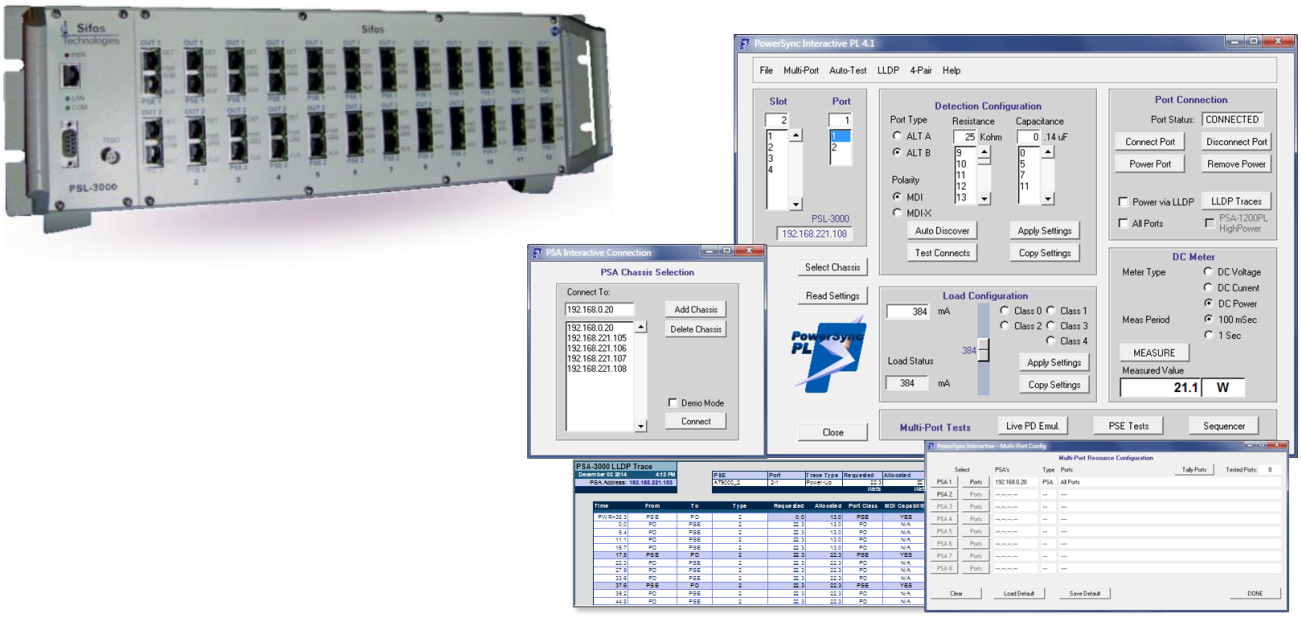
PSL-3000

PowerSync® Programmable Load

IEEE 802.3at Power over Ethernet

Product Overview



Key Features

- Multi-Port Precise PSE Loading & Measurements
- Unique, Fully Automated Multi-Port PSE System Analysis
- Continuous Static PSE Loading > 42 Watts Per Port x 24 Ports
- Continuous 4-Pair PSE Loading to 95 Watts Per Test Blade x 12 Ports
- DC Voltage, Current, and Power Metering on 2-Pair and 4-Pair PSE's
- Flexible Powered Device LLDP Emulation and LLDP Protocol Analysis
- Scalable, Cost-Efficient Architecture
- PSA Interactive-PL Graphical User Interface
- Enables PSE Packet Transmission Testing with PoE Loads
- Flexible 4-Pair Signature and Static Load Control
- Smart Fan Control – Runs Cool and Quiet
- Flexible Script Automation and Graphical User Interface for Microsoft Windows and Linux PC's.
- Fully Certified Commercial Test Instrument

Verification, *Simplified.*

IEEE 802.3at and Pre-802.3bt PSE's

End-Spans

Mid-Spans

PoE/PoE+ Connectors

Injectors

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

Automate QA, Manufacturing

Multi-Port Automation

Ready-to-Use, High Throughput Test Script

Commercial Test Instrumentation

Fully Certified

Factory Calibrated

Comprehensive Software and Documentation

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 testing and analysis of **IEEE 802.3at** Power Sourcing Equipment (PSE) behaviors. Each test port inside a PowerSync 3000 Programmable Load is an autonomous and fully isolated instrument offering stimulus and measurement resources. Test ports are configured and controlled via a high level automation interface, **PowerShell PSA**, and may also be rapidly accessed and managed from an intuitive graphical user interface, **PSA Interactive PL**.

