Tektronix®

PWRVIEW

Online Help

077-1165-00

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077-1165-00

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tek.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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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 Setup (see page 13) 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 Measure (see page 63) 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 Test (see page 77) 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.

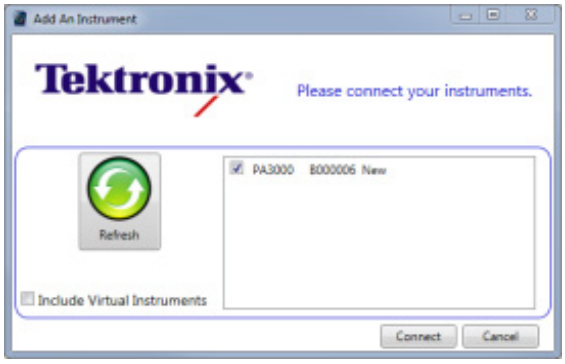
See the Quick Start (see page 2) guide to quickly begin making measurements.

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:

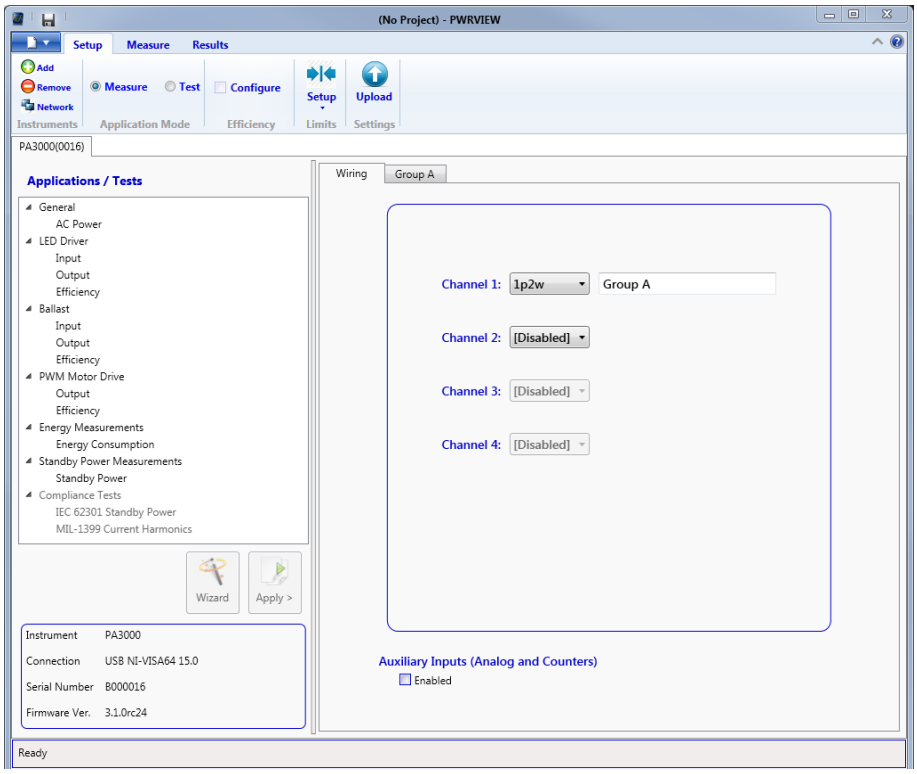


4. Click the Connect button to connect your instrument to PWRVIEW.

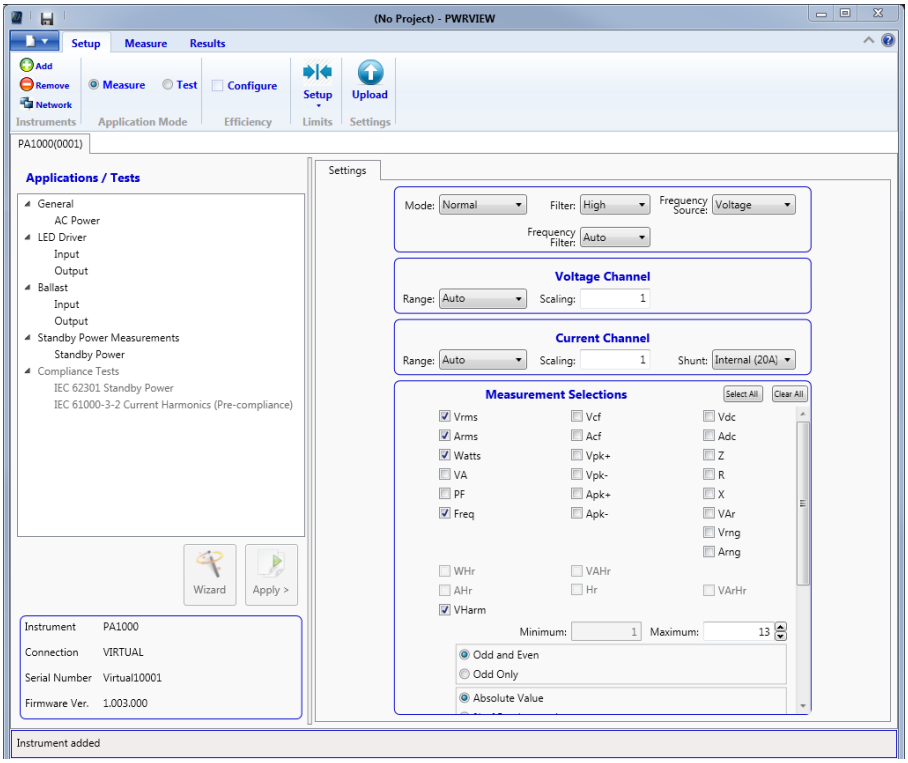
   If desired, check the "Include Virtual Instruments" box to add demonstration instruments to the list and then select one or more instruments before clicking the Connect button.

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.

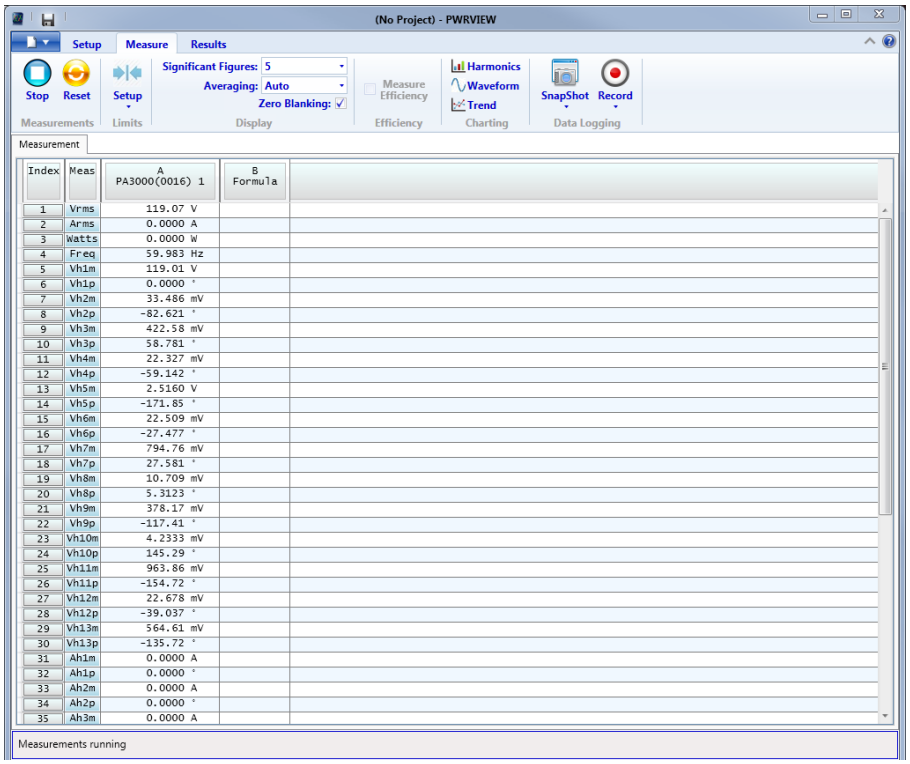


   If you have a single-channel instrument such as a PA1000, the Setup tab will show the settings configuration.



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:



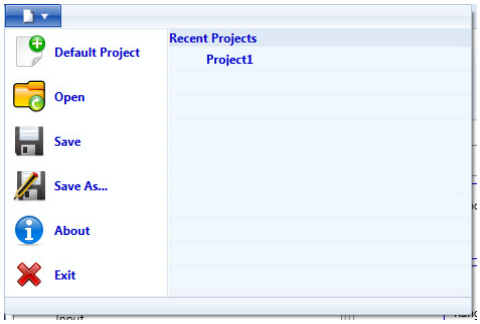
8. Click the Stop button to stop the measurements.

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.



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.

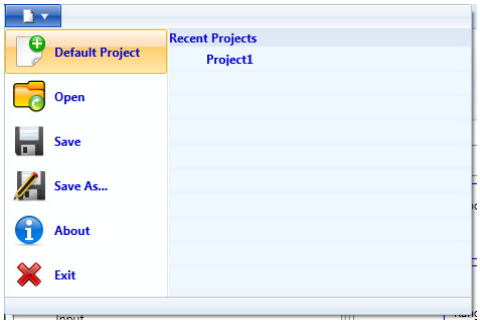
Default Project

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.

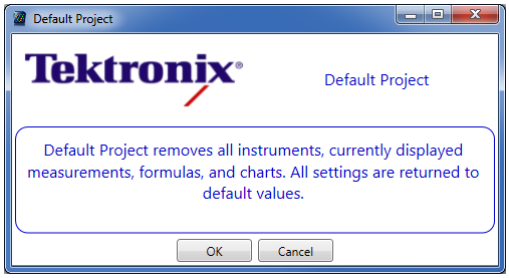
NOTE. *Default Project does not affect the current settings on the power analyzer.*

Default Project does not affect database or recorded test results.

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



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



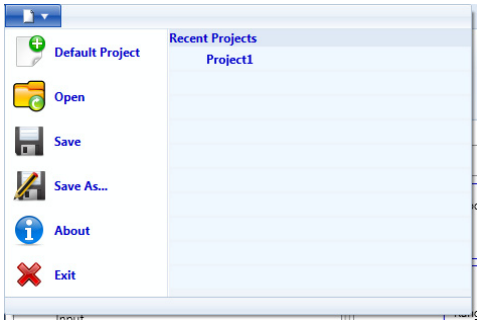
After confirmation, PWRVIEW will be returned to default settings: all instruments and defined formulas will be removed, averaging, blanking, significant digits, and logging settings will be returned to default settings.

Open / recent project

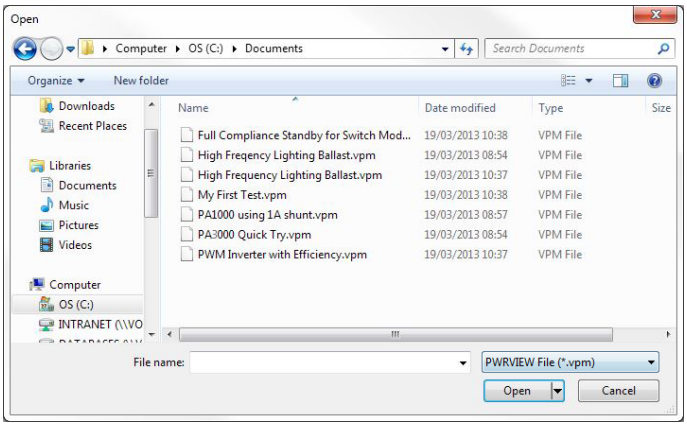
Open

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

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



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



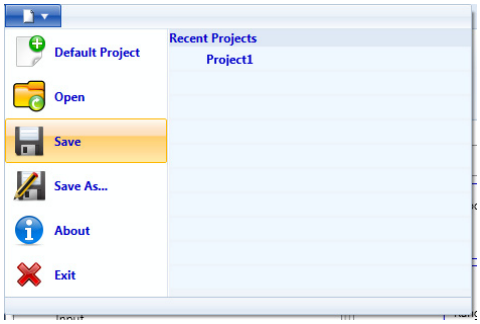
PWRVIEW will be set based on the settings within the opened file.

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.

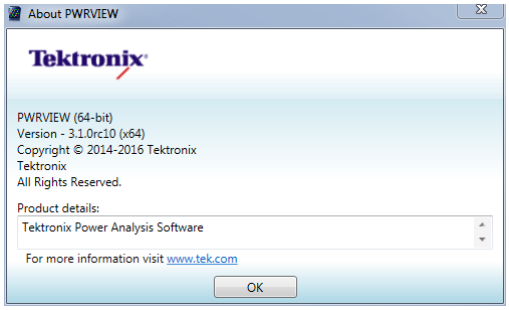
Save / Save As

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



About

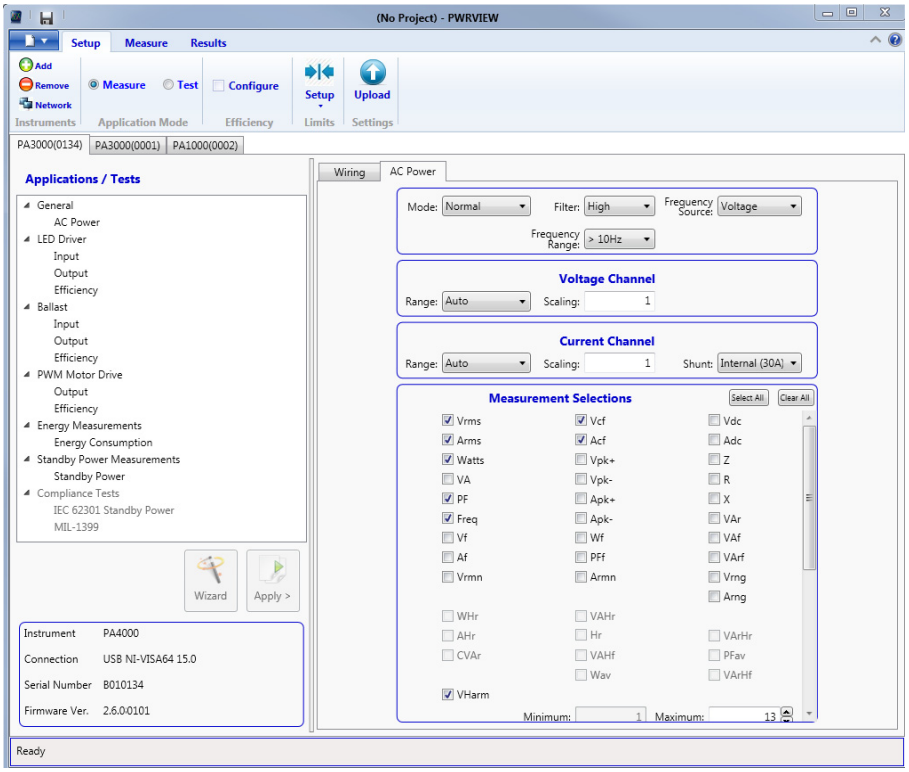
The About dialog box shows information about the PWRVIEW software.



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:
  - Applications / Tests Panel (see page 21) 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 setup an instrument (see page 20) for various wiring configurations.



Instrument add/remove

The setup ribbon provides the user with functionality that:

- Adds (see page 15) new instruments
- Removes (see page 16) 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 www.tek.com. 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 Network address dialog box (see page 17). 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 → Interfaces → Ethernet → 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)

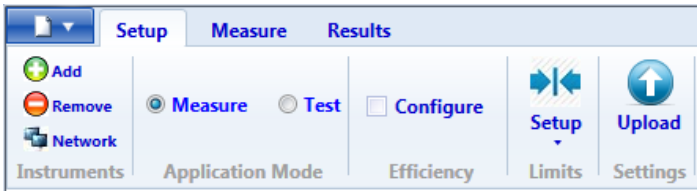
General Purpose Instrument Bus connections require the addition of a GPIB controller to the host computer. GPIB controllers come in a variety of formats from PCI cards that require installation inside desktop computers to USB-GPIB converters that can simply be attached to the USB port of the computer.

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.

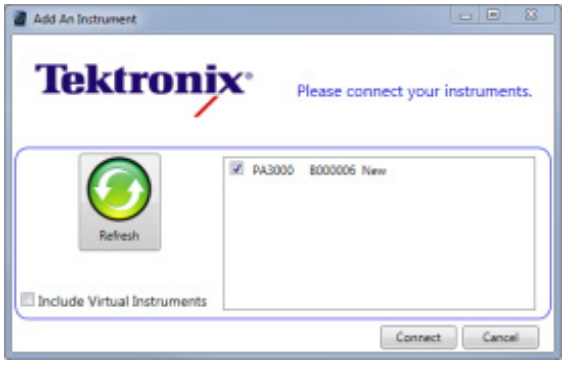
Add

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.

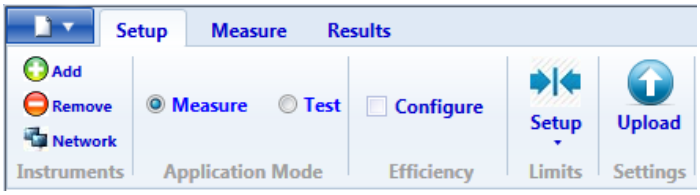


- Clicking the Refresh button will initiate a new search for connected instruments.
- Checking "Include Virtual Instruments" adds Virtual Instruments to the list of available instruments. Virtual instruments can be used to learn the features of either product without a physical instrument being present.

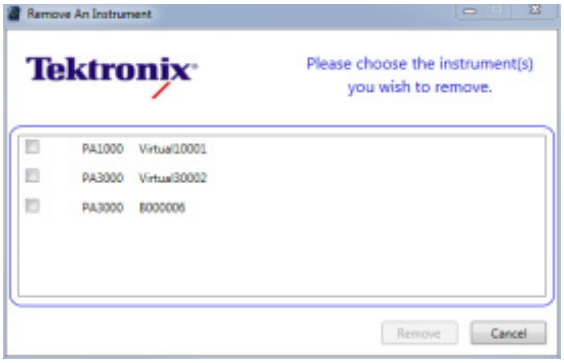
Remove

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

1. Click **Remove** for removing already added instrument.



2. Select the instrument to remove.



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

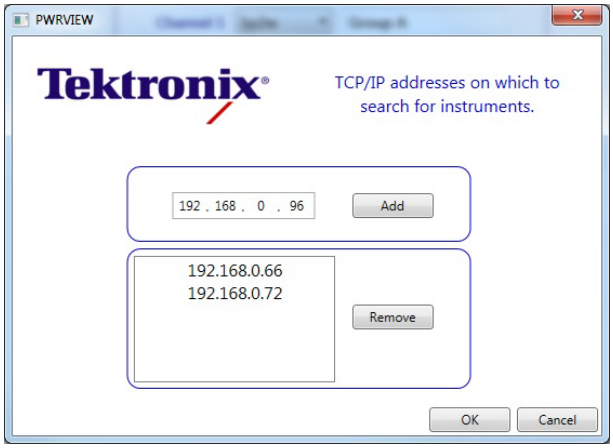
Network

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.



Application Mode

Use the Application Mode to select either the Measure or Test modes. The Applications / Test (see page 21) 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.

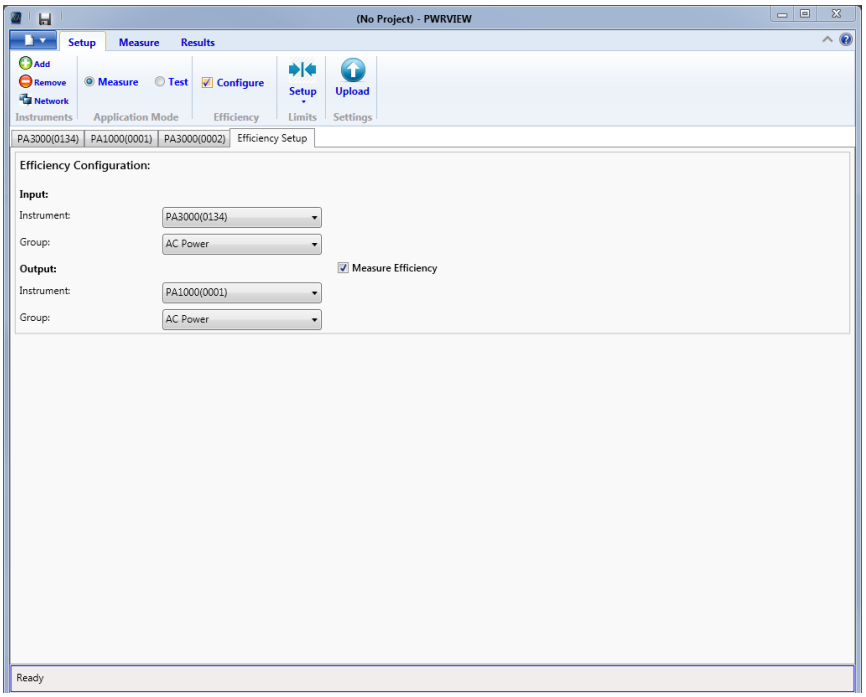
Use Measure to select the measurements, such as AC Power or LED Driver Input, and then click either the Wizard button or the Apply button. After selecting the measurement, the configuration details appear on the right side of the screen. When you select the Measure application mode, the Measure tab becomes 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.

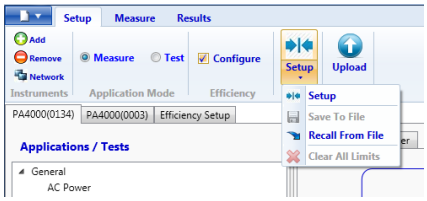


Limits

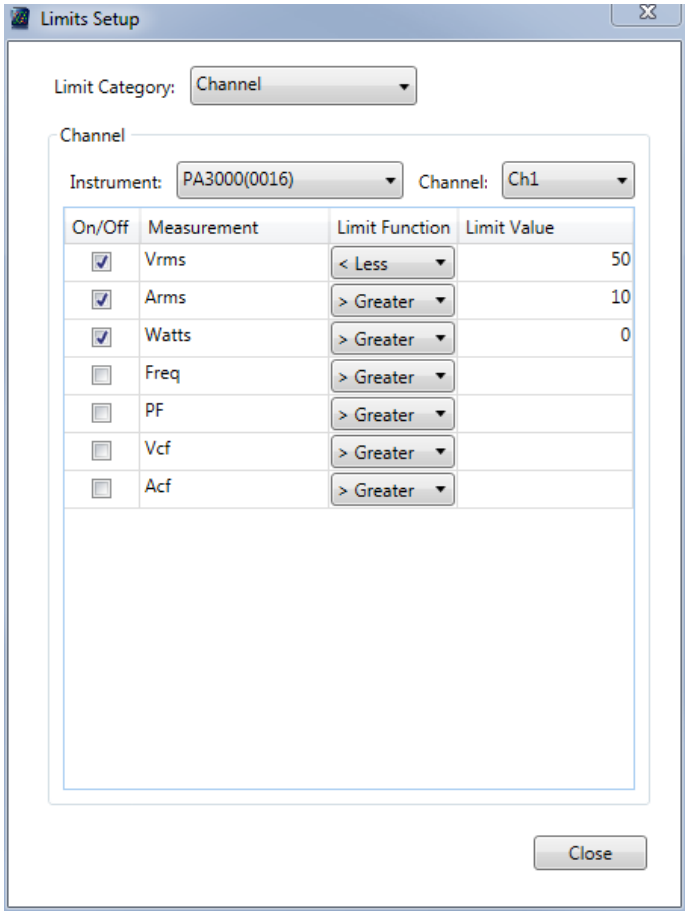
Use the Limits setup to configure user defined limits for various measurement parameters.

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

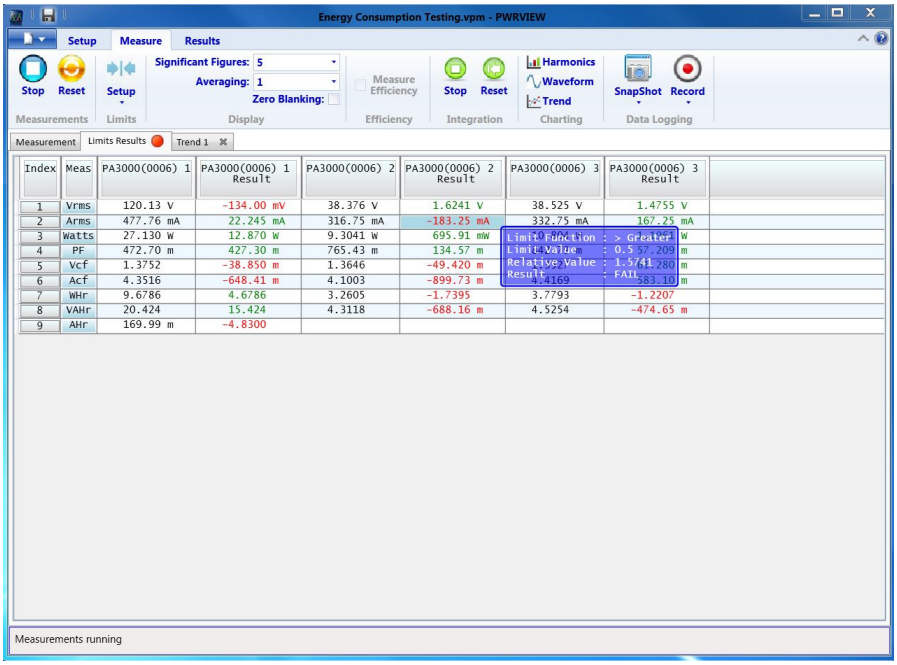
Click the down arrow for more options such as setting up limit values, saving limits to a file, recalling limits from a file, and clearing all limits. The limits file is independent of the PWRVIEW configuration file and can be saved and recalled independently.



