MXCTS Systems

IEC Compliance Test Systems

Complete test solution for Harmonics and Flicker testing of high power AC products.

California Instruments

A growing number of electronic products manufactured today have to meet international regulatory requirements for emissions and immunity. This is particularly true for products sold in the European community as well as a growing list of countries in the Far East. The California Instruments MXCTS System provides a cost-effective test solution aimed at verifying higher power product compliance to a number of AC and DC related harmonized test standards.

The MXCTS system offers many of the same features and capabilities of the California Instruments CTS Series product line already in use at many EMC labs around the world.

Compliance Testing to:

- **EN / IEC 61000-3-12** *(-CTSH, -CTSHL)*
  Harmonics, < 75 Arms/phase

- **EN / IEC 61000-3-11** *(-CTSH, -CTSHL)*
  Flicker Measurement, < 75 Arms/phase

- **EN / IEC 61000-3-2** *(-CTSL, -CTSHL)*
  Harmonics - Including Am 14, < 16 Arms/Phase

- **EN / IEC 61000-3-3** *(-CTSL, -CTSHL)*
  Flicker Measurement, < 16 Arms/phase

- **EN / IEC 61000-4-13 (option)**
  Harmonics & Interharmonics Immunity (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 61000-4-11 (option)**
  AC Voltage Dips and Variations (option)

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

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

NPL Certified Compliance

The MXCTS System is based on the same technology deployed in the California Instruments CTS series products. The CTS series 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.

Unique Features and Benefits

The MXCTS System provides the following unique benefits:

- Direct PC bus access data acquisition system provides the required sampling rate and resolution to meet IEC 61000-4-7 measurement requirements and supports high speed data transfers, unlike competing IEC test systems which provide only limited throughput using IEEE-488.

- PC based Harmonic and Flicker test software provides real-time full color data display updates and continuous PASS/FAIL monitoring.

- Automatic calculation of the maximum permissible system impedance Z_{sys}, using the Z_{ref} and measured Flicker parameters, as required per EN/IEC 61000-3-11.

- Simple user operation under Windows provides IEC test setup, data analysis, display and MS Word test reports.

- High resolution, no gap acquisition data storage to ensure that all data can be streamed to disk (in ASCII format if needed) for later review and replay of actual test.

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

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.

The MX Series AC power source required for the MXCTS system provides a wealth of features and capabilities for other AC and DC power applications as well, further enhancing your return on investment.

MX45-3Pi Power Source

The MXCTS System was designed to be used in conjunction with the MX45-3Pi AC and DC power source. The MX45-3Pi provides up to 65 ARMS per phase for high power harmonics and Flicker testing.

All MX45-3Pi Series AC sources offer arbitrary waveform generation, precision measurements, and waveform analysis capabilities. Refer to the MX Series data sheet for detailed information on the MX Series' capabilities and features.

The MX45-3Pi not only supports high power harmonics and flicker emissions test but can also be used for a range of IEC 61000-4 AC immunity standards (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 the IEEE-488 instrumentation bus to communicate with the PC.

This architecture offers several advantages, not the least of which is the ability to support future versions of test standards by merely installing new PC software. This greatly reduces the risk of product obsolescence 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, further analysis or to prove compliance to the test standard.

A special signal conditioning and isolation unit (PACS-3-75) 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 is wired to a rear panel mounted terminal block.

Harmonics Analyzer

A key part of the MXCTS 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 standards 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 Impedances

An IEC 868 compliant Flicker meter is an integral part of the -CTSMH system. The required reference impedance is implemented using a lumped impedance capable of handling 75 A RMS per phase. Due to the high amount of dissipation that occurs at these power levels, the OMNI-3-75 is housed in a 43" cabinet. This same cabinet is used to mount the PACS-3-75 unit. The lumped impedance is designed for testing to the IEC 61000-3-11 Flicker standard.

For IEC 61000-3-3 low power Flicker testing (< 16 ARMS), the OMNI-3-37MX is used instead mounted in a similar 43" cabinet.(-CTSL system).

A combination of both is available on the -CTSMXHL system. In this case, only one lumped impedance is in the circuit at any one time and a quick connect scheme is used to allow switching between the two lumped impedances (OMNI-3-37MX for -3-3 and OMNI-3-75 for -3-11).

