

# PA3000

## Four-channel, Multi-phase AC/DC Power Analyzer



The Tektronix PA3000 is a one to four channel power analyzer that is optimized for testing today's single and multi-phase, high efficiency power conversion products and designs. Use it to quickly visualize, analyze, and document power efficiency, energy consumption, and electrical performance to the latest regional and international standards, including Level VI, EnergyStar, CEC, IEC 62301, CQC-3146, and more.

### Key features and specifications

- One to four channels support single and three phase applications
- 10 mW standby power measurement
- 1 MHz bandwidth
- 1 MS/s sampling rate
- 16 bit A/D
- Harmonic analysis to 100th order
- $\pm 0.04\%$  basic voltage and current accuracy
- Measurements to 30 A<sub>rms</sub> and 600 V<sub>rms</sub> Cat II (2000 V<sub>pk</sub>)
- USB and LAN interfaces standard (GPIB option)
- Free PWRVIEW software
- Full color graphical display for intuitive readouts of measured values, waveforms, harmonics, and energy integration plots

### The essential power measurement tool for R&D and validation

- High accuracy supports testing to Level VI efficiency standards for external AC/DC power supplies
- Dedicated energy consumption testing in integration mode for standards like Energy star and CEC
- Complete solution for full compliance testing to IEC 62301 standby power requirements
- High 1 MHz bandwidth supports the LED module energy certification requirements of CQC-3146 as well as harmonic analysis of designs with higher fundamental frequencies
- More than 50 standard measurement functions, including harmonics, frequency, and star-delta computation
- Multiple analog and digital inputs for sensor data such as thermocouples, speeds sensors, and torques sensors
- Built-in  $\pm 15$  V supplies for external transducers to support high current applications

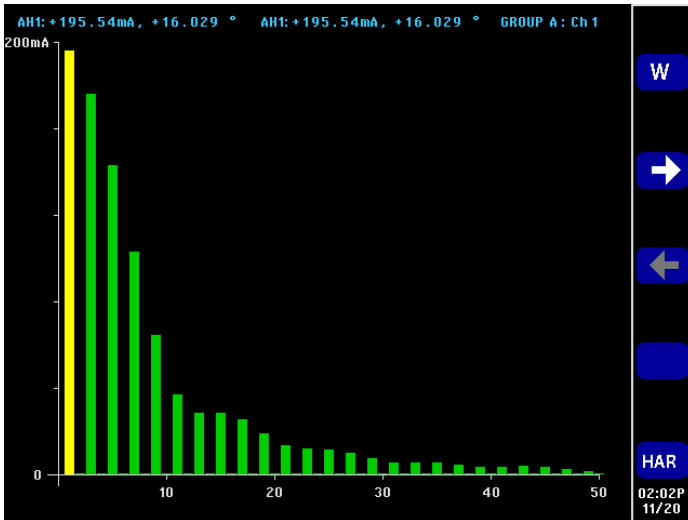
### Applications

- AC/DC power supplies and LED drivers
- Appliances and consumer electronics
- UPS systems, inverters, and DC/AC conversion systems
- Wireless battery charging
- Three phase motors and drives



## Harmonic analysis

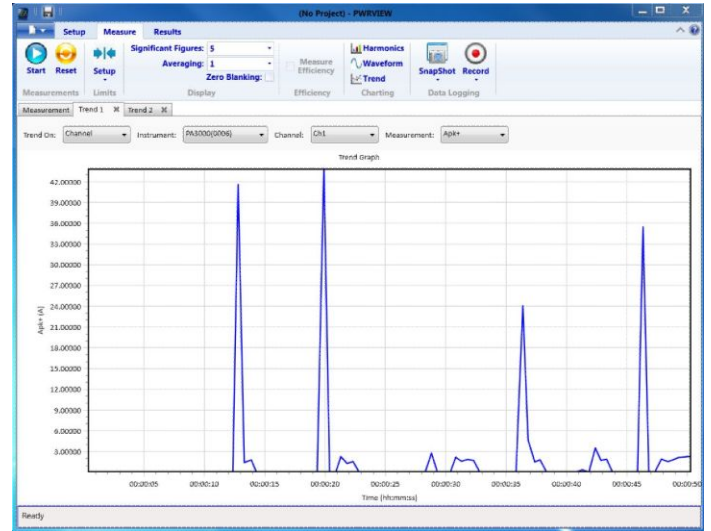
- Voltage and current harmonic analysis up to 100<sup>th</sup> order
- Easy THD and distortion factor measurements



Harmonics testing up to 100th order

## Inrush Current testing

- Min Max hold feature with 1 MS/s sampling rate allows testing for inrush events



Inrush event testing with Trend chart and Min Max hold feature

## Limits and Specification testing

- Custom limits setup with free PWRVIEW software enables standards and specification testing to set limits

Index	Meas	PA3000(0006) 1	PA3000(0006) 2	PA3000(0006) 3	PA3000(0006) 4
1	Vrms	320.13 V	-134.00 mV	38.376 V	3.6241 V
2	Arms	477.76 mA	22.245 mA	316.75 mA	-183.25 mA
3	Watts	27.130 W	12.870 W	9.3041 W	695.91 mW
4	Pp	472.70 m	427.30 m	765.43 m	134.57 m
5	Vcf	3.3752	-38.850 m	3.3666	-49.420 m
6	Act	4.3516	-648.41 m	4.1003	-899.73 m
7	amp	9.6786	4.6786	3.2605	-1.7395
8	Vmer	20.424	15.424	4.3118	-688.16 m
9	Ahr	169.98 m	-4.8300		4.5254

