



**"SPE Testing Made Easy"**

## **Model 4925 Reference Link Partner**

**Single Pair Ethernet (10BASE-T1L/SPoE/Ethernet-APL)  
Testing Solution For Testing PSE or PD Devices**



*Model 4925 Front View*

Single Pair Ethernet (SPE) 10BASE-T1L and Single Pair Power over Ethernet (SPoE) are based on the IEEE 802.3-2022 and IEEE 802.3dd-2022 standards and offer game-changing advances for Operational Technology (OT) networks. These emerging technologies allow OT networks to deliver data and power up to 1km. SPoE provides 1.85W or a higher power of 79W, depending on the application, cable length, and device power demand. In addition, the 10BASE-T1L protocol provides a 10Mb/s full duplex data link.

The Telebyte 4925 Reference Link Partner Single Pair Ethernet (10BASE-T1L/SPoE/Ethernet-APL) Testing Solution is designed specifically for convenient, repeatable testing of Power Load (PD) or Power Source (PSE) devices. This specialized, multipurpose instrument is used with Telebyte's Model 4950 Channel Emulator and probes, as well as a programmable power supply and load to provide engineers with a valuable debugging and compliance test tool in the development and verification of a PD or PSE device.

The Emulator can serve as a reference link partner for power and data conformance testing of the IEEE 802.3-2022 and IEEE 802.3dd-2022 standards (SPE). It is capable of simulating an Ethernet-APL Spur and Trunk Power Source (PSE) device or an Ethernet-APL Load (PD) device and supports the Ethernet-APL Data Test Specification Group 3 Transmit Packet Formation tests and Group 4 Receive Error Handling tests.



*Model 4925 Back View*



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## Highlights

- Test against the Analog Devices ADIN1100 (SPE and Ethernet-APL)
  - 1.0Vpp or 2.4Vpp Operating Modes
  - Auto-Negotiation, Full Duplex Traffic
  - Network Master/Slave configuration
- Testing of SPE Power Devices (PD / Load devices)
  - PSE Emulator supports IEEE 802.3-2022 Type E Power Class 10-15
    - Delivers class power up to 1000m with a programmable power supply
    - Load Detection
    - Polarity Mode A (Positive) or B (Reverse Polarity)
  - Simulate PSE Master SCCP waveforms and Cable Resistance Measurement
    - Variable bit timing for SCCP typical / min / max cases
    - Insert bit timing errors
    - Fault conditions
- Testing of SPE Power Devices (PSE / Power Source devices)
  - PD Emulator supports IEEE802.3-2022 Type E Power Class 10-15
    - PPD Requested Power 0 to 57.5 W in 25 mW Resolution per Power Class with a programmable load
  - Simulate PD SCCP Waveforms
    - Variable bit timing for SCCP typical / min / max cases
    - Simulate bit timing errors
    - Simulate CRC errors
    - Simulate PD fault condition
- Testing of Ethernet-APL Devices
  - PSE Mode: Generate Ethernet-APL Power Source Ports (Class A, B, C, 3, & 4) current and voltage with a programmable power supply
  - PD Mode: Simulate APL Load Ports (Power Class A, B, C, 3 & 4) current sink and voltage with DC Programmable Load
  - Support for Group 3 and Group 4 Transmit and Receive Packet Tests to test PHY / MAC interface
  - Support for Packet Error Rate Stress Tests



**The Reference Link partner**  
**is part of Telebyte's Universal Test Setup for**  
**Conformance Testing**



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## Power Class Validation

Perform four-corner, worst-case minimum and maximum voltage and current testing with power requirements per power class. Test the power stability of the link over varying link segment lengths, cable types, and DC Loop Resistance. Test with power faults such as shorts or impedance discontinuities on the in-line connections (using micro-interruptions on a single conductor) or a loss of signal (LoS) on both conductors.

