

## Available Features:

Includes Complete Test Sequences for the following IEC 61000-4 Conducted Immunity Test Standards:

- **IEC 61000-4-11**, Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current less than 16 A per phase. (Includes Korean version)
- **IEC61000-4-13**, Harmonics and inter harmonics including mains signaling at AC power port, low frequency immunity tests
- **IEC61000-4-14**, Voltage fluctuation immunity test
- **IEC61000-4-17**, Ripple on DC input power port immunity test (AFX Series only)
- **IEC61000-4-27**, Unbalance, immunity test for equipment with input current not exceeding 16 A per phase
- **IEC61000-4-28**, Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase
- **IEC 61000-4-29**, Voltage dips, short interruptions and voltage variations on DC input power port immunity tests. (Includes Korean version)
- **IEC61000-4-34**, Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase

Common Features for all IEC 61000-4 Test Sequences Provided:

- Pre-set test sequences and test levels conform to IEC 61000-4 test standards, *ready to test out of the box. No need for any programming by the end-user saves time.*
- Immunity tests can be run continuously or in single step mode to allow close observation of EUT performance. *Enables detailed review of EUT behavior to help implement needed design changes.*
- Measurements such as voltage and current are recorded at each test step and included in test reports. *Documents and validates correct EUT behavior during and after test runs.*
- User guided prompts the operator through entire test procedure. *No IEC Standards knowledge required on the part of the operator, less chance of mistakes.*
- Reports are generated in Rich Text Format for compatibility with most word processors allowing customization of test reports. *Makes it easy to meet documentation requirements and augment technical construction files with test reports.*
- All test sequences are fully customizable by user if needed to create custom version or special purpose test variations as desired. *Accommodate changing IEC standards if needed. Test sequences can be locked down with a password to insure integrity of the tests applied.*



International  
Electrotechnical  
Commission



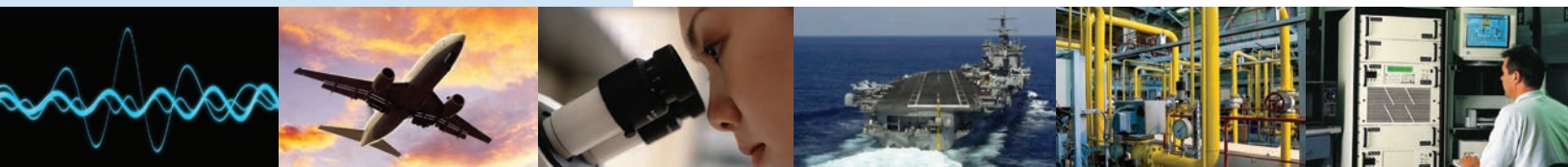
## IEC Immunity Testing

The EMC Directive is one of the 'New Approach' Directives and applies across all 27 member states of the European Union (EU). The Directive applies to all electronic or electrical products liable to cause or be disturbed by electromagnetic interference (EMI). As a result a large number of manufacturers in the electronics or electrical industries need to ensure that their products are compliant with the requirements of the Directive and be able to demonstrate that this is the case in order to affix the CE Mark.

To verify compliance with these directives, the International Electrotechnical Commission (<http://www.iec.ch>) has issued a number of harmonized standards that describe test methods, test levels and pass or fail criteria. A number of these test standards cover immunity to commonly found AC line anomalies that are known to occur on the public Low Voltage (LV) network. These conducted immunity standards are numbered IEC 61000-4-nn. These IEC 61000-4 standards are not product specific but rather generic and may be applied to numerous product categories to ensure compliance with CE mark requirements.

There are additional product specific IEC standards that cover individual product types. To determine the IEC 61000-4 tests that apply to a particular product category, refer to the relevant product standard. For example, the IEC EMC product standard that applies to programmable AC power sources is IEC 61326-1, "Electrical equipment for measurement, control and laboratory use – EMC requirements". It calls out which IEC 61000-4 tests must be performed, what product class if applicable and any specific set of test levels and pass/fail criteria. Consult the product specific EMC immunity standard for the product you intend to test. Copies of these standards can be purchased at the IEC web store (<http://webstore.iec.ch>).

All standards included in Pacific Power Source's IEC Test option package relate to AC conducted immunity except for IEC 61000-4-29 which is a DC Test.



FREQUENCY CONVERSION

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## Standard and Editions Supported

The Pacific Power Source IEC AC Immunity Test option includes pre-defined test sequences for all relevant IEC 61000-4 standards, including some Korean versions. This option provides a complete solution for IEC AC conducted

immunity testing when combined with an AFX, AZX, LMX, ASX, AMX or MS Series AC Power Source. As of the date of publication of this data sheet, all test sequences conform to the latest standard revisions that are in effect. A summary of standard numbers, descriptions, editions and publication dates is provided in the table below.

IEC Standard	Description	Supported Version	Edition	Dated
IEC 61000-4-11	Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	IEC 61000-4-11:2020 RLV	3.0	2020-01-28
IEC 61000-4-13	Harmonics and interharmonics including mains signalling at a.c. power port, low frequency immunity tests	IEC 61000-4-13:2002+AMD1:2009+AMD2:2015 CSV	1.2	2015-12-14
IEC 61000-4-14	Voltage fluctuation immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-14:1999+AMD1:2001+AMD2:2009 CSV	1.2	2009-08-12
IEC 61000-4-17	Ripple on DC input power port immunity test	IEC 61000-4-17:1999+AMD1:2001+AMD2:2008 CSV	1.2	2009-01-28
IEC 61000-4-27	Unbalance, immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-27:2000+AMD1:2009 CSV	1.1	2009-04-07
IEC 61000-4-28	Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase	IEC 61000-4-28:1999+AMD1:2001+AMD2:2009 CSV	1.2	2009-04-07
IEC 61000-4-29	Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	IEC 61000-4-29:2000	1.0	2000-08-30
IEC 61000-4-34	Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase	IEC 61000-4-34:2005+AMD1:2009 CSV	1.1	2009-11-26

Korean Standard	Description	Supported Version
KS C 9610-4-11	Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	KS C 9610-4-11
KS C 9610-4-29	Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests	KS C 9610-4-29

## Common Features

All IEC test sequences share a common user interface and controls making it easy for an operator to perform multiple tests on a given EUT. The underlying execution platform for the IEC AC Immunity test option is the UPC Test Manager<sup>1</sup> program which is a component of the Pacific Power Source UPC Studio suite of Windows software.

The UPC Studio software provides an easy to use Windows based control and execution environment that allows the operator to control and document all aspects of compliance testing. The Test Manager component adds advanced capabilities for controlling not only the AC Power Source but also additional test equipment that may be needed to perform specific EUT tests.

All IEC tests are controlled from the UPC Test Manager main window (Figure 1) which offers four individual tabs. The tabs listed in the table to the right are available to the user.

