# **Tektronix**<sup>®</sup>

PWRVIEW Online Help



077-1165-00

# **Tektronix**<sup>®</sup>

PWRVIEW Online Help

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### Introduction

Welcome to the PWRVIEW online help for the Tektronix power analyzers.

PWRVIEW has been designed to make power measurement and analysis as simple as possible using Tektronix power analyzers.

- Measure efficiency, energy consumption, standby power, harmonics, and other power parameters for single and three phase applications
- Remotely monitor, control and log power measurements
- Take measurements simultaneously from multiple power analyzers
- View voltage, current and power waveforms
- Chart harmonics to instantly visualize a voltage or current frequency spectrum
- Set custom measurement limits to monitor when measurements have exceeded a user specified threshold
- Trend measurements by plotting their values over time
- Save measurement snapshots
- Record results for future analysis in spread sheets or comma separated value files
- Run, compliance and pre-compliance tests for various regulatory standards such as IEC 62301 (Standby Power), IEC 61000-3-2 (Current Harmonics) or MIL-1399 (Current Harmonics)

#### Minimum system requirements

The minimum system requirements for running PWRVIEW are:

- Microsoft Windows 7 or 8.1
- 2 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- 2 GB RAM (minimum), 4 GB RAM (recommended)
- Minimum display resolution of XGA (1024 x 768)

PWRVIEW also supports "Virtual" instruments; these instruments can be used to learn the features of either product without a physical instrument being present.

Use the <u>Setup (see page 13)</u> screen to configure instruments and switch between Measure and Test modes. Setup Wizards make the most complex measurement settings simple by taking you step by step through your unique requirements.

Use the <u>Measure (see page 63)</u> screen to monitor and analyze measurement results. This screen is where all the selected measurement can be viewed in a grid. Harmonics, waveforms, and trend plots can also be enabled on this screen.

Use the <u>Test (see page 77)</u> screen to perform Regulatory Standards testing based on measured results. IEC 62301 (Low Power Standby), IEC 61000-3-2 (Current Harmonics) and MIL-1399 (Current Harmonics) standards testing is supported.

Use the Results (see page 101) screen to export recorded data or to analyze and report the test results.

Use the File Menu (see page 7) to save and manage measurement projects.

See the <u>Quick Start (see page 2)</u> guide to quickly begin making measurements.

## **Quick start**

This section provides a step-by-step guide for setting up and measuring results. This section uses a single four-channel PA3000; if you have a single-channel instrument or multiple instruments, some of the screens will differ from the ones shown.

- 1. Connect your power analyzer to the computer using your preferred communications method. Communications are possible using USB, Ethernet, and GPIB. Not all instrument models have all types of communication port available, and some may be optional. Please consult the documentation for your model.
- 2. If using USB or GPIB, instruments are automatically detected. If using Ethernet, make sure the instruments IP Addresses are configured in the Network Setup.

3. Press the Add button to detect and add your instrument. The following dialog box will appear:



4. Click the Connect button to connect your instrument to PWRVIEW.

If desired, check the "Include Virtual Instruments" box to add demonstration instruments to the list and then select one or more instruments before clicking the Connect button.

5. After closing the Add dialog box, the Setup tab will be displayed with the newly selected instruments.

The following figure shows the Setup tab with the wiring configuration for the PA3000.

	(No Project) - PWRVIEW	
Setup Measure Results		^ <b>(</b> )
O Add         O         Measure         Test         Configure         S           Instruments         Application Mode         Efficiency         Lit	etup mits Settings	
PA3000(0016)	1	
Applications / Tests	Wiring Group A	
	Channel 1: 1p2w Group A Channel 2: [Disabled] • Channel 3: [Disabled] • Channel 4: [Disabled] • Auxiliary Inputs (Analog and Counters)	
Ready		

If you have a single-channel instrument such as a PA1000, the Setup tab will show the settings configuration.

				(No	Project) - PWRVIEW				
🗋 🕶 🛛 Se	tup Measure Re	sults							^
Add									
Remove	Measure     O Test	Configure		-					
Network			Setup	Upload					
struments	Application Mode	Efficiency	Limits	Settings					
1000(0001)									
Applicatio	ons / Tests		Se	ettings					
General					Mode: Normal	▼ Filter: High	Frequency Voltage	•	
AC Po	wer					Errorupper (	3001Ce		
LED Drive	r					Filter: Auto	•		
Outpu	Jt					Vales of Ch			
Ballast					D Auto	voltage Ch	annei		
Input					Range: Auto	<ul> <li>Scaling:</li> </ul>	1		
Outpu Standby I	ut Jower Mescurements					Current Ch	annol		
Stand	by Power				Revenue Auto	• Carlian	1 Shurth Internal (20	- (4)	
Complian	ce Tests				Kange: Huto	• scaling:	1 Shunt: Internal (20		
IEC 62	2301 Standby Power				Meas	surement Selection	Select All	Clear All	
1EC 01	1000-5-2 Current Harmon	ics (Pre-compliance	.,		Vrms	Vcf	🔲 Vdc	~	
					🔽 Arms	C Acf	Adc		
					Watts	Vpk+	🔲 Z		
					🗆 VA	🔲 Vpk-	🔲 R		
					PF	🔲 Apk+	🕅 X	=	
					🔽 Freq	🔲 Apk-	🔲 VAr		
							Vrng		
		<del>?</del>					C Arng		
		<b>N</b>			WHr	VAHr			
	~	Apply >			AHr	L Hr	VArHr		
nstrument	PA1000				VHarm				
						Minimum:	1 Maximum: 13		
onnection	VIRTUAL				Odd and	Even			
erial Numb	er Virtual10001				© Odd Onl	у			
irmware Ve	er. 1.003.000				Absolute	Value		*	

- **6.** By default, the General/AC Power Application is applied to each instrument. This is used to make general power measurements.
- 7. To start gathering measurement results, go to Measure tab on the top and click the Start button. The settings will be automatically uploaded to the instrument. The measurements will be updated and results will be shown in the results grid:

			(No Project) - PWRVIEW	
1	Setup	Measure Resu	lts	^
		Significan	Figures: 5 - I Harmonics	
J '	$\mathbf{\nabla}$	A	veraging: Auto Measure A Waveform	
top	Reset	Setup	Zee Blackies Z Efficiency Let SnapShot Record	
		•	Zero blanking: V	
easure	ments	Limits	Display Efficiency Charting Data Logging	
asurem	nent			
ndex	Meas	A PA3000(0016) 1	B Formula	
1	Vrms	119.07 V		
2	Arms	0.0000 A		
3	Watts	0.0000 W		
4	Freq	59.983 Hz		
5	Vh1m	119.01 V		
6	Vh1p	0.0000 °		
7	Vh2m	33.486 mV		
8	Vh2p	-82.621 °		
9	Vh3m	422.58 mV		
10	Vh3p	58.781 °		
11	Vh4m	22.327 mV		
12	Vh4p	-59.142 °		
13	Vh5m	2.5160 V		
14	Vh5p	-171.85 '		
15	Vh6m	22.509 mV		
16	Vh6p	-27.477 *		
17	Vh7m	794.76 mV		
18	Vh7p	27.581 *		
19	Vh8m	10.709 mV		
20	Vh8p	5.3123 *		
21	Vh9m	378.17 mV		
22	Vh9p	-117.41 *		
23	Vh10m	4.2333 mV		
24	vh10p	145.29 *		
25	vhllm	963.86 mV		
26	vhllp	-154.72 °		
27	vh12m	22.678 mV		
28	vn12p	-39.037		
29	Vn13m	564.61 mV		
30	vh13p	-135.72 °		
31	Ahlm	0.0000 A		
32	Ah1p	0.0000 °		
33	Ah2m	0.0000 A		
34	Ah2p	0.0000 *		
35	Ah3m	0.0000 A		

8. Click the Stop button to stop the measurements.

#### File menu

The File menu contains all functionality to manage project files.

- Default Project (see page 9) returns PWRVIEW to a default state.
- Open (see page 10) opens an existing project.
- Save / Save As (see page 11) saves the current PWRVIEW configuration to a file.
- About (see page 11) provides information about PWRVIEW.
- Exit closes the application.

A Recent Projects list conveniently shows a list of the most recently used projects to open with a click of the mouse.

	Recent Projects	
Default Project	Project1	
Open		
Save		
Save As		
About		
💥 Exit		

#### **Projects**

The current settings of the PWRVIEW application can be stored in a project file. The file suffix is .vpm.

The file includes:

- A list of all the instruments currently added to PWRVIEW
- The wiring setup for each instrument
- The configuration for each instrument group including the mode, Voltage channel, Current channel, and measurement selections for all groups
- The Auxiliary input configuration for an instrument (applicable to PA3000 or PA4000 instruments)
- The Efficiency measurement settings
- All limits definitions

- All values that can be set from the Measurement tab:
  - Significant figures setting
  - Averaging setting
  - Zero blanking
  - The number of charts that are displayed
  - The logging setup
- If a test is active, all values associated with that test. The details vary per test.

Project files can be saved and recalled anywhere within the file system. Saving a project file has no impact on the current PWRVIEW setup. Recalling a project file replaces the current PWRVIEW setup.

PWRVIEW automatically prompts you to save any changes you made to the setup settings before exiting. This allows you to continue working with the same configuration setting when you restart PWRVIEW. PWRVIEW provides a Default Project option to remove all instruments and return all settings to default values when desired.

# **Default Project**

Default Project resets PWRVIEW to a default state. All instruments and defined formulas will be removed, averaging, blanking, significant digits, and logging settings will be returned to default settings.

**NOTE.** Default Project does not affect the current settings on the power analyzer.

Default Project does not affect database or recorded test results.

1. Click the blue tab with white arrow below to expand the <u>File Menu (see page 7)</u>, then select the Default Project entry.

- 🗋 🔻		
		Recent Projects
	Default Project	Project1
6	Open	
	Save	
	Save As	
6	About	
×	Exit	

2. Upon clicking Default Project you will be asked to confirm the removal of instruments and resetting of values.



After confirmation, PWRVIEW will be returned to default settings: all instruments and defined formulas will be removed, averaging, blanking, significant digits, and logging settings will be returned to default settings.

# **Open / recent project**

#### Open

The Open button allows you to open previously saved project files.

1. Click the blue tab with white arrow to expand the <u>File Menu (see page 7)</u> and click Open to open a saved project.

<b>•</b>	Recent Projects	
Default Project	Project1	
Open		
Save		
Save As		
About		
💥 Exit		

2. Select a file as shown below with a .vpm extension and click Open.

Organize 🔻 Nev	v folder			8≡ ▼	1 0
퉳 Downloads	•	Name	Date modified	Туре	Siz
🔛 Recent Places		Full Compliance Standby for Switch Mod	19/03/2013 10:38	VPM File	
		High Fregency Lighting Ballast.vpm	19/03/2013 08:54	VPM File	
libraries	H	High Frequency Lighting Ballast.vpm	19/03/2013 10:37	VPM File	
Documents		My First Test.vpm	19/03/2013 10:38	VPM File	
J Music		PA1000 using 1A shunt.vpm	19/03/2013 08:57	VPM File	
Pictures		PA3000 Quick Try.vpm	19/03/2013 08:54	VPM File	
Videos		PWM Inverter with Efficiency.vpm	19/03/2013 10:37	VPM File	
Computer					
🚮 OS (C:)					
PINTRANET (\\V	0 - 4	III			

PWRVIEW will be set based on the settings within the opened file.

#### **Recent Projects**

The Recent Projects area is a list of recently Saved/Saved As project files. A new entry will appear after saving a project to file. Selecting an entry in this area opens that project file (it is equivalent to pressing the Open selection and browsing to the project file path). Hovering the mouse over one of the recent projects shows the full path of the project file.

# Save / Save As

Use the Save or Save As buttons to save the current PWRVIEW configuration to file.

Defente Desired	Recent Projects
Default Project	Project1
Open	
Save	
<b>D</b> Sarc	
Save As	
About	
💥 Exit	
I Input	

# About

The About dialog box shows information about the PWRVIEW software.

About PWRVIEW	×
Tektronix	
PWRVIEW (64-bit)	
Version - 3.1.0rc10 (x64)	
Copyright © 2014-2016 Tektronix	
Tektronix	
All Rights Reserved.	
Product details:	
Tektronix Power Analysis Software	* *
For more information visit <u>www.tek.com</u>	
ОК	

#### Setup

The Setup ribbon provides the ability to add and remove instruments as well as the ability to configure instruments to make the desired measurements. It contains the following areas:

- Instruments (see page 14): Adds and removes power analyzers to and from PWRVIEW
- Application Mode (see page 17): Switches between Measure and Test modes
- Efficiency (see page 18): Configures the Efficiency measurement
- Limits (see page 18): Configures user defined limits for Measurement, Auxiliary inputs, and Formulas
- Settings (see page 20): Uploads the current PWRVIEW settings to each added instrument
- The Instrument Setup Panel (see page 20) has a dedicated tab for each instrument. Each instrument tab has the following sub panels:
  - <u>Applications / Tests Panel (see page 21)</u> is used to configure instruments for specific applications including enabling tests.
  - Information Panel (see page 37) showing instrument details.
  - Wiring and Group panel which is used to <u>setup an instrument (see page 20)</u> for various wiring configurations.

	(No Project) - PWRVIEW	1		- 1
Setup Measure Results				
Add				
Remove  Measure  Test  Configure				
Network	Setup Upload			
nstruments Application Mode Efficiency	imits Settings			
PA3000(0134) PA3000(0001) PA1000(0002)				
	Wiring AC Power			
Applications / Tests				
4 General	Mode: Normal	▼ Filter: High ▼	Frequency Source: Voltage -	
AC Power		Frequency		
4 LED Driver		Range: > 10Hz •		
Outout		1212		
Efficiency		Voltage Channe		
▲ Ballast	Range: Auto	<ul> <li>Scaling: 1</li> </ul>		
Input				
Output		Current Channel		
Efficiency	Range: Auto	<ul> <li>Scaling: 1</li> </ul>	Shunt: Internal (30A) 🔻	
<ul> <li>PWM Motor Drive</li> </ul>				
Output	N	leasurement Selections	Select All Clear All	
4 Energy Measurements	Vrms	Vcf	Vdc 🔺	
Energy Consumption	Arms	Acf	Adc	
<ul> <li>Standby Power Measurements</li> </ul>	Watts	Vpk+	Z	
Standby Power		Vok-	T B	
<ul> <li>Compliance Tests</li> </ul>	PF	Apk+	x =	
IEC 62301 Standby Power	V Freq	Apk-		
MIL-1399	₩ Heq	Wf	VΔf	
	Δf	PFf	VArf	
er b	Venn	Armo	Vrog	
Wizard Apply >			Arna A	
Страто Срру -	Wile	VAHr	E ony	
Instrument PA4000		Hr	VArHr	
		U VALIF	DEm.	
Connection USB NI-VISA64 15.0	CVAP	VAHT	I Prov	
Serial Number B010134	THE NO. I	Wav	varHt	
	VHarm			
Firmware Ver 2600101				

#### Instrument add/remove

The setup ribbon provides the user with functionality that:

- Adds (see page 15) new instruments
- <u>Removes (see page 16)</u> currently added instruments
- Network (see page 17) configures the IP addresses over which to communicate

PWRVIEW interacts with one or more power analyzers to send setup information and receive measurement results. Communication is achieved using TekVISA software which is available from <u>www.tek.com</u>. The VISA system manages all communications links allowing PWRVIEW to use a common framework regardless of the physical communication layer chosen. NI-VISA, National Instruments VISA, is also supported.

Communication is possible using USB, Ethernet, and GPIB. All three buses are always available on the PA1000 products. GPIB is optional for PA3000 products.

#### **USB** connections

Using the Universal Serial Bus is the simplest way to connect your instrument to the computer. Just plug a cable into any USB port on the computer running PWRVIEW and the square USB port (Standard B) on the rear of the instrument. The computer should automatically detect and install an appropriate communication driver. After driver installation, the attached power analyzer will be shown in the list of available instruments.

#### Ethernet (Network) connections

Unlike USB and GPIB, an Ethernet enabled instruments are not automatically detected by VISA. The IP address of each instrument must be entered into the <u>Network address dialog box (see page 17)</u>. This approach eliminates long VISA Ethernet search times.

First connect both the PWRVIEW host computer and power analyzer onto the same Ethernet network. The power analyzer will, by default, obtain an IP address automatically from the DHCP server. The IP address can be accessed on PA1000 front panel by selecting Menu  $\rightarrow$  Interfaces  $\rightarrow$  Ethernet  $\rightarrow$  Current IP Settings. On the PA3000, the IP addresses can be accessed on the instrument front panel by pressing the Setup button and then scrolling to the bottom of the screen.

Once the correct network IP address is entered into the Network dialog box, the instrument will be added to the list of available instruments.

#### **GPIB** connections (IEEE 488.1)

General Purpose Instrument Bus connections require the addition of a GPIB controller to the host computer. GPIB controllers come in a variety of formats from PCI cards that require installation inside desktop computers to USB-GPIB converters that can simply be attached to the USB port of the computer.

Whichever option is used the manufacturer must supply drivers that interface with the VISA system. Connect the instrument to the GPIB controller using a GPIB cable and the instrument should be shown in the list of available instruments.

#### Add

The Add button activates the Add An Instrument dialog box. When this dialog is activated, PWRVIEW will search for instruments attached to the computer on USB, GPIB, and the Ethernet addresses defined in the Network dialog box (see page 17).

1. Click Add to detect and add an instrument.



**2.** Upon clicking Add the following dialog box displays. It shows the instruments available for connection. Click the box next to an instrument to add it to PWRVIEW.



- Clicking the Refresh button will initiate a new search for connected instruments.
- Checking "Include Virtual Instruments" adds Virtual Instruments to the list of available instruments. Virtual instruments can be used to learn the features of either product without a physical instrument being present.

#### Setup

# Remove

Remove opens a dialog box that can be used to remove instruments from PWRVIEW.

1. Click Remove for removing already added instrument.

Se Se	etup Measure Re	sults		
O Add	Measure O Test	Configure	♦ Setup	<b>D</b> Upload
Instruments	Application Mode	Efficiency	Limits	Settings

2. Select the instrument to remove.



3. All selected instruments will be removed from the project.

#### Network

The Network dialog box specifies instrument IP addresses. PWRVIEW will only search the Ethernet for addresses in this list.

The Add area allows you to enter new addresses to be searched. To remove an address, select it from the list and click **Remove**.

The addresses in the list will be searched when the Add instrument function is performed.

