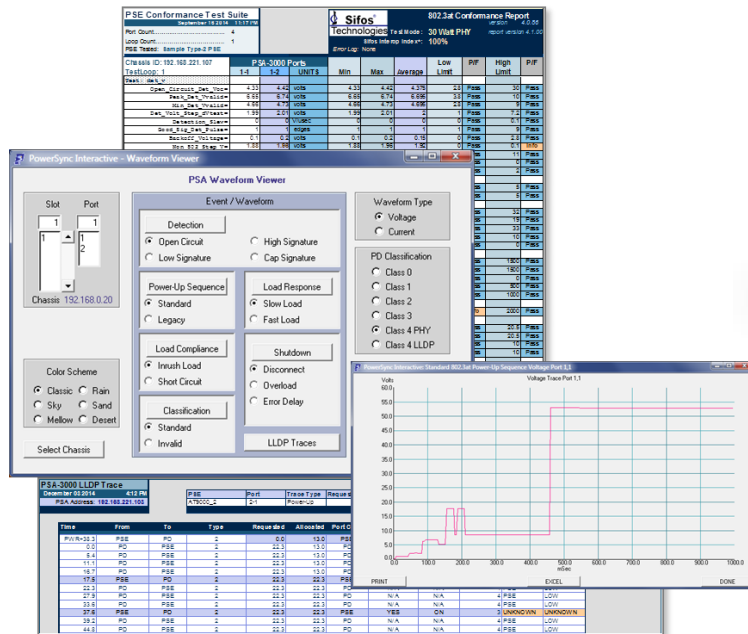# Sifos® Technologies

# PSA-3002
## Compact PowerSync® Analyzer
**IEEE 802.3at Power over Ethernet**

### *Product Overview*



## Key Features

- ☐ **Industry Leading IEEE 802.3at PoE PSE Conformance Tests**
- ☐ **Replaces All General Purpose Test Equipment & Fixtures**
- ☐ **Small, Light Weight, Transportable**
- ☐ **Continuous PSE Loading > 42 Watts Per Test Port (2 Test Ports)**
- ☐ **Continuous 4-Pair PSE Loading to 75 Watts (Single Port)**
- ☐ **One-Button 2-Pair and 4-Pair PSE Waveform Analysis**
- ☐ **Flexible Powered Device LLDP Emulation and LLDP Analysis**
- ☐ **Flexible and Accurate Measurements of Voltage, Current, Noise**
- ☐ **Noise Immune Triggering, Transients, and Time Interval Measurements**
- ☐ **Supports PSE Packet Transmission Testing with PoE Loads**
- ☐ **High Level Script Automation and Graphical User Interface**
- ☐ **Software Compatible with Sifos PSA-3000 Family**

## *Verification, Simplified.*

## 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**

## Compact but Capable

**Visualize Common 802.3at and pre-802.bt (4-Pair) PSE Behaviors and Responses**

**Prototype Tests and Software for PSA-3000**

**Troubleshoot PSE Ports Anywhere**

## Portable PoE Service Analyzer

**Automated PoE Service Outlet Interoperability Analysis**

## 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 and overall compliance to the **IEEE 802.3at** specification.   Each test port inside a PowerSync Analyzer is an autonomous and fully isolated instrument offering a rich set of stimulus and measurement resources. Test ports are configured and controlled via a high level automation interface, **PowerShell PSA**, and may also be accessed and managed from an intuitive graphical user interface, **PSA Interactive**.

### Automated PSE Conformance Testing
The PSA-3002 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 port statistics and clearly notated pass/fail limit analysis.

### 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-3002 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-3002 has the ability to internally combine both test port resources for the purpose of emulating a variety of 4-Pair PD signatures and power loads with continuous power loading up to 75 watts.  4-Pair metering of load power, load current, voltage-per-pair, power-per-pair, and current-per-pair is readily accessed through menus in **PSA Interactive** and through high level **PowerShell PSA** commands.  PSA Interactive offers Standard Waveforms to allow visual analysis of PSE signaling, power-up, load response, disconnect (2 or 4 pair), and overload (2 or 4 pair) responses.   PD emulation is flexibly configured to work with a variety of proprietary 4-Pair PSE's including UPoE PSE's deploying extended LLDP protocols for 4-pair powering.