**Note 1:** For AFX Series, the PPSC Manager software is used.

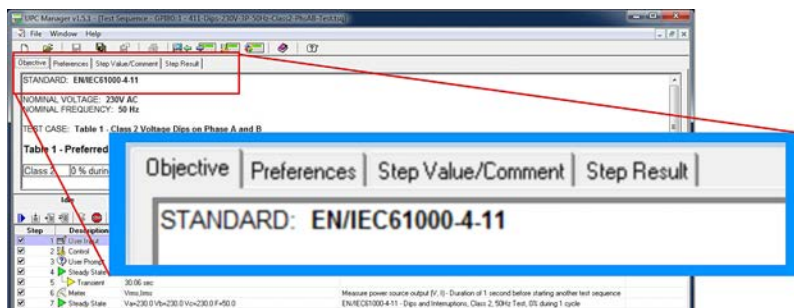


Figure 1: PPSC Test Manager Control Tabs

Objective	This tab describes the purpose of the test and is used to document test settings such as nominal voltage and frequency used, test classes if any apply and any pass or fail criteria. It documents the selected test.
Preferences	This tab is used to display and set any test preferences that are to be applied such as the ability to edit the test sequence or not, the Report template to be used and any global AC Power Source limits that are to be applied such as maximum allowable voltage or frequency permitted. These settings are all pre-defined by the IEC AC Immunity test option package conform the relevant IEC 61000-4 standard document but can be over-riden if required for any specific purpose. Any user editing of test sequences requires a password however so the integrity of these test can be controlled.
Step Value/Comments	This tab provides specific information relating to individual test steps in the test sequence shown in the bottom part of the window. As each step is selected (highlighted), the information displayed in this tab will change accordingly. This feature is useful to provide additional comments and information relating to specific test steps.
Step Result	This tab is step specific and contains summary data on the result for each test step in the sequence. Results can include any measurement data recorded by the AC Power Source or comments regarding EUT operation added by the operator.

These control elements are identical for all IEC 61000-4 test sequences contained in this option package. For more details on UPC Studio and UPC Test Manager operation, refer to the UPC Software Product Brochure.

IEC 61000-4-11 Voltage Dips, Interruptions and Variations

Voltage Dips and Interruptions immunity applies to virtually all electrical products that require the CE mark. This requires testing per IEC 61000-4-11 to determine the ability of the equipment under test to withstand such AC line anomalies. Actual test levels and durations depend on the product class. Products are categorized into four classes, 1, 2, 3 and X, with X being a class defined by individual product committees with the restriction that they cannot be less severe than class 2. Test levels for class 1 and X are not specified in the IEC 61000-4-11 standard itself. Testing levels for these classes are defined in product specific IEC standards which refer to the generic IEC 61000-4-11 standard for test methods and equipment to be used.

The IEC 61000-4-11 test sequences contained in the IEC AC Option package cover all defined classes and nominal voltage and frequency permutations for single, split or three phase products as detailed in Table 2.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-11 test sequence is shown in Figure 3. Text execution is normally continuous but the user has the option of single stepping through the sequence. A typical IEC 61000-4-11 Phase-to-Phase voltage dip of 1/2 cycle duration is shown in Figure 4.

IEC 61000-4-11 Table	Test	Voltage $V_{LN}/V_{LL} (V_{RMS})$	Frequency (Hz)	Class / Test Level	Phase Mode
Table 1	Voltage Dips	115 / 208Vac	60 Hz	Class 2	1 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 2	Short Interruptions	115 / 208Vac	60 Hz	Class 2	1 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 3	Voltage Variations	115 / 208Vac	60 Hz	V = 70%	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50Hz	V = 70%	1 $\phi$ , 2 $\phi$ , 3 $\phi$

Table 2: IEC 61000-4-11 Test Coverage

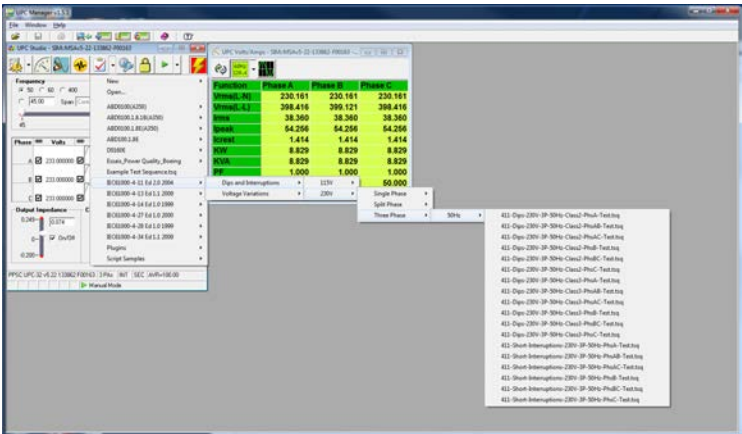


Figure 2: IEC 61000-4-11 Test Selection Screen

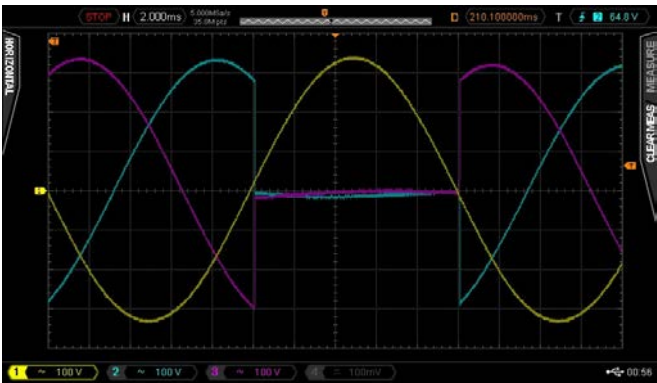


Figure 4: IEC 61000-4-11 1/2 Cycle Phase-to-Phase Voltage Dip

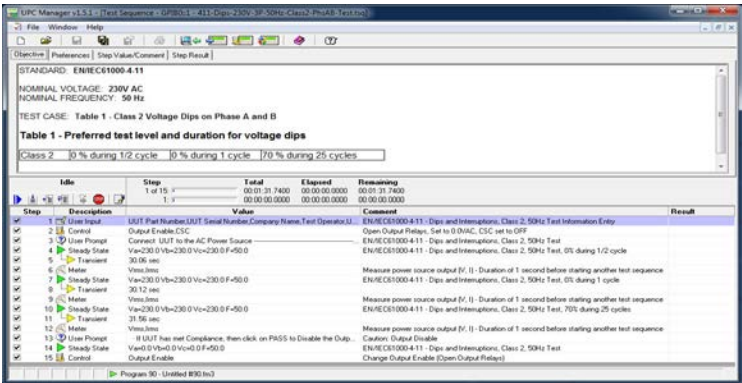


Figure 3: IEC 61000-4-11 Test Execution Control Screen



## AC Source Requirements – IEC 61000-4-11

Table 4 in Section 6.1.1 of the IEC 61000-4-11 standard specifies AC generator performance requirements. The LMX, ASX and AFX Series AC sources all meet or exceed these requirements except for rise and fall time. To obtain full compliance testing, the [EPTS](#) (Electronic Power Transfer Switch) hardware option is required (Fig 5). This option also supports IEC 61000-4-29 DC Dips and IEC 61000-4-34 high power AC Dips testing. Seeiwthas Table 3 for details.