The IP address list will be searched each time instruments are added. Therefore this list should be kept as small as possible. Addresses that are not valid extend the search time.

PWRVIEW	X
<b>Tektronix</b> <sup>®</sup>	TCP/IP addresses on which to search for instruments.
192.168.0.96	Add
192.168.0.66 192.168.0.72	Remove
	OK Cancel

## **Application Mode**

Use the Application Mode to select either the Measure or Test modes. The <u>Applications / Test (see page 21)</u> area on the left side of the screen provides a list of preset applications and tests. The selections in the list depend on the instrument; The PA3000 and PA4000 have different tests than the PA1000. The application mode selection helps set up the measurements or tests for your particular application.

Depending on the application mode, some selections are grayed out and are not active until you change the mode. For example Compliance Tests are not available in Measure mode, but only in Test mode.

Use Measure to select the measurements, such as AC Power or LED Driver Input, and then click either the Wizard button or the Apply button. After selecting the measurement, the configuration details appear on the right side of the screen. When you select the Measure application mode, the Measure tab becomes available where you can start or stop measurements and display the results using different tools such as Harmonics (see page 98), Waveforms (see page 74), or Trend (see page 75) charts.

Use Test to select compliance tests for your instrument, such as IEC 62301 Standby Power. Click either the Wizard button or the Apply button to apply the test setups on the right side of the screen. When you select the Test application mode, the Test tab is available where you can start or stop the test.

## Efficiency

The Efficiency Configure check box allows for configuring the Efficiency measurement. This feature requires at least two groups added in PWRVIEW. Click the Configure check box to bring up the Efficiency Setup tab to configure the input and output instruments and groups.

Click the Measure Efficiency check box to enable selected efficiency calculations on the measure grid.

		(No Project) - PWRVIEW	
Setup Measure Resu	ults		^ <b>@</b>
© Add © Remove © Measure © Test © Network Instruments Application Mode	Configure	Upload Settings	
PA3000(0134) PA1000(0001) PA3000(	(0002) Efficiency Setup	а а	
Efficiency Configuration:			
Input: Instrument: PA30000 Group: AC Power	(0134) • er •		
Output:		✓ Measure Efficiency	
Instrument: PA1000(	(0001) -		
Group: AC Powe	er 🔻		
Ready			

#### Limits

Use the Limits setup to configure user defined limits for various measurement parameters.

Limits can be set for different categories (Standard, Harmonics, Sum, Aux and Formulas).

Click the down arrow for more options such as setting up limit values, saving limits to a file, recalling limits from a file, and clearing all limits. The limits file is independent of the PWRVIEW configuration file and can be saved and recalled independently.



Select Setup from the menu to open the Limits Setup dialog box for configuring limit values.

Limits Setup	)		L ک
Limit Cate	gory: Channel	•	
- Channel -			
Instrume	PA3000(0016)	Channel: Ch1	•
On/Off	Vrms	Limit Function Limit Value	50
	Arms	Creater T	10
	Watts	> Greater	0
	Freq	> Greater 🔻	
	PF	> Greater 🔻	
	Vcf	> Greater 🔻	
	Acf	> Greater 🔻	
		Clo	se

Limits will show up on the Measurement grid as an individual tab. Hovering over the results cell displays the set Limit Function, Limit Value, Relative Value, and Pass-Fail Status in real-time.

🖉 🛛 🔚 🕴 Energy Consumption Testing.vpm - PWRVIEW									_ <b>_</b> ×	
	Setup	Measu	ure Re	sults						^ 😧
O Stop	eet	♦ ♦ Setup ▼	Significa	ant Figures: 5 Averaging: 1 Zero Blan	Meas	ure ency Stop F	Co	Harmonics	SnapShot Record	
Measure	ments	Limits		Display	Efficier	ncy Integrat	tion	Charting	Data Logging	
Measuren	nent Lir	nits Results	Tren	d 1 🕷						
Index	Meas	PA3000(0	0006) 1	PA3000(0006) 1 Result	PA3000(0006) 2	PA3000(0006) Result	2	PA3000(0006) 3	PA3000(0006) 3 Result	
1	Vrms	120.	13 V	-134.00 mV	38.376 V	1.6241 V		38.525 V	1.4755 V	
2	Arms	477.	76 mA	22.245 mA	316.75 mA	-183.25 m	A	332.75 mA	167.25 mA	
3	Watts	27.1	30 W	12.870 W	9.3041 W	695.91 m	N	Limi <sup>10</sup> Fånction	: > Greater1 W	
4	PF	472.	70 m	427.30 m	765.43 m	134.57 m	_	Limi#4¥al9em	0.557.209 m	
5	Vcf	1.3752		-38.850 m	1.3646	-49.420 m		Result	FAIL-02 40	
6	ACT	4.35	10	-648.41 m	4.1003	-899./3 m	U	4.4169	1 2207	
	VAHr	20.4	24	15 424	4 3118	-688 16 m		4 5254	-1.2207 -474 65 m	
9	AHr	169.	99 m	-4.8300						
Measurements running										

# Upload

Use the Upload button to remotely control and change settings on the power analyzer.

Upload sends the commands necessary to configure the power analyzer to measure the selected parameters. The use of this button is not mandatory as the uploads take place automatically when trying to take measurements; but it can be used for controlling the instrument remotely and for diagnostic purposes.

Se Se	etup Measu	ire Re	sults		
O Add Remove	Measure	Test	Configure	♦ ♦ Setup	Upload
Instruments	Application	Mode	Efficiency	Limits	Settings

# **Instrument Setup panel**

All instruments added to the configuration using the <u>Add (see page 15)</u> button will appear as a series of tabs in the Instrument Setup panel. Select the instrument to configure by clicking the tab. Information to allow simple identification of the instrument is shown in the <u>Information Panel (see page 37)</u>. Applications and tests can be configured using <u>Applications / Tests Panel (see page 21)</u>. Other parameters are configured using the <u>Wiring (see page 37)</u> and <u>Group Configuration (see page 40)</u> panels.

2 ' H '	Project1.vpm - PWRVIEW	- • ×						
Setup Measure Results		^ <b>()</b>						
OAdd         Measure         Test         ♥ Configure           Instruments         Application Mode         Efficiency         Instruments	Setup Upload Settings							
PA1000(0001) PA3000(0002) PA3000(0006) Efficiency Se	PA1000(0001) PA3000(0002) PA3000(0006) Efficiency Setup							
Applications / Tests	Wiring Group A Group B							
General     General     General     General     Gapoint     G	Channel 1: 1p2w Group A Channel 2: 1p2w Group B Channel 3: [Disabled] • Channel 4: [Disabled] • Auxiliary Inputs (Analog and Counters) Frabled							
Ready								

# **Applications/Tests panel**

The Applications / Tests selector provides a list of preset applications and tests. These suggest the parameters for the applications and tests; when applied they can be modified to suit the application or test.

Select from the list of available applications and tests and then use the <u>Wizard (see page 23)</u> or <u>Apply (see page 22)</u> button to quickly generate an instrument setup. The following figure shows the applications and tests available for a PA3000; other test are available with other power analyzers.

**NOTE.** Some items in the list are grayed out depending on the whether the Application Mode is Measure or Test. In the following figure, the Compliance Tests are grayed out because the Application Mode is Measure.



# Apply button

The Apply button applies the default setup for the selected application / test.

After clicking Apply, the instrument configuration is generated. You can then make any necessary changes before saving and uploading the configuration.



**NOTE.** The Apply button does not upload the settings to the power analyzer, it just configures the settings of PWRVIEW. Click either the Upload button or the Start button under the Measure or Test tab to send all the settings to the power analyzer.

#### **Applications wizard**

The Applications wizard launches a series of prompts that ask questions about the measurement application before automatically generating an instrument configuration. It can also provide help and wiring diagrams to connect the instrument. The available applications vary depending on which power analyzer is being used and the number of available channels.

1. Click the wizard button and follow the screen prompts.



#### **AC Power**

AC Power does not have a wizard; but is used to apply a default configuration for making general AC power measurements in Normal mode. This configuration will expect steady state power for each line cycle.

#### **LED Driver**

LED - Light Emitting Diode - applications are those that involve making AC-DC LED drive measurements. An LED drive is the supply unit used to drive LED devices. They typically take line power in and produce a constant current DC output.

LED Driver Input (see page 24), Output (see page 25), and Efficiency (see page 26) wizards are available.

#### **LED Driver Input**

The LED Driver Input wizard provides a wiring diagram showing how to connect the input of an LED driver to the mains. The last page of the wizard presents a wiring summary showing a schematic with wiring instruction (see page 36).


# **LED Driver Output**

The LED Driver Output wizard provides a wiring diagram showing how to connect the Output of an LED Driver to the LED module. The last page of the wizard presents a wiring summary showing a schematic with wiring instructions. (see page 36)



# **LED Driver Efficiency**

The LED Driver Efficiency wizard generates a configuration suitable for measuring the efficiency of LED (see page 24) Drive systems. Prompts are generated the same as those of the LED Driver Input (see page 24) and LED Driver Output (see page 25) wizards before presenting the wiring instructions (see page 36) shown.



# Ballast

Ballast applications involve measurements of lighting ballast systems. A typical ballast system will take the line input and convert it to high frequency signals that can be heavily amplitude-modulated at line frequencies.

Ballast Input (see page 27), Output (see page 28), and Efficiency (see page 29) wizards are available to guide you through the measurement application and apply an appropriate configuration.

## **Ballast Input**

This wizard generates a suitable configuration for measuring the power input of ballast systems.

The maximum expected peak current is requested to determine which shunt (1 A or 30 A) should be used. The last page of the wizard provides a wiring summary showing a schematic with <u>wiring instructions</u> (see page 36).



# **Ballast Output**

This wizard generates a suitable configuration for measuring the output power of ballast systems. The wizard requests the maximum expected peak current to determine which shunt (1 A or 30 A) should be used. The line frequency is requested and used by the power analyzer to synchronize the measurements to the fundamental power frequency. Selecting a tube with a filament presents the required schematic diagram. The last page of the wizard provides a wiring summary showing a schematic with wiring instructions. (see page 36)



**NOTE.** The image shows the use of the Tektronix Ballast CT accessory for measuring output power and tube current in high frequency electronic lighting ballast applications.

# **Ballast Efficiency**

This wizard generates a suitable configuration for measuring the efficiency of ballast systems. Prompts are generated the same as those of the <u>ballast input (see page 27)</u> and <u>ballast output (see page 28)</u> wizards before creating the <u>wiring instructions (see page 36)</u> shown below.



**NOTE.** The image demonstrates the use of the Tektronix Ballast CT accessory for measuring output power and tube current in high frequency electronic lighting ballast application.

## **PWM Motor Drive**

PWM (Pulse Width Modulation) motor drive applications are those involved with measuring the power consumption and efficiency of PWM motor inverter systems.

A typical PWM motor drive operates from a single or a three phase supply and converts the output voltage to a high frequency pulse width modulated signal to accurately control a three phase motor. The resultant output current is at motor frequency and represents the fundamental frequency for output power but can often be highly distorted and not fit for frequency detection. The <u>PWM mode (see page 45)</u> digitally filters

and demodulates the output voltage to accurately detect the fundamental power frequency. The digital filter in PWM mode is only used for frequency detection and does not affect the actual RMS readings of voltage.

#### **PWM Motor Drive Output**

This wizard generates a suitable configuration for measuring the output power of PWM motor drive systems using the two watt meter method.

The maximum expected peak current is requested to determine which shunt (1 A or 30 A) should be used. The number of phases might be requested to determine the number of channels to use.

The following current measurement options are presented:

- Direct Measurement
- Current Transformer
- Voltage Output Transducer

The last page of the wizard provides a wiring summary showing a schematic with <u>wiring instructions</u>. (see page 36)



# **PWM Motor Drive Efficiency**

This wizard generates a suitable configuration for measuring the efficiency of PWM motor drive systems using the two watt meter method. Prompts are generated to ask questions about the power into the inverter, followed by questions similar to those of the PWM Drive Output (see page 30) wizard.

Questions are asked about peak current (to determine the shunt selection) and number of input phases. The following input current measurement options are presented:

- Direct Measurement
- Current Transformer
- Voltage Output Transducer

The last page of the wizard provides a wiring summary showing a schematic with <u>wiring instructions</u>. (see page 36)



### **Energy Measurements**

Energy consumption measurements require power integration over long periods of time to determine the energy used (in kilowatt hours, for example). Integrator mode is used for these measurements.

## **Energy Consumption**

This wizard generates a suitable configuration for measuring energy consumption of a device. The maximum expected peak current is requested to determine which shunt (1 A or 30 A) should be used. The number of input phases is requested. The software can also compute the Correction VArs (CVArs) based on the target power factor for this measurement.



The last page of the wizard provides a wiring summary showing a schematic with <u>wiring instructions</u>. (see page 36)

## **Standby Power Measurements**

Standby power is generally defined as power consumption when the device under test is operating in a no load or a low load scenario.

Standby power is usually very low and highly distorted. The signal normally has very low power factor and high irregular peaks. Such signals require wide dynamic measuring range and long averaging to obtain a stable power measurement.

PWRVIEW provides default application modes to measure or test standby power either for quick measurement checks or for full compliance tests to the IEC 62301 standard.

- Standby power
- IEC 62301 Standby Power (Full Compliance Test)



#### **Standby Power**

This wizard generates a suitable configuration for measuring the input power of devices operating in standby mode (see page 44). The maximum expected peak current is requested to determine which shunt (1 A or 30 A) and range should be used. The power analyzer is then set in Auto-up-only range setting, where the range is set to increase every time a peak is detected but never switches down. This helps power analyzer determine the optimum range for a given signal and not miss any irregular current peaks. The operating cycle time is also requested so that an integration time of three times the cycle time can be set. An integration time of 10 seconds is used as default. The last page of the wizard provides a wiring summary showing a schematic with wiring instructions. (see page 36)



**NOTE.** The image demonstrates the use of the Tektronix Breakout box (BB1000) for measuring input *AC* standby power.

#### **Compliance tests**

The Compliance tests are available when the Application Mode is Test; none of these tests are available under Measure. If you are in the Measure mode, you need to change the Application Mode to Test to enable the compliance tests.

PWRVIEW will only run one test at a time on a single channel on a single instrument.

#### IEC 62301 Standby Power

This wizard generates a suitable configuration for testing the standby power of devices according to IEC 62301 ED 2.0 standard.

The instrument will be configured to use the IEC 62301 mode which uses the auto-up ranging system. The auto-up ranging system allows the maximum test current to be measured and the range to be fixed so that no range changes occur during the main test. The last page of the wizard provides a wiring summary showing a schematic with wiring instructions. (see page 36)

After applying this wizard the IEC 62301 Standby Power Test can be controlled from the <u>Test (see page 77)</u> tab.



**NOTE.** The image demonstrates the use of the Tektronix Breakout box (BB1000) for measuring input *AC* standby power.

#### **MIL-1399 Current Harmonics**

The MIL-1399 Current Harmonics test is available with PA3000 and PA4000 instruments. This test does not have a wizard. Click the Apply button to apply the test.

### IEC 61000-3-2 Current Harmonics (Pre-compliance)

The IEC 61000-3-2 Current Harmonics (Pre-compliance) test is available with PA1000 instruments. This test does not have a wizard. Click the Apply button to apply the test.

#### Wiring Instructions

Wiring instructions on the last page of each wizard summarize the wiring configuration and shunt selection for each channel based on the application and user inputs. In the following example, the power analyzer is setup in a 3p3w configuration using two watt meter method on input and output. Current Transducers (CTs) are selected for each channel based on the user input. 1 A current shunts are used to connect the output (secondary) of the current transducers as indicated by the instruction on the bottom of the wizard page. The voltage and current connections are shown in the schematic as  $V_n$  and  $A_n$  symbols where n is the channel number. A "+" indication denotes the "Hi" side connection.



# Instrument information panel

The Instrument Information Panel shows the following:

- Instrument type
- Connection details including:
  - Connection type used for communication
  - = VISA vendor and version number
- Instrument serial number
- Instrument firmware version

Instrument	PA3000
Connection	USB NI-VISA64 15.0
Serial Number	B010134
Firmware Ver.	3.1.0

# Wiring configuration

The wiring configuration is only present for a multi-channel instrument and is used to set up the channels used in a group. The <u>wiring type (see page 39)</u> can be set for each channel and the number of groups required will be generated. Group tabs are shown to allow further group configuration. (see page 40). Group names (see page 39) can be changed by editing the values shown.

Wiring	AC Power	Group B	Group C	]			
		Channel 1:	1p2w	•	AC Power		
				_			
		Channel 2:	1p2w	•	Group B		
		Thannal 3:	30300	•	Group C		
		snanner 5.	Sham		dioup c		
		Channel 4:	3p3w	Ŧ	Group C		
						J	
	Luxiliary In Enable	d d	g and Coun	ters	)		

NOTE.	In	Test mod	le, th	ıe wiri	ng ty <sub>f</sub>	oe is f	ixed	at Ip	o2w	and	canne	ot be	e change	ed.	Use the radio	o button in
the from	nt o	f each c	hann	el to s	elect	which	ı chai	nnel	to r	un ti	he test	t on.				

/iring IE	62301
	Channel 1: 1p2w     IEC 62301
	Channel 2: [Disabled] *
	Channel 3: [Disabled] *
	Channel 4: [Disabled] *
Διιν	iany Inputs (Analog and Counters)
Aux	Enabled

# Wiring type

The wiring type groups channels together as required by the application and specifies the wiring configuration for the group.

Wiring type	Number of channels in group		
1p2w - 1 phase 2 wire	1		
1p3w - 1 phase 3 wire	2		
3p3w - 3 phase 3 wire	2		
3p4w - 3 phase 4 wire	3		
[Disabled]	None – channel not used		

## **Group names**

Group names can be edited to allow for simple identification. Use a group a name that describes its purpose.