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



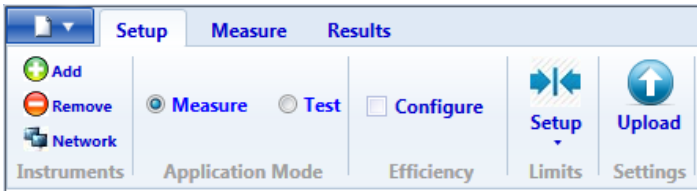
Limits will show up on the Measurement grid as an individual tab. Hovering over the results cell displays the set Limit Function, Limit Value, Relative Value, and Pass-Fail Status in real-time.



Upload

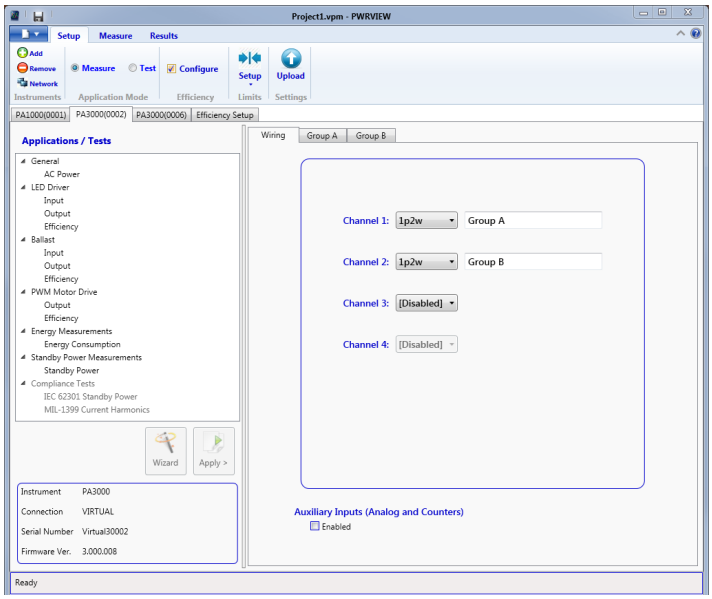
Use the Upload button to remotely control and change settings on the power analyzer.

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.



Instrument Setup panel

All instruments added to the configuration using the Add (see page 15) 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 Information Panel (see page 37). Applications and tests can be configured using Applications / Tests Panel (see page 21). Other parameters are configured using the Wiring (see page 37) and Group Configuration (see page 40) panels.

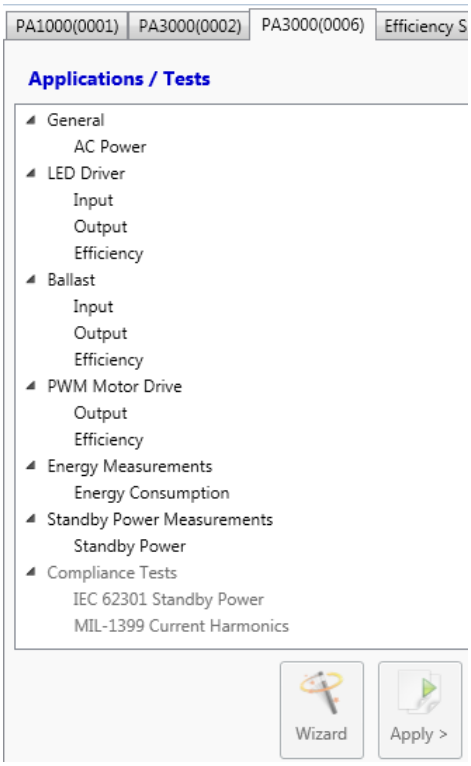


Applications/Tests panel

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 Wizard (see page 23) or Apply (see page 22) 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.

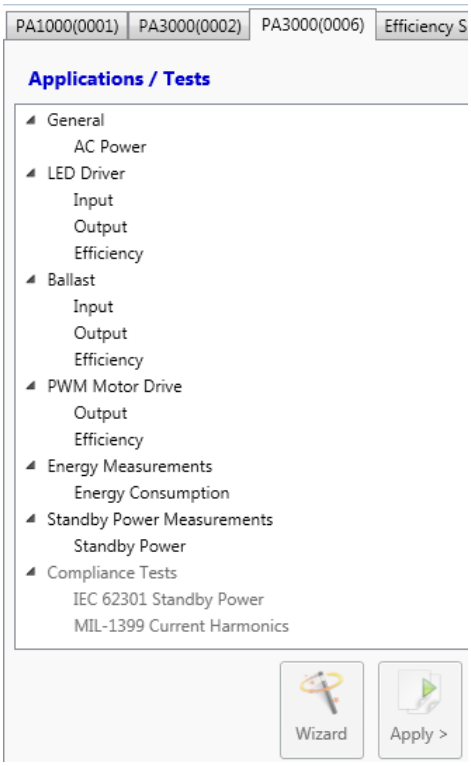
NOTE. *Some items in the list are grayed out depending on the whether the Application Mode is Measure or Test. In the following figure, the Compliance Tests are grayed out because the Application Mode is Measure.*



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.

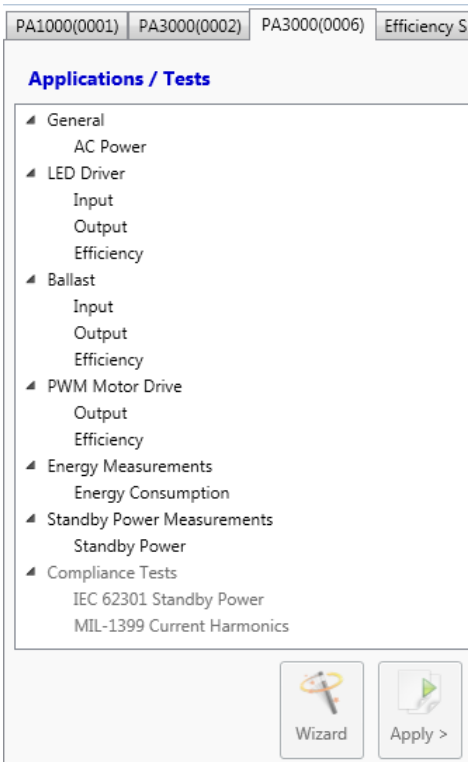


NOTE. *The Apply button does not upload the settings to the power analyzer, it just configures the settings of PWRVIEW. Click either the Upload button or the Start button under the Measure or Test tab to send all the settings to the power analyzer.*

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.



Available wizards (depending on instrument) are:

- LED Driver Input Wizard (see page 24)
- LED Driver Output Wizard (see page 25)
- LED driver efficiency wizard (see page 26)
- Ballast Input (see page 27)
- Ballast Output (see page 28)
- Ballast Efficiency (see page 29)
- Standby Power (see page 33)
- PWM Drive Output (see page 30)
- PWM Drive Efficiency (see page 31)
- Energy Consumption (see page 32)
- Full Compliance Standby (see page 34)

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.

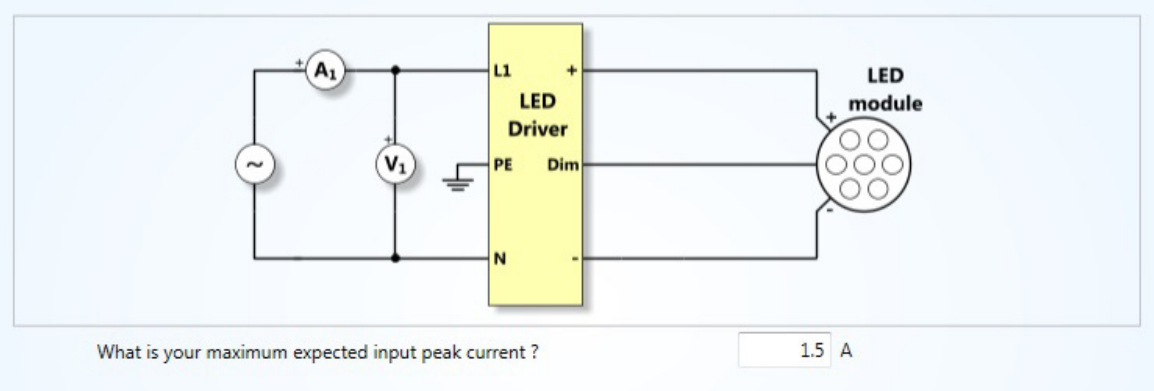
LED Driver

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.

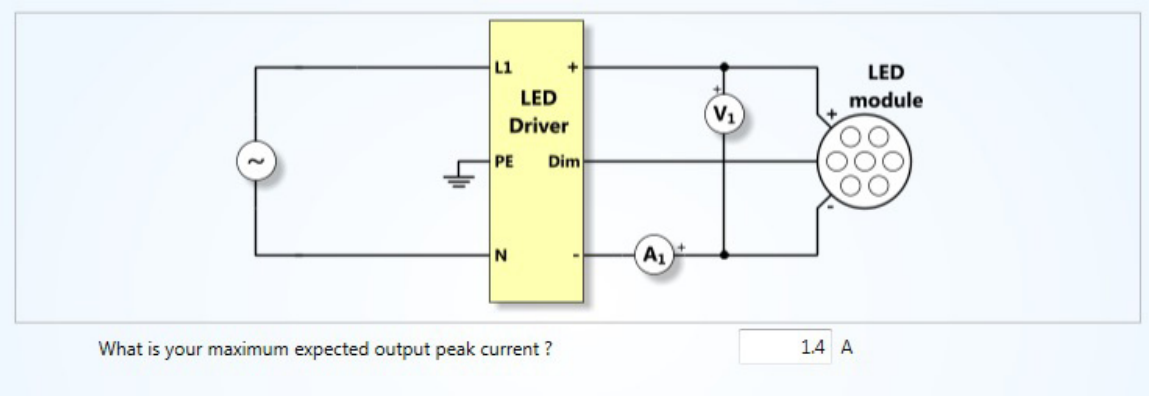
LED Driver Input

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).



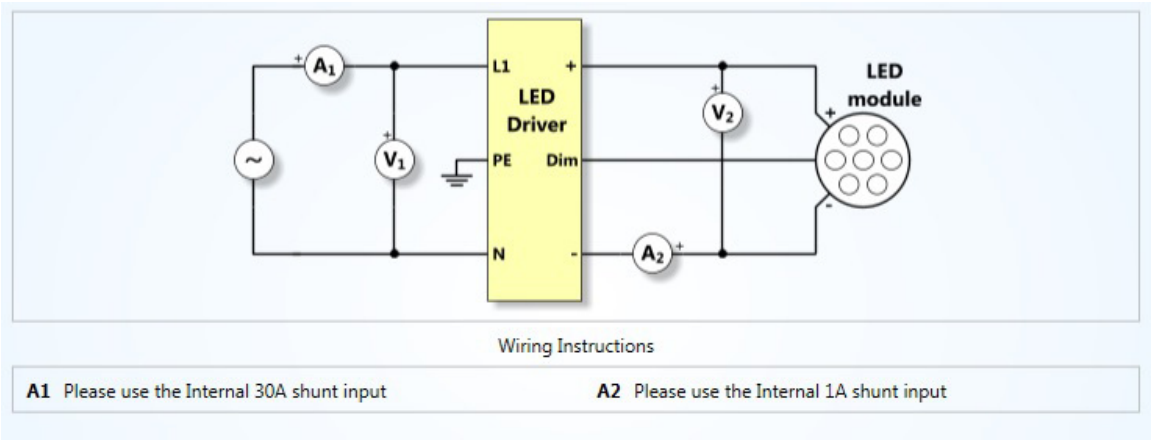
LED Driver Output

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

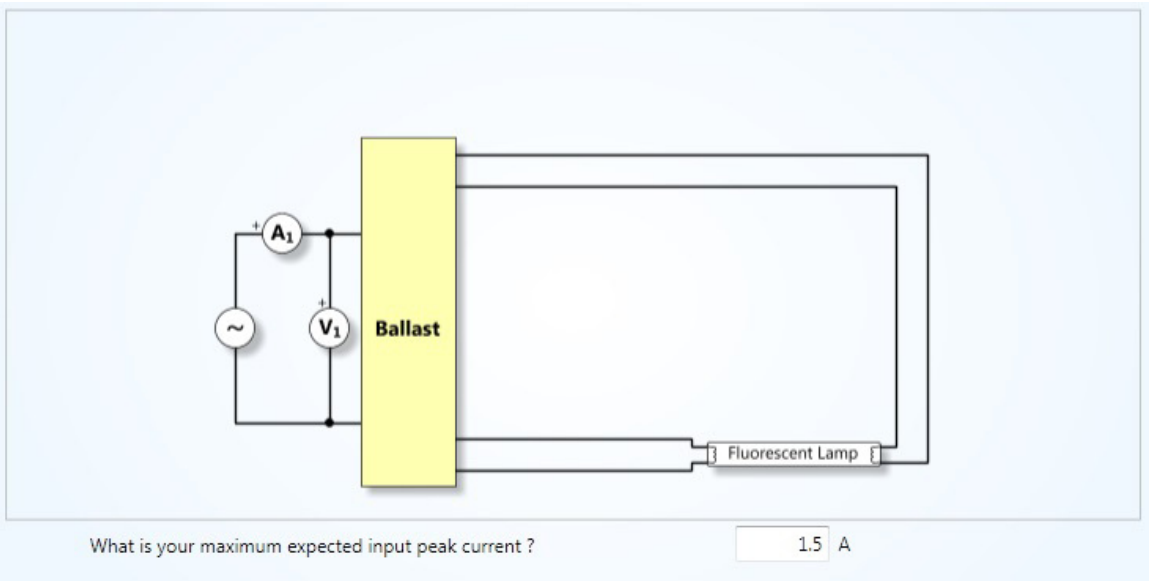
Ballast applications involve measurements of lighting ballast systems. A typical ballast system will take the line input and convert it to high frequency signals that can be heavily amplitude-modulated at line frequencies.

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

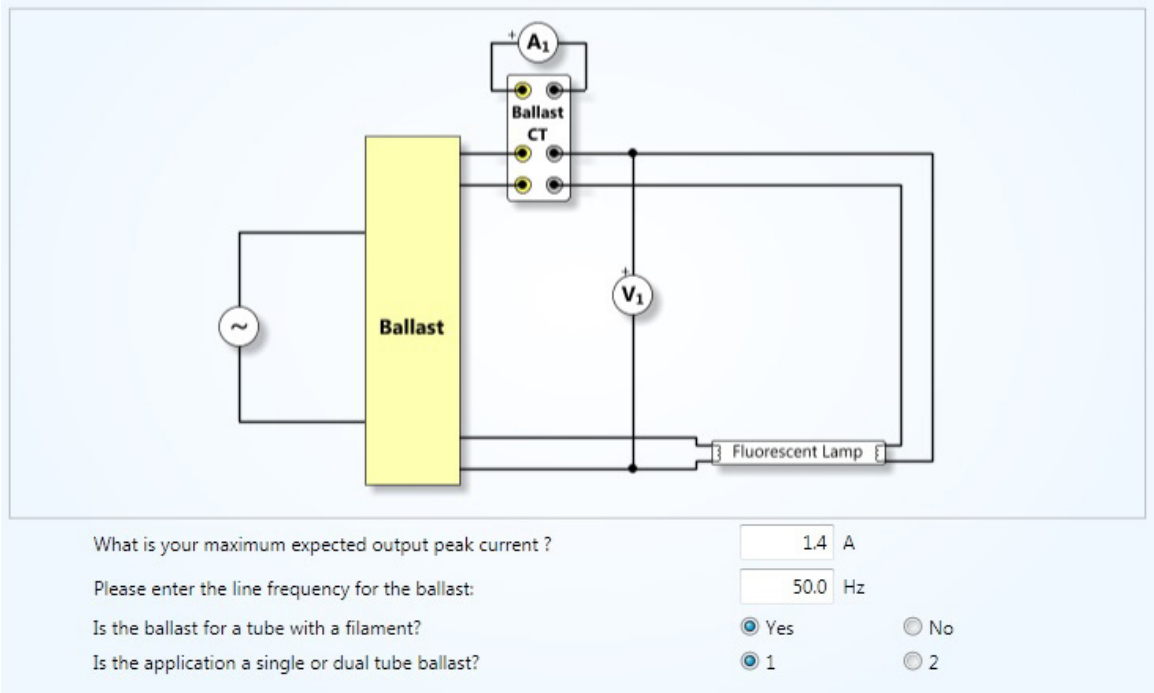
This wizard generates a suitable configuration for measuring the power input of ballast systems.

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 wiring instructions (see page 36).



Ballast Output

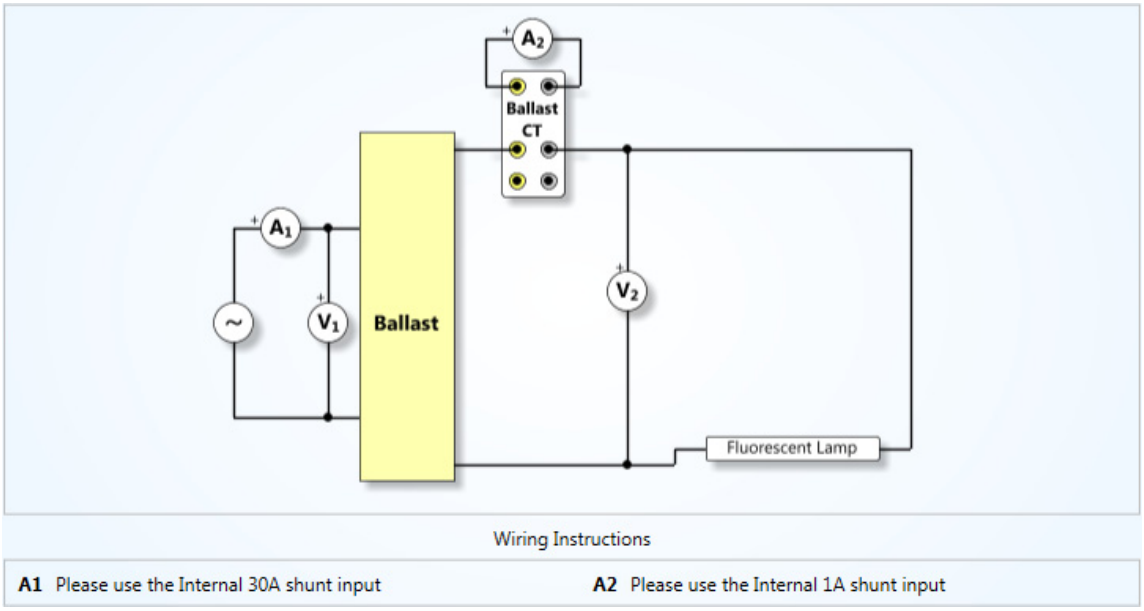
This wizard generates a suitable configuration for measuring the output power of ballast systems. The wizard requests the maximum expected peak current to determine which shunt (1 A or 30 A) should be used. The line frequency is requested and used by the power analyzer to synchronize the measurements 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 ballast input (see page 27) and ballast output (see page 28) wizards before creating the wiring instructions (see page 36) 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 PWM mode (see page 45) 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

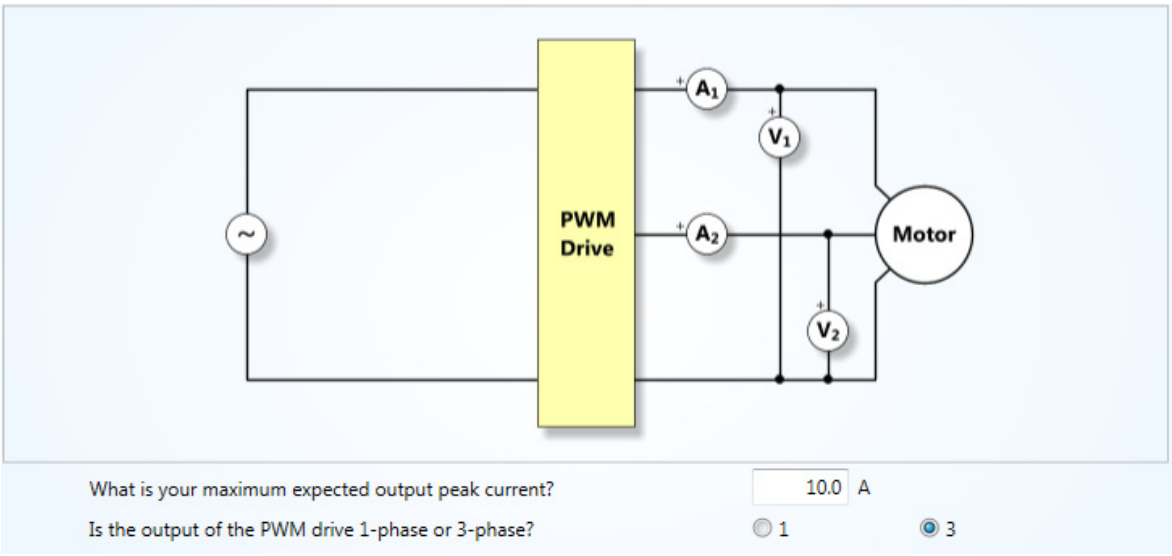
This wizard generates a suitable configuration for measuring the output power of PWM motor drive systems using the two watt meter method.

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 wiring instructions. (see page 36)



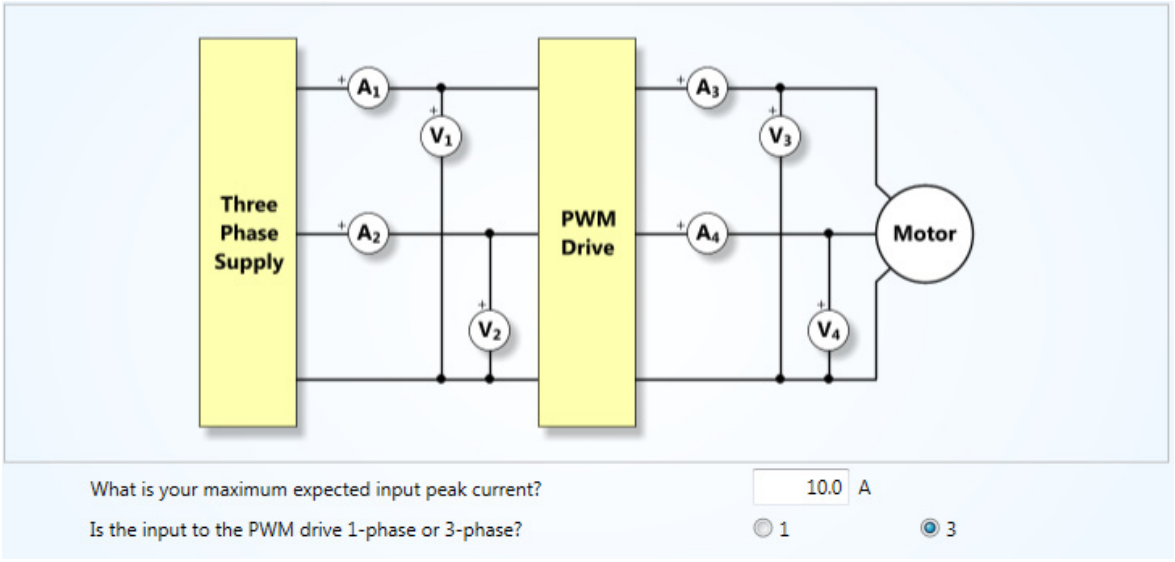
PWM Motor Drive Efficiency

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 wiring instructions. (see page 36)

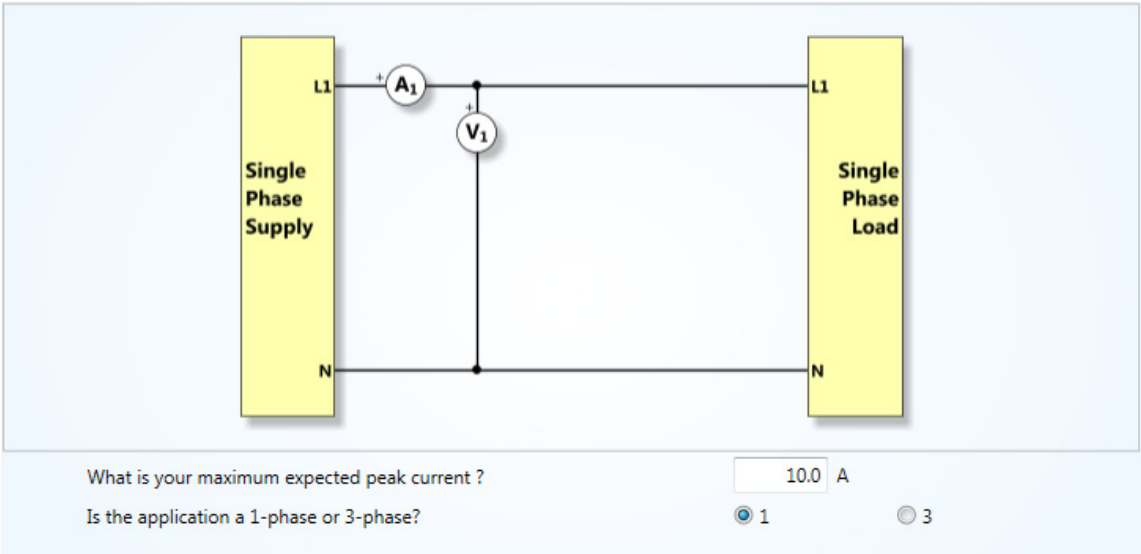


Energy Measurements

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 wiring instructions. (see page 36)

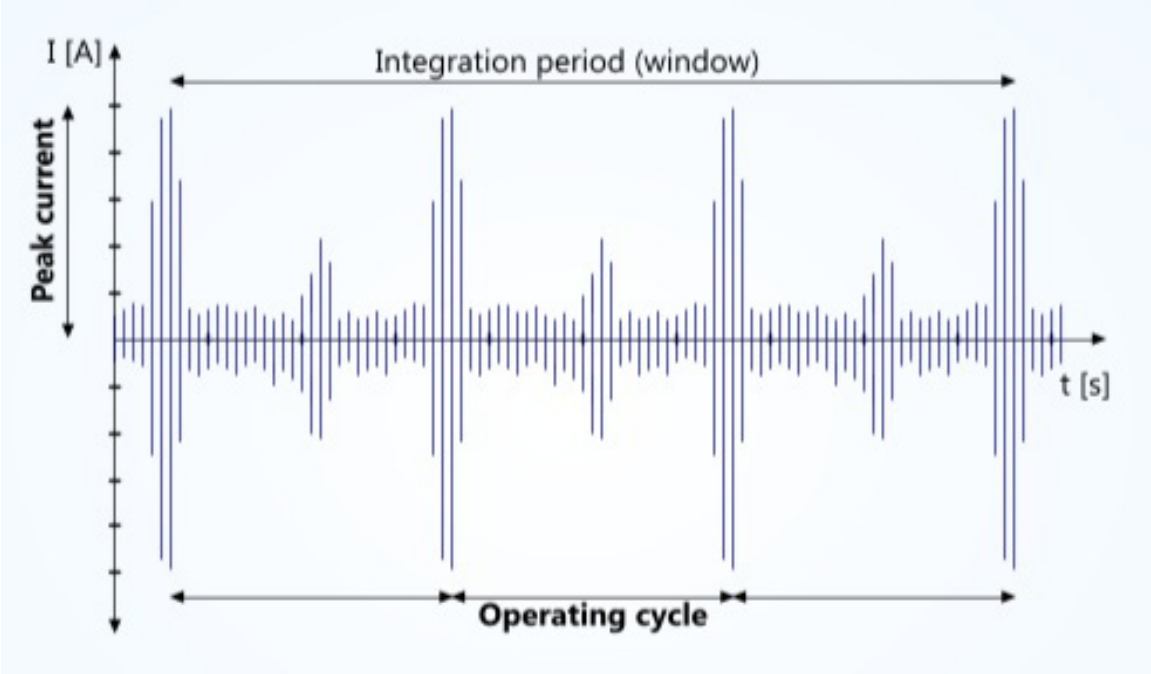
Standby Power Measurements

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.