The MXCTSH system offers full compliance harmonics testing per EN/IEC 61000-3-12 and can also be used to perform EN/IEC 61000-3-2 (additional CTSMXL software required or MXCTSHL system).

The MXCTS system supports several new capabilities that are required to meet the first IEC 61000-3-12 harmonics standard revision. This includes measurement of both harmonics and interharmonics and Partial Weighted Harmonics Distortion (PWHD) evaluation per the latest IEC 61000-4-7 standard (General guide on harmonics and interharmonics measurements and instrumentation, for power supply systems and equipment connected thereto).

Despite these advanced capabilities, the MXCTS system is easy to use.
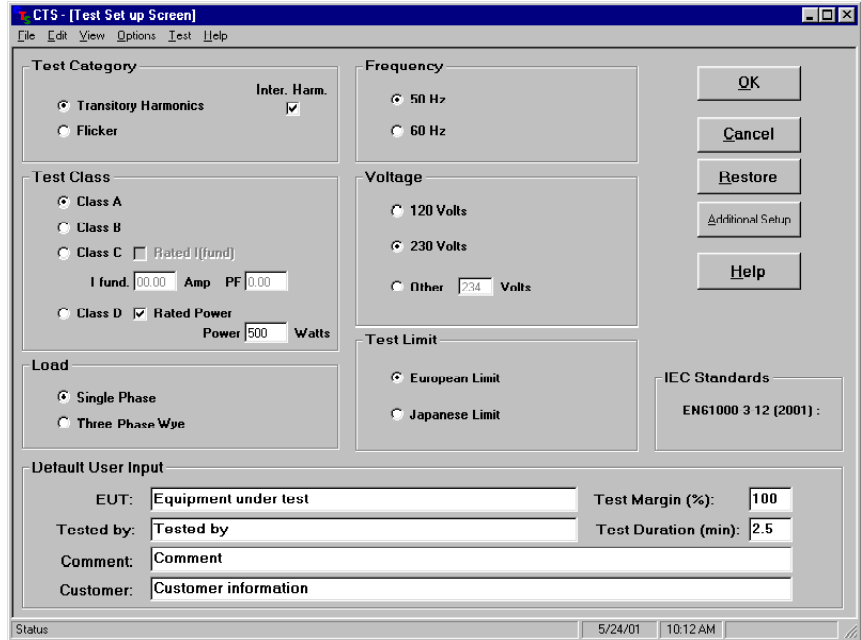

MXCTS System GUI Setup Window

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. 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).

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.

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 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.
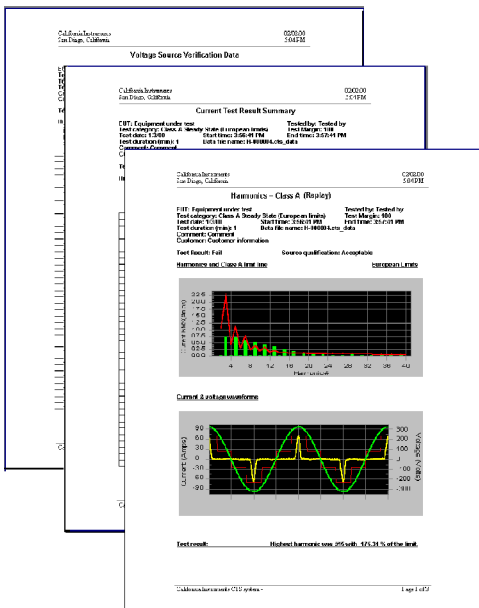
Harmonics Test Report in MS Word