Automated PSE System Testing

PSL-3000'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 proprietary 4-Pair PD's. A fully automated 2nd 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 and 802.3at LLDP power administration. 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-3000 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)

Each test blade within a PSL-3000 has the ability to internally combine test port resources for the purpose of emulating a variety of 4-Pair PD signatures and power loads with continuous power loading up to 95 watts. 4-Pair DC 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. 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.

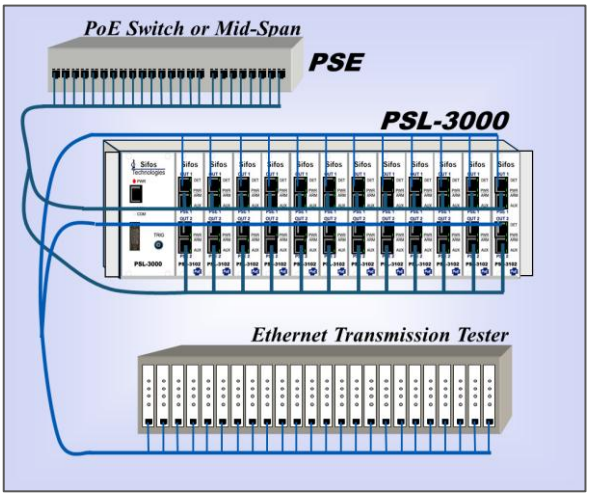
Cost Effective, Scaleable, and Backward Compatible

The PSL-3000 may be configured with 2 to 24 test ports, or with a fixed 24 test ports (**PSL-3024**) to further reduce per-port cost. Unlike other low cost PSE load solutions, the PSL-3000 is a **fully certified** and factory calibrated commercial test instrument.

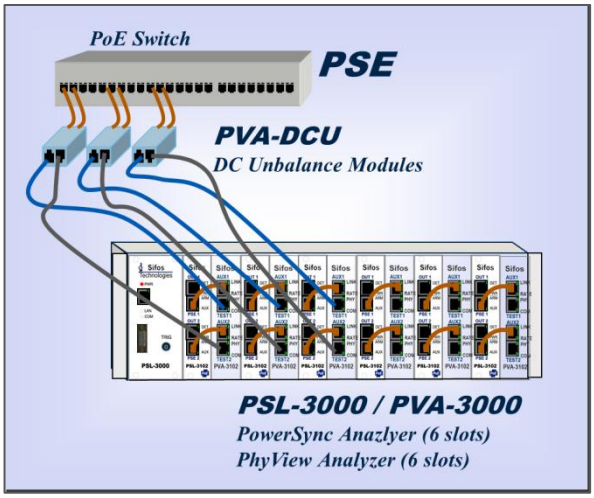
Verification, Simplified.

PowerSync Programmable Load Test Equipment Setups

PSE Multi-Port System QA, Manufacturing Test



PSE PoE & 10/100/1000 Physical Layer Analysis, PSE DC Unbalance Tolerance



Flexible PD Emulation with Measurements (per Port)

Alternative A/B Pair Configuration

Polarity Configuration

Configurable Detection Resistance

Configurable Detection Capacitance

Configurable PD Classification Emulation

Static DC Load Current to 750mA

Average DC Voltage Measurement

Average DC Current Measurement

Average DC Power Measurement

4-Pair Loading and Measurements (per Blade)

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

Power Administration by PD Class and Port Group Subsets

Group Power-Up, Power Negotiation, and Disconnect Timing

Static Power 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 LAN Transmission Testing

