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IEC Compliance Test Systems CTS Series

- **Certified IEC Compliance**
  Certified by the National Physics Laboratory in the United Kingdom for full compliance with the IEC Harmonics and Flicker standards.
- **PC Based IEC Test System**
  High speed PC Based data acquisition system streams all data to disk.
- **Field Upgradable**
  Software only upgrades to meet future standard requirements
- **IEC 61000-3-2 Harmonics**
- **IEC 61000-3-3 Flicker**
- **IEC 61000-4-11 Voltage Dips and Variations**
- **IEC 61000-4-13 Harmonics & Interharmonics**
- **IEC 61000-4-14 Voltage Fluctuations**
- **IEC 61000-4-17 DC Ripple**
- **IEC 61000-4-28 Frequency Variations**



CE

Unique Features

- Single and Three phase systems to accommodate a range of power levels.
- Direct PC bus access data acquisition system provides high sampling rate and resolution for accurate measurements and high speed data transfers, even in three phase mode.
- PC based harmonic and flicker test software provides real-time full color data display updates and continuous PASS/FAIL monitoring.
- Support for both **European** and **Japanese** standards.
- Simple user operation under Windows 95/98® or Windows NT®, provides IEC test setup, data analysis, display and reporting.
- High resolution, no gap acquisition data storage to disk in ASCII format for post-acquisition analysis and reporting.
- Single Step and Fast Forward replay of recorded test data.

Modular Architecture

The CTS system is a complete IEC compliant test system, consisting of a separate AC power source and a PC based AC power analyzer.

- Programmable IEC compliant AC power source in single or three phase configurations.
- PC Based single or three phase digital power analyzer (PC not included).
- Choice of ISA, PCI or PCMCIA based A/D cards to accommodate desktop or laptop PC's.
- Harmonics Analyzer and Flicker meter software.
- Programmable reference impedance per IEC 725 for Flicker and Japanese Harmonics measurements.
- Optional IEC 725 lumped flicker reference impedance available for European Flicker standard.
- Optional Electronic Output Switch (EOS) to meet IEC 1000-4-11 source requirements.

Full Featured AC Power Source

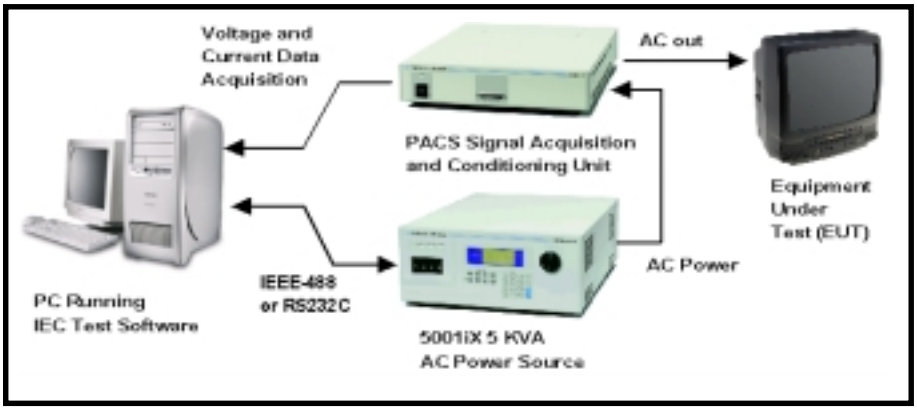
Available in a choice of power levels ranging from 1250 VA to 30,000 VA, CTS Systems cover the complete range of single and three phase products that need testing to conform with existing and pending IEC standards. All iX Series AC sources meet IEC requirements for low voltage distortion and offer arbitrary waveform generation, precision measurements, and waveform analysis capabilities.

All iX Series based CTS systems support full compliance IEC 61000-4 AC immunity test as well (certain options may be required).

The 1251RP source meets the same requirements for low power loads with crest factors less than three. AC Source voltage distortion is measured in real-time during the harmonics test and any distortion that could affect the test results is clearly indicated.

California Instruments

CTS Series - System Components



PC Bus Data Acquisition

A high speed digital signal processor based data acquisition system is used to implement the required IEC compliance measurement system. Direct access to the PC bus ensures a much higher data throughput capability than typically found in single box IEC test systems that use the IEEE-488 instrumentation bus to communicate with the PC.



