California Instruments

An **AMETEK**® Company

CTS Series 3.2
IEC COMPLIANCE TEST SYSTEMS

1250VA-45000VA
Programmable AC and DC
Immunity Compliance Testing

CE

Complete Test Solutions
Complete test solutions for emissions and immunity compliance testing of AC and DC powered products

Single & Three Phase Operation
User-defined

Harmonic & Flicker Testing
provides real-time full color data display updates and continuous PASS/FAIL monitoring.

Supports Global Standards
Supports European and Japanese standards

Easy-to-Use Interface
Provides IEC test setup, data analysis, display, MS Word test reports, and data files are generated in MS Excel format

Single Step
Single Step and Fast Forward replay of recorded test data

Integrated System

The CTS Series represents an innovative approach to Immunity Compliace Testing. The direct PC bus access data acquisition system provides a high sampling rate and resolution for accurate measreuments and high speed data transfers; unlike competing IEC test systems, which only provide limited data throughput from the analyzer to the PC.

Virtually all electrical and electronic products manufactured today must meet international regulatory requirements for emissions and immunity. This is particularly true for products sold in Europe and Japan. As standards are increasing globally, compliance testing has become a mandatory function for manufacturers.

Featuring either our *i*X or MX Series controller, the CTS Series provides a cost effective test solution aimed at verifying product compliance to a large number of AC and DC related harmonized test standards. The CTS is used by hundreds of EMC labs and in-house test facilities throughout the world; widely recognized for it's plethora of features and capabilities combined with it's easy of use.

CTS Series - Certified, Unique and Cost Effective

Compliance Testing to:

- **EN / IEC 61000-3-2 Ed. 3 (2005-11)**
  Harmonics < 16 Arms/Phase

- **EN / IEC 61000-3-12**
  Harmonics, 16 - < 75 Arms/phase

- **EN / IEC 61000-3-3 incl. Amd. 1, 2**
  Flicker Measurement, < 16 Arms/phase

- **EN / IEC 61000-3-11[1]**
  Flicker Measurement, < 75 Arms/phase

- **EN / IEC 61000-4-11 Ed. 2 (option)**
  AC Voltage Dips and Variations

- **EN / IEC 61000-4-13 (option)**
  Harmonics & Interharmonics (option)

- **EN / IEC 61000-4-14**
  AC Voltage Fluctuations

- **EN / IEC 61000-4-17**
  DC Ripple

- **EN / IEC 61000-4-28**
  Frequency Variations

Pre-compliance Testing to:

- **EN / IEC 61000-4-27**
  Three phase AC Voltage Unbalance

- **EN / IEC 61000-4-29**
  DC Voltage Dips and Interruptions

NPL Certified Compliance

The CTS System has been certified by the National Physics Laboratory (NPL) in the United Kingdom for full compliance with the IEC Harmonics and Flicker standards. The NPL is an independent test laboratory and a recognized authority on AC calibration.

Cost-Effective and Upgradable

The use of PC based acquisition and processing of data and test limits provides a cost effective platform that can grow with your needs and ensures that more processing power will be available in the future without costly hardware upgrades. Single phase systems can be upgraded to three phase capabilities when your test load demands it.

The iX and MX Series AC power sources used in CTS systems (except 1251RP-CTS) provide a wealth of features and capabilities for other AC and DC power applications as well, further enhancing your return on investment.

Note 1: *Maximum current per phase supported on MX45-3Pi-CTS is 63 A/phase for EN/IEC 61000-3-11 Flicker test and IEC61000-3-12 Harmonics. Contact factory for requirements > 63 A/phase.*

Graphical User Interface

Windows® Graphical User Interface is included with the Compact *i*X and *i* Series[1]. This software provides easy access to the power source's capabilities without the need to develop any custom code. The following functions are available:

- Steady state output control (all parameters)
- Create, run, save, reload & print transient programs
- Generate & save harmonic waveforms [C-*i*X only]
- Generate & save arbitrary waveforms [C-*i*X only]
- Measure & log standard measurements
- Capture & display output voltage & current waveforms [C-*i*X only]
- Measure, display, print & log harmonic voltage & current measurements [C-*i*X only]
- Display bus traffic to & from the AC Source to help you develop your own test programs.

1. *Requires PC running Windows Vista™, Windows XP™, or Windows 2000™.*

CTS Series - Modular System Components

AC Power Source

Available in a choice of power levels ranging from 1250 VA to > 45,000 VA, the CTS Systems covers the complete range of single and three phase products that require 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. Actual 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.

All iX Series based CTS systems support full compliance testing for several IEC 61000-4 AC immunity standards as well (certain options may be required, see ordering information for details).

Direct PC 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 either the IEEE-488 instrumentation, USB, LXI or RS-232 bus to communicate between the analysis instrument and the PC.

This high-speed acquisition system architecture stores raw data to the hard drive and offers several features. It not only possesses the ability to support future versions of test standards by merely installing new PC software but it also greatly reduces the risk of product obscolescence as test standards evolve. Furthermore, since the data is streamed to hard disk in real-time, a complete data record is created each time which may be used for audit purposes, data replay and further analysis or to prove compliance to all the measurement requirements specified in the test standard.

