# ELECTRONIC POWER TRANSFER SWITCH

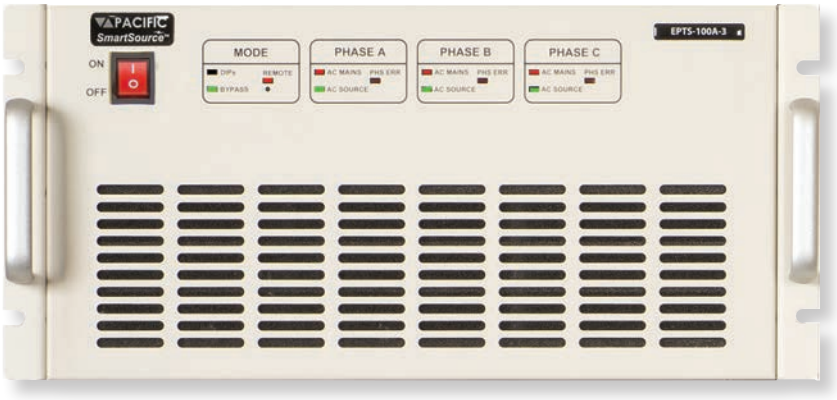
## EPTS SERIES

## EPTS MODULE

Key features:

- Supports AC Voltage Dips & Interruptions IEC61000-4-11 and IEC61000-4-34 Test Standards
- Supports Three Phase AC Voltage Unbalance IEC61000-4-27 Test Standard
- Supports DC Voltage Dips & Interruptions per IEC61000-4-29[1] Test Standard
- 5U Rack Mount Chassis integrates with ECTS2 Compliance Test Systems
- Windows Software for Voltage Dips, Interruptions and Variations Programming and Execution
- Meets 1 to 5 usec Rise / Fall Time for AC Voltage Dips
- Meets 1 to 50 usec Rise/Fall Time for DC Voltage Dips
- Uses Mains Power or Generator for 100% AC Voltage
- User Programmable AC Source for 0%, 40%, 70% or 80% Dip Levels
- Single or Three Phase Version
- Supports currents up to 100 Arms
- Compatible with AFX, AZX and LMX[2] Series Power Sources
- USB Interface for Control

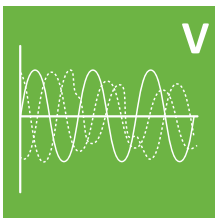
***Note 1:*** *Requires use of a DC Power Supply to provide nominal DC voltage to EUT.*
***Note 2:*** *LMX Series supports AC tests only.*





AC VOLTAGE DIPS


DC VOLTAGE DIPS




VOLTAGE UNBALANCE

## OVERVIEW

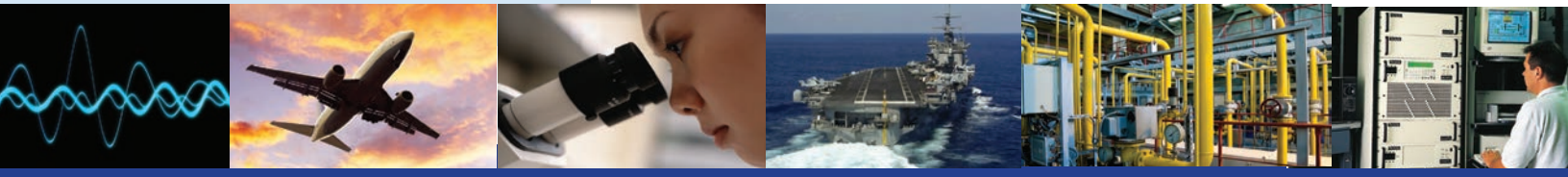
The Pacific Power Source Electronic Power Transfer Switch module (EPTS) uses solid state electronic switch technology to meet the IEC61000-4-11 (AC), IEC61000-4-27 (AC), IEC61000-4-34 (AC) or IEC61000-4-29 (DC[1]) Test requirements for voltage dips, short interruptions and voltage unbalance with voltage transition rates less than 5 usec. This supports full compliance testing of equipment for CE compliance.

### Voltage Dips, Interrupts, Variations & Phase Unbalance

The EPTS Series units are designed to support full-compliance voltage dip testing for any dip level. It requires the use of AC mains, fixed AC generator or DC Power Supply for the nominal 100% test level and a programmable AC and DC capable power source for the dip levels needed.

