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IEC AC Option

IEC 61000-4 AC Immunity Test Routines

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
- **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
- **IEC61000-4-27,** 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 61000-4-29p,** Voltage dips, short interruptions and voltage variations on DC input power port immunity tests
- **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.*

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.

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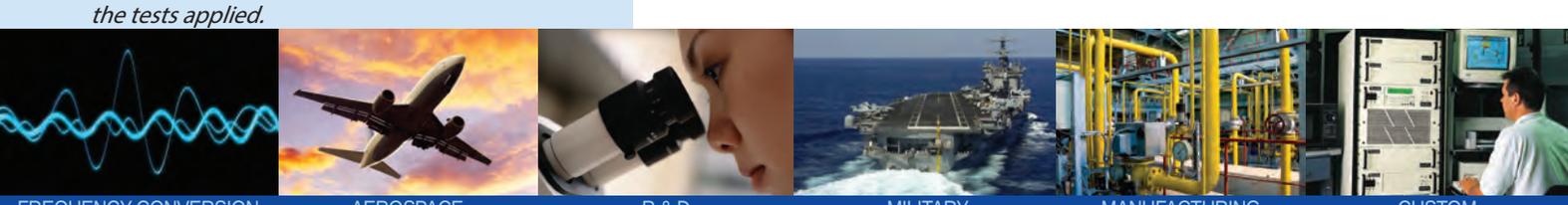

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Standard and Editions included in the IEC AC Immunity Option

The Pacific Power Source IEC AC Immunity Test option includes pre-defined test sequences for all relevant IEC 61000-4 standards. This option provides a complete solution for IEC AC conducted immunity testing when combined with an AMX, ASX 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	Edition	PPS P/N
IEC61000-4-11	Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests (AC, <16A)	Edition 2.0, 2004-03	149117
IEC61000-4-13	Testing and measurement techniques – Harmonics and inter harmonics including mains signaling at AC power port, low frequency immunity tests	Edition 1.1, 2009-07	149123
IEC61000-4-14	Testing and measurement techniques – Voltage fluctuation immunity test	Edition 1.2, 2009-08	149120
IEC61000-4-27	Testing and measurement techniques - Unbalance, immunity test for equipment with input current not exceeding 16 A per phase	Edition 1.1 Consol. with am1, 2009-04	149121
IEC61000-4-28	Testing and measurement techniques - Variation of power frequency, immunity test for equipment with input current not exceeding 16 A per phase	Edition 1.2 Consol. with am1&2, 2009-04	149119
IEC61000-4-29p	Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on DC input power port immunity tests (pre-compiance)	Edition 1.0, 2000-08	149129
IEC61000-4-34	Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with mains current more than 16 A per phase	Edition 1.1, 2009-11	149118

Table 1: Included IEC Standards and Editions

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 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 avaliable the user.

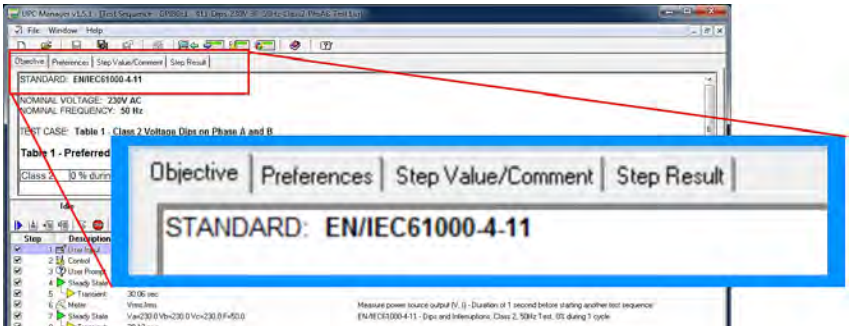

Figure 1: UPC Test Manager Control Tabs

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-ridden 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.

UPC Studio Software Suite

Master the Power of the Wave!