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 (single phase systems only), or wired to a rear panel mounted terminal block.

Harmonics Analyzer

A key part of the CTS system is the IEC compliant power analyzer which provides detailed information on both voltage and current. Measurements of both harmonics and interharmonics are made in real-time with no measurement gaps to fully conform to the latest revision of the IEC 61000-4-7 test standard. 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.

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 installing new PC software. No harmonics testing software resides in system firmware which would require more costly field upgrades.

Flicker Reference Impedance

An IEC61000-4-15 compliant flicker meter is an integral part of the CTS software. The required IEC 60725 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 as compared to the European test standard.

Optionally, a lumped impedance compliant with IEC 60725 or the Z-test specification of IEC61000-3-11 can be ordered for single or three phase iX Series based CTS systems. For three phase CTS systems, a lumped impedance option is recommended. The software can be configured to use either impedance type during flicker testing.

The 751iX/1501iX and 10001iX based CTS versions and MX45-3Pi-CTS systems do not support programmable impedance and require option -LR2, LR4 or OMNI-3-75i for flicker testing.

The 1251RP-CTS system comes standard with a lumped impedance which is integrated in the PACS-1RP.

Model 15003iX-CTS 15 kVA three phase test system shown in optional Cabinet

Note: Specifications are subject to change without notice. Specifications are warranted over an ambient temperature range of 25°± 5° C. Unless otherwise noted, specifications are per phase for a sinewave with a resistive load and apply after a 30 minute warm-up period. For three phase configurations, all specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.

The CTS system offers full compliance harmonics testing per EN/IEC 61000-3-2 Ed. 3 (2005) as well as EN/IEC 61000-3-12 (additional software will be required). Third generation software version 3.0 implements the latest revisions of the test standard.

The CTS system supports several new capabilities that are required to meet IEC 61000-4-7 Ed. 2 and upcoming amendments thereto. This includes measurement of both harmonics and interharmonics, Partial Odd harmonic Current (POHC) and Partial Weighted Harmonics Distortion (PWHD) evaluation per the latest standards.

In addition, the system measures the H_5 phase and determines if there is a prevailing phase angle per IEC61000-3-12 (CTS-H version).

Despite these advanced capabilities, the CTS system remains as easy to use as it has been from its first inception, with easy configuration and test selection menus.

Harmonics Test Report in MS Word
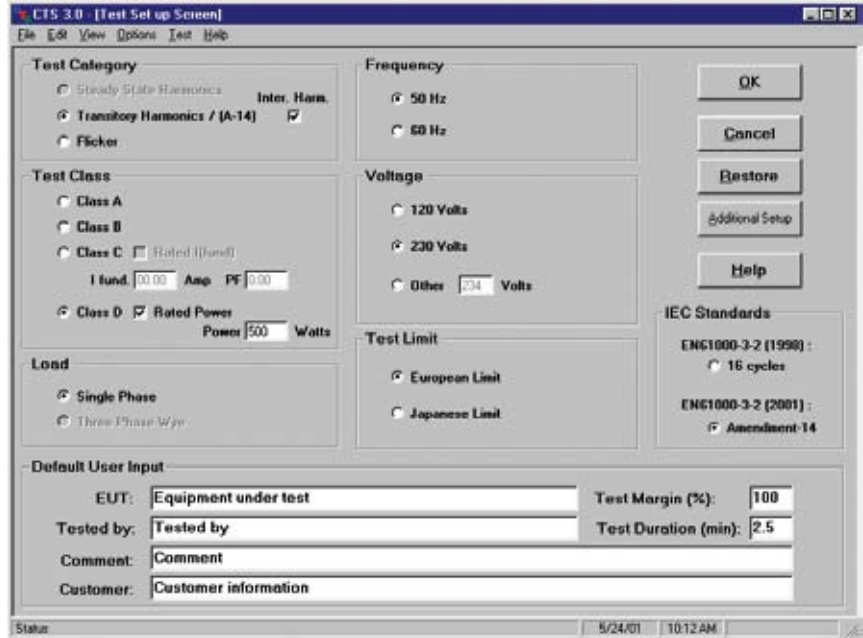
CTS System GUI Setup Window