### Power Connections

All power connections are made at the rear panel of the EPTS chassis. There are no user controls on the front other than the power On/Off switch. Status and Error indicators are provided for each phase. The EPTS generates a phase sync signal from the AC Main input to synchronize the programmable AC source. All control of the programmable AC power source and the EPTS is done using the included Epts_Gui IEC Test software.



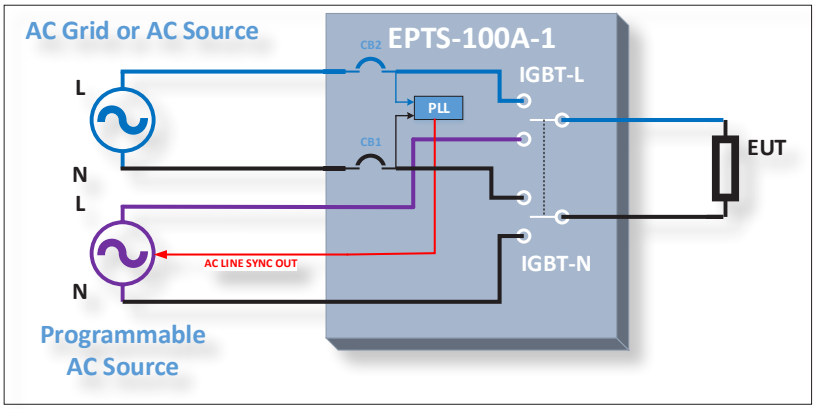
FREQUENCY CONVERSION | AEROSPACE | R & D | MILITARY | MANUFACTURING | CUSTOM

## Principle of Operation

The EPTS hardware is designed specifically to provide full compliance testing of products for CE marking. This requires support of the fast voltage rise and fall time called out in IEC test standards like IEC61000-4-11, IEC61000-4-27, IEC61000-4-34 (AC) and IEC 61000-4-29 (DC).

This is accomplished by using an electronic power transfer switch controlled by the same IEC Test software that controls the AC or DC dip level of the programmable power source. The nominal voltage to the unit under test is supplied by either a second AC or DC power supply or in case of AC, from the local mains.

For IEC 61000-4-29 DC voltage test applications, a DC power source is used in place of the AC Mains.




*Electronic Power Transfer Switch -- Functional Diagram*

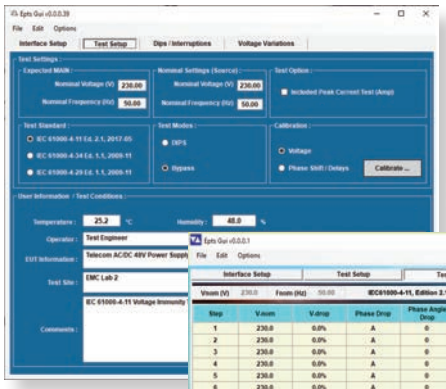
## Epts_Gui Test Software

The provided Epts_Gui test software is used to control the voltage dip or interrupt phase angle and duration for AC testing or the duration for DC testing. It also controls the programmable power source to set the correct dip level in percent of nominal. Test sequences and time intervals can be created and saved for repeated use by product category. Test setup parameters include:

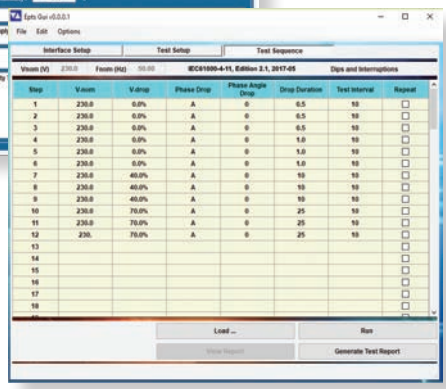
- Nominal Voltage: 0 - 400 Vac or 0 -425Vdc
- Product test class: 1, 2, 3 or X.
- Dip Level in % of Unom: 0%, 40%, 70%, 80% or user defined
- Dip duration in cycles: 0.5 to 500 cycles (or msec)
- Test Interval Time: 1.000 to 100.0 seconds

At the end of a test, the user is prompted to provide the pass/fail classification based on observation or examination of the EUT. Available selections are a, b, c or d.