Channel 1:	1p2w •	AC Power	
Channel 2:	1p2w •	Motor2 input	
Channel 3:	1p2w •	Motor2 output	
Channel 4:	[Disabled] •		

# **Group configuration**

The group configuration section, shown for each group tab, allows configuration of a group of channels with the following information:

- Modes (see page 41)
- Filtering (see page 48)
- Frequency Source (see page 49)
- Frequency Range (see page 50)
- Voltage Channel (see page 51)
- Current Channel (see page 51)
- Measurement selections (see page 53)

Mode: Normal 🔹	Filter: High	Frequency Voltage     Source: Voltage	ge 🔹
	Frequency Filter: Auto	•	
	Voltage Cha	nnel	
Range: Auto 🔻	Scaling:	1	
	Current Cha	nnel	
Range: Auto 🔻	Scaling:	1 Shunt: Intern	al (20A) 🔻
Measur	ement Selections	Selec	t All Clear All
Vrms	✓ Vcf	Vdc	*
📝 Arms	📝 Acf	Adc 🗌	
📝 Watts	Vpk+	🔲 Z	
VA	Vpk-	R	
PF	Apk+	□ x	
🗹 Freq	Apk-	VAr	
		Vrng	
WHr	VAHr	E Amg	
AHr	Hr	VArH	r
VHarm			
N	linimum:	1 Maximum:	13
Odd and Ev	en		
Odd Only			
Absolute Value	alue		
% of Funda	mental		
AHarm			
N	linimum:	1 Maximum:	13
Odd and Ev	en		
Odd Only			
Absolute V	alue		
© % of Funda	mental		
WHarm			*

### Mode

The mode setting configures the instrument to operate in the manner required by certain measurement applications. The available modes differ depending on the type of instrument. On changing the mode the available measurement selections (see page 53) and other setup options can change.

The following modes are available when the Application Mode is set to Measure:

- Normal Mode (see page 42)
- Ballast Mode (see page 43)
- Standby Mode (see page 44)
- PWM Mode [Applicable only for the PA3000] (see page 45)

- Integrator Mode (see page 45)
- Inrush Mode [Applicable only for the PA1000] (see page 46)

List of modes available in the PA3000 are:

Mode:	Normal 🔹	Filter: Hi	igh 🔹	Frequency Source: Voltage 🔹		
	Normal Ballast Standby	Frequency > Range: >	10Hz 🔹			
	PWM Integrator	Voltag	e Channel			
Range:	Auto 🔻	Scaling:	1			
Current Channel						
Range:	Auto 🔹	Scaling:	1	Shunt: Internal (30A) 🔻		

List of modes available in the PA1000 are:

Mode:	Normal 🔹	Filter:	High •	Frequency Voltage 🔹		
	Ballast Standby	Frequency Filter:	Auto 🔻			
	Integrator Inrush	Volt	age Channel			
Range:	Auto 🔹	Scaling:	1			
Current Channel						
Range:	Auto 🔹	Scaling:	1	Shunt: Internal (20A) 🔻		

Mode is set to one of the following tests when the Application Mode is set to Test:

- IEC 62301 Standby Power (see page 46)
- MIL 1399 Current Harmonics (see page 47), applicable only for the PA3000 and PA4000
- IEC 61000-3-2 Current Harmonics (Pre-compliance) (see page 47), applicable only for the PA1000

# Normal mode

Normal mode is the most common operating mode of the instrument. It can measure all available measurement parameters and detects the frequency of the signals from the zero crossings of the waveforms.

#### PA3000 Normal mode

Mode: Normal 🔹	Filter: High 🔹	Frequency Source:	Voltage 🔹
Fre	equency Range: > 10Hz 🔹		

#### PA1000 Normal mode

Mode: Normal 🔹	Filter: High	Frequency     Voltage	•
	requency Filter: Auto	•	

#### **Ballast mode**

Ballast mode is required to measure parameters of an AM (Amplitude Modulated) waveform typical of the voltage outputs of ballast systems. The Tektronix power analyzers use a proprietary dynamic frequency detection technique for tracking periodic modulation frequency as zero crossing can be unreliable for such applications.

PA3000 Ballast mode

Mode: Ballast 🔹 Filter:	High - Frequency Source: Voltage -	•
Frequency Range:	> 10Hz •	
	Line Frequency (Hz): 50	C

#### PA1000 Ballast mode

Mode: Ballast	High   Frequency Voltage  Volt
Frequency Filter:	Auto 🔹

On selecting ballast mode, any filter settings will normally be fixed to high bandwidth (to capture the faster switching frequencies of the ballast) and a prompt for the line frequency will be given.

# Standby mode

Standby mode is required when the current drawn by a load is low, very intermittent and irregular, such as with modern power supplies running under no load conditions. Measurements are integrated over long periods of time to ensure that accurate average values can be determined.

PA3000 Standby mode

Mode: Standby   Filter: High   Frequency  Source:	Voltage 🔹		
Frequency Range: > 10Hz  w			
Integration Time (s):	10		

PA1000 Standby mode

Mode: Standby   Filter: High   Frequency Voltage  Voltage	•
Frequency Auto -	
Integration Time (s):	LO

On selecting Standby mode, the filter frequency is locked on High Bandwidth and a time period is requested over which to integrate the measurement. The default value of 10 seconds is recommended for most applications, but if the unit under test draws variable power over a longer cycle time, this integration period should be set to at least three times the longest cycle time.

All integrated measurement results will not be further averaged by PWRVIEW so the result is unaffected by the <u>averaging setting (see page 66)</u>.

### **PWM mode**

PWM mode is designed to demodulate a pulse width modulated voltage signal to determine the modulation frequency without affecting the RMS values. This allows the power analyzer to synchronize measurements to the modulation frequency and get the most stable readings possible.

P3000 and PA4000 PWM Mode

Mode: PWM	lter: High	- Freque Sou	ncy rce: Voltage	•
Freque Ran	ncy nge: > 10Hz	•		

#### Integrator mode

Integrator mode is used for energy consumption measurements where the power is integrated over time to produce measurements such as watt-hours or average watts. In the Integrator mode the energy consumption measurements will become available in the <u>measurement selections (see page 53)</u> and options to <u>start and stop the integrator (see page 67)</u> will be available in the <u>Measurement tab. (see page 63)</u>

PA3000 and PA4000 Integrator mode

Mode: Integrator   Filter: High   Frequency  Source:	Voltage 🔹	
Frequency Range: > 10Hz 💌		
Target Power Factor for Correction VAr's (CVAr):	1	

PA1000 Integrator mode

Mode: Integrator 🔹	Filter: High	✓ Frequency Source: Voltage ▼	
I	Frequency Filter: Auto	•	

On some instruments a target power factor value can be entered here to compute the value of CVArs.

## Inrush mode

Inrush mode is used to measure the peak current drawn by a load, normally at mains power on. This mode tells the power analyzer to continuously sample using fixed ranges on the <u>Voltage Channel (see page 51)</u> and <u>Current Channel (see page 51)</u> so that a peak event is not missed. Select the correct range before <u>uploading (see page 20)</u> the configuration. A smaller subset of <u>measurement selections (see page 53)</u> are available in inrush mode with <u>Filter (see page 48)</u> and <u>Frequency Source (see page 49)</u> settings unavailable. Click <u>Reset (see page 65)</u> in the <u>Measurement tab (see page 63)</u> to restart an inrush measurement.

PA1000 Inrush mode

Mode: Inrush 🔹 Filter	High -	Frequency Source: Voltage 🔻
Frequency Filter	Auto 🔹	

#### IEC 62301 mode

In IEC 62301 mode the test group is configured to perform low power standby tests suitable for full compliance testing to IEC 62301 using the Sampling test method. The <u>IEC 62301 (see page 82)</u> test will become available under the <u>Test (see page 77)</u> tab, the minimum measurement parameters will be fixed and the <u>auto-up only current ranging (see page 51)</u> will be preselected. The auto-up ranging system allows the maximum test current to be measured and the range to be fixed so that no range changes occur during the main test. A range change would break the conditions defined in IEC 62301 which require continuous measurements.

PA3000 IEC 62301 mode

Mode: IEC 62301	▼ Filter: High	Frequency Source: Voltage
	Frequency Range: > 10Hz	Ŧ

#### PA1000 IEC 62301 mode

Mode: IEC 62301	▼ Filter: High ▼ Frequer Sour	ce: Voltage 🔹
	Frequency Filter: Auto	

### MIL-1399 mode

In MIL-1399 mode the test group is configured to test current harmonics according to MIL-STD-1399 – Section 300B as published by *Department of Defense Interface Standard – Electric Power, Alternating Current*. The MIL-1399 Current Harmonics (see page 86) test will become available under the Test (see page 77) tab and the minimum measurement parameters and auto current ranging will be fixed.

MIL-1399 mode is available when interacting with PA3000 and PA4000 instruments.

PA3000 and PA4000 MIL-1399 mode

Mode: MIL-1399	• Filter:	High	Frequency Source:	Voltage 🔹
	Frequency Range:	> 10Hz "	,	

### IEC 61000-3-2 mode

In IEC 61000-3-2 mode the measurement group is configured to perform current harmonics measurements suitable for pre-compliance testing to IEC 61000-3-2 standard. The <u>IEC 61000-3-2 Current Harmonics</u> (<u>Pre-compliance</u>) (see page 91) test will become available under the <u>Test (see page 77)</u> tab and the minimum measurement parameters along with auto-up only current ranging (see page 51) will be pre-selected.

The IEC 61000-3-2 mode is available when interacting with PA1000 instruments.

PA1000 IEC 61000-3-2 mode

Mode: IEC 61000-3-2 V Filter:	High •	Frequency Source: Voltage
Frequency Filter:	Auto 👻	

# Filter

Depending on the connected instrument a number of filter selections will be available. These are all low pass filters designed to remove high frequency components. See the instrument user manual for more information.

The PA3000 and PA4000 have the following filter selections.

Mode: Normal 🔹 Filter:	High 🔹	Frequency Source: Voltage 🔹
	High	
Frequency Range:	Low	

The PA1000 has the following filter selections.

Mode: Normal	High 🔻	Frequency Source: Voltage 🔹
Frequency Filter:	High 10kHz 50kHz	

#### **Frequency source**

To accurately measure most measurement parameters the frequency of the signals must be determined. The frequency source selects the method by which this frequency is measured. The mode (see page 41) selection affects the frequency detection operation, but generally either the voltage or the current channel is used to detect the frequency by looking at the zero crossings of the waveform. The voltage channel is used by default, but current should be used if only measuring current or if the current waveform is less distorted than the voltage so that the frequency can be determined more accurately. The PA3000 and PA4000 also offer an external frequency option.

When Test is selected in the Application Mode, Voltage is the only available frequency source.

The PA3000 and PA4000 have the following frequency source selections.

Mode: Normal   Filter: High   Frequency Source:	Voltage 🔹
Frequency Range: > 10Hz •	Voltage Current Ext 1
Voltage Channel	Ext 2
Range: Auto   Scaling: 1	

The PA1000 has the following frequency source selections.

Mode: Normal	High 🔹	Frequency Source:	Voltage 🔹
-			Voltage
Frequency Filter:	Auto 🔻		Current

# **Frequency range**

When the PA3000 Application Mode is set to Measure, the frequency range setting configures the fundamental frequencies that can be measured. Normally this is only needed when making very low frequency measurements, probably in PWM mode. When the application mode is set to Test, the frequency range is fixed at > 10 Hz.

DC can be measured in all ranges.

Mode: PWM	High 🔹	Frequency Source: Voltage 🔹
Frequency Range:	> 10Hz •	
Volt Range: Auto	> 10H2 1 100Hz 0.1 10Hz 1	

The frequency range is only available for the PA3000 and PA4000.

### Voltage channel

The Voltage Channel section allows the set up of ranging and scaling as shown below.

1. Use the Range selection to select auto range (when available) or to select fixed individual ranges applicable to the connected instrument.

For example, if the PA3000 is connected, the following ranges are applicable:

		Volt	age Channel	
Range:	Auto 🔻	Scaling:	1	
Range:	Auto 5Vpk 10Vpk 20Vpk	<b>Curr</b> Scaling:	ent Channel	Shunt: Internal (30A) 🔻
	50Vpk 100Vpk 200Vpk	ement Se	elections	Select All Clear All
	500Vpk 1000Vpk		Vcf Acf	Vdc
	✓ Watts		Vpk+	Z

**2.** Use Scaling to provide a method to adjust the measured value where voltage probes or voltage transformers are used.

The Scaling value entered is multiplied by the applied voltage to give the correct scaled voltage value.

# **Current Channel**

The Current Channel section allows the set up of ranging and scaling as well as the current shunt selection.

1. Use the Range selection to select auto range (when available) or to select fixed individual ranges applicable to the connected instrument.

For example, if the PA3000 is connected, the following ranges are applicable:

		Curr	ent Chan	nel		
Range:	Auto 🔹	Scaling:		1	Shunt: Internal (30	A) 🔻
$\equiv$	Auto	-				
	Auto Up Only	ement Se	lections		Select All	Clear All
	500mApk		1			
	1Apk		Vcf		Vdc	Â
	2Apk		Acf		🔲 Adc	
	5Apk		Vok+		7	
	10Apk		1 VPK+		<u> </u>	
	20Apk		Vpk-		R	
	50Apk		Apk+		X	=
	100Apk					
	200Apk		Apk-		VAr	
	V£		\WF		□ VAf	

- 2. Use Scaling to provide a method to adjust the measured value where current transformer, current clamps, or specific custom shunts are being used. The value entered as Scaling is multiplied by the applied current to give the correct scaled current value.
- **3.** Use the Shunt selection to select a shunt to use for current measurements. Make sure the selection matches the location where the current is connected on the instrument.

The PA3000 has the following shunt selections.

	Current Cl	hannel			
Range: Auto	<ul> <li>Scaling:</li> </ul>	1	Shunt:	Internal (30A)	•
				Internal (30A)	E
Meas	urement Selectio	ns		Internal (1A)	AII
Vrm5	Vcf			External	

The PA1000 has the following shunt selections.

	Current	Channel			
Range: Auto	▼ Scaling:	1	Shunt:	Internal (20A) 🔻	
	Measurement Select	ions		Internal (20A) Internal (1A) External	

#### **Measurement selections**

The Measurement selections allow the required measurements to be checked for inclusion in the measurement results returned by the instrument. The available options depend on the type of instrument and the measurement mode. In the figure below, a number of options grayed out because they are results available in Integrator mode (see page 45) only and Normal mode (see page 42) is selected. Enabling the Sum results (see page 53) adds an extra Sum column to the group in the measurement results.

Volts Harmonics, Amp, and Watts Harmonics (see page 58), Total Harmonic Distortion (see page 59), and Distortion Factor (see page 60) automatically expand to give further options.

Measure	ement Selections	Select All Clear All
Vrms	Vcf	Vdc
🗸 Arms	🗸 Acf	Adc 📃
✓ Watts	Vpk+	🔲 Z
VA	Vpk-	🔲 R
V PF	Apk+	🔲 X
🔽 Freq	Apk-	VAr 📃
Vf	Wf	VAf
Af	PFf	VArf
Vrmn	Armn	Vrng
		Arng
WHr	VAHr	
AHr	Hr	VArHr
CVAr	VAHf	PFav
	Wav	VArHf
VHarm		
AHarm		
WHarm		
🔲 Total Harmonic I	Distortion	
Distortion Factor	r	

#### Sum results

Selecting Sum results creates an extra column in the measurement results that shows the Sum values computed according to the wiring type of the group. The formulas or equations used to calculate the results are shown in the following links:

- <u>1P3W Sum formulas (see page 54)</u>
- <u>3P3W Sum formulas (see page 56)</u>
- <u>3P4W Sum formulas (see page 57)</u>

For additional information on using Sum formulas or Sum equations, refer to the *Sum Equations* section in the *PA3000 User Manual*.

**NOTE.** The Sum results are not available when selecting the 1p2W wiring type.

## **1P3W Sum formulas**

The formulas used to compute the Sum results for 1P3W measurements are as follows:

$$\sum V = ch1V + ch2V$$

$$\sum V \cdot fund = ch1V \cdot fund + ch2V \cdot fund$$

$$\sum W = ch1W + ch2W$$

$$\sum W \cdot fund = ch1W \cdot fund + ch2W \cdot fund$$
\* 
$$\sum VAr = \sqrt{\sum VAr \cdot fund^2} + (ch1VAr \cdot h + ch2VAr \cdot h)^2$$

$$\sum VAr \cdot fund = ch1VAr \cdot fund + ch2VAr \cdot fund$$

$$\sum VA = \sqrt{\sum W^2 + \sum VAr^2}$$

$$\sum VA \cdot fund = \sqrt{\sum W \cdot fund^2} + \sum VAr \cdot fund^2$$

$$\sum A = \frac{\sum VA}{\sum V}$$

$$\sum A \cdot fund = \frac{\sum VA \cdot fund}{\sum V \cdot fund}$$

$$\sum PF = \frac{\sum W}{\sum VA}$$

$$\sum PF \cdot fund = \frac{\sum W \cdot fund}{\sum VA \cdot fund}$$

# **3P3W Sum formulas**

The formulas used to compute the Sum results for 3P3W measurements are as follows:

$$\sum V = \frac{ch1V + ch2V}{2}$$

$$\sum V \cdot fund = \frac{ch1V \cdot fund + ch2V \cdot fund}{2}$$

$$\sum W = ch1W + ch2W$$

$$\sum W \cdot fund = ch1W \cdot fund + ch2W \cdot fund$$
\* 
$$\sum VAr = \sqrt{\sum VAr \cdot fund^2} + \left(\sqrt{\frac{3}{2}} \times (ch1VAr \cdot h + ch2VAr \cdot h)^2}\right)$$

$$\sum VAr \cdot fund = ch1VAr \cdot fund + ch2VAr \cdot fund$$

$$\sum VA = \sqrt{\sum W^2 + \sum VAr^2}$$

$$\sum VA \cdot fund = \sqrt{\sum W \cdot fund^2} + \sum VAr \cdot fund^2$$

$$\sum A = \frac{\sum VA}{\sum V} / \sqrt{3}$$

$$\sum A \cdot fund = \frac{\sum VA \cdot fund}{\sum V \cdot fund} / \sqrt{3}$$

$$\sum PF = \sum \frac{W}{\sum VA}$$

$$\sum PF \cdot fund = \frac{\sum W \cdot fund}{\sum VA \cdot fund}$$

# **3P4W Sum formulas**

The formulas used to compute the Sum results for 3P4W measurements are as follows:

$$\sum V = \frac{chIV + ch2V + ch3V}{\sqrt{3}}$$

$$\sum V.fund = \frac{chIV.fund + ch2V.fund + ch3V.fund}{\sqrt{3}}$$

$$\sum W = chIW + ch2W + ch3W$$

$$\sum W.fund = chIW.fund + ch2W.fund + ch3W.fund$$

$$\cdot \sum VAr = \sqrt{\sum VAr.fund^{2} + (chIVAr h + ch2VAr h + ch3VAr h)^{2}}$$

$$\sum VAr.fund = chIVAr.fund + ch2VAr.fund + ch3VAr.fund$$

$$\sum VA = \sqrt{\sum W^{2} + \sum VAr^{2}}$$

$$\sum VA.fund = \sqrt{\sum W.fund^{2} + \sum VAr^{2}}$$

$$\sum VA.fund = \sqrt{\sum W.fund^{2} + \sum VAr.fund^{2}}$$

$$\sum A = \frac{\sum VA}{\sum V} / \sqrt{3}$$

$$\sum PF = \frac{\sum W}{\sum VA}$$

$$\sum PF .fund = \frac{\sum W.fund}{\sum VA.fund}$$

$$\cdot VAr .h = \sqrt{VAr^{2}} + VAr.fund^{2}$$

# Harmonics

Depending on the power analyzer, either 50 or 100 harmonics are available. The PA1000 supports 50 and the PA3000 and the PA4000 support 100 harmonics.