A special signal conditioning and isolation unit is used to provide quick and easy connection between the AC source output and the Equipment Under Test. This unit provides the required isolation, signal conditioning and anti-alias filtering for the measurement system. The equipment under test can be plugged in the front panel mounted European style outlet, or wired to a rear panel mounted terminal block. An optional international socket strip with multiple country specific outlets is available.

Harmonics Analyzer

A key part of the CTS system is the IEC compliant power analyzer which provides detailed information on both voltage and current harmonics. Measurements are made in real-time with no measurement gaps to fully conform to IEC 61000-3-2 transitory harmonics test requirements. AC source voltage and EUT power are monitored continuously during the entire test. Voltage distortion and current harmonic data is checked against IEC class limits for pass or fail detection. Comprehensive test reports can be generated easily. Continuous measurement of the EUT power consumption allows class C and D test limits to be calculated dynamically.

Test limits are retained in a password protected database and can be updated if needed in the future without the need to change software. Other software changes as a result of changing IEC harmonics standard can be accomplished by simply downloading new PC software. No harmonics testing software resides in system firmware which would require more costly upgrades.

Source Control

The IEC GUI software controls the AC power source using the IEEE-488 or RS232C interface. Settings for nominal voltage and frequency are automatically applied and possible overload conditions are detected and reported to the operator. IEC 61000-4 AC immunity tests run completely under software control.

Flicker Meter and Impedance

An IEC 868 compliant flicker meter is provided with the CTS software. The required IEC 725 compliant reference impedance is implemented in the iX Series AC Source using programmable output impedance. Programmable impedance offers improved accuracy compared to a lumped reference impedance and the ability to support different national standards without the need to switch out lumped reference impedance hardware. A good example is testing for compliance with the Japanese harmonics and flicker standard, which requires different impedance values to be programmed from the European test standard.

Optionally, a lumped impedance compliant with IEC 725 can be ordered for both single and three phase iX Series based CTS systems. The GUI software can be configured to use either impedance type during flicker testing.



The three phase lumped impedance option (-LR3) for the 15003iX-CTS system is shown here. The 30003iX-CTS system does not support programmable impedance and requires option -LR4 for flicker testing.

The RP-Series based CTS systems use a lumped impedance integrated in the PACS-1RP and PACS-1RP2.

CTS Series - IEC 61000-3-2 Harmonics Test

Simple buttons start and stop automated test.

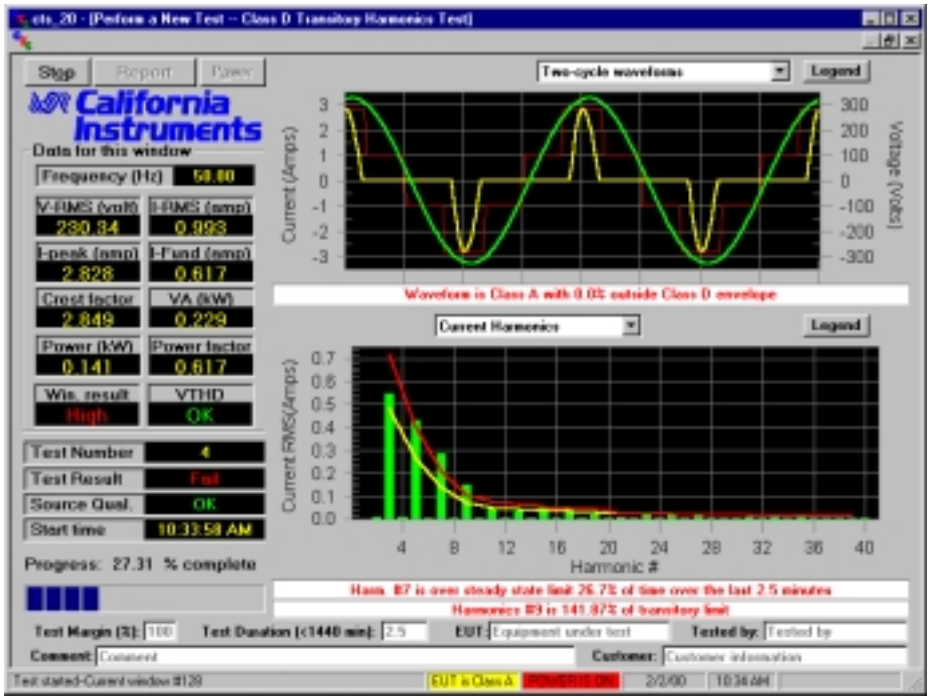
Key EUT electrical parameters are updated continuously.