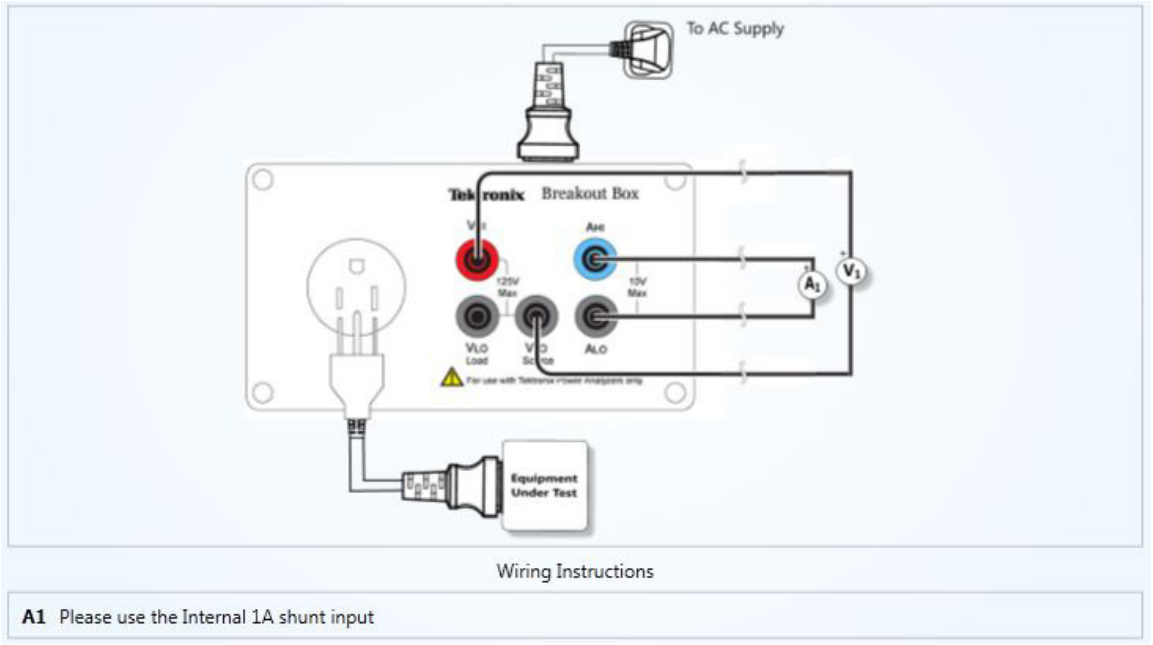
PWRVIEW provides default application modes to measure or test standby power either for quick measurement checks or for full compliance tests to the IEC 62301 standard.

- 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.

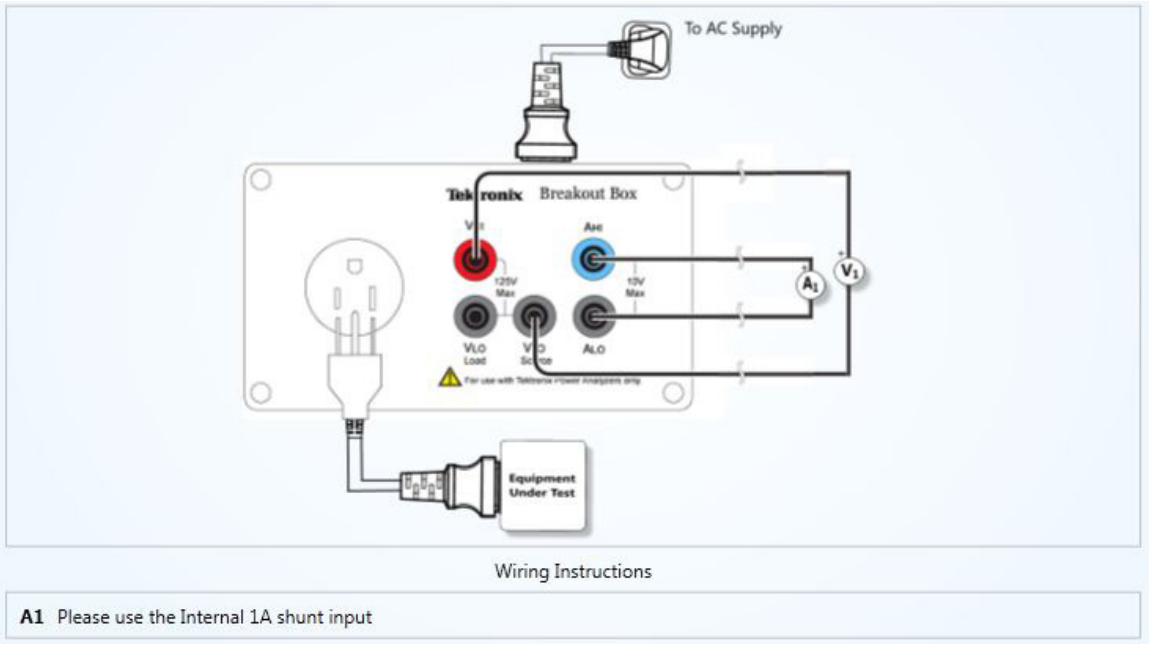
PWRVIEW will only run one test at a time on a single channel on a single instrument.

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 Test (see page 77) tab.



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

MIL-1399 Current Harmonics

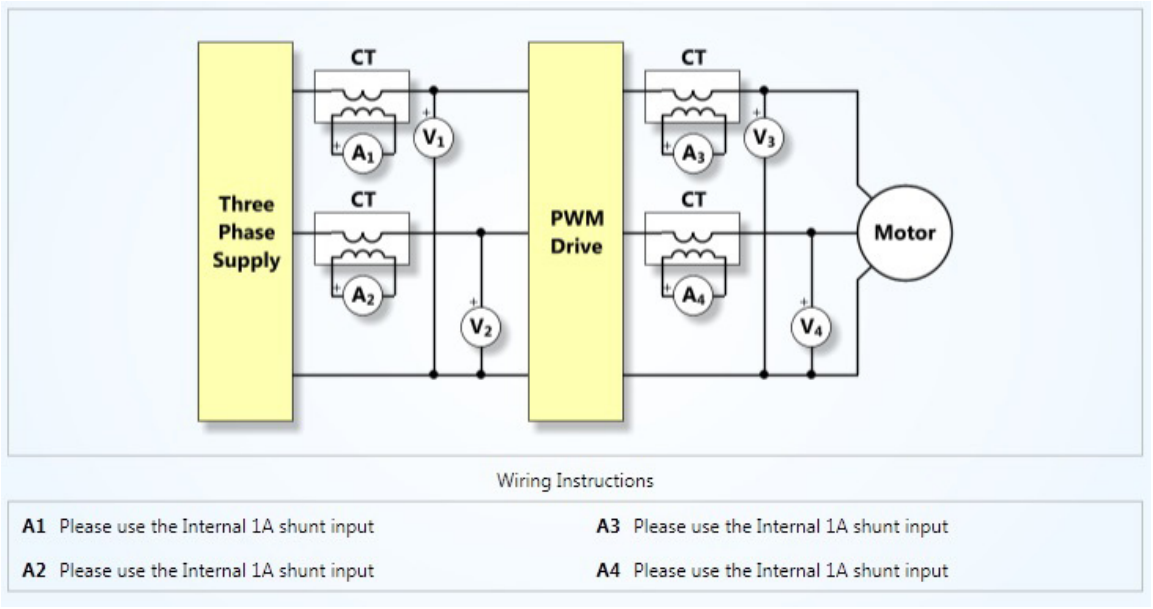
The MIL-1399 Current Harmonics test is available with PA3000 and PA4000 instruments. This test does not have a wizard. Click the Apply button to apply the test.

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.



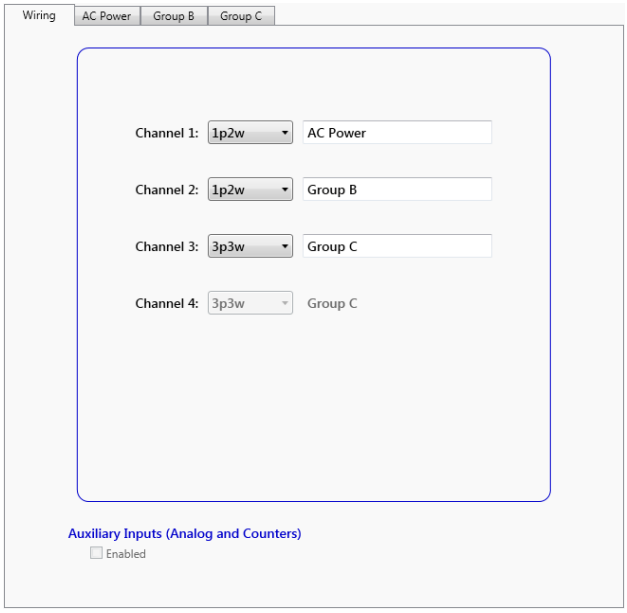
Instrument information panel

The Instrument Information Panel shows the following:

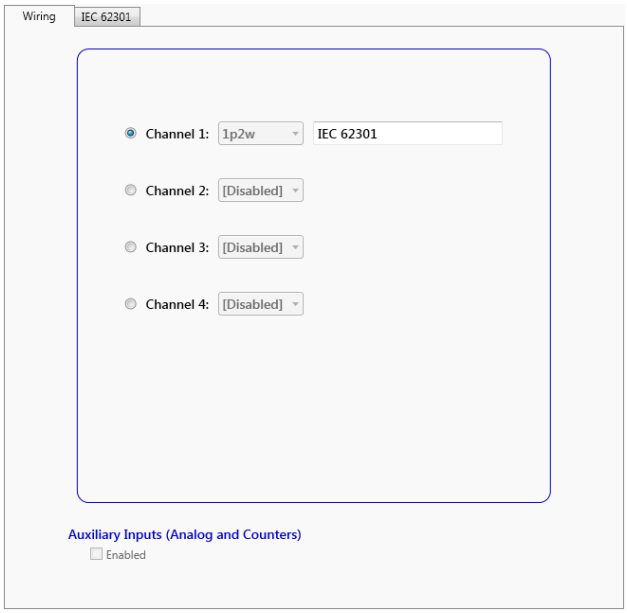
- Instrument type
- Connection details including:
  - Connection type used for communication
  - VISA vendor and version number
- Instrument serial number
- Instrument firmware version

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 wiring type (see page 39) 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.



NOTE. *In Test mode, the wiring type is fixed at 1p2w and cannot be changed. Use the radio button in the front of each channel to select which channel to run the test on.*



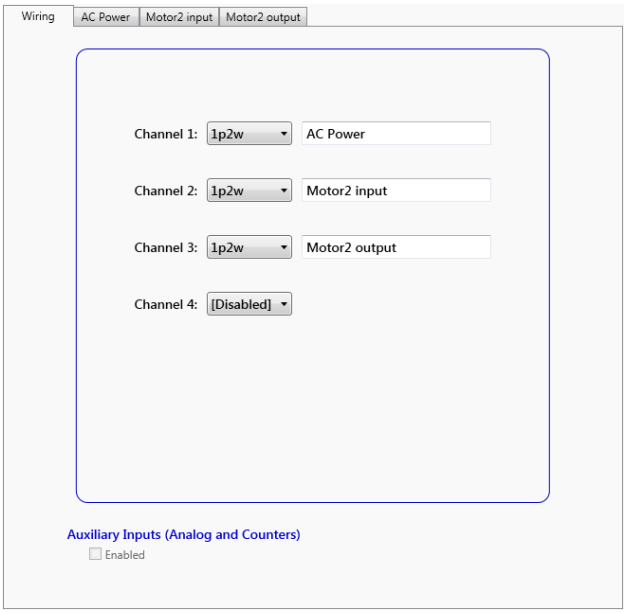
Wiring type

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

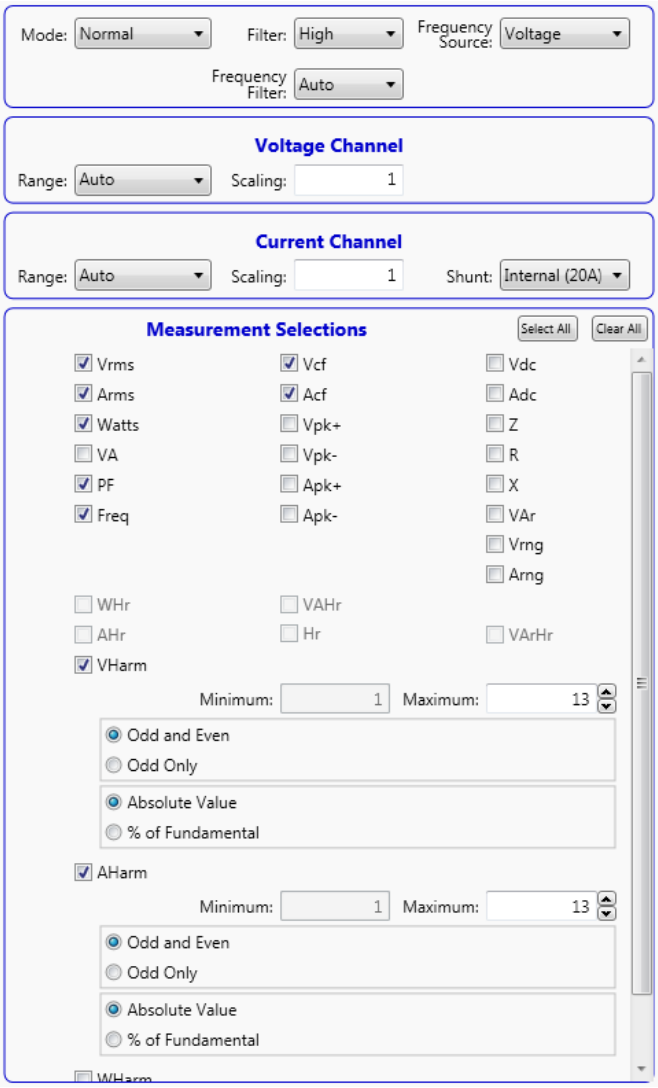
Group names can be edited to allow for simple identification. Use a group a name that describes its purpose.



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

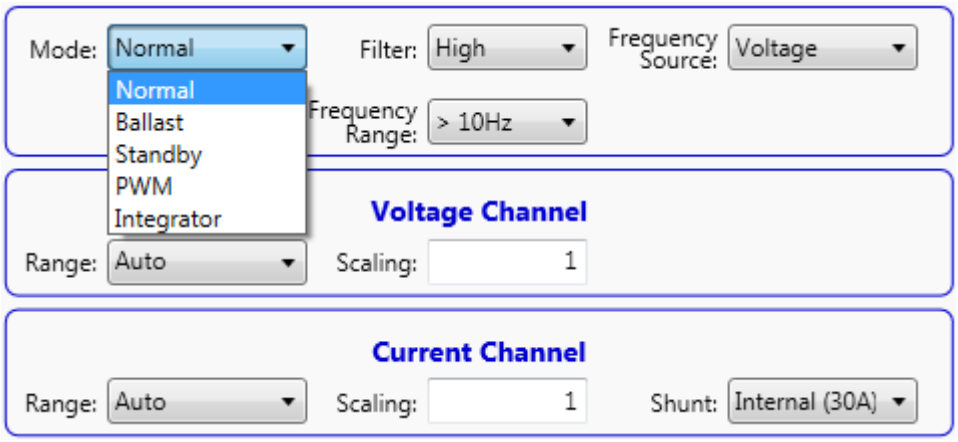
The mode setting configures the instrument to operate in the manner required by certain measurement applications. The available modes differ depending on the type of instrument. On changing the mode the available measurement selections (see page 53) and other setup options can change.

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

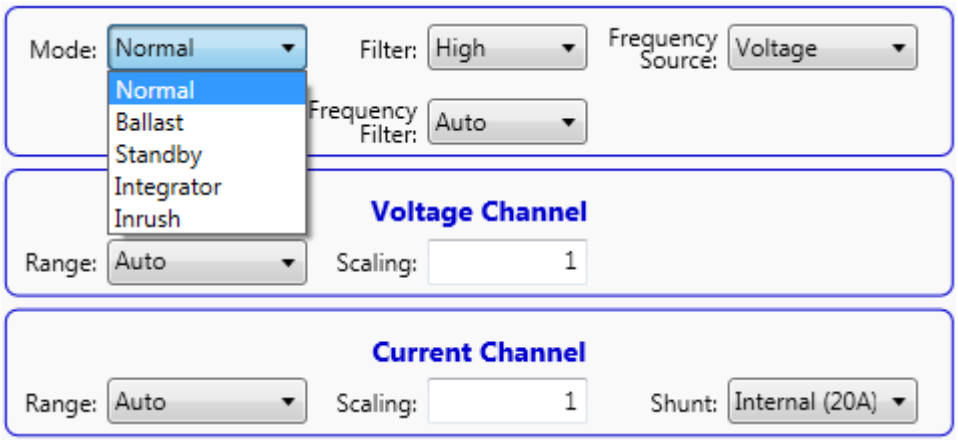
- Normal Mode (see page 42)
- Ballast Mode (see page 43)
- Standby Mode (see page 44)
- PWM Mode [Applicable only for the PA3000] (see page 45)

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

List of modes available in the PA3000 are:



List of modes available in the PA1000 are:



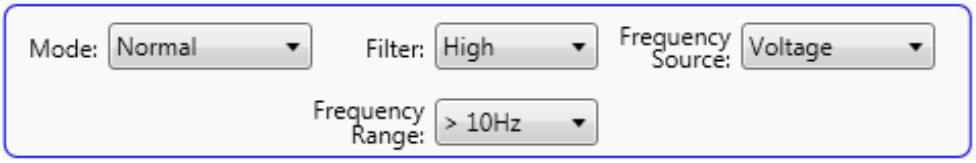
Mode is set to one of the following tests when the Application Mode is set to Test:

- 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

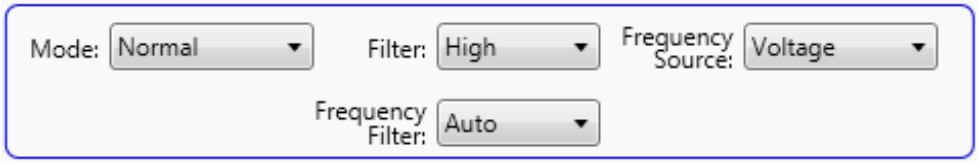
Normal mode

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



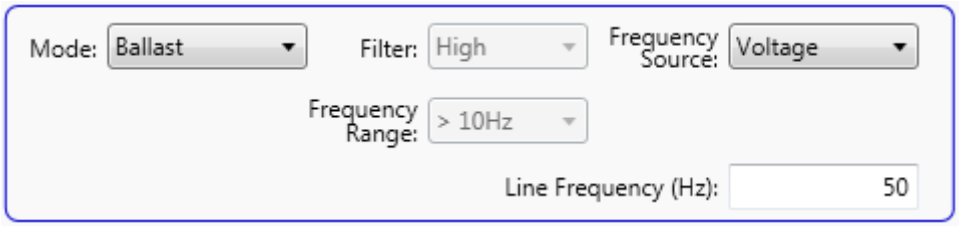
PA1000 Normal mode



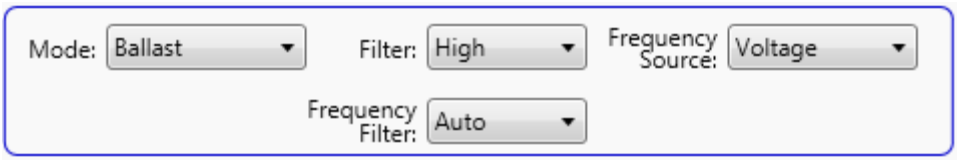
Ballast mode

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



PA1000 Ballast mode

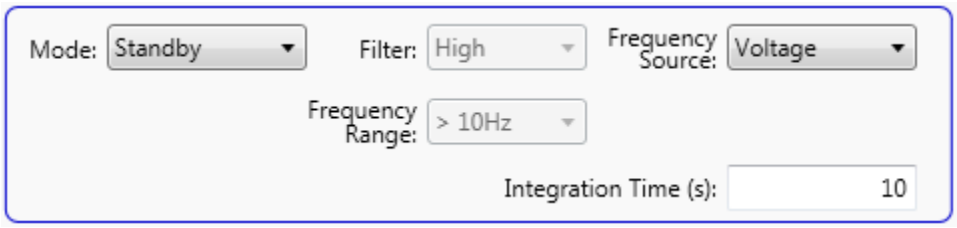


On selecting ballast mode, any filter settings will normally be fixed to high bandwidth (to capture the faster switching frequencies of the ballast) and a prompt for the line frequency will be given.

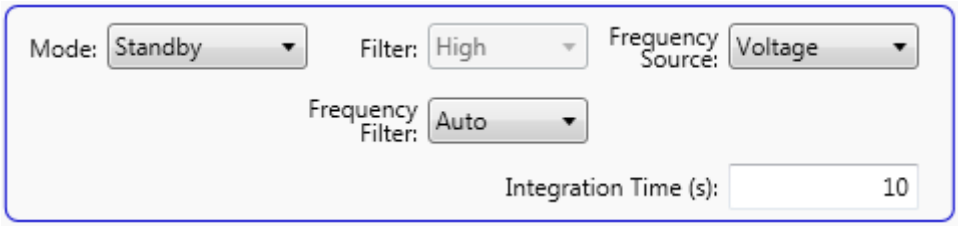
Standby mode

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



PA1000 Standby mode



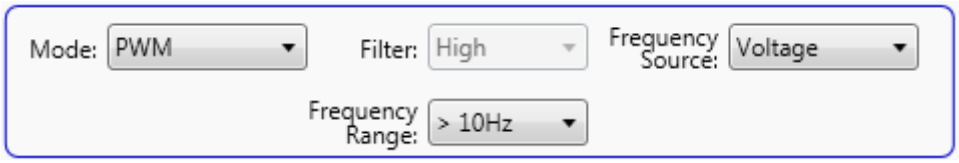
On selecting Standby mode, the filter frequency is locked on High Bandwidth and a time period is requested over which to integrate the measurement. The default value of 10 seconds is recommended for most applications, but if the unit under test draws variable power over a longer cycle time, this integration 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 averaging setting (see page 66).