The IEC AC Immunity test sequences are installed as part of the UPC Studio Software and provide preprogrammed AC Immunity test sequences per the various IEC 61000-4 test standards. This allows the operator to quickly and easily apply required immunity tests and generate detailed test reports verifying compliance of the EUT. With the combination of UPC Test Manager and the IEC AC test sequence option, our graphical interface controls all areas of your AC Immunity testing with simple presets, user prompts, test sequences, test plans and reports.

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 ½ cycle duration is shown in Figure 4.

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 AMX and ASX AC sources meet or exceed these requirements with only one exception as indicated in table 3.

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	1ø , 3ø
				Class 3	1ø , 3ø
		230 / 400Vac	50Hz	Class 2	1ø , 2ø, 3ø
				Class 3	1ø , 2ø, 3ø
Table 2	Short Interruptions	115 / 208Vac	60 Hz	Class 2	1ø , 3ø
				Class 3	1ø , 3ø
		230 / 400Vac	50Hz	Class 2	1ø , 2ø, 3ø
				Class 3	1ø , 2ø, 3ø
Table 3	Voltage Variations	115 / 208Vac	60 Hz	V = 70%	1ø , 3ø
		230 / 400Vac	50Hz	V = 70%	1ø , 2ø, 3ø

Table 2: IEC 61000-4-11 Test Coverage

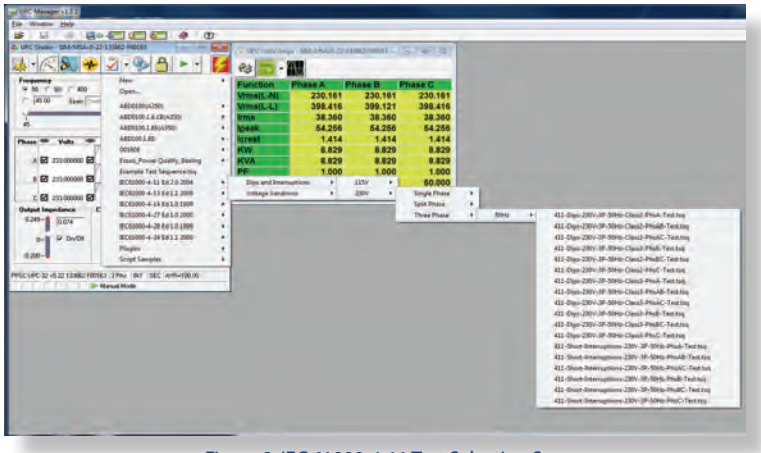

Figure 2: IEC 61000-4-11 Test Selection Screen

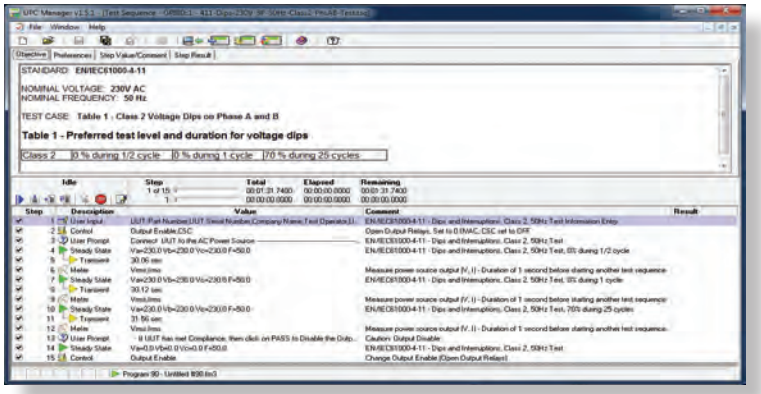

Figure 3: IEC 61000-4-11 Test Execution Control Screen

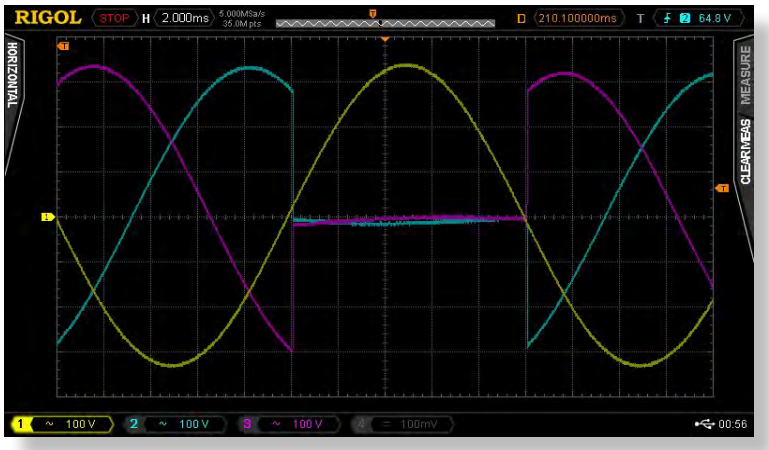

Figure 4: IEC 61000-4-11 1/2 Cycle Phase-to-Phase Voltage Dip

Voltage Rise and Fall Time Requirement Clarification

The requirement to meet a 1 to 5 µsec rise and fall time of the AC voltage has been the cause of much confusion over the years as it necessitated the use of multi-tap transformers and electronic transfer switches to meet this requirement, adding excessive cost and economic burden to test labs and other end users of EMC compliance equipment. As the actual voltage dips and interruptions called out in product standards that reference the IEC 61000-4-11 standard are all performed at zero crossings of the AC sine wave (0° or 180° phase angle). At that point, no rise or fall time is applicable. The IEC SC77A Working Group 6 that is responsible for the IEC 61000-4-11 has issued an interpretation sheet that addresses this long standing controversy.

Document 77A/720/DC states the following:

1. In IEC 61000-4-11 Ed 2, Table 4 (Generator Specifications) does not apply to EUT (Equipment Under Test) testing. Table 4 is for generator calibration and design only.
2. With reference to Table 1 and Table 2 (Test Levels and Durations), there is no requirement in 61000-4- 1 Ed 2 for rise-time and fall-time when testing an EUT; therefore, it is not necessary to measure these parameters during tests.
3. With reference to Table 4 (Generator Specifications), all of the requirements apply to design and calibration of the generator. The requirements of Table 4 only apply when the load is a non-inductive 100-ohm resistor. The requirements of Table 4 do not apply during EUT testing.

As such, it is not necessary to burden the AC Power Source used for IEC 61000-4-11 testing with this requirement.

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 5 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	AMX/ASX with UPC Controller Compliance
Output voltage at no load	0 to 100%, ±5% of residual voltage	Voltage Accuracy: ±0.5%
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%
Output current capability	Capable of supporting current stated in row 2 of this table for 5 sec at 80% of U and 3 sec at 70% or 40% of U. This requirement may be reduced according to EUT rated steady state supply current.	Model dependent. See ASX/AMX 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/AMX 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 µs and 5 µs.	Exception. However, not relevant to actual voltage dips and interruption testing of products. Refer to IEC issued clarification statement 77A/720/DC on this topic.
Phase Shifting	0° to 360°	0° to 360°
Phase relationship of voltage dips and interruptions with the power frequency	Less than ±10°	±0.5°
Zero crossing control of the generator	±10°	±0.5°

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

Figure 5: IEC 61000-4-11 Phase BC Voltage Dip to 70% of UT

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. In case of the IEC AC Immunity test option, an SCU-UPC32-413 three phase capable external controller is used to accomplish this.

The IEC 61000-4-13 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. Harmonics and Inter Harmonics frequency ranges are swept using pre-scribed 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 6. Text execution is normally continuous but the user has the option of single stepping through the sequence.

A typical IEC 61000-4-13 three phase interharmonic frequency sweep tests is shown in Figure 7.