### IEEE 802.3 - 2022

Class	Max Cable DC Resistance (ohms)	Max I PI (mA)	Max VPSE (Volts)	Min VPSE (Volts)	Max PPD (Watts)	Min VPD (Volts)	Max cable length 18AWG (2.4V-pp) (Meters)
10	<65	92	30	20	1.23	14	1000 *
11	<25	240	30	20	3.2	14	500
12	<9.5	632	30	20	8.4	14	200
13	<65	231	58	50	7.7	35	1000 *
14	<25	600	58	50	20	35	500
15	<9.5	1579	58	50	52	35	200

\* 1400m based on DCR

### Ethernet-APL v1.0

Class	Max Cable DC Resistance (ohms)	Min PPS (W)	Max I PS (mA)	Max VPS (Volts)	Min VPS (Volts)	Min PPL (Watts)	Min VPL (Volts)	Max cable length 18AWG (Meters)
A	<10.6	0.54	55.5	15	9.6	0.5	9	200
B	<10.6	1.17	115	15	10.1	1.0	8.8 / 9	200
C	<10.6	1.1	95	15	11.61	1.0	10.6	200
3	<47.6	57.5	1250	50	46	36	28.8	1000
4	<47.6	92	2000	50	46	57.6	28.8	1000

## Serial Communication Classification Protocol (SCCP)

Serial Communication Classification Protocol (SCCP) is the bidirectional, single-wire serial communication protocol specified by the IEEE 802.3-2022 standard for negotiating power transfer requirements between the PSE and PD before the PSE applies power to the link.

The Telebyte 4925 supports SCCP for communicating with a PD or PSE device and is able to negotiate the six IEEE 802.3-2022 Type E power classes: 10, 11, 12, 13, 14, and 15. In addition, it can vary bit timing for SCCP typical / min / max cases and insert bit timing errors.



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## Data Validation

The IEEE 802.3-2022 10BASE-T1L standard enables 10Mb/s full-duplex communications on Operational Technology (OT) networks up to a distance of 1,000m over a single twisted pair cable. 10BASE-T1L core capability is a full duplex, dc balanced, point-to-point communication scheme with PAM 3 modulation at a 7.5 MBd symbol rate with 4B3T coding to enable long link segments.

Users may configure the instrument to support auto-negotiation, advertise and / or request as a master or slave in the 1.0Vpp or 2.4Vpp operating modes, as well as capture the link signals on an oscilloscope after the 10BASE-T1L links up.

This device may also be used for Transmit and Receive Packet Tests that stress the PHY / MAC Interface with preamble count, Start of Frame Delimiter (SFD), programmable transmit Inter-Packet Gap (IPG), and Assert TX\_ER to monitor if DUT responds correctly with Receive Errors (RX\_ER, RX\_DV).

Convenient and easy-to-use software is available to control the Analog Devices ADIN1100 10BASE-T1L PHY.

## Specifications

<b>Model 4925 Reference Link Partner</b> <b>Single Pair Ethernet (10BASE-T1L/SPoE/Ethernet-APL) Testing Solution</b>	
<b>10Base-T1L PHY</b>	Analog Devices ADIN1100
<b>Max. DC Voltage*</b>	58 VDC
<b>Max. DC Current*</b>	2.0 A
<b>Bandwidth</b>	100 kHz to 20 MHz
<b>Connectors</b>	<ul style="list-style-type: none"> <li>• 1 x 3-position terminal block</li> <li>• 1 x USB2.0 MINI B</li> <li>• 2 x USB Connectors USB 3.0</li> <li>• 1 x RJ45 Uplink Port</li> <li>• 4 x SMA (50 ohm)</li> <li>• 2 x BNC</li> <li>• +12VDC Power jack (2.50mm ID, 5.50mm OD)</li> <li>• Ground</li> </ul>
<b>Output Triggers</b>	Oscilloscope, Waveform Generator, Programmable Power Supply, Programmable DC Electronic Load, Channel Emulator
<b>Power</b>	*Provided by external programmable 12VDC power adapter
<b>Dimensions: Inches (mm)</b>	W: 8.70" (221mm), D: 6.52" (165.61mm), H: 1.75" (44.45mm)

*Specifications subject to change without notice.*

## Ordering Options

<b>Model Number</b>	<b>Description</b>
<b>4925-001</b>	Reference Link Partner. (Supports Ethernet-APL and SPE)
<b>4925-002</b>	Reference Link Partner. (Supports Ethernet-APL only)

Note: DC Programmable Power Supply or DC Programmable Load required with Link Partners