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.

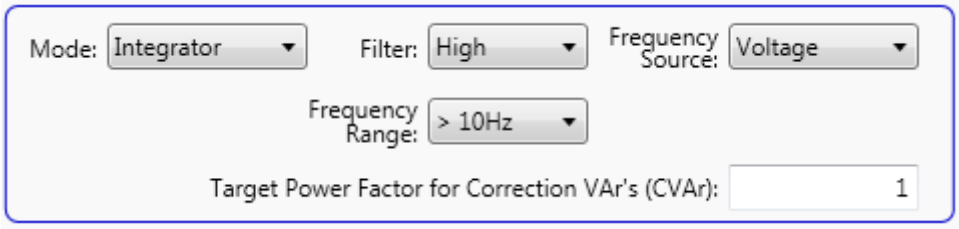
P3000 and PA4000 PWM Mode



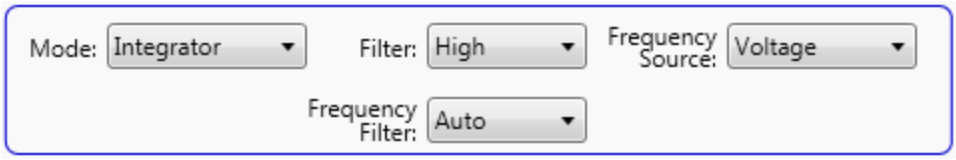
Integrator mode

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 measurement selections (see page 53) and options to start and stop the integrator (see page 67) will be available in the Measurement tab. (see page 63)

PA3000 and PA4000 Integrator mode



PA1000 Integrator mode

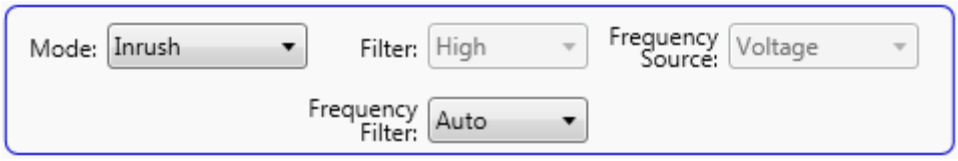


On some instruments a target power factor value can be entered here to compute the value of CVArs.

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 Voltage Channel (see page 51) and Current Channel (see page 51) so that a peak event is not missed. Select the correct range before uploading (see page 20) the configuration. A smaller subset of measurement selections (see page 53) are available in inrush mode with Filter (see page 48) and Frequency Source (see page 49) settings unavailable. Click Reset (see page 65) in the Measurement tab (see page 63) to restart an inrush measurement.

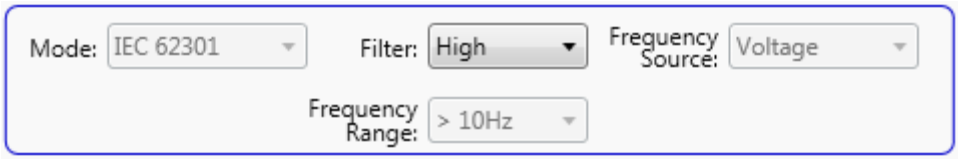
PA1000 Inrush mode



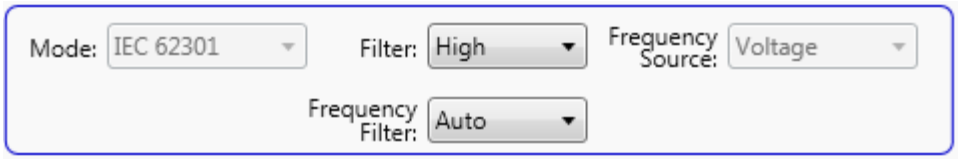
IEC 62301 mode

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 IEC 62301 (see page 82) test will become available under the Test (see page 77) tab, the minimum measurement parameters will be fixed and the auto-up only current ranging (see page 51) 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



PA1000 IEC 62301 mode

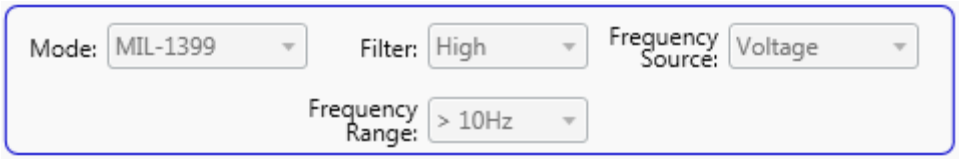


MIL-1399 mode

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

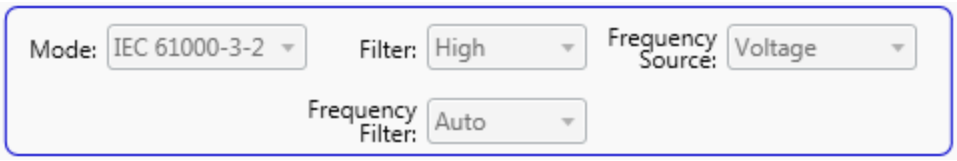


IEC 61000-3-2 mode

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 IEC 61000-3-2 Current Harmonics (Pre-compliance) (see page 91) test will become available under the Test (see page 77) 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.

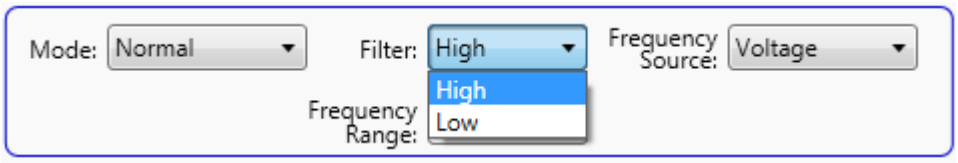
PA1000 IEC 61000-3-2 mode



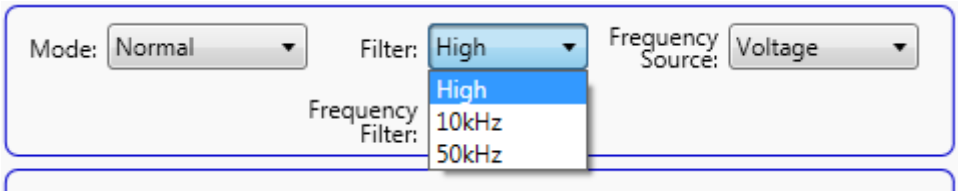
Filter

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.



The PA1000 has the following filter selections.

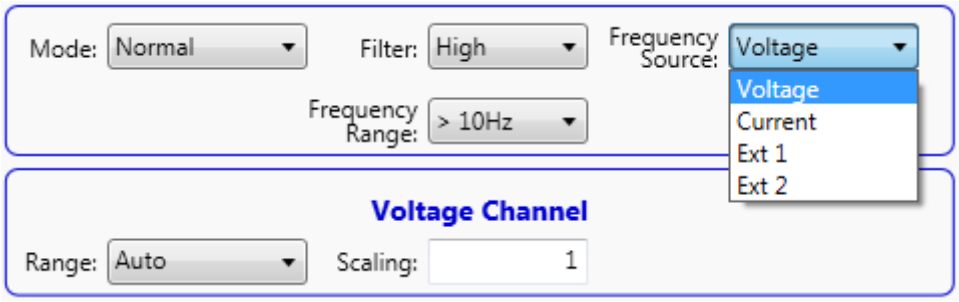


Frequency source

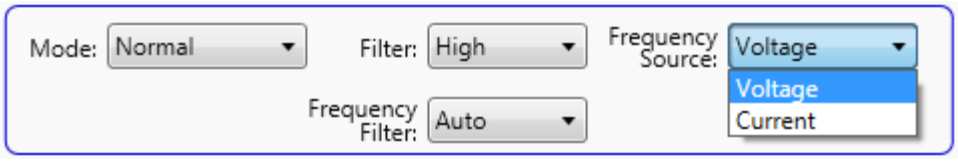
To accurately measure most measurement parameters the frequency of the signals must be determined. The frequency source selects the method by which this frequency is measured. The mode (see page 41) selection affects the frequency detection operation, but generally either the voltage or the current channel 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.



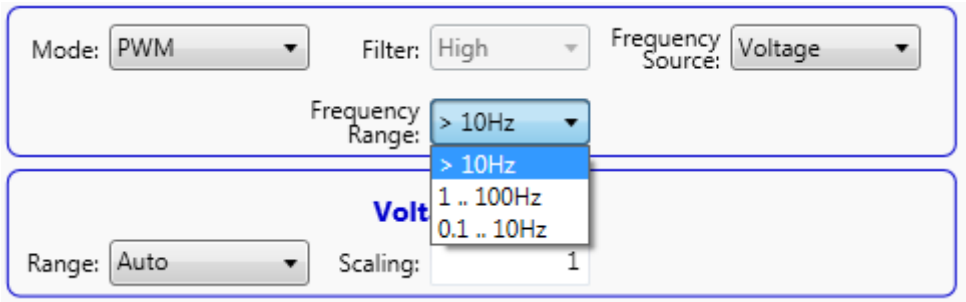
The PA1000 has the following frequency source selections.



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.



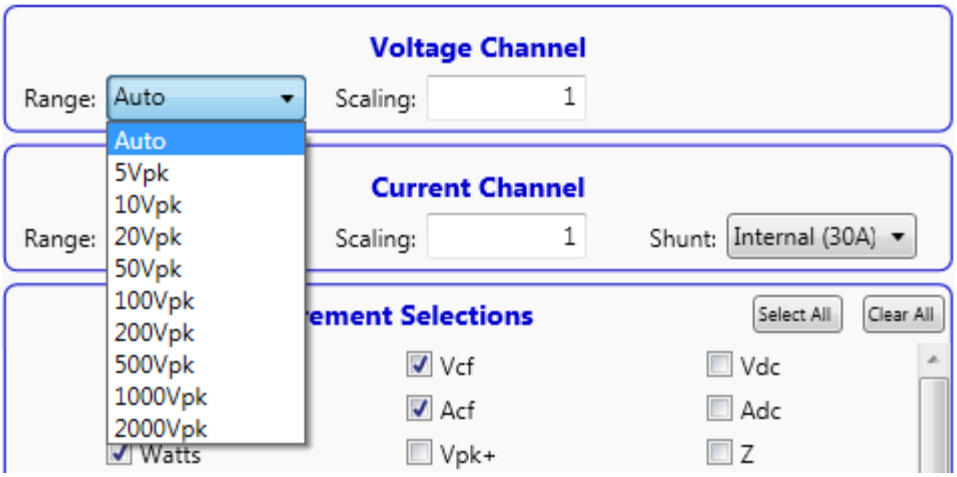
The frequency range is only available for the PA3000 and PA4000.

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:



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

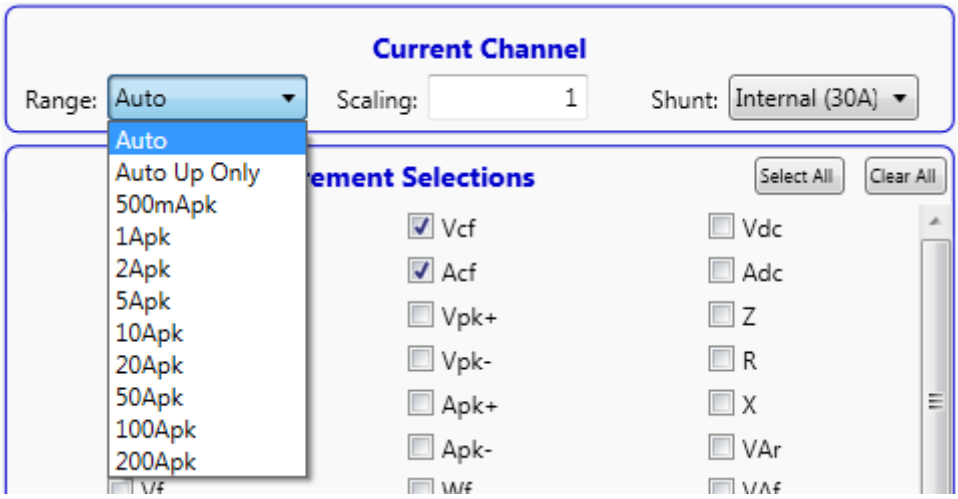
   The Scaling value entered is multiplied by the applied voltage to give the correct scaled voltage value.

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.

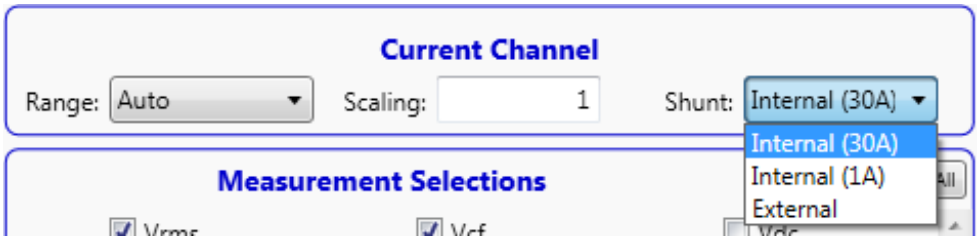
   For example, if the PA3000 is connected, the following ranges are applicable:



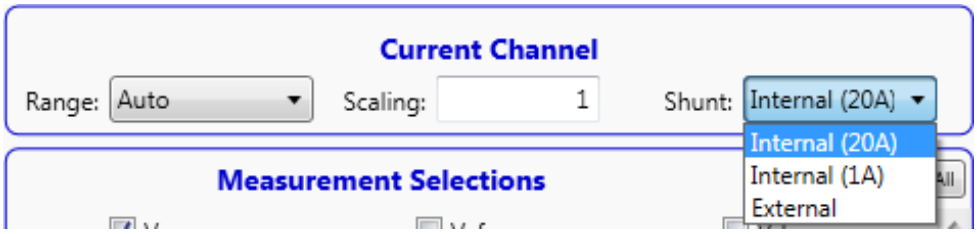
2. Use Scaling to provide a method to adjust the measured value where current transformer, current clamps, or specific custom shunts are being used. The value entered as Scaling is multiplied by the applied current to give the correct scaled current value.

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.



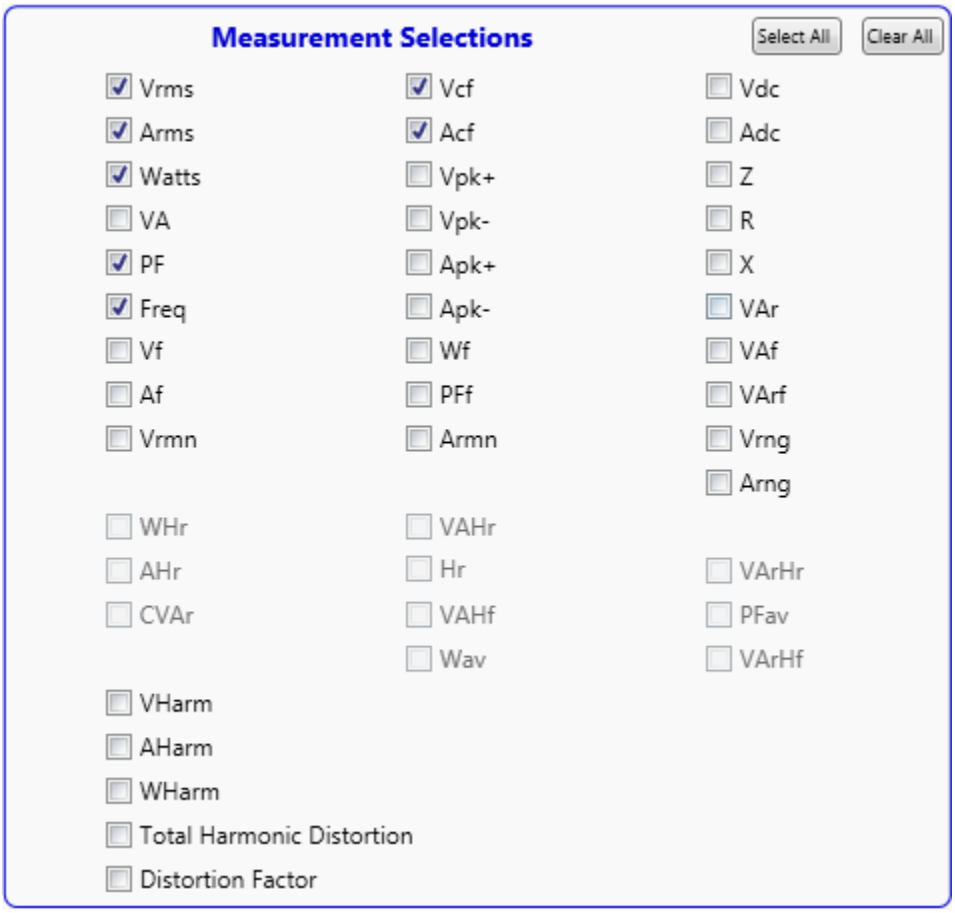
   The PA1000 has the following shunt selections.



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.



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:

- 1P3W Sum formulas (see page 54)
- 3P3W Sum formulas (see page 56)
- 3P4W Sum formulas (see page 57)

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:

$$\sum V = ch1V + ch2V$$

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

$$\sum W = ch1W + ch2W$$

$$\sum W.fund = ch1W.fund + ch2W.fund$$

$$^{*}\sum VAr = \sqrt{\sum VAr.fund^{2} + \left(ch1VAr.h + ch2VAr.h\right)^{2}}$$

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

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

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

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

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

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

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

3P3W Sum formulas

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

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

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

$$\sum W = ch1W + ch2W$$

$$\sum W.fund = ch1W.fund + ch2W.fund$$

$$\sum VAr = \sqrt{\sum VAr.fund^2 + \left(\sqrt{\frac{3}{2}} \times (ch1VAr.h + ch2VAr.h)^2\right)}$$

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

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

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

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

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

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

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

3P4W Sum formulas

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

$$\sum V = \frac{ch1V + ch2V + ch3V}{\sqrt{3}}$$

$$\sum V.fund = \frac{ch1V.fund + ch2V.fund + ch3V.fund}{\sqrt{3}}$$

$$\sum W = ch1W + ch2W + ch3W$$

$$\sum W.fund = ch1W.fund + ch2W.fund + ch3W.fund$$

$$^{*}\sum VAr = \sqrt{\sum VAr.fund^{2} + \left(ch1VAr.h + ch2VAr.h + ch3VAr.h\right)^{2}}$$

$$\sum VAr.fund = ch1VAr.fund + ch2VAr.fund + ch3VAr.fund$$

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

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

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

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

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

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

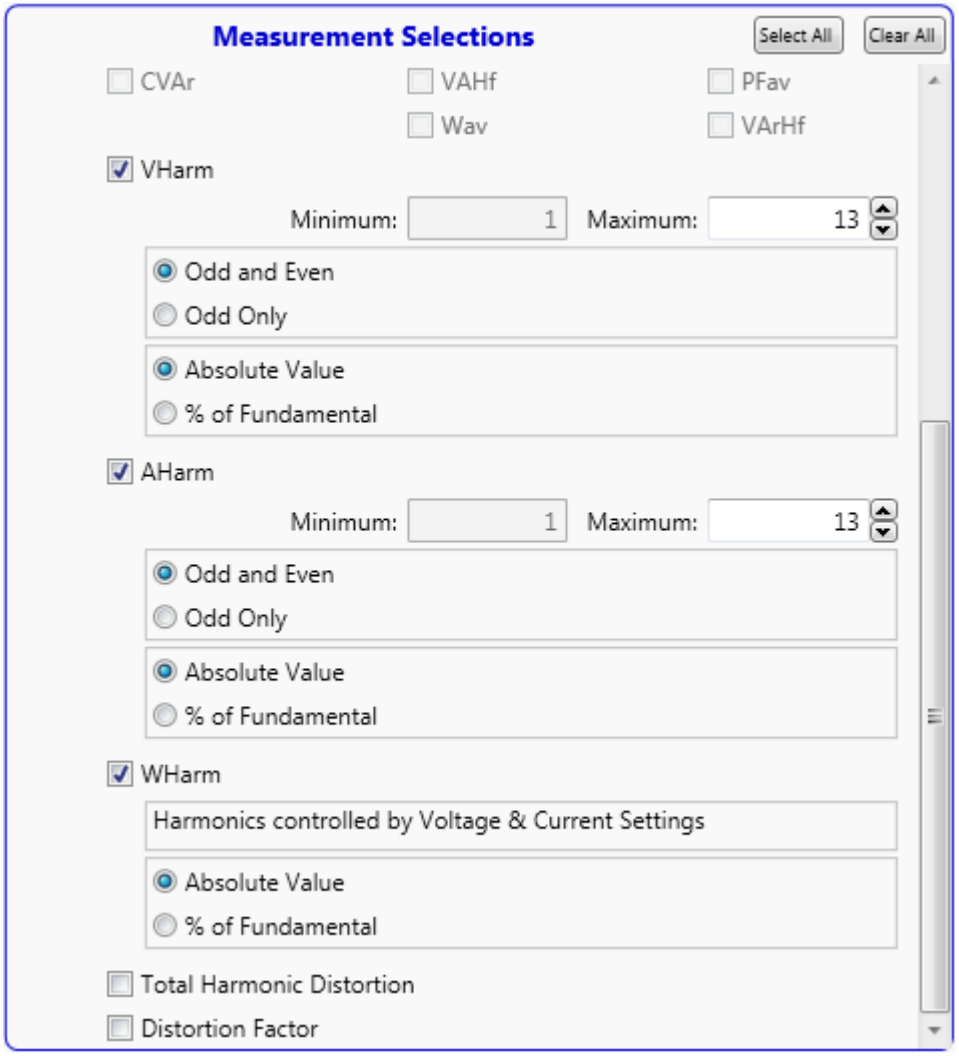
$$^{*}VAr.h = \sqrt{VAr^{2} + VAr.fund^{2}}$$

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).

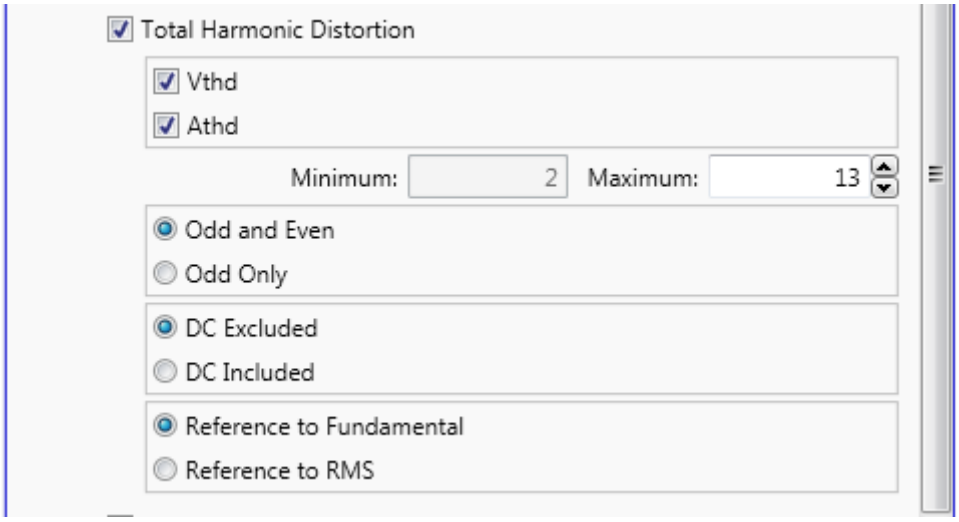


Total harmonic distortion

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.



The selection of harmonics used in the THD measurement is independent of Volts Harmonics and Amp Harmonics (see page 58) 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:

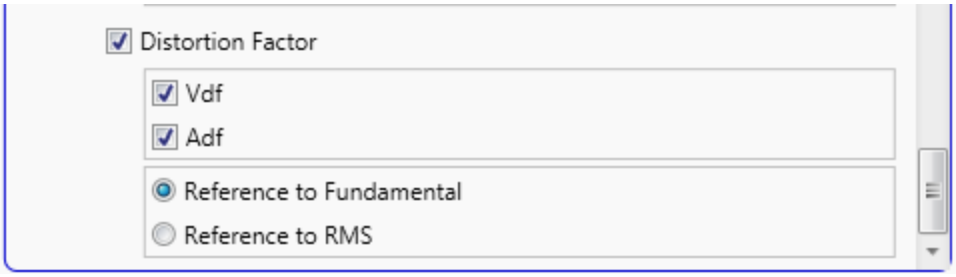
$$Vthd = \frac{1}{V_{ref}} \sqrt{\sum_{\min harm}^{\max harm} (Vh_n)^2} \times 100\%$$

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

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.



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 ±10 V and ±1 V.