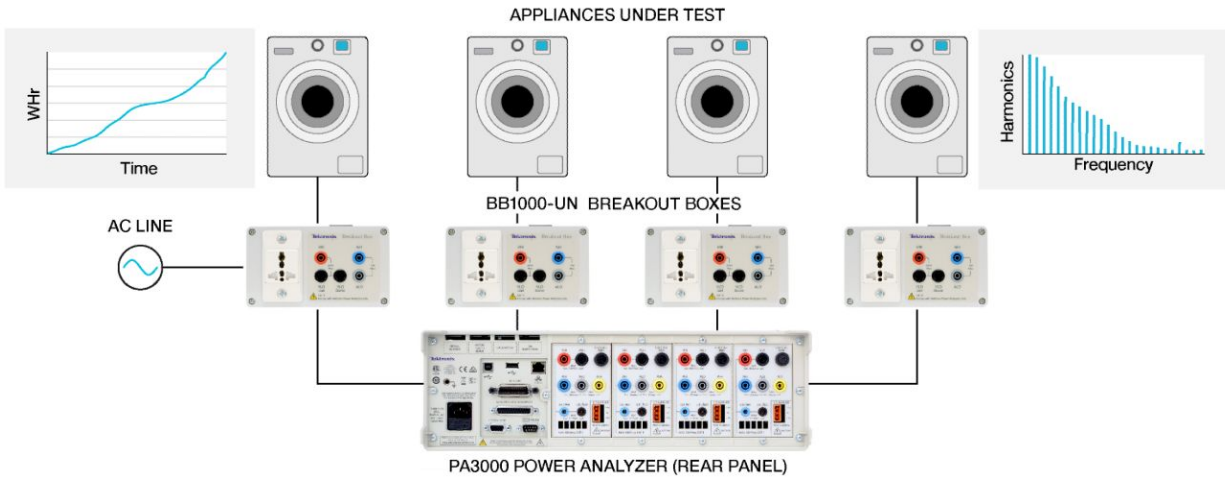
Custom limits setup for personalized limit checks on all measured parameters

## Input Power analysis

- More than 50 measurement parameters including Power factor, crest factor, THD
- Continuous 1 MS/s sampling rate enables accurate and gap-less input power analysis on non-sinusoidal signals

## Appliances and consumer electronics

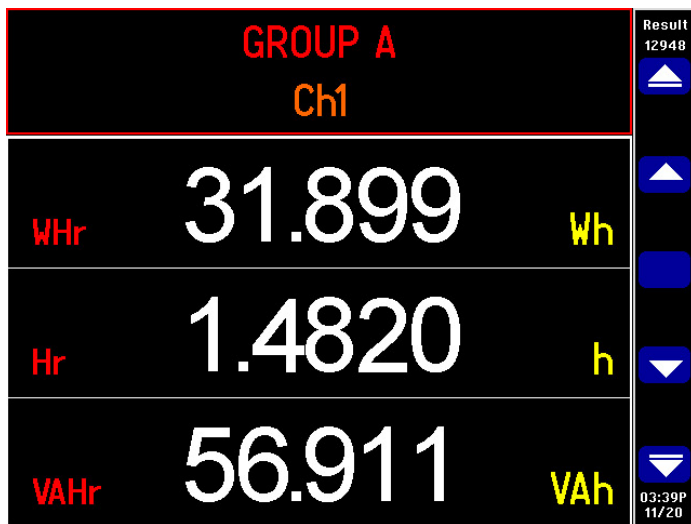
Key tests include energy consumption and standby power. The PA3000's built-in test modes simplify test setup.



Example test configuration and measurement results for testing appliances and consumer electronics

### Energy Consumption testing

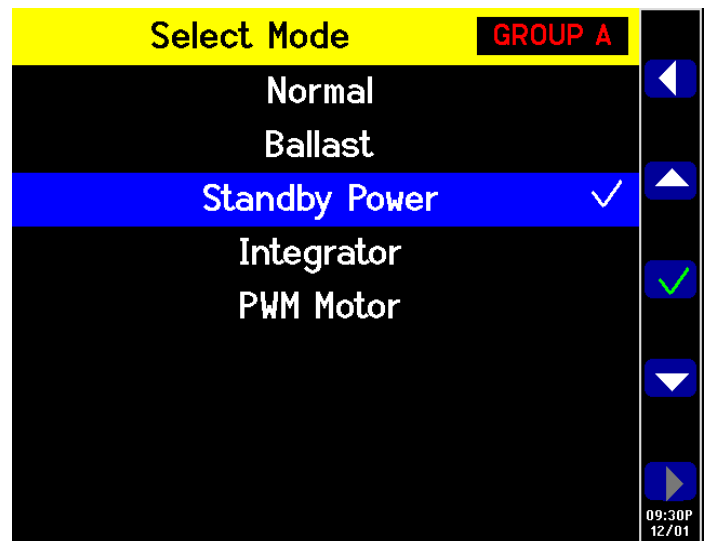
- Dedicated Energy Consumption (Integrator) mode enables easy setup and testing for home and office appliances
- Auto-up-only ranging feature with PWRVIEW enables gapless energy consumption testing
- Integration and trend charts for long term monitoring
- 1 to 4 channels enable simultaneous testing of multiple products



Energy Consumption testing

### Standby Power testing

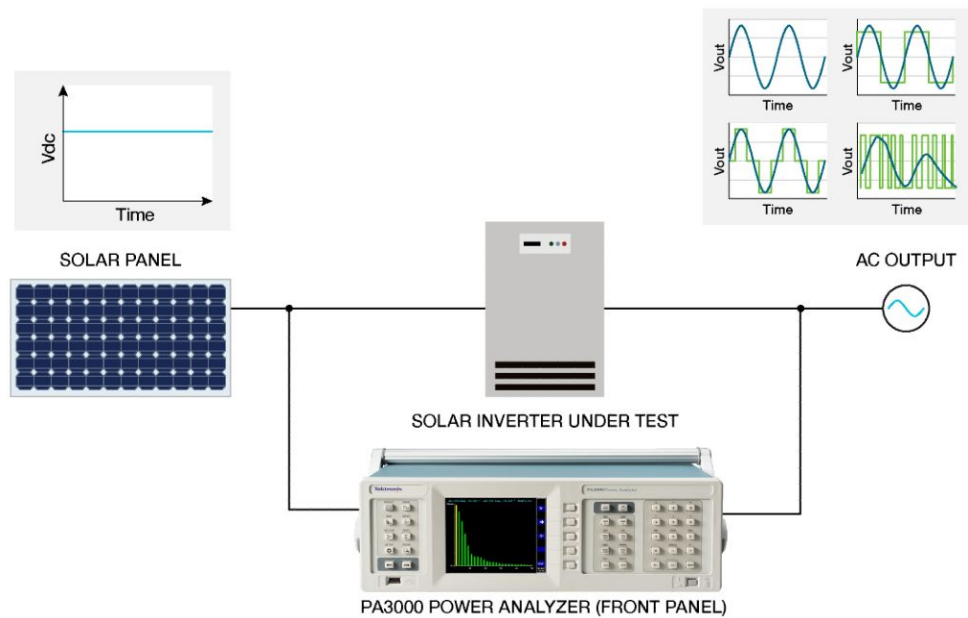
- 90  $\mu$ A current measuring capability and various ranging features for standby power testing on modern appliances
- Full compliance IEC 62301 standby power standard test with device uncertainty calculations as required by the standard
- Long averaging enables stable standby power results
- Auto-up ranging mode enables gap-less measurement



