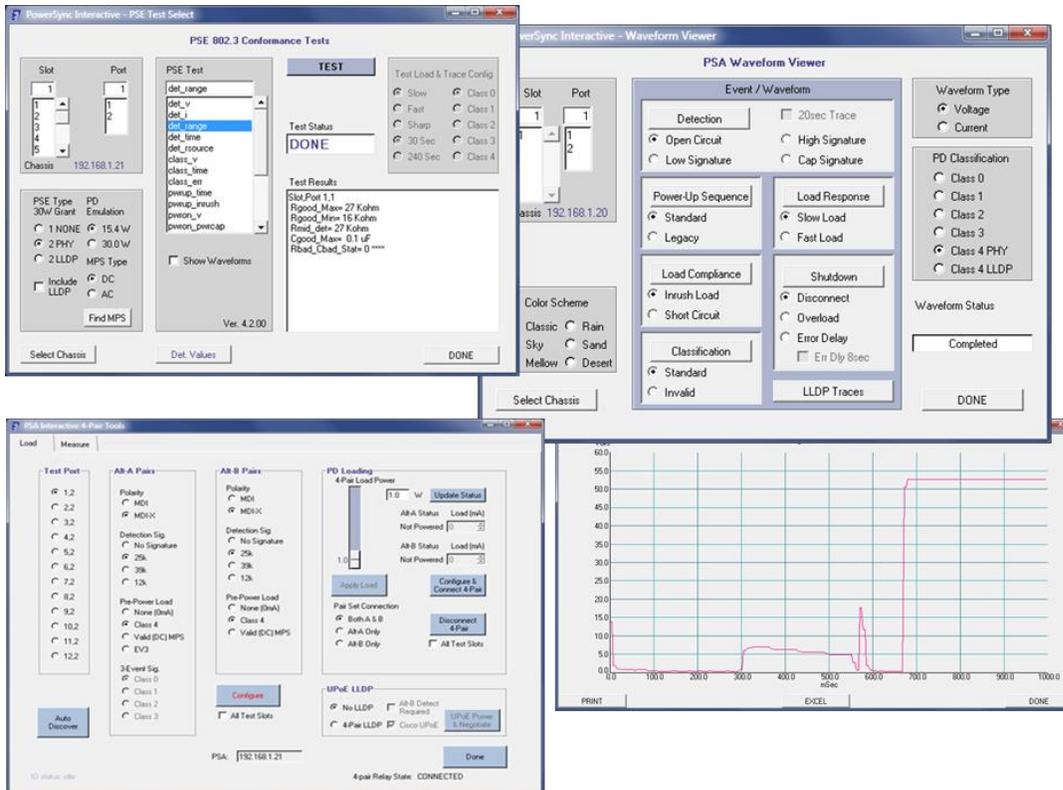
The optional Sifos **PSA Interactive** graphical user interface (GUI) is a flexible and powerful tool designed to allow user to quickly configure and perform both standard and user-defined measurements on IEEE 802.3 compliant power sourcing equipment (PSE). PSA Interactive provides an intuitive view of the full range of testing resources available within the PSA-3000 PowerSync Analyzer. Users can quickly harness the flexibility and power of these resources to perform design verification and diagnostic measurements or to prototype sequences that will eventually be automated in PowerShell PSA scripts.

PSA Interactive organizes PSA-3248 resources and testing features into a variety of distinct subsystems:

- Port Detection Configuration
- Trigger Configuration
- Load and Load Transient Configuration and Activation
- DC Meters (Average, Max Peak, Min Peak, and Trace Voltage and Current meters)
- AC Peak Voltage Meter
- Time Interval / Slew Rate Meter
- PSE Conformance Tests
- PSE Conformance Test Sequencer
- One-Button Standard Waveforms
- One-Button PD LLDP Emulation and Protocol Testing
- Multi-Port Live PD Emulation (*using up to 4 PSA-3248's*)
- PSE Multi-Port Tests (*using up to 4 PSA-3248's*)
- PSE Multi-Port Test Sequencer (*using up to 4 PSA-3248's*)
- Pre-802.3bt 4-Pair PSE Signature / Load Configurations and Metering (including Standard Waveforms)
- PSE LLDP Emulation / Testing
- “Quick-Test” PSE Fast Multi-Port PSE Verification



PSA Interactive Main Menu



PSA Interactive Menus for PSE Conformance Selected Test, Standard One-Button Waveform Analysis, and Pre-802.3bt 4-Pair PSE Signature and Load Configuration