User selectable test limit margin.

Test start time and test progress are clearly indicated.

Clearly marked Pass (Green) or Fail (Red) indication is active during the entire test run. AC Source distortion is also monitored at all times.

Graphs and reports provide complete test data documentation.



IEC Harmonics Test Window

Both Voltage and Current waveforms are shown in real-time. For class A and D test, the special waveshape template (red) is shown.

Bottom graphs show current harmonics against IEC class limits. The user can also view the source voltage harmonics in real-time.

Equipment Under Test description and operator ID are added to all test reports.

Simple User Interface

All IEC Harmonics tests can be accessed from a single control and data display window on the PC. Both Quasi Stationary and Transitory (Fluctuating) Harmonics tests can be run. The operator is presented with a simple screen that shows the type of test that will be run and the test duration. Clearly labeled buttons are provided for Starting and Stopping a test. During the test run, voltage and current time domain waveform displays are updated in real time. The left part of the display shows all power analyzer parameters for the EUT such as V_{RMS}, I_{RMS}, I_{FUND} I_{PEAK}, Real Power, Apparent Power and Power Factor. The current harmonics window displays instantaneous current harmonics and a line marking the applicable test limits. During the entire test run, a clear PASS or FAIL indication is provided. Any conditions occurring during the test run that may affect the test results can be displayed. This includes voltage THD of the AC source, which is monitored during the entire test. Information about the operator and the unit under test can be entered. A general user comment field is provided to enter any relevant data concerning the test. All this information is added to the final test report.

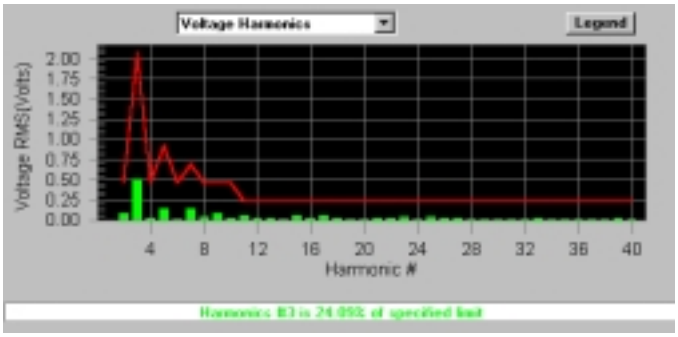
Available Data Displays

The following graphics displays are provided in the IEC 61000-3-2 test program

- Voltage and Current time domain
- Current Harmonics and IEC limits graph
- AC Source Voltage Harmonics and IEC limits graph
- Numeric display of F, V_{RMS}, I_{RMS}, I_{FUND}, I_{PEAK}, PF, W, VA

Test Reports & Data Logging

A complete IEC harmonics test report, which includes all test results for the EUT, can be printed at the end of the test. This report includes graphs showing voltage and current waveforms as well as current harmonic spectrum and class limits. All graphs are included in the test report or can be copied to the Windows® Clipboard for inclusion in custom reports. Comprehensive test data, including timing waveform data, is available from disk for use in detailed



Real-time Voltage Distortion against IEC limit

reporting or further data analysis applications. Data is stored in ASCII format files that can be loaded directly in popular spreadsheet programs. A test file replay mode is supported by the CTS system software that allows frame by frame playback of test data files for detailed analysis of EUT behavior.