A test report is generated by the EMC Test software to document test parameters and observed EUT performance. Available report formats are Adobe PDF and Rich Text (RTF).



*GUI - Test Setup Screen*



*GUI - Test Sequence Screen*

## Choose the System Size You Need

Voltage Dips and Variation test systems come in all sizes and power levels. Entry level single phase systems start at up to 16A of current max.

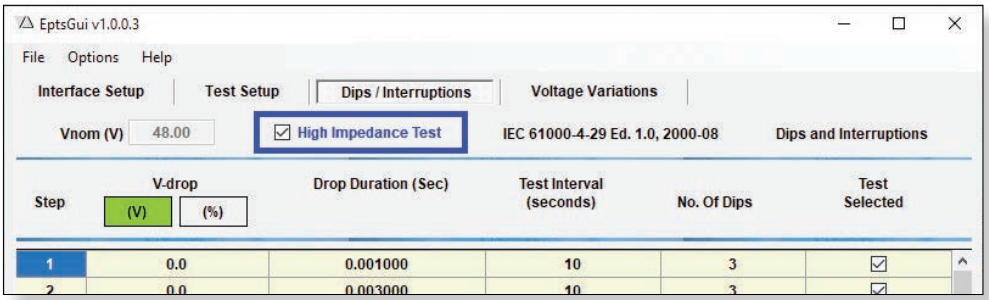
A suitable power level LMX Series or AFX Series power source pairs with the EPTS-1-16A for a compact, bench top test systems.

For higher current needs and three phase applications, EPTS units start at 16Arms per phase and top out at 100Arms per phase.


*LMX Series Based AC Voltage Dips Test System*

## IEC61000-4-29 Low Impedance and High Impedance Modes

For full compliance to the IEC 61000-4-29 DC Voltage dips standard, the EPTS supports both Low Impedance and High Impedance dip modes.




*IEC61000-4-29 DC Voltage Dip GUI screen with High Impedance mode selected.*

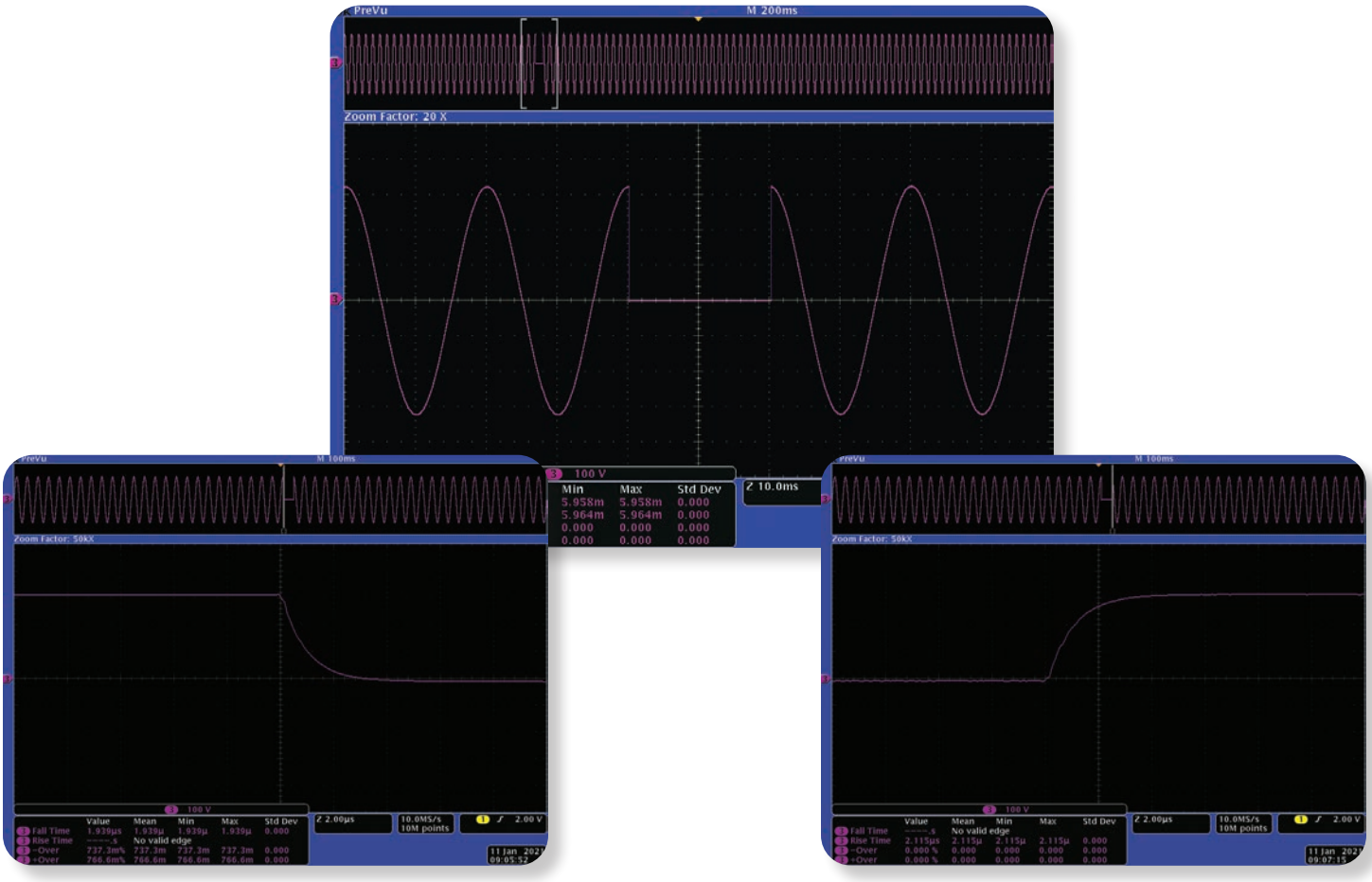
## Voltage Rise and Fall Time Compliance