## PowerShell PSA Tcl/Tk Interface

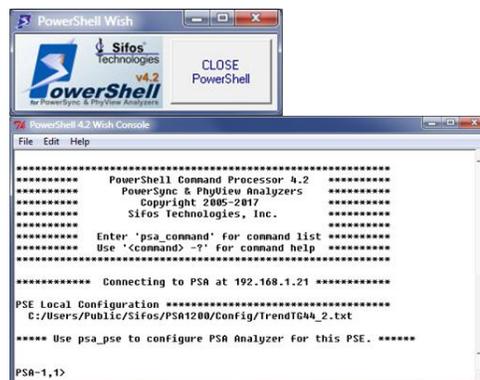
The PowerShell PSA Scripting Environment provides a high level, interactive means to control and program automated test sequences for the PSA-3248 PowerSync Analyzer. PowerShell enables fully automated testing suites that span multiple ports, blades, and instruments. Built upon the popular Tool Command Language (Tcl), it offers an extensive and extensible programming language well suited for automated testing.

PowerShell PSA provides a complete API for the PSA-3248 including high level commands that execute and sequence standard **802.3 PSE Conformance** and **Multi-Port System Test** suites. PowerShell PSA commands access all of the resources of the PSA-3248 and enable the rapid development of highly customized test scripts. PowerShell PSA supports off-line script development and debug through its robust built-in emulation mode.

PowerShell PSA libraries can be integrated into broader Tcl environments that interlace traditional network transmission tests with Power-over-Ethernet tests. This enables seamless integration of custom or standard PSE tests with existing Tcl-based test suites.

Other features offered by the PowerShell PSA environment include:

- Interpretive command execution (no compilation, easy debug)
- Simple, intuitive PowerSync Analyzer commands (API)
- Integrated and extensive command “help” features
- Fast test execution speeds
- DUT-specific configuration files to configure settings
- Sequencing of test suite sequences
- DUT-specific report routing
- Use sided-by-side with PSA Interactive GUI
- Notepad++ Editor Extension for PowerShell PSA Development
- Command-Knowledgeable Wish Console with PSA waveform viewer capability
- Traditional Tcl Command Console



PowerShell Wish Console

## IEEE 802.3 PSE Conformance Test Suite

The IEEE 802.3at PSE Conformance Test Suite is a library of **fully automated, flexibly sequenced, and self-adapting** tests that provide a high degree of specification compliance testing on PSE ports without the need for any external instrumentation. The PSE Conformance Test Suite may be used to fully assess interoperability of one or more PSE ports given a single button press or single command. Colorful Microsoft Excel spreadsheet reports analyze all test results relative to IEEE 802.3at specification parameters, flagging failures and compiling statistics.

The PSE Conformance Test Suite serves as a virtual industry standard for PSE specification compliance. Testing can be completed without deep, internal knowledge of the 802.3at standard and without high expertise in PSA-3248 capabilities. Test coverage **exceeds 95%** of 802.3at PSE PICS.

See Sifos datasheet, **PSE Conformance Test Product Overview**, for further information regarding the 802.3at PSE Conformance Test Suite.

## PSE Multi-Port Suite

While IEEE 802.3at describes a PSE as a single port device, most PSE's are multi-port systems such as Ethernet switches. This fact leads to the need for system test methods and tools to assess PSE behavior across a multitude of ports. The **PSE Multi-Port Suite** offers two fundamental testing capabilities that address this need.

**Multi-Port PD Emulation** turns every PSA-3248 test port into an emulated Powered Device where behaviors such as static power load, PD classification, line power loss, and even PoE LLDP protocol characteristics are modeled simultaneously across as many as 192 PSA ports. Type-1 ( $\leq 13W$ ) and Type-2 ( $\leq 25.5W$ ) PD's may be emulated. See Sifos datasheet, **Multi-Port Live PD Emulation Overview**, for further information on Live PD Emulation.

The **Multi-Port Test Suite** is a set of fully automated tests and reporting that takes the PSA-3248 into the realm of fully automated 802.3at PSE System Power Management and Multi-Port Stimulus-Response testing. The Multi-Port Test Suite assesses system-wide behaviors only observable when many IEEE 802.3at PD's are powered by a PSE. The test suite will acquire and distill information regarding key behaviors of a PSE including **class-based power administration**, multi-port **LLDP granting**, power-up and LLDP grant timing, **static power** capacity, **transient reserve** capacity, power down timing, power-per-port **uniformity and uncertainty**, and power **stress test** analyses. Results are presented in colorful, graphical spreadsheet reports. See Sifos datasheet, **Multi-Port 2 Test Suite Overview**, for further information about this test suite.