You can view only odd harmonics or both odd and even harmonics.

The harmonic results can be selected as the absolute values (the actual reading) or as a percentage of the fundamental (harmonic 1).

Measurem	ent Selections	Select All
CVAr	VAHf	PFav
	Wav	VArHf
<b>V</b> Harm		
Minin	ium: 1 Max	timum: 13 🖨
Odd and Even		
Odd Only		
Absolute Value		
% of Fundamen	tal	
✓ AHarm		
Minin	ium: 1 Max	timum: 13 🖨
Odd and Even		
Odd Only		
Absolute Value		
% of Fundament	tal	
📝 WHarm		
Harmonics control	ed by Voltage & Current S	ettings
Absolute Value		
% of Fundamen	tal	
Total Harmonic Dist	ortion	

#### **Total harmonic distortion**

THD (Total Harmonic Distortion) is a measure of the distortion of a waveform.

Voltage and Current (Vthd & Athd) are available as separate selections. The minimum & maximum harmonics to use for the computation are shown. The maximum is adjustable. Odd and Even or Odd Only harmonics can be selected.

You can choose whether to include DC in the formula, and whether the measurement is expressed as a percentage of the fundamental or the RMS value.

Total Harmonic Distortion	
<ul> <li>✓ Vthd</li> <li>✓ Athd</li> </ul>	
Minimum: 2 Maximum: 13	•
<ul> <li>Odd and Even</li> <li>Odd Only</li> </ul>	
<ul> <li>DC Excluded</li> <li>DC Included</li> </ul>	
<ul> <li>Reference to Fundamental</li> <li>Reference to RMS</li> </ul>	

The selection of harmonics used in the THD measurement is independent of <u>Volts Harmonics and Amp</u> <u>Harmonics (see page 58)</u> results. However the selections for the THD measurement must be a subset of the Volts and Amps Harmonics selection. For example, the THD measurement could include odd only harmonics 2 through 21, yet the Volts and Amps Harmonics could be configured for odd and even 1 through 50. If necessary, PWRVIEW will automatically adjust the Volts and Amps Harmonics selections to accommodate THD selections.

The formulas for voltage and current THD are:

$$Vthd = \frac{1}{V_{ref}} \sqrt{\sum_{\min harm}^{\max harm} (Vh_n)^2} \times 100\%$$

$$Athd = \frac{1}{A_{ref}} \sqrt{\sum_{\min harm}^{\max harm} (Ah_n)^2} \times 100\%$$

The Total Harmonic Distortion formula (sometimes referred to as the series formula) will produce more accurate results when the THD is less than 5%. It is important to set the maximum harmonic setting to cover the majority of the harmonic components contained in the signal being measured. The higher the harmonic count, the more accurate the result.

#### **Distortion factor**

Distortion Factor is a measure of the distortion of a waveform. Voltage and Current (Vdf & Adf) are available as separate selections. You can choose whether the measurement is expressed as a percentage of the fundamental or the RMS value.

Vdf	
☑ Adf	
Reference to Fundamental	

The formulas for voltage and current Distortion Factor are:

$$Vdf = \frac{1}{V_{ref}} \sqrt{Vrms^2 - Vh_{01}^2} \times 100\%$$

$$Adf = \frac{1}{A_{ref}} \sqrt{Arms^2 - Ah_{01}^2} \times 100\%$$

#### **Auxiliary inputs**

The PA3000 and PA4000 have four analog inputs on the rear of the instrument. Each of the four inputs can be used to measure signals from a device such as a torque sensor. Each of the four inputs has two different ranges. The ranges are  $\pm 10$  V and  $\pm 1$  V.

The PA3000 and PA4000 also have two counter inputs on the Auxiliary Inputs connector on the rear of the instrument. Either of these can be used as an external frequency source for signals where there is too much noise or speed sensors. Each of the two counter inputs accepts TTL-compatible square wave signals.
The Auxiliary Inputs option on the Instrument Tab must be enabled as shown in the following figure to view and configure the auxiliary inputs.

**NOTE.** The Auxiliary Inputs option is not available for the PA1000.



After the Auxiliary Inputs option is enabled, the Auxiliary Inputs tab becomes available as shown in the following figure.

You can configure the label, units, and equation to be calculated from the measurement read from each of the auxiliary inputs. You can also set the range for each of the four analog inputs and select which auxiliary inputs are enabled.

Setup Measure Results							
							~ (
Add         Remove              • Measure               Test          Configure               • Measure               Upload							
struments Application Mode Efficiency Limits Settings							
A1000(0001) PA3000(0002) PA3000(0006)							
Applications / Tests Wiring AC	Power Auxiliar	y Inputs					
IAC Drover LED Driver Dopot Efficiency Ballist Input Output Efficiency							
PWM Motor Drive     Output		Label	Units	Equation	Range	Enabled	
Efficiency	Analog Input 1	Analog1			10V 🔻		
Energy Measurements	Analog Input 2	Analog2			10V 💌	V	
Energy Consumption	Analog Input 3	Analog3			10V -	V	
Standby Power Measurements	Analog Input 4	Analog4			10V -	V	
	Counter Input 1	Counter1					
	Counter Input 2	Counter2				7	
Wizard Apply >				🗊 Equation Guide	lines		
Instrument PA3000 Connection USB NE-VISA64 15.0 Serial Number 8000006 Firmware Ver. 3.1.0rc24							

## **Equation guidelines**

Here is a brief explanation on the configurable columns in the Auxiliary Inputs screen:

**Label.** While measuring the auxiliary input, you can name a custom equation that is being configured. For example: Torque.

Units. Specify the unit in which the measurement should be read, such as NM or RPM.

**Equation**. The formula or equation to be calculated from the measurement read. See below for more details.

**Range.** 1 V or 10 V can be selected based on the Auxiliary input Volts Range of the physical input being provided.

**Enabled**. If the check box is selected, the Auxiliary input will be considered for measurement and will be displayed in the Measure tab.

Use the following guidelines to help configure the equation.

- Equations can be a scaling number, expression, or empty.
- Scaling numbers can be either integers or simple floating point values.
- Expressions must contain the base name for the specific input source. Expressions can also contain arithmetic operators and numbers. Parenthesis are also supported.
- The defined base names are: ANA1, ANA2, ANA3, ANA4, COUNT1, COUNT2. They are not case sensitive.
- Arithmetic operators include operators and simple numbers.
  - = Supported operators: +, -, /, \*, (, ) characters are allowed.
  - Numbers include integers and simple floating point values such as 20, -35, 0.23, 100.15, -0.5

## Measure

Use the Measure tab to control, log, monitor, and chart measurements. The Measure tab is only available when Application mode under the Setup tab is set to Measure. The Measure tab allows you to perform the following tasks:

- Start (see page 63) the measurements
- <u>Stop (see page 64)</u> the measurements
- Reset (see page 65) averaging and Min and Max values
- Setup Limits (see page 18) for different limit categories
- Set the <u>Significant Figures (see page 65)</u> or number format shown in the <u>results grid (see page 71)</u>
- Set the <u>Averaging (see page 66)</u> depth
- Turn on/off <u>Zero Blanking (see page 66)</u>
- Enable/disable Efficiency (see page 18) measurement
- Control Integration (see page 67)
- Chart (see page 72) measurement results
- Perform <u>data logging (see page 67)</u>
- Monitor measurement results in the results grid (see page 71)

Ribbon options available on the Measure tab:



## Start

The Start button starts the measurement process to list the results into the results grid as shown below:

		Project1.vpm	- PWRVIEW		
Setup Measur	e Results				^ <b>@</b>
Start taking measureme	Significant Figures: 5 • Averaging: Auto • Its Zero Blanking: 🗸	Measure Efficiency	Harmonics	SnapShot Record	
Measurements Limits	Display	Efficiency	Charting	Data Logging	

						(No Project)	- PWRVIEW		
	Setup	Measu	re Result	ts					~
	😔 Reset	▶  Setup	Significant Ave	Figures: 5 eraging: Auto Zero Bla	• • nking: 🗸	Measure     Efficiency	Harmonics	SnapShot Record	
Measure	ments	Limits		Display		Efficiency	Charting	Data Logging	
Measuren	hent								
measuren									
Index	Meas	PA3000	A (0016) 1	B Formula					
1	Vrms	11	L9.07 V						
2	Arms	0.	.0000 A						
3	Watts	0.	.0000 W						
4	Freq	59	9.983 Hz						
5	Vh1m	11	L9.01 V						
6	Vh1p	0.	. 0000 °						
7	Vh2m	3	3.486 mV						
8	Vh2p	-82	2.621 *						
9	Vh3m	42	22.58 mV						
10	Vh3p	51	8.781 *						
11	Vh4m	22	2.327 mV						
12	Vh4p	-51	9.142						
13	Vh5m	2.	5160 V						
14	vnsp	-1,	1.85						
15	Vnom	2.	2.509 mV						
16	Vn6p	-2	.4//						
17	Vn/m	/!	94.76 mV						
18	Vh/p	2	.581						
19	Vn8m	10	0.709 mV						
20	vnsp	5.	. 3123 .						
21	Vn9m	3	/8.1/ mv						
22	Vn9p	-11	17.41						
23	VNIOM	4.	.2333 mV						
24	vn10p	14	15.29						
25	Vhiim	91	55.86 mV						
26	Vh12m	-1:	04.72						
27	Vh12m	24	2.6/8 mV						
28	Vh12p	- 51	5.03/						
29	Vh12n	-13	25 72 °						
21	Ab1m	-1:	0000 A						
22	Ahlo	0.	0000 3						
22	Ah2m	0.	0000 A						
24	Ah2n	0.	0000 *						
24	Ah3m	0.	0000 4						
22	A								

# Stop

The Stop button stops the current measurement cycle.



# Reset

Use the Reset button to reset the <u>averaging (see page 66)</u>, all Min and Max results, and inrush measurements when in <u>inrush mode (see page 46)</u>. This is useful to find new Min and Max values and to start averaging the results again. Large averaging values can take a long time to show changes.



# **Significant figures**

The significant figures affect the results and determine the number of digits displayed.

The following figure specifies five significant figures to give a fixed width of five digits.

<u> </u>	Setup	Measu	ure	Results		
			Sig	nificant Figures:	5	-
Start	Reset	Setup		Averaging:	3	*
		- • ·		2	4	
Measure	ements	Limits		Displ	5	
Measurer	nent				6	
Index	Meas		A		7	*

# Averaging

Averaging is a function that smooths out results to improve the readability of varying quantities. The higher the averaging, the more stable the result will be. You can specify an averaging depth up to 64. The default averaging is Auto, which is effectively an averaging of eight with an algorithm that improves the response to large step changes. Normally leave the setting to Auto. Click the <u>Reset (see page 65)</u> button to restart the averaging process.

🖉 🗆 📊					
	Setup	Meas	ure	Results	
			Sig	nificant Figures:	5 •
Start	Pacat	7/12		Averaging:	Auto •
Start	neset	-		7	Zero Blanking: 🗸
Measure	ments	Limits		Displ	ay

# **Zero Blanking**

Turn off Zero Blanking to see very small readings that would normally show up as zero.



# Integration

Integration can be controlled using the Integrator Start/Stop/Reset buttons available on the Measurement ribbon. On pressing Start, the integrator will start running on the instrument and integrator results will begin to accumulate. The button will also change to a Stop button which is used to stop the integrator. Reset clears the integrator results to zero. These controls are only visible when at least one group is configured for the Integrator Mode. (see page 45)



# **Data logging**

Data logging allows recording and exporting measurement results.



- Snapshot (see page 67) takes the results as shown in the results grid (see page 71) and saves them to a file.
- Record (see page 68) saves all measurement results continuously to a database system for later exporting and analysis.

# Snapshot

Snapshot saves a copy of the results grid in CSV format for reading into spread sheet applications.



Click the down arrow for more snapshot options such as view after creation:



Upon clicking Snapshot all listed results are exported to the CSV format. A Save As dialog box prompts you for a location and file name for saving the file. When View after creation is checked, the file will be automatically opened for viewing.

X	🔒 🗲 👌	Ŧ	Snapshot_201	.6-01-12_11-15-33.cs	v - Excel	?		- 🗆	×
F	ILE HOME	INSERT PAGE LA	YOUT FORM	IULAS DATA	REVIEW VIEW	ACROBA	T Tre	tzen, Her	*
Pa	Calibri □ □ - B I ste ✓ □ - 2 pboard □ F	$\begin{array}{c c} \bullet & 11 \\ \bullet & \bullet \\ \hline \\ \hline & \bullet \\ \hline \\$	≡ ≡ ₽ = = ⊡ + Æ ≫ + Alignment ₽	General         ▼           \$ ▼ % >         ₩           \$ ∞ % >         ₩           \$ ∞ % >         ₩           Number         ™	Conditional Formattin Format as Table * Cell Styles * Styles	ng • 🔐 Ins 🛣 Del 📰 For Ce	ert ▼ lete ▼ mat ▼ IIs	Editing	*
A:	L • :	$\land \checkmark Jx$	Tektronix PW	/RVIEW measurer	nent snap-shot				~
1	Α	В	с	D	E	F	G	н	
1	Tektronix PWRVIE	W measurement s	nap-shot						
2	Created	Tuesday	12 January 201	11:15:50					
3	'PA1000(0001)'	'S/N Virtual10001	Ver.1.003.000						
4	'PA3000(0002)'	'S/N Virtual30002	Ver.3.000.008						
5	'PA3000(0006)'	'S/N B000006'	Ver.3.1.0rc24						
6	Meas	'PA1000(0001) 1'	'PA3000(0002)	'PA3000(0002) 2'	'PA3000(0006) 1'				
7	Vrms	230.03 V	230.03 V	230.06 V	119.30 V				
8	Arms	999.73 mA	1.0002 A	1.0001 A	A 0000.0				
9	Watts	230.03 W	230.02 W	230.00 W	0.0000 W				
10	Freq	49.992 Hz	49.992 Hz	50.008 Hz	59.996 Hz				
11	PF	1.0001			0				
12	Vcf	1.4139			1.3803				
13	Acf	1.4143			0				
14	Vh1m	230.03 V	229.99 V	230.05 V	119.25 V				
15	Vh1p	° 0.0000 °	° 0.0000	° 0.0000	° 0.0000				
16	Vh2m	113.72 μV	107.05 μV	96.560 μV	56.170 mV				
17	Vh2p	137.14 °	-133.77°	166.32°	-111.45 °				
18	Vh3m	26.325 μV	125.85 μV	73.178 μV	460.17 mV				
19	Vh3p	119.28 °	46.727 °	57.366 °	65.166 °				
20	Vh/m	53 018 uV	101 69 uV	AA 780 uV	21 7/11 mV				

# Record

Click Record at any time to immediately start recording all measurement results to the PWRVIEW database system.



The Status Bar indicates that results are being recorded and the Record button will change to Stop.



The minimal amount of data to represent all measurement results is stored to the database to save space - not the results shown on the results grid. This means that results that can be computed from the other results are not stored in the database.

Click the down arrow for more record options such as data logging setup.



Selecting the Setup option opens the Data Logging Setup dialog box to configure the logging duration and interval. The logging duration can be set to log data until stopped or for a specific duration in days, hours, minutes, and seconds. The logging interval can be specified to log data as fast as possible, at a specific interval, or manually.



If Log Data Manually is selected, a log button appears on the status bar when the data logging has started. Data logging will only occur whenever the log button is selected. A counter shows the amount of logged data.

	-
Logging Duration: 00h:00m:39sec Manual Log Count: 0 Press Log to Record. 👔 Lo	9

## Measurement results and charts

Measurement results are shown in the results grid (see page 71) or charted (see page 72) as Harmonic Bar (see page 73), Waveform (see page 74), or Trend (see page 75) charts.

## **Results grid**

The results grid is used to view the results from all instruments and to compute other values by entering formulas and text (see page 72). Only cells in the Formula column can be edited. The formula column width can be re-sized by grabbing the dividing lines of the header row (hold the left mouse button and click when the grab cursor displays) and dragging them to the desired width.

Hovering the mouse over a result will display Min and Max values. Click the <u>Reset (see page 65)</u> button to reset these values to the present reading and begin accumulating the Min and Max values again.

50.008 Hz	50.004 Hz
229.98 V	230_00_V
0.0000 °	$1n: 229_{2900}$
106.18 µV	<u>22.11</u> μV
-46.584 °	-172.63 °

Right-click the mouse within the results column to open a dialog box with options for handling the data such as adding or editing limits or adding a Trend measurement.



# Formulas and text

Custom formulas and text can be entered into the results grid. This allows the calculation and labelling of parameters to be computed across multiple instruments. All arithmetic operations of +, -, \*, and / are available. Terms can be placed in brackets to control the order of computation. Use standard spread sheet type Row/Column notation where the row number is the table index and column letter shown in each results column. Clicking the desired cell automatically fills in the Row/Column information. Type '=' followed by the formula, or omit the '=' and enter text. For example, an efficiency calculation is shown.