Test Selections

At the onset of a harmonics test, the operator is able to select from a number of options using the setup screen shown here. Version 3.0 of the CTS software supports the IEC 61000-3-2:Ed. 3 (2005) standard and the user can select inter-harmonic evaluation, with grouping according to the method specified in IEC61000-4-7. Data is acquired in 10 cycles per window for 50 Hz EUT's and 12 cycles per window for 60 Hz EUT's (200 msec time windows), and products may be evaluated per the European limits at 230 Volt, or 100, 120, or 200 Volt per the Japanese limits.
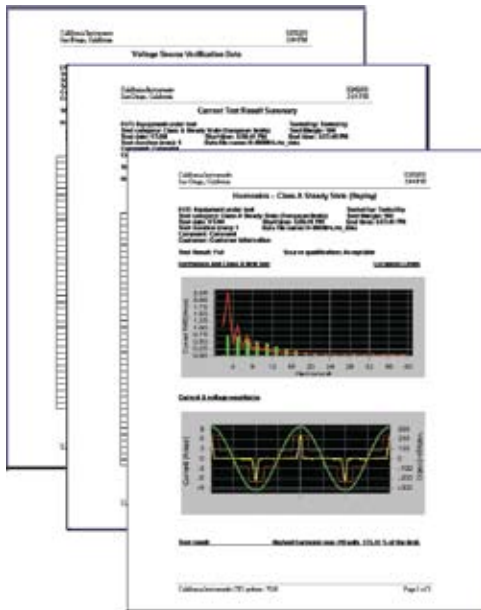
The rated current, respectively power level of class C or D EUT's can be entered based on the manufacturer's rating. The CTS system will verify that the averaged EUT power is within 10 % of the stated value and recalculate the limits for class C and D products if it is outside of the tolerance level. The user may also select the test for self-ballasted lamps per clause 7.3.b of IEC61000-3-2. For this test, current conduction angles and the peak current phase are compared against the permissible limits, as well as the 3rd and 5th harmonic levels.

The operator can select nominal voltage and frequency for the EUT, all from the same setup screen. If needed, the Japanese evaluation method may be selected in lieu of the more common European standard. Settings can be saved to disk for later recall and are also retained with the data records of any test run.

For Class-D products, the power level is verified, and the password protected configuration screen permits the system administrator to define the minimum power level that is acceptable for Class-D. Thus, the system can easily be reconfigured if either the 75 Watt lower power or the 600 Watt upper bound for Class-D products is changed in the future. This same capability is available for low power Class-C products, in the event the 25 Watt boundary level for self ballasted lamps is changed in a future amendment.

Simple User Interface

All IEC Harmonics tests can be accessed from a single control and data display window on the PC. Simple on screen buttons control test setup and execution. During the test run, voltage and current time domain waveform displays are updated

CTS Series - EN / IEC 61000-3-2 & EN / IEC 61000-3-12 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.
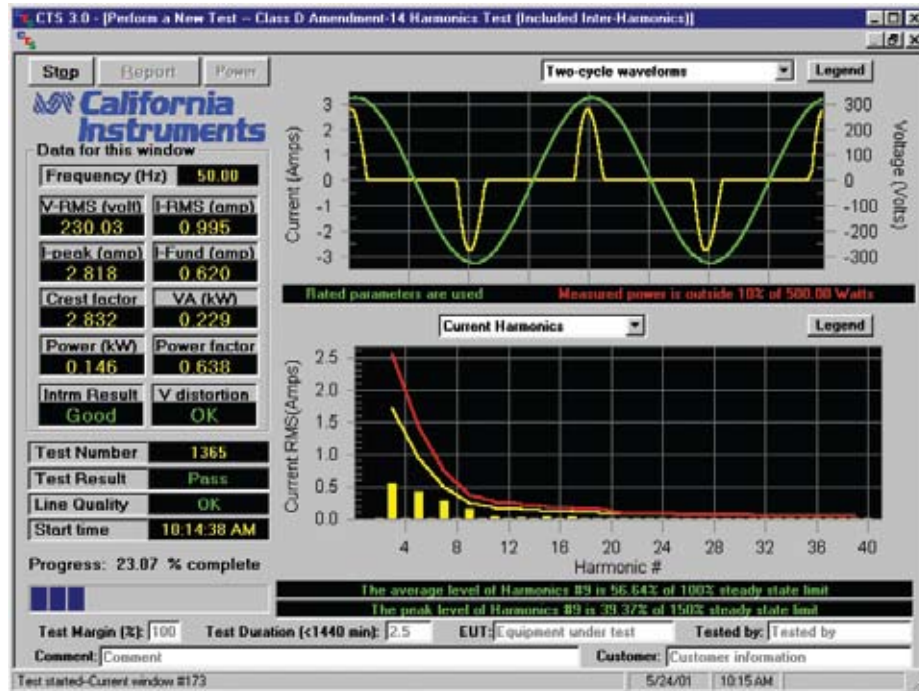
Both Voltage and Current waveforms are shown in real-time.

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.

IEC Harmonics Test Window

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. Voltage distortion of the AC source 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.

Available Data Displays

The following graphics displays are provided, and updated every 200 ms in Harmonics mode:

- Voltage and Current time domain
- Current Harmonics and IEC Test Class 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
- Worst harmonic and percent of limits
- H5 phase angle for IEC 61000-3-12 (CTS-H version)
- Measured power vs. rated power

Test Reports & Data Records

A complete IEC harmonics test report, which includes all test results for the EUT, can be printed at the end of the test in MS Word format. This report includes voltage and current waveform graphs, current harmonic tables and class limits. A sample report is shown on the opposite page.