## PoE LLDP Emulation and Analysis

The PSA-3248 includes a subsystem designed to flexibly emulate LLDP capable PD's on a per test port basis. Fully automated applications allow in depth capture and analysis of protocol between the PSE and the PD.

See Sifos datasheet, **LLDP Emulation and Analysis Overview**, for further information on this topic.

| Time    | From | To  | Type | Requested | Allocated | Port Class | MDI Capability | MDI Status | PowerClass | Source  | Priority |
|---------|------|-----|------|-----------|-----------|------------|----------------|------------|------------|---------|----------|
| PWR=2.4 | PSE  | PD  | 2    | 13.0      | 13.0      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 0.0     | PD   | PSE | 2    | 20.3      | 13.0      | PD         | N/A            | N/A        | 4          | PSE     | LOW      |
| 2.1     | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 3.0     | PD   | PSE | 2    | 20.3      | 20.3      | PD         | N/A            | N/A        | 4          | PSE     | LOW      |
| 5.9     | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 12.0    | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 14.0    | PD   | PSE | 2    | 20.3      | 20.3      | PD         | N/A            | N/A        | 4          | PSE     | LOW      |
| 16.3    | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 24.5    | PD   | PSE | 2    | 20.3      | 20.3      | PD         | N/A            | N/A        | 4          | PSE     | LOW      |
| 26.8    | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 34.9    | PD   | PSE | 2    | 20.3      | 20.3      | PD         | N/A            | N/A        | 4          | PSE     | LOW      |
| 37.2    | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |
| 42.2    | PSE  | PD  | 2    | 20.3      | 20.3      | PSE        | YES            | ON         | 4          | PRIMARY | LOW      |

LLDP Protocol Trace

## Multi-Port High Throughput PSE Verification

The PSA-3248 is provided with a sample PSE automated test script, **psa\_quick\_test**, that recovers critical PoE parameters from PSE ports with an effective test throughput of less than 15 seconds per tested port. This application can be used in both QA and manufacturing test to *rapidly* qualify PSE functional performance.

Important features of the **psa\_quick\_test** include:

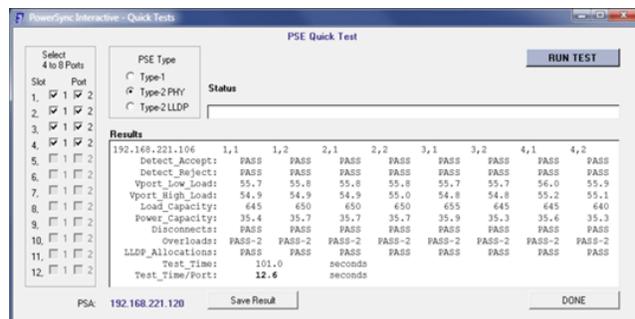
- **Source Code Provided:** May be used as is, may be modified, or may be used as template script
- Scans 4 to 8 PSE ports per test cycle
- Tests **Type-1**, **Type-2 (2-event)**, and **Type-2 (LLDP\*)** PSE's
- Validates PoE **Detection Acceptance** and **Rejection** Ranges
- Measures PSE **Port Voltage** at min. and max. load conditions
- Determines **Power Capacity** in Watts and mA
- Assesses **Disconnect Power Removal** response and timing
- Assesses **Overload Power Removal** and **Power-Type** Threshold
- Assesses **LLDP Power Allocations\*** and associated timing

Typical test times will range from 8 to 14 seconds per port tested, even when testing Type-2 LLDP capable PSE's.

```
PSA-1,1>psa_quick_test 1,1 1,2 2,1 2,2 3,1 3,2 4,1 4,2 type-2 lldp
TESTING WITH 192.168.221.106 ON PORTS 1,1 1,2 2,1 2,2 3,1 3,2 4,1 4,2
EVALUATING DETECTION REJECT SIGNATURES...
EVALUATING DETECTION ACCEPT, LOW LOAD Vport, AND DISCONNECTS...
EVALUATING DETECTION ACCEPT, HIGH LOAD Vport, CAPACITY, & OVERLOADS...
ASSESSING LLDP POWER-UPS...
REQUESTING FULL TYPE-2 POWER...
ASSESSING LLDP ALLOCATIONS...

192.168.221.106      1,1      1,2      2,1      2,2      3,1      3,2      4,1      4,2
Detect_Accept:      PASS      PASS      PASS      PASS      PASS      PASS      PASS      PASS
Detect_Reject:      PASS      PASS      PASS      PASS      PASS      PASS      PASS      PASS
Vport_Low_Load:    55.7      55.8      55.8      55.8      55.7      55.7      56.0      55.9
Vport_High_Load:   54.9      54.9      54.9      55.0      54.8      54.8      55.2      55.1
Load_Capacity:     645      650      650      650      655      645      645      640
Power_Capacity:    35.4      35.7      35.7      35.9      35.9      35.3      35.6      35.3
Disconnects:       PASS      PASS      PASS      PASS      PASS      PASS      PASS      PASS
Overloads:         PASS-2   PASS-2   PASS-2   PASS-2   PASS-2   PASS-2   PASS-2   PASS-2
LLDP_Allocations:  PASS      PASS      PASS      PASS      PASS      PASS      PASS      PASS
Test_Time:         101.0      seconds
Test_Time/Port:    12.6      seconds
```