8 H				LED Driver Efficie	ncy.vpm - PWRVIE		_ <b>_</b> X
1.	Setup	Measure Resu	dts				~ 6
0	6	milde Significant	Figures: 5	•	Harmonics		
0	•	A	veraging: Auto	- Measure	Waveform		
Stop	Reset	Setup	Zero Blanking	Efficiency	Int Trend	SnapShot Record	
		1 miles	Disates	Elliphone and	Continu	Date Leasting	
research of the	merrea	Cirieta -	unipag	Emolency	Charting	Data cogging	
Measuren	Nent						
Index	Meas	PA3000(0006) 1	PA3000(0006) 2	Formula			
1	Vires	120.29 V	11.969 V	Efficiency			
2	Ares	206.30 mA	1.0004 A	81.769e+00			
3	watts	14.642 W	11.973 W				
4	Freq	59.967 Hz					
5	PF	590.04 m					
6	Vdc		11.969 V				
7	Adc		1.0003 A				
8	Vcf	1.3761					
9	Acf	3.0160					
10	Vthd	2.2572 %					
11	Athd	125.51 %					
12	vhim	120.24 V					
13	vhlp	0.0000 '					
-14	Vh2m	18.315 mV					
15	vh2p	-9.0618 '					
16	vh3m	291.52 mV					
17	vh3p	20.847					
18	Vh4m	35.540 mV					
19	vh4p	-150.57 *					
20	Vh5m	2.4083 V					
21	vh5p	-168.46 '					
22	Vh6m	12.938 mV					
23	vh6p	-125.69 '	-				
-24	Mh7m	869.50 mV		5 C C C C C C C C C C C C C C C C C C C			
-25	Vh7p	4.2581 '	1				
26	vh8m	19,788 mV		20 2 2			
27	vhāp	-54.288 '					
28	Vh9m	169.59 mV		-			
29	vhip	-99.692 '		-			
30	white	2.8242 mV					

Measurements running

# Charts

Different chart types are available to view for different types of information. Available options are:

- Harmonic Bar Charts (see page 73)
- Waveform Charts (see page 74)
- Trend Charts (see page 75)

A number of charts can be added to the Measure tab and customized as needed.

When selecting Harmonics, Waveform, or Trend from Charting a new tab appears. Click them to create one of the available charts. Multiple charts of each type can be created for Harmonics, Waveform, and Trend charts. The total number of charts that can be created is three times the number of instrument

channels shown in the results grid. The Harmonics, Waveform, and Trend buttons are disabled when the limit is reached.

## Harmonic bar charts

Harmonic bar charts are useful to view the relative strengths of the harmonic amplitudes. Hovering over the individual harmonic bar presents the harmonic number, harmonic absolute amplitude, and the percentage value with respect to fundamental harmonic.

**NOTE.** If no harmonics are selected on the Setup screen, the Harmonics graph feature displays a blank screen.



# Waveform charts

Waveform charts show the waveform being measured by the power analyzer.

PWRVIEW waveforms are constructed using the harmonic data collected from the power analyzer. The accuracy of the waveform depends on the amount of harmonic information available. For optimum results, select maximum number of harmonics to display in the setup area. Selecting 50 harmonics for the PA1000 and 100 harmonics for the PA3000 gives the best results.

**NOTE.** If no harmonics are selected on the Setup screen, the Waveform feature displays a blank screen.



The Waveform feature cannot display DC waveforms.

# **Trend charts**

Trend charts are useful to view the trend of a selected measurement over a period of time.

Activate the Trend chart by either clicking on the Trend button on the Measure tab or by right-clicking the desired value in the Measure Grid and then clicking Trend Measurement.

To refresh/reset the chart, click the Reset button. Resetting the trend chart will not affect logging results.



## Test tab

The Test tab allows for the setup and execution of various power standards tests. The Test tab is only available when the Application Mode under the Setup tab is set to Test.

PWRVIEW will only run one test type at a time. The test will be run on a single channel of the instrument. If multiple instruments or channels are added in the Setup tab, the last configured test will replace any previously configured tests.

The selected test type, instrument, and channel are displayed to the right of the Start button. Go back to the Setup tab if you need to change any of these selections. The Test ribbon includes the test details and configuration options.



PWRVIEW supports three different test types:

**IEC 62301 Standby Power**. This test is designed to test according to IEC 62301 Measurement of Standby Power. It uses the Sampling method as defined in this standard. The IEC 62301 Standby Power test is available for the PA3000, PA4000, and PA1000 instruments.

**MIL-1399 Current Harmonics.** This test is designed to test current harmonics according to MIL-STD-1399 – Section 300B as published by Department of Defense Interface Standard – Electric Power, Alternating Current. Available for PA3000 and PA4000 instruments.

**IEC 61000-3-2 Current Harmonics (Pre-Compliance).** This test is designed to test current harmonics according to the limits specified in the IEC 61000-3-2:2014 Ed.4 and IEC 61000-4-7:2002+A1:2009 (including interharmonics) standard. Available for PA1000 instruments.

## Test

The Test section of the Test ribbon contains a Start/Stop button and a read-only summary of test configuration as selected in the <u>Setup (see page 13)</u> tab.



### Start / Stop button

The Start/Stop button allows the control of the test execution. This button shows Start initially but changes to Stop when the test is running. Click the button to start the test. Click Stop to stop the test and to save the test results to the results database.

Test configuration summary

The test configuration summary shows three essential fields:

Test Type. The type of test selected

Instrument. The instrument to use for testing

Channel. The instrument channel from which to take the results used for the test

## **Test details**

Use the Details area to enter specific details of the test, including the following information:

- The <u>Laboratory (see page 79)</u> defines the institution performing the testing.
- The <u>Customer (see page 80)</u> defines who the testing is being done for.
- The <u>Product (see page 80)</u> defines information about the product being tested.
- The <u>Test Info (see page 82)</u> provides a way to enter test information for reporting purposes.

## Laboratory

Add, Delete, or Select the Laboratory using the buttons below the list box on the left. Click the Edit button to make changes to the Laboratory information. The information will be added to test reports.

	Laboratory:	Lab3 Inc.		
	Customer:	Lab3 Inc.	Company name	Lab3 Inc. 🔺
	Product:		Address	
				E
	Results Form			
-	Amps		City	
5			State/Region	
			Post code	
	100		Country	-
	-	<ul><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li><li></li></ul> <li></li>		Edit

## Customer

Add, Delete, or Select the Customer using the buttons below the list box on the left. Click the Edit button to make changes to the Customer information. The information will be added to test reports as well as providing a convenient method for a laboratory to manage the customer contacts.

	Laboratory:	Lab3 Inc.			
	Customer:	Customer3	Tert		
	Product:	Customer3	Company name	Customer3	
			Address		
					=
	Results Forn				
-	Amps				
5			City		
			State/Region		
	100		Post code		
			Country		-
	-	<ul><li>O</li></ul>			Edit

# Product

Add, Delete, or Select the Product using the buttons below the list box on the left. Click the Edit button to make changes to the Product information. A <u>Manufacturer (see page 81)</u> product field allows management of manufacturer information. The information will be added to test reports.



# Manufacturer

Add, Delete, or Select the Manufacturer using the buttons below the list box on the left. Click the Edit button to make changes to the Manufacturer information. The information will be added to test reports.

	Laboratory:	Lab3 Inc. 🔹	0000				
	Customer:	Customer3 •	Test				
	Product:	Appliance •	Info •				
		Appliance	Manufacturer	Producer21 🔹	*		
			Description	AJJSW	Company name	Producer21	
	Results Form		Model	Producer21	Address		
L	A		Part Number				=
	Amps		Serial Number				
	_		Hardware Rev.				
	100		Firmware Ver.		City		
			Rated voltage		State/Region		
	-		Rated frequency		Post code		
i					Country		-
	-			<ul><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><li>•</li><l< th=""><th></th><th>(</th><th>Edit</th></l<></ul>		(	Edit

## Test info

Test Info is the place to enter test information for reporting purposes.

You can enter the following information:

- Test officer name
- Ambient temperature
- Relative humidity
- Test notes



**NOTE.** Temperature and humidity are not measured. The values entered by the user will be used on the test report.

# IEC 62301 Standby power test

The Standby Power test is designed to test according to IEC 62301 Edition 2.0 Measurement of Standby Power. It uses the Sampling method as defined in this standard and can be used to measure the standby power of any appliance.

Measurement parameters and limits are derived from the information entered into the fields on the left side of the screen:

Test Time Duration sets the minimum test time period which must pass (15 minutes is the minimum defined in IEC 62301 ED 2.0). This test time can exceed the minimum required if the equipment under

test operates with a cycle time greater than this. The test can run longer than the default minimum time until either the power stability (see page 85) criteria is met or three hours have passed.

- Power Limit sets the maximum average power allowed over the last two-thirds of the test to pass. The power limit should be derived from the standards applicable to the device under test.
- Test Voltage and Frequency are checked to be within the limits defined in IEC 62301 ED 2.0.

On the right side of the screen, the <u>Power Plot (see page 83)</u> chart shows power measurements taken during the test. The <u>Voltage Quality (see page 84)</u>, <u>Power Stability (see page 85)</u> and <u>Uncertainty (see page 85)</u> parameters are displayed under the Power Plot chart.



## **Power plot**

The power readings are shown as a graph that automatically scales both power and time axis.



# Voltage quality

During a Standby Power measurement, the voltage quality, as defined in IEC 62301 ED 2.0, is continuously monitored. If any of the parameters go outside of specification, then the result box will turn *red*. An *orange* result box will be shown if the current reading is within specification but it has gone outside of specification in the past. Any single result outside of specification at any point during the test will result in a *FAIL*.

Volts. The measured line voltage

V CF. The Voltage Crest Factor

V THC. The Voltage Total Harmonic Content



## **Power stability**

Power stability is measured according to IEC 62310 ED 2.0.

Watts Average 1/3. The average power during the first third of the test

Watts Average 2/3. The average power during the second two thirds of the test

**Stability.** Determined by a linear regression over the last two thirds of the test and is shown in *red* if the stability criteria is not met.

Power Stability	
Watts Average 1/3:	6.3004 W
Watts Average 2/3:	6.2990 W
Stability:	-5.5280 mW/h

## Uncertainty

Uncertainty is checked according to IEC 62301 ED 2.0. MCR and Ulim are defined by the standard. Ulim is the limit of uncertainty and Ures is the uncertainty of the result (as calculated from the specification of the instruments). Ures must always be less than Ulim. If this is not true for any single measurement, then the results box will turn *red*. An *orange* results box means that the current Ures value is within specification but has previously gone outside of specification. Ulim and Ures are used in the Standby Power Results to compute the value of TUR (Test Uncertainty Ratio) which is defined as Ulim/Ures. This figure gives a convenient representation of how close Ures is to Ulim. If TUR is < 1 then the test is failed.



## Test status

The Test status shows one of the following:

Running. The test is running.

PASS. The test has passed.

FAIL. The test has failed.

N/A. Not Applicable. This is because the test has not been run long enough to determine PASS or FAIL

## **MIL-1399 Current Harmonics test**

The MIL-1399 Current Harmonics test is designed to test current harmonics according to MIL-STD-1399 - Section 300B as published by Department of Defense Interface Standard – Electric Power, Alternating Current.

The MIL-1399 Current Harmonics test limit-checks all the individual current harmonic values up to 100 harmonics against the levels set by the standard. Enter information into the Rated Amps Fundamental field; the software will limit-check all 100 harmonics including the measured fundamental based on the standard. The standard set limits are displayed on the graph with a dashed line. To fully comply with the standard, the individual current harmonics should be at or below the set limit as discussed in Limit (see page 88) section. Any individual current harmonics that exceed these limits are displayed as red bars on the graph view. If any of the current harmonics exceed the set level, the overall Test Status displays Run Failing.

Measurement parameters and limits are derived from the information entered into the following fields on the left side of the screen:

- Limit class as described in the Limit (see page 88) section
- Rated Amps Fundamental
- Test Time Duration

On the right side of the screen, all <u>harmonics measurement results (see page 89)</u> taken during the test can be displayed in either graph or table format.

Jotup     Intervalue     Text       Stop     Instrument     PA4000(0100)       Channel     Chi       Text     Product:       Mil-1399 Compliance:     Results Format:       Limit:     60Hz < 1k/A       Text Status:     Run Passing       Rated     0.3 A       Messured     34.018 mA       Watts     6.3424 W       Vatts     6.3424 W <t< th=""><th>~</th></t<>	~
Stop     Instrument     Product     Test       Mil-1399 Compliance:     Results format:     @ Graph © Table       Limit:     60Hz < LWA     Ramps       Amps Fundamental:     0.3 A       Measured       Amps Fundamental:     56.018 mA       Val:     128-7       Val:     13974       Act:     3.6402	
Channel Chi         Product:         Mproduct:         Info*           Test         Details           Mil-1399 Compliance:         Results format:         @ Graph © Table           Limit:         60Hz < tk/A	
Test         Details           Mil-1399 Compliance:         Results format: @ Graph © Table           Limit:         60Hz < Lk/A	
Mil-1399 Compliance:     Results Format: @ Graph © Table       Linit:     60Hz <1kVA	
Umit:         60H2 <1kV/A         Amps           Text Status:         Run Passing         Amps           Rated         Amps Fundamental:         0.3 A           Amps Fundamental:         0.3 A         10%           Watts:         6.3424 W         16%           Watts:         6.3424 W         16%           VWms:         106.56 mA         12%           VWms:         106.56 mA         12%           VA:         128.37 VA         12%           VA:         128.37 VA         10%           VMtd:         167.22 %         8%           VCf:         1.3974         6%           VCf:         1.3974         6%	
Test Status:         Run Passing         Test Status:         Test Status: </td <td></td>	
Rated         0.3 A         100 -           Amps Fundamental:         0.3 A         100 -           Messured         18%         18%           Amps Fundamental:         54.018 mA         16%           Vists:         6.324 M         16%           Vists:         6.324 M         14%           Vists:         6.324 M         14%           Vists:         6.324 M         14%           Vists:         6.324 M         14%           Vists:         128,57 VA         14%           Vist:         128,37 VA         15%           Vist:         16,72 M         15%           Vcf:         1.3974         8%           Vcf:         1.3974         6%	
Amps Fundamental:     0.3     A     100 *       Messured     -     -     15%       Amps Fundamental:     54.018 mA     16%       VMsts:     6.3424 W     16%       Vms:     120.47 V     14%       Ams:     106.56 mA     12%       Power Factor:     494.09 m     12%       VA:     12.837 VA     10%       VA:     12.837 VA     10%       Vdn:     167.22 %     8%       Vcf:     1.3974     6%	
Messured         Amps Fundamental:         54.018 mA         16%           Watts:         6.3424 W         16%         16%           Vms:         120.47 V         14%         12%           Amms:         106.56 mA         12%         12%           VA:         12.837 VA         10%         12%           VA:         12.837 VA         10%         10%           VA:         16.722 %         8%         10%           Vcf:         1.3974         6%         6%	
Amps Fundamental:     54.018 mA     16%       Watts:     6.3424 W     14%       Vmrs:     120.47 V     14%       Arms:     106.56 mA     14%       Power Factor:     494.09 m     12%       VA:     12.837 VA     10%       Vthd:     167.22 %     8%       Vcf:     1.3374     8%       Actr:     3.6402     6%	
Watts:         6.3424 W           Vrms:         120.47 V           Arms:         106.56 mA           Power Factor:         494.09 m           VA:         12.87 VA           VA:         12.837 VA           Vthd:         167.22 %           Vcf:         1.3374           Actt:         3.6402	
Vrms:         120, 47 V         14%           Arms:         106, 56 mA           Power Factor:         494, 09 m           VA:         12, 837 VA           Vthd:         167, 22 %           Athd:         167, 22 %           Vcf:         1, 13974           Acf:         3, 6402	
Arms:         106.56 mA           Power Factor:         494.09 m           VA:         128.97 VA           Vthit:         167.22 %           Athd:         167.22 %           Vcf:         1.3974           Acf:         3.6402	
Power Factor: 494.09 m V&: 12.837 VA Vthd: 167.22 % Athd: 167.22 % Vcf: 1.3374 Acf: 3.6402 e%	
VA: 12.837 VA Vthd: 167.22 % Athd: 167.22 % Vcf: 1.3974 Acf: 3.6402	
Vihd: 167.22 % Athd: 167.22 % Vcf: 1.3374 Acf: 3.6402 6% -	Harmonics
Athd: 167.22 % Vcf: 1.3974 Acf: 3.6402	- Limit1
Vcf: 1.3374 Acf: 3.6402	
Act: 3.6402 6%-	
requercy	
Expected: 60.000 Hz 4%-	
Measured: 60.025 Hz	
Test Time	
Duration: 00:01:00 🗘	
Elapsed: 00:00:27 + 0 - 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 00 95 100	
Test numino	

The following figure is an extreme case where the Rated Amps Fundamental is set to be lower than the real rated current to display the failing harmonics clearly. (Not a real scenario)



## **Test limits**

MIL-1399 Current Harmonics Test limits can be set using the drop down menu on the left column.

Based on the MIL-1399 standard, there are four limits to choose from.

#### 60 Hz user equipment greater than or equal to 1 kVA

This option is applicable to user equipment or aggregate with power ratings  $\geq 1$  kVA and fundamental frequency of 60 Hz. This setting checks individual current harmonics at or above 60 Hz, up to 2000 Hz against 3% of the fundamental current amplitude. This applies to the 2<sup>nd</sup> through the 33<sup>rd</sup> harmonic.

Additionally it also checks any harmonic line current above 2000 Hz through 20 kHz against a limit line of (6000/f) percent of the fundamental full load current, where, f is the nominal frequency of that particular harmonic current. This applies to the 34<sup>th</sup> through the 100<sup>th</sup> harmonic.

### 60 Hz user equipment less than 1 kVA

This option is applicable to user equipment or aggregate with power ratings < 1 kVA and fundamental frequency of 60 Hz. This setting checks any harmonic line current from 60 Hz through 20 kHz against a limit line of (6000/f) percent of the fundamental full load current, where, f is the nominal frequency of that particular harmonic current. This applies to the 2<sup>nd</sup> through the 100<sup>th</sup> harmonic.

#### 400 Hz user equipment greater than or equal to 0.2 kVA

This option is applicable to user equipment or aggregate with power ratings  $\ge 0.2$  kVA and fundamental frequency of 400 Hz. This setting checks individual current harmonics at or above 400 Hz up to 13.33 kHz against 3% of the fundamental current amplitude. This applies to the 2<sup>nd</sup> through the 33<sup>rd</sup> harmonic.

Additionally, it also checks any harmonic line current above 13.34 kHz through 20 kHz against a limit line of (40,000/f) percent of the fundamental full load current, where, f is the nominal frequency of that particular harmonic current. This applies to the 34<sup>th</sup> through the 50<sup>th</sup> harmonic.

#### 400 Hz user equipment less than 0.2 kVA

This option is applicable to user equipment or aggregate with power ratings < 0.2 kVA and fundamental frequency of 400 Hz. The setting checks any harmonic line current from 400 Hz through 20 kHz against a limit line of (40,000/f) percent of the fundamental full load current, where, f is the nominal frequency of that particular harmonic current. This applies to the 2<sup>nd</sup> through the 50<sup>th</sup> harmonic.