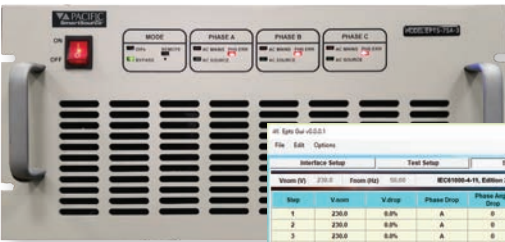


Figure 5: EPTS-75A-3 Option

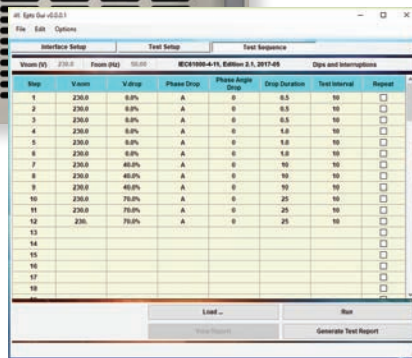


Figure 6: EPTSGui IEC 61000-4-11 Test Sequence

## Three Phase EUT Voltage Dip Testing

For three phase EUT testing, the voltage dips and interruptions applied are different between Delta and WYE configurations. Figure 7 shows an example of the output of the AC source during a 70% voltage dip test on a three phase Delta AC product. For three phase delta systems, each phase-to-phase voltage must be dropped and phase shifted to accomplish the required resulting vector voltage drop. This requires three tests to be run (Phase A-B, Phase A-C and Phase B-C).

On three phase Y systems (with Neutral), each individual phase must be dropped but also each combination of phase-to-phase voltage. This requires six tests. All six test sequences are provided in the IEC AC Immunity test option.

Parameter	IEC 61000-4-11 Requirement	LMX/ASX with UPC Controller Compliance	AFX Series Compliance
Output voltage at no load	0 to 100%, $\pm 5\%$ of residual voltage	Voltage Accuracy: $\pm 0.5\%$	Voltage Accuracy: $\pm 0.25\%$
Voltage change with load at the output of generator 100% output, 0A – 16A 80% output, 0A – 20A 70% output, 0A – 23A 40% output, 0A – 40A	Less than 5% of $U_T$	Load Regulation: 0.25%	Load Regulation: 0.02%
Output current capability	Capable of supporting current stated in row 2 of this table for 5 sec at 80% of $U_T$ and 3 sec at 70% or 40% of $U_T$ . This requirement may be reduced according to EUT rated steady state supply current.	Model dependent. See ASX/LMX Data sheet for Current/Voltage rating chart by model.	Model dependent. See AFX Data sheet for Current/Voltage rating chart by model.
Peak Inrush current capability, (no requirement for voltage variation tests)	Not to be limited by generator. However, maximum peak capability need not exceed 1000A for 250V to 600V or 500A for 200V to 240V, or 250A for 100V to 120V mains.	Model dependent. See ASX/LMX Data sheet for Current/Voltage rating chart by model.	Model dependent. See AFX Data sheet for Current/Voltage rating chart by model.
Instantaneous peak overshoot/undershoot of the actual voltage, generator loaded with 100 Ohm resistive load.	Less than 5% of $U_T$	< 2%	
Voltage rise and fall time during abrupt change, generator loaded with 100 Ohm resistive load.	Between 1 $\mu$ s and 5 $\mu$ s.	Requires Option EPTS available in different current ratings. Compatible with AFX, ASX and LMX Power Sources	
Phase Shifting	0° to 360°	0° to 360°	
Phase relationship of voltage dips and interruptions with the power frequency	Less than $\pm 10^\circ$	$\pm 0.5^\circ$	
Zero crossing control of the generator	$\pm 10^\circ$	$\pm 0.5^\circ$	

Table 3: IEC 61000-4-11 Section 6.1.1, Table 4 Generator Requirements



Figure 7: IEC 61000-4-11 Phase BC Voltage Dip to 70% of  $U_T$

## IEC 61000-4-13 Harmonics and Inter Harmonics

The objective of the IEC 61000-4-13 standard is to ensure that products are impervious to the effects of signaling frequencies that may be present on the public utility power grid. Signaling over AC power lines is often used to remotely control switch gear or other devices.

The IEC 61000-4-13 test requirements are rather extensive compared to the other IEC 61000-4 tests. It also requires a second, asynchronous wave form generator capable of generating inter harmonics. Inter harmonics are not harmonically related to the fundamental power frequency (50Hz or 60Hz) and therefore, it is mandatory that a separate oscillator is used to generate these frequencies. AFX, AZX and LMX power source models can be ordered with the -413 interharmonics generator option. For ASX, AMX or MS models, the SCU-UPC32-413 three phase capable external controller option is required.

The IEC 61000-4-13 test sequences contained in the IEC 413 Option package or the Ects\_413Gui cover all defined classes and nominal voltage and frequency permutations for single, split or three phase products. Harmonics and Inter Harmonics frequency ranges are swept using prescribed frequency step sizes resulting in long test times.

The appropriate IEC 61000-4-13 test sequence can be selected from the UPC Test Manager pull down menu based on nominal voltage, frequency, phase mode and test level or EUT class.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-13 test sequence is shown in Figure 8. Text execution is normally continuous but the user has the option of single stepping through the sequence. A sample GUI screen for the Ects\_413Gui Windows test software for the AFX, AZX or ECTS2 EMC test system is shown in Figure 9.

## SCU-UPC32 Inter Harmonics Generator

To perform the inter harmonics tests included in the IEC 61000-4-13 test standard on **ASX** AC power sources, the external three phase waveform generator – model SCU-UPC32-413 - is required.

This additional generator is housed in a 19" inch wide chassis (3U panel height) that can be placed near or on top of the AC Power Source used. All interactions with this external inter harmonic generator are controlled through the IEEE- 488 interface so its operation is transparent to the operator. The same unit is used for both single, two or three phase applications.

Note: On AFX, AZX or LMX power source models, the interharmonics generator -413 option is installed in the power source so no external generator is needed.

IEC 61000-4-13 Table	Test	Voltage $V_N / V_L (V_{RMS})$	Frequency (Hz)	Class/Test Level	Phase Mode
Table 1, 2 & 3	Odd Harmonics	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 4	Inter Harmonics	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 7	Flat Curve	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 8	Over Swing	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 9	Frequency Sweep	115 / 208Vac	60 Hz	Class 1, 2 & 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 1, 2 & 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 11	Meister Curve	115 / 208Vac	60 Hz	Class 2	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$

