

# **PowerSync® PD PoE Powered-Device Analyzer**

## **Installation Manual and User Guide Revision 1.012**

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## **Introduction**

Sifos Technologies' PoE Powered-Device Tester provides parametric and functional testing of products which are powered under the 802.3af Power-over-Ethernet standard. This standard describes PSE (power-sourcing equipment) and PD (powered-device) behavior during detection, classification, powered, and transitional states. PD's which do not conform to the standard may not power up or may not reliably remain powered by a PSE.

The standard includes many PSE discretionary measurement regions and decision points where power-up of a PD is optional. Typical PSE's only provide power over one of two possible wire pairs and at one of two possible polarities. Consequently, it would be an incorrect assumption that a go/no-go test with a given PSE would verify functionality with all other 802.3af PSE's.

Sifos' PowerSync PD Analyzer addresses the need for PD testing in several areas, including product development, QA departments, manufacturing, incoming inspection, and field testing. Its small size and simple interface also allow it to be used as a general purpose power supply for the powering and monitoring of PD's in lab, engineering desktop, or field installations.

The PDA-100 is capable of stand-alone operation, or can be controlled via its RS232 port for automated testing and data collection.

## Specifications

<b>Test Modes</b>	<b>Description</b>	
802.3af Test Mode	Pass/Fail and Parametric Testing	
Load Meter Mode	PD Power Monitoring, Powered functional testing using Pass-through Data Port	
User Configurable	Semi-Custom PoE and PD Load Testing, Pass/Fail set-up Capability for Production Test	Up to 4 Test Configurations stored in non-Volatile Memory

### **802.3af Test Mode**

Port Tests	Alternate A, B; Pos. and Neg. Polarities 802.3af PD Compliance requirement	All tests performed in each mode Pass all or Fail
Detection Resistance	Measurement 802.3af PD Pass/Fail Compliance Limits	2k - 50k Ohms, +/- 1% 23.75k-Ohm, 26.25k-Ohm
Detection Capacitance	Measurement 802.3af PD Pass/Fail Compliance Limits	1nF-50uF, +/-3% 0.05uF, 0.12uF
Classification Current	Measurement 802.3af PD Class Current Compliance Limits	0mA - 60mA, +/-2% 0-4mA, 9-12mA, 17-20mA, 30-36mA
Classification Class Avg. Power	802.3af, based upon Class Current Measurement 802.3af PD Class Power Compliance Limits	Class 0,1,2,3,4 0W - 30Watts, +/-2% 3.84W, 6.49W, 12.95W
Peak, Average and Minimum Port Current	Measurement 802.3af PD Class Peak-Current Comp. Limits	0mA- 600mA, +/-1% 120mA, 210mA, 400mA
Current, Power Turn-on Voltage	Sample Rate, Duration Measurement 802.3af PD Turn-on Voltage Limits	20ms/sample, 5-second Test 25V - 48V +/-1%, 0.1V Res. 42V Max.
Turn-off Voltage	Measurement 802.3af PD Turn-off Voltage Limits	25V - 48V +/-1%, 0.1V Res. 30V Min.

### **Load Meter Mode**

Port Configuration	Alternative A or Alternative B	Selectable
Port Polarity	Positive or Negative (MDI/MDI-X)	Selectable
Port Voltage	User Adjustable	20V-57V, 1% 1 Volt Resolution
Port Current	Measured Continuously 0.5 second update rate	0mA-600mA, +/-1% 0.1mA Resolution
Port Power	Measured Continuously 0.5 second update rate	0W-30W, +/-2% 0.1W Resolution

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<b>User Configurable Mode</b>	<i>(See 802.3af Test Mode for Measurement Specifications and 802.3af PD limits)</i>	
Port Configuration	Alternative A and/or Alternative B	Selectable
Port Polarity	Positive and/or Negative (MDI/MDI-X)	Selectable
Detection Resistance	802.3af PD, 802.3af PSE, or Disable	Selectable
Detection Capacitance	802.3af PD, 802.3af PSE, or Disable	Selectable
Classification Current	802.3af PD, 802.3af PSE, or Disable	Selectable
Class	802.3af PSE-side Acceptable Pass Limits:	19k-Ohm through 26.5k-Ohm
Class Avg. Power	Set Class value for Pass/Fail Testing	Selectable
Max., Average and Min. Port Current	802.3af PD Limits, or Disable Limits	Selectable
Custom Port Currents	802.3af PSE-side Acceptable Pass Limits:	0mF through 0.15uF
Custom Port Current Measurement Timing	Measurement Start Time After Power Applied	0-255 Seconds
Port Voltage	User Adjustable	Resolution
Turn-on Voltage	802.3af or disable	Selectable
Turn-off Voltage	802.3af or disable	Selectable

### **Interface and Control**

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PoE Test Port	RJ45 Jack	
Ethernet Data Port	RJ45 Jack; 10/100/1000BaseT Ethernet	
RS232	Rear-Panel connector	
Instrument Control	Front panel Display with 4-Button Menu-based control	Menu-based control is mirrored at the RS232 port for remote operation
Display LED's	White/Blue LCD screen	
	Detect, Classify, and Power-On	

### **Physical and Environmental**

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W x H x L	7.5" x 3" x 10"
Weight	3.2 Lbs.
Power	100VAC - 240VAC, 50-60Hz, 700mA Max.
Operating Temperature	0°C to 40°C
Storage Temperature	-20°C to 85°C
Humidity	5% to 95% RH, Non-Condensing

## **Certifications**

Emissions:           FCC Part 15, Class A  
                          Meets EN55011, VCCI, AS/NZS 3548

Safety:                CSA Listed (CSA22.2 No. 61010)  
                          Meets EN61010-1

EMC                    Meets 89/336/EEC Directive

### **FCC Statement:**

This Equipment has been tested and found to comply with the limits of 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 his own expense.