Dedicated Standby Power testing mode and Integrator mode

## Solar inverters and UPS systems

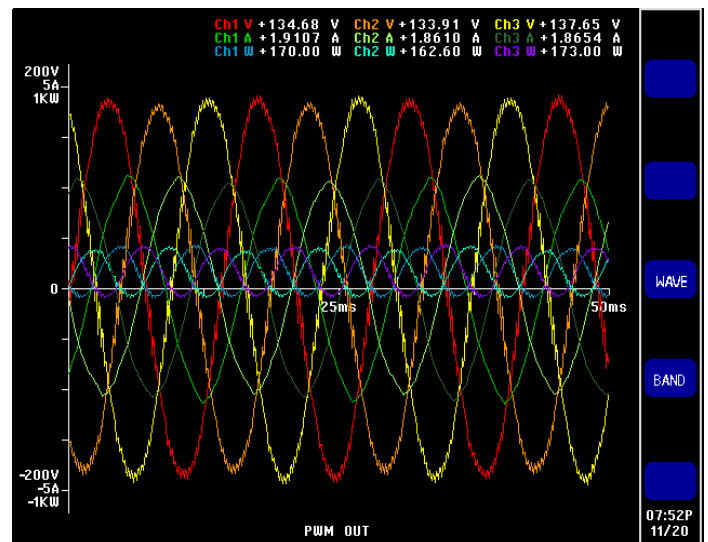
Key requirements include system efficiency testing and single or three-phase output waveform analysis. The PA3000 enables long-term datalogging in PWRVIEW software or to a USB memory stick.



Example test configuration and measurement results for testing solar inverters and UPS systems

### System Efficiency testing

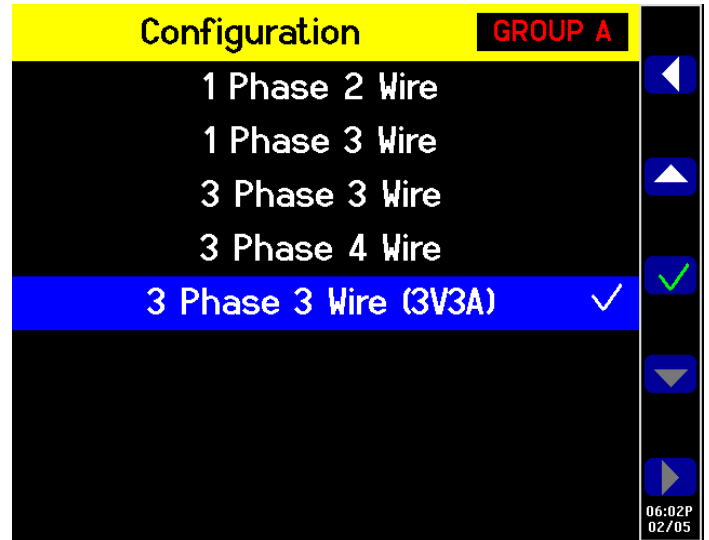
- Up to four channels for simultaneously measuring all the stages of a UPS system or solar inverters
- High AC (0.04%) and DC (0.05%) basic accuracy for accurate measurements on all conversion stages
- 90  $\mu$ A-30 A direct current measurement enables testing on wide range of loads
- Available high accuracy current transducers enable high power testing in kilowatt range
- Waveform view enables monitoring all phases simultaneously on single and three phase systems



Three phase waveform view

## Output Voltage and Power Analysis (10 & 30 )

- Default wiring configurations for single and three phase systems make it easy to setup and test complex voltage and power parameters
- 3 Phase 3 Wire (3V3A) configuration allows star delta conversion for line to line voltage, line to neutral voltage and phase or neutral current measurement.
- Voltage crest factor, VTHD and harmonics up to 100th order enable analyzing output voltage for various load conditions
- Trend charts in PWRVIEW software for long term monitoring
- Data logging via USB flash drive or PWRVIEW software for logging tracking data over a long period.