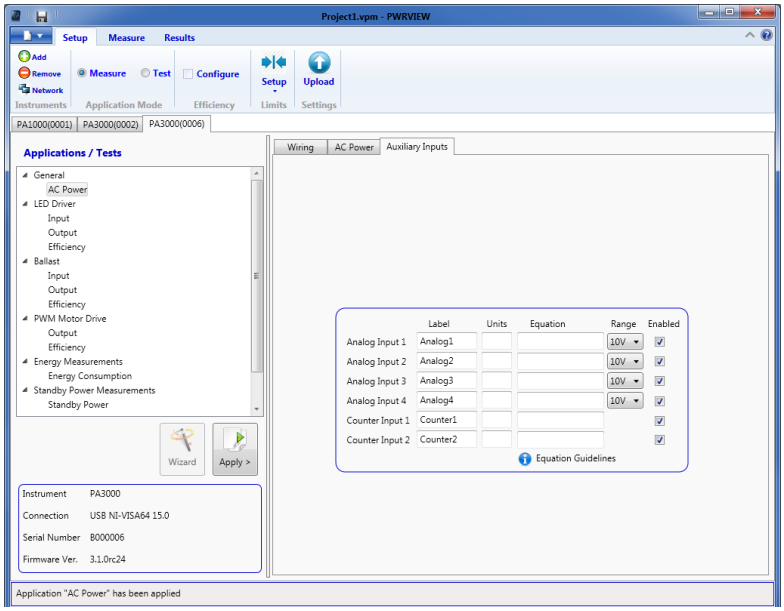
The PA3000 and PA4000 also have two counter inputs on the Auxiliary Inputs connector on the rear of the instrument. Either of these can be used as an external frequency source for signals where there is too much noise or speed sensors. Each of the two counter inputs accepts TTL-compatible square wave 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.



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.

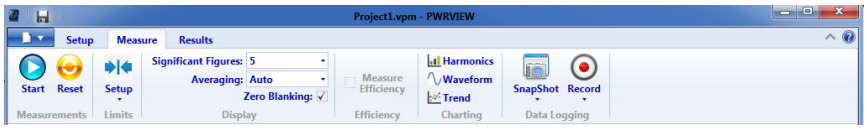
- Equations can be a scaling number, expression, or empty.
- Scaling numbers can be either integers or simple floating point values.
- Expressions must contain the base name for the specific input source. Expressions can also contain arithmetic operators and numbers. Parenthesis are also supported.
- 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:

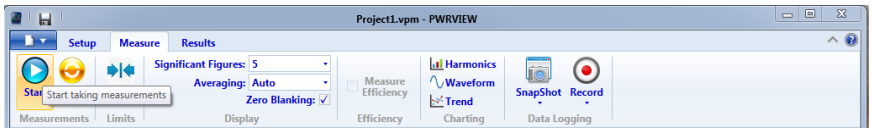
- Start (see page 63) the measurements
- Stop (see page 64) the measurements
- Reset (see page 65) averaging and Min and Max values
- Setup Limits (see page 18) for different limit categories
- Set the Significant Figures (see page 65) or number format shown in the results grid (see page 71)
- Set the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

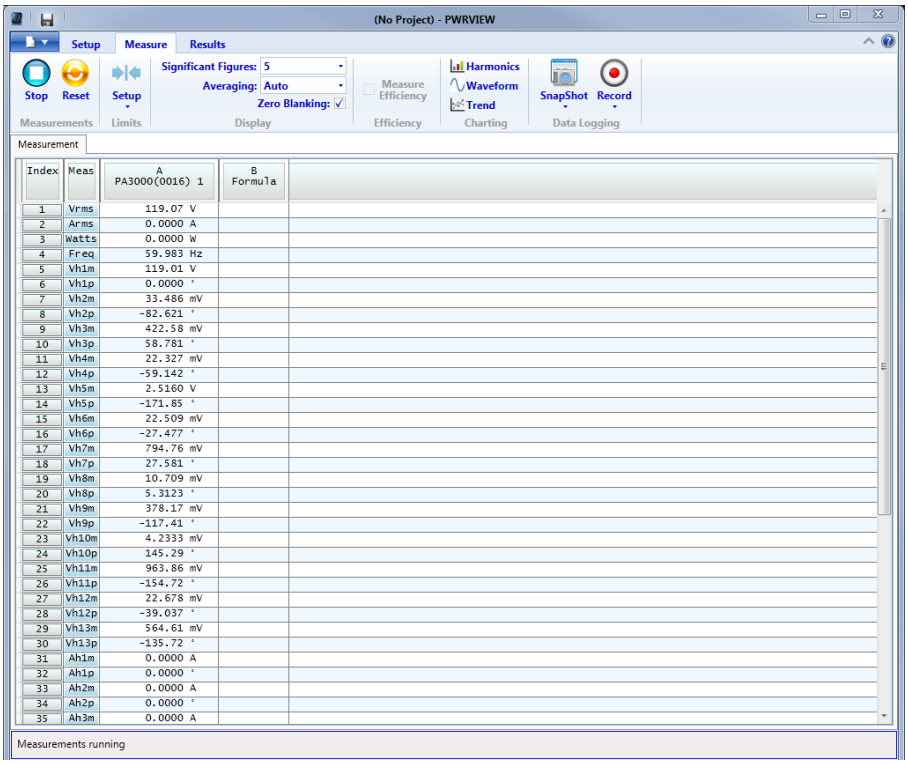
Ribbon options available on the Measure tab:



Start

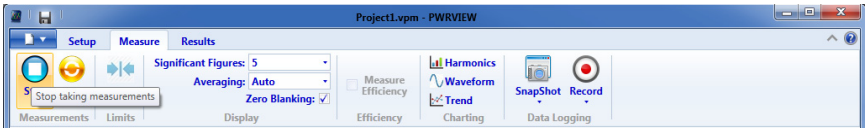
The Start button starts the measurement process to list the results into the results grid as shown below:





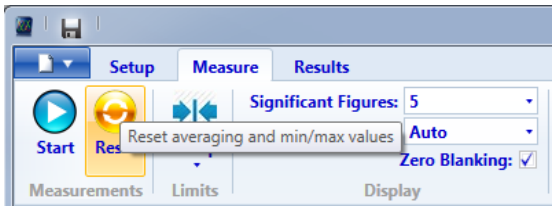
Stop

The Stop button stops the current measurement cycle.



Reset

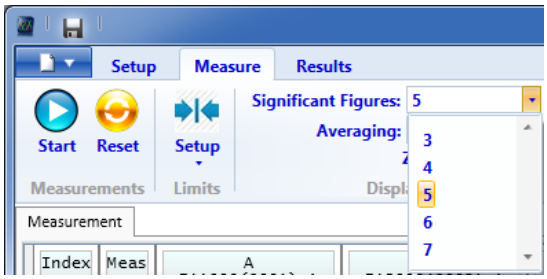
Use the Reset button to reset the averaging (see page 66), all Min and Max results, and inrush measurements when in inrush mode (see page 46). This is useful to find new Min and Max values and to start averaging the results again. Large averaging values can take a long time to show changes.



Significant figures

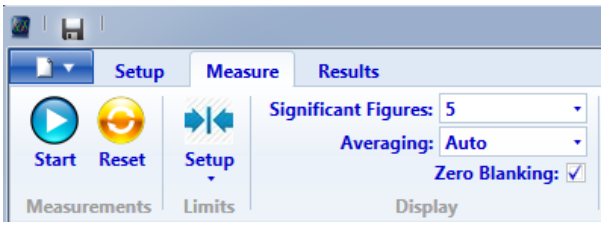
The significant figures affect the results and determine the number of digits displayed.

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



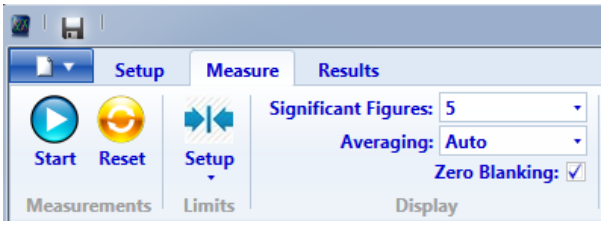
Averaging

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 Reset (see page 65) button to restart the averaging process.



Zero Blanking

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



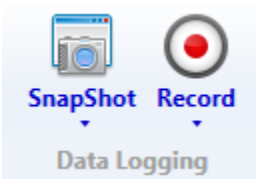
Integration

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)

or

Data logging

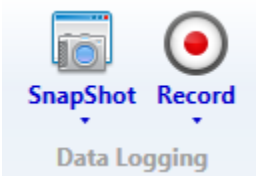
Data logging allows recording and exporting measurement results.



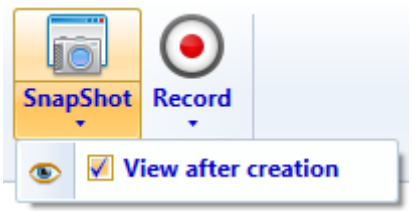
- Snapshot (see page 67) takes the results as shown in the results grid (see page 71) and saves them to a file.
- Record (see page 68) saves all measurement results continuously to a database system for later exporting and analysis.

Snapshot

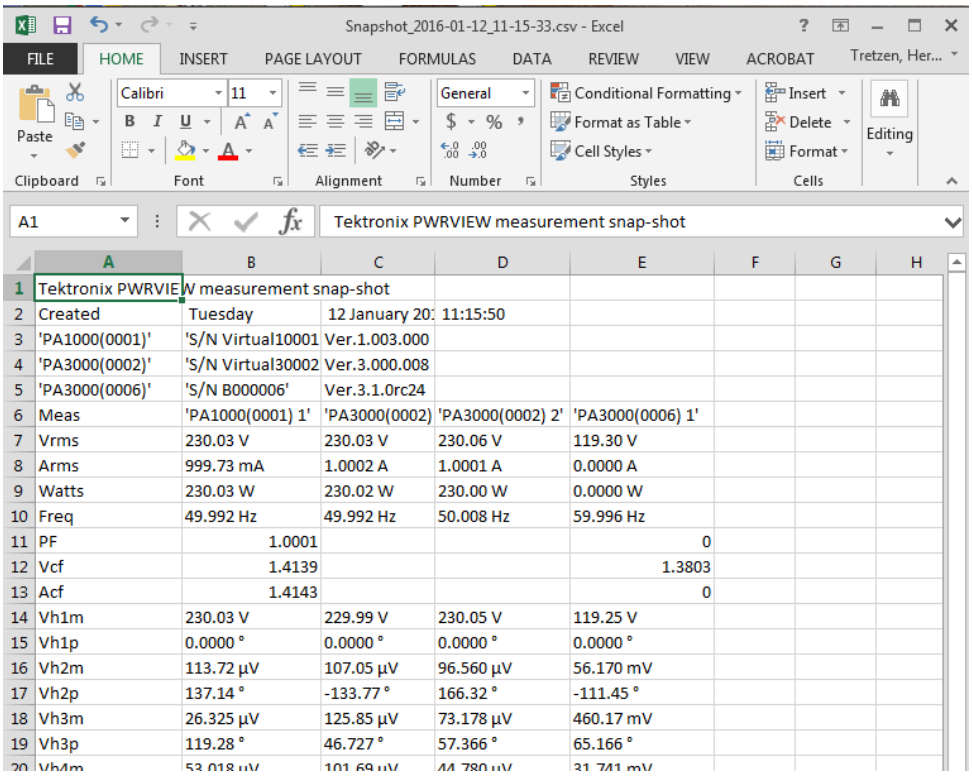
Snapshot saves a copy of the results grid in CSV format for reading into spread sheet applications.



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



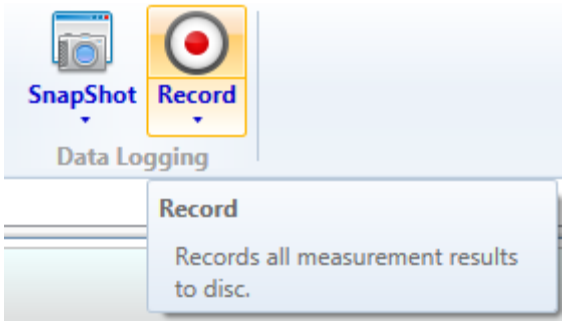
Upon clicking Snapshot all listed results are exported to the CSV format. A Save As dialog box prompts you for a location and file name for saving the file. When View after creation is checked, the file will be automatically opened for viewing.



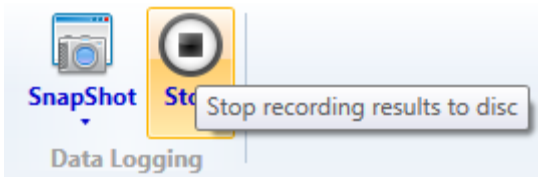
	A	B	C	D	E	F	G	H
1	Tektronix PWRVIEW measurement snap-shot							
2	Created	Tuesday	12 January 201	11:15:50				
3	'PA1000(0001)'	'S/N Virtual10001	Ver.1.003.000					
4	'PA3000(0002)'	'S/N Virtual30002	Ver.3.000.008					
5	'PA3000(0006)'	'S/N B000006'	Ver.3.1.0rc24					
6	Meas	'PA1000(0001) 1'	'PA3000(0002)	'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	0.0000 A			
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	Vh4m	53.018 µV	101.69 µV	44.780 µV	31.741 mV			

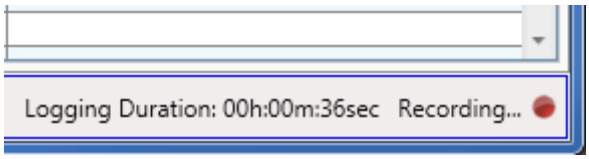
Record

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



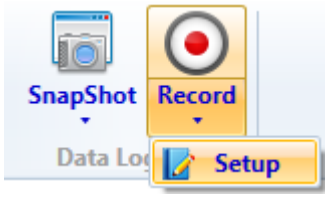
The Status Bar indicates that results are being recorded and the Record button will change to Stop.



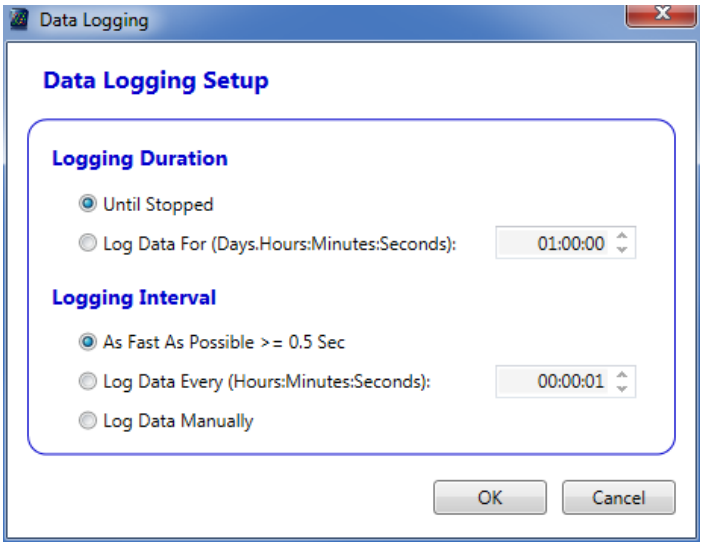


The minimal amount of data to represent all measurement results is stored to the database to save space - not the results shown on the results grid. This means that results that can be computed from the other results are not stored in the database.

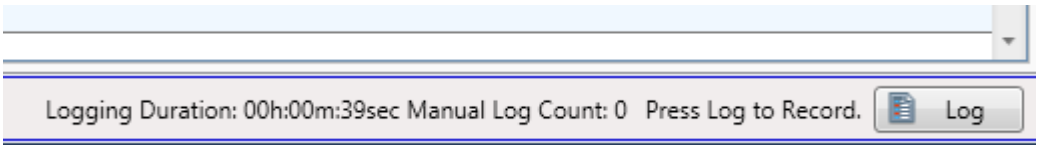
Click the down arrow for more record options such as data logging setup.



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.



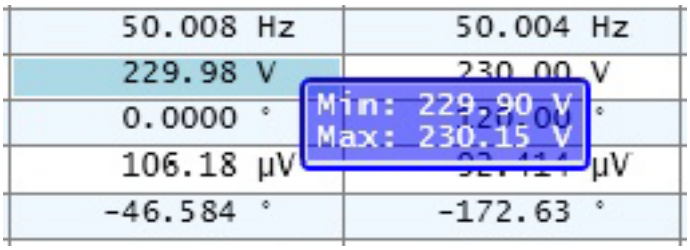
Measurement results and charts

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.

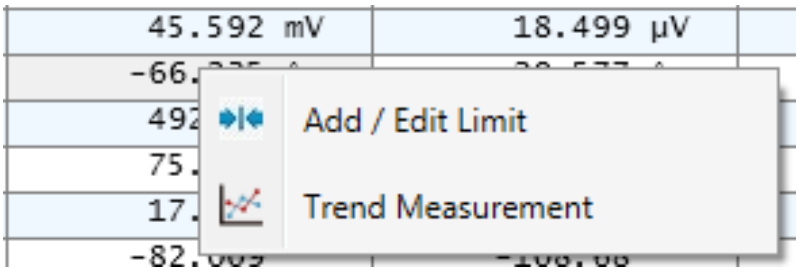
Results grid

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 Reset (see page 65) button to reset these values to the present reading and begin accumulating the Min and Max values again.

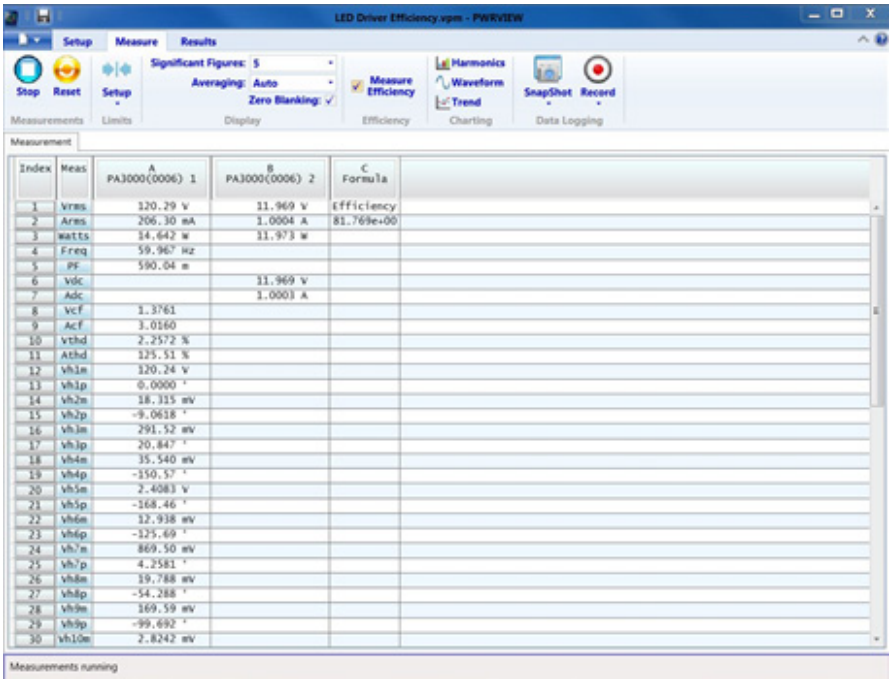


Right-click the mouse within the results column to open a dialog box with options for handling the data such as adding or editing limits or adding a Trend measurement.



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.



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.

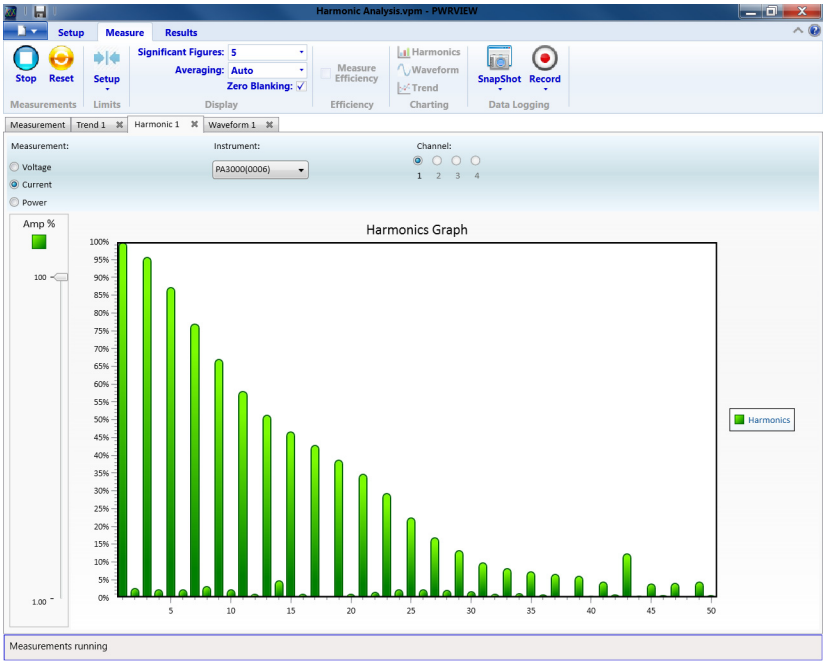
When selecting Harmonics, Waveform, or Trend from Charting a new tab appears. Click them to create one of the available charts. Multiple charts of each type can be created for Harmonics, Waveform, and Trend charts. The total number of charts that can be created is three times the number of instrument

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.*



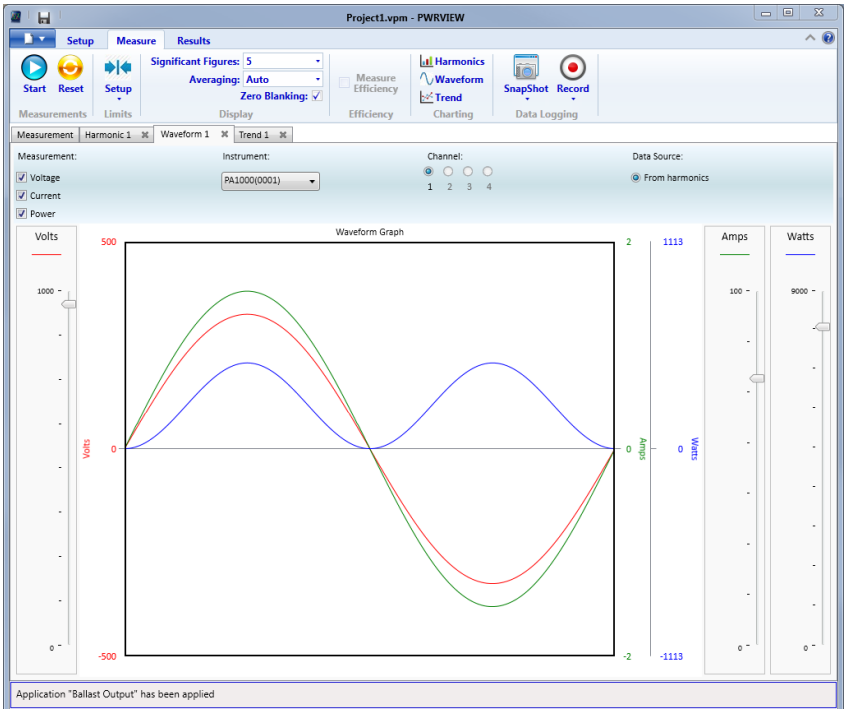
Waveform charts

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.

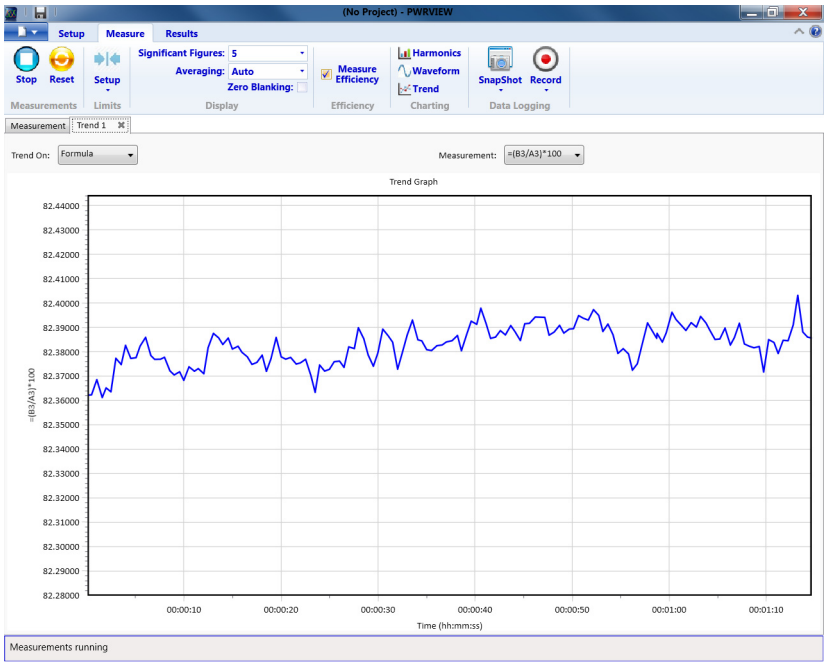


Trend charts

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.