All graphs are included in the test report or can be copied to the

Windows® Clipboard for inclusion in custom reports. In addition to these harmonics test reports, the CTS system also delivers comprehensive test data records - including voltage and current timing waveform data - on disk for use in detailed reporting or further data analysis applications. Data is stored in both compact binary and ASCII format files. The latter format 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. This replay capability also allows the CTS owner to submit test data to California Instruments for review so he can benefit from the experience of our technical staff when interpreting test results.
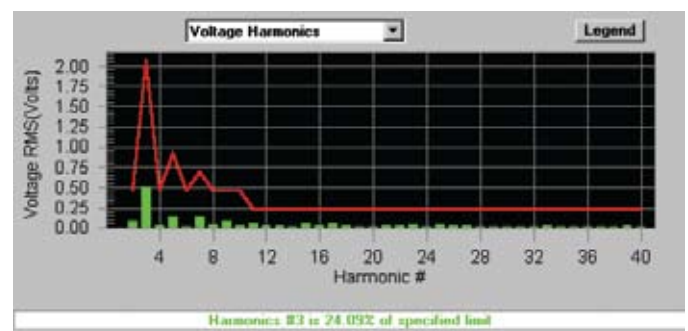
Real-time Voltage Distortion against IEC limit

CTS Series - EN / IEC 61000-3-3 Flicker Test - Includes Amendment 1 & 2

The CTS system offers full compliance flicker testing in accordance with the latest revisions and amendments of the EN/IEC 61000-3-3 and EN/IEC 61000-3-11 flicker standards.

New in version 3.0 is measurement of EUT inrush current, semi-automatic data acquisition and average calculation for 24 each d_{max} tests and the new limits of 3.3 % for d_t and d_c and 6 - 7 % for d_{max} parameters.

A choice of programmable and lumped reference impedances is available for either European or Japanse test requirements.

The CTS system remains one of the few flicker test systems that provide real-time flicker results, with all parameters updated every second, while the flicker test is in progress, eliminating the need to wait for the end of a two hour test run only to find out an EUT failed.

CTS System GUI Setup Window

Flicker Test Report in MS Word
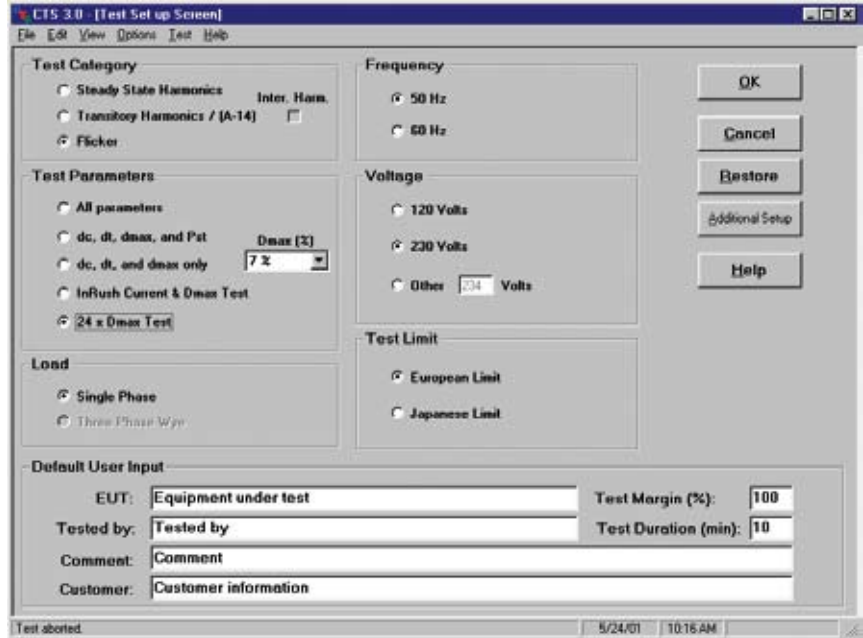
Test Selection

Flicker tests can be run at either 230 V, 115 V or a user specified nominal EUT voltage and at 50 or 60 Hz. While presently no mandatory test standard for 60 Hz flicker exists, the CTS system applies the algorithm based on the specification for 60 Hz flicker evaluation in IEC61000-4-15.

With the release of the latest IEC 61000-3-3 (including Amendment 1& 2) and IEC 61000-3-11 flicker standards, the operator has an increased number of options for different types of EUT's. This is particularly true for the evaluation of d_{max}. These new choices are fully supported by the CTS system.

Test selections are made in much the same way as is the case for harmonics tests, providing a consistent user interface. Frequently used settings can be saved to disk if needed and any setup used is automatically saved with the test data recorded for possible replay later.

Test times for flicker generally extend up to two hours depending on the type of EUT. The CTS flicker mode can be run unattended. A large PASS or FAIL marquee can be set to appear on the PC screen at the end of the test which can be seen across the room. This means operator time can be used elsewhere more productively while the flicker test is in progress.

IEC 725 Reference Impedance

The required IEC 60725 flicker reference impedance is automatically engaged when a flicker test is exectued. iX Series AC power source based CTS configurations (except 10001iX-CTS and 30003iX-CTS) can use the programmable output impedance of the AC Source. For three phase CTS sytems, a lumped reference impedance is recommended. See application note 119 for details.