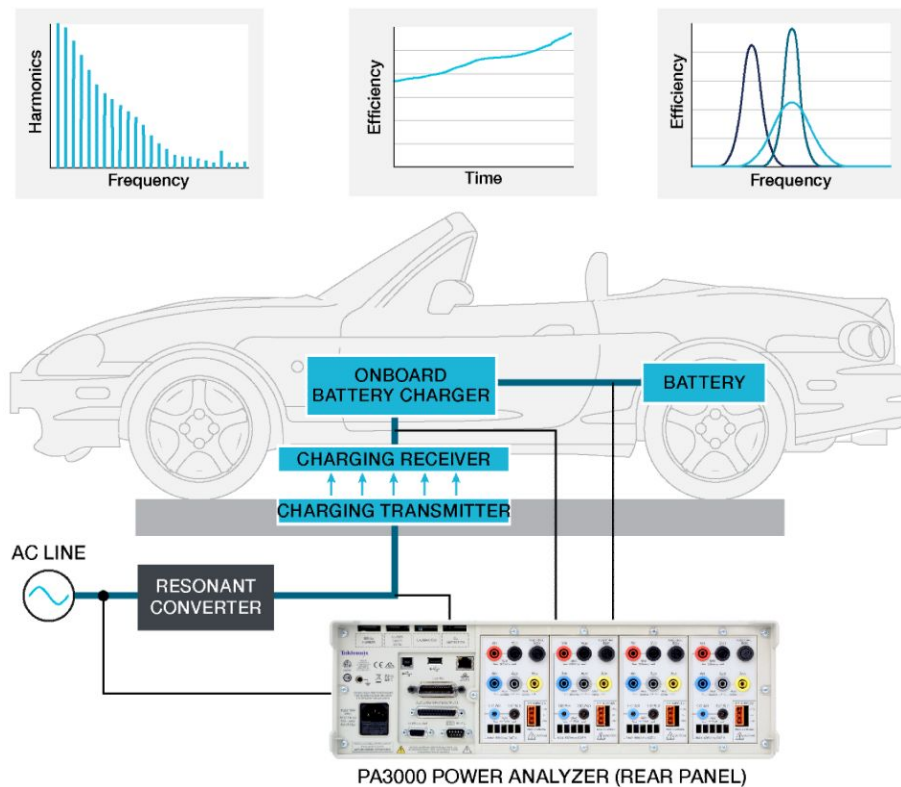


Default wiring configuration choices



## Wired and wireless automotive battery chargers

Key tests include efficiency and harmonic analysis. The 4-channel PA3000 enables testing power at each stage of the wireless charging system, including transmitter and receiver.



Example test configuration and measurement results for testing wireless automotive battery chargers

### Efficiency testing

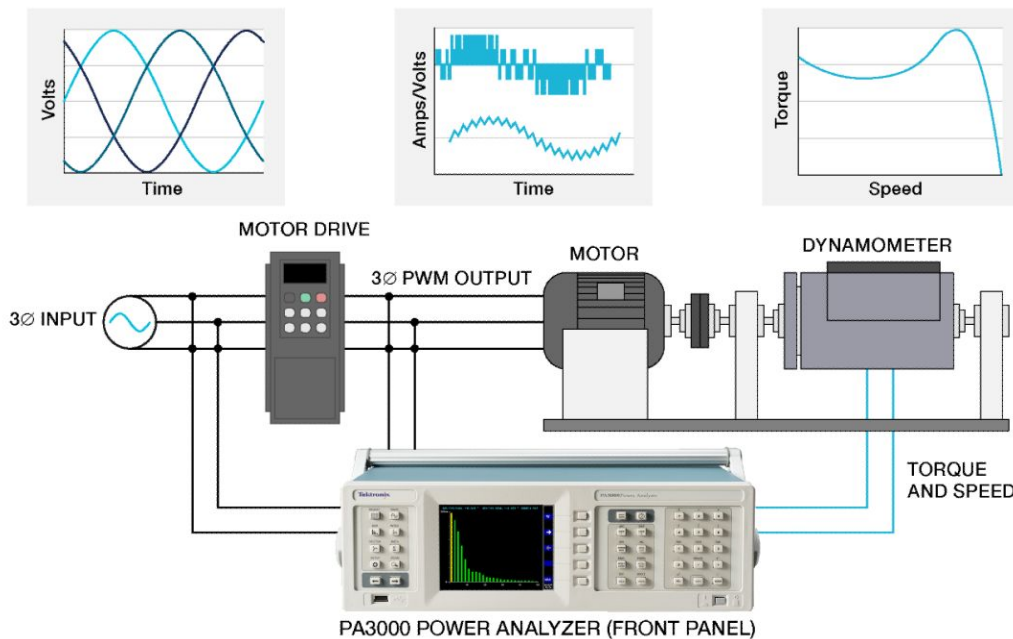
- High AC (0.04%) and DC (0.05%) basic accuracy for accurate measurements on all battery charger stages
- 30 A internal shunt and available high accuracy current transducers for high power testing in kilowatt range
- Standard  $\pm 15$  V power supply on the back panel to power external current transducers
- Up to four channels enable testing power on each stage of wireless charger including the transmitter and the receiver
- Dedicated efficiency measurement on PWRIVEW software and Math function on PA3000 enable easy setup
- 1 MHz bandwidth enables accurate RMS and efficiency measurements for high frequency transmitter and receiver power signals

### Harmonic analysis

- 1 MHz bandwidth enables harmonic analysis on wireless chargers with KHz fundamental frequency on transmitter and receiver
- Voltage, current and power harmonics to 100<sup>th</sup> order with THD and distortion factor to analyze distorted input and output signals

## Three phase motor drives

Key tests include output power, efficiency, and harmonic analysis. The PA3000's PWRVIEW software offers wizard-driven setups to simplify 3-phase 3-wire and 3-phase 4-wire test configurations.



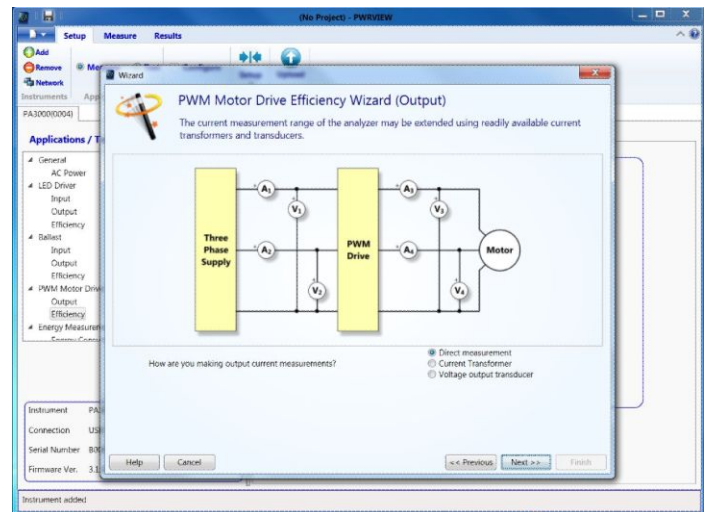
Example test configuration and measurement results for testing three-phase motor drives

## Output power

- Dedicated PWM Motor drive mode to test output voltage waveforms
- High frequency sampling with digital filtering in PWM mode, to reject the carrier frequency and detect the motor frequency while still using pre-filtered data for all measurements
- Optimized for steady-state three phase power measurements on the output.