### Start Small and Grow
The PSA-3002 is well suited to early device qualification and design verification applications as well as to field application and support activities.  Test plans and software developed with the PSA-3002 are readily extendable into PSA-3000 (24-port) and PSA-3048 (48-port) test platforms.
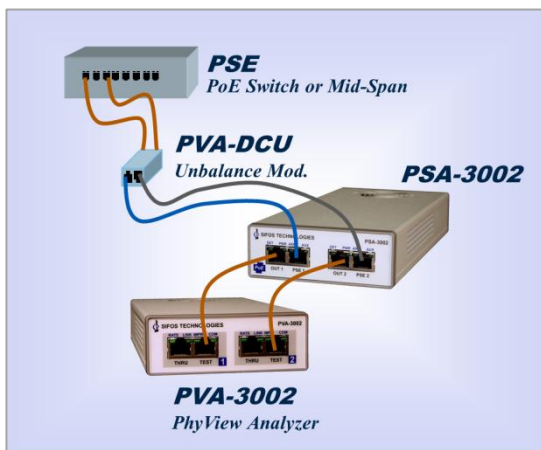
**Verification, Simplified.**
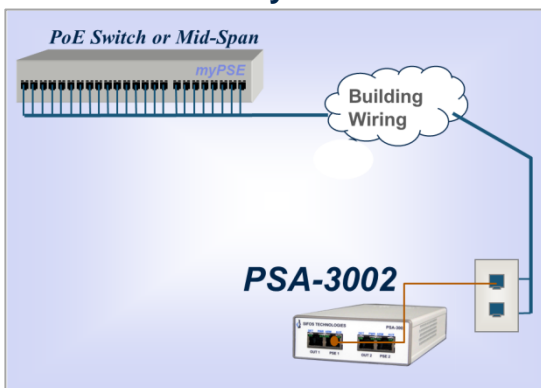
## PowerSync Analyzer Test Equipment Setups

### PSE DV, QA Test
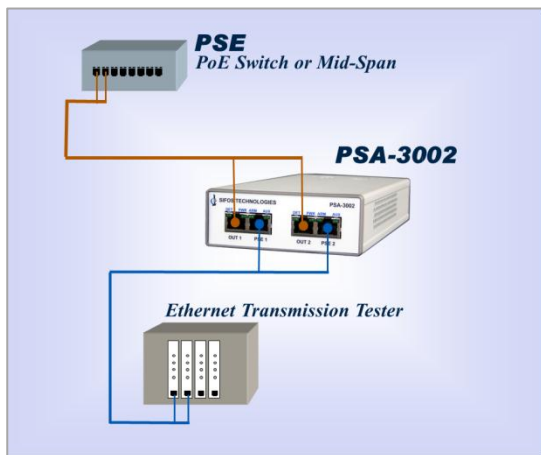


### PSE DC Unbalance Tolerance



### PoE Service Analysis



## Per-Port PSE Test Resources

**Flexible 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 (*Port 2 only*)**

## 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**

## 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 LAN Transmission Testing**

**Negligible Through-Channel LAN Impairment**

## PoE Service Analyzer

**Comprehensive Evaluation of PoE Service at a PD Interface**

**PoE Service Interoperability Analysis**

**In-Band Control of PoE Service-Under-Test**

**Colorful Spreadsheet Reporting**

## Powerful Software

**PSA Interactive GUI for Control of all Test & Diagnostic Resources**

**Automated Test Menus for PSE Conformance and PoE Service Test Suites**

**Comprehensive, User-Friendly PowerShell Script Development and Execution Environment Built on Tcl/Tk**

\* Available as an optional feature to the PSA-3002. See feature-specific data sheet.