Automated Manufacturing/QA PowerShell Test Script, **psa\_quick\_test**



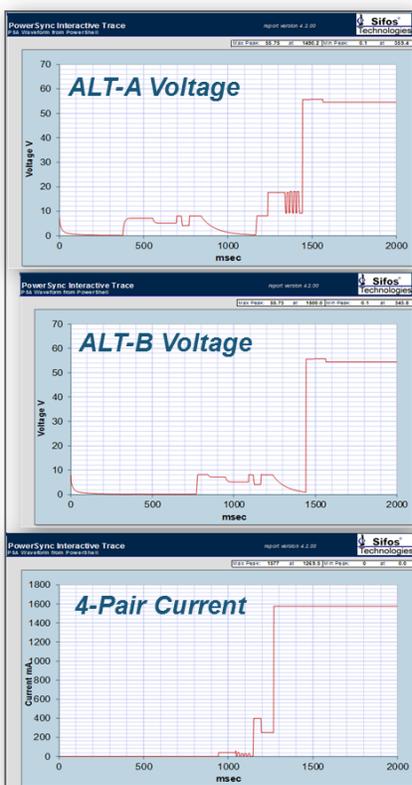
\* LLDP testing requires PoE LLDP Emulation and Analysis feature.

PSA Quick Test Menu

## 802.3bt Powering Emulations & Analysis

The PSA-3248 is hardware and firmware ready for IEEE 802.3bt PSE testing and PD emulation. Features for analysis of 802.3bt PSE's include:

- 4-Pair Testing from **Either** Port 1 or Port 2
- Emulate 802.3bt **Single** and **Dual Detection** Signatures
- Accurately and Flexibly Emulate 802.3bt **Class 5, 6, 7, and 8 Single Signature** PD's with 4-Pair Loading Over 99 Watts per Test Blade (Up to 12 test blades per PSA chassis)
- Accurately and Flexibly Emulate 802.3bt **Dual Class 1, 2, 3, 4, and 5 Signature** PD's with Class and Load defined per Pairset
- Accurately Emulate 802.3bt **Pair Unbalance** Loads from 0% to 100%
- Accurately Emulate 802.3bt **Auto-Class** Signatures and Loading
- Reliable Multi-Event Edge Transition De-bouncing
- Accurately Emulate Minimum DC MPS Low-Power Loading Cases

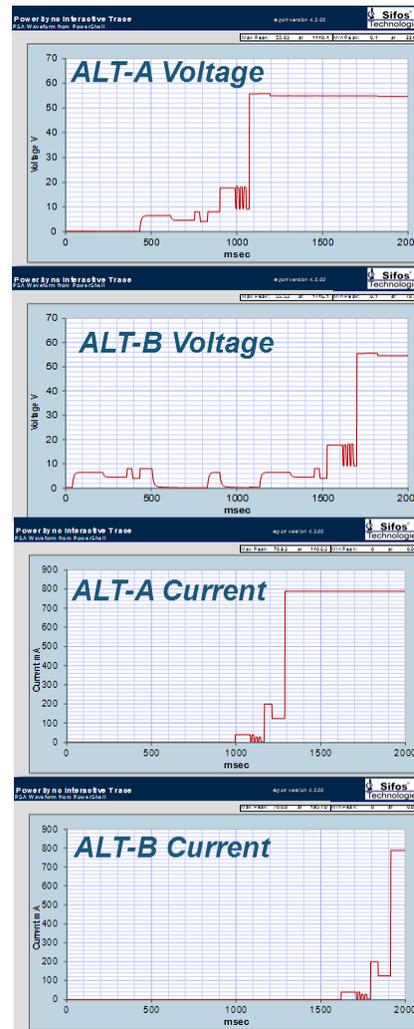


802.3bt Class 8, 90W Power-Up

Each of these features are available in PowerShell PSA version 4.2 (see above). Over time, they will be incorporated into PSA Interactive and eventually into fully automated test suites for 802.3bt PSE Conformance and Multi-Port System testing. Additionally, LLDP will be extended to support PoE LLDP extensions associated with the 802.3bt standard.