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

Table 4: IEC 61000-4-13 Test Coverage

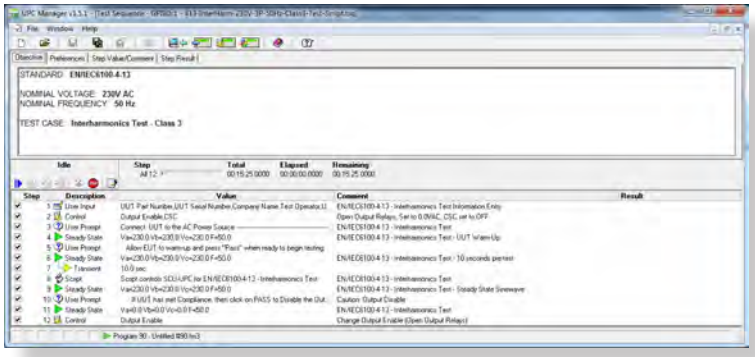

Figure 6: IEC 61000-4-13 Test Execution Control Screen

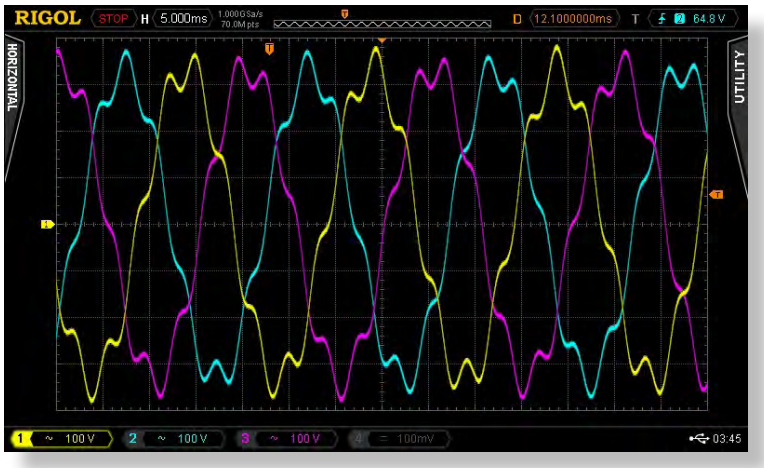

Figure 7: IEC 61000-4-13 Inter Harmonic Frequency Sweep Test

SCU-UPC32 Inter Harmonics Generator

To perform the inter harmonics tests included in the IEC 61000-4-13 test standard, a fully independent single or three phase waveform generator – model SCU-UPC32-413 - is required in addition to the main AC Power Source generator which produces the fundamental and harmonics frequency components of the test signal. 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.

Figure 8: Model SCU-UPC32-413 Inter Harmonic Generator-3 Phase

AC Source Requirements-IEC 61000-4-13

Table 5 of the IEC 61000-4-13 standard specifies AC generator performance requirements. The AMX and ASX AC sources meet or exceed these requirements as indicated in table 5.

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 AMX series linear AC sources are recommended.

Voltage Distortion Check-HAS Option

To verify compliance with this voltage distortion requirement, the HAS option 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. If no suitable Harmonics and Flicker analyzer is available, this test can be performed by the Pacific Power Source AC Source itself as long as the Waveform Harmonic Analysis and Synthesis (HAS) option is installed. See the HAS option data sheet for more details.

http://www.pacificpower.com/Resource/Documents/Has%20Option0712.pdf

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

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

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 9. 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 10.

AC Source Requirements- IEC 61000-4-14

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

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

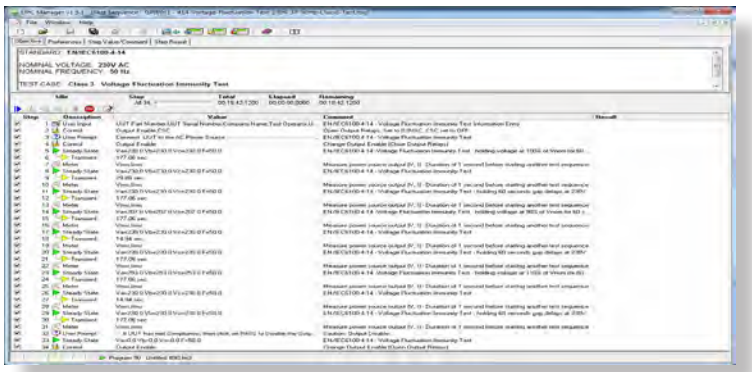

Figure 9: IEC 61000-4-14 Test Execution Control Screen

Figure 10: IEC 61000-4-14 Three Phase Voltage Fluctuation Test

Parameter	IEC 61000-4-14 Requirement	AMX/ASX with UPC Controller 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.
Voltage accuracy	± 1%	± 0.5%
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 ASX/ AMX 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 61000-4-27 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 11. 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 12.