For full compliance to the IEC 61000-4-11/4-34 standards, the voltage rise and fall times as well as voltage over & under shoot **must** meet the stated standard requirements.

The EPTS meets both criteria into a 100 Ohm resistive load as can be seen in the scope traces shown.

These captures show a half cycle at 90° voltage dip to 0%, 40% and 70% of Unom. For each dip, the details for the rise and fall time are shown at a magnified time scale of 2 usec per division.

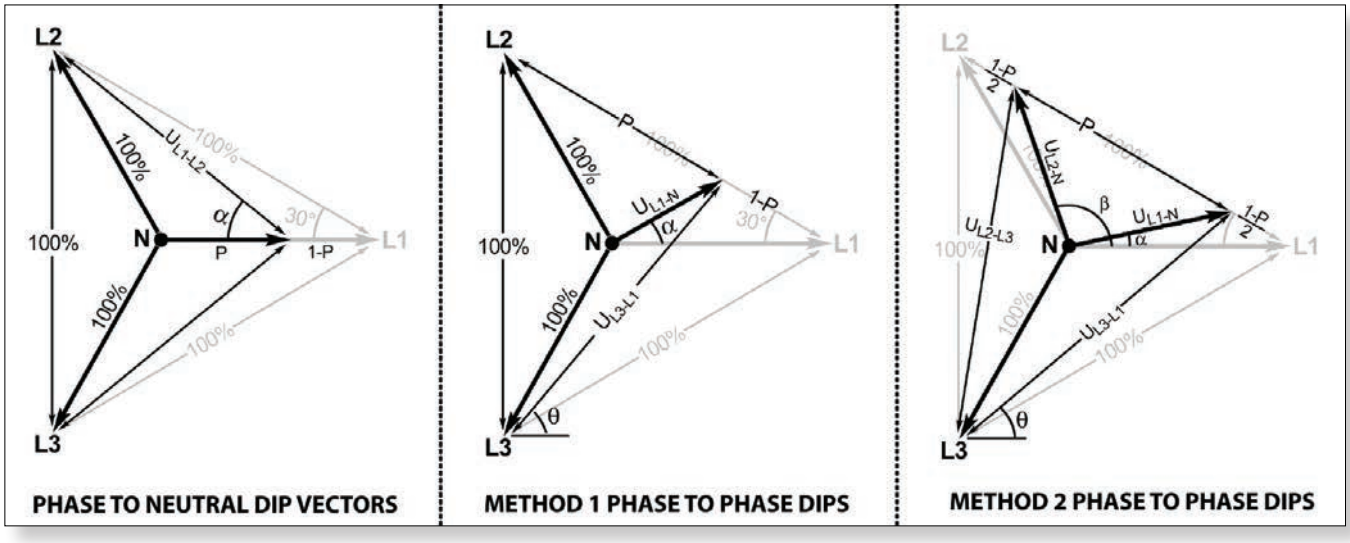
## Voltage Dip to 0% of Unom @ 90°




*Fall Time < 2.2 µsec with no undershoot*

*Rise Time < 2.2 µsec with no overshoot*

## IEC61000-4-11 & IEC61000-4-34 Three Phase AC Voltage Drop Methods Supported




*Three Phase Voltage Dips Vector Diagrams*

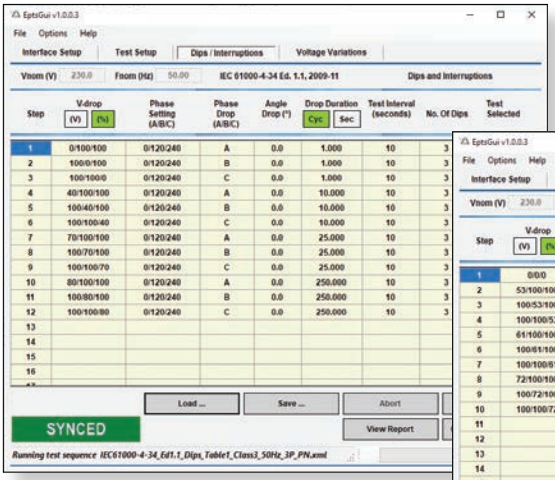
For three phase EUT's, voltages dips must be applied using several phase vector methods in order to meet full compliance with the IEC61000-4-11 or IEC61000-4-34 test standard. This is covered in Annex C of the standard.