CTS Series - IEC 61000-3-3 Flicker Test

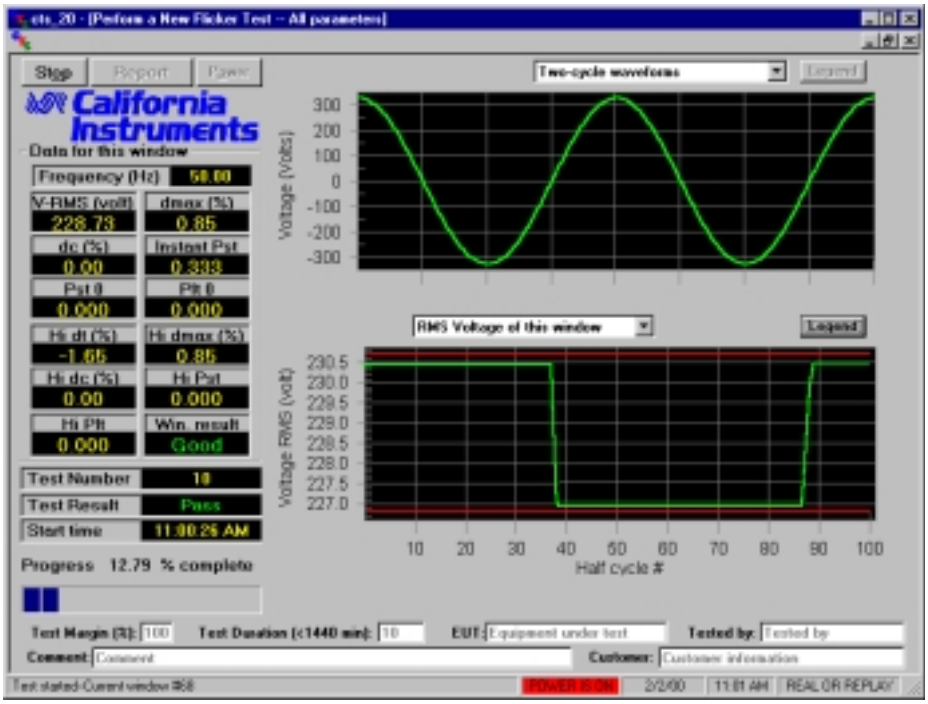
Start and Stop Flicker tests with the click of a button.

Start time, current time and stop time monitoring.

Highest values found during test are continuously shown and updated.

Clear Pass (Green) or Fail (Red) indication leaves no doubt about the test result.

User selectable test time.



IEC Flicker Test Window

Select test parameters and data display options.

IEC Test limits can be changed for pre-compliance applications.

Real time display of d_t, d_c and V_{rms}.

Continuous readouts of V_{rms}, d_{max}, d_c, Plt and Pst provide test progress feedback.

Equipment Under Test description and operator ID are added to all test reports.

Simple User Interface

The Flicker test software module uses a similar user interface as the Harmonics module. This makes it instantly familiar to the user. Setup is minimal and test runs can be started quickly. During the test run, graphical displays of V_{RMS}, d_c and d_t as a function of time are updated continuously. The bottom part of the display shows Flicker test related parameters for the EUT such as V_{RMS}, d_{max}, d_c and d_t. At the end of the test sequence, short term (P_{st}) and long term Flicker (P_{lt}) are calculated and a clear PASS or FAIL indication is provided.

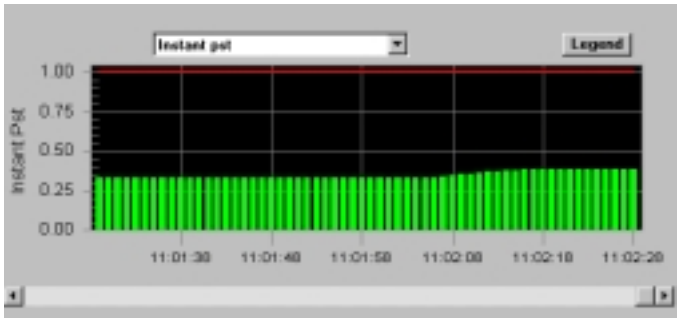
IEC 725 Reference Impedance

The reference impedance required to perform flicker measurements per IEC 725 is built-in to the PACS-1RP unit for the 1251RP-CTS system or the PACS-1RP2 for the 2001RP-CTS system. All iX Series based CTS configurations use the programmable output impedance of the AC Source to provide the required output impedance. Users that prefer to use a lumped reference impedance can order option -LR1 for single phase iX-Series based CTS systems or option -LR3 or -LR4 for three phase systems.

Available Data Displays

The following graphics displays are provided in the IEC 61000-3-3 test program:

- Chart of d_c and d_t versus time
- Chart of V_{RMS} versus time
- Color PASS/FAIL indicator
- Numeric display of V_{RMS}, d_{max}, d_c, P_{st}, and P_{lt}
- Numeric display of maximum d_c, d_{max}, d_t, P_{st} and P_{lt}



Real-time display of instantaneous Pst

Test Reports and Data Logging

A summary IEC 61000-3-3 Flicker test report can be printed at the end of the test which includes all test results for the EUT. Refer to the section on IEC 61000-3-2 for report details and capabilities. A test file replay mode is supported by the CTS system software that allows frame by frame playback of test data files for detailed analysis of EUT behavior.