## PSA Interactive Graphical User Interface

The Sifos PSA Interactive graphical user interface (GUI) is a flexible and powerful tool designed to allow users 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-3002 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-3002 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
- Standard Waveforms & PD LLDP Emulation / Testing
- 4-Pair PSE Signature, Load Configurations and Metering (including Standard Waveforms)
- PSE LLDP Emulation / Testing
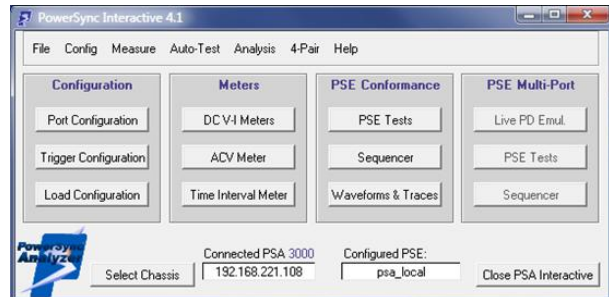


PSA Interactive Main Menu

PSA Interactive enables rapid single or two-port configurations and one-button testing and analysis through intuitive subsystem dialogs that flexibly address test ports and PSA chassis.
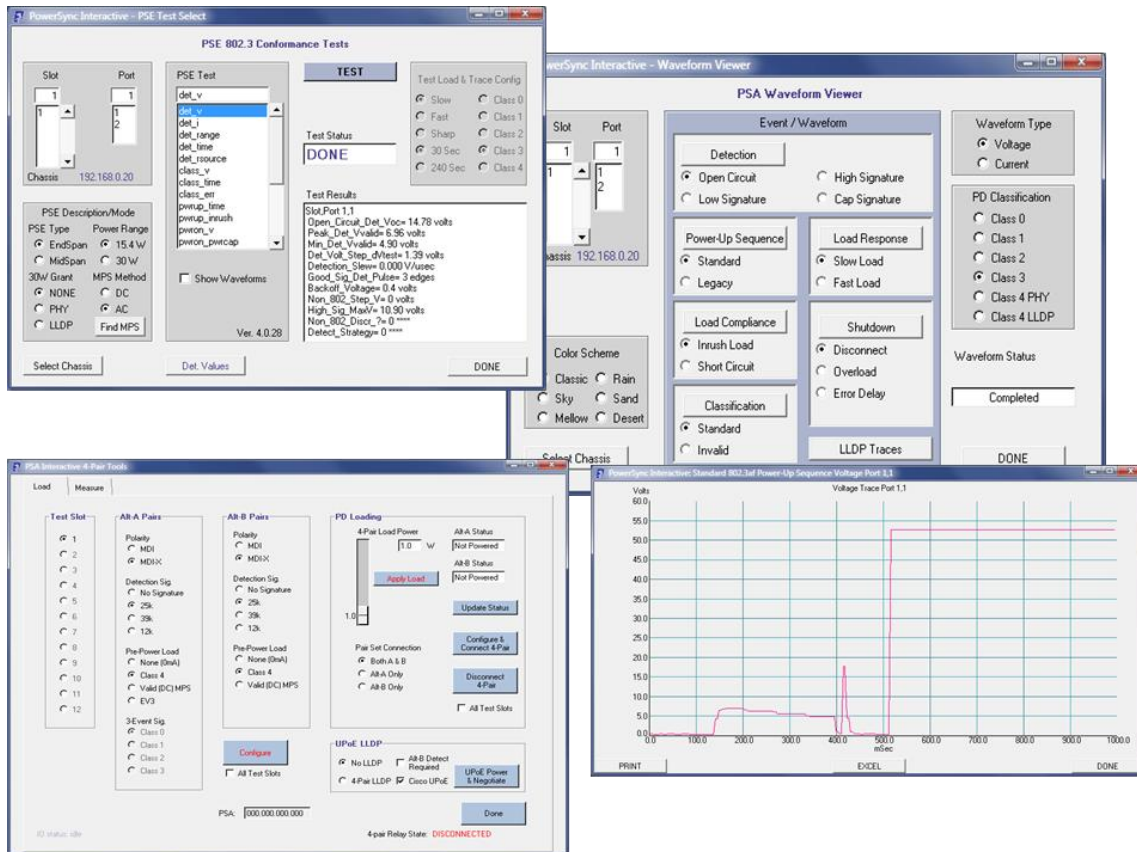