## **Safety Precautions**

TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE THE COVER OF THE PDA-100. NO USER SERVICEABLE PARTS ARE INSIDE. SERVICE SHOULD BE REFERRED TO QUALIFIED PERSONNEL.

THE PDA-100 SHOULD NOT BE CONNECTED TO THE TELECOMMUNICATION NETWORK. THE PDA-100 SHOULD BE POWERED WITH THE SUPPLIED AC CORD, WHICH INCLUDES AN EARTHING CONDUCTOR. THE GROUND TERMINAL SHOULD NOT BE MODIFIED, SINCE THIS COULD RESULT IN A PRODUCT THAT IS NOT PROPERLY EARTHED.

## **Instrument Set-up**

The Powered-Device Tester includes an AC Power Cord, an RS-232 cable and a CAT-5E Ethernet cable.

The RS-232 cable is not required for instrument operation, however it can be used for remote operation of the instrument, data collection, and general maintenance, such as for installation of Firmware upgrades.

The CAT-5E cable supplied with the instrument is a standard cable which can be used to connect the instrument to a PD or data source. There are two RJ45 connectors on the front of the instrument. The connector on the right, labeled “Test Port” should be used for the connection to the PD under test.

The connector on the left labeled “Data Port” may optionally be connected to a network or other data source for PD control and/or operation during tests. This port is connected to the Test Port internally via an isolation transformer, and is capable of 10/100 and 1000baseT operation.

There are fold-out feet on the instrument which can be used to tilt the instrument up for easier desktop viewing of the display.

The AC power cord should be connected from the back of the instrument to the AC mains. There is an On/Off power switch at the back of the instrument adjacent to the Power cord. When the unit is turned on, the display will show the Sifos logo followed by the main menu. At this point the instrument is set-up and ready to operate.



## **Operating Instructions**

### **Overview**

The instrument has three basic modes of operation:

- 802.3af PoE Test
- Load Meter
- Custom Test

These are selectable in the main menu. The 802.3af PoE test sequences through a fixed set of tests, which measures parameters and compares the results to limits described in the IEEE 802.3af standard. This is a single-button, Pass/Fail test, which provides optional access to the measurement results. The PDA-100 is not a full compliance tester, however the tests performed will resolve common and major issues that could cause problems with device operation by 802.3af-compliant PSE's.

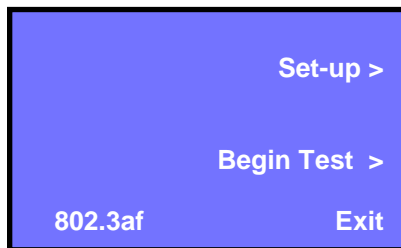
The Load Meter mode allows the user to power a PD continuously at various Voltages. The Load Meter provides real-time current and power measurement results.

The Custom Test allows a user to modify or bypass certain PoE Tests, and can be used to tailor measurements to a specific PD device. As an example, it can test for a selected class and can be used to set maximum and minimum current load limits and test times. As in the case of the 802.3af test, this mode provides single-button Pass/Fail operation (for production tests), and access to the measurement results. This mode provides up to four custom test configurations which are stored in non-volatile memory.

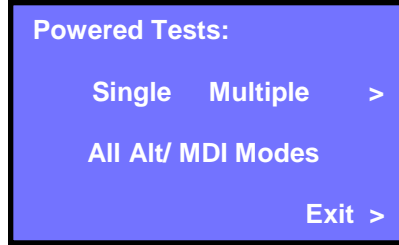
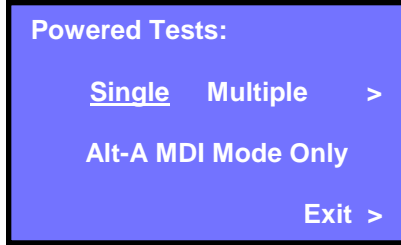
Each of these modes of operation is described in detail in the following sections.

### **802.3af PoE Test**

The screen below appears when the 802.3af test mode is selected. The selections are “Begin Test”, which initiates a full 802.3af test sequence, “Set-up”, which is explained in the next paragraph, and “Exit”, which returns the user to the main menu.



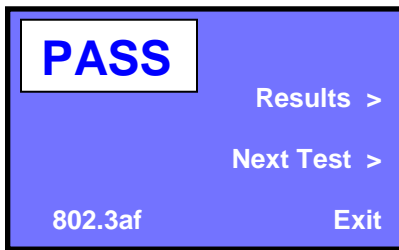
When the user selects “Set-up”, a screen appears with a selection which toggles between “Single” and “Multiple” powered test mode. These are shown below:



The underlined item is the active selection. “Powered tests” refer to tests that are performed when the PD is powered, and includes Average Power, Max, Min, and Avg Current, and turn-on and turn-off Voltage tests. 802.3af Detection and Classification tests are automatically performed in all modes and are unaffected by this selection.

Powered tests are generally of a longer duration than detection and classification tests because observation periods are involved. These tests are also unlikely to be affected by the ALT/MDI connection mode if the detection and classification tests are successful. The above selections offer the user a choice between a thorough multiple mode test set, and a faster one-time check of the powered-on operation.