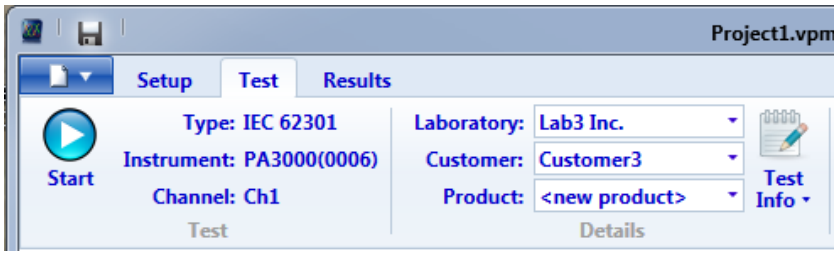


Test tab

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:

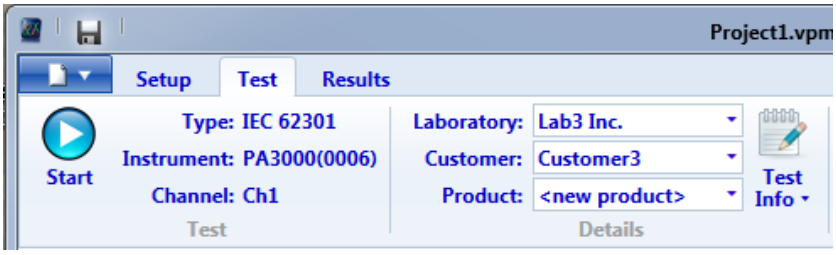
IEC 62301 Standby Power. This test is designed to test according to IEC 62301 Measurement of Standby Power. It uses the Sampling method as defined in this standard. The IEC 62301 Standby Power test is available for the PA3000, PA4000, and PA1000 instruments.

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 Setup (see page 13) 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

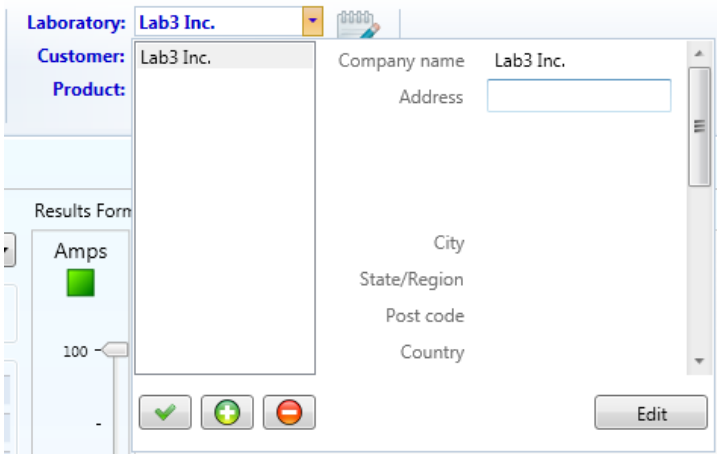
Test details

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

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

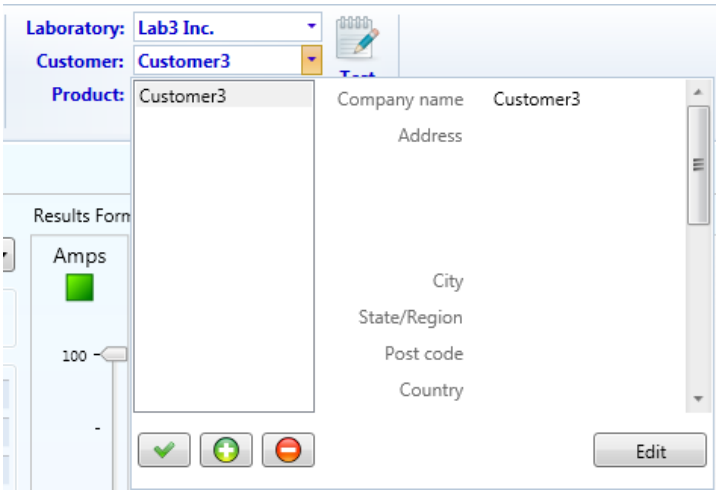
Laboratory

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.



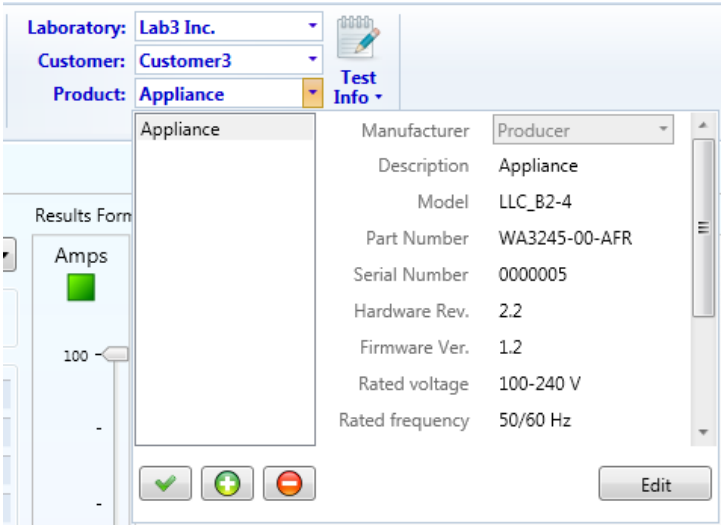
Customer

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.



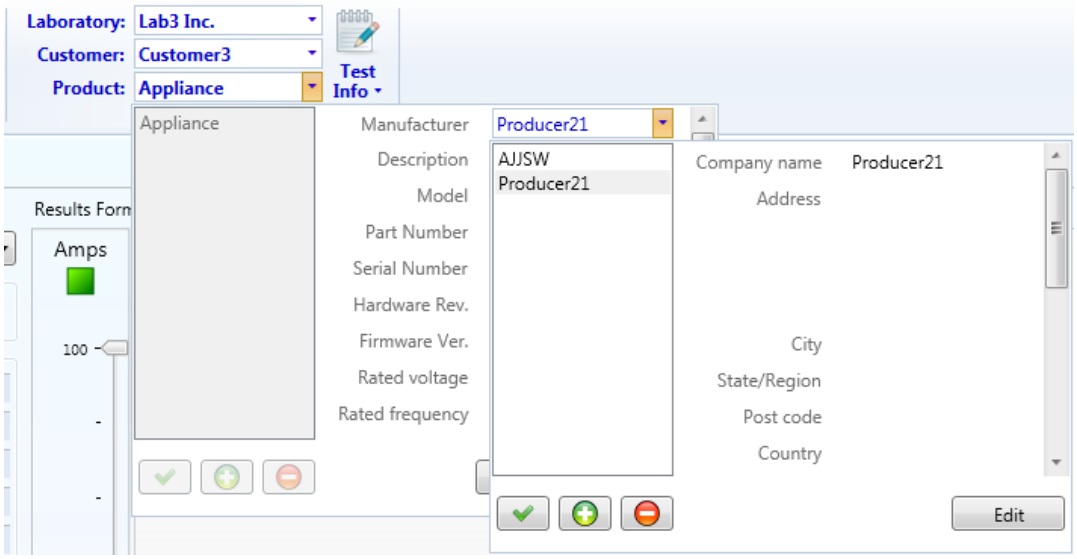
Product

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 Manufacturer (see page 81) 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.

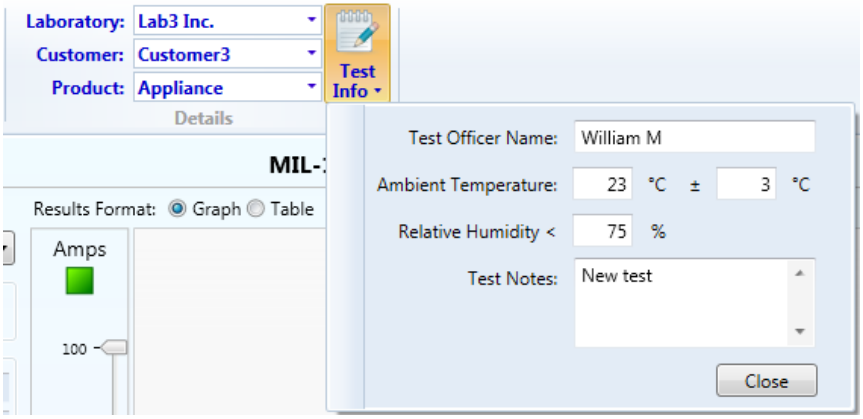


Test info

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.

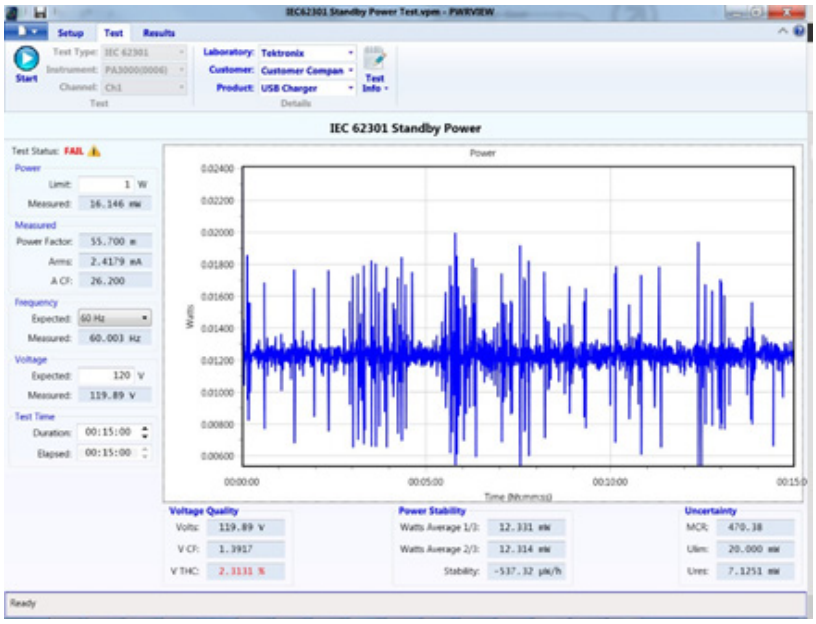
Measurement parameters and limits are derived from the information entered into the fields on the left side of the screen:

- **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.

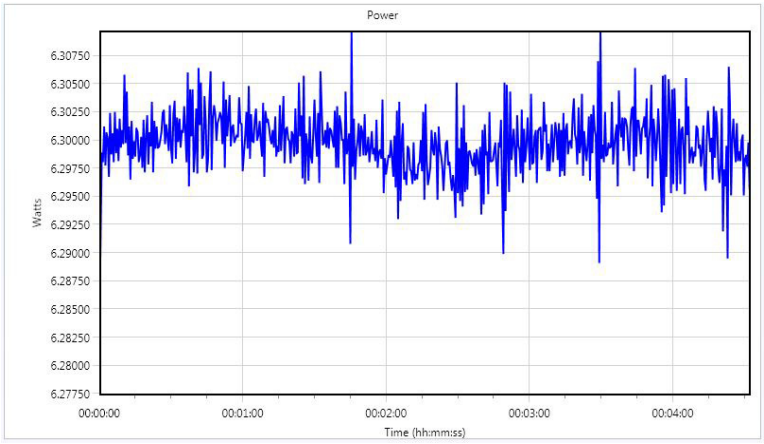
- **Power Limit** sets the maximum average power allowed over the last two-thirds of the test to pass. The power limit should be derived from the standards applicable to the device under test.
- Test **Voltage** and **Frequency** are checked to be within the limits defined in IEC 62301 ED 2.0.

On the right side of the screen, the Power Plot (see page 83) chart shows power measurements taken during the test. The Voltage Quality (see page 84), Power Stability (see page 85) and Uncertainty (see page 85) 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.



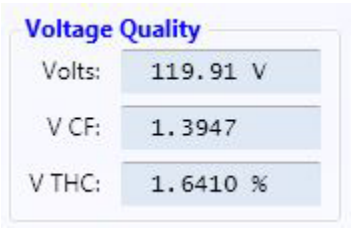
Voltage quality

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



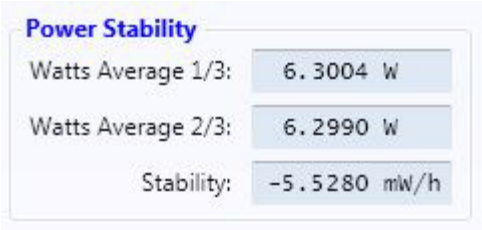
Power stability

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.



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

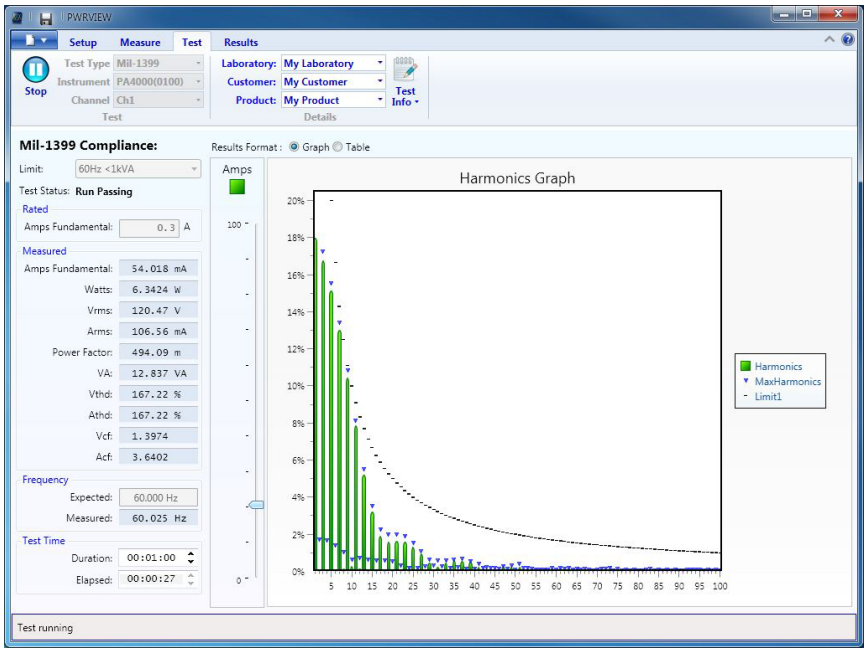
The MIL-1399 Current Harmonics test is designed to test current harmonics according to MIL-STD-1399 - Section 300B as published by Department of Defense Interface Standard – Electric Power, Alternating Current.

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.

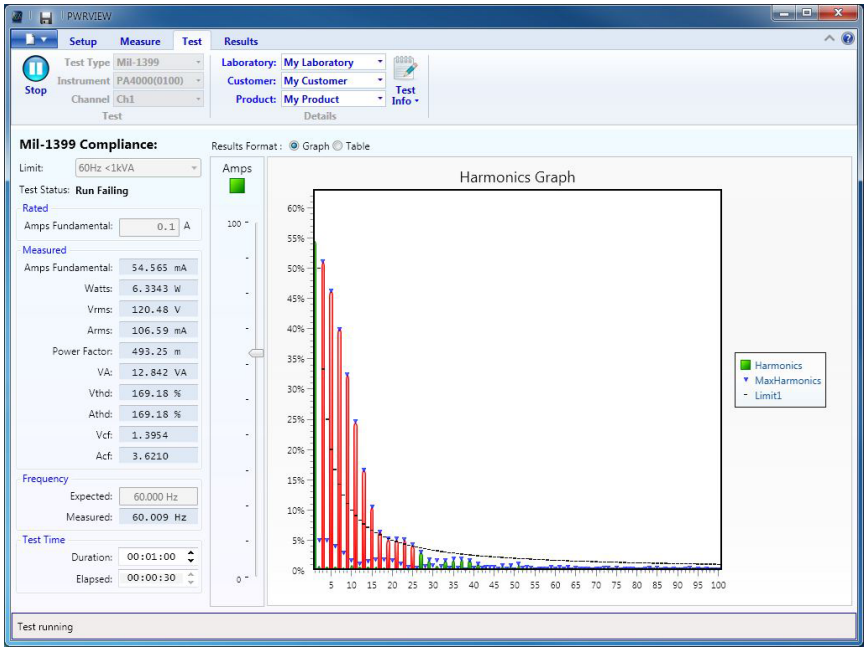
Measurement parameters and limits are derived from the information entered into the following fields on the left side of the screen:

- 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 harmonics measurement results (see page 89) taken during the test can be displayed in either graph or table format.



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 ≥ 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 2nd through the 33rd 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 34th through the 100th 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 2nd through the 100th 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 ≥ 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 2nd through the 33rd 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 34th through the 50th 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 2nd through the 50th harmonic.

Harmonics graph/table

Current harmonics graph

The current harmonics bar graph shows real time levels of the 2nd harmonic to the 100th 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.

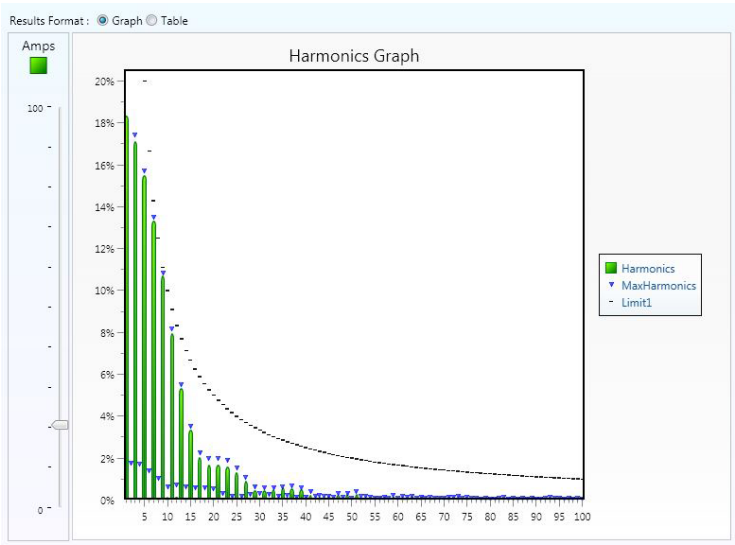
Hovering over the bar chart displays the individual percentage and absolute value of each bar.

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

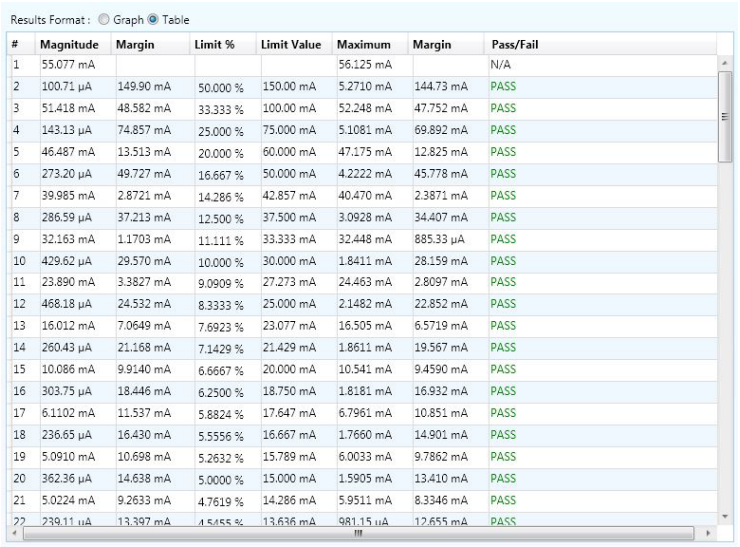
Table view

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 100th harmonic.



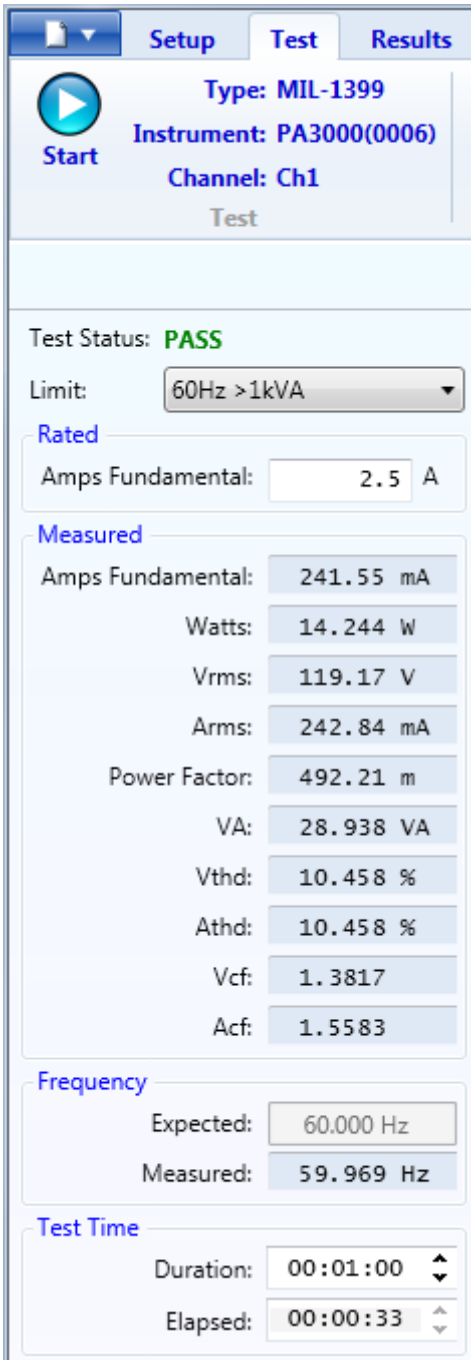
Harmonics readings are also represented in the form of table.


Results Format : Graph 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 µA	13.397 mA	4.5455 %	13.636 mA	981.15 µA	12.655 mA	PASS

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.

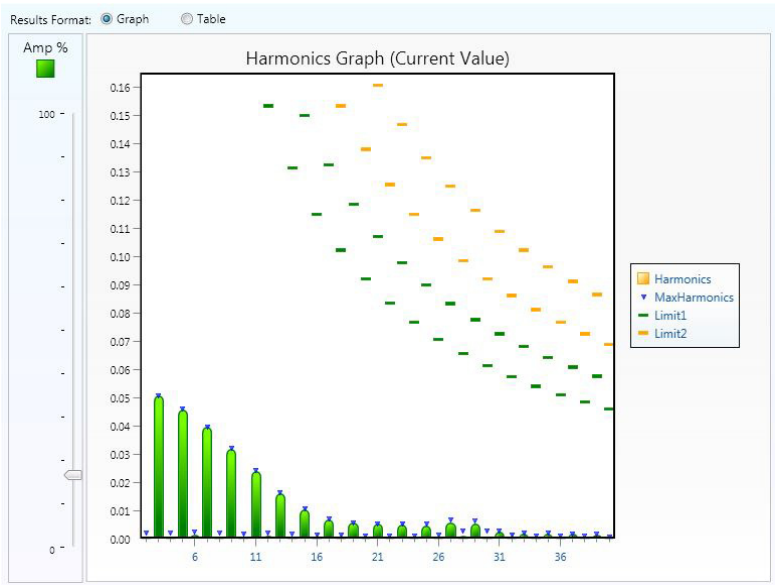
IEC 61000-3-2 Current Harmonics (pre-compliance) test

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 Rated Parameters (see page 96) section
- Test Voltage and Frequency
- Test Time Duration

On the right side of the screen, all harmonics measurement results (see page 98) 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:

Harmonic order	Maximum permissible harmonic current A
n	*A*
Odd harmonics	
3	2.30
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
$15 \leq n \leq 39$	0.15 x (15 / n)
Even harmonics	
2	1.08
4	0.43

Harmonic order	Maximum permissible harmonic current A
6	0.30
8 ≤ *n* ≤ 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:

Harmonic order	Maximum permissible harmonic current expressed as a percentage of the input current as the fundamental frequency
n	%
2	2
3	30 – λ [1]
5	10
7	7
9	5
11 ≤ *n* ≤ 39 (Odd harmonics only)	3

[1] λ 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 ≤ *n* ≤ 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 ≤ 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:

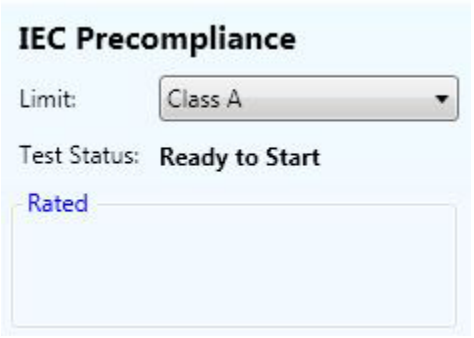
Harmonic order	Maximum permissible harmonic current per watt	Maximum permissible harmonic current
n	mA / W	A
3	3.4	2.30
5	1.9	1.14
7	1.0	0.77
9	0.5	0.40
11	0.35	0.33
13 ≤ *n* ≤ 39 (Odd harmonics only)	3.85 / N	See the Class A table

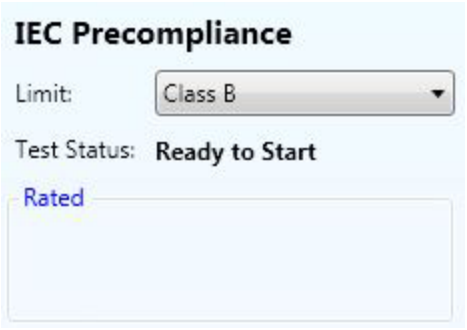
Rated parameters

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

Class A & B

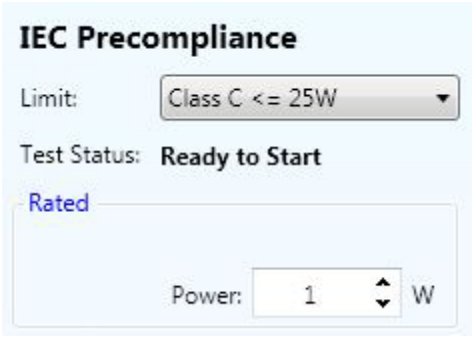
Class A and B do not require any rated parameters.