PSA Interactive Menus for PSE Conformance Selected Test, Standard One-Button Waveform Analysis, and 4-Pair PSE Signature and Load Configuration

*\* PSA Multi-Port Suite Features and Menus are not available on the PSA-3002.*

## 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-3002 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-3002 including high level commands that execute and sequence standard **802.3 PSE Conformance Tests** and **LLDP Protocol Analyzers**. PowerShell PSA commands access all of the resources of the PSA-3002 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
- Supports sequencing of test suite sequences and DUT-specific report routing
- Use sided-by-side with PSA Interactive GUI
- AnyEdit PSA Smart Editor for PowerShell PSA
- Traditional Tcl Console
- Command-Knowledgeable Wish Console with PSA waveform viewer capability
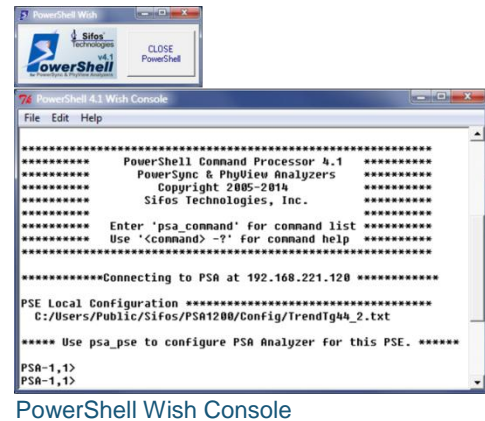

PowerShell Wish Console

## 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-3002 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.

## PoE LLDP Emulation and Analysis

The PSA-3002 includes a subsystem designed to flexibly emulate LLDP capable PD's (and PSE's) on a per test port basis. Fully automated applications allow in depth capture and analysis of protocol between the PSE and the PD.


LLDP Protocol Trace

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

## PoE Service Analyzer Application

The PoE Service Analyzer is a special automated test and reporting application to enable comprehensive parametric and interoperability analysis at any PD connection point in a PoE enabled wiring plant.

See **Sifos Technologies, PoE Service Analyzer Product Overview** for further information regarding the PoE Service Analyzer.
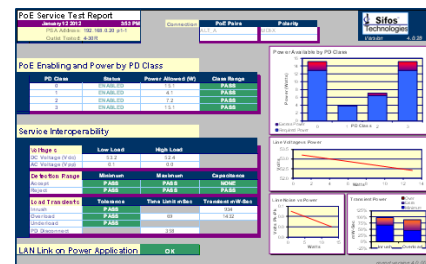

Service Analyzer Report

## Technical Data: PSA-3002

### LAN Interface Specifications

| Operating Mode | Signal Path | Parameter | Specification |
|---|---|---|---|
| Data Through Mode | PSE-# to OUT-# | Connections | RJ45 |
| | | Data Rates and Signaling | 10/100/1000BaseT |
| | | Latency | 0 ( 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 (OUT pairs terminated into 100Ω) | ≤ -24dB, 1MHz to 100MHz |
| Data Connect (LLDP Emulation) Mode | PSE-# to Blade Transceiver | Connection | RJ45 |
| | | Data Rate and Signaling | 10BaseT |
| | | 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 2 (Port 1 bypassed) | Powered Pair | ALT-A and ALT-B |
| | | Polarity | MDI or MDI-X for each pair |

### 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 KΩ |
| | | Accuracy $\Delta V / \Delta I$ at 1 Volt Spacings | ≤ 24KΩ, $\pm$ 250Ω > 24KΩ, $\pm$ 400Ω |
| Detection Capacitance | Vport = 2.5VDC - 12VDC, Port Connected, Transition Current Load = 0 | Range | 0.14, 5, 7, 11μF |
| | | Accuracy | 15% |
| Detection Signature Cut-Off Threshold | Port Connected | Vport | 12V $\pm$ 2% |
| AC MPS Signature | Vport = 12VDC - 60VDC, Port Connected | AC Impedance | 24KΩ ‖ (0.1μF + 330Ω) |
| | | Resistance Accuracy $\Delta V / \Delta I$ at 2 Volt Spacings | 22.8KΩ, $\pm$ 250Ω |
| | Port Isolated | AC Impedance ($\leq$ 500 Hz) AC Impedance ($\leq$ 120 Hz) | $\geq$ 1.1 MΩ $\geq$ 3.0 MΩ |