When the Set-up menu is exited, the previous menu appears. Selecting “Begin Test” initiates the 802.3af test sequence. The screen indicates that a test is active by flashing the word “-Testing-“ on the screen. Once the test is completed, the screen below appears.



A Pass/Fail indication is displayed, and the user may select “Results” to view the screen shown below, which contains the actual results of the tests. The screen has 4 selections, for viewing the tests. The up and down arrows are used to scroll through the test entries on the screen, and the “X” is used to exit back to the starting test screen. The top selection selects one of the 4 port configurations. All tests are run on all 4 port configurations (Alt-A MDI, MDI-X and Alt-B MDI and MDI-X), and each configuration has its own test results.

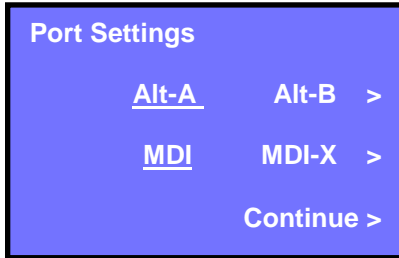
Alt-A	MDI	P/F	>
RDET	24.96kΩ	P	
CDET	0.100uF	P	↑
IClass	0mA	P	
Class	0	P	↓
Power	3.15W	P	
Imax	69.4mA	P	X

This test performs tests of critical parameters described in the IEEE 802.3af Power-Over-Ethernet Standard. The tests that are performed are listed below, along with an explanation of the pass/fail limits associated with each test.

Each test is described in the Test Description section.

## Load Meter

The Load Meter mode is equivalent to an adjustable power-supply with built-in Voltage, Current, and Power displays. When the load meter is selected, the first screen presented is the Port set-up screen. This is shown below:

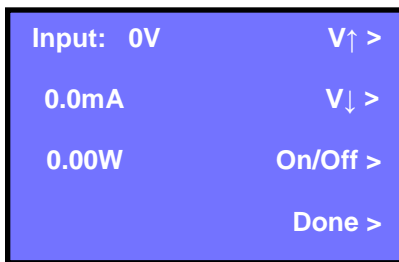


The Alt-A/B and MDI/MDI-X settings determine which port and polarity will be powered by the instrument. The underlined selection is active, and selections are changed via the buttons to the right of each row. These selections correspond to the settings listed in the 802.3af standard, and are as follows:

RJ45 Conductor	Alt-A MDI	Alt-A MDI-X	Alt-B All(MDI)	Alt-B (MDI-X)
1	+	-		
2	+	-		
3	-	+		
4			+	-
5			+	-
6	-	+		
7			-	+
8			-	+

The + and - symbols refer to the power supply connection and polarity. The reader will note that the Alt-B, MDI column is labeled “All”. From the perspective of the PSE, the Alt-B polarities are all mandated as shown in that column. The standard however specifies that PD’s must be able to handle any polarity, therefore the Alt-B, MDI-X column settings are also implemented in the instrument.

After selecting the desired ports settings, the user selects continue and proceeds to the menu shown below:



The On/Off selection toggles the power supply on and off. When the supply is on, the Voltage setting will appear in the upper left next to “Input:”. The Voltage is adjusted up or down over a 30V-57V range via the two upper selection on the right. The Current and Power consumption of the PD will be shown in the mA and W sections respectively, and will be updated at 0.5 second intervals.

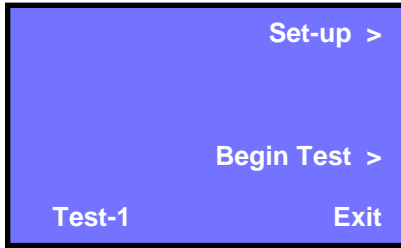
When “Done” is selected, the power supply will turn off and the screen will change to the main menu.

## Custom Test

The Custom Test Mode selection will display a top menu, where 1 of 4 tests can be selected:



Each test is independent of the other tests, and can be set up by the tester or engineer for selected PD characteristics. Upon selection of one of the four Test configurations, the following screen appears:



The test configuration is shown in the lower left of the screen (Test-1 in this case). The “Begin Test” and “Exit” selections function the same way as they do in the 802.3af test.

The “Set-up” selection steps through a number of set-up screens which the user uses to set up the test.

The first screen, shown below, is the port set-up and class selection screen.



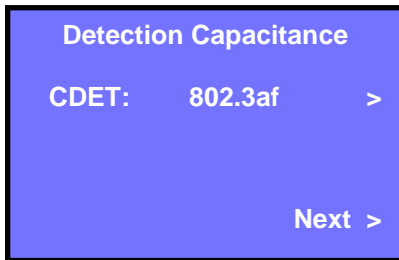
The underlined item in each row is the selected parameter. The MDI and Alt selections refer to the powered wire pairs and polarity of the Voltage, as described in the load meter section. The selected class will determine whether a “passed” test requires detection of a specific class or if it will pass any class.

The next screen is the detection resistance screen. The button to the right will select one of three modes: “802.3af” (shown), “PSE Accept”, or “Disabled”.