## Efficiency testing

- Dedicated application wizard on PWRVIEW software and Math function on PA3000 enable easy setup for motor drive efficiency
- Available 3 Phase 3 Wire configuration makes it easy to measure three phase inputs and outputs with four channels for system efficiency
- Four analog inputs rated at  $\pm 10$  V and two counter inputs with 1 MHz bandwidth for torque and speed measurements enable measuring complete mechanical system efficiency
- 30 A internal shunt and available high accuracy current transducers for high power testing in kilowatt range
- Standard  $\pm 15$  V power supply on the back panel to power external current transducers

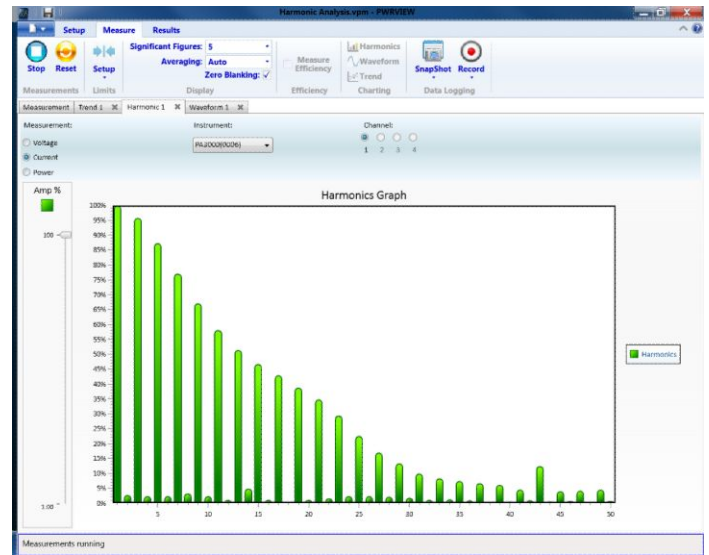


PWM Motor Efficiency Wizard in the PWRVIEW software



## Harmonic analysis

- Accurate frequency detection from 0.1 Hz – 1 MHz enables accurate frequency and harmonic measurements from low to high motor speeds
- Voltage, current and power harmonics to 100<sup>th</sup> order with THD and distortion factor to analyze distorted input and output signals and understand the heating effects of the signal

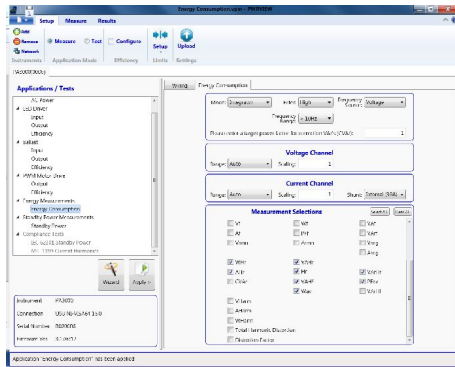


PWRVIEW Harmonic analysis

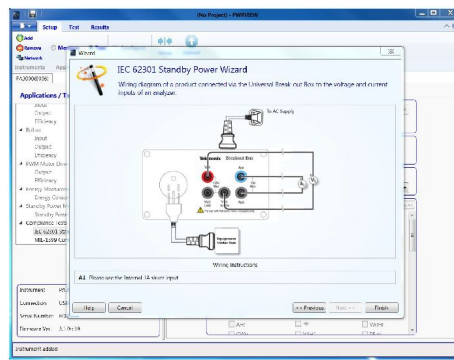
## PWRVIEW PC software

PWRVIEW is a supporting software application for Windows PCs that compliments and extends the functionality of the PA3000. PWRVIEW enables you to do the following:

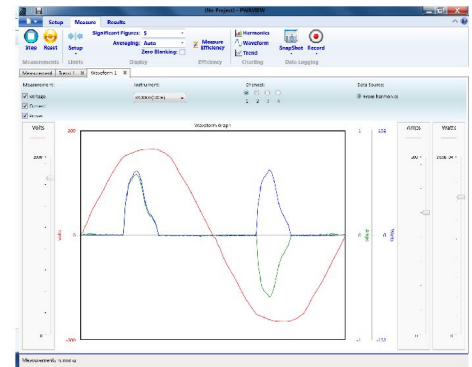
- Communicate with the PA3000 over any of the instrument's comm ports (USB, LAN, GPIB, RS-232)
- Change instrument settings remotely
- Transfer, view, and save measurement data in real-time from the instrument, including user-defined hi/lo limit waveforms, harmonic bar charts, and plots
- Log measurement data over a period of time or with manual trigger
- Communicate with and download data from multiple PA3000 instruments simultaneously
- Create formulas for the calculation of power conversion efficiency and other values
- Export measurement data to .csv format for importing into other applications
- Automate instrument setup, data collection, and report generation for key applications with just a few clicks, using wizard-driven interfaces
- Perform automated full compliance testing for Low Power Standby per IEC62301 ED 2.0 and MIL-STD-1399-Section 300B
- Additional information for using PWRVIEW is available in the built-in online help or can be downloaded as a PDF file from the Tektronix Web site. Go to [www.tek.com/manual/downloads](http://www.tek.com/manual/downloads) and search for PWRVIEW Online Help (Tektronix part number 077-1165-00).



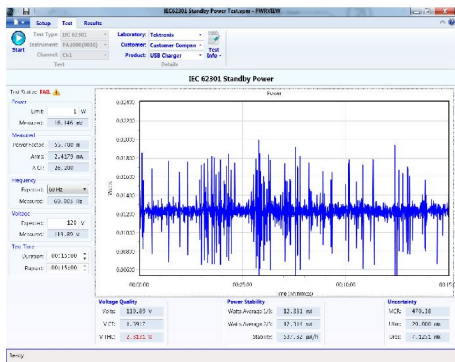
PWRVIEW setup page with variety of default applications and tests



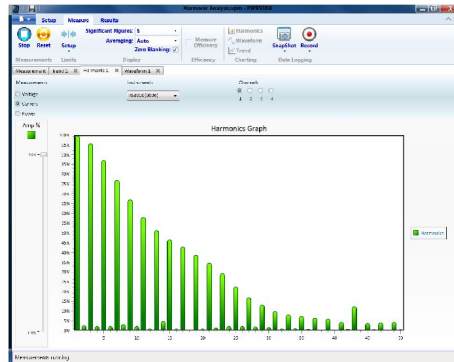
Application wizards for easy and accurate test setup