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.
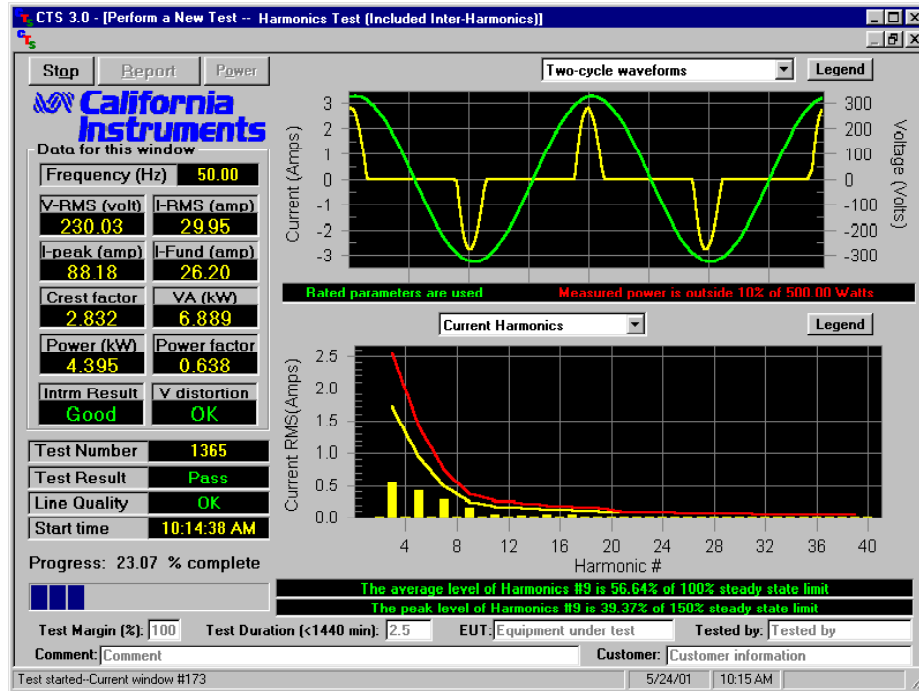
Both Voltage and Current waveforms are shown in real-time.

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

Available Data Displays

The following graphics displays are provided in Harmonics mode:

- Voltage and Current time domain
- Current Harmonics and IEC limits graph
- Source voltage distortion and IEC limit
- 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 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 MXCTS 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 MXCTS system software that allows frame by frame playback of test data files for detailed analysis of EUT behavior. This replay capability also allows the MXCTS 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.
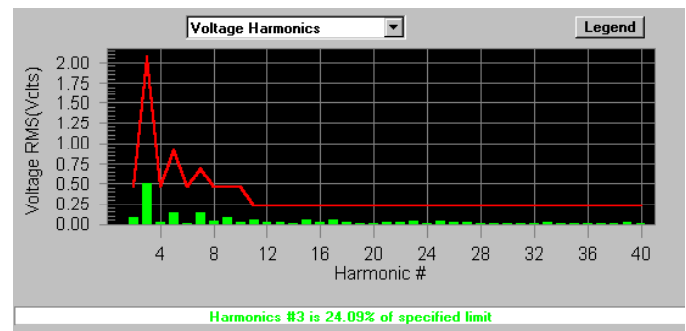
Real-time Voltage Distortion against IEC limit

The MXCTSH system offers full compliance Flicker testing in accordance with the new EN/IEC 61000-3-11 Flicker standard. The MXCTSL system includes software and an OMNI-3-37MX for EN/IEC 61000-3-3 Flicker testing. For both, the MXCTSHL system combines both capabilities into one system.

Included in the CTSMX software supplied with the MXCTS system is measurement of EUT inrush current, semi-automatic data acquisition and average calculation for 24 each d_{max} tests and the new limit of 3.3 % for d_t and d_c parameters.

The MXCTS system is one of the few Flicker test systems that provides real-time Flicker results 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.