The required application of voltage dips are:

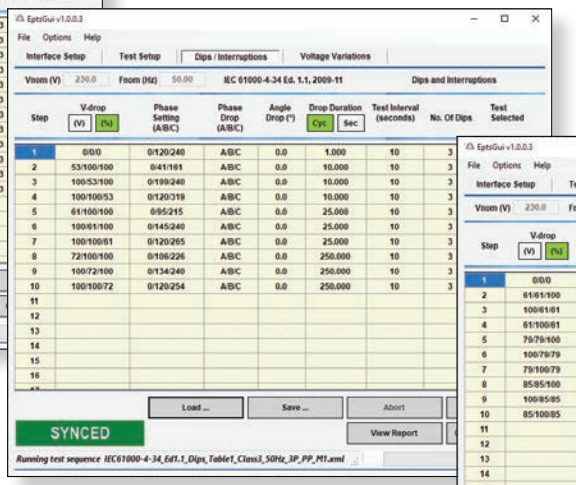
- Phase to Neutral Dips - One phase is dropped at a time, repeated for all phases. Phase angles between A, B and C remain constant.
- Phase to Phase Dips - Method 1: Two phases are dropped at a time by changing the amplitude of **one** phase amplitude and two phase angles. Repeated for each phase.
- Phase to Phase Dips - Method 2: Two phases are dropped at a time by changing the amplitude of **two** phase amplitudes and two phase angles. Repeated for each phase pair.

The image below shows the required three phase voltage dip vector diagrams.

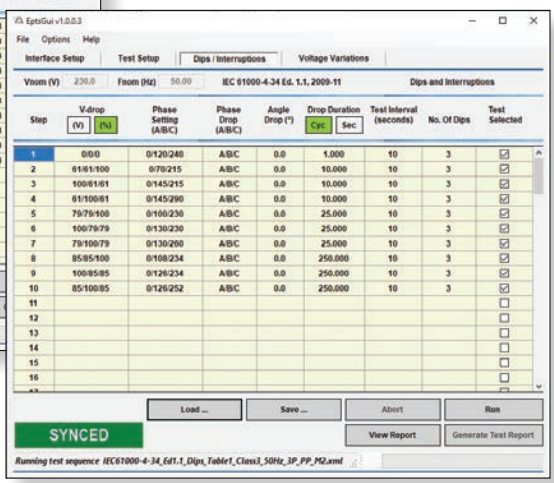
The EPTS GUI software supports all allowable methods and comes with these amplitude and phase angle settings in its Voltage Dips library. Sample Voltage Dips screen from the EPTS Gui are shown at the bottom of this page.