CTS Series - IEC 61000-4 Immunity Test[1]

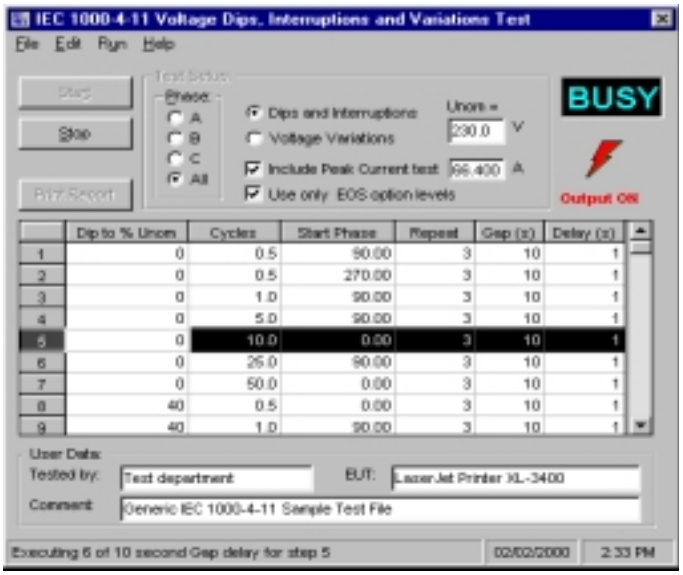
iX-Series based CTS systems are supplied with additional software that allows a series of AC immunity tests to be performed on the unit under test. Pass or Fail results are determined by the user based on an evaluation of the unit under test at the end of the test run.

IEC 61000-4-11 Voltage Dips and Interruptions Test[2]

The Voltage Dips and Interruptions test are included in the AC source control program supplied with the CTS system. The operator is presented with a simple screen that shows the type of test that will be run and the test duration. The operator can enter the desired nominal test voltage and frequency.

Clearly labeled buttons are provided for Test Run and Test Abort. During the test run, the EUT load current is measured to help the operator observe any EUT failures.

Test parameters can be changed by the user if needed to accommodate different test levels called out by product standard committees. For AC source compliance, the EOS option is required. This option is available on 3001iX-CTS, 5001iX-CTS and 15003iX-CTS systems.



IEC 61000-4-11 Test Window



IEC 61000-4-13 Test Window

IEC 61000-4-13 Harmonics and Interharmonics[3]

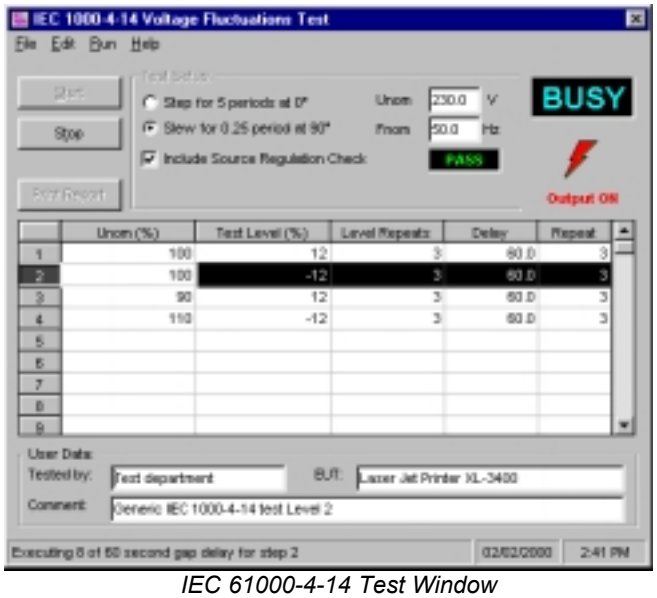
The iX Series AC/DC Source can be equipped with the -413 option to provide full support for IEC 61000-4-13 Harmonics and Interharmonics testing. An independent, digitally controlled sweep generator is used to superimpose interharmonics on the AC output. The high speed data acquisition system is used to determine EUT resonance points during the frequency sweep test. Flat top curve and overswing curve waveforms are generated using the arbitrary waveform generation capability of the iX Series AC/DC source.

At the end of the test run, a detailed test report can be printed for complete documentation of test setup and results.

IEC 61000-4-14 Voltage Fluctuations, IEC 61000-4-17 DC Ripple[4] & IEC 61000-4-28 Frequency Variations

Rounding out the suite of IEC 61000-4 test programs are IEC 61000-4-14 Voltage Fluctuations, IEC 61000-4-17 DC Ripple and IEC 61000-4-28 Frequency Variations immunity tests. Test parameters are pre-programmed or can be modified easily if needed. The user is capable of specifying a library of test sequences and test levels for different product categories. These test setups can be quickly recalled for application to the EUT.