MXCTS System GUI Setup Window

Flicker Test Report in MS Word
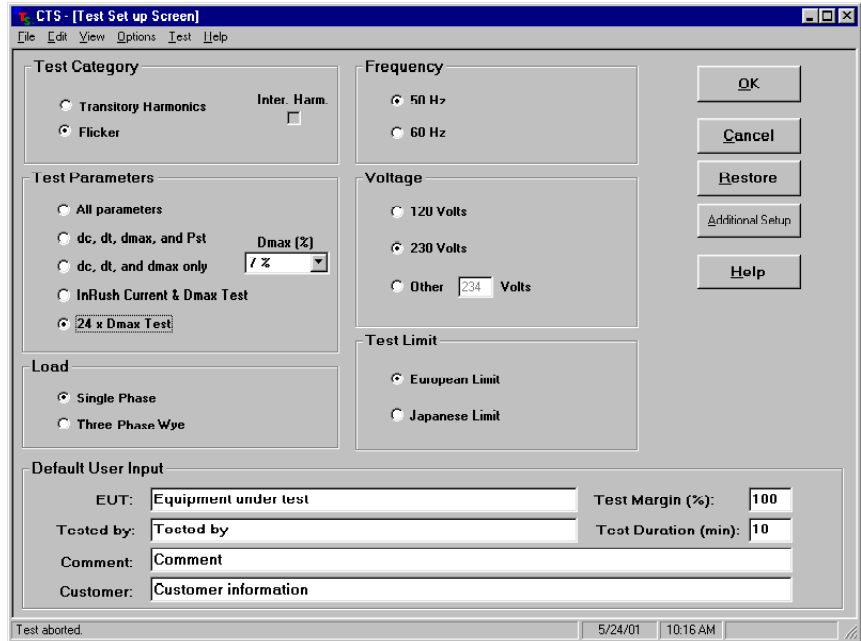
Test Selection

Flicker tests can be run at either 230 V, 115 V L-N or a user specified nominal EUT voltage and at 50 or 60 Hz. While no official standard for 60 Hz flicker exists to date, the CTS system applies an equivalent algorithm based on standards work presently underway for 60 Hz flicker evaluation.

With the release of the IEC 61000-3-11 flicker standard, the operator has a 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 MXCTS system.
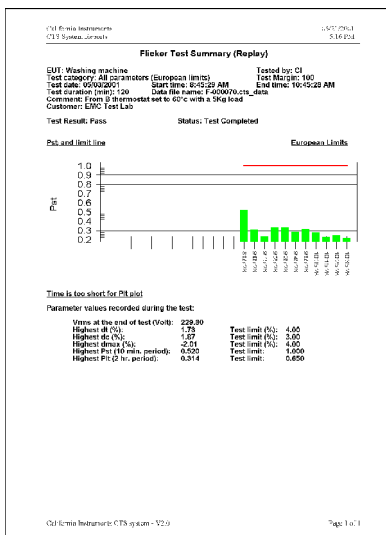
EN / IEC 61000-3-11 not only uses a different test impedance (see below) but also requires the calculation of Z_{sys} in the event that the unit under test cannot meet the Flicker parameters limits with this lower test impedance. This Zsys must then be specified by the manufacturer, so that the user knows under which conditions the product can be used. The MXCTS calculates this Z_{sys} and thus automates this important requirement - providing valuable time savings to the user.

Test times for flicker generally extend up to two hours depending on the type of EUT. The MXCTS 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.

Reference Impedance

The required flicker reference impedance is automatically engaged when a flicker test is executed. A lumped impedance (OMNI-3-75) is used to provide the recommended reference impedance for IEC 61000-3-11 flicker testing. The OMNI-3-75 is contained in a 43" instrument cabinet and can be located next to the MX45-3Pi AC source cabinet.