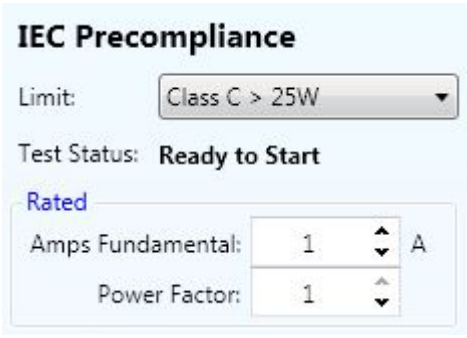
Class C ≤ 25 W

Class C ≤ 25 W requires the rated power of the equipment under test.



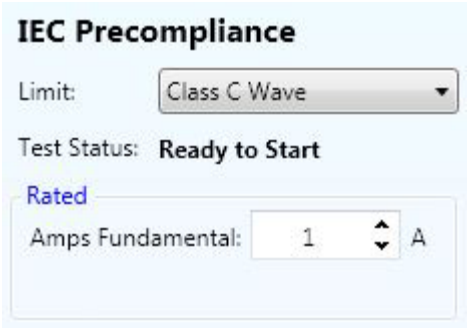
Class C > 25 W

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



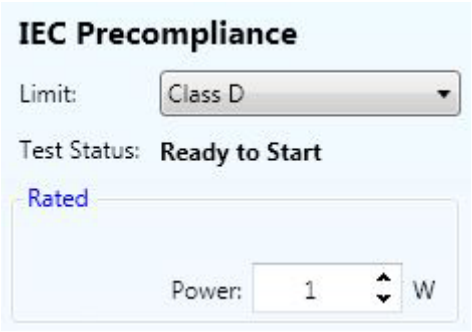
Class C wave

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



Class D

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



Harmonics graph/table

Current harmonics graph

The current harmonics bar graph shows real time levels of the 2nd harmonic up to the 40th 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.

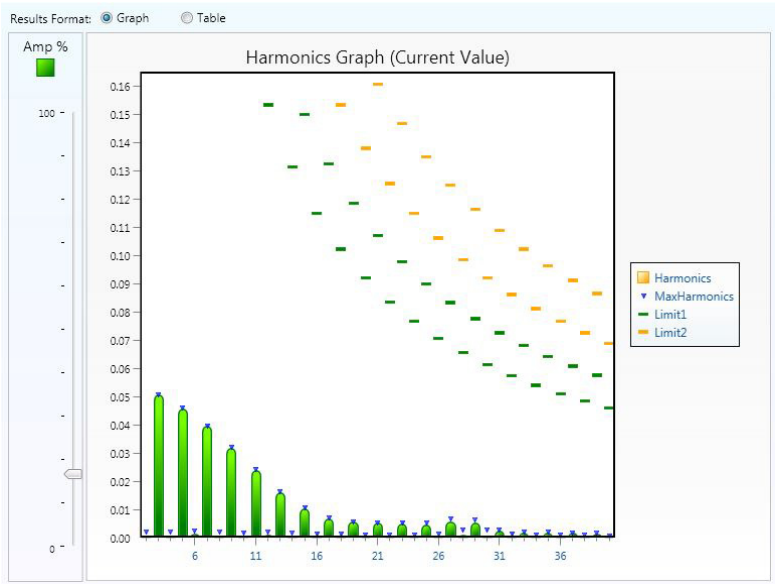
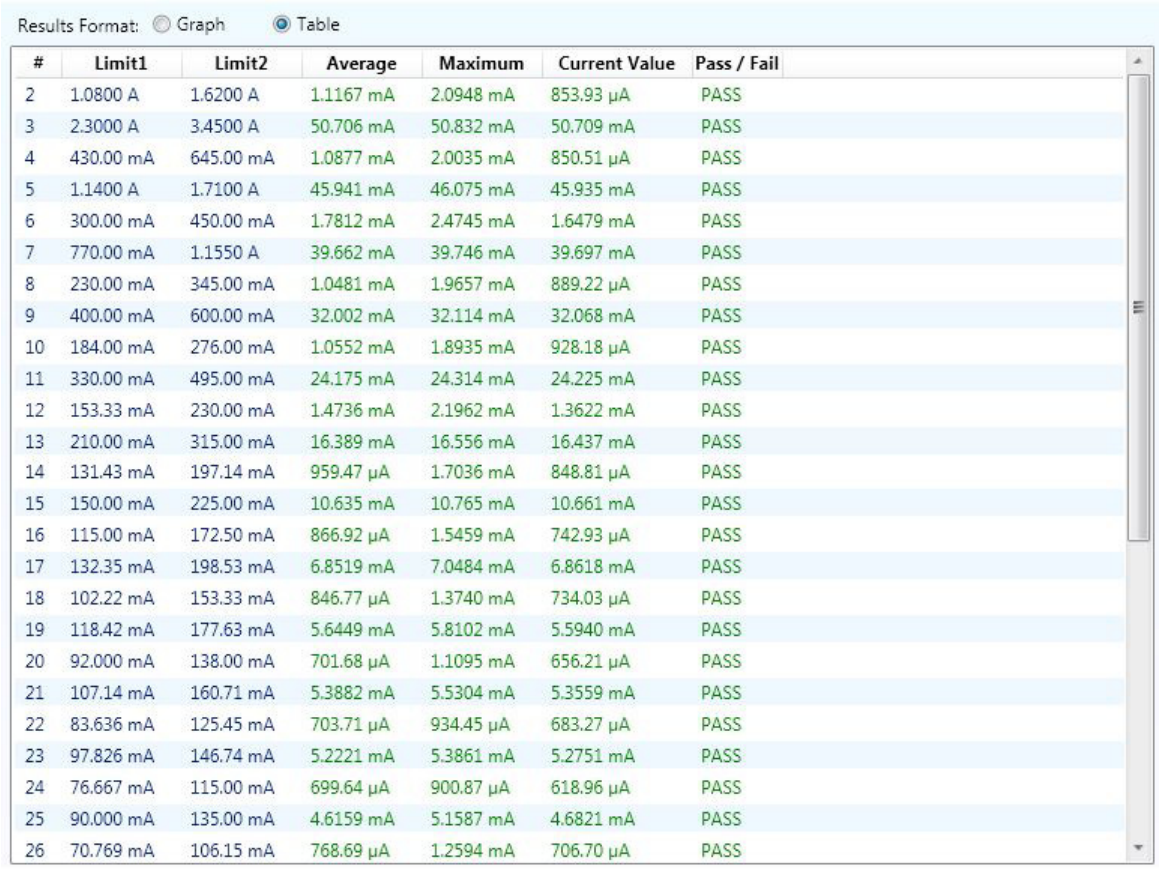


Table view

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 39th or 40th depending on the selected limit class type.


Results Format: Graph Table

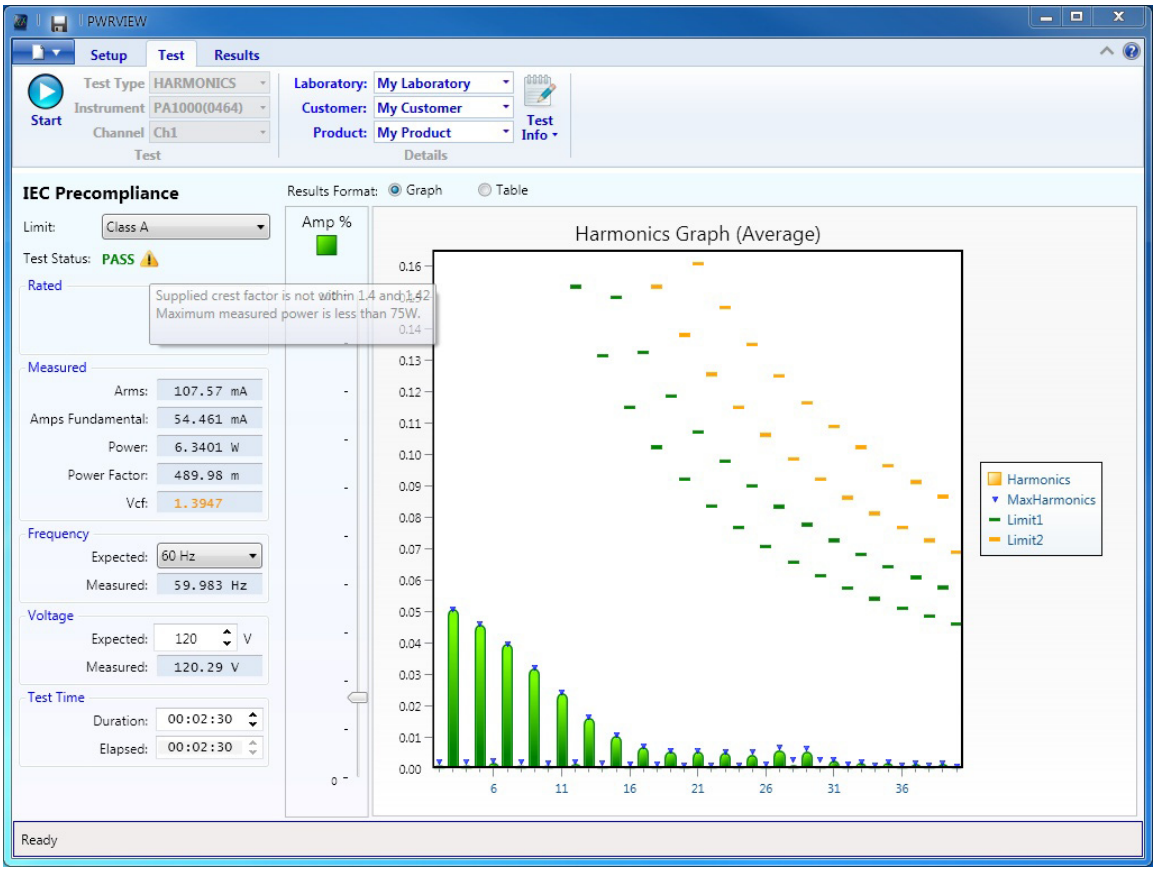
#	Limit1	Limit2	Average	Maximum	Current Value	Pass / Fail
2	1.0800 A	1.6200 A	1.1167 mA	2.0948 mA	853.93 µA	PASS
3	2.3000 A	3.4500 A	50.706 mA	50.832 mA	50.709 mA	PASS
4	430.00 mA	645.00 mA	1.0877 mA	2.0035 mA	850.51 µA	PASS
5	1.1400 A	1.7100 A	45.941 mA	46.075 mA	45.935 mA	PASS
6	300.00 mA	450.00 mA	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
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:

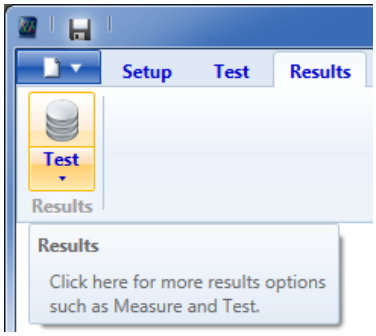
- PASS. The test has passed.
- FAIL. The test has failed.
- N/A. Not Applicable

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



Results tab

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

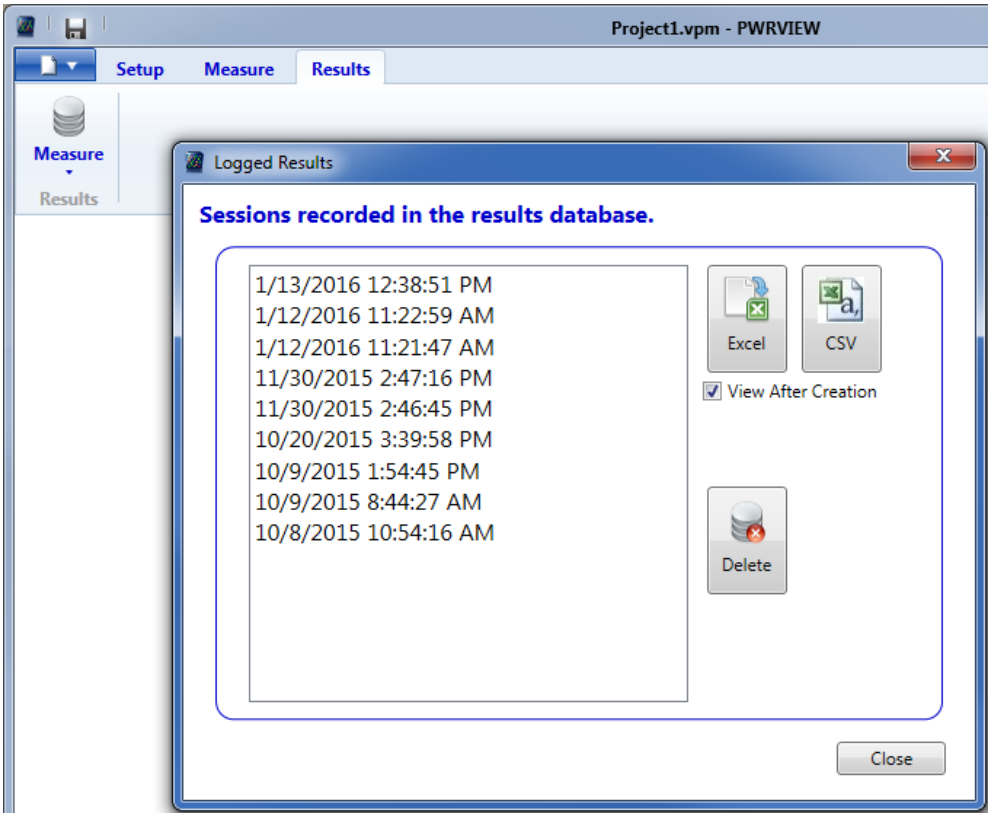


After opening test results they will be displayed in the results window and further options will be available from the ribbon control. See Standby Power Results (see page 104), MIL 1399 Results (see page 105), and Current Harmonics Results (see page 108).

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.

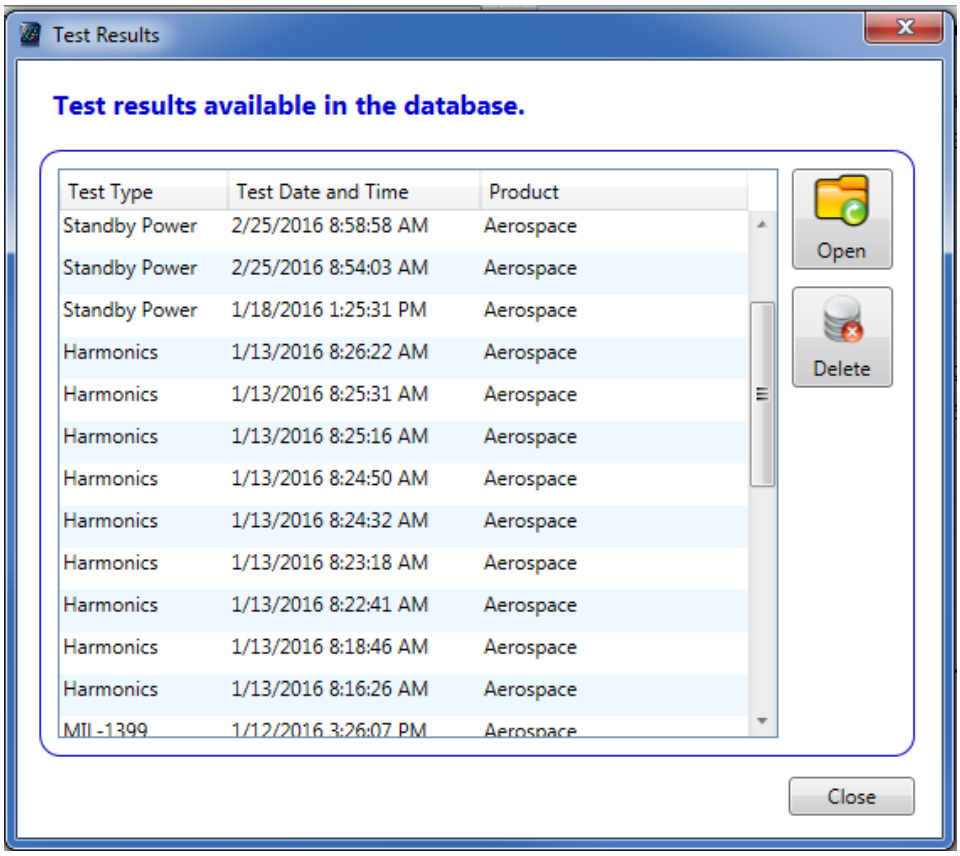
Hovering over a session shows the duration of the session.


Project1.vpm - PWRVIEW
Setup
Measure
Results
Measure
Results
Logged Results
Sessions recorded in the results database.
1/13/2016 12:38:51 PM
1/12/2016 11:22:59 AM
1/12/2016 11:21:47 AM
11/30/2015 2:47:16 PM
11/30/2015 2:46:45 PM
10/20/2015 3:39:58 PM
10/9/2015 1:54:45 PM
10/9/2015 8:44:27 AM
10/8/2015 10:54:16 AM
Excel
CSV
View After Creation
Delete
Close

Test results

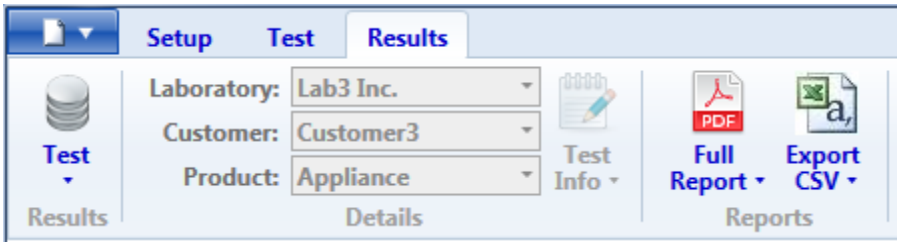
Click the Test button in the Results tab to open the Test Results as shown below. The list box shows a list of all available test results from the database. First identify a result by the test type, test date and time, and the product selected when the test was performed. Click on any of the three column 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.



Standby power results

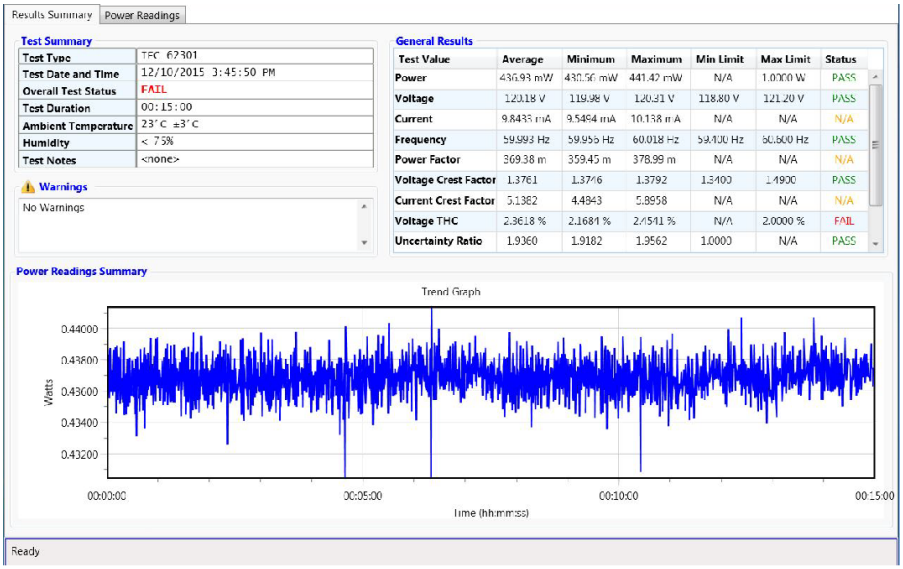
After using the Test Results button and opening some Standby Power results, the ribbon control and results windows display the results as shown below. The Details section shows a read-only version of the test information entered in the Test tab (see page 77). The Reports (see page 112) section allows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



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

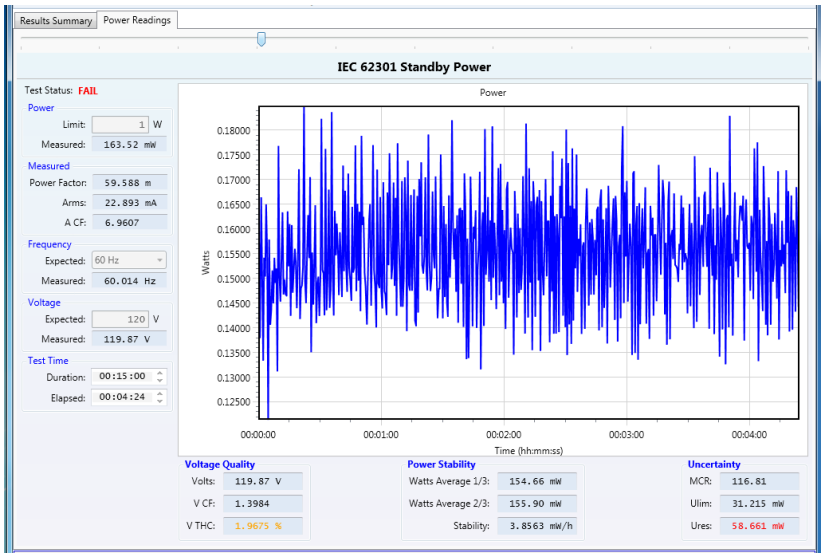
Results Summary tab

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.



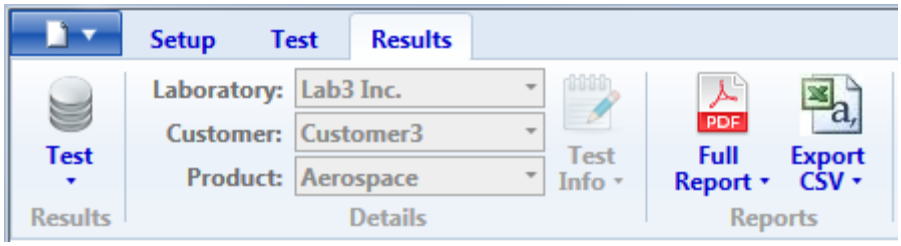
Power Readings tab

The Power Readings tab displays the IEC 62301 Standby Power Test (see page 82) 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 Test (see page 103) 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 Test tab (see page 77). The Reports (see page 112) section allows the creation of PDF (see page 113) and CSV (see page 114) results reports.

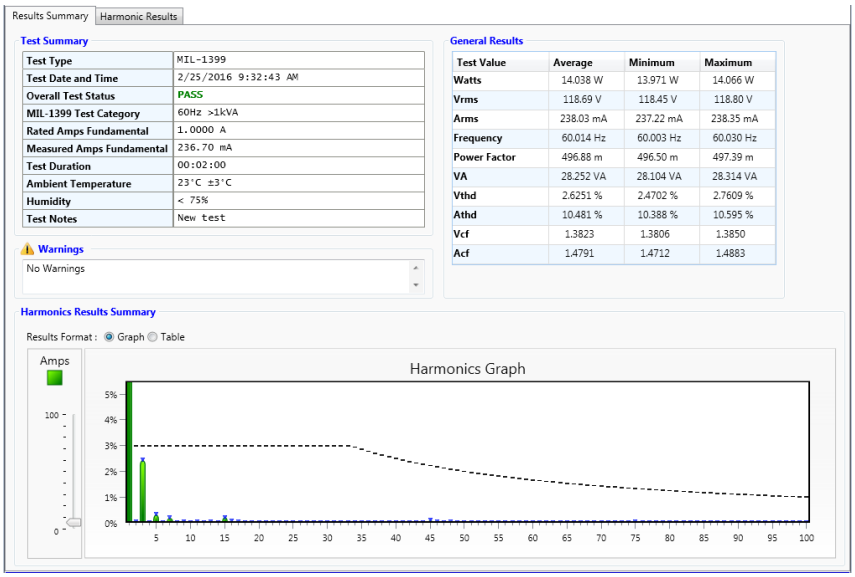


The results window shows Results Summary (see page 106) and Harmonic Results (see page 107) that allow analysis of the results data.