At the end of each test run, a test report can be generated by clicking on the Print Report button.



IEC 61000-4-14 Test Window

[1] Compliant IEC 61000-4 Tests are not supported on RP-Series based CTS systems or systems without an AC source (100-CTS and 300-CTS).
[2] IEC 61000-4-11 AC Source compliance requires -EOS option.
[3] IEC 61000-4-13 test requires -413 option.
[4] IEC 61000-4-17 test requires iX Series based CTS systems.

CTS Series - Report Generation

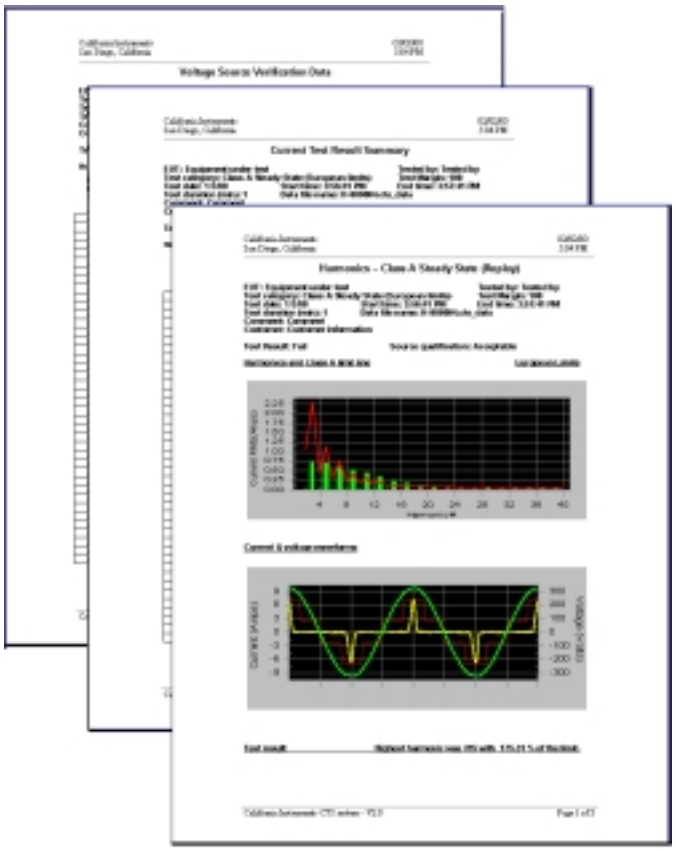
MS Word Test Reports

Test reports for harmonics, flicker and immunity tests are generated using MS Word format. This widely used format report can be integrated into more elaborate reports covering all aspects of compliance testing if needed.

Test reports contain data on the EUT, the test lab and operator, all measurement results and a clear pass or fail indication. Harmonics test reports include current harmonics and voltage harmonics data in both bar charts and tabular formats.

Detailed measurement data is also available on disk and can be exported to a tab delimited ASCII text format for use in other application programs such as MS Excel. This allows further analysis of the acquired data for engineering troubleshooting purposes of EUT's that did not pass.

Note: A copy of MS Word must be installed on the PC to generate test reports.



CTS Series - PACS Specifications

The Power Analyzer and Conditioning System unit provides the required interface between the AC source, the Equipment Under Test and the PC. Single phase CTS Systems are supplied with a PACS-1, three phase CTS systems are supplied with a PACS-3. RP Series based CTS systems include a lumped reference impedance in the PACS-1

PACS Model:		PACS-1	PACS-3
Number of phases		1	3
Channels	Voltage and Current	2	6
Connector Style	Front panel	CEE/77 front	none
	Rear panel	terminal block	terminal block
Maximum voltage	Front panel	240 Vac	n/a
	Rear panel	300 Vac	480 Vac
Maximum current	Front panel	16 Arms	n/a
	Rear panel	40 Arms	40 Arms/phase
IEC 725 Reference	RP-Series CTS:	internal	n/a
Impedance[1]	iX-Series CTS:	programmable Z	programmable Z
	Optional Lumped:	option -LR1	option -LR3/-LR4
Dimensions	HxWxD	3.5 x 16.8 x 22	5.25 x 16.8 x 22
	HxWxD	89 x 427 x 560	134 x 427 x 560

1 *30003iX-CTS systems do not offer programmable impedance and require option -LR4 for Flicker test. Options -LR1 and -LR3 may be added to 3001iX-CTS / 5001iX-CTS or 15003iX-CTS configurations to be used in lieu of the standard programmable impedance. Option -LR1 is built-in to PACS-1. Option -LR3 and -LR4 consist of OMNI-3-18i and OMNI-3-37i respectively. See OMNI data in options section of this catalog.*

CTS Series - Measurement Specifications

The following specifications are valid for the power analyzer portion of the CTS.