Table 4: IEC 61000-4-13 Test Coverage

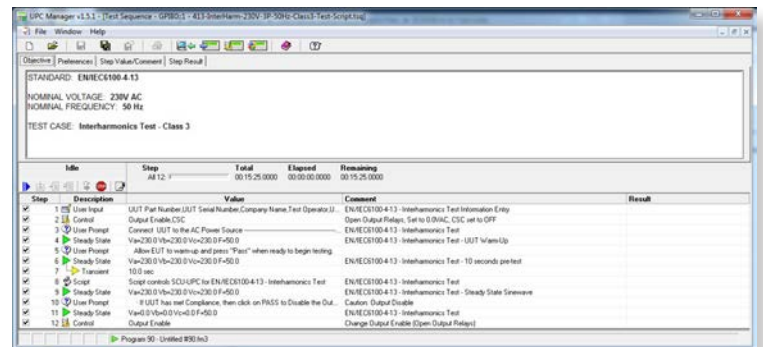


Figure 8: IEC 61000-4-13 Test Execution Control Screen

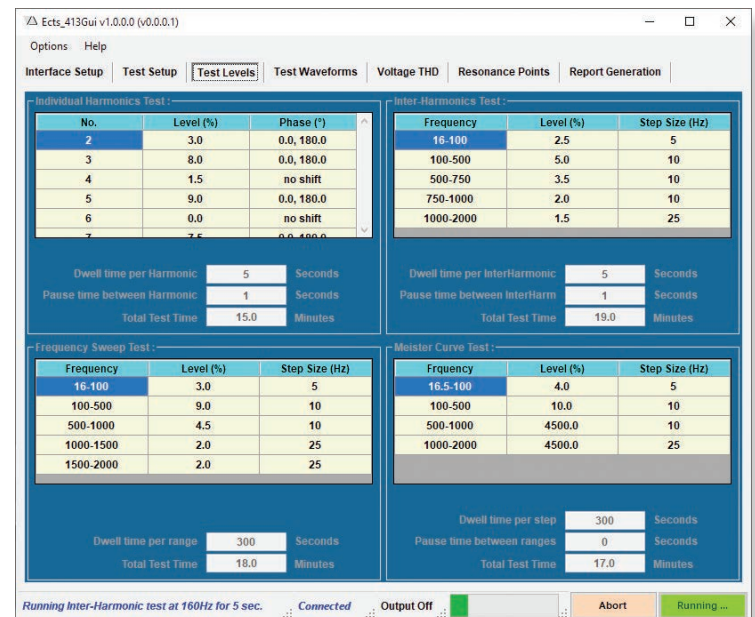


Figure 9: IEC 61000-4-13 Inter Harmonic Windows GUI for AFX, AZX or ECTS2

## AC Source Requirements-IEC 61000-4-13

Table 5 of the IEC 61000-4-13 standard specifies AC generator performance requirements. The LMX and ASX AC sources meet or exceed these requirements as indicated in table 5. AFX Series model power sources do not support IEC 61000-4-13 testing at this time.

In addition to the AC Source requirements shown in Table 5, the AC voltage distortion of the AC Power Source output under load must meet the same requirements as for IEC 61000-3-2 Harmonics emissions testing. For best performance, the LMX series linear AC sources are recommended.

**Note:** IEC 61000-4-13 Option is not available on AFX Series models.

## Voltage Distortion Check

To verify compliance with this voltage distortion requirement, the harmonic measurement function of the power source may be used to run a pre-test on the AC Source with the EUT connected. This can be done prior to running any of the IEC 61000-4-13 test sequences.

## IEC 61000-4-13 Test Reports

Test reports are generated by either the PPSC Test Manager for ASX, AMX or MS systems or the Ects\_413GUI for AFX, AZX or ECTS2 users. A sample Ects\_413GUI test report is shown in Figure 10. Reports include user provided EUT information and operator assessment of EUT pass or fail status.

Parameter	IEC 61000-4-13 Requirement	LMX/ASX with UPC Controller Compliance
<b>Fundamental Voltage:</b>		
- Magnitude U1	Nominal main voltage ±2% single phase Nominal main voltage ±2% three phase	Voltage Accuracy: ±0.5% single phase Voltage Accuracy: ±0.5% three phase
- Frequency	50Hz ± 0.5% or 60Hz ±0.5%	50Hz ± 0.01% 120° ± 0.5°
- Angle between phases	120° ± 1.5° (star connection)	
<b>Individual Harmonics:</b>		
- Order	2 to 40	2 to 51
-Magnitude Uh Range Accuracy	0% - 14% Larger of ±5% or 0.1% U1	0% to 100% Meets
- Phase angle h = 2 to 9 Accuracy of zero phase crossing with respect to fundamental	0°, 180° ±2° of fundamental	Programmable 0° to 359° ±0.5° of fundamental
<b>Inter Harmonics</b>		
-Magnitude Range Accuracy	0% to 10% Larger of ±5% or 0.1% U1	0% to 100% Meets
-Frequency Range Steps for adjusting Maximum error of adjusted value	0.33 x f1 to 40 x f1 0.1 x f1 to 0.5 x f1 ±0.5% f	0.33 x f1 to 80 x f1 Exceeds requirements ±0.01% f

Table 5: IEC 61000-4-13, Table 5 Generator Requirements

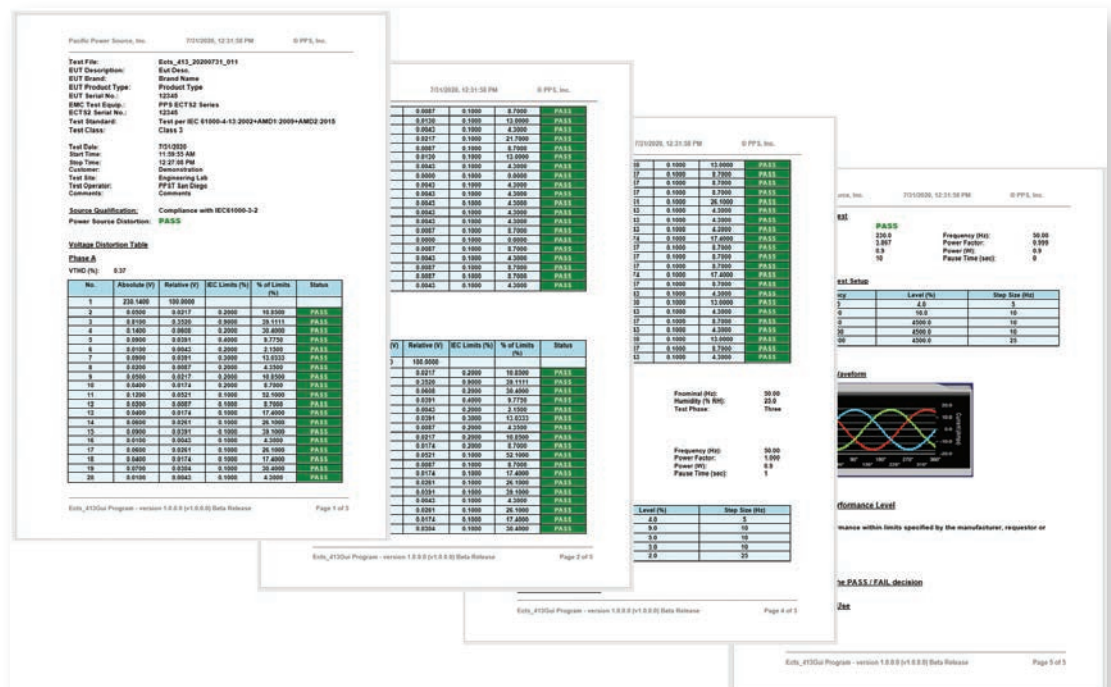


Figure 10: Sample IEC 61000-4-13 EUT Test Report Pages



## IEC 61000-4-14 Voltage Fluctuations

The IEC 61000-4-14 standard applies a series of repetitive voltage fluctuations. The required IEC 61000-4-14 test sequences are included in the IEC AC Immunity option package and cover all defined classes and nominal voltage and frequency permutations for single, split or three phase products.

The appropriate IEC 61000-4-14 test sequence can be selected from the UPC Test Manager pull down menu based on nominal voltage, frequency, phase mode and test level or class.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-14 test sequence is shown in Figure 11. Text execution is normally continuous but the user has the option of single stepping through the sequence.

A typical IEC 61000-4-14 three phase voltage fluctuation test is shown in Figure 12.

## AC Source Requirements- IEC 61000-4-14

Table 2 of the IEC 61000-4-14 standard specifies AC generator performance requirements. AFX, ASX and LMX AC sources meet or exceed these requirements as indicated in table 7.