AC Source Requirements – IEC 61000-4-27

Table 2 of the IEC 61000-4-27 standard specifies AC generator performance requirements. The AMX and ASX AC sources meet or exceed these requirements as indicated in table 9.

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 8: IEC 61000-4-27 Test Coverage

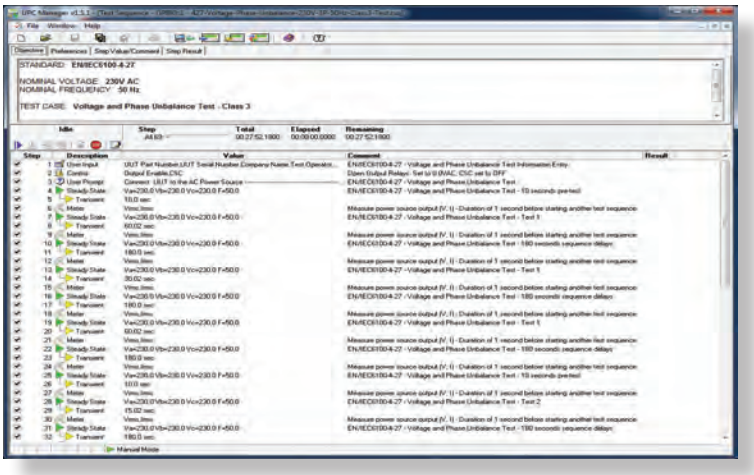

Figure 11: IEC 61000-4-27 Test Execution Control Screen

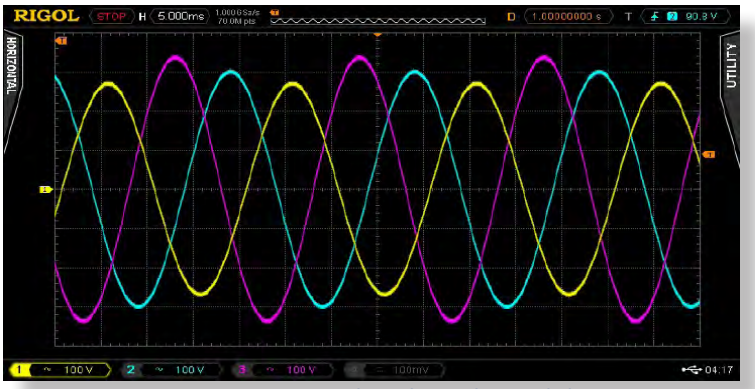

Figure 12: IEC 61000-4-27 Three Phase Voltage Unbalance Test

Parameter	IEC 61000-4-27 Requirement	AMX/ASX with UPC Controller Compliance
Output Voltage Capability	Un ± 50%	Maximum voltage is a function of the AC Power Source model used. Actual test levels do not exceed Un+10% so a 260Vrms L-N or L-L voltage range is sufficient for Un = 230Vrms.
Output Voltage Accuracy	± 2% of Un	± 0.5%
Output Current Capability	Sufficient to supply the EUT under all test conditions	Model dependent. See ASX/ AMX 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 armonic distortion of the output voltage	Less than 3%	ASX Series: Less than 0.25%, 15Hz – 1200Hz AMX Series: Less than 0.1%, 45Hz-1000Hz
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 9: IEC 61000-4-27, Table 2 Generator Requirements

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 13. 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 14. 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 AMX and ASX AC sources meet or exceed these requirements as indicated in table 11.

IEC 61000-4-29p DC Voltage 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 use of the optional DCR hardware available from Pacific Power Source (not included with IEC Option software).