The waveforms here depict two 802.3bt emulated power-ups performed using a single command, `power_bt` in PowerShell PSA. One power-up is an emulated 802.3bt Class 8 PD drawing 90 watts while the second power-up emulates an 802.3bt dual Class 5 PD that also draws 90W at the PSE.

These waveforms are optionally produced by the `power_bt` command.



802.3bt Dual Class 5, 90W Power-Up

## Technical Data: PSA-3248

| LAN Interface Specifications                 |                         |                          |   |
|--|-------------------------|--------------------------|---|
| Operating Mode                               | Signal Path             | Parameter                | Specification   |
| Data Through Mode                            | PSE # to THRU #         | Connections              | RJ45  |
|  |                         | Data Rates and Signaling | 10/100/1000BaseT/2.5GBaseT<br>5GBase-T, 10GBase-T with minor impairment |
|  |                         | Latency                  | None - Passively Coupled  |
|  |                         | Impedance                | 100Ω, Balanced  |
|  |                         | Pair-Pair Isolation      | ≥ 36dB @ 100MHz   |
|  |                         | Insertion Loss           | ≤ 2dB, 0.1MHz to 100 MHz  |
|  |                         | Insertion Loss Variation | ≤ 0.75dB, 0.1MHz to 100 MHz   |
| Return Loss (THRU port terminated into 100Ω) | ≤ -24dB, 1MHz to 100MHz |                          |   |

| LAN Interface Specifications       |                            |                         |                           |
|------------------------------------|----------------------------|-------------------------|---------------------------|
| Operating Mode                     | Signal Path                | Parameter               | Specification             |
| Data Connect (LLDP Emulation) Mode | PSE-# to Blade Transceiver | Connection              | RJ45                      |
|                                    |                            | Data Rate and Signaling | 10/100Base-T              |
|                                    |                            | Orientation             | MDI End Point             |
|                                    |                            | Protocol                | 802.1ab, 802.3bc, 802.3at |
|                                    |                            | Impedance               | 100Ω, Balanced            |
|                                    |                            | Return Loss             | ≤-20dB, 1MHz to 100MHz    |

| PoE Port Connections |  |                          |   |
|----------------------|--|--------------------------|---|
| Operating Mode       | Dependency   | Parameter                | Selections                                  |
| 2-Pair Power         | Port 1 and Port 2 operate independently                                    | Powered Pair             | ALT-A or ALT-B                              |
|                      |  | Polarity                 | MDI or MDI-X                                |
| 4-Pair Power:        | Connect to Port 1 (Port 2 disabled) or Connect to Port 2 (Port 1 disabled) | ALT-A Polarity (Port 2)  | MDI or MDI-X                                |
|                      |  | ALT-B Polarity (Port 1)  | MDI or MDI-X                                |
|                      |  | Detection Signature Type | Single (Port 1) or Dual (Port 1 and Port 2) |

| Detection and AC MPS Specifications   |   |  |                        |
|---------------------------------------|---|--|------------------------|
| Description                           | Conditions  | Parameter  | Specification          |
| Detection Resistance                  | Vport = 2.5VDC - 12VDC, Port Connected, Transition Current Load = 0 | Range  | 9 KΩ to 39 KΩ          |
|                                       |   | Resolution   | 1 KW                   |
|                                       |   | Accuracy vs Setting<br>$\Delta V / \Delta I$ at 4.5 Volt Spacing | ±1.75% + 300Ω          |
| Detection Capacitance                 | Vport = 2.5VDC - 12VDC, Port Connected, Transition Current Load = 0 | Range  | 0.14, 5, 7, 11mF       |
|                                       |   | Accuracy   | ±15%                   |
| Detection Signature Cut-Off Threshold | Port Connected  | Vport  | 12V ± 2%               |
| AC MPS Signature                      | Vport = 12VDC - 60VDC, Port Connected                               | AC Impedance   | 24KΩ    (0.1μF + 330Ω) |
|                                       |   | Resistance Accuracy<br>$\Delta V / \Delta I$ at 2 Volt Spacing   | 22.8KΩ ± 250Ω          |
|                                       | Port Isolated   | AC Impedance (< 500 Hz)  | > 1.1 MΩ               |
|                                       |   | AC Impedance (< 120 Hz)  | > 3.0 MΩ               |