PC Based A/D Conversion

The Harmonics Analyzer is implemented using a high performance Digital Signal Processor based PC plug-in A/D card. This digitizer connects directly to the Power Analyzer and Conditioning System (PACS) unit through a shielded cable. No other connections between the PACS unit and the PC are required.

The use of a fast multi-channel A/D card that transfers data to PC memory using Direct Memory Access (DMA) enables the CTS to perform continuous measurements without any gaps in measured data, an important requirement for Transitory Harmonics and flicker testing.

A choice of ISA, PCI or PCMCIA (PC-Cardbus) options is available to accommodate a wide range of PC platforms. *Note: PCMCIA (-MC Option) only supports single phase CTS configurations.*

Signal Conditioning

The Power Analyzer and Conditioning System (PACS) unit is used to provide isolation between the PC based acquisition system and the Equipment Under Test (EUT). Precision current transformers provide accurate current sensing over three different current ranges for maximum resolution. The PC based acquisition system captures data on all current ranges and automatically selects the appropriate range to use for further processing. This eliminates the need for range switching as is commonly done in conventional power analyzers.

Anti-aliasing filters are provided for all voltage and current channels to prevent unwanted frequency components from affecting the measurement results.

The same PACS unit also provides a convenient way for the user to connect the unit under test. A single signal cable connects between the PC and the PACS unit and provides all the analog and digital signals needed to and from the A/D card.

Measurement		Specification	Unit
Bandwidth			
Anti Aliasing		> 60 dB at 5 kHz	
Bandpass ripple		< 2 % up to 2.5 kHz	%
Volts			
Range		0.001 - 312.00	V_{rms}
Max. input		1000	V_{peak}
Max. crest factor		5:1	
Accuracy		±0.1 % ± 0.05 % FS ± 3 mV	
Resolution		10	mV
Voltage CMRR		80	dB
RMS Current			
Current ranges (Auto ranging)		4, 16, 40	A_{rms}
Highest range		40.00	A_{rms}
Max. input [permanent, no damage if < 200 A_{peak}]		40.00	A_{rms}
Max. Crest Factor [High Range]		5:1	
Max. Crest Factor [Low Range]		20:1	
Accuracy		±0.1 % ± 0.05 % FS ± 3 mA	mA
Resolution		1	mA
Power			
Range		0.1 - 12,500	W
Accuracy		±0.25 % ± 0.25 % FS ± 20 mW	mW
Resolution		0.1	W
Apparent Power			
Range		0.1 12,500	VA
Accuracy		±0.15% ± 0.15% FS±20mVA	mVA
Resolution		0.1	VA
Power Factor			
Range		0.000 - ± 1.000	
Accuracy		± 0.005	
Resolution		0.001	
Crest Factor			
Range		20:1	
Accuracy		± 0.005	
Resolution		0.001	
Frequency			
Range		45.0 - 65.0	Hz
Accuracy		0.01 % of reading	Hz
Resolution		0.1	Hz
Harmonic Analysis			
Range		Fundamental to 40th	
Accuracy Fundamental		±0.05% FS±0.05%/kHz	
Accuracy Harmonics		±0.1 %±0.1%/kHz	
Measurement window		16 periods	
Smoothing filter		1.5	sec
Flicker			
Pst	Range	0.1 - 10	Pst
	Accuracy	3	%
	Resolution	0.01	
	Integration time	10	min
Plt	Range	0.1 - 10	
	Integration time	120	min
dmax	Range	0 - 100	%
dc	Range	0.1 - 100	%
dt	Range	0.1 - 100	%
dt over 3% (4%)	Range	0 - 1000	ms



CI400PCI - PCI A/D Card



CI68C - PACS to PC Cable

Note: For three phase configurations, all specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.

Ordering Information

For specifications on the AC power source included with each CTS system, refer to the relevant AC Source data sheet.