Negligible Through-Channel LAN Impairment

Powerful Software

PSA Interactive GUI for Rapid Setup and Intuitive Manual Testing

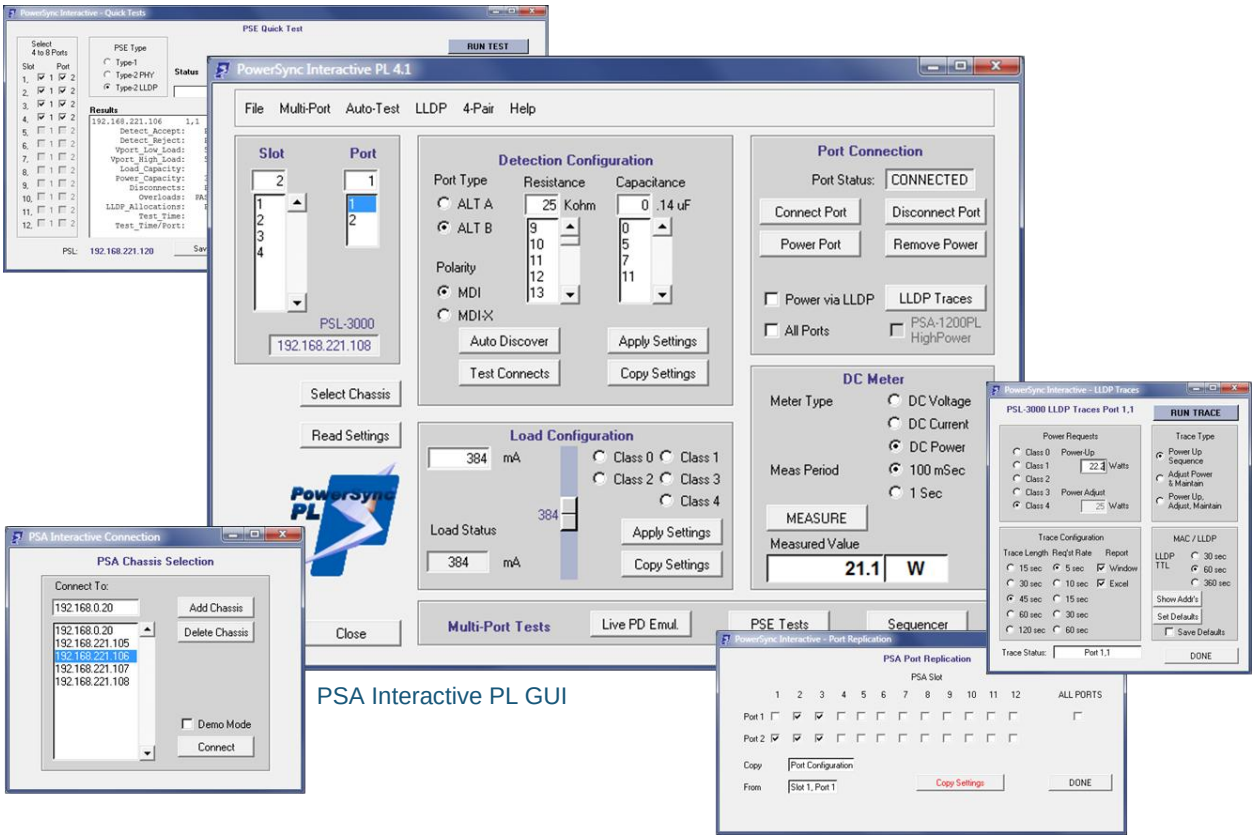
PowerShell Script Automation for Interactive Automated Test Development and Fast Test Execution

High Throughput, Multi-Port QA/Manufacturing Test Script Included

* *Available as an optional feature to the PSL-3000. See feature-specific data sheet.*

PSA Interactive Graphical User Interface

The PSA Interactive Programmable Load Graphical User Interface (GUI) is an intuitive tool designed to allow user quickly to setup load configurations and perform measurements on IEEE 802.3at compliant and emerging 4-Pair power sourcing equipment (PSE). The PSA Interactive Programmable Load GUI provides an intuitive view of the full range of testing resources available within the PowerSync Programmable Load. Users can quickly harness the flexibility and power of these resources to set up load configurations, perform measurements, and to prototype sequences that will eventually be automated in PowerShell PL scripts.



PSA Interactive PL GUI

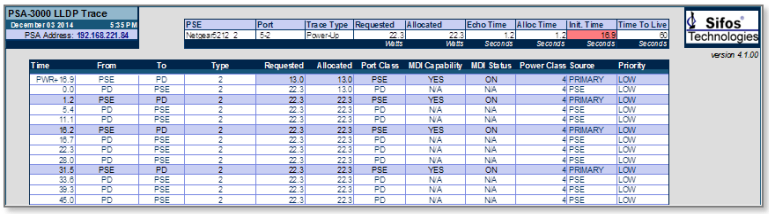
The Sifos PSA Interactive Programmable Load GUI offers intuitive controls for:

- Chassis & Port Selection
- Port Configuration (ALT A/B, Polarity MDI/MDI-X, Detection Signatures)
- Replication of Settings Across Multiple Ports
- Automated ALT/Polarity Discovery
- Single or Multi-Port PD Connect, Disconnect, Power-Up, and Power-Down
- Static Load Control
- PD Classification and One Button Single or Multi-Port PD Power-Up Emulation
- One Button LLDP Power-Up Emulation
- Average DC Voltage, DC Current, and DC Power Measurements
- PSE Multi-Port Tests
- PSE Multi-Port Test Sequencer
- 4-Pair PSE Signature, Load Configurations and Metering (including Standard Waveforms)
- PSE LLDP Emulation / Testing
- “Quick-Test” PSE Fast Multi-Port PSE Verification

PoE LLDP Emulation and Analysis

The PSL-3000 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.



LLDP Protocol Trace

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 PSL-3000 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 (≤13W) and Type-2 (≤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 PSL-3000 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, power down behavior, 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.

PowerShell PSA Tcl/Tk Interface

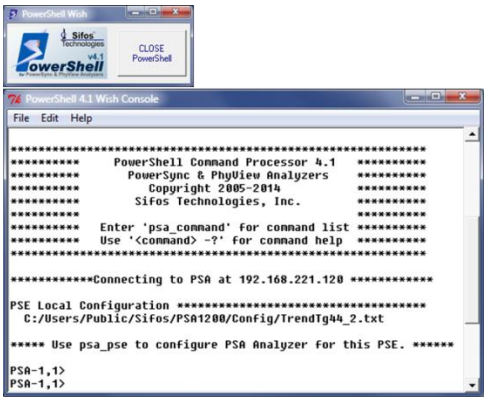
The PowerShell PSA Scripting Environment provides a high level, interactive means to control and program automated test sequences for the PSA-3000 PowerSync Analyzer. PowerShell enables fully automated testing suites that span multiple ports, blades, and instruments. Built upon the popular Tool Command Language (Tcl), it offers an extensive and extensible programming language well suited for automated testing.

PowerShell PSA provides a complete API for the PSL-3000 including high level commands that **emulate PD Power-Ups**, execute **LLDP Protocol Traces**, and execute or sequence **Multi-Port System** tests. PowerShell commands access all of the resources of the PSL-3000 and enable the rapid development of highly customized test scripts. PowerShell fully supports off-line script development and debug through its robust built-in demo 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 Tcl environment include:

- Interpretive command execution (no compilation, simple debug)
- Simple, intuitive PowerSync PL commands (API)
- Integrated command "help" tools
- Upward compatible to PSA-3000 platforms
- Fast test execution speeds
- Script-configured test report files
- AnyEdit Smart Editor for PowerShell PSA
- Traditional Tcl Console or Command-Knowledgeable Wish Console with PSA waveform viewer capability



PowerShell Wish Console

Multi-Port High Throughput PSE Verification

The PSL-3000 and PSL-3024 are provided with a sample PSE automated test script, **psl_quick_test**, that recovers critical PoE parameters from PSE test ports with an effective test throughput of less than 30 seconds per tested port. This application can be used as is, or with user modifications, in both QA and manufacturing test to rapidly qualify PSE functional performance.

Important features of the **psl_quick_test** include:

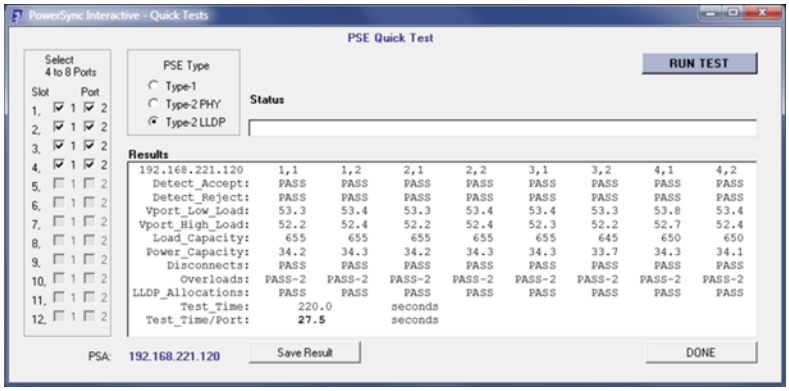
- **Source Code Provided**: May be used as is, may be modified, or may be used as template script
- Scans 4 to 8 PSE ports per test cycle
- Tests **Type-1**, **Type-2** (**2-event**), and **Type-2** (**LLDP***) PSE's
- Validates PoE **Detection Acceptance** and **Rejection** Ranges
- Measures PSE **Port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

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>psl_quick_test 1,1 1,2 2,1 2,2 3,1 3,2 4,1 4,2  type-2 lldp
TESTING WITH 192.168.221.120 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...