| Current Load Specifications      |                                       |                             |  |
|----------------------------------|---------------------------------------|-----------------------------|--|
| Description                      | Conditions                            | Parameter                   | Specification  |
| Load Current                     | Per Powered (or classifying) Pair     | Range                       | 0 to 950 mA  |
|                                  |                                       | Resolution                  | 0.25 mA  |
|                                  |                                       | Accuracy                    | ± (0.5% setting + 0.25mA)                                  |
|                                  |                                       | Slew Rates                  | > 4mA / μsec   |
|                                  |                                       | Activation Voltage          | 15V, Rising Vport  |
|                                  |                                       | De-Activation Voltage       | 14V, Falling Vport   |
| Transition (Mark Region) Current | Load Current Active, Per Powered Pair | Range                       | 0 to 400 mA  |
|                                  |                                       | Resolution                  | 0.25 mA  |
|                                  |                                       | Accuracy                    | ± (0.5% setting + 0.25mA)                                  |
|                                  |                                       | Slew Rates                  | > 4mA / μsec   |
|                                  |                                       | De-Activation Voltage       | 4.5V, Falling Vport  |
| Multi-Event Classification       | Multi-Event Activated, Vport > 15VDC  | 802.3bt Signatures Emulated | Single Signature Class 5 - 8<br>Dual Signature Class 1 - 5 |
|                                  |                                       | Non-Standard Signatures     | Class Current per Event                                    |
|                                  |                                       | 802.3bt Auto-Class          | 2mA @ 80msec of LCE1                                       |
|                                  |                                       | Multi-Event Activation      | psa_connect or mclass                                      |
|                                  |                                       | Multi-Event Deactivation    | psa_disconnect or mclass                                   |
|                                  |                                       | Multi-Event Timeout         | 100 msec @ > 15V   |

| Current Load Specifications                      |                          |   |  |
|--|--------------------------|---|--|
| Description                                      | Conditions               | Parameter   | Specification                          |
|  |                          | Event Start Glitch De-bounce                                      | 150µsec                                |
|  |                          | Mark and Idle Transition Glitch De-bounce                         | 500µsec                                |
|  |                          | Event Count Reset Condition                                       | < 4.5V for > 500µsec                   |
|  |                          | Power-On Expiration (default)                                     | 115 msec                               |
| Configurable Load Transient                      | Vport > 15VDC            | Sequential Load Steps   | 2                                      |
|  |                          | Transient Sequence Repeats  | 0 to 4                                 |
|  |                          | Load Step 1 Range   | 0 to 1800 mA                           |
|  |                          | Load Step 2 Range   | 0 to 950 mA                            |
|  |                          | Resolution (0 – 1023 mA)  | 0.25 mA                                |
|  |                          | Resolution > 1023 mA  | 0.50 mA                                |
|  |                          | Accuracy  | ± (1% setting + 0.5mA)                 |
|  |                          | Slew Rate   | < 10mA / µsec                          |
|  |                          | Step 1 Duration < 1024 mA   | 200 µsec to 1 sec                      |
|  |                          | Step 1 Duration > 1023 mA   | 200 µsec to 80 msec                    |
|  |                          | Step 2 Duration<br>Load Step 1 < 1024 mA<br>Load Step 1 > 1023 mA | 20 µsec to 1 sec (or persist)<br>1 sec |
|  |                          | Step Resolution   | 100 µs                                 |
|  |                          | Trigger Modes: < 1024 mA<br>> 1023 mA                             | Immediate, Edge, Event<br>Immediate    |
|  |                          | Active Load Resistance  | 37 Ω                                   |
| Foldback Suppression Min. Port Voltage (@ 400mA) | 30 VDC                   |   |  |
| Foldback Suppression Duration                    | Step 1 + Step 2 Duration |   |  |