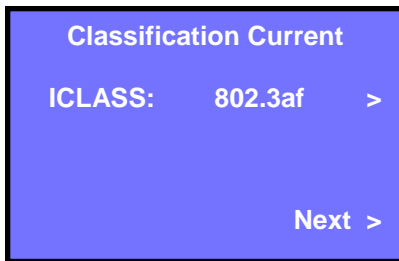
The 802.3af setting uses the PD compliance limits as specified in the standard. The PSE Accept setting uses limits in the 802.3af standard which correspond to the values that a PSE must power a PD. These are relaxed relative to the more stringent PD compliance limits. The Disabled setting simply disables the resistance test.

The next screen is the Detection Capacitance screen. The button to the right will select one of three modes: “802.3af” (shown), “PSE Accept”, or “Disabled”.

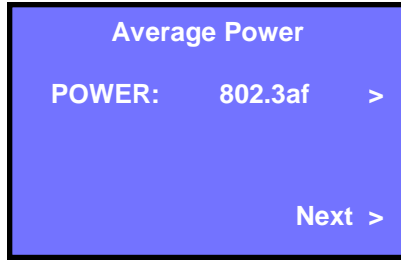


The 802.3af setting uses the PD compliance limits as specified in the standard. The PSE Accept setting uses limits in the 802.3af standard which correspond to the values that a PSE must power a PD. The Disabled setting simply disables the capacitance test.

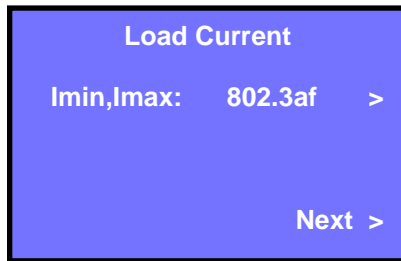
The next screen is the Classification current setting. There are 3 selections; 802.3af, PSE Accept, and Disable. The 802.3af setting uses the PD limits for each class as specified in the standard. PSE Accept uses the PSE limit, which is any current under 51mA. Selecting “Disable” will bypass the class current test.



The Average Power screen shown below has two selections: 802.3af, and disable. Selecting disable will remove the limit test associated with the average power and detected class.

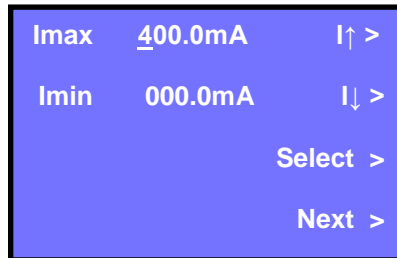


The Load Current menu is used to select either 802.3af limit testing, or Custom limit testing of the load current. If 802.3af testing is selected, the PDA-100 will use the maximum current load limits specified in the standard.

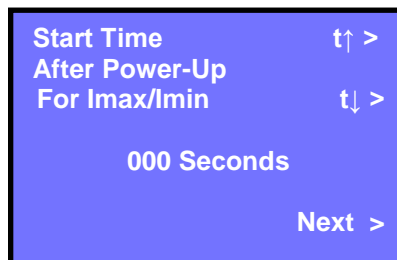


If Custom testing is selected, the next set of menus will allow input of custom current limits and test times.

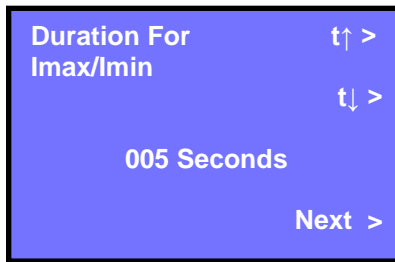
The first submenu is used to input the desired maximum and minimum current limits. The digit that is underlined can be changed with the top two buttons. The third button selects the digit to be changed, and underlines it.



The next sub-menu is used to select the time when the current load measurement starts. Times ranging from 0 to 255 seconds following power-up are possible.

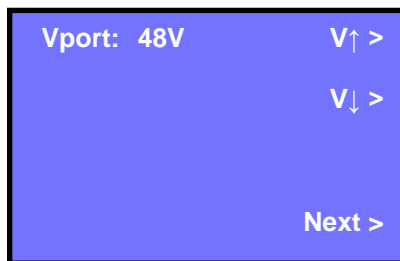


The next sub-menu is used to select the duration of the current load test. The test begins after the start-time selected above and lasts for the duration set in the menu below. The start-time delay is useful for bypassing initial PD boot-up times, in cases where a processor must power up circuitry.



The custom current load test is an effective tool that can be used to detect circuit problems that result in a change in expected power consumption, and which may not be detected by other PD test methods.

The Vport menu follows the load current section, and is shown below. The user may enter a custom Voltage value for powered-up tests.



## PDA-Interactive Instructions

Included with the PDA-100 is a Utility which provides a graphical user interface (GUI), and the ability to collect data directly to Microsoft Excel. The following requirements are necessary to operate the program:

- Windows 2000, Windows XP, Windows Vista, or Windows 7 Operating System
- Dot.net version 2.0 or higher
- Microsoft Excel 2000 or Excel 2007
- An available RS232 Port

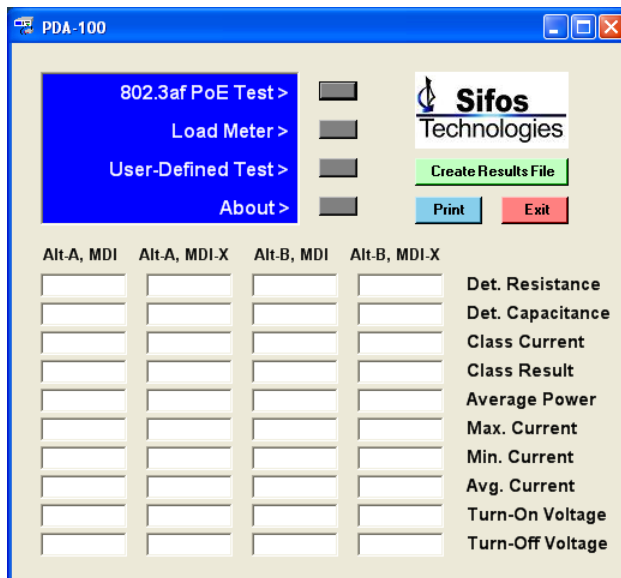
The PDA-Interactive program installation file is provided on the enclosed CD.