Waveform view for graphical analysis



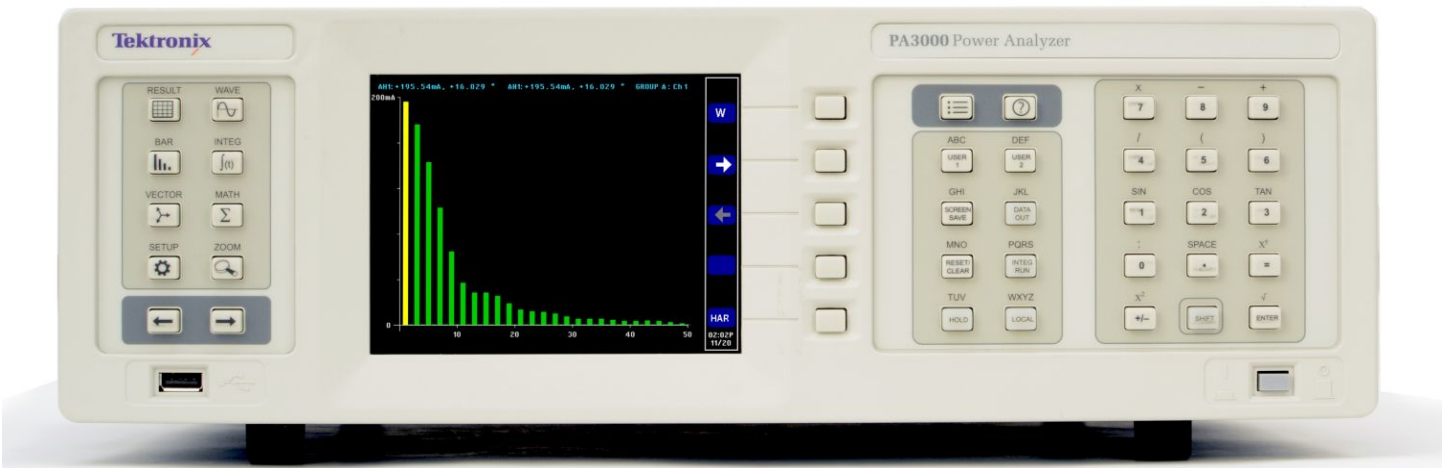
IEC62301 Standby power testing with real-time uncertainty and stability measurements



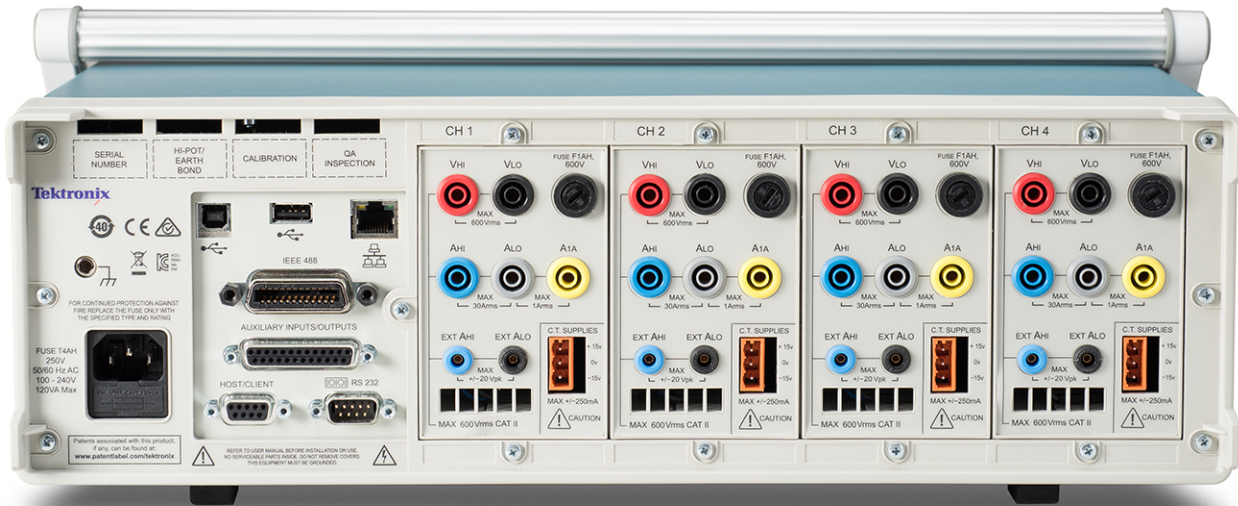
Harmonic analysis to the 100<sup>th</sup> order with user-definable limits

Test Report No 151125-09032 - F						
Measurement of Standby Power for IEC 62301 Ed 2.0						
Parameter	Range	Minimum	Maximum	Min Limit	Max Limit	Status
Power	22.04 mW	22.04 mW	22.06 mW	N/A	1.000 mW	PASS
Voltage	120.00 V	119.97 V	120.03 V	118.00 V	122.00 V	PASS
Current	0.0003 A	0.0003 A	0.0003 A	N/A	N/A	N/A
Power Factor	0.9347	0.9347	0.9347	0.9100	0.9500	PASS
Power Factor	0.9347	0.9347	0.9347	N/A	N/A	N/A
Current Dist. Factor	2.0517	1.9774	1.4145	1.3400	1.4000	PASS
Voltage THD	2.3222 %	2.3222 %	2.3145 %	N/A	2.0000 %	N/A
Uncertainty Index	1.3076	1.3450	0.9222	1.0000	N/A	PASS
Power Stability	N/A	N/A	0.0000 %	N/A	1.0000 %	PASS