### Current Load Specifications

| Description | Conditions | Parameter | Specification |
|---|---|---|---|
| Load Current | Per Powered Pair | Range | 0 to 750 mA |
| | | Resolution | 0.25 mA |
| | | Accuracy | $\pm$ 0.5% $\pm$ 0.25mA |
| | | Slew Rates | > 4mA / μsec |
| | | Activation Voltage | 15V, Rising Vport |
| | | De-Activation Voltage | 14V, Falling Vport |

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## Current Load Specifications

| Description | Conditions | Parameter | Specification |
|---|---|---|---|
| Transition (Mark Region) Current | Load Current Active, Per Powered Pair | Range | 0 to 400 mA |
| | | Resolution | 0.25 mA |
| | | Accuracy | $\pm$ 0.5% $\pm$ 0.25mA |
| | | Slew Rates | > 4mA / $\mu$sec |
| | | Activation Voltage | 14V, Falling Vport |
| | | De-Activation Voltage | 6V, Falling Vport |
| Configurable Load Transient | Vport > 15VDC | Sequential Load Steps | 2 |
| | | Load Step 1 Range | 0 to 1800 mA |
| | | Load Step 2 Range | 0 to 750 mA |
| | | Resolution  (0 – 1023 mA) Resolution > 1023 mA | 0.25 mA 0.50 mA |
| | | Accuracy | $\pm$ 1% $\pm$ 0.5mA |
| | | Slew Rate | < 10mA / $\mu$sec |
| | | Step 1 Duration < 1024 mA | 200 $\mu$sec to 1 sec |
| | | Step 1 Duration > 1023 mA | 200 $\mu$sec to 80 msec |
| | | Step 2 Duration     Load Step 1 < 1024 mA     Load Step 1 > 1023 mA | 200 $\mu$sec to 1 sec (or persist) 1 sec |
| | | Step Resolution | 100 $\mu$sec |
| | | Trigger Modes: < 1024 mA                     > 1023 mA | Immediate, Edge, Event Immediate |
| | | Effective Load Source Resistance | 37$\Omega$ |
| | | Foldback Suppression Min. Port Voltage (@ 400mA PSE Current Lim.) | 30 VDC |
| | | Foldback Suppression Duration | Step 1 + Step 2 Duration |

## DC Metering Specifications

| Description | Conditions | Parameter | Specification |
|---|---|---|---|
| Voltage Meter | Average, Max-Peak, Min-Peak, Scope Trace | Voltage Range | 0 - 60V |
| | | Trace Length | 256 Samples |
| | | Sample Rates | 39.1 $\mu$sec – 39.1 msec (10msec --   10sec traces) |
| | | Resolution | 0.025 V |
| | | Accuracy1 | > 30VDC: $\pm$ 1.5% $\pm$15.6 mV < 30VDC: $\pm$ 2.0% $\pm$15.6 mV |
| | | Measurement Triggers | Immediate, Edge, Event |
| Current Meter | Average, Max-Peak, Min-Peak, Scope Trace | Current Range | 0 – 2000 mA |
| | | Trace Length | 256 Samples |
| | | Sample Rates | 39.1 $\mu$sec – 39.1 msec (10 msec --  10sec traces) |
| | | Resolution  (0 – 1023 mA) | 0.25mA |
| | | Resolution  (1024 – 2000 mA) | 0.5mA |
| | | Accuracy2 | $\pm$ 0.5% $\pm$ 0.5mA |
| | | Triggers | Immediate, Edge, Event |

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.