In order to run the program, a PDA-100 must be attached via the RS232 connection, and powered on long enough for the main menu to appear before the program is started. PDA-Interactive begins by searching for the PDA-100 over the available RS232 connection(s). Once found, the main screen appears.

**Note: If there is no PDA-100 attached, or if the Program cannot connect to a PDA-100, the user will be prompted to either terminate the program or enter Demo Mode. Demo mode allows the user to operate the software without an attached PDA-100.**

The main screen below shows the initial screen. The blue field and four buttons to the right of it directly correspond to the screen and controls on the front panel of the instrument. (There are minor exceptions, such as the ability to enter certain numeric values at the keyboard rather than scrolling through values, which is the case with the instrument front panel control.)

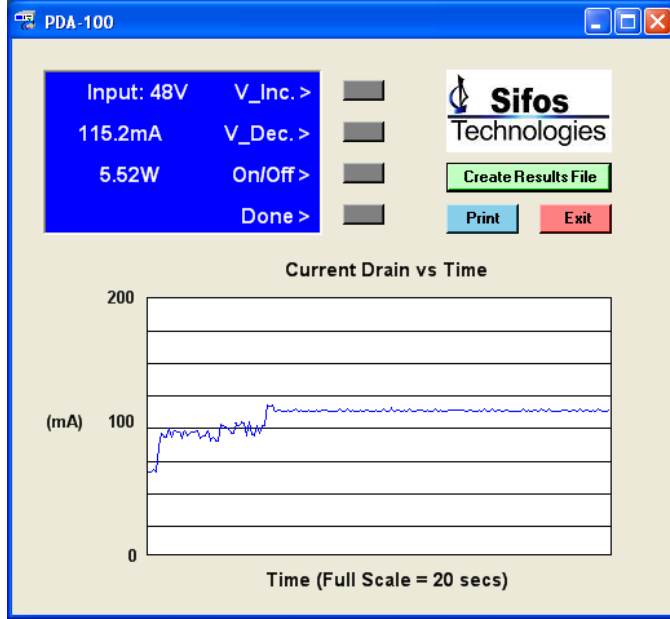
**Note:** When PDA-Interactive is controlling the instrument, the front panel controls are disabled, except for the ability to scroll through results at the completion of a test.



The 802.3af, load meter, and user-defined tests operate in the same manner as the stand-alone instrument. Set-up and operating screens appear on both the PC screen and Instrument display.



In load-meter mode a graph actively displays the powered-on characteristics of the PD under test. The graph continually updates while the PD is powered, and resets each time power a PD is powered-up. An example is shown below.

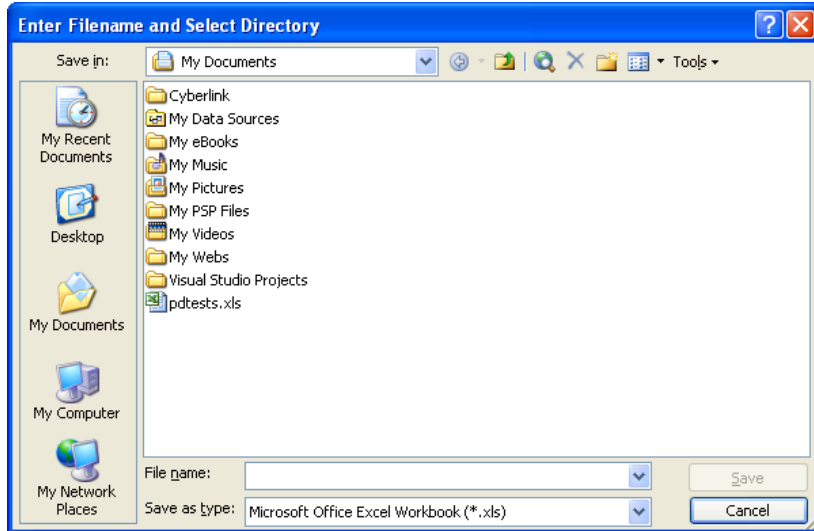


802.3af and User-defined results are presented in a data table screen as shown below. Values with Red backgrounds indicate a failure to meet the limits.

Alt-A, MDI	Alt-A, MDI-X	Alt-B, MDI	Alt-B, MDI-X	
24.88k	24.90k	24.97k	24.97k	Det. Resistance
0.006uF	0.006uF	0.006uF	0.006uF	Det. Capacitance
0.5mA	0.6mA	0.6mA	0.6mA	Class Current
0	0	0	0	Class Result
3.20W	3.20W	3.19W	3.19W	Average Power
70.4mA	70.5mA	70.5mA	70.0mA	Max. Current
59.0mA	58.9mA	59.1mA	58.9mA	Min. Current
66.8mA	66.7mA	66.6mA	66.6mA	Avg. Current
31.3V	31.3V	31.3V	31.3V	Turn-On Voltage
30.8V	30.8V	30.8V	30.8V	Turn-Off Voltage

## Result Files

It's often desired that results are stored for later analysis or record-keeping purposes. PDA-Interactive creates Microsoft Excel files for this purpose. A results file is started when the green "Create Results File" button is selected. Upon selection, a file creation window appears, as shown below:



The user browses to the desired directory and enters a filename. PDA Interactive creates and opens the file. The "Create Results File" button changes from Green to Red and reads "Close Results File".