Formatted test reports to prove design performance



PA3000 front panel



PA3000 rear panel with four input channels and optional GPIB interface

## Available measurements

$V_{rms}$ – Volts RMS	$A_{cf}$ – Amps crest factor	$VAH_f$ – Fundamental VA hours
$A_{rms}$ – Amps RMS	$V_{thd}$ – Volts total harmonic distortion	$VA_rH_f$ – Fundamental VAR hours
Watt – Watts	$V_{df}$ – Volts distortion factor	$V_f$ – Fundamental volts rms
VA – Volts-Amps	$V_{tif}$ – Volts telephone influence factor	$A_f$ – Fundamental amps rms
$VA_r$ – Volts-Amps reactive power	$A_{thd}$ – Amps total harmonic distortion	$W_f$ – Fundamental power
Freq – Frequency	$A_{df}$ – Amps distortion factor	$VA_f$ – Fundamental apparent power
PF – Power factor	$A_{tif}$ – Amps telephone influence factor	$VA_{rf}$ – Fundamental reactive power
$V_{pk+}$ – Volts peak (positive)	Z – Impedance	$PF_f$ – Fundamental power factor
$V_{pk-}$ – Volts peak (negative)	R – Resistance	$V_{mg}$ – Voltage range
$A_{pk+}$ – Amps peak (positive)	X – Reactance	$A_{mg}$ – Amps range
$A_{pk-}$ – Amps peak (negative)	Hr – Hour	$V_{ll}$ – Voltage Line-to-Line
$V_{dc}$ – DC Volts	WHr – Watt hours	$V_{ln}$ – Voltage Line-to-Neutral
$A_{dc}$ – DC Amps	VAHr – VA hours	$A_n$ – Neutral current ( or phase 3 current for 3p3w )
$V_{rnm}$ – Volts rectified mean	$VA_rHr$ – VAR hours	V Harmonics – Voltage harmonics
$A_{rnm}$ – Amps rectified mean	AHr – Amp hours	A Harmonics – Amps harmonics
$V_{cmn}$ – Volts corrected rectified mean	$W_{av}$ – Average watts	W Harmonics – Watts harmonics
$A_{cmn}$ – Amps corrected rectified mean	$PF_{av}$ – Average power factor	
$V_{cf}$ – Volts crest factor	$CVA_r$ – Correction VAR	

## Measurement channels

One to four channels, factory configurable

Voltage connections (4 mm safety banana jack inputs)	Measurements to 600 $V_{rms}$ , DC to 1 MHz, continuous Measurements to 2000 $V_{pk}$ , maximum crest factor of 10
30 A current connection (4 mm safety banana jack inputs)	Measurements to 30 $A_{rms}$ , DC to 1 MHz, continuous Measurements to 200 $A_{pk}$ , maximum crest factor of 10 Measurements to 75 $A_{rms}$ for 1 s non-repetitive
1 A current connection (4 mm safety banana jack inputs)	Measurements to 1 $A_{rms}$ , DC to 1 MHz, continuous Measurements to 5 $A_{pk}$ , maximum crest factor of 10 Measurements to 2 $A_{rms}$ for 1 s non-repetitive
External current connection (2 mm safety banana jack inputs)	Measurements to 20 $V_{pk}$ , DC to 1 MHz, continuous Measurements to 50 $V_{pk}$ for 1 s
Analog card power supply outputs	$\pm 15$ V supply $\pm 15$ V $\pm 5\%$ , 250 mA max (protected) per analog card output
Each measurement channel includes a set of 4 mm stackable banana safety test leads and 2 mm stackable banana safety test leads.	

## Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise. Specifications are subject to change without notice.

For detailed information on the PA3000 Power Analyzer product specifications refer to the Model PA3000 Power Analyzer Instrument Specifications document, Tektronix part number 077-1252-00 downloadable from [www.tek.com/manual/downloads](http://www.tek.com/manual/downloads).

### Current accuracy

<b>Accuracy <math>A_{rms}</math></b>	(45 Hz to 850 Hz)
<b>1 A shunt</b>	$\pm 0.04\%$ reading $\pm 0.04\%$ range
<b>30 A shunt</b>	$\pm 0.04\%$ reading $\pm 0.04\%$ range
<b>External shunt</b>	$\pm 0.1\%$ reading $\pm 0.04\%$ range
<b>Accuracy <math>A_{rms}</math>, typical</b>	(10 Hz to 45 Hz, 850 Hz to 1 MHz)
<b>1 A shunt</b>	$\pm(0.05 + 2 \times 10^{-5} \times f)\%$ reading $\pm 0.05\%$ range $\pm 40 \mu\text{A}$
<b>30 A shunt</b>	$\pm(0.05 + 2 \times 10^{-5} \times f)\%$ reading $\pm 0.05\%$ range $\pm 4 \text{ mA}$
<b>External shunt</b>	$\pm(0.1 + 2 \times 10^{-5} \times f)\%$ reading $\pm 0.05\%$ range $\pm 1.1 \text{ mV}$
<b>Accuracy <math>A_{dc}</math></b>	
<b>1 A shunt</b>	$\pm 0.05\%$ reading $\pm 0.1\%$ range $\pm 100 \mu\text{A}$
<b>30 A shunt</b>	$\pm 0.05\%$ reading $\pm 0.1\%$ range $\pm 10 \text{ mA}$
<b>External A shunt</b>	$\pm 0.1\%$ reading $\pm 0.1\%$ range $\pm 1.1 \text{ mV}$
<b>Ranges</b>	(peak)
<b>1 A shunt</b>	12.5 mA, 25 mA, 50 mA, 125 mA, 250 mA, 500 mA, 1.25 A, 2.5 A, 5 A
<b>30 A shunt</b>	500 mA, 1 A, 2 A, 5 A, 10 A, 20 A, 50 A, 100 A, 200 A
<b>External A shunt</b>	50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V, 5 V, 10 V, 20 V

### Voltage accuracy

<b>Accuracy <math>V_{rms}</math> (45 Hz to 850 Hz)</b>	$\pm 0.04\%$ reading $\pm 0.04\%$ range
<b>Accuracy <math>V_{rms}</math> (10 Hz to 45 Hz, 850 Hz to 1 MHz), typical</b>	$\pm(0.05 + 1 \times 10^{-5} \times f)\%$ reading $\pm 0.05\%$ range $\pm 20 \text{ mV}$
<b>Accuracy <math>V_{dc}</math></b>	$\pm 0.05\%$ reading $\pm 0.1\%$ Range $\pm 50 \text{ mV}$
<b>Ranges (peak)</b>	5 V, 10 V, 20 V, 50 V, 100 V, 200 V, 500 V, 1000 V, 2000 V

## Supplemental characteristics

The following specifications are supplemental characteristics that provide additional information about instrument functions and performance. These characteristics are non-warranted specifications; they describe the typical performance of the PA3000.

For detailed information on the PA3000 Power Analyzer product specifications refer to the Model PA3000 Power Analyzer Instrument Specifications document, Tektronix part number 077-1252-00 downloadable from [www.tek.com/manual/downloads](http://www.tek.com/manual/downloads).