## Harmonics graph/table

### **Current harmonics graph**

The current harmonics bar graph shows real time levels of the 2<sup>nd</sup> harmonic to the 100<sup>th</sup> harmonic as a percentage of the fundamental current as entered on the left test panel under Rated Amps Fundamental. Whenever the individual harmonics exceed the limit marked by a dashed line on the graph, they will appear *red*. A down arrow marker will appear on the peak detected value of each individual harmonic bar and it will continue to set a new value whenever a higher peak is detected. This peak value is used for generating the report at the end of the test.

Hovering over the bar chart displays the individual percentage and absolute value of each bar.

The Amps scale on the left of the graph can be used to scale the bar graph for a better view.

#### Table view

You can also choose to view results in a table format instead of a bar graph. Select the radio button on top of the graph area to toggle between Graph view and Table view.

The Table view will display Magnitude, Margin, Percentage limit, Absolute limit, Absolute maximum value (cumulative), Absolute margin (cumulative), and Pass/ Fail (cumulative) for each current harmonic up to the 100<sup>th</sup> harmonic.



Harmonics readings are also represented in the form of table.

#	Magnitude	Margin	Limit %	Limit Value	Maximum	Margin	Pass/Fail		
1	55.077 mA				56.125 mA		N/A	-	
2	100.71 μA	149.90 mA	50.000 %	150.00 mA	5.2710 mA	144.73 mA	PASS		
3	51.418 mA	48.582 mA	33.333 %	100.00 mA	52.248 mA	47.752 mA	PASS	-	
4	143.13 µA	74.857 mA	25.000 %	75.000 mA	5.1081 mA	69.892 mA	PASS		
5	46.487 mA	13.513 mA	20.000 %	60.000 mA	47.175 mA	12.825 mA	PASS		
6	273.20 µA	49.727 mA	16.667 %	50.000 mA	4.2222 mA	45.778 mA	PASS		
7	39.985 mA	2.8721 mA	14.286 %	42.857 mA	40.470 mA	2.3871 mA	PASS		
8	286.59 µA	37.213 mA	12.500 %	37.500 mA	3.0928 mA	34.407 mA	PASS		
9	32.163 mA	1.1703 mA	11.111 %	33.333 mA	32.448 mA	885.33 µA	PASS		
10	429.62 µA	29.570 mA	10.000 %	30.000 mA	1.8411 mA	28.159 mA	PASS		
11	23.890 mA	3.3827 mA	9.0909 %	27.273 mA	24.463 mA	2.8097 mA	PASS		
12	468.18 µA	24.532 mA	8.3333 %	25.000 mA	2.1482 mA	22.852 mA	PASS		
13	16.012 mA	7.0649 mA	7.6923 %	23.077 mA	16.505 mA	6.5719 mA	PASS		
14	260.43 µA	21.168 mA	7.1429 %	21.429 mA	1.8611 mA	19.567 mA	PASS		
15	10.086 mA	9.9140 mA	6.6667 %	20.000 mA	10.541 mA	9.4590 mA	PASS		
16	303.75 µA	18.446 mA	6.2500 %	18.750 mA	1.8181 mA	16.932 mA	PASS		
17	6.1102 mA	11.537 mA	5.8824 %	17.647 mA	6.7961 mA	10.851 mA	PASS		
18	236.65 µA	16.430 mA	5.5556 %	16.667 mA	1.7660 mA	14.901 mA	PASS		
19	5.0910 mA	10.698 mA	5.2632 %	15.789 mA	6.0033 mA	9.7862 mA	PASS		
20	362.36 µA	14.638 mA	5.0000 %	15.000 mA	1.5905 mA	13.410 mA	PASS		
21	5.0224 mA	9.2633 mA	4.7619 %	14.286 mA	5.9511 mA	8.3346 mA	PASS		
22	239.11 uA	13.397 mA	1 5/155 %	13.636 mA	981.15 uA	12.655 mA	PASS	•	ŝ

# **Test status**

MIL-1399 Current Harmonics Compliance test is performed based on the frequency limit and rated amps fundamental specified. If any of the parameters go outside of specification, then the test status will turn *red*. Any single result outside of specification at any point during the test will result in a *FAIL*.



#### Test Status:

- Run Passing. The test is passing all the limits.
- Run Failing. The test is failing some or all of the limits.
- PASS. The test has passed; the indicator is green.
- FAIL. The test has failed; the indicator is red.

#### **Rated Amps fundamental**

The rated fundamental current value can be entered in this field. The MIL-1399 standard compares and limits all the individual current harmonics against this absolute current fundamental value as described in the Limit (see page 88) section.

#### **Measured values**

Actual measured fundamental current amplitude is displayed in this area. For convenience and reporting, the left column also displays real time values of:

- Watts. Measured Power in the line
- Vrms. Voltage Root Mean Square of voltage signal (Volts RMS)
- Arms. Amps Root Mean Square
- Power Factor
- VA. Volt Amps
- Vthd. Volts Total Harmonic Distortion
- Athd. Amps Total Harmonic Distortion
- Vcf. The Voltage Crest Factor
- Acf. The Amps Crest Factor

#### Frequency

This is the expected and measured line voltage frequency.

#### Test time

This is the test time duration and elapsed time.

## IEC 61000-3-2 Current Harmonics (pre-compliance) test

The IEC 61000-3-2 Current Harmonics pre-compliance test is designed to measure current harmonics and compare the results to the limits specified in the IEC 61000-3-2:2014 Ed.4 and IEC 61000-4-7:2002+A1:2009 (including the interharmonics) standard.

Measurement parameters and limits are derived from the information entered into the following fields on the left side of the screen:

- Limit class as described in the Limit Class Types (see page 93) section
- Rated parameters as described in the <u>Rated Parameters (see page 96)</u> section
- Test Voltage and Frequency
- Test Time Duration

On the right side of the screen, all <u>harmonics measurement results (see page 98)</u> taken during the test can be displayed in either graph or table format.



**NOTE.** The PA1000 pre-compliance solution does not meet the following requirements of the IEC 61000-3-2:2014 Ed.4 and IEC 61000-4-7:2002+A1:2009 standard listed below:

- 50 dB filtering of signals above the maximum harmonic
- Various exceptions for pass fail criteria as detailed in section 6.2.3.4 of IEC 61000-3-2. (The determination of pass or fail will only be based on the comparison of the average measurement of each harmonic to the limit and the maximum of each harmonic to 150% of the limit.)
- Partial Odd Harmonic Content (POHC) as required for one of the exceptions in section 6.2.3.4 is not calculated.
- A repeatability test as defined in section 6.2.3.1 of IEC 61000-3-2 is not implemented.

- Full Class C waveform shape check as defined in section 7.3, Limits for Class C equipment of IEC 61000-3-2.
- Full AC source qualification testing requiring the monitoring of the voltage harmonics throughout the test as defined in A.2 of IEC 61000-3-2. (The PA1000 pre-compliance solution monitors that the test voltage stays within 2% of the of specified value and frequency stays within 0.5% of the specified value. It also checks that the source crest factor requirement is met, but does not continuously monitor the harmonic content or the wave shape of the AC voltage source.)

## Limit class types

The IEC 61000-3-2 Standard defines six limit class types:

#### Class A

Class A includes the following types of equipment:

- Balanced three-phase equipment
- Household appliances, excluding equipment identified as Class D
- Tools, excluding portable tools
- Dimmers for incandescent lamps
- Audio equipment

Equipment not specified in one of the three other classes (B, C, and D) is considered as Class A equipment.

For Class A equipment, the harmonics of the input current cannot exceed the values given in the table:

	Maximum permissible	
Harmonic order	harmonic current A	
n	А	
	Odd harmonics	
3	2.30	
5	1.14	
7	0.77	
9	0.40	
11	0.33	
13	0.21	
15 ≤ <i>n</i> ≤ 39	0.15 x (15 / n)	
	Even harmonics	
2	1.08	
4	0.43	

Harmonic order	Maximum permissible harmonic current A
6	0.30
$8 \le n \le 40$	0.23 x (8 / N)

#### **Class B**

Class B includes the following types of equipment:

- Portable tools
- Arc welding equipment which is not professional equipment

For Class B equipment, the harmonics of the input current cannot exceed the values given in the Class A table multiplied by a factor of 1.5.

#### Class C > 25 Watts

Class C is for lighting equipment.

For lighting equipment having an active input power greater than 25 W, the harmonics currents cannot exceed the relative limits given in the table:

	Maximum permissible harmonic	
	current expressed as a percentage of	
	the input current as the fundamental	
Harmonic order	frequency	
n	%	
2	2	
3	$30 - \lambda^{1}$	
5	10	
7	7	
9	5	
11 ≤ <i>n</i> ≤ 39	3	
(Odd harmonics only)		

1  $\lambda$  is the circuit power factor

#### Class C ≤ 25 Watts

For discharge lighting equipment having an active input power smaller than or equal to 25 W, the harmonics currents cannot exceed the limits given in one of two sets of requirements:

- The limits specified in the following table, or
- The limits specified in the Class C Waveform section below

Harmonic order	Maximum permissible harmonic current per watt	
n	mA / W	
3	3.4	
5	1.9	
7	1.0	
9	0.5	
11	0.35	
$13 \le n \le 39$ (Odd harmonics only)	3.85 / N	

#### **Class C waveform**

For discharge lighting equipment having an active input power smaller than or equal to 25 W, the harmonics currents cannot exceed the limits given in one of two sets of requirements:

- The limits specified in the Class  $C \le 25$  Watts section above, or
- The limits specified below:
  - The third harmonic current, expressed as a percentage of the fundamental current, shall not exceed 86%, and
  - The fifth harmonic current, expressed as a percentage of the fundamental current, shall not exceed 61%.

#### **Class D**

Class D includes the following types of equipment with less than or equal to 600 W:

- Personal computers and personal computer monitors
- Television receivers
- Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s)

For Class D equipment, the harmonics of the input current cannot exceed the values given in the following table:

Harmonic order	Maximum permissible harmonic current per watt	Maximum permissible harmonic current
n	mA / W	А
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
$13 \le n \le 39$ (Odd harmonics only)	3.85 / N	See the Class A table

# **Rated parameters**

Depending on which <u>Limit Class Type (see page 93)</u> is selected, one or more rated parameters may be needed to calculate the limit values.

#### Class A & B

Class A and B do not require any rated parameters.

IEC Prece	ompliance	IEC Prece	ompliance
Limit:	Class A 🔹	Limit:	Class B 🔹
Test Status: Rated	Ready to Start	Test Status: Rated	Ready to Start

### Class C $\leq$ 25 W

Class  $C \le 25$  W requires the rated power of the equipment under test.

Test
IEC	Preco	ompliance
Limit	t:	Class C <= 25W
Test	Status:	Ready to Start
Rate	ed	

Power:

#### Class C > 25 W

Class C > 25 W requires the rated amps fundamental and power factor of the equipment under test.

IEC Preco	omplian	ce		
Limit:	Class C >	25W		
Test Status:	Ready to 9	Start		
100000000	neauy to .	June		
Rated	iteauy to .	Juit		
Rated Amps Fund	amental:	1	÷	А

#### **Class C wave**

Class C wave requires the rated amps fundamental of the equipment under test.

\$ w

1

Limit:	Class C W	ave	•
Test Status:	Ready to 3	Start	
Rated			

#### Class D

Class DWave requires the rated power of the equipment under test.

#### **IEC Precompliance**

Limit:	Class D 🔹								
Test Status:	Ready to Start								
Rated									
	Power:	1	<u>^</u>	w					

# Harmonics graph/table

#### **Current harmonics graph**

The current harmonics bar graph shows real time levels of the 2<sup>nd</sup> harmonic up to the 40<sup>th</sup> harmonic as a percentage of the fundamental current. There are two limit values for each harmonic: Limit1 at 100% of the limit value and Limit2 at 150% of the limit value. A down arrow marker will appear on the peak detected value of each individual harmonic bar and it continue setting a new value whenever a higher peak is detected.

Hovering over the bar chart displays the individual absolute value of each bar.

The Amps scale on the left of the graph can be used to scale the bar graph for a better view.



#### Table view

You can also view results in a table format instead of a bar graph. Select the radio button on top of the graph area to toggle between Graph view and Table view.

The table view displays Limit1, Limit2, Average, Maximum, Current Value, and Pass/ Fail (cumulative) for each current harmonic up to the 39<sup>th</sup> or 40<sup>th</sup> depending on the selected limit class type.

#	Limit1	Limit2	Average	Maximum	Current Value	Pass / Fail	*
2	1.0800 A	1.6200 A	1.1167 mA	2.0948 mA	853.93 µA	PASS	
3	2.3000 A	3.4500 A	50.706 mA	50.832 mA	50.709 mA	PASS	
4	430.00 mA	645.00 mA	1.0877 mA	2.0035 mA	850.51 µA	PASS	
5	1.1400 A	1.7100 A	45.941 mA	46.075 mA	45.935 mA	PASS	
6	300.00 mA	450.00 mA	1.7812 mA	2.4745 mA	1.6479 mA	PASS	
7	770.00 mA	1.1550 A	39.662 mA	39.746 mA	39.697 mA	PASS	
8	230.00 mA	345.00 mA	1.0481 mA	1.9657 mA	889.22 µA	PASS	
9	400.00 mA	600.00 mA	32.002 mA	32.114 mA	32.068 mA	PASS	E
10	184.00 mA	276.00 mA	1.0552 mA	1.8935 mA	928.18 µA	PASS	
11	330.00 mA	495.00 mA	24.175 mA	24.314 mA	24.225 mA	PASS	
12	153.33 mA	230.00 mA	1.4736 mA	2.1962 mA	1.3622 mA	PASS	
13	210.00 mA	315.00 mA	16.389 mA	16.556 mA	16.437 mA	PASS	
14	131.43 mA	197.14 mA	959.47 µA	1.7036 mA	848.81 µA	PASS	
15	150.00 mA	225.00 mA	10.635 mA	10.765 mA	10.661 mA	PASS	
16	115.00 mA	172.50 mA	866.92 µA	1.5459 mA	742.93 µA	PASS	
17	132.35 mA	198.53 mA	6.8519 mA	7.0484 mA	6.8618 mA	PASS	
18	102.22 mA	153.33 mA	846.77 µA	1.3740 mA	734.03 µA	PASS	
19	118.42 mA	177.63 mA	5.6449 mA	5.8102 mA	5.5940 mA	PASS	
20	92.000 mA	138.00 mA	701.68 µA	1.1095 mA	656.21 µA	PASS	
21	107.14 mA	160.71 mA	5.3882 mA	5.5304 mA	5.3559 mA	PASS	
22	83.636 mA	125.45 mA	703.71 µA	934.45 µA	683.27 µA	PASS	
23	97.826 mA	146.74 mA	5.2221 mA	5.3861 mA	5.2751 mA	PASS	
24	76.667 mA	115.00 mA	699.64 µA	900.87 µA	618.96 µA	PASS	
25	90.000 mA	135.00 mA	4.6159 mA	5.1587 mA	4.6821 mA	PASS	
26	70.769 mA	106.15 mA	768.69 µA	1.2594 mA	706.70 µA	PASS	*

# **Test results**

When the IEC 61000-3-2 Current Harmonics Pre-compliance test is complete, PWRVIEW switches from displaying current values to the cumulative average values of measured results. The Test Status shows one of the following:

- PASS. The test has passed.
- FAIL. The test has failed.
- N/A. Not Applicable

In addition, a warning icon might appear next to the test status. Hovering the mouse over the warning icon displays the warning messages.

2   📙   PWRVIEW	
Setup Test Results	^ 0
Start Type HARMONICS • Instrument PA1000(0464) • Channel Ch1 • Test	Laboratory: My Laboratory  Customer My Customer Product My Product Details
IEC Precompliance	Results Format: 🔘 Graph 💦 Table
Limit: Class A 🔹	Amp % Harmonics Graph (Average)
Test Status: PASS 🔔	0.16-
Rated Supplied crest factor Maximum measured	is not within 1.4 and) <u>1.42</u> power is less than 75W. 0.14 –
Measured Arms: 107.57 mA	0.13 - 0.12 -
Amps Fundamental: 54.461 mA Power: 6.3401 W	
Power Factor: 489.98 m Vcf: 1.3947	- 0.09 Harmonics • MaxHarmonics • Limit1
Expected: 60 Hz	0.07
Voltage Expected: 120 V	
Measured: 120.29 V	_ 0.03 -
Test Time           Duration:         00:02:30           Elapsed:         00:02:30	
Ready	0 - 0.00 - 6 11 16 21 26 31 36

# **Results tab**

The results screen allows the retrieval and reporting of measurements or test results stored in the <u>results</u> <u>database (see page 101)</u>. Click the down arrow to select either Test or Measure and then click the button to find and open the results.



After opening test results they will be displayed in the results window and further options will be available from the ribbon control. See <u>Standby Power Results (see page 104)</u>, <u>MIL 1399 Results (see page 105)</u>, and <u>Current Harmonics Results (see page 108)</u>.

## **Measurement results**

Previously recorded measurement results can be opened using the Measure button in the Results tab. The data is stored in a proprietary database system that references disk files. The measurement results can be exported to an Excel or csv file for later use. You can also delete sessions that are no longer needed. Please note that deleting a session can take a long time depending on the database size.

Hovering over a session shows the duration of the session.



# **Test results**

Click the Test button in the Results tab to open the Test Results as shown below. The list box shows a list of all available test results from the database. First identify a result by the test type, test date and time, and the product selected when the test was performed. Click on any of the three column headers to sort the list by the test type, test date and time, or by the product. More information is available to help with the selection when the mouse is hovered over a result. Click Open to open the results, or Delete to remove the results from the database.

The test results are independent of the measurement results. The Test results are only used for standards testing and reporting with the Test tab. The Measurement results are used for generic logging with the Measure tab.

est results a	available in the data	base.	
Test Type	Test Date and Time	Product	
Standby Power	2/25/2016 8:58:58 AM	Aerospace	
Standby Power	2/25/2016 8:54:03 AM	Aerospace	Open
Standby Power	1/18/2016 1:25:31 PM	Aerospace	
Harmonics	1/13/2016 8:26:22 AM	Aerospace	Delete
Harmonics	1/13/2016 8:25:31 AM	Aerospace	E
Harmonics	1/13/2016 8:25:16 AM	Aerospace	
Harmonics	1/13/2016 8:24:50 AM	Aerospace	
Harmonics	1/13/2016 8:24:32 AM	Aerospace	
Harmonics	1/13/2016 8:23:18 AM	Aerospace	
Harmonics	1/13/2016 8:22:41 AM	Aerospace	
Harmonics	1/13/2016 8:18:46 AM	Aerospace	
Harmonics	1/13/2016 8:16:26 AM	Aerospace	
MII -1399	1/12/2016 3:26:07 PM	Aerospace	<b>.</b>

# Standby power results

After using the Test Results button and opening some Standby Power results, the ribbon control and results windows display the results as shown below. The Details section shows a read-only version of the test information entered in the <u>Test tab (see page 77)</u>. The <u>Reports (see page 112)</u> section allows the creation of <u>PDF (see page 113)</u> and <u>CSV (see page 114)</u> results reports.