When a results file is open, the user is prompted with a "Store Result?" message each time test results appear on the screen. If the user answers yes, a second entry box appears prompting the user for an optional device serial number of identifier. Once the user enters a value, the results are saved, and the user may proceed to the next test. Results are stored as a record list in the Excel file as shown below:

	A	B	C	D	E	F	G	H	I	J	K	L
1	00408c7cf09e	1/12/2007 13:28	RDET	CDET	IClass	CLASS	POWER	I_max	I_min	I_avg	V_on	V_off
2		ALT-A, MDI	24.74k	0.102uF	18.4mA	2	2.02W	46.8mA	23.0mA	42.2mA	40.4V	32.0V
3		ALT-A, MDI-X	24.60k	0.102uF	18.4mA	2	2.06W	46.7mA	25.1mA	43.0mA	40.4V	32.0V
4		ALT-B, MDI	24.76k	0.102uF	18.4mA	2	2.02W	46.8mA	25.0mA	43.0mA	40.4V	32.0V
5		ALT-B, MDI-X	24.71k	0.102uF	18.4mA	2	2.05W	47.0mA	25.0mA	42.9mA	40.4V	32.0V
6	tdy74y71b4a5e	1/12/2007 13:30	RDET	CDET	IClass	CLASS	POWER	I_max	I_min	I_avg	V_on	V_off
7		ALT-A, MDI	24.90k	0.006uF	10.6mA	1	1.93W	44.5mA	33.7mA	40.3mA	40.4V	31.9V
8		ALT-A, MDI-X	24.85k	0.006uF	10.6mA	1	1.85W	40.9mA	35.2mA	38.6mA	40.3V	31.9V
9		ALT-B, MDI	24.95k	0.006uF	10.6mA	1	1.93W	40.8mA	35.1mA	38.5mA	40.3V	31.9V
10		ALT-B, MDI-X	24.90k	0.006uF	10.6mA	1	1.84W	40.9mA	35.2mA	38.4mA	40.3V	31.9V
11	min005b00546	1/12/2007 13:32	RDET	CDET	IClass	CLASS	POWER	I_max	I_min	I_avg	V_on	V_off
12		ALT-A, MDI	24.78k	0.101uF	28.1mA	3	4.46W	105.8mA	56.9mA	93.0mA	40.6V	32.2V
13		ALT-A, MDI-X	24.67k	0.099uF	28.1mA	3	4.27W	105.0mA	48.9mA	89.0mA	40.6V	32.3V
14		ALT-B, MDI	24.64k	0.099uF	28.1mA	3	4.46W	105.3mA	50.9mA	88.2mA	40.6V	32.2V
15		ALT-B, MDI-X	24.74k	0.101uF	28.1mA	3	4.27W	107.7mA	48.8mA	89.1mA	40.6V	32.2V
16	00408c7cf098	1/12/2007 13:33	RDET	CDET	IClass	CLASS	POWER	I_max	I_min	I_avg	V_on	V_off
17		ALT-A, MDI	24.67k	0.101uF	10.7mA	1	0.68W	19.2mA	11.0mA	14.3mA	40.5V	32.4V
18		ALT-A, MDI-X	24.76k	0.101uF	10.7mA	1	0.69W	19.4mA	10.9mA	14.5mA	40.5V	32.3V
19		ALT-B, MDI	24.74k	0.101uF	10.7mA	1	0.68W	19.3mA	10.9mA	14.5mA	40.5V	32.3V
20		ALT-B, MDI-X	24.78k	0.101uF	10.7mA	1	0.69W	19.3mA	10.9mA	14.5mA	40.5V	32.3V

The Excel file shown illustrates a typical results file. Each test is labeled with the device identifier (column 1), followed by the date and time of the test, and the column headings for the resulting values. Results are then presented below. Failures appear in bold Red print.

The storage method is particularly well suited for production testing due to the time-stamped, serial-numbered format used. In the example shown, a low-cost bar-code reader was used to enter the device serial numbers from a few different types of products.

There is also a “Print” button provided. When selected, a bit-mapped screen shot of the PDA-Interactive window will be printed on the users default printer.

## **RS-232 Port Control Without PDA-Interactive**

The RS232 Port can be used to directly operate the PDA-100 for data collection and automated test applications. The HyperTerminal program that resides under Windows or a similar program can be used to communicate to the PDA-100, and can capture data to a file so that it can be loaded into Excel or some other program if desired. An example follows:

- 1 Connect the supplied DB9 cable to the PDA-100 serial port and to a PC that has the Windows HyperTerminal program.
- 2 Start HyperTerminal. This is usually on the Windows Start menu under **Programs > Accessories > Communications**.
- 3 When prompted, type a name for the connection, and click **OK**.
- 4 Select the COM port you are using in the **Connect using** box, and click **OK**.
- 5 Select the following port settings:
  - Bits per second** – 9600
  - Data bits** – 8
  - Parity** – None
  - Stop bits** – 1
  - Flow Control** – None or Hardware
- 6 Click **OK** to establish the connection with the PDA-100 chassis.