<b>Hours accuracy</b>	$\pm 0.0125\%$
<b>Watts accuracy (45 Hz to 850 Hz)</b>	$\pm(V_{\text{rms acc}} \times A_{\text{rms}}) \pm(A_{\text{rms acc}} \times V_{\text{rms}})$
<b>Watt hour accuracy</b>	$\pm(\text{Wattacc} + \text{Houracc})$
<b>VA accuracy (45 Hz to 850 Hz)</b>	$\pm(V_{\text{rms acc}} \times A_{\text{rms}}) \pm(A_{\text{rms acc}} \times V_{\text{rms}})$
<b>PF accuracy</b>	$\text{Wacc} / \text{VA}$
<b>Frequency accuracy</b>	
<b>0.1 Hz to 10 Hz</b>	0.1% of reading
<b>10 Hz to 1 MHz</b>	0.5% of reading
<b>Analog inputs</b>	
<b>Ranges</b>	10 $V_{\text{dc}}$ range: $\pm 1 \text{ V}$ to $\pm 10 \text{ V}$ $V_{\text{dc}}$ range: $\pm 0.1 \text{ V}$ to $\pm 1 \text{ V}$
<b>Accuracy</b>	$\pm 0.2\%$ of reading $\pm 0.2\%$ of range $\pm 0.005 \text{ V}$
<b>Sample rate</b>	1000 samples per second

## Communications

<b>IEEE-488 (Option)</b>	IEEE Std 488.1 compliant
<b>RS-232</b>	Baud rates from 9600 bps, 19200 bps (default), and 38400 bps 8 bit, No parity, 1 stop bit, hardware flow control 9 pin male D-type connector
<b>Ethernet</b>	IEEE 802.3 compatible, 10Base-T RJ-45 connector with Link and Activity indicators TCP/IP connection on port 5025
<b>USB device</b>	USB 2.0 compatible, Full speed (12 Mb/sec)



## General specifications

<b>EMC</b>	Conforms to European Union EMC directive
<b>Safety</b>	Conforms to European Union Low Voltage directive
<b>Temperature</b>	
<b>Operating</b>	0 °C to 40 °C (32 °F to 104 °F), 70% relative humidity up to 31 °C (87.8 °F)
<b>Storage</b>	-25 °C to 65 °C (-13 °F to 149 °F)
<b>Altitude</b>	Up to 2000 m (6562 ft) above sea level
<b>Warm up time</b>	One hour
<b>Calibration period</b>	One year
<b>Power supply</b>	100 V to 240 VAC, 50 Hz or 60 Hz, 120 VA maximum
<b>Transducer power supply</b>	±15 V, Maximum current 250 mA per analog card
<b>Dielectric strength</b>	Mains supply inlet (Live + Neutral to earth): 1.5 kVAC Voltage measurement inputs : 2 kV <sub>pk</sub> to earth Current measurement inputs : 2 kV <sub>pk</sub> to earth
<b>Dimensions</b>	
<b>With handle and feet</b>	14.6 cm high × 45 cm wide × 33.5 cm deep (5.75 in × 17.75 in × 13.2 in)
<b>Without handle and feet</b>	13.2 cm high × 42 cm wide × 33.5 cm deep (5.2 in × 16.5 in × 13.2 in)
<b>Weight</b>	9.5 kg (20.9 lb) – 4 channel instrument with GPIB option installed
<b>Warranty</b>	Three years

## Ordering information

### PA3000 models

A PA3000 must be ordered with one of the following options:

<b>Opt. 1CH</b>	One input module installed
<b>Opt. 2CH</b>	Two input modules installed
<b>Opt. 3CH</b>	Three input modules installed
<b>Opt. 4CH</b>	Four input modules installed

### Standard accessories

- Lead Set (one per input module)
- Country-specific power cord
- Power output for external current transducers
- USB Host - to - Device interface cable
- Certificate of calibration documenting traceability to National Metrology Institute(s) and ISO9001 Quality System Registration
- Three year product warranty

### Options

<b>Opt. GPIB</b>	GPIB Interface
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### Language options

No language options. Translated manuals can be downloaded from the Tektronix Web Site for the following languages:

- French (Tektronix part number, 077115300)
- German (Tektronix part number, 077115400)
- Japanese (Tektronix part number, 077115500)
- Korean (Tektronix part number, 07711600)
- Simplified Chinese (Tektronix part number, 077115700)
- Spanish (Tektronix part number, 077116000)
- Portuguese (Tektronix part number, 077116100)

### Power cord options

<b>Opt. A0</b>	North America power plug (115 V, 60 Hz)
<b>Opt. A1</b>	Universal Euro power plug (220 V, 50 Hz)
<b>Opt. A2</b>	United Kingdom power plug (240 V, 50 Hz)
<b>Opt. A3</b>	Australia power plug (240 V, 50 Hz)
<b>Opt. A4</b>	North America power plug (240 V, 50 Hz)
<b>Opt. A5</b>	Switzerland power plug (220 V, 50 Hz)
<b>Opt. A6</b>	Japan power plug (100 V, 50/60 Hz)
<b>Opt. A10</b>	China power plug (50 Hz)

Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

### Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)

### Recommended accessories

BB1000-UN	Universal breakout box (120 V/240 V)
CT-60-S	Fixed-core current transducer, AC/DC, high accuracy, up to 60 A
CT-200-S	Fixed-core current transducer, AC/DC, high accuracy, up to 200 A
CT-1000-S	Fixed-core current transducer, AC/DC, high accuracy, up to 1000 A
CT-100-M	Fixed-core current transducer, AC/DC, Hall effect, up to 100 A
CT-200-M	Fixed-core current transducer, AC/DC, Hall effect, up to 200 A
CT-1000-M	Fixed-core current transducer, AC/DC, Hall effect, up to 1000 A
CL200	Current clamp, 1 A - 200 A, for Tektronix Power Analyzers, AC only
CL1200	Current clamp, 0.1 A - 1200 A, for Tektronix Power Analyzers, AC only
PA-LEADSET	Replacement lead set for Tektronix Power Analyzers (One channel lead set)

See Accessories datasheet # 55W-30309-0 for more detailed descriptions.



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.



Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

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