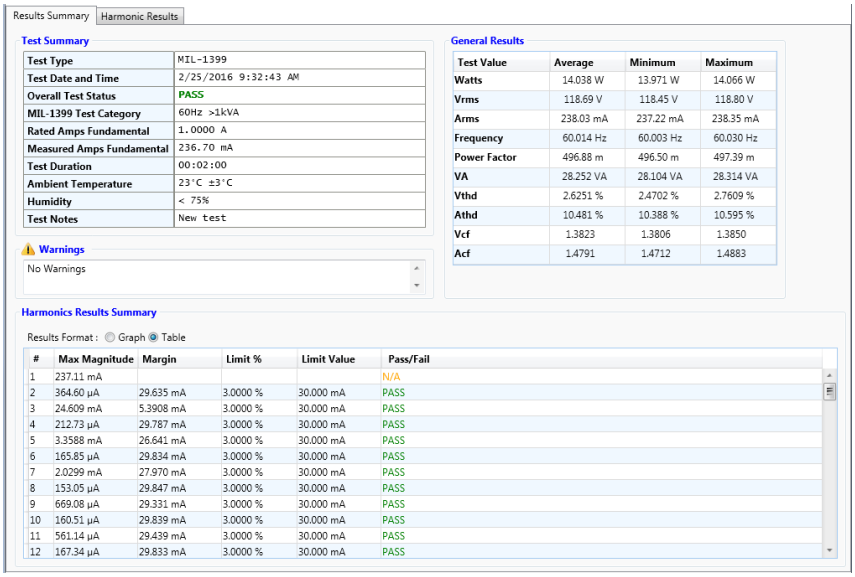
Results Summary tab

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.



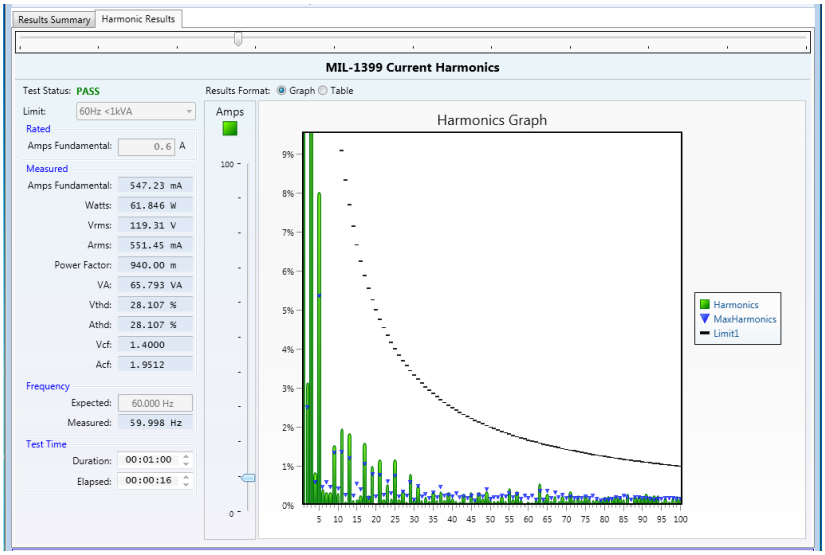
Maximum Harmonics values are represented in graph form. Click the Table radio button to view the tabular representation.



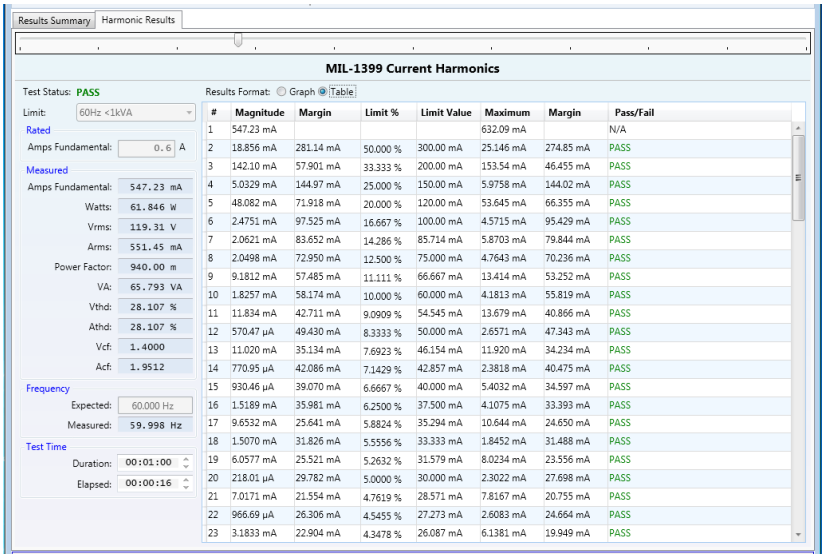
Harmonics Results tab

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.



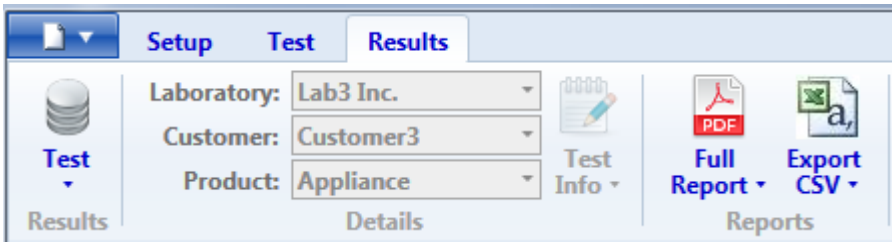
Tabular form of harmonic values can be viewed, by selecting the Table radio button.



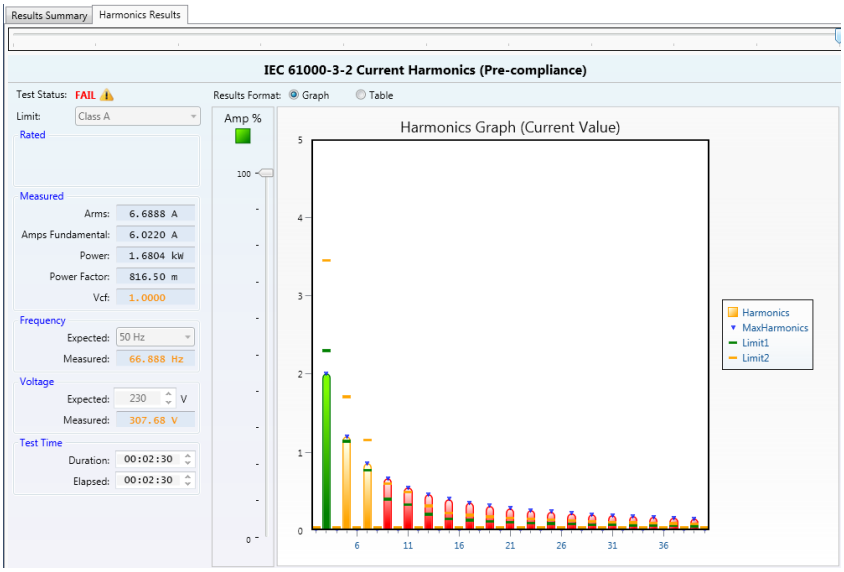
#	Magnitude	Margin	Limit %	Limit Value	Maximum	Margin	Pass/Fail
1	547.23 mA				632.09 mA		N/A
2	18.856 mA	281.14 mA	50.000 %	300.00 mA	25.146 mA	274.85 mA	PASS
3	142.10 mA	57.901 mA	33.333 %	200.00 mA	153.54 mA	46.455 mA	PASS
4	5.0329 mA	144.97 mA	25.000 %	150.00 mA	5.9758 mA	144.02 mA	PASS
5	48.082 mA	71.918 mA	20.000 %	120.00 mA	53.645 mA	66.355 mA	PASS
6	2.4751 mA	97.525 mA	16.667 %	100.00 mA	4.5715 mA	95.429 mA	PASS
7	2.0621 mA	83.652 mA	14.286 %	85.714 mA	5.8703 mA	79.844 mA	PASS
8	2.0498 mA	72.950 mA	12.500 %	75.000 mA	4.7643 mA	70.236 mA	PASS
9	9.1812 mA	57.485 mA	11.111 %	66.667 mA	13.414 mA	53.252 mA	PASS
10	1.8257 mA	58.174 mA	10.000 %	60.000 mA	4.1813 mA	55.819 mA	PASS
11	11.834 mA	42.711 mA	9.0909 %	54.545 mA	13.679 mA	40.866 mA	PASS
12	570.47 µA	49.430 mA	8.3333 %	50.000 mA	2.6571 mA	47.343 mA	PASS
13	11.020 mA	35.134 mA	7.6923 %	46.154 mA	11.920 mA	34.234 mA	PASS
14	770.95 µA	42.086 mA	7.1429 %	42.857 mA	2.3818 mA	40.475 mA	PASS
15	930.46 µA	39.070 mA	6.6667 %	40.000 mA	5.4032 mA	34.597 mA	PASS
16	1.5189 mA	35.981 mA	6.2500 %	37.500 mA	4.1075 mA	33.393 mA	PASS
17	9.6532 mA	25.641 mA	5.8824 %	35.294 mA	10.644 mA	24.650 mA	PASS
18	1.5070 mA	31.826 mA	5.5556 %	33.333 mA	1.8452 mA	31.488 mA	PASS
19	6.0577 mA	25.521 mA	5.2632 %	31.579 mA	8.0234 mA	23.556 mA	PASS
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 Test (see page 103) 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 Test tab (see page 77). The Reports (see page 112) section allows the creation of PDF (see page 113) and CSV (see page 114) results reports.



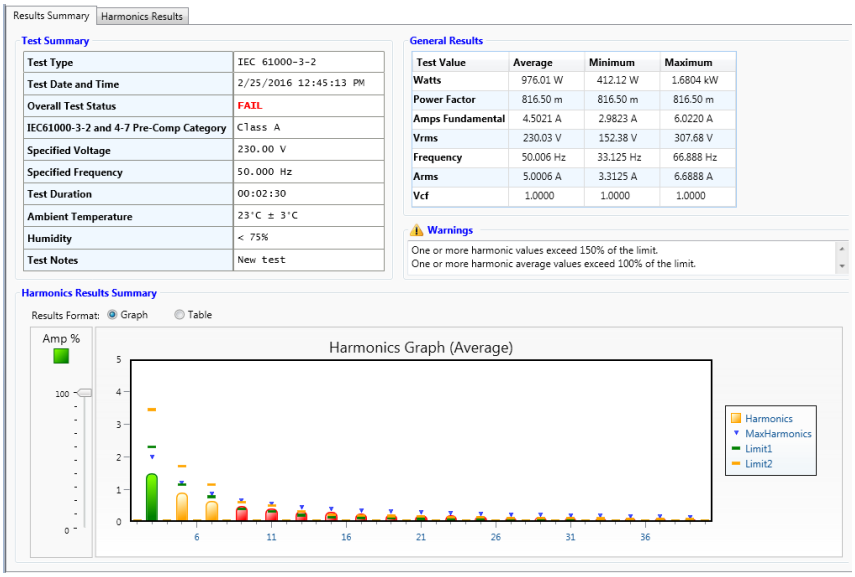
The results window shows the Results Summary (see page 109) and the Harmonics Results (see page 111) that allow analysis of the results data.



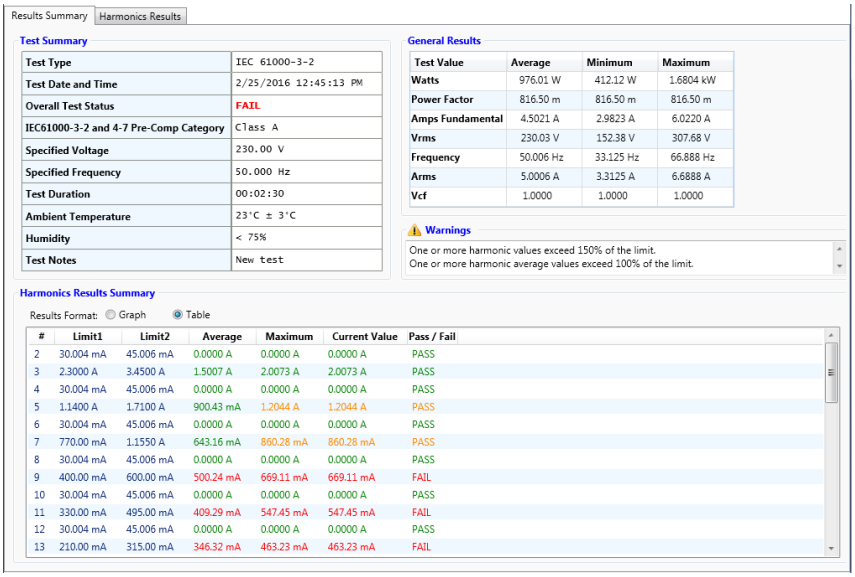
Results Summary tab

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.



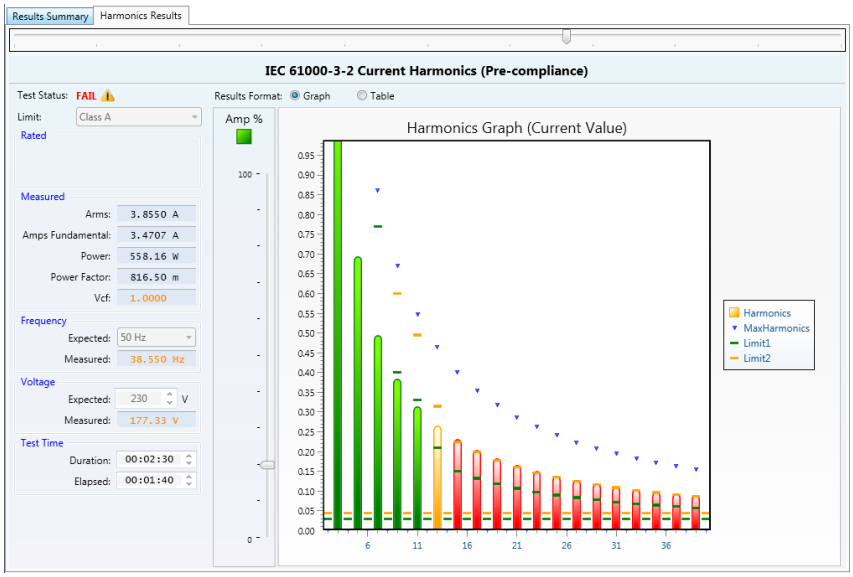
Average harmonics values are represented in graph form. Click the Table radio button to view the tabular representation



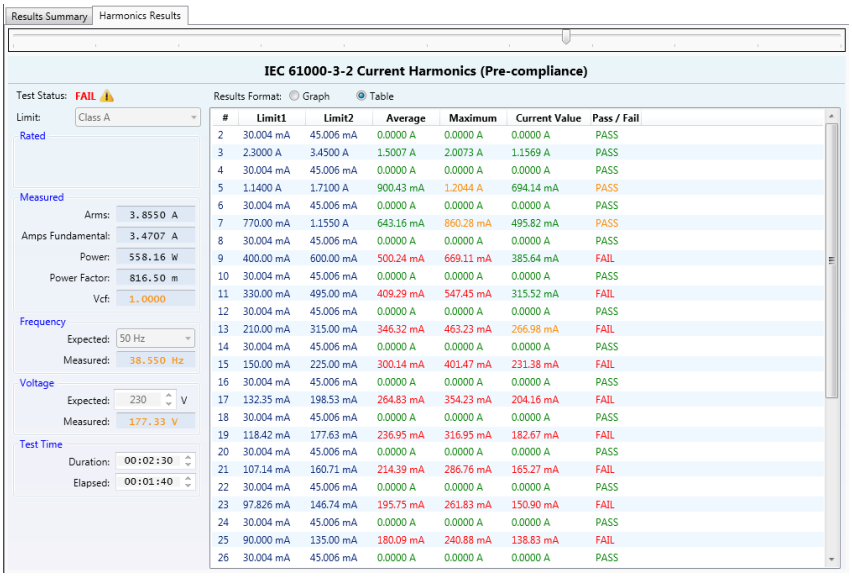
Harmonics results tab

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.

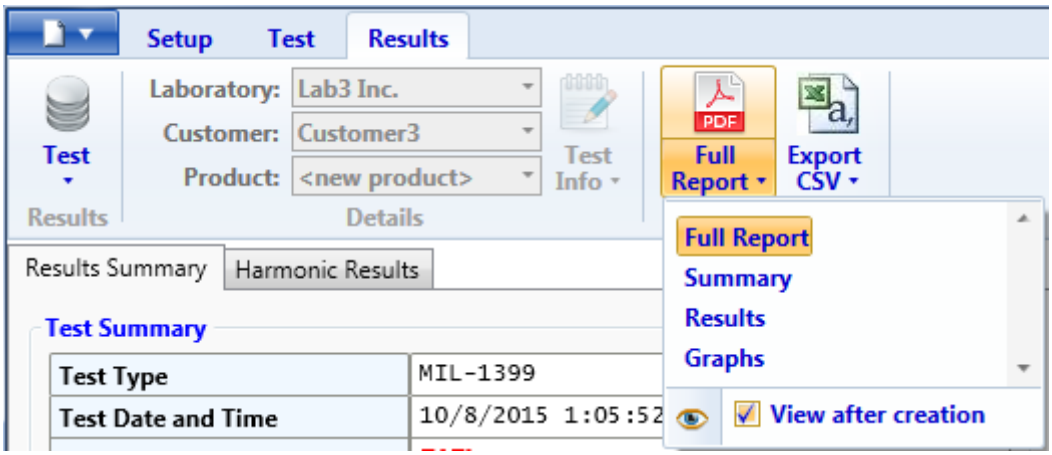


Tabular form of harmonic values can be viewed, by selecting the Table radio button.



Reports

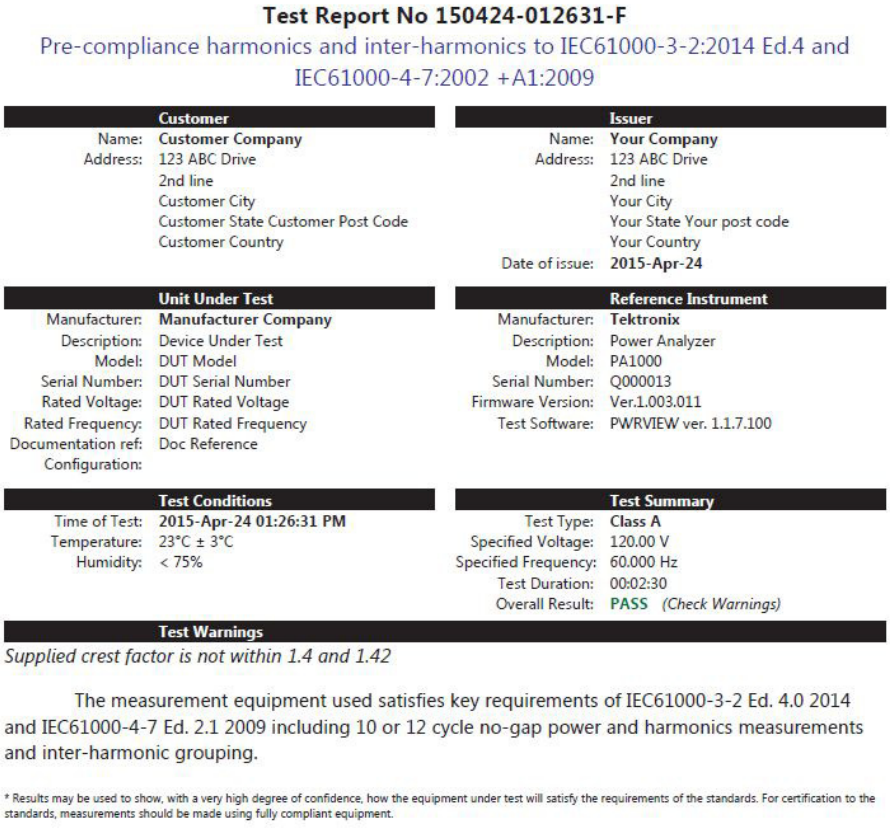
You can generate reports in PDF (see page 113) or CSV (see page 114) format. Select the type of report by clicking the lower half of the button and then clicking the main button to generate the report.



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.



Test Report No 150424-012631-F

Pre-compliance harmonics and inter-harmonics to IEC61000-3-2:2014 Ed.4 and IEC61000-4-7:2002 +A1:2009

Customer	
Name:	**Customer Company**
Address:	123 ABC Drive
	2nd line
	Customer City
	Customer State Customer Post Code
	Customer Country

Issuer	
Name:	**Your Company**
Address:	123 ABC Drive
	2nd line
	Your City
	Your State Your post code
	Your Country
Date of issue:	**2015-Apr-24**

Unit Under Test	
Manufacturer:	**Manufacturer Company**
Description:	Device Under Test
Model:	DUT Model
Serial Number:	DUT Serial Number
Rated Voltage:	DUT Rated Voltage
Rated Frequency:	DUT Rated Frequency
Documentation ref:	Doc Reference
Configuration:	

Reference Instrument	
Manufacturer:	**Tektronix**
Description:	Power Analyzer
Model:	PA1000
Serial Number:	Q000013
Firmware Version:	Ver.1.003.011
Test Software:	PWRVIEW ver. 1.1.7.100

Test Conditions	
Time of Test:	**2015-Apr-24 01:26:31 PM**
Temperature:	23°C ± 3°C
Humidity:	< 75%

Test Summary	
Test Type:	**Class A**
Specified Voltage:	120.00 V
Specified Frequency:	60.000 Hz
Test Duration:	00:02:30
Overall Result:	**PASS** *(Check Warnings)*

Test Warnings

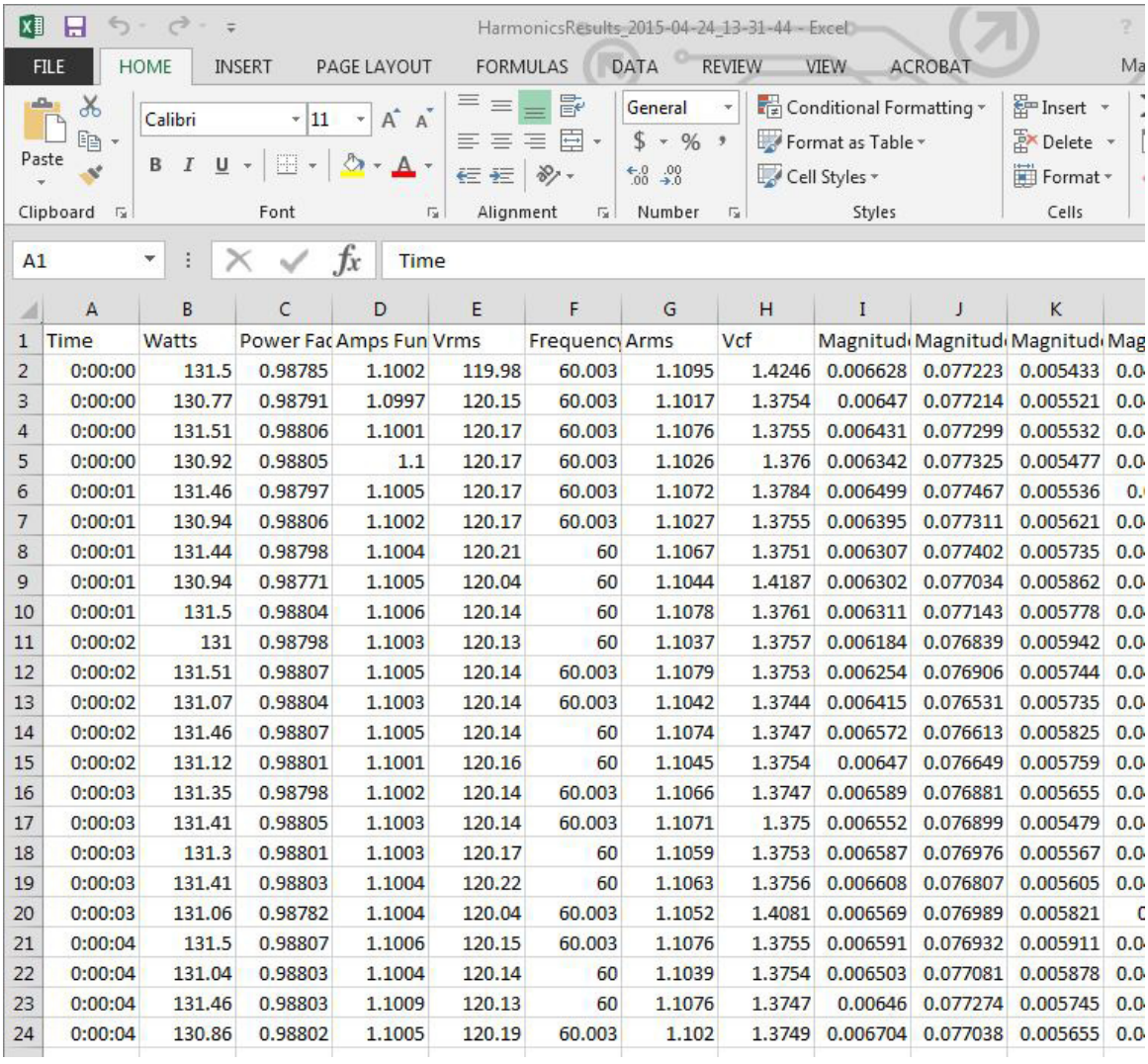
Supplied crest factor is not within 1.4 and 1.42

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.



	A	B	C	D	E	F	G	H	I	J	K	
1	Time	Watts	Power Fac	Amps Fun	Vrms	Frequenc	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	0
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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