DC Source Requirements – IEC 61000-4-29

This test requires the use of the DCR option to produce the required DC voltage output. Not all DC source requirements can be met with the DCR option so this test is included for pre-compliance test purposes only.

Parameter	IEC 61000-4-29 Requirement	AMX with DCR Compliance
Output voltage range (Uo)	up to 360 V	up tp 600Vdc%
Output voltage variation with the load (0 to rated current)	less than 5 %	less than 1 % of FS.
Ripple content	less than 1% of the output voltage	Complies for test voltage Uo > 20Vdc
Rise and fall time of the voltage change, generator loaded with 100 Ohm resistive load	between 1 µs and 50 µs	Does not comply.
Overshoot/undershoot of the output voltage (100. Ohm Rload)	less than 10 % of the change in voltage	Partial compliance only
Output current (steady state)	up to 25 A	up to 20 A

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 & 8	1ø, 3ø
		230 / 400Vac	50 Hz	Class 2 ,3 & 4	1ø, 3ø

Table 10: IEC 61000-4-28 Test Coverage

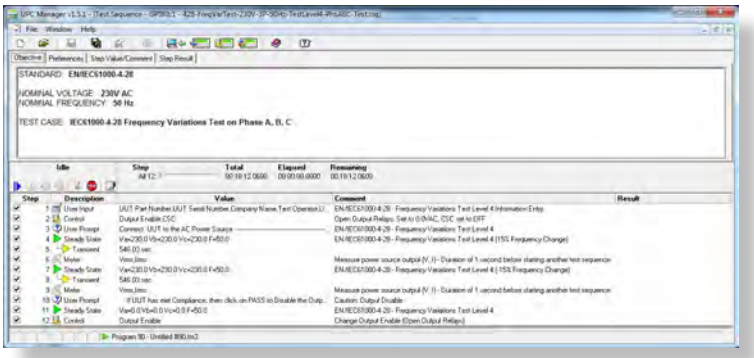

Figure 13: IEC 61000-4-28 Test Execution Control Screen

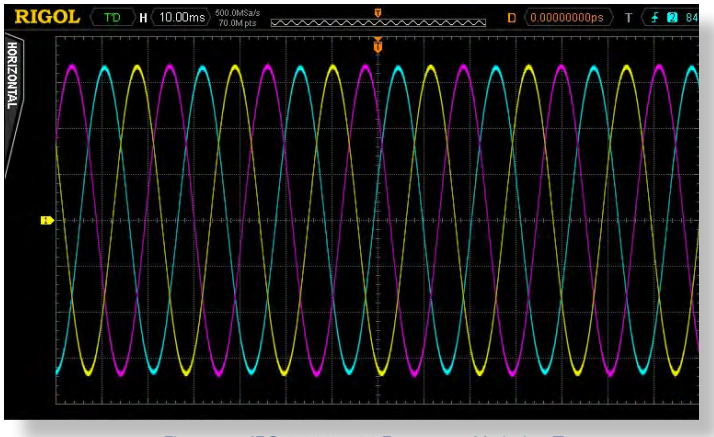

Figure 14: IEC 61000-4-28 Frequency Variation Test

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

Table 11: IEC 61000-4-28, Table 2 Generator Requirements

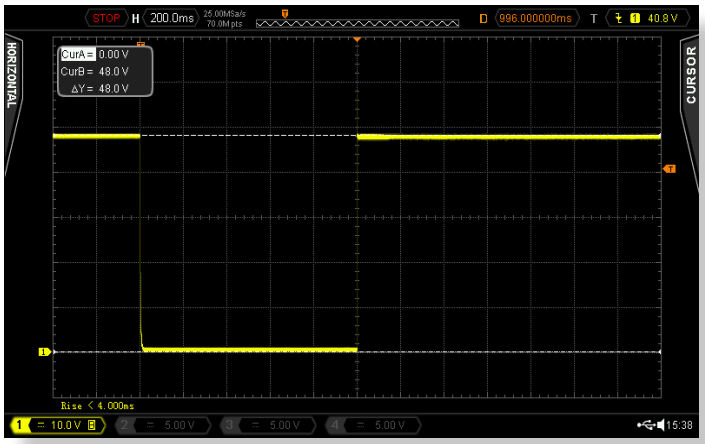

Figure 15: IEC 61000-4-29 DC Voltage Dip Test

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 15. 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 17.