	Setup Tes	st Results				
	Laboratory:	Lab3 Inc.	*		L	
	Customer:	Customer3	Ŧ	Test	PDF	_d,
Test	Product:	Appliance	Ŧ	Info *	Report •	CSV •
Results		Details			Repo	orts

The results window shows <u>Results Summary (see page 104)</u> and <u>Power Readings (see page 105)</u> that allow analysis of the results data.

# **Results Summary tab**

The Results Summary tab gives an overview of the results data in table and graph formats. The top-left table shows the test conditions and any warning messages; the top-right table shows the test results. The test results are all taken from the last two-thirds of the test as defined in the IEC 62301 standard. A trend graph in the lower part of the screen provides a summary view of power readings for the entire test duration.



# **Power Readings tab**

The Power Readings tab displays the <u>IEC 62301 Standby Power Test (see page 82)</u> window with a Time Slider at the top. Left click and drag the slider backwards and forwards to analyze each reading over the duration of the test. As the slider moves, every reading will update to show the value at the selected time.



# **MIL-1399 results**

After using the <u>Test (see page 103)</u> results button and opening some MIL-1399 results, the ribbon control and results windows display the results as shown. The Details section shows a read-only version of the test information entered in the <u>Test tab (see page 77)</u>. The <u>Reports (see page 112)</u> section allows the creation of <u>PDF (see page 113)</u> and <u>CSV (see page 114)</u> results reports.

<b>1</b> •	Setup Te	est Results				
	Laboratory:	Lab3 Inc.	-		1	×
Jest	Customer:	Customer3	Ŧ	Tart	PDF	a,
Test	Product:	Aerospace	Ŧ	Info *	Report •	CSV •
Results		Details			Repo	orts

The results window shows <u>Results Summary (see page 106)</u> and <u>Harmonic Results (see page 107)</u> that allow analysis of the results data.

# **Results Summary tab**

The Results summary shows all the vital test information.

The results summary Graph shows the maximum values of all 100 harmonics during the test run. Alternatively, you can view the Table summary for the test by clicking the respective radio button. The Table view displays the maximum magnitude, margin from the limit, the limit %, absolute value of the limit, and pass/fail status for individual harmonics up to 100.

c Summary		General Results			
est Type	MIL-1399	Test Value	Average	Minimum	Maximum
est Date and Time	2/25/2016 9:32:43 AM	Watts	14.038 W	13.971 W	14.066 W
verall Test Status	all Test Status PASS		118.69 V	118.45 V	118.80 V
ML-1399 Test Category	60Hz >1kVA	Arms	238.03 mA	237.22 mA	238.35 mA
ated Amps Fundamental	1.0000 A	Frequency	60.014 Hz	60.003 Hz	60.030 Hz
leasured Amps Fundamental	236.70 mA	Power Factor	496.88 m	496 50 m	497.39 m
est Duration	00:02:00	TOWER FACTOR	400.00 III	490.90 III	20.2141/4
mbient Temperature	23°C ±3°C	VA	26.252 VA	26.104 VA	28.514 VA
lumidity	< 75%	Vthd	2.6251 %	2.4/02 %	2.7609 %
est Notes	New test	Athd	10.481 %	10.388 %	10.595 %
		Vcf	1.3823	1.3806	1.3850
Warnings		Acf	1.4791	1.4712	1.4883
rmonics Results Summary —		•			
esults Format :   Graph Ta	ble	• University Crash			
esults Format :	ble	• Harmonics Graph			
rmonics Results Summary esults Format:  Graph Ta Amps 5% - 100 - 4% - 3% -	ble	Harmonics Graph			
rmonics Results Summary esuits Format : @ Graph @ Ta Amps 5% - 4% - 3% - 1% - 1% - 1% - 1% - 1% -	Die 	Harmonics Graph			

Maximum Harmonics values are represented in graph form. Click the Table radio button to view the tabular representation.

st !	Summary					General Results				
est	Туре		MIL-1399			Test Value	Average	Minimum	Maximum	
Test	Date and Time		2/25/2016 9:32:4	3 AM		Watts	14.038 W	13.971 W	14.066 W	
Ove	rall Test Status		PASS		Vrms	118.69 V	118.45 V	118.80 V		
MIL	-1399 Test Categor	y	60Hz >1kVA		Arms	238.03 mA	237.22 mA	238 35 mA		
Rate	d Amps Fundamen	tal	1.0000 A		Farmer	£0.014.U-	60,002 11-	60.030.11-		
Mea	sured Amps Funda	mental	236.70 mA			Frequency	60.014 Hz	60.003 Hz	60.030 Hz	
Test	Duration		00:02:00			Power Factor	496.88 m	496.50 m	497.39 m	
Aml	pient Temperature		23°C ±3°C			VA	28.252 VA	28.104 VA	28.314 VA	
Hun	nidity		< 75%			Vthd	2.6251 %	2.4702 %	2.7609 %	
Test	Notes		New test			Athd	10.481 %	10.388 %	10.595 %	
						Vcf	1.3823	1.3806	1.3850	
i v	/arnings					Acf	1.4791	1.4712	1.4883	
larm	ionics Results Sumr	nary			Ŧ					
larm Resu	ionics Results Sumr	<b>nary</b> oh @ Tab	le							
larm Resu #	onics Results Sumr Its Format : © Grap Max Magnitude	nary oh @ Tab Margin	le Limit %	Limit Value	• Pass/Fail					
larm Resu # 1	International States Summer States St	nary oh @ Tab Margin	le Limit %	Limit Value	Pass/Fail					
Resu # 1 2	Interpretation of the second s	mary oh @ Tab Margin 29.635 m	Limit %	Limit Value	Pass/Fail N/A PASS					
Resu # 1 2 3	In the second se	nary oh @ Tab Margin 29.635 n 5.3908 n	1A 3.000 %	Limit Value 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS					
Resu # 1 2 3 4	Its Format : Grap Max Magnitude 237.11 mA 364.60 µA 24.609 mA 212.73 µA 2 3588 mA	nary oh @ Tab Margin 29.635 r 5.3908 r 29.787 r 26.641 r	Limit % A 3.0000 % A 3.0000 % A 3.0000 %	Limit Value 30.000 mA 30.000 mA 20.000 mA	Pass/Fail N/A PASS PASS PASS					
Resu # 1 2 3 4 5	anics Results Summ Its Format : ◎ Gray Max Magnitude 237.11 mA 364.60 µA 24.609 mA 212.73 µA 3.3588 mA 155.85 µA	nary oh @ Tab Margin 29.635 m 5.3908 m 29.787 m 26.641 m 29.834 m	Limit % ΔA 3.0000 % ΔA 3.0000 % ΔA 3.0000 % ΔA 3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS					
Resu # 1 2 3 4 5 6 7	Max Magnitude 237.11 mA 364.60 µA 24.609 mA 212.73 µA 3.3588 mA 165.85 µA 20.299 mA	Margin 29.635 r 5.3908 r 29.787 r 26.641 r 29.834 r 27.970 r	le Limit % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS PASS					
Resu # 1 2 3 4 5 6 7 8	Max         Magnitude           237.11 mA         364.60 µA           24.609 mA         212.73 µA           33588 mA         165.85 µA           20.209 mA         153.05 µA	Margin 29.635 n 5.3908 n 29.787 n 26.641 n 29.834 n 27.970 n 29.847 n	Limit % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 % 1A 3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS PASS PASS PASS					
Resu # 1 2 3 4 5 6 7 8 9	Its Format : Gray Max Magnitude 237.11 mA 364.60 mA 24.609 mA 212.73 µA 3.3588 mA 165.85 µA 2.0299 mA 153.05 µA 669.08 µA	mary bh @ Tab Margin 29.635 m 5.3908 m 29.787 m 26.641 m 29.834 m 27.970 m 29.847 m 29.847 m 29.831 m	Ie Limit % A 3.0000 % A 3.0000 % A 3.0000 % A 3.0000 % A 3.0000 % A 3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS PASS PASS PASS					
Resu # 1 2 3 4 5 6 7 8 9 10	Amounics Results Summer           Intersection         Grap           Max Magnitude         237.11 mA           364.60 µA         24.609 mA           212.73 µA         33588 mA           165.85 µA         2.0299 mA           153.05 µA         669.06 µA           160.51 µA         160.51 µA	mary bh @ Tab 29.635 m 5.3908 m 29.787 m 26.641 m 29.834 m 27.970 m 29.847 m 29.847 m 29.831 m 29.839 m	Limit % Limit % 1A 3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS PASS PASS PASS PA					
Resu # 1 2 3 4 5 6 7 8 9 10 11	Lits Format : Gray Max Magnitude 237.11 mA 364.60 µA 24.609 mA 212.73 µA 3.3588 mA 165.85 µA 20.299 mA 153.05 µA 6650.8 µA 160.51 µA	nary bh @ Tab 29.635 n 5.3908 n 29.787 n 26.641 n 29.834 n 27.970 n 29.847 n 29.847 n 29.839 n 29.839 n 29.839 n	Limit %           hA         3.0000 %	Limit Value 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA 30.000 mA	Pass/Fail N/A PASS PASS PASS PASS PASS PASS PASS PA					

# Harmonics Results tab

The Harmonics Results tab gives access to the harmonics information over the time of the test. In Graph view, a horizontal scale has been provided on the top of the graph that can be adjusted to see the harmonic values over a specific time. As the scale pointer is moved, the Time information on the left column will reflect the actual time of the test. The Amps vertical scale on the left of the graph can be used to get a better view of smaller value harmonics. Hovering over individual harmonics will display a pop-up with a percentage value and absolute value of the current harmonic.

Alternatively, you can view the Table summary for the test by clicking the respective radio button. Table view displays magnitude, margin from the limit, the limit %, absolute value of the limit, maximum until that time in the test, margin until that time in the test, and pass/fail status for individual harmonics up to 100. The horizontal scale bar can be adjusted similar to the graph view; each value in table corresponds to that specific time in the test. The corresponding time in the test is displayed on the left column.



Tabular form of harmonic values can be viewed, by selecting the Table radio button.

Results Summa	ry Harr	monic Results									
				0							
					MATI	1200 Cur	name Hanna				
					IVIIL-	1399 Cur	rent narmo	onics			
Test Status: P.	ASS		Resu	ilts Format: 🔘	Graph 🖲 Table						
Limit: 6	50Hz <1k	VA –	#	Magnitude	Margin	Limit %	Limit Value	Maximum	Margin	Pass/Fail	
Rated			1	547.23 mA				632.09 mA		N/A	
Amps Fundar	mental:	0.6 A	2	18.856 mA	281.14 mA	50.000 %	300.00 mA	25.146 mA	274.85 mA	PASS	
Measured			3	142.10 mA	57.901 mA	33.333 %	200.00 mA	153.54 mA	46.455 mA	PASS	-
Amps Fundar	mental:	547.23 mA	4	5.0329 mA	144.97 mA	25.000 %	150.00 mA	5.9758 mA	144.02 mA	PASS	-
	Watts:	61.846 W	5	48.082 mA	71.918 mA	20.000 %	120.00 mA	53.645 mA	66.355 mA	PASS	
	Vrms:	119.31 V	6	2.4751 mA	97.525 mA	16.667 %	100.00 mA	4.5715 mA	95.429 mA	PASS	
	Arms:	551.45 mA	7	2.0621 mA	83.652 mA	14.286 %	85.714 mA	5.8703 mA	79.844 mA	PASS	
Power	Factor	940.00 m	8	2.0498 mA	72.950 mA	12.500 %	75.000 mA	4.7643 mA	70.236 mA	PASS	
1 OWCI	1/4.	540700 M	9	9.1812 mA	57.485 mA	11.111 %	66.667 mA	13.414 mA	53.252 mA	PASS	
	VA:	65.795 VA	10	1.8257 mA	58.174 mA	10.000 %	60.000 mA	4.1813 mA	55.819 mA	PASS	
	Vthd:	28.107 %	11	11.834 mA	42.711 mA	9.0909 %	54.545 mA	13.679 mA	40.866 mA	PASS	
	Athd:	28.107 %	12	570.47 µA	49.430 mA	8.3333 %	50.000 mA	2.6571 mA	47.343 mA	PASS	
	Vcf:	1.4000	13	11.020 mA	35.134 mA	7.6923 %	46.154 mA	11.920 mA	34.234 mA	PASS	
	Acf:	1.9512	14	770.95 µA	42.086 mA	7.1429 %	42.857 mA	2.3818 mA	40.475 mA	PASS	
Frequency			15	930.46 µA	39.070 mA	6.6667 %	40.000 mA	5.4032 mA	34.597 mA	PASS	
Exp	pected:	60.000 Hz	16	1.5189 mA	35.981 mA	6.2500 %	37.500 mA	4.1075 mA	33.393 mA	PASS	
Mei	asured:	59.998 Hz	17	9.6532 mA	25.641 mA	5.8824 %	35.294 mA	10.644 mA	24.650 mA	PASS	
Test Time			18	1.5070 mA	31.826 mA	5.5556 %	33.333 mA	1.8452 mA	31.488 mA	PASS	
Du	uration:	00:01:00 🗘	19	6.0577 mA	25.521 mA	5.2632 %	31.579 mA	8.0234 mA	23.556 mA	PASS	
F	lapsed	00:00:16 ^	20	218.01 µA	29.782 mA	5.0000 %	30.000 mA	2.3022 mA	27.698 mA	PASS	
		*	21	7.0171 mA	21.554 mA	4.7619 %	28.571 mA	7.8167 mA	20.755 mA	PASS	
			22	966.69 µA	26.306 mA	4.5455 %	27.273 mA	2.6083 mA	24.664 mA	PASS	
			23	3.1833 mA	22.904 mA	4.3478 %	26.087 mA	6.1381 mA	19.949 mA	PASS	-

# **Current harmonic results**

After using the <u>Test (see page 103)</u> results button and opening some Current Harmonics results, the ribbon control and results windows display the results as shown below. The Details section shows a read-only version of the test information entered in the <u>Test tab (see page 77)</u>. The <u>Reports (see page 112)</u> section allows the creation of <u>PDF (see page 113)</u> and <u>CSV (see page 114)</u> results reports.

<b>1</b> •	Setup Te	est Results	]	
	Laboratory:	Lab3 Inc.	-	<u>}</u>
Tast	Customer:	Customer3	• Lact	PDF d,
Test	Product:	Appliance	Info *	Report • CSV •
Results		Details		Reports

The results window shows the <u>Results Summary (see page 109)</u> and the <u>Harmonics Results (see page 111)</u> that allow analysis of the results data.

		IEC	61000-	-2 Current Harmonics (Pre-compliance)	
est Status: 🛛 <b>FAIL</b> 🧃	<b>.</b>	Results Format	Graph	© Table	
mit: Class A lated	•	Amp %	5	Harmonics Graph (Current Value)	]
Measured					
Arms	6.6888 A	•	4		
Amps Fundamental	6.0220 A				
Power	1.6804 kW		- 1		
Power Factor	816.50 m				
Vcf	1.0000		з —		
requency		-			<ul> <li>Harmonics</li> <li>MaxHarmonics</li> </ul>
Expected	50 Hz -		- 1		- Limit1
Measured	66.888 Hz		2-		- Limit2
/oltage	220 1 1/			_	
Expected	207 69 1				
Wiedsbred	507.00 V	•		<u>م</u> ـ	
Duration	00:02:30 🗘		1 -		
Elapsed	00:02:30 🗘				

# **Results Summary tab**

The Results summary shows all the vital test information as shown in the screen shot.