Lumped Reference Impedance Option -LR3

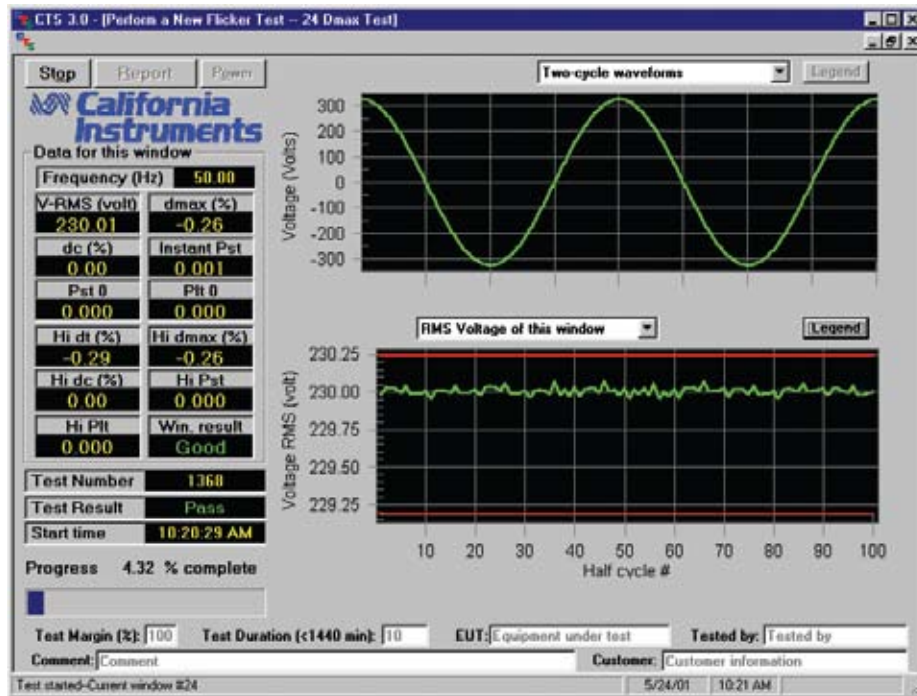## CTS Series - EN / IEC 61000-3-3 Flicker Test- Includes Amendment 1

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 every second.

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 and harmonics test modes use similar , easy to use interfaces. 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 left hand side of the display shows both, instantaneous and peak-hold parameters for the EUT such as V_{RMS}, d_{max}, d_c, d_t and instantaneous Pst. 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.

Available Data Displays

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

*   Chart of 100 ea. half cycle values per 1 second for

    user selctable for d_c - d_t - Vrms, inst. Pst - or the mean voltage level.

*   Chart of Voltage waveform
*   Color PASS/FAIL indicator
*   Numeric display of V_{RMS}, d_{max}, d_c, d_t, P_{st}, P_{lt},

    and the maximum values occurring during the test
*   Numeric display in ms that d_t exceeds 4 %

Test Reports and Data Logging

A Flicker test report can be printed at the end of the test in MS Word or Open Office format. This report includes all flicker test results for the EUT. If the test was selected, inrush current and d_{max} measurement results are included in the report. A sample report is shown on the opposite page.

The CTS system also records comprehensive test data records on disk for use in detailed reporting or further data analysis applications. Flicker data is stored in both compact binary and ASCII format files. The latter format 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. This replay capability also allows the CTS owner to submit test data to California Instruments for review so he can benefit from the experience of our technical staff when interpreting test results.
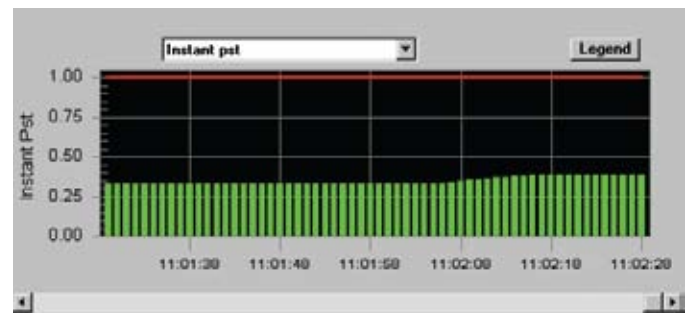
Real-time display of instantaneous Pst

CTS Series - EN / IEC 61000-4 Immunity Test 1

CTS systems extend their usefulness by offering a wide range of Immunity tests in addition to Harmonics and Flicker emission tests. These AC immunity tests are controlled from the PC using the included CIGUI32 AC source control software.

Pass or Fail results are determined by the operator based on an evaluation of the condition of the equipment under test at the end of the test run. Operater observations made during the test and test settings used are included in the MS Word format test report.
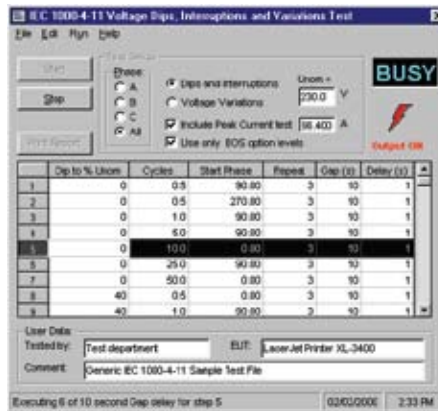
Test parameters for most EN/IEC 1000-4 tests are set by product committees for various product categories. The CIGUI32 software allows test parameters for any number of EUT's to be saved to disk. This makes it easy to create a library of commonly used IEC test setups for quick recall.