*Phase to Neutral Voltage Dips Test Screen*




*Phase to Phase Voltage Dips Method 1 Screen*




*Phase to Phase Voltage Dips Method 2 Screen*

## IEC61000-4-27 Three Phase Voltage Unbalance Tests

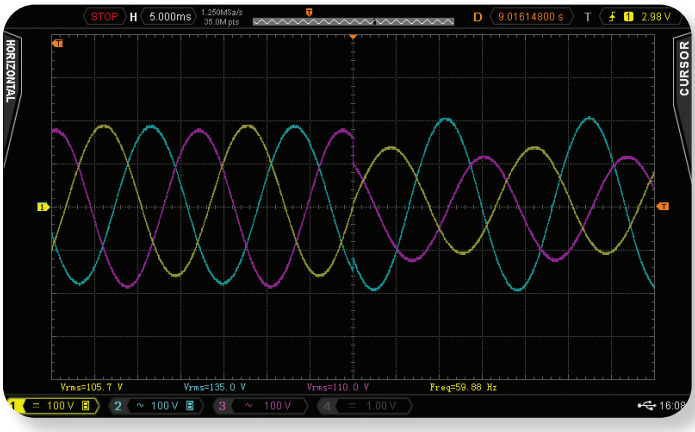
### Voltage Rise and Fall Time Compliance

For full compliance to the IEC 61000-4-27 Three phase AC voltage unbalance immunity test standards, the voltage rise and fall times as well as voltage over & under shoot **must** meet the stated standard requirements.

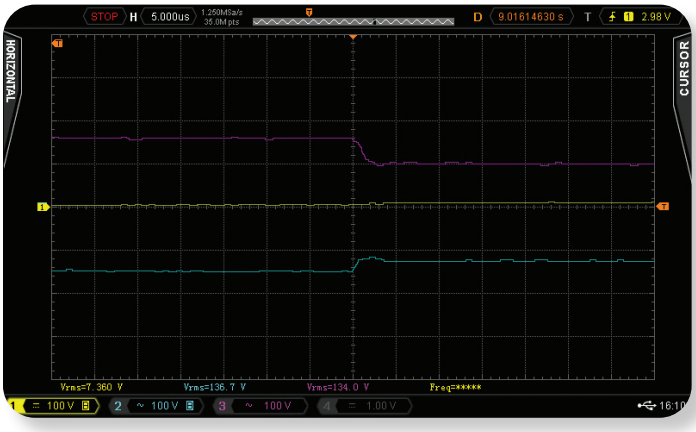
The EPTS meets both criteria into a 100 Ohm resistive load as can be seen in the scope traces shown.

These captures an unbalance event of 66% and 71% drops on phases B and C. The expanded scope screen shows this event at a 5µsec/division time scale illustrating the transition time is well below the 5µsec maximum allowed by the test standard.

## Three Phase Voltage Unbalance 71 / 119 /66 @ 139° and 235°




*Voltage Unbalance Event*




*Rise Time < 5 µsec with no overshoot*

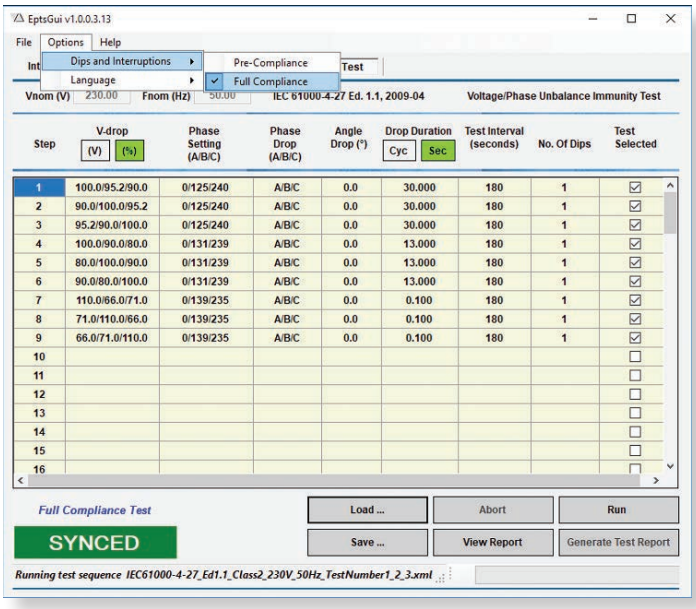
## Pre-Compliance Test Mode

The included Epts_Gui Windows software can be operated in pre-compliance mode in the absence of the EPTS power transfer switch hardware if needed.