| DC Metering Specifications |   |                                    |   |
|----------------------------|---|------------------------------------|---|
| Description                | Conditions  | Parameter                          | Specification   |
| Voltage Meter              | Average,<br>Max-Peak,<br>Min-Peak,<br>Scope Trace       | Voltage Range                      | 0 - 60V   |
|                            |   | Aperture or Trace Length           | 256 Samples (10ms, 20ms, 0ms...10s)                                   |
|                            |   | Extended Trace Length <sup>3</sup> | 1024 Samples (200ms, 2s, 4s, 8s, 20s)                                 |
|                            |   | Sample Rates                       | 39.1 µsec - 39.1 msec (1,2,5 steps)                                   |
|                            |   | Resolution                         | 16 mV   |
|                            |   | Displayed Resolution               | Avg & Peak: 2 decimal places<br>O-scope Traces: 25 mV                 |
|                            |   | Accuracy <sup>1</sup>              | > 30VDC: ± (1.5% reading + 16mV)<br>< 30VDC: ± (2.0% reading + 16 mV) |
| Current Meter              | Average,<br>Max-Peak,<br>Min-Peak,<br>Scope Trace       | Measurement Triggers               | Immediate, Edge, Event,<br>Power-Up ( <i>traces only</i> )            |
|                            |   | Current Range                      | 0 – 2000 mA   |
|                            |   | Aperture or Trace Length           | 256 Samples (10ms, 20ms, 50ms...10s)                                  |
|                            |   | Extended Trace Length <sup>3</sup> | 1024 Samples (200ms, 2s, 4s, 8s, 20s)                                 |
|                            |   | Sample Rates                       | 39.1 µsec - 39.1 msec (1,2,5 steps)                                   |
|                            |   | Resolution (0– 1023 mA)            | 0.25mA  |
|                            |   | Resolution (1024–2000 mA)          | 0.5mA   |
|                            |   | Accuracy <sup>2</sup>              | ± (0.5% reading + 0.5mA)  |
| Triggers                   | Immediate, Edge, Event, Power-Up ( <i>traces only</i> ) |                                    |   |

1. Does not include Voltage drop due to cable losses and 0.45Ω maximum test port input resistance.
2. Does not include Port-Connected MPS current, which is approximately (Vport - 12V)/24kΩ.
3. Scope Traces only - require PSA controller firmware 3.10 or newer.

| AC Metering Specifications |                        |                           |               |
|----------------------------|------------------------|---------------------------|---------------|
| Description                | Conditions             | Parameter                 | Specification |
| AC Peak-Peak Meter         | Low Band, VDC= 40-57V  | Accuracy, 25Hz – 325Hz    | -15%, +11%    |
|                            |                        | Accuracy, 50Hz – 300Hz    | -7.5%, +11%   |
|                            | High Band, VDC= 40-57V | Accuracy, 2.5KHz – 250KHz | -15%, +7%     |
|                            |                        | Accuracy, 20KHz – 250KHz  | -6%, +7%      |
|                            | Full Band, VDC= 40-57V | Accuracy, 50Hz – 250KHz   | -7.5%, +8.5%  |
| All Bands, VDC= 40-57V     | Resolution             | 1mV                       |               |
|                            | Range                  | 1Vp-p                     |               |
|                            | Input Impedance        | 0.05 $\mu$ F <sup>1</sup> |               |

1. Input impedance models the lowest possible PD input capacitance – measurements are therefore affected by the effective source impedance of the PSE, including any frequency specific variations in that source impedance.

| Triggering Specifications |                        |  |                  |
|---------------------------|------------------------|--|------------------|
| Description               | Conditions             | Parameter  | Specification    |
| Edge & Event Triggers     | All Modes              | Range  | 0.25V - 59.5V    |
|                           |                        | Resolution   | 0.125 mV         |
|                           |                        | Accuracy (relative to DC Meter)  | $\pm$ 0.0625 mV  |
|                           |                        | Trig1 to Meter or Transient Latency  | ~ 50 $\mu$ secs  |
|                           |                        | Event Trigger Latency  | < 500 $\mu$ secs |
|                           | Trigger Noise Immunity | Pre-Trigger Qualification Time<br>(Voltage below Rising threshold or<br>above Falling threshold) | 1.5 msec         |
|                           |                        | Normal Mode Edge Noise Rejection   | 125 mV           |
|                           |                        | Noisy Mode Edge Noise Rejection  | 500 mV           |

| Time Interval Metering Specifications |                             |                                  |                    |
|---------------------------------------|-----------------------------|----------------------------------|--------------------|
| Description                           | Conditions                  | Parameter                        | Specification      |
| Time Interval Meter                   | Microsecond scale           | Time Range                       | 4 – 26200 $\mu$ s  |
|                                       |                             | Time Resolution                  | 1 $\mu$ sec        |
|                                       |                             | Time Accuracy                    | $\pm$ 2 $\mu$ secs |
|                                       |                             | Min. Resolvable Time Interval    | ~ 4 $\mu$ secs     |
|                                       | Millisecond scale           | Time Range                       | 2-6550 msec        |
|                                       |                             | Time Resolution                  | 0.1 msec           |
|                                       |                             | Time Accuracy                    | $\pm$ 1 msec       |
|                                       |                             | Min. Resolvable Time Interval    | 2 msec             |
|                                       | Second Scale                | Time Range                       | 0.1 – 16.1 sec     |
|                                       |                             | Time Resolution                  | 0.1 sec            |
|                                       |                             | Time Accuracy                    | $\pm$ 50 msec      |
|                                       |                             | Min. Resolvable Time Interval    | 0.1 sec            |
|                                       | Triggering & Noise Immunity | Start Trigger                    | Edge or Event      |
|                                       |                             | Stop Trigger                     | Edge               |
|                                       |                             | Normal Mode Edge Noise Rejection | 125 mV             |
|                                       |                             | Noisy Mode Edge Noise Rejection  | 500 mV             |