Once the connection is made, the Hyperterminal window will display menu selections that mirror those on the front panel. An example follows:

```
1: 802.3af PoE Test
2: Load Meter
3: User-Defined Test
4: About
>1
1: Set-up
2: -
3: Begin Test
4: Exit
>3
```

Pass

1: -

2: Results

3: Next Test

4: Exit

>2

Alt-A MDI,24.78k,P,0.099uF,P,28.1mA,P,3,P,5.31W,P,103.3mA,P,57.4mA,P,91.7mA,40.6V,P,32.2V,P,  
Alt-A MDI-X,24.67k,P,0.101uF,P,28.1mA,P,3,P,5.16W,P,104.2mA,P,50.9mA,P,89.0mA,40.7V,P,32.2V,P,  
Alt-B MDI,24.74k,P,0.099uF,P,28.1mA,P,3,P,5.06W,P,103.2mA,P,49.6mA,P,87.3mA,40.7V,P,32.2V,P,  
Alt-B MDI-X,24.71k,P,0.101uF,P,28.1mA,P,3,P,5.05W,P,103.7mA,P,48.5mA,P,87.2mA,40.6V,P,32.2V,P,

1: -

2: -

3: -

4: Exit

>

The above example shows the basic menu structure; the menus mirror the ones displayed on the front of the instrument, and commands 1,2,3 and 4 always correspond to the four push-button switches next to that display. User entries are entered only at the prompt (>), and user selections made at either the RS232 port or at the front of the instrument result in menu updates at both interfaces.

Minor self-explanatory menu differences exist between the RS232 menus and the display menus on the instrument. An example is shown above, where the result menu at the RS232 port only has the “Exit” selection, while the front panel menu has scroll selections to scroll through the result data. (In the case of the RS232 interface, all of the data is sent, so scrolling is not necessary or applicable.) Another difference is that certain set-up menus allow direct keyboard entry of Voltage or Current limits, as opposed to increment/decrement scroll selections provided at the front panel.

Load Meter mode presents a fifth menu selection when the DUT is powered on:

5: Toggle Data

This selection allows the user to enable a continuously updated output of current and power, mirroring the values that are shown on the instrument’s display screen. When enabled the format is comma delimited with <returns> between data pairs (as shown below) for easy column-oriented data transfer to Excel.

25.4mA,1.22W  
32.8mA,1.57W  
57.9mA,2.78W  
(etc.)

The data results sent to the screen are in comma-delimited format. The result sequence is: Connection type, RDET, CDET, IClass, Class, Avg Power, Max Current, Min Current, Avg Current, Turn-on Voltage, and Turn-off Voltage. If applicable, a “P” for pass or “F” for fail follow each result.

## Test Descriptions

### RDET – Detection Resistance

The 802.3af standard specifies a PD detection resistance between 23.75kΩ and 26.25kΩ. The PDA-100 measures this at 4V and 8V using the two-step detection method described in the standard. Measured values which fall outside these limits fail the test.

In the user-defined menu, a “PSE Accept” option is available. This option specifies limits that a PSE must accept as a “passed” detection. The detection resistance limits for this are 19kΩ and 26.5kΩ. PD’s which present detection resistances outside the 802.3af PD required range, but inside this “PSE Accept” range, are non-compliant to the standard, but are still likely to be powered up by a compliant PSE, if all other requirements are met.

### CDET – Detection Capacitance

The 802.3af standard requires PD’s to present a detection capacitance between 0.05uF and 0.12uF. The PDA-100 measures capacitance using a constant current source and a slope measurement between 3V and 4V. The resulting capacitance is determined by the following equation.

$$C = I \frac{dt}{dV}$$

In the user-defined menu, a “PSE Accept” option is available. This option specifies limits that a PSE must accept as a “passed” detection. The detection capacitance limits for this are 0uF and 0.15uF. PD’s which present detection capacitances outside the 802.3af PD required range, but inside this “PSE Accept” range, are non-compliant to the standard, but are still likely to be powered up by a compliant PSE, if all other requirements are met.

### ICLASS – Classification Current

Measurement of the Classification current is performed at 17V. The IClass test will fail if the current is outside the PD class current ranges described in the 802.3af standard. The values are shown below:

- Class 0: 0mA – 4mA
- Class 1: 9mA – 12mA
- Class 2: 17mA – 20mA
- Class 3: 26mA – 30mA

Class 4 is specified to be between 36mA and 44mA, however the standard states that a PD which presents a Class 4 signature is non-compliant, thus the PDA-100 will fail a Class 4 signature.

In the user-defined menu, a “PSE Accept” option is available. This option specifies limits that a PSE must accept as a “passed” classification. The standard gives the PSE some leeway in the interpretation of classification currents that fall outside or between the ranges shown, and the only limit placed on the PSE is that classification currents in excess of 51mA are not accepted. If “PSE Accept” is selected, the PDA-100 will accept all values under 51mA as passing values. PD’s which present classification currents outside the 802.3af PD required range, but inside this “PSE Accept” range, are non-compliant to the standard, and may have problems in deployment, depending on how a PSE classifies the PD.

## **CLASS – Class of Device**

The 802.3af test mode detects the Class, and passes units which exhibit Class 0, 1, 2 or 3. The user-defined mode allows selection of a specific class result as a pass/fail test.