## AC Metering Specifications

| Description | Conditions | Parameter | Specification |
|---|---|---|---|
| AC Peak-Peak Meter | Low Band, VDC= 40-57V | Accuracy, 25Hz – 325Hz Accuracy, 50Hz – 300Hz | -15%, +11% -7.5%, +11% |
| | High Band, VDC= 40-57V | Accuracy, 2.5KHz – 250KHz Accuracy, 20KHz – 250KHz | -15%, +7% -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 |

## 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) | ± 0.0625 mV |
| | | Trig1 to Meter or Transient Latency | ~ 50 μsec |
| | | Event Trigger Latency | < 500 μsec |
| | Trigger Noise Immunity | Pre-Trigger Qualification Time (Voltage below Rising threshold or 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 μsec |
| | | Time Resolution | 1 μsec |
| | | Time Accuracy | + 2 μsec |
| | | Min. Resolvable Time Interval | ~ 4 μsec |
| | Millisecond scale | Time Range | 2-6550 msec |
| | | Time Resolution | 0.1 msec |
| | | Time Accuracy | + 1 msec |
| | | Min. Resolvable Time Interval | 2 msec |
| | Second Scale | Time Range | 0.1 – 16.1 sec |
| | | Time Resolution | 0.1 sec |
| | | Time Accuracy | + 0.05 sec |
| | | 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 |
|---|---|---|
| DET | Detection Enabled | **ON**: Valid Detection Signature Connected (R= 19 to 26 KΩ, C= 0μF) AND Port Switch Connected<br>**BLINKING**: Configured for LAN Termination. Long on-time blink for LINK UP, short on-time blink for UNLINKED.<br>**OFF**: Invalid or no PD Signature AND configured as through. |
| PWR | PSE Power On | **ON**: Indicates Power-Up with Vport > 36 VDC (Regardless of Trigger State)<br>**OFF**: Vport < 36 VDC |
| ARM | Trigger ARM | **ON**: Trigger 1 in the ARMED State<br>**OFF**: Trigger 1 NOT in the ARMED State |
| AUX | Communications | **ON** or **BLINKING**: Indicates Communications to PSA Test Port |

## Programming and Control

| Description | Specification |
|---|---|
| Interface | Ethernet 10/100BaseT |
| Host Requirements | PC running Microsoft Windows NT, 2000, XP, Vista, or Linux PC (Fedora, SUSE) |
| Control Environment | Sifos PowerShell or PSA-Interactive |
| Recommended Network Latency: | < 5 msec |

## Physical and Environmental

| Description | Specification |
|---|---|
| Dimensions | 4"W x 1. 5"H x 8.5"D |
| Weight | 1.2 lbs |
| Power | 100VAC-240VAC, 50-60 Hz, 5VDC, 700mA (External Power Module Included) |
| Ambient Operating Temperature | 0°C to 50°C (≤ 42.75 Watt loading per port) |
| Storage Temperature | -20°C to 85°C |
| Operating Humidity | 5% to 95% RH, Non-Condensing. |

## Certifications

| Description | Certifications |
|---|---|
| Emissions | FCC Part 15, Class A<br>Meets EN55022<br>VCCI, AS/NZS 3548 |
| Safety | CSA Listed (CSA22.2 No. 61010)<br>Meets EN61010-1<br>CB Scheme IEC 61010-1 |
| European Commission | Low Voltage Directive (73/23/EEC)<br>Electromagnetic Compatibility Directive (89/336/EEC)<br>CE Marking Directive (93/68/EEC) |

FCC Statement:

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.

## Ordering Information

**PSA-3002**, PowerSync Analyzer 3002 including PowerShell PSA and PSA Interactive Software

**PSA-LLPD**, LLDP Emulation and Analysis Feature for One PSA PSA-3002 Instrument

**PSA-CT**, PSE Conformance Test Suite for One PSA-3002 Instrument

**PSA-TS1**, PSE Automated Test Suite Tracking Service for One Year for One PSA-3002 Instrument

**PSA-TS2**, PSE Automated Test Suite Tracking Service for Two Years for One PSA-3002 Instrument

**Accessories Included**:
- Installation Guide & Configuration Chart
- PowerSync Analyzer Reference Manual (Binder and CD)
- Power Cord
- Cross-Over Ethernet Cable
- RS-232 Cable

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**Verification, *Simplified.***