Parameter	IEC 61000-4-14 Requirement	LMX/ASX with UPC Controller Compliance	AFX Series Compliance
Output voltage capability	Un ± 25%	Maximum voltage is a function of the AC Power Source model used. Actual test levels do not exceed Un+12% so a 260Vrms L-N or L-L voltage range is sufficient for Un = 230Vrms.	300Vrms
Voltage accuracy	± 1%	± 0.5%	± 0.02%
Zero crossing accuracy	250 msec at zero voltage crossover	< 1 msec	
Output current capability	Able to supply enough current to EUT at test voltage	Model dependent. See LMX/ASX/AFX Data sheet for Current/Voltage rating chart by model.	
Voltage overshoot/undershoot	Less than 5% of the change in voltage	Meets requirement	
Voltage rise/fall time during switching	< 1 µsec	< 1 µsec	
Maximum interphase error (Three Phase)	2.5°	0.5°	
Frequency accuracy	2.5% of fn (50 Hz of 60 Hz)	0.01% of fn (15 Hz – 150 Hz)	

Table 7: IEC 61000-4-14, Table 2 Generator Requirements

IEC 61000-4-14	Test	Voltage $V_{LN}/V_{LL}$ ( $V_{RMS}$ )	Frequency (Hz)	Class / Test Level	Phase Mode
Table 1	Voltage Fluctuations	115 / 208Vac	60 Hz	Class 2 & 3	1ø, 3ø
		230 / 400Vac	50 Hz	Class 2 & 3	1ø, 2ø, 3ø

Table 6: IEC 61000-4-14 Test Coverage

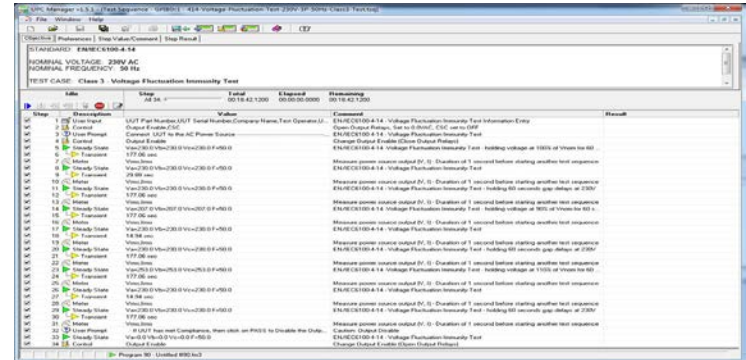


Figure 11: IEC 61000-4-14 Test Execution Control Screen

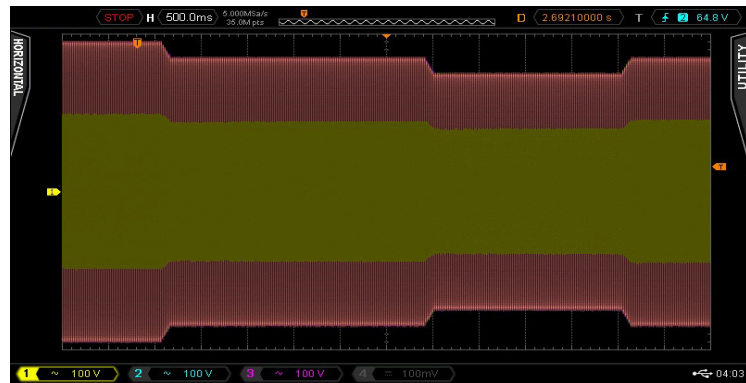


Figure 12: IEC 61000-4-14 Three Phase Voltage Fluctuation Test

## IEC 61000-4-17 Ripple on DC

The IEC 61000-4-17 standard covers only DC powered products. The Pacific Power Source IEC 61000-4-17 option, when used with the AFX Series, covers DC powered products up to 425Vdc. Included test voltages are shown in the table below. Additional DC test levels can be created by copying and editing any of the provided test sequence files. The AFX Series meets all IEC 61000-4-17 Power Source requirements.

Power Group	Nominal Voltage	Ripple Frequency	Ripple Amplitude
DC	24Vdc	50Hz	2%, 5%, 10%, 15%
	24Vdc	100Hz	
	24Vdc	150Hz	
	24Vdc	300Hz	
	48Vdc	50Hz	2%, 5%, 10%, 15%
	48Vdc	100Hz	
	48Vdc	150Hz	
	48Vdc	300Hz	

Table 8: IEC 61000-4-17 Test Coverage

## IEC 61000-4-27 Voltage Unbalance

The IEC 61000-4-27 standard applies only to 50Hz or 60Hz three-phase powered electrical and/or electronic equipment with rated line current up to 16Arms per phase. It establishes a reference for evaluating the immunity of such equipment when subjected to an unbalanced power supply voltage. This test can only be performed using a three phase AC Power Source. An error message will be generated when attempting to execute any of these tests on a AC Power Source in single phase or split phase mode and the test will not start.

The IEC 61000-4-27 test sequences included in the IEC AC Immunity option package covers class 2 and 3 for nominal voltage and frequency permutations and in three phase mode only.

The appropriate IEC 61000-4-27 test sequence can be selected from the UPC Test Manager pull down menu based on nominal voltage, frequency and test level or EUT class.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-27 test sequence is shown in Figure 13. Text execution is normally continuous but the user has the option of single stepping through the sequence.

A typical IEC 61000-4-27 three phase voltage unbalance test is shown in Figure 14.

## AC Source Requirements – IEC 61000-4-27

Table 2 of the IEC 61000-4-27 standard specifies AC generator performance requirements. The LMX, ASX and AFX AC sources meet or exceed these requirements as indicated in table 10.

Parameter	IEC 61000-4-27 Requirement	LMX/ASX with UPC Controller Compliance	AFX Series Compliance
Output Voltage Capability	Un ± 50%	Actual test levels do not exceed Un+10% so a 260Vrms L-N or L-L voltage range is sufficient for Un = 230Vrms.	300Vrms
Output Voltage Accuracy	± 2% of Un	± 0.5%	
Output Current Capability	Sufficient to supply the EUT under all test conditions	Model dependent. See LMX/ASX/AFX Data sheet for Current/Voltage rating chart by model.	
Voltage overshoot / undershoot, generator loaded with 100 Ohm resistive load	Less than 5% of the change in voltage	Meets requirement	
Voltage rise/fall time during switching, generator loaded with 100 Ohm resistive load	1 µsec to 5 µsec	See comment under IEC 61000-4-11, Table 3.	
Total harmonic distortion of the output voltage	Less than 3%	ASX Series: Less than 0.25%, 15Hz – 1200Hz LMX Series: Less than 0.1%, 45Hz-1000Hz	< 0.25%
Phase Shifting	0°, 120°, 240° ± 30°	0°, 120°, 240° ± 30°	
Phase Accuracy	1° between any two phases	0.5° between any two phases	
Frequency Accuracy	0.5% of f1 (50 Hz of 60 Hz)	0.01% of f1 (15 Hz – 150 Hz)	

Table 10: IEC 61000-4-27, Table 2 Generator Requirements

IEC 61000-4-27	Test	Voltage $V_{LN}/V_{LL}$ ( $V_{RMS}$ )	Frequency (Hz)	Class / Test Level	Phase Mode
Table 1	Voltage Unbalance	115 / 208Vac	60 Hz	Class 2 & 3	3ø
		230 / 400Vac	50 Hz	Class 2 & 3	3ø