In addition to the IEC immunity tests, software modules for avionics power test standards Mil-Std-704,RTCA-DO160, ABD0100, and AMD-24 are available as options on iX power source based CTS systems.

EN / IEC 61000-4-11[2] Ed. 2

The Voltage Dips and Interruptions tests 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. 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.
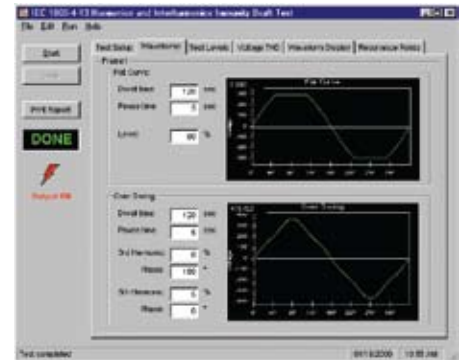
EN / IEC 61000-4-13[3]

The iX Series AC/DC Source can be equipped with the -413 option to provide full support for EN/IEC 61000-4-13 harmonics and Interharmonics testing. An independent, digitally controlled sweep generator is used to superimpose interharmonics on the AC output. The AC source's 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.

EN/IEC 61000-4-11 Test Window

EN/IEC 61000-4-13 Test Window
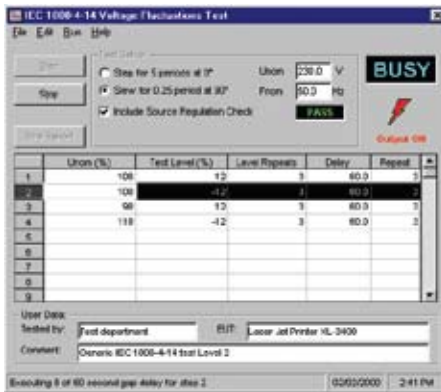
[1] Compliant IEC 61000-4 Tests are not supported on RP-Series based CTS systems or systems without an AC source (100-CTS & 300-CTS-75).
[2] IEC 61000-4-11 AC Source compliance requires -EOS option.   [3] IEC 61000-4-13 test requires iX or MX Series with -413 option.
[4] IEC 61000-4-17, -27 and -29p test requires iX Series based CTS systems. 4-27 and 4-29 are pre-compliance only.

CTS Series - EN / IEC 61000-4 Immunity Test 1

EN / IEC 61000-4-14

This test applies a series of precisely timed voltage fluctuations to the equipment under test. The nominal voltage and frequency of the EUT can be set by the operator.

Test levels are pre-programmed for level 1 and level 2 class EUT's or can be modified and saved to disk easily if needed. Changes can be made on screen using a spreadsheet style data entry grid and saved to disk. These test setups can be quickly recalled for application to different EUT's.

EN/IEC 61000-4-14 Test Window

EN / IEC 61000-4-28

This test applies a series of slowly changing frequency variations to the EUT. The level and duration of the frequency shift can be set by the operator or recalled from a file. Test levels 2, 3 and 4, as specified by the IEC standard, are provided with the program. 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.

EN/IEC 61000-4-28 Test Window

EN / IEC 61000-4-17[4]

This test applies a DC ripple level in percent of DC nominal to the EUT. The test is done at nominal, high and low DC voltage levels. The ripple frequency can be programmed as a multiple of the AC line frequency. Test parameters are pre-programmed or can be modified easily if needed.

The DC voltage applied to the EUT is acquired by the power source and displayed graphically for reference.
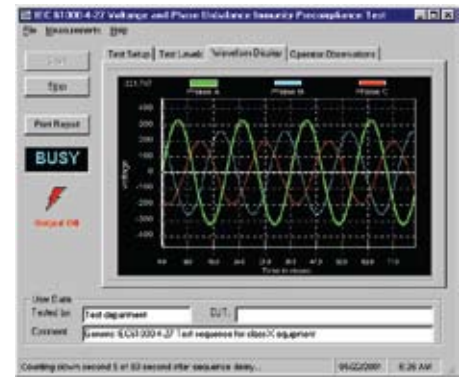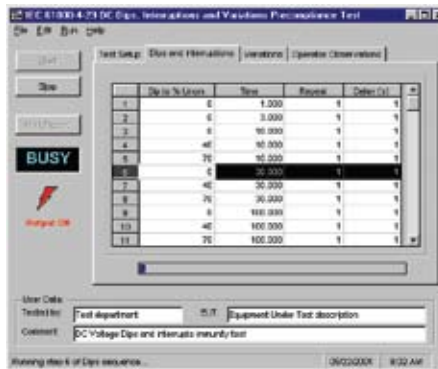

EN/IEC 61000-4-17 Test Window

EN / IEC 61000-4-29p[4]

This test is similar to the IEC 61000-4-11 dips/interrupt test but applies to DC powered products. A series of DC voltage dips, interruptions and variations is applied. Test levels and durations are generally defined by product category and can be entered using a spreadsheet data entry grid and subsequently saved to disk for later recall. The AC/DC source meets most of the test generator requirements and supports pre-compliance testing to this standard.