For IEC 61000-3-3 flicker testing of low power EUT's, the OMNI-3-37MX can be added. This also requires the optional CTSMXL software.
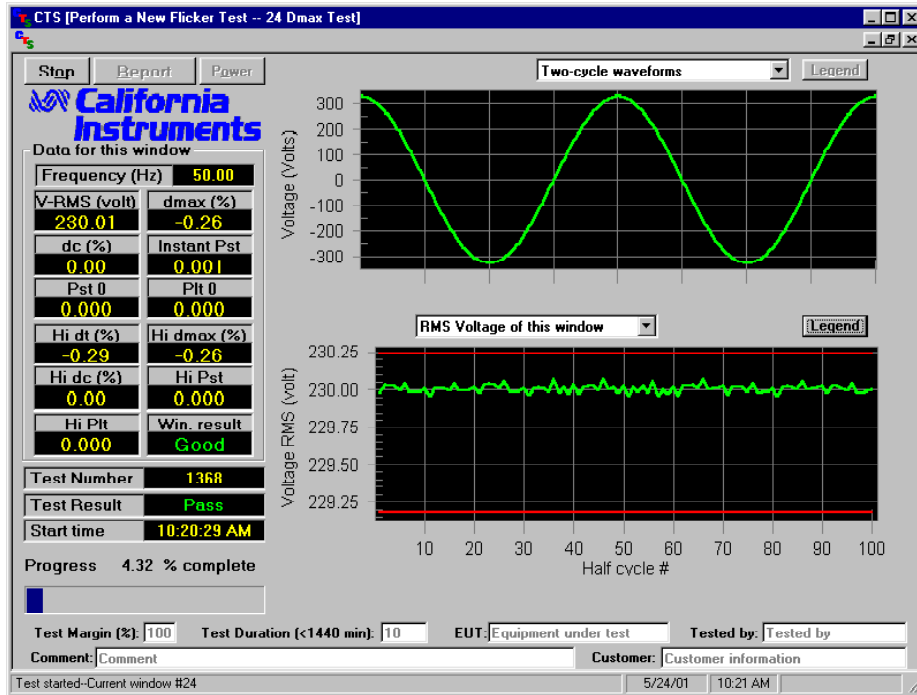
Start and Stop Flicker tests with the click of a button.

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.

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.

IEC Flicker Test Window

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 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.

Available Data Displays

The following graphics displays are provided in the IEC 61000-3-11 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}

Test Reports and Data Logging

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

The MXCTS 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 MXCTS system software that allows frame by frame playback of test data files for detailed analysis of EUT behavior. This replay capability also allows the MXCTS 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.
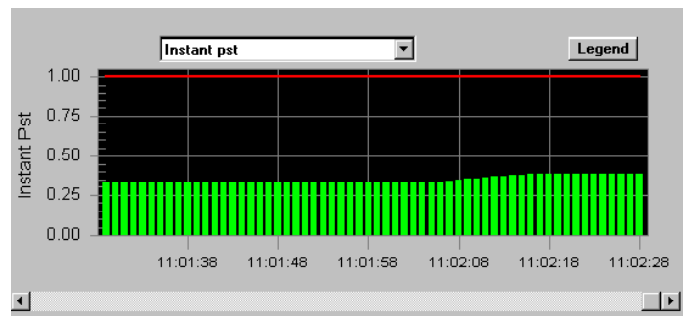
Real-time display of instantaneous Pst

The MXCTS system extends its usefulness by offering a wide range of Immunity tests in addition to Harmonics and Flicker emission tests. These AC and DC immunity tests are controlled from the PC using the included MXGUI 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. Operator observations made during the test and settings used are included in the MS Word format test report.
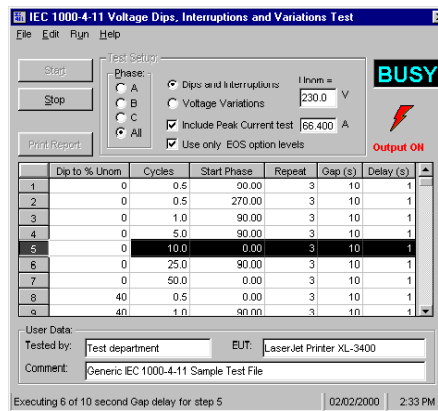
Test parameters for most EN/IEC 61000-4 tests are set by product committees for various product categories. The MXGUI software allows test parameters for any number of EUT's to be saved to disk. This makes it easy to create a library of commonly used IEC test setups for quick recall.

In addition to the IEC immunity tests, avionics power test standards Mil-Std-704 and RTCA DO-160 are available as options.

EN / IEC 61000-4-11p[1]

The Voltage Dips and Interruptions tests are included in the AC source control program supplied with the MXCTS 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. Due to voltage rise and fall time limitations of the MX AC source, this test is offered for pre-compliance testing only.
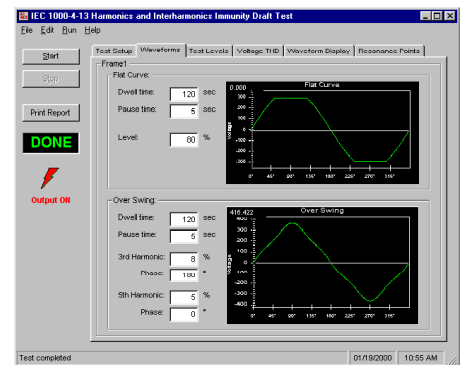
EN / IEC 61000-4-13[2]

The MX 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 MX 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

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[1] IEC 61000-4-11 tests are pre-compliance. Requires -411 option.
[2] IEC 61000-4-13 test requires -413 option.
[3] IEC 61000-4-27 and -29 tests are pre-compliance.