Model	VA Power	AC Source	IEC 61000-4	PACS model
Single Phase Systems				
100-CTS	AC Line	none	-	PACS-1
1251RP-CTS	1250 VA	1251RP	-	PACS-1RP
2001RP-CTS	2000 VA	2001RP-LZ	-	PACS-1RP2
3001iX-CTS	3000 VA	3001iX	◆	PACS-1
5001iX-CTS (-400)	5000 VA	5001iX (-400)	◆	PACS-1
Three Phase Systems				
300-CTS	AC Line	none	-	PACS-3
15003iX-CTS (-400)	15000 VA	15003iX (-400)	◆	PACS-3
30003iX-CTS (-400)	30000 VA	30003iX (-400)	◆	PACS-3

PC Requirements

The CTS requires the use of a PC capable of running Windows 95/98® or Win NT 4.0/2000. For best performance, networking should be disabled. Recommended PC hardware specifications are as follows:

CPU Pentium 333 MHz or faster.

RAM 64 Mbytes or more.

Hard Disk 500 Mbytes or more. 20 Mbytes required for program storage.

Display Color SVGA Monitor

Slots Available PCI, ISA or PCMCIA slot for A/D card.

Software MS Word, Windows

IEEE-488 If IEEE-488 is used for AC source control, a National Instruments bus controller and available PC slot is required. An RS232C serial port can be used also.

California Instruments will quote a PC as part of the system on request. Contact factory for details.

Options

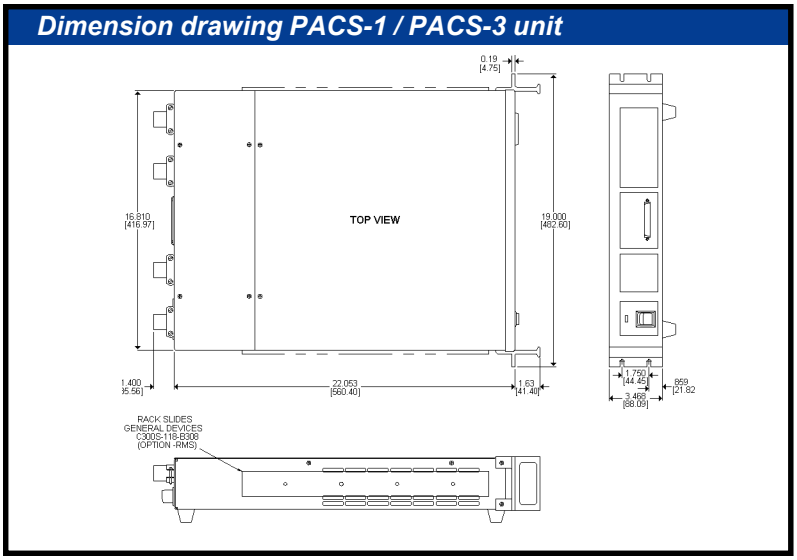
One of the following A/D cards must be specified with any CTS order:

-ISA CI400AD ISA Bus A/D Card. (default)

-PCI CI400PCI PCI Bus, 16 bit A/D Card

-MC CI400MC PCMCIA A/D Card. (Single phase CTS configurations only.)

Dimension drawing PACS-1 / PACS-3 unit



iX Series CTS Options:

-LR1 Lumped Reference Impedance for single phase iX Series based configurations.

-LR3 Lumped Reference Impedance for 15003iX-CTS. (OMNI-3-18i)

-LR4 Lumped Reference Impedance for three 30003iX-CTS. (OMNI-3-37i)

-EOS1 IEC 61000-4-11 AC source compliance Electronic Output Switch for single phase CTS Systems.

-EOS3 IEC 61000-4-11 AC source compliance Electronic Output Switch for 15003iX System.

-411 IEC 61000-4-11 Voltage Dips and Interruptions test option.

-413 IEC 61000-4-13 Harmonics and Inter-Harmonics test option.

-LNS Internal AC Line Sync. (iX Series only)

-XLS External AC Line Sync. (iX Series only)

General Options:

-RMS Rack mount slides.

Accessories:

CI400AD Spare ISA A/D card.

CI400PCI Spare PCI A/D Card

CI400MC Spare PCMCIA A/D Card

CI37C Spare 37 pin signal interface cable for ISA.

CI68C Spare 37 pin signal interface cable for PCI.

CI50C Spare 37 pin signal interface cable for MC.

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