This mode may be used for applications where full compliance is not required such as when performing in-house tests in preparation for submitting an EUT to a third party EMC lab for full compliance testing at a later time.

This allows the Epts_Gui to perform these tests using the programmable AC or DC power source only and without the use of the local AC grid or an additional DC power supply. In pre-compliance mode, the Epts_Gui uses the power source's transient system to perform all IEC61000-4 tests listed.

In this mode of operation, the voltage rise and fall times for voltage changes are considerably longer than 5 µsec so full compliance is not met.



## Technical Specifications

| PARAMETER | IEC REQUIREMENT | EPTS-xxA |
|---|---|---|
| AC Voltage Range | 230Vac (Europe)<br>100, 120 or 200Vac (Japan) | 400Vac max. |
| DC Voltage Range | 360Vdc | 425Vdc max. |
| Accuracy | < 5% | < 0.25% |
| Rise / Fall Time | 1 to 5 usec | 1 to 5 usec |
| Frequency | 50.0 or 60.0 Hz ±2% | 45.0 - 65.0 Hz |
| Phase error (3 phase) | < 5° | ± 0.5° |
| Current | | |
| IEC 61000-4-11, Max. | 16A / Ph | 100A / Ph[1)] |
| IEC 61000-4-34, Max. | 75A / Ph | 100A / Ph[1)] |

***Note 1:*** *Max. Current based on EPTS model. Max. available is 100A.*

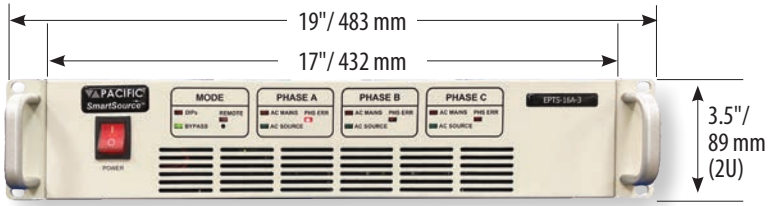
| AC INPUT | |
|---|---|
| AC Input Voltage (Bias) | |
| EPTS-1-16A / -3-16A | 100V ~ 240 Vac |
| All other EPTS models | 120Vac or 230Vac, 2W+G<br>Note: AC input voltage must be specified at tome of order |
| Frequency | 50 / 60 Hz |
| AC Current | 2.0 A |

| TEST STANDARDS SUPPORTED | |
|---|---|
| IEC 61000-4-11 | AC - Voltage Dips and Interruptions |
| IEC 61000-4-34 | AC - Voltage Dips and Interruptions |
| IEC 61000-4-29 | DC - Voltage Dips and Interruptions |

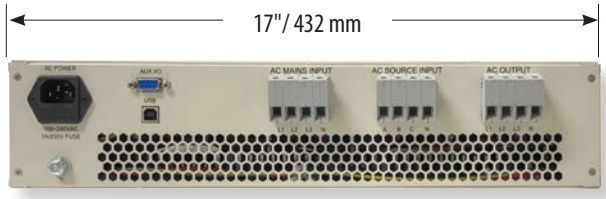
| INTERFACES, INDICATORS & CONTROLS | |
|---|---|
| Connectors - Rear Panel | |
| Power Input | AC Mains, 1 or 3 Phases + Neutral<br>AC Source, 1 or 3 Phases + Neutral |
| Power Output | To EUT, 1 or 3 Phases + Neutral |
| Control Interface | USB Device Type B, Rear panel |
| Line Sync | From AC Mains or Generator |
| Auxiliary I/O | DB9 Connector, Female, Rear panel |
| LED Indicators - Front Panel | |
| Mode | DIPS or Bypass |
| Phase Status | Mains or Source |
| Phase Error | For each Phase |
| Controls - Front Panel | |
| Power On/Off | Toggle Switch, Front panel |