    192.168.221.120     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:    53.3     53.4     53.3     53.4     53.4     53.3     53.8     53.4
    Vport_High_Load:    52.2     52.4     52.2     52.4     52.3     52.2     52.7     52.4
      Load_Capacity:     655      655      655      655      655      645      650      650
     Power_Capacity:    34.2     34.3     34.2     34.3     34.3     33.7     34.3     34.1
        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:       220.0          seconds
     Test_Time/Port:       27.5          seconds
```

Automated Manufacturing/QA PowerShell Test Script, **psl_quick_test**



PSL Quick Test in PSA Interactive PL

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

Technical Data: PSL-3000 & PSL-3024

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 (Port 2) and ALT-B (Port 1)
		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	Range	9 KΩ to 39 KΩ
		Resolution	1 KΩ
		Accuracy ΔV / ΔI at 1 Volt Spacings	≤ 24KΩ, ± 250Ω > 24KΩ, ± 400Ω
Detection Capacitance	Vport = 2.5VDC - 12VDC, Port Connected	Range	0.14, 5, 7, 11μF
		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 ΔV / ΔI at 2 Volt Spacings	22.8KΩ, ± 250Ω
	Port Isolated	AC Impedance (≤ 500 Hz) AC Impedance (≤ 120 Hz)	≥ 1.1 MΩ ≥ 3.0 MΩ

Current Load Specifications

Description	Conditions	Parameter	Specification
Load Current	Per Powered Pair	Range	0 to 750 mA
		Resolution	1.00 mA
		Accuracy	± 0.5% ± 0.25mA
		Slew Rates	> 4mA / μsec
		Activation Voltage	15V, Rising Vport
		De-Activation Voltage	14V, Falling Vport

DC Metering Specifications

Description	Conditions	Parameter	Specification
Voltage Meter	Average	Voltage Range	0 - 60V
		Sample Averaging	256 Samples
		Sample Rate (100 msec Period) Sample Rate (1 sec Period)	390 msec 3.9 msec
		Resolution	.0625 V
		Accuracy[1]	± 2% ± 0.62.5 mV
Current Meter	Average	Current Range	0 – 1000 mA
		Sample Averaging	256 Samples
		Sample Rate (100 msec Period) Sample Rate (1 sec Period)	390 msec 3.9 msec
		Resolution	1.00 mA
		Accuracy[2]	± 2% ± 1.0 mA

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.

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 **BLINKING**: Configured for LAN Termination. Long on-time blink for LINK UP, short on-time blink for UNLINKED. **OFF**: Invalid or no PD Signature AND configured as through.
PWR	PSE Power On	**ON**: Indicates Power-Up with Vport > 36 **OFF**: Vport < 36 VDC
ARM	(*LED Not Utilized on PSL-3000)*	**OFF**: (*LED Not Utilized*)
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 PSA or PSA Interactive-PL
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. (Fully Populated with PSA-3102 Cards)
Power	100VAC-240VAC, 50-60 Hz, 1350mA Max.
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 Meets EN55022 VCCI, AS/NZS 3548
Safety	CSA Listed (CSA22.2 No. 61010) Meets EN61010-1 CB Scheme IEC 61010-1
European Commission	Low Voltage Directive (73/23/EEC) Electromagnetic Compatibility Directive (89/336/EEC) 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

PSL-3000, PowerSync Programmable Load 3000 Chassis and Controller including PowerShell PSA and PSA Interactive-PL Software

PSL-3102, Dual Port PoE+ PSE Load Card for PSL-3000

PSL-3024, PowerSync Programmable Load 3000 Chassis and Controller including 12 PSL-3102 Load Cards, PowerShell PSA, and PSA Interactive-PL Software

PSL-LLPD, LLDP Emulation and Analysis Feature for One PSL-3000 Controller

PSL-MPT, 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 Cable

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Verification, Simplified.

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