EN/IEC 61000-4-29 Test Window

EN / IEC 61000-4-27p[4]

This test applies a series of three phase voltage and phase angle unbalance conditions to the EUT. Test levels for EUT classes 2 and 3 as well as X (user defined) are provided. Additional test levels may be entered and saved for later recall as needed. Output voltage waveforms for all phases are acquired and displayed graphically during the test.

The AC source meets most of the test generator requirements and supports pre-compliance testing to this standard.

EN/IEC 61000-4-27 Test Window

MIL-STD-704,DO-160,ABD,AMD

In addition to the European immunity test standards, the CTS system can be configured with Mil-Std-704E ,DO-160, ABD0100, and AMD-24 Avionics power immunity test options. The -160 option includes the new EURO-CAE ED-14D standard (115 V). These options implement testing to these standards to further enhance the usefulness of the CTS test system. These options are available on iX and MX Series based CTS systems only.

RTCA / DO-160D Test Window

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 report format can be integrated into more elaborate user specific reports, in Word, WordPerfect, or Open Office covering all aspects of compliance testing.

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.
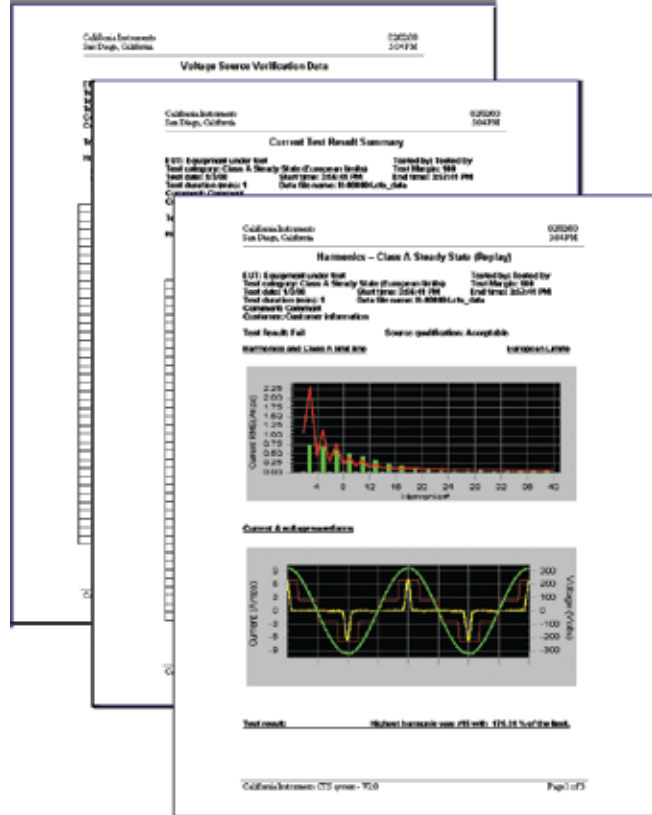
CTS Series - PACS Specifications

The Power Analyzer and Conditioning System unit provides the required interface between the AC source, the Equipment Under Test and the PC. A high current (75 Arms) version, PACS-3-75, is supplied with MX-CTS systems.

PACS Model:			PACS-1	PACS-3 (PACS-3-75)
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/ph (75 Arms/ph)
IEC 60725 Reference	RP-Series CTS:		internal	n/a
Impedance[1]	iX-Series CTS:		programmable Z	programmable Z
	Optional Lumped:		option -LR1	option -LR3/-LR4
Input Power	Voltage		115 / 230 V ± 10 %	115 / 230 V ± 10 %
	Current / Frequency		< 0.5 A / 50 or 60 Hz	< 0.75 A / 50 or 60 Hz
Dimensions	HxWxD		3.5 x 16.8 x 22	3.5 x 16.8 x 22
	HxWxD		89 x 427 x 560	89 x 427 x 560

1   MX-CTS systems do not offer programmable impedance and require option -LR4/OMNI-3-75 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 under options on last page.

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 i data, an important requirement for compliance with IEC 61000-4-7 as well as IEC 61000-4-15.

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 PACS unit 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.

A high current version of the PACS-3 (PACS-3-75) is supplied with the 300-CTS-75 and MX-CTS system.