IEC 61000-4-34 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	1ø , 3ø
				Class 3	1ø , 3ø
		230 / 400Vac	50 Hz	Class 2	1ø , 2ø, 3ø
				Class 3	1ø , 2ø, 3ø
Table 2	Short Interruptions	115 / 208Vac	60 Hz	Class 2	1ø , 3ø
				Class 3	1ø , 3ø
		230 / 400Vac	50 Hz	Class 2	1ø , 2ø, 3ø
				Class 3	1ø , 2ø, 3ø
Table 3	Voltage Variations	115 / 208Vac	60 Hz	V = 70%	1ø , 3ø
		230 / 400Vac	50 Hz	V = 70%	1ø , 2ø, 3ø

Table 12: IEC 61000-4-11 Test Coverage

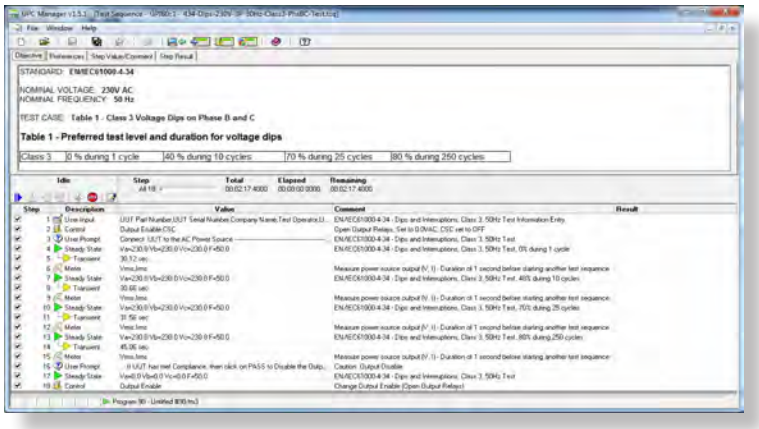

Figure 16: IEC 61000-4-34 Test Execution Control Screen

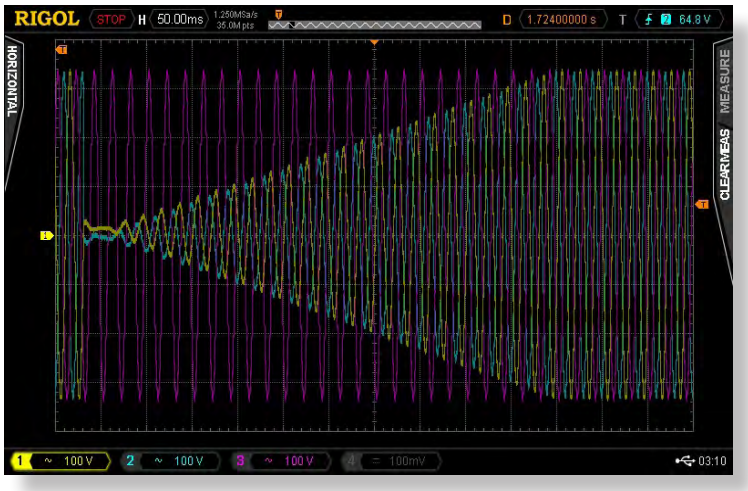

Figure 17: IEC 61000-4-34 Three Phase Voltage Variation Test

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 AMX and ASX AC Power Sources meet or exceed these requirements with only one exception as indicated in table 13.

Model 3060-MS for High Current Test Applications

To support the high currents required for IEC 61000-3-34 testing or large EUT's, the 3060-MS with a 270Vrms high voltage range option should be considered as the AC Power Source to run these tests.

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 18.