The Results summary graph shows the average values of all 40 harmonics during the test run. Alternatively, you can view the Table summary for the test by clicking the respective radio button. Table view displays Limit1, Limit2, Average, Maximum, Current Value, and pass/fail status for individual harmonics up to 40.

r summary		General Results							
est Type	IEC 61000-3-2	Test Value	Average	Minimum	Maximum				
est Date and Time	2/25/2016 12:45:13 PM	Watts	976.01 W	412.12 W	1.6804 kW				
Overall Test Status	FAIL	Power Factor	816.50 m	816.50 m	816.50 m				
EC61000-3-2 and 4-7 Pre-Comp Category	Class A	Amps Fundamental	4.5021 A	2.9823 A	6.0220 A				
Specified Voltage	230.00 V	Vrms	230.03 V	152.38 V	307.68 V				
	50.000 H7	Frequency	50.006 Hz	33.125 Hz	66.888 Hz				
specified requency	50.000 Hz	Arms	5.0006 A	3.3125 A	6.6888 A				
Test Duration	00:02:50	Vcf	1.0000	1.0000	1.0000				
Ambient Temperature	23°C ± 3°C	A Warnings							
Humidity	< 75%		is unlines europe	1509/ of the line					
Test Notes	New test	One or more harmonic values exceed 100% of the limit.							
armonics Results Summary Results Format:									
armonics Results Summary Results Format:  Graph Table Amp %	Harmoni	cs Graph (Average	)						
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)						
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)						
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)						
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)			Harmonics			
Armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)			Harmonics MaxHarmonics			
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)			Harmonics MaxHarmonics Limit1 Limit2			
armonics Results Summary Results Format:  Graph  Table  Amp %  5  4  3  2	Harmoni	cs Graph (Average	)			Harmonics Y MaxHarmonics – Limit1 – Limit2			
armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)			Harmonics MaxHarmonics Limit1 Limit2			
Armonics Results Summary Results Format:  Graph Table	Harmoni	cs Graph (Average	)			Harmonics Y MaxHarmonics – Limit1 – Limit2			

Average harmonics values are represented in graph form. Click the Table radio button to view the tabular representation

st Summary est Type IEC 61000-3-2						General Results						
Test Type IE				IEC 61000-3-2		Test Value	Average	Minimum	Maximum			
est Date and Time				2/25/2016 12:45:13 PM		Watts	976.01 W	412.12 W	1.6804 kW			
verall Test Status			FATI		Power Factor	816.50 m	816.50 m	816.50 m				
-614	61000-3-2 and 4-7 Pre-Comp Category			Class A		Amps Fundamental	4.5021 A	2.9823 A	6.0220 A			
.010			ategory	Class A		Vrms	230.03 V	152.38 V	307.68 V			
pecified Voltage pecified Frequency			230.00 V		Frequency	50.006 Hz	33.125 Hz	66.888 Hz				
			50.000 Hz		Arms	5.0006 A	3.3125 A	6.6888 A				
st D	uration			00:02:30		Vcf	1.0000	1.0000	1.0000			
nbie	ent Temperati	ure		23°C ± 3°C								
imia	ditv			< 75%		A Warnings						
				New Aret		One or more harmonic values exceed 150% of the limit.						
est Notes					One or more harmoni	c average value	s exceed 100% of	f the limit				
mo	nics Results S	ummary	Tabla			One or more harmoni	c average value	s exceed 100% o	f the limit.			
moi esul	nics Results So ts Format: 〇 Limit1	ummary Graph (0)	Table	ne Maximum	Current Value	One or more harmoni	c average value	s exceed 100% of	f the limit.			
moi isul #	nics Results So ts Format: Limit1 30.004 mA	Graph Limit2 45.006 mA	Table Avera	ge Maximum 0.0000 A	Current Value	One or more harmoni	c average value	s exceed 100% of	f the limit.			
moi isul #	nics Results Si ts Format: C Limit1 30.004 mA 2.3000 A	Graph (a) Limit2 45.006 mA 3.4500 A	Table Averag 0.0000 A 1.5007 A	ge Maximum 0.0000 A 2.0073 A	Current Value 0.0000 A 2.0073 A	One or more harmoni Pass / Fail PASS PASS	c average value	s exceed 100% of	f the limit.			
moi esul #	nics Results So ts Format: C Limit1 30.004 mA 2.3000 A 30.004 mA	Graph (************************************	Table Averag 0.0000 A 1.5007 A 0.0000 A	ge Maximum 0.0000 A 2.0073 A 0.0000 A	Current Value 0.0000 A 2.0073 A 0.0000 A	One or more harmoni Pass / Fail PASS PASS PASS	c average value	s exceed 100% of	f the limit.			
moi esul #	nics Results So ts Format: C Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A	Graph (*) Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A	Table <b>Avera</b> 0.0000 A 1.5007 A 0.0000 A 900.43 m	ge Maximum 0.0000 A 2.0073 A 0.0000 A A 1.2044 A	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A	One or more harmoni Pass / Fail PASS PASS PASS PASS	c average value	s exceed 100% of	f the limit.			
mo esul # 2 3 4 5 5	nics Results Si ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA	Graph (a) Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA	Table <b>Averag</b> 0.0000 A 1.5007 A 0.0000 A 900.43 m 0.0000 A	ge Maximum 0.0000 A 2.0073 A 0.0000 A A 1.2044 A 0.0000 A	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A	One or more harmoni Pass / Fail PASS PASS PASS PASS PASS	c average value	s exceed 100% of	f the limit.			
mor esul # 2 3 4 5 5 7	nics Results Si ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA 770.00 mA	Graph (a) Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA 1.1550 A	Table Averag 0.0000 A 1.5007 A 0.0000 A 900.43 m 0.0000 A 643.16 m	ge Maximum 0.0000 A 2.0073 A 0.0000 A A 1.2044 A 0.0000 A A 860.28 mA	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 860.28 mA	One or more harmoni Pass / Fail PASS PASS PASS PASS PASS PASS	c average value	s exceed 100% of	f the limit.			
moi # 2 3 5 5 7 8	nics Results So ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA 770.00 mA 30.004 mA	Graph (a) Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA 1.1550 A 45.006 mA	Table Averat 0.0000 A 1.5007 A 0.0000 A 900.43 m 0.0000 A 643.16 m 0.0000 A	ge         Maximum           0.0000 A         2.0073 A           0.0000 A         A	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 560.28 mA 0.0000 A	One or more harmoni Pass / Fail PASS PASS PASS PASS PASS PASS PASS	c average value	s exceed 100% of	f the limit.			
moi esult # 2 3 4 5 5 7 7 8 9	nics Results So ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA 770.00 mA 30.004 mA 400.00 mA	Graph (*) Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA 1.1550 A 45.006 mA 600.00 mA	Table Average 0.0000 A 1.5007 A 0.0000 A 900.43 m 0.0000 A 643.16 m 0.0000 A 500.24 m	Maximum           0.0000 A           2.0073 A           0.0000 A           A           1.2044 A           0.0000 A           A           860.28 mA           0.0000 A           A           669.11 mA	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 860.28 mA 0.0000 A 669.11 mA	One or more harmoni Pass / Fail PASS PASS PASS PASS PASS PASS PASS FALL	c average value	s exceed 100% of	f the limit.			
moi esul 2 3 4 5 5 7 8 9	nics Results So ts Format: C Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA 770.00 mA 30.004 mA 400.00 mA 30.004 mA	Graph (*) Graph (*) 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA 1.1550 A 45.006 mA 600.00 mA 45.006 mA	Table Average 0.0000 A 1.5007 A 0.0000 A 900.43 m 0.0000 A 643.16 m 0.0000 A 500.24 m 0.0000 A	Maximum           0.0000 A           2.0073 A           0.0000 A           A           1.2044 A           0.0000 A           A           860.26 mA           0.0000 A           A           669.11 mA           0.0000 A	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 860.28 mA 0.0000 A 669.11 mA 0.0000 A	One or more harmoni           Pass / Fail           PASS           PASS	c average value	s exceed 100% of	f the limit.			
mon esult 2 3 4 5 5 7 8 9 10 11	nics Results Si ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 1.1400 A 30.004 mA 30.004 mA 30.004 mA 30.004 mA 30.004 mA	Graph Graph Limit2 45.006 mA 3.4500 A 45.006 mA 1.7100 A 45.006 mA 1.1550 A 45.006 mA 45.006 mA 45.006 mA	Table           Average           0.0000 A           1.5007 A           0.0000 A           900.43 m           0.0000 A           643.16 m           0.0000 A           500.24 m           0.0000 A           409.29 m	ye Maximum 0.0000 A 2.0073 A 0.0000 A A 1.2044 A 0.0000 A A 860.28 mA 0.0000 A A 669.11 mA 0.0000 A A 547.45 mA	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 669.11 mA 0.0000 A 669.11 mA 0.0000 A 547.45 mA	One or more harmoni Pass / Fail PASS PASS PASS PASS PASS PASS FAIL PASS FAIL	c average value	s exceed 100% of	f the limit.			
moi esul 2 3 4 5 5 7 7 8 9 10 11 12	nics Results Si ts Format: Limit1 30.004 mA 2.3000 A 30.004 mA 30.004 mA 30.004 mA 30.004 mA 400.00 mA 30.004 mA 30.004 mA	Graph Graph 45.006 mA 3.4500 A 45.006 mA 45.006 mA 1.1550 A 45.006 mA 45.006 mA 45.0	Table           Average           0.0000 A           1.5007 A           0.0000 A           900.43 m           0.0000 A           643.16 m           0.0000 A           500.24 m           0.0000 A           409.29 m           0.0000 A	Je         Maximum           0.0000 A         2.0073 A           0.0000 A         0.0000 A           1.2044 A         0.0000 A           A         8.60.28 mA           0.0000 A         0.0000 A           A         669.11 mA           0.0000 A         547.45 mA           0.0000 A         0.0000 A	Current Value 0.0000 A 2.0073 A 0.0000 A 1.2044 A 0.0000 A 560.28 mA 0.0000 A 569.11 mA 0.0000 A 547.45 mA 0.0000 A	Pass / Fail           PASS         PASS           PASS         PASS           PASS         PASS           PASS         PASS           PASS         FAIL           PASS         FAIL           PASS         FAIL           PASS         FAIL           PASS         FAIL           PASS         FAIL	c average value	s exceed 100% of	the limit.			

# Harmonics results tab

The Harmonics results tab gives you access to the harmonics information over the time of the test. In Graph view, a horizontal scale is provided on the top of the graph that can be adjusted to see the harmonic values over a specific time. As the scale pointer is moved, the Elapsed Test Time information on the left column reflects the actual time of the test. The Amp % - vertical scale on the left of the graph can also be used to get a better view of smaller value harmonics. Hovering over individual harmonics will display a pop-up with an absolute value of the current harmonic.

Alternatively, you can view the Table summary for the test by selecting the Table radio button. Table view displays Limit1, Limit2, average, maximum, current value, and pass/fail status for individual harmonics up to 40. The horizontal scale bar can be adjusted similar to the graph view; each value in table corresponds to the specific time in the test. The corresponding time in the test is displayed on the left column.



Tabular form of harmonic values can be viewed, by selecting the Table radio button.

									and the second	
				IEC 61	L000-3-2 C	urrent Hari	monics (Pre	-compliance)		
'est Status:	FAIL 🗥		Resu	lts Format: 🔘	Graph 💿	Table				
imit:	Class A	Ŧ	#	Limit1	Limit2	Average	Maximum	Current Value	Pass / Fail	
Rated			2	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
			3	2.3000 A	3.4500 A	1.5007 A	2.0073 A	1.1569 A	PASS	
			4	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
			5	1.1400 A	1.7100 A	900.43 mA	1.2044 A	694.14 mA	PASS	
measured	A	2.0550.4	6	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
	Arms:	5.8550 A	7	770.00 mA	1.1550 A	643.16 mA	860.28 mA	495.82 mA	PASS	
Amps Funda	mental:	3.4707 A	8	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
	Power:	558.16 W	9	400.00 mA	600.00 mA	500.24 mA	669.11 mA	385.64 mA	FAIL	
Power	r Factor:	816.50 m	10	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
	Vcf:	1,0000	11	330.00 mA	495.00 mA	409.29 mA	547.45 mA	315.52 mA	FAIL	
			12	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
requency		(FO.1)	13	210.00 mA	315.00 mA	346.32 mA	463.23 mA	266.98 mA	FAIL	
Ex	pected:	50 Hz +	14	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
Me	easured:	38.550 Hz	15	150.00 mA	225.00 mA	300.14 mA	401.47 mA	231.38 mA	FAIL	
/oltage			16	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
Ex	pected:	230 🗘 V	17	132.35 mA	198.53 mA	264.83 mA	354.23 mA	204.16 mA	FAIL	
Me	asured:	177.33 V	18	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
			19	118.42 mA	177.63 mA	236.95 mA	316.95 mA	182.67 mA	FAIL	
lest lime		00.00.00	20	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
D	uration:	00:02:50 🖕	21	107.14 mA	160.71 mA	214.39 mA	286.76 mA	165.27 mA	FAIL	
E	Elapsed:	00:01:40 🗘	22	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
			23	97.826 mA	146.74 mA	195.75 mA	261.83 mA	150.90 mA	FAIL	
			24	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	
			25	90.000 mA	135.00 mA	180.09 mA	240.88 mA	138.83 mA	FAIL	
			26	30.004 mA	45.006 mA	0.0000 A	0.0000 A	0.0000 A	PASS	

# Reports

You can generate reports in <u>PDF (see page 113)</u> or <u>CSV (see page 114)</u> format. Select the type of report by clicking the lower half of the button and then clicking the main button to generate the report.

	) 🔻	Setup T	est Res	ults							
111	3	Laboratory:	Lab3 Inc.				SF.	ĭ≊a,			
Т	Test • Product:		<new pro<="" td=""><td colspan="2">r3 Test oduct&gt; Info</td><td>Test Info ▼</td><td>Fu Repo</td><td>ll ort •</td><td>Export CSV •</td><td></td><td></td></new>	r3 Test oduct> Info		Test Info ▼	Fu Repo	ll ort •	Export CSV •		
Res	sults		Detai	ls			Ful	Rep	ort		*
Res	ults S	ummary Harn	nonic Result	ts			Sur	nmar	y		
_T	est Su	immary					Results				
•	Test Type				MIL-1399			phs			*
	Test Date and Time			10/8/2015 1:05:52			۲	V 🗸	/iew after	creation	

NOTE. The reports will have common interfaces across Test types. Standby Power Report generation, MIL-1399 Report generation, and Current Harmonics Report generation share the same interface for exporting the reports.

## **PDF** reports

After clicking the PDF report button a dialog box opens to save the file. You can change the file name if required. Click Save to save the file and automatically open the PDF report if appropriate software is installed on the PC.

IEC61000-4-7:2002 +A1:2009

	Customer		Issuer				
Name:	Customer Company	Name:	Your Company				
Address:	123 ABC Drive	Address:	123 ABC Drive				
	2nd line		2nd line				
	Customer City		Your City				
	Customer State Customer Post Code		Your State Your post code				
	Customer Country		Your Country				
	-	Date of issue:	2015-Apr-24				
	Unit Under Test		Reference Instrument				
Manufacturer:	Manufacturer Company	Manufacturer:	Tektronix				
Description:	Device Under Test	Description:	Power Analyzer				
Model:	DUT Model	Model:	PA1000				
Serial Number:	DUT Serial Number	Serial Number:	Q000013				
Rated Voltage:	DUT Rated Voltage	Firmware Version:	Ver.1.003.011				
Rated Frequency:	DUT Rated Frequency	Test Software:	PWRVIEW ver. 1.1.7.100				
Documentation ref:	Doc Reference						
Configuration:							
	Test Conditions		Test Summary				
Time of Test:	2015-Apr-24 01:26:31 PM	Test Type:	Class A				
Temperature:	23°C ± 3°C	Specified Voltage:	120.00 V				
Humidity:	< 75%	Specified Frequency:	60.000 Hz				
		Test Duration:	00:02:30				
		Overall Result:	PASS (Check Warnings)				
	Test Warnings						

Test Report No 150424-012631-F

Pre-compliance harmonics and inter-harmonics to IEC61000-3-2:2014 Ed.4 and

Supplied crest factor is not within 1.4 and 1.42

The measurement equipment used satisfies key requirements of IEC61000-3-2 Ed. 4.0 2014 and IEC61000-4-7 Ed. 2.1 2009 including 10 or 12 cycle no-gap power and harmonics measurements and inter-harmonic grouping.

\* Results may be used to show, with a very high degree of confidence, how the equipment under test will satisfy the requirements of the standards. For certification to the standards, measurements should be made using fully compliant equipment.

# **Spreadsheet reports**

The CSV (Comma Separated Values) export is compatible with most spread sheet applications including Microsoft Excel and contains columns for time and every measured parameter over the entire test duration. This file can be used to import the results into other software packages for analysis.

X	5	- ¢- =			HarmonicsResults_2015-04-24_13-31-44 - Excel								
F	ILE HO	DME IN	SERT PA	AGE LAYOUT	FORM		ATA RE	EVIEV	v v	IEW AC	ROBAT		Ma
-	× ×	Calibri	- 11	× 0 <sup>+</sup> 0 <sup>×</sup>	= =		General	•	🔡 Cor	nditional For	matting -	E Insert	- 13
	L 🕞 🖌	Calibri	. 11	AA		三日・	\$ + %	9	For	mat as Table	<b>*</b>	Ex Delete	- 1
Pa	ste 🧹	в <i>I</i> <u>U</u>	•		∉∄	8/ -	00. 0.→ 0.€ 00.		Cel	l Styles *		Format	+
Clip	board 🗔		Font	F2	Alignr	ment 🗔	Number	F2		Styles		Cells	
A1		- 1 2	x 🗸	f <sub>x</sub> Time	2								
	Α	в	с	D	E	F	G	13	н	I	j	К	3
1	Time	Watts	Power Fac	Amps Fun \	/rms	Frequence	Arms	Vcf		Magnitud	Magnitud	Magnitud	Mag
2	0:00:00	131.5	0.98785	1.1002	119.98	60.003	1.1095		1.4246	0.006628	0.077223	0.005433	0.0
3	0:00:00	130.77	0.98791	1.0997	120.15	60.003	1.1017		1.3754	0.00647	0.077214	0.005521	0.0
4	0:00:00	131.51	0.98806	1.1001	120.17	60.003	1.1076		1.3755	0.006431	0.077299	0.005532	0.0
5	0:00:00	130.92	0.98805	1.1	120.17	60.003	1.1026		1.376	0.006342	0.077325	0.005477	0.0
6	0:00:01	131.46	0.98797	1.1005	120.17	60.003	1.1072		1.3784	0.006499	0.077467	0.005536	0.
7	0:00:01	130.94	0.98806	1.1002	120.17	60.003	1.1027		1.3755	0.006395	0.077311	0.005621	0.0
8	0:00:01	131.44	0.98798	1.1004	120.21	60	1.1067		1.3751	0.006307	0.077402	0.005735	0.0
9	0:00:01	130.94	0.98771	1.1005	120.04	60	1.1044		1.4187	0.006302	0.077034	0.005862	0.0
10	0:00:01	131.5	0.98804	1.1006	120.14	60	1.1078		1.3761	0.006311	0.077143	0.005778	0.0
11	0:00:02	131	0.98798	1.1003	120.13	60	1.1037		1.3757	0.006184	0.076839	0.005942	0.0
12	0:00:02	131.51	0.98807	1.1005	120.14	60.003	1.1079		1.3753	0.006254	0.076906	0.005744	0.0
13	0:00:02	131.07	0.98804	1.1003	120.14	60.003	1.1042		1.3744	0.006415	0.076531	0.005735	0.0
14	0:00:02	131.46	0.98807	1.1005	120.14	60	1.1074		1.3747	0.006572	0.076613	0.005825	0.0
15	0:00:02	131.12	0.98801	1.1001	120.16	60	1.1045		1.3754	0.00647	0.076649	0.005759	0.0
16	0:00:03	131.35	0.98798	1.1002	120.14	60.003	1.1066		1.3747	0.006589	0.076881	0.005655	0.0
17	0:00:03	131.41	0.98805	1.1003	120.14	60.003	1.1071		1.375	0.006552	0.076899	0.005479	0.0
18	0:00:03	131.3	0.98801	1.1003	120.17	60	1.1059		1.3753	0.006587	0.076976	0.005567	0.0
19	0:00:03	131.41	0.98803	1.1004	120.22	60	1.1063		1.3756	0.006608	0.076807	0.005605	0.0
20	0:00:03	131.06	0.98782	1.1004	120.04	60.003	1.1052		1.4081	0.006569	0.076989	0.005821	C
21	0:00:04	131.5	0.98807	1.1006	120.15	60.003	1.1076		1.3755	0.006591	0.076932	0.005911	0.0
22	0:00:04	131.04	0.98803	1.1004	120.14	60	1.1039		1.3754	0.006503	0.077081	0.005878	0.0
23	0:00:04	131.46	0.98803	1.1009	120.13	60	1.1076		1.3747	0.00646	0.077274	0.005745	0.0
24	0:00:04	130.86	0.98802	1.1005	120.19	60.003	1.102		1.3749	0.006704	0.077038	0.005655	0.0

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