Table 9: IEC 61000-4-27 Test Coverage

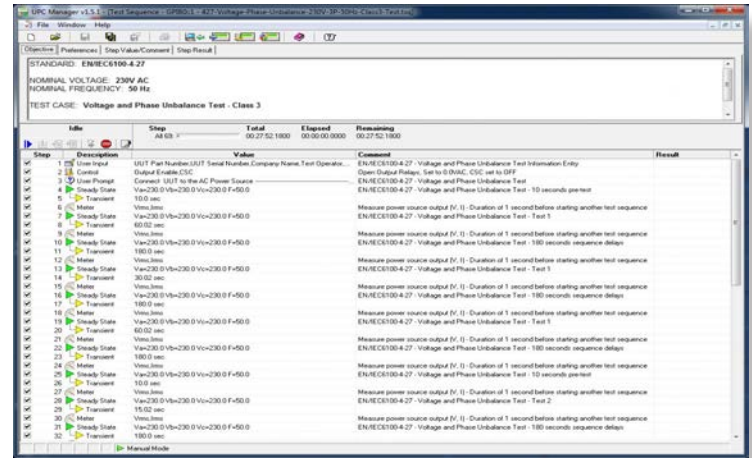


Figure 13: IEC 61000-4-27 Test Execution Control Screen

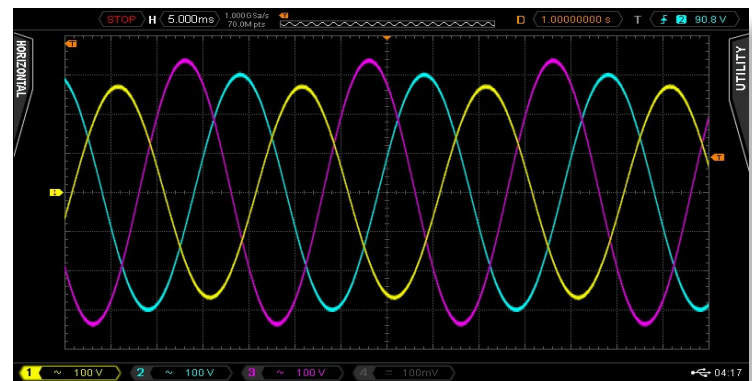


Figure 14: IEC 61000-4-27 Three Phase Voltage Unbalance Test



## IEC 61000-4-28 Frequency Variations

The IEC 61000-4-28 standard is intended to evaluate the effect of power frequency variations on equipment which may be sensitive to such disturbances. These effects are generally instantaneous. To this end, these tests apply frequency variations using specific frequency slew rates to the EUT.

The IEC 61000-4-28 test sequences included in the IEC AC Immunity option package covers test levels 1, 2, 3 and 4 for nominal voltage and frequency permutations and in single, split or three phase mode. These test levels relate to product Classes 1, 2 and 3 per section 5 of the standard.

The appropriate IEC 61000-4-28 test sequence can be selected from the UPC Test Manager pull down menu based on nominal voltage, frequency, phase mode and test level.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-28 test sequence is shown in Figure 15. Text execution is normally continuous but the user has the option of single stepping through the sequence.

A typical IEC 61000-4-28 three phase frequency variation test is shown in Figure 16. Since the frequency change is very gradual, it is near impossible to see on a digital scope. A frequency counter is required to measure the actual frequency changes.

## AC Source Requirements – IEC 61000-4-28

Table 2 of the IEC 61000-4-28 standard specifies AC generator performance requirements. The LMX, ASX and AFX AC sources meet or exceed these requirements as indicated in table 11.

## IEC 61000-4-29 DC Dips & Interruptions

The IEC 61000-4-29 standard is intended to evaluate the effect of voltage dips and interruptions on equipment which may be sensitive to such disturbances. Note that this is a DC tests and requires the use an AFX Series source.

## DC Source Requirements – IEC 61000-4-29

This test requires the use of an AFX power source to produce the required DC voltage output. For full compliance, the EPTS Electronic Power Transfer Switch is required (Refer to IEC61000-4-11 section).

Parameter - IEC 61000-4-29	Requirement	AFX Series
Output voltage range ( $U_o$ )	up to 360 V	up to 425 Vdc
Output voltage variation with the load (0 to rated current)	Less than 5 %	Less than 0.02 % of FS.
Ripple content	Less than 1% of the output voltage	Complies for test voltage $U_o > 15Vdc$
Rise and fall time of the voltage change, generator loaded with 100 Ohm resistive load	Between 1 $\mu s$ and 50 $\mu s$	< 140 $\mu s$
Overshoot/undershoot of the output voltage (100. Ohm Rload)	Less than 10 % of the change in voltage	Full compliance
Output current (steady state)	Up to 25 A	All AFX models > 25A

IEC 61000-4-27	Test	Voltage $V_{LN}/V_{LL}$ ( $V_{RMS}$ )	Frequency (Hz)	Class / Test Level	Phase Mode
Table 1	Voltage Unbalance	115 / 208Vac 230 / 400Vac	60 Hz 50 Hz	Class 2, 3 & 8 Class 2, 3 & 4	1 $\phi$ , 3 $\phi$ 1 $\phi$ , 3 $\phi$

Table 11: IEC 61000-4-28 Test Coverage

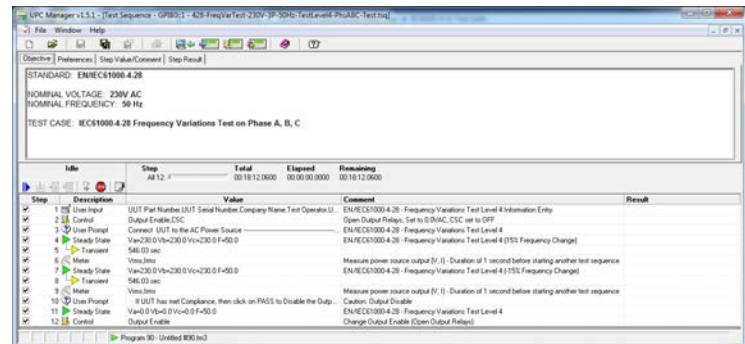


Figure 15: IEC 61000-4-28 Test Execution Control Screen

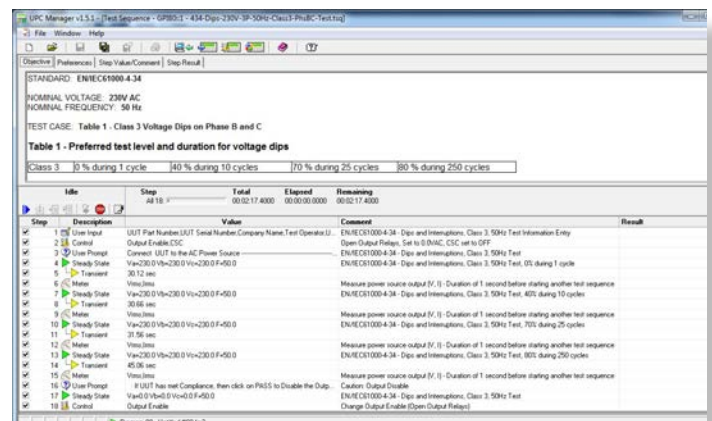


Figure 16: IEC 61000-4-28 Frequency Variation Test

Parameter	IEC 61000-4-28 Requirement	AFX, LMX, ASX Compliance
Output voltage accuracy	$\pm 2\%$	$\pm 0.5\%$
Output voltage and current capability	Able to supply enough voltage and current according to the type of EUT	Model dependent. See ASX/LMX Data sheet for Current/Voltage rating chart by model.
Phase accuracy for each phase	2° (0.5% of 360°)	0.5° or better
Frequency accuracy	0.3% of f1 (50 Hz of 60 Hz)	0.01% of f1 (15 Hz – 150 Hz)
Frequency capability range	f1 $\pm 20\%$	Exceeds requirements
Test duration accuracy	$\pm 10\%$	$\pm 0.01\%$