| LED Indicators |                             |   |
|----------------|-----------------------------|---|
| LED Label      | Parameter                   | Description   |
| LINK           | LLDP Link Status & Activity | <b>GREEN:</b> Linked at 100Base-Tx for LLDP, Blink with Activity<br><b>AMBER:</b> Linked at 10Base-T for LLDP, Blink with Activity<br><b>OFF:</b> Unlinked (or Disconnected)        |
| PD             | PoE Power Status            | <b>GREEN:</b> PSE powered with Vport > 36 VDC<br><b>AMBER:</b> Valid 802.3 Detection Signature Connected (No PSE Power)<br><b>OFF:</b> PSE not powered & PD signature not connected |
| 4PR            | Test Port Mode              | <b>GREEN:</b> Test port configured for 4-Pair powering<br><b>AMBER:</b> Opposite test port configured for 4-Pair powering<br><b>OFF:</b> Test port configured for 2-Pair powering   |
| COM            | Communications              | <b>ON:</b> Indicates active communications with test port   |

| Programming and Control      |   |
|------------------------------|---|
| Description                  | Specification   |
| Interface                    | Ethernet 10/100BaseT (Telnet Port 23 protocols)<br><b>NOTE:</b> The <b>Console</b> interface is for IP Address config only. |
| Host Requirements            | PC running Microsoft Windows XP, Vista, 7, 8, 10, or Linux PC (Fedora, SUSE, Debian)  |
| Control Environment          | Sifos PowerShell PSA or PSA-Interactive   |
| Recommended Network Latency: | < 5 msec  |

| Physical and Environmental    |   |
|-------------------------------|---|
| Description                   | Specification   |
| Dimensions                    | 19"W x 5.25"H x 12"L (3U Rack Mount)  |
| Weight                        | 20.4 lbs. per Chassis   |
| Power                         | 100VAC-240VAC, 50-60 Hz, 1.35A Max.   |
| Ambient Operating Temperature | 0°C to 40°C (≤ 100W combined PoE loading per test blade or 50W per test port) |
| Storage Temperature           | -20°C to 85°C   |
| Operating Humidity            | 5% to 95% RH, Non-Condensing.   |

| Certifications  |  |   |
|---|--|---|
| Description   | North America                            | Europe & International  |
| Emissions   | FCC Part 15, Class A                     | Meets EN55011<br>VCCI, AS/NZS 3548, ICES-001  |
| Safety  | <b>CSA Listed</b><br>(CSA22.2 No. 61010) | Meets EN61010-1<br>CB Scheme IEC 61010-1  |
| European Commission   |  | Low Voltage Directive (2014/35/EU)<br>Electromagnetic Compatibility Directive (2014/30/EU)<br><b>CE Marking</b> Directive (93/68/EEC) |
| <p>FCC Statement:<br/>This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.</p> |  |   |

## Ordering Information

**PSA-3248**, PowerSync Analyzer RackPack PSA including (24) PSA-3202 test blades and PowerShell PSA

**PSA-3248-GUI**, PSA Interactive Graphical User Interface Software for PSA-3248

**PSA-LLDP**, LLDP Emulation and Analysis Feature for One PSA Controller

**PSA-CT**, IEEE 802.3at PSE Conformance Test Suite for One PSA Controller (Up to 24 Test Ports)\*

**PSA-TS1**, IEEE 802.3at PSE Conformance Suite Tracking Service for One Year

**PSA-TS2**, IEEE 802.3at PSE Conformance Suite Tracking Service for Two Years

**PSA-MPT**, IEEE 802.3at PSE Multi-Port Test Suite for One PSA Controller (Up to 24 Test Ports)\*

**Accessories Included:**

- Installation Guide & Configuration Chart
- PowerSync Analyzer Reference Manual (Binder and CD)
- Power Cord
- Cross-Over Ethernet Cable
- RS-232 or USB Cable

\* **Note:** There are 2 PSA Controllers per PSA-3248 RackPack PSA

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