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.
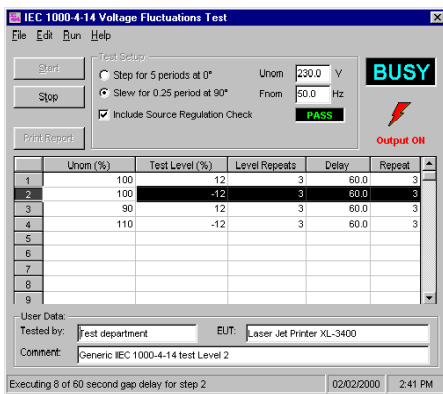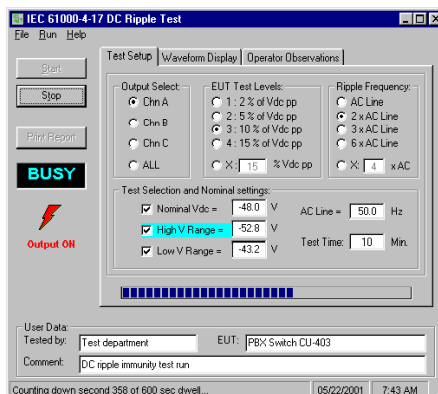

EN/IEC 61000-4-14 Test Window

EN / IEC 61000-4-17

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.
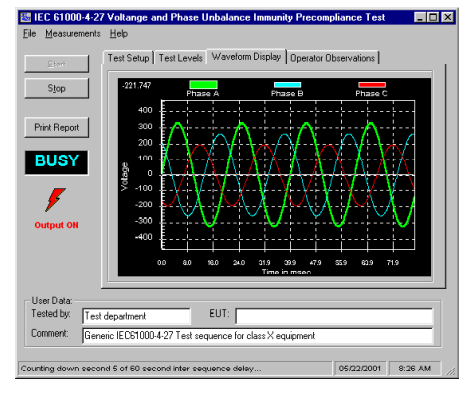

EN/IEC 61000-4-17 Test Window

EN / IEC 61000-4-27p[3]

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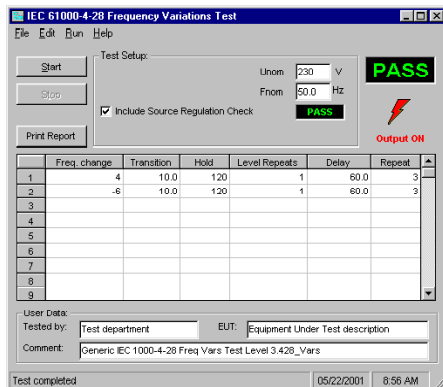
The AC source meets most of the test generator requirements and supports pre-compliance testing to this standard.

EN/IEC 61000-4-27 Test Window
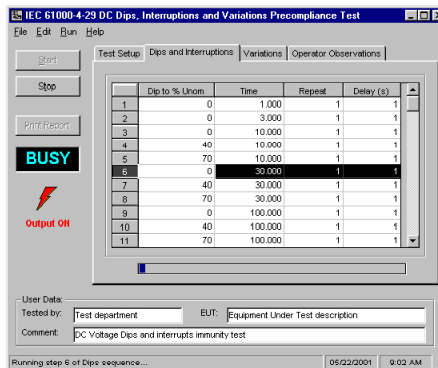
EN / IEC 61000-4-28

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 61000-4-29p[3]

This test is similar to the IEC 61000-4-11 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 MX source meets most of the test generator requirements and supports pre-compliance testing to this standard.