Table 12: IEC 61000-4-28, Table 2 Generator Requirements

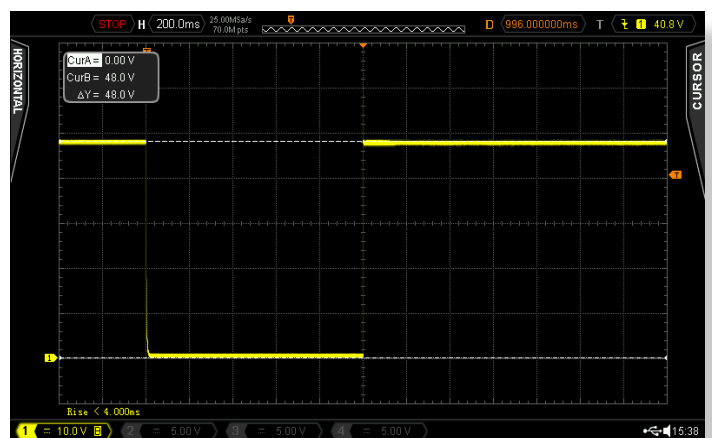


Figure 17: IEC 61000-4-29 DC Voltage Dip Test

## IEC 61000-4-34 Voltage Dips, Interruptions and Variations

The IEC61000-4-34 is closely related to the IEC 61000-4-11 standard as both cover Voltage dips, short interruption and voltage variations. The main difference is that the IEC 61000-4-11 standard only covers products requiring no more than 16 Arms per phase while the IEC 61000-4-34 covers products with higher current requirements.

IEC 61000-4-34 tests are used to determine the ability of the equipment under test to withstand short duration voltage dips and variations. Products test levels and durations are categorized into four classes, 1, 2, 3 and X with X being a class defined by individual product committees with the restriction that they cannot be less severe than class 2. Test levels for class 1 and X are not specified in the IEC 61000-4-34 standard itself. Testing levels for these classes are defined in product specific IEC standards which refer to the generic IEC 61000-4-34 standard for test methods and equipment to be used.

The IEC 61000-4-34 tests covers all defined classes and nominal voltage and frequency permutations for single, split or three phase products. Both Voltage Dips and Voltage Variations are covered.

The appropriate IEC 61000-4-34 test sequence can be selected from the UPC Test Manager pull down menu based on nominal voltage, frequency, phase mode and test level or EUT class.

Once selected, the corresponding test screen is displayed allowing a test to be started. A typical IEC 61000-4-34 test sequence is shown in Figure 18. Text execution is normally continuous but the user has the option of single stepping through the sequence.

A typical IEC 61000-4-34 three phase voltage variation test is shown in Figure 19.

IEC 61000-4-34 Table	Test	Voltage $V_{IN} / V_{UL} (V_{RMS})$	Frequency (Hz)	Class/Test Level	Phase Mode
Table 1	Voltage Dips	115 / 208Vac	60 Hz	Class 2	1 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 2	Short Interruptions	115 / 208Vac	60 Hz	Class 2	1 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	Class 2	1 $\phi$ , 2 $\phi$ , 3 $\phi$
				Class 3	1 $\phi$ , 2 $\phi$ , 3 $\phi$
Table 3	Voltage Variations	115 / 208Vac	60 Hz	V = 70%	1 $\phi$ , 3 $\phi$
		230 / 400Vac	50 Hz	V = 70%	1 $\phi$ , 2 $\phi$ , 3 $\phi$

Table 13: IEC 61000-4-34 Test Coverage

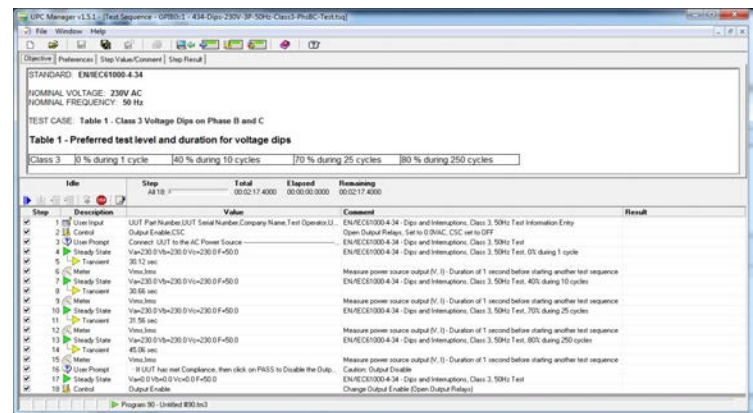


Figure 18: IEC 61000-4-34 Test Execution Control Screen

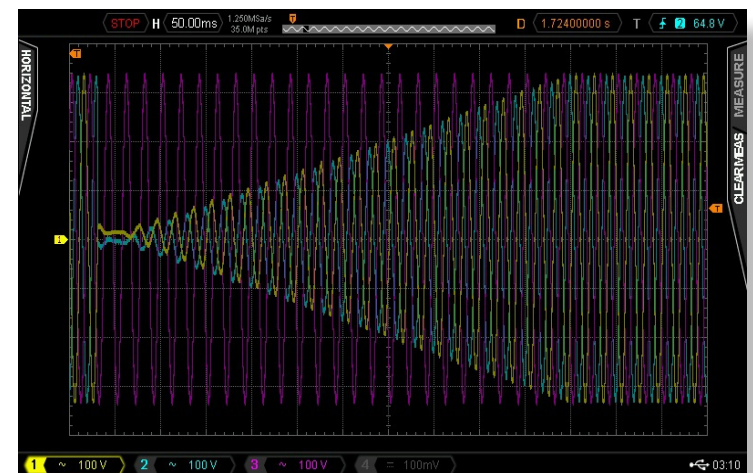


Figure 19: IEC 61000-4-34 Three Phase Voltage Variation Test

## AC Source Requirements – IEC 61000-4-34

Due to the similarities between the IEC 61000-4-11 and IEC 61000-4-34 Voltage Dips and Interruptions test standards, source requirements are similar with the obvious exception of the current capability of the AC Power Source used. Table 4 in Section 6.1.1 of the IEC 61000-4-34 standard specifies AC generator performance requirements. The LMX, ASX and AFX AC Power Sources meet or exceed these requirements with only one exception as indicated in table 13.

## Test Reports

To document product compliance to IEC test standards, it is necessary to fully document the tests performed and results from the test. To this end, the IEC AC option provides a comprehensive report generation capability. IEC Test reports are created in a Rich Text Format which is compatible with a wide range of word processors including those contained in MS Office, OpenOffice or LibreOffice. Templates can be customized with company logos and descriptions as desired.

At the end of a test run, the test reports documents the tests applied to the EUT as well as any measurement results and comments added by the operator as prompted by the program. An on-screen copy of the report is displayed and then saved to the Reports directory on disk.

A sample IEC 61000-4-14 Test Report is shown in Figure 20.