Parameter	IEC 61000-4-34 Requirement	AMX/ASX with UPC Controller Compliance
Output voltage at no load	0 to 100%, ±5% of residual voltage	Voltage Accuracy: ±0.5%
Voltage at the output of generator during equipment test	±10% of residual voltage value, measured as rms value every ½ cycle.	Meets requirements
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 ±10% of UT	Model dependent. See ASX/AMX 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/AMX 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 ±5°	±0.5°
Zero crossing control of the generator	±10°	±0.5°

Table 13: IEC 61000-4-34 Section 6.1.1, Table 4 Generator Requirements

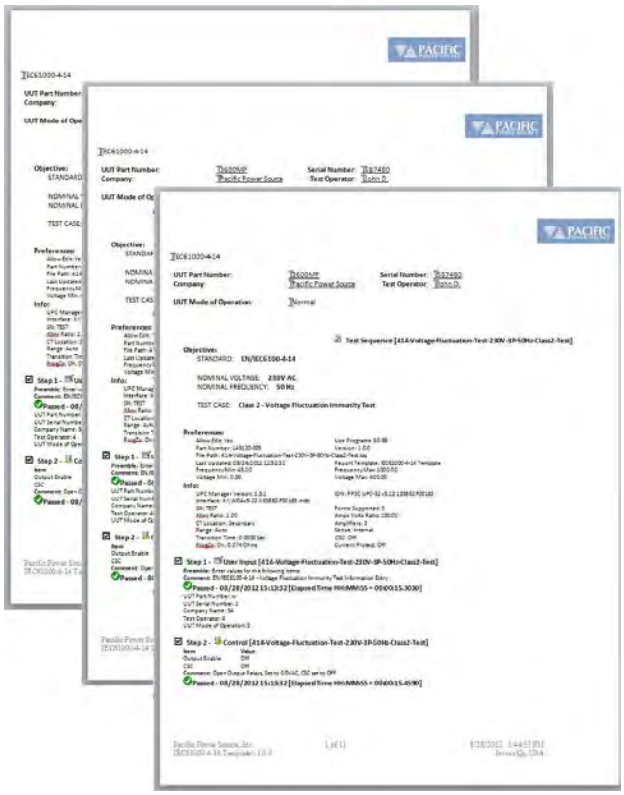

Figure 18: Sample IEC Test Report

Requirements

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

- UPC Studio Windows Software: Available at no charge to all Pacific Power Source customers and can be downloaded from our website. (www.pacificpower.com)
- UPC Test Manager: This is a cost option and not included as part of the IEC AC Immunity test option package. If you do not already own 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.
- A user provided Windows XP or Windows 7 PC with either a National Instruments GPIB/IEEE-488 controller or RS232 interface is required to run 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, an inter harmonics generator is required in the form of the SCU-UPC32-413. This additional controller is controlled by the IEC 61000-4-13 test sequence using a second IEEE-488 address. 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 3060-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.
- Testing per IEC 61000-4-29p requires the optional DCR module. This DCR module is **not** included in the IEC-AC-4XX option package and must be ordered seperately.

Ordering Information

Required options needed to support the following tests:

Item	Description	Details
UPC Studio	AC Power Source Control Software	Available to all PPS customers at no charge.
UPC Test Manager	Test Manager Option	Required to use IEC AC-4XX software and SCU-UPC32-413 options.
IEC-AC-4XX	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.
SCU-UPC32-413	IEC 61000-4-13 Inter Harmonic Generator	Required to run 4-13 tests. Includes 4-13 software.
Prog Z Option	Programmable Output Impedance	Required when using ASXT or AMXT in transformer coupled mode.
HAS Option	Harmonic Analysis and Synthesis option	Suggested for use with IEC 61000-4-13 testing if no Harmonics and Flicker or Power analyzer is available.

Order Example

IEC-AC-4XX SCU/UP32-413

- Option IEC 61000-4-XX test software
- Option IEC 61000-4-13 test hardware and software
- Assumes user already owns UPC Studio and UPC Test Manager Software

Parts of the Standard Delivery

- Distribution CD ROM
- IEC AC Immunity Test Option User Manual, P/N 149151
- Compatible with UPC Studio Software
- 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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