EN/IEC 61000-4-29 Test Window

MIL-STD-704 and DO-160

In addition to the European immunity test standards, the MXCTS system can be configured with Mil-Std-704E and RTCA/DO-160D Avionics power immunity test options. (-704 and -160 respectively). The -160 option includes the new EUROCAE ED-14D standard (115 V). These firmware options implement testing to these standards to further enhance the usefulness of the MXCTS test system.
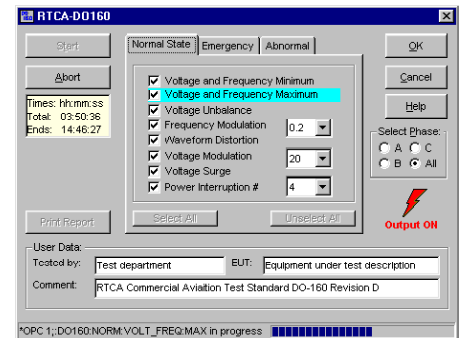

RTCA / DO-160D Test Window

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 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.
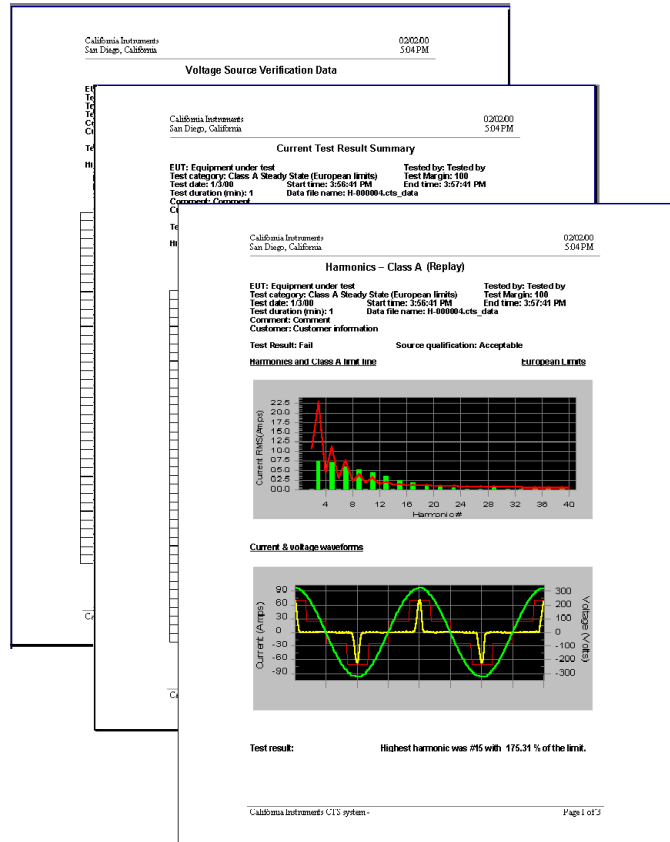
MXCTS Series - PACS-3-75 Specifications

The Power Analyzer and Conditioning System unit provides the required interface between the MX AC source, the Equipment Under Test and the PC.

Parameters		PACS-3-75
Number of phases		3
Channels	Voltage and Current	6
Connector Style	Rear panel	Compression terminal block
Maximum voltage	L-N	480 Vac
Maximum current	per phase	75 Arms/ph
Input Power	Voltage	115 / 230 V ± 10 %
	Current	< 0.75 A
	Frequency	50 / 60 Hz
Dimensions	HxWxD	5.25" x 16.8" x 22"
	HxWxD	134 x 427 x 560 mm

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

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-3-75 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 MXCTS system to perform continuous measurements without any gaps in measured data, an important requirement for compliance with IEC 61000-4-7 as well as IEC 868.

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-3-75 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-3-75 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 (L-N)		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)		16, 40, 75	A_{rms}
Highest range		75	A_{rms}
Max. input [permanent,			
no damage if < 225 A_{peak}]		75	A_{rms}
Max. CF [75 A Range]		3:1	@ max Irms
Max. CF [16 A Range]		12:1	@ max Irms
Accuracy		± 0.1 % ± 0.05 % FS ± 5 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% ± 0.05% FS	
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 - 10	Pst
	Accuracy[2]	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 3.3%	Range	0 - 1000	ms

CI400PCI - PCI A/D Card

Note 1: All specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.
Note 2: Excludes Reference Impedance Error.