Parameter	IEC 61000-4-34 Requirement	LMX/ASX with UPC Controller Compliance	AFX Series Compliance
Output voltage at no load	0 to 100%, $\pm 5\%$ of residual voltage	Voltage Accuracy: $\pm 0.5\%$	Voltage Accuracy: $\pm 0.25\%$
Voltage at the output of generator during equipment test	$\pm 10\%$ of residual voltage value, measured as rms value every $\frac{1}{2}$ cycle.	Meets requirements	Load Regulation: 0.02%
Output current capability	On phases that are not dipped, 200% of rated current. On phases that are dipped, sufficient current to maintain test voltage within $\pm 10\%$ of UT	Model dependent. See ASX/LMX Data sheet for Current/Voltage rating chart by model.	Model dependent. See AFX Data sheet for Current/Voltage rating chart by model.
Peak Inrush current capability. (no requirement for voltage variation tests)	Not to be limited by generator. However, maximum peak capability need not exceed 1000A for 250V to 600V or 500A for 200V to 240V, or 250A for 100V to 120V mains.	Model dependent. See ASX/LMX Data sheet for Current/Voltage rating chart by model.	Model dependent. See AFX Data sheet for Current/Voltage rating chart by model.
Instantaneous peak overshoot/undershoot of the actual voltage, generator loaded with 100, 50 or 25 Ohm resistive load.	Less than 10% of UT	< 2%	
Voltage rise and fall time during abrupt change, generator loaded with 100 Ohm resistive load.	Between 1 and 5 msec for current < 75A	Exception. However, not relevant to actual voltage dips and interruption testing of products. Refer to IEC clarification statement 77A/720/DC on this topic.	
Phase angle at which the voltage dip begins and ends.	0° to 360° with a maximum resolution of 5°	0° to 360°, resolution 0.1°	
Phase relationship of voltage dips and interruptions with the power frequency	Less than $\pm 5^\circ$	$\pm 0.5^\circ$	
Zero crossing control of the generator	$\pm 10^\circ$	$\pm 0.5^\circ$	

Table 14: IEC 61000-4-34 Section 6.1.1, Table 4 Generator Requirements

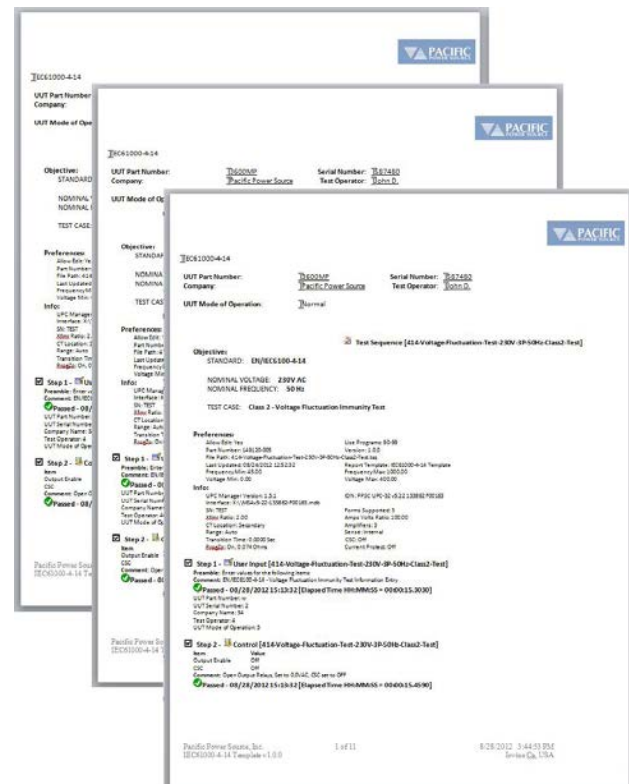


Figure 20: Sample IEC Test Report



## Requirements

To deploy the IEC AC Immunity test option, the following items are required in addition to the IEC-AC-4XX Option itself:

- PPSC Test Manager or UPC Studio Windows Software: Available at no charge to all Pacific Power Source customers and can be downloaded from our website. ([www.pacificpower.com](http://www.pacificpower.com))
- PPSC Test Manager (AFX, AZX, LMX) or UPC Test Manager (ASX, AMX, MS): This is a cost option and not included as part of the IEC AC Immunity test option package. It is included with ECTS2 Harmonics and Flicker Test systems however. If you do not already own PPSC or UPC Test Manager, contact Pacific Power Source to order a copy.
- Pacific Power Source AC Power Source with either UPC1/UPC3 or UPC12/UPC32 controller or AFX, AZX or LMX Series.
- A user provided Windows 10 PC with either a National Instruments LAN, USB, GPIB or RS232 interface is required to run PPSC Manager or UPC Studio software. A pre-configured Laptop PC with all software pre-installed is available as an option through Pacific Power Source if needed.
- For IEC 61000-4-13, one of two possible Interharmonics Generators:
  - Inter harmonics generator -413 option for AFX, AZX & LMX.
  - SCU-UPC32-413 option for ASX, AMX or MS. This additional controller is controlled by the IEC 61000-4-13 test sequence. It is only required for IEC 61000-4-13 and sold separately. This option includes the required wire harness to interface to the ASX, AMX or MS AC power source Auxiliary inputs. Customer must have a National Instruments GPIB Interface controller in the PC used to run UPC Studio to use the SCU-UPC32-413 controller.

## Ordering Information

Required options needed to support the following tests:

Item	Description	Details
<b>PPSC Manager</b>	AC Power Source Control Software	Available to all PPS customers at no charge
<b>PPCS Test Manager</b>	Test Manager Option	Required to use IEC AC-4XX software and -413 option
<b>IEC-AC-4XX</b>	IEC 61000-4 AC Immunity Test Sequences	Includes 4-11, 4-14, 4-27, 4-28, 4-29 and 4-34. Excludes 4-13 option. Also includes Korean versions KS-4-11, KS-4-29
<b>-413</b>	Interharmonic Generator & Test Sequences for IEC 61000-4-13 for AFX, AZX and LMX Models	Interharmonics generator is built into power source. Must be specified at time of power source order. Available on AFX, AZX and LMX Models
<b>SCU-UPC32-413<sup>1</sup></b>	IEC 61000-4-13 Inter Harmonic Generator for ASX, AMX and MS Series power sources	Required to run 4-13 tests on ASX, AMX and 3060MS. Includes 4-13 test sequences.
<b>Prog Z Option</b>	Programmable Output Impedance	Required when using ASXT in transformer coupled mode
<b>HAS Option</b>	Harmonic Analysis and Synthesis option	Suggested for use with IEC 61000-4-13 testing if no Harmonics and Flicker or Power analyzer is available. Applies to ASX, AMX & MS Series only

**Note 1:** SCU-UPC32-413 required for ASX Series models only

### Order Example

#### IEC-AC-4XX

- Option IEC 61000-4-XX test software
- Assumes user already owns Test Manager Software

### Test Coverage By Source Model Series

IEC 61000-4 Test	Mode	AFX / AZX / LMX / ECTS2	AMX / ASX / MS
IEC 61000-4-11	AC	☺	☺
IEC 61000-4-13	AC	Opt -413	Opt SCU
IEC 61000-4-14	AC	☺	☺
IEC 61000-4-17	AC + DC	☺	
IEC 61000-4-27	AC	☺	☺
IEC 61000-4-28	AC	☺	☺
IEC 61000-4-29	DC	☺	
IEC 61000-4-34	AC	☺	☺
KS C 9610-4-11	AC	☺	☺
KS C 9610-4-29	DC	☺	

### Parts of the Standard Delivery

- Distribution CD ROM
- IEC AC Immunity Test Option User Manual, P/N 149151
- Compatible with UPC Studio and PPSC Manager Software
- ASX Option: SCU/UPC32-413 (P/N P001156) includes US Line cord and required cabling (P/N 150219) between SCU/UPC32 and AC Power Sources; UPC32 controller.

**Note:** This option requires a GPIB/IEEE-488 Interface.



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