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 / 75	A_{rms}
Highest range		40 / 75	A_{rms}
Max. input [permanent,			
no damage if < 200 A_{peak}]		40 / 75	A_{rms}
Max. CF [40 / 75 A Range]		5:1 / 2:5:1	@ max Irms
Max. CF [4 A Range]		20:1	@ max Irms
Accuracy		±0.1 % ± 0.05 % FS ± 3 mA	mA
Resolution		1	mA
Power			
Range		0.1 - 24,000	W
Accuracy		±0.25 % ± 0.25 % FS ± 20 mW	mW
Resolution		0.1	W
Apparent Power			
Range		0.1 - 24,000	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	
Interharmonics resolution		5	Hz
Measurement window		10, 12 and 16 periods	
Smoothing filter		1.5	sec
Flicker			
Pst	Range	0.1 - 5	Pst
	Accuracy	3	%
	Resolution	0.01	
	Integration time	10	min
Plt	Range	0.1 - 5	
	Integration time	120	min
dmax	Range	0 - 100	%
dc	Range	0.1 - 100	%
dt	Range	0.1 - 100	%
dt over 3.3%	Range	0 - 2000	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. For PACS-3-75 models, maximum current range is 75 Arms.

Ordering Information

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

Standard controller versions with single voltage range:

Model	VA Power	AC Source	EN61000-4	PACS model
Single Phase Systems				
100-CTS	AC Line	none	-	PACS-1
1251RP-CTS	1250 VA	1251RP	-	PACS-1RP
3001iX-CTS	3000 VA	3001iX	◆	PACS-1
5001iX-CTS (-400)	5000 VA	5001iX (-400)	◆	PACS-1
10001iX-CTS (-400)	10000 VA	10001iX (-400)	◆	PACS-1
Three Phase Systems				
300-CTS-75	AC Line	none	-	PACS-3-75
15003iX-CTS (-400)	15000 VA	15003iX (-400)	◆	PACS-3
MX45-3Pi-CTS	45000 VA	MX45-3Pi	◆	PACS-3-75

PC Requirements

The CTS requires the use of a PC capable of running Win XP/2000 or Vista. Recommended PC hardware specifications are as follows:

CPU	Pentium / Athlon 2.0 GHz or faster.
RAM	1 GBytes or more.
Hard Disk	10 Gbytes or more. 30 Mbytes required for program storage.
Display	Color SVGA/XGA Monitor
Slots	Available PCI slot for A/D card.
Software	MS Word, Windows
IEEE-488	For control of the power source, a NI IEEE-488 bus controller and available PC slot, RS232 or USB port are required.

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

Included with each CTS system:

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

iX Series based CTS Options:

-LR1	Lumped Reference Impedance for 3/5001iX-CTS configurations. Installed in PACS-1.
-LR2[1]	Lumped Reference Impedance for 10001iX-CTS configuration.
-LR3[2]	Lumped Reference Impedance for 15003iX-CTS. (OMNI-3-18i)
-OMNI-3-75	Lumped Reference Impedance for MX45-CTS. (OMNI-3-75i - 3 phase)

-LR5	Japanese Lumped Reference Impedance (100 V) for single phase systems. (OMNI-1-37iJ)
-EOS1	EN/IEC 61000-4-11 AC source compliance Electronic Output Switch for single phase CTS Systems.
-EOS3	EN/IEC 61000-4-11 AC source compliance Electronic Output Switch for 15003iX System.
-411	EN/IEC 61000-4-11 Voltage Dips and Interruptions test option. (included with -EOS options)
-413	EN/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:

C	Cabinet. System installed in 19" instrument rack. Highly recommended for all three phase systems. Prefix 'C' to standard model number to order.
CIC-PC	Suitable PC with preinstalled CTS and CIGUI software. Includes Case, keyboard, mouse, Windows and MS Word.
CIC-PCX	Adds 17 inch monitor and printer to CIC-PC.
-RMS	Rack mount slides.

Accessories:

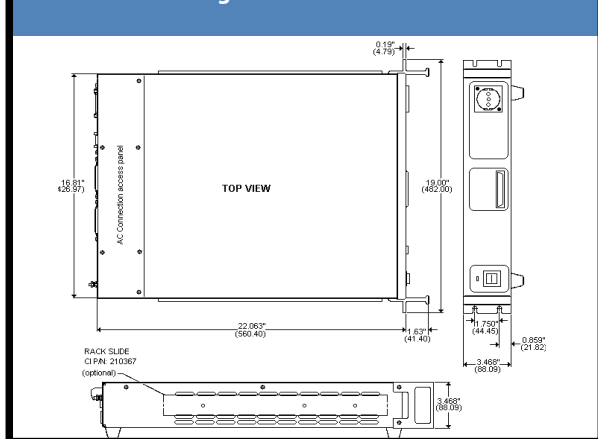|	
CI400PCI	Spare PCI A/D Card
CI68C	Spare 37 pin signal interface cable for PCI.

Higher Power Systems

For higher power three phase systems, contact factory.

Note 1: Required item for Flicker test.

Note 2: Option -LR3 is recommended for 15003iX-CTS systems. See App note 119 for details.

Dimension drawing PACS-1 / PACS-3 / PACS-3-75 unit

Note: *Specifications are subject to change without notice. Specifications are warranted over an ambient temperature range of 25°± 5° C. Unless otherwise noted, specifications are per phase for a sinewave with a resistive load and apply after a 30 minute warm-up period. For three phase configurations, all specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.*

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