Ordering Information

For specifications on the MX Series AC/DC power sources, refer to the MX Series data sheet. The MXCTS system requires an MX45-3Pi to function. The MXCTS system is an option for the MX45-3Pi power source.

Specify MX45 model and one of three system configuration suffixes:.

-CTSH — **High Power Test Standards System includes:**

PACS-3-75	Measurement system. Mounted in OMNI-3-75 cabinet.
OMNI-3-75	Three phase Lumped impedance cabinet for IEC 61000-3-11 Flicker
CIC651	CTSMXH Software for IEC 61000-3-12 (Harmonics and IEC 61000-3-11 (Flicker) testing. (P/N CIC651)
CI400PCI	A/D Card PCI Bus.
CI68C	Cable from CI400PCI to PACS-3-75.

-CTSL — **Low Power Test Standards System includes:**

PACS-3-75	Measurement system. Mounted in OMNI-3-75 cabinet.
OMNI-3-37MX	Three phase Lumped impedance for IEC 61000-3-3 Flicker
CIC652	CTSMXL Software for IEC 61000-3-2 (Harmonics and IEC 61000-3-3 (Flicker) testing. (P/N CIC652)
CI400PCI	A/D Card PCI Bus.
CI68C	Cable from CI400PCI to PACS-3-75.
Cabinet	42" cabinet with PACS-3-75 and OMNI-3-37MX installed.

-CTSHL — **High and Low Power Test Standards System:**

Combines CTSH and CTSL components.

Relevant MX45 Options:

-411	EN/IEC 61000-4-11 Voltage Dips and Interruptions test option. (included with -EOS options)	-160	RTCA/DO-160 test firmware.	
		-704	MIL-STD704 test firmware.	
-413	EN/IEC 61000-4-13 Harmonics and Inter-Harmonics test option.			

Dimension drawing PACS-3-75 unit

PC Requirements

The MXCTS requires the use of a PC capable of running Windows 98™ or Win 2000. Recommended PC hardware specifications are as follows:

|	
CPU	Pentium 4, 1.2 GHz clock or faster.
RAM	256 Mbytes or more.
Hard Disk	20 Gbytes or more. 20 Mbytes required for program storage.
Display	Color SVGA Monitor
Slots	Available PCI slot for A/D card.
Software	MS Word, Windows
IEEE-488	For control of the power source, a National Instruments IEEE bus controller and available PC slot or RS232 port are required.

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

PC Options:

CIC-PC	Suitable Pentium class PC with preinstalled CTS and MXGUI software. Includes Case, keyboard, mouse, Windows and MS Word.
CIC-PCX	Adds 15 inch monitor and printer to CIC-PC.

Accessories:

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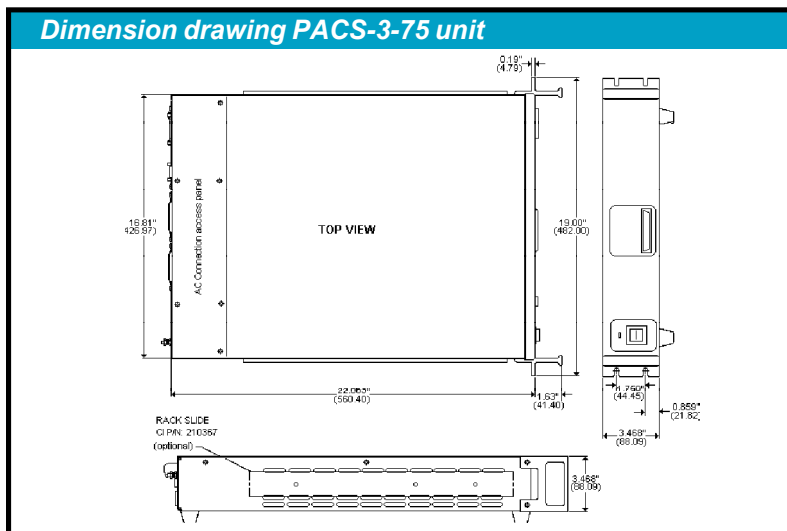
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