## **POWER – Average Power Consumption**

The 802.3af test measures power consumption for a period of 5 seconds, and uses the resulting average to determine whether the limits meet those specified in the standard for the detected Class. The limits are 12.95W, 3.84W, 6.49W, and 12.95W for Classes 0, 1, 2, and 3 respectively.

There is no practical method to measure the maximum average power without prior knowledge of when and under what circumstances the maximum average power draw occurs. There are two other options in the PDA-100 for measurement of power; the first is the Load Meter, which simply powers up a PD and continuously monitors the power consumption, and the second is the Custom Test, which allows the user to set both the start time for the Average Power measurement, and the duration of the measurement. The times can range up to 255 seconds.

This measurement is derived from the VPort value of 48V (or the setting selected in the user-defined mode), and the average current result. Results are based upon an average of samples over the measurement duration. The sample rate is approximately 50 samples per second.

## **IMAX – Maximum Load Current**

The Maximum Load Current is measured following a PD power-up. This measurement is sampled continuously at a rate of approximately 50 samples per second. The result is compared to the peak operating currents allowed for 802.3af-compliant PDs. The limits are 400mA, 120mA, 210mA, and 400mA for Classes 0, 1, 2, and 3 respectively.

The user-defined mode allows a custom limit value to be entered for the maximum load current. It also allows the user to select a time window for this limit.

The result is the maximum current sample obtained over the measurement duration. The sample rate is approximately 50 samples per second.

## **IMIN – Minimum Load Current**

The minimum load current is also derived from the sampled load current measurement described above. For 802.3af, there is a minimum load current which guarantees that the PSE will not power-down the PD. This current, also known as the DC MPS current, is 10mA. The PDA-100 will fail a PD which is less than this value, however it will allow the PD to remain powered in order to perform other powered tests.

The user-defined mode allows a custom limit value to be entered for the minimum load current. It also allows the user to select a time window for this limit.

The result is the minimum current sample obtained over the measurement duration. The sample rate is approximately 50 samples per second.

## **IAVG – Average Load Current**

The measurements of current are also averaged and presented in the results. There is no associated Pass/Fail mechanism for the average current.

The result is the average of all samples taken over the measurement duration. The sample rate is approximately 50 samples per second.

## **V-On – Turn-on Voltage**

The Turn-on Voltage determines the Voltage where the PD powers up. This is measured by ramping the Voltage and measuring the current drain in order to identify an increase in current, relative to the classification current. Minimum and maximum passing values for an 802.3af test are 30V and 42V.

See the note following the V-Off measurement below for additional information.

## **V-Off – Turn-off Voltage**

The Turn-off Voltage determines the Voltage where the PD powers down after being powered-up. This is measured by ramping the Voltage downward and measuring the current drain in order to identify a decrease in current. The limit for the decrease is slightly higher than the classification current. Minimum and maximum passing values for an 802.3af test are 30V and 42V.

The V-on and V-Off measurements have some dependency upon the difference between classification current and operating current. If a particular PD does not exhibit a difference between these currents of more than 8 or 9 mA, the measurement may result in a “No Result”. If this occurs, it will be flagged in both the initial “PASS/FAIL” indicator, and in the results table.

## **Firmware Upgrade Instructions**

Firmware Upgrades may be released from time to time that may implement additional functionality in the PDA-100. A firmware file is provided when an upgrade is issued. This file has a **.hex** extension and should be installed as follows:

- 1** Turn on the power to the PDA-100.
- 2** Connect the supplied DB9 cable to the PDA-100 serial port and to a PC that has the Windows HyperTerminal program.
- 3** Start HyperTerminal. This is usually on the Windows Start menu under **Programs > Accessories > Communications**.
- 4** When prompted, type a name for the connection you are about to make, and click **OK**.
- 5** Select the COM port you are using in the **Connect using** box, and click **OK**.
- 6** Select the following port settings:
  - Bits per second** – 9600
  - Data bits** – 8
  - Parity** – None
  - Stop bits** – 1
  - Flow Control** – Hardware

**Note:** **Hardware flow control is required for a firmware upload to work correctly.**

- 7** Click **OK** to establish the connection with the PDA-100 chassis.
- 8** With HyperTerminal running and the PDA-100 connected, turn off power to the PDA-100.
- 9** Turn the PDA-100 on. The Hyperterminal screen should read as follows:
  - Firmware Version ###**
  - Upgrade Firmware? (Y or N)**

- 10** Type **Y (Do not ht <return>)**

The PDA-100 should respond with the following:

**Select Transfer > Send Text File**  
**Select Files of Type: All Files (\*.\*)**



**Then Browse To, Select, and Open  
The Firmware File**

**Note:** The Upgrade Firmware Question appears for about four seconds before the PDA-100 deletes it and enters its normal operating mode. “Y” must be entered within this 4-second period.

- 11 Turn In HyperTerminal, click **Transfer > Send Text File**.... A Windows Explorer screen will appear.
- 11 Find and select the firmware upgrade file. You might have to select **All Files (\*.\*)** in the Files of Type box to see the firmware upgrade file.
- 12 Click Open. The file should begin to load. A series of dots (.....) will be written to the screen indicating that the upload is in progress. At the conclusion of the upload, the word **PASS** should be written to the screen indicating a successful upload. If the word **FAIL** appears, or if **PASS** does not appear, repeat the previous procedures.
- 13 When the download finishes, reboot the PDA-100.

The firmware upgrade is now complete.