| MECHANICAL & ENVIRONMENTAL | |
|---|---|
| Dimensions - EPTS-16A | |
| (HxWxD) | 89 x 425 x 552 mm<br>3.5" x 16.7" x 20.5" |
| Dimensions - EPTS-32A, EPTS-75A & EPTS-100A | |
| (HxWxD) | 222 x 432 x 585 mm<br>8.75" x 17" x 23" |
| Weight | |
| EPTS-16A-1 | 11.5 Kg / 25.4 lbs |
| EPTS-16A-1 | 12.0 Kg / 26.5 lbs |
| All other EPTS | 42.5 Kg / 93.7 lbs |
| All EPTS Models | |
| Temperature | 0 - 40° / 32 - 104° |
| Humidity | 0-95 % non-condensing |
| Altitude | 6500 ft / 2000 m (operating) |

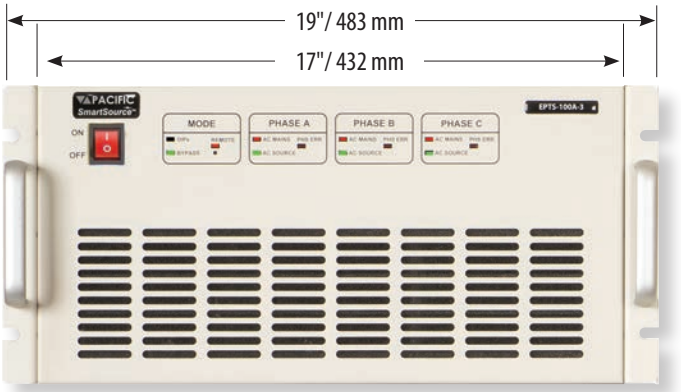
## Dimensions



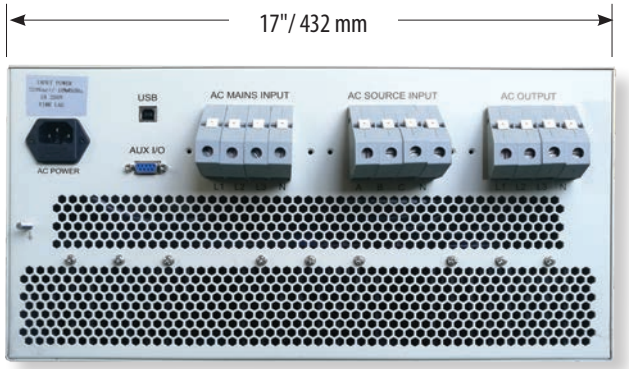

*Front Panel View EPTS-16A-3 (2U Chassis)*




*Rear Panel View EPTS-16A-3 (2U Chassis)*




*Front Panel View EPTS-100A-3 (5U Chassis)*




*Rear Panel View EPTS-100A-3 (5U Chassis)*

## Generator Compliance Tables

| IEC 61000-4-11 & IEC 61000-4-34 | IEC REQUIREMENT | EPTS-100A-1 / EPTS-100A-3 |
|---|---|---|
| Output Voltage at no load | Test Voltage ± 5% of residual voltage | Test Voltage ± 0.5% |
| Output Voltage Change with load:<br>100% output, 0-16 A<br>80% output, 0-20 A<br>70% output, 0-23 A<br>40% output, 0-40 A | < 5% of $U_T$ | Complies |
| Output Current Capability - IEC 61000-4-11 | 16 A @ 100% $U_T$<br>20 A @ 80% $U_T$ > 5 sec<br>23 A @ 70% $U_T$ > 3 sec<br>40 A @ 40% $U_T$ > 3 sec | Complies |
| Output Current Capability - IEC 61000-4-11 | Determined by Power Grid | AFX, AZX & LMX Series specifications meet or exceed requirements based on Model configuration |
| Peak Inrush Capability - IEC 61000-4-11 | Not limited by generator | |
| Peak Inrush Capability - IEC 61000-4-34<br>16A - 50A Rated Equipment<br>50.1A - 100A Rated Equipment<br>> 100A Rated Equipment | <br>500A<br>1000 A<br>Sufficient to maintain ±10% of $U_T$ | |
| Voltage Over / Undershoot into 100 Ohm R Load | < 5% of $U_T$ | < 5% of $U_T$ |
| Voltage Rise & Fall Time into 100 Ohm R Load | Between 1 and 5 usec for currents < 75A<br>Between 1 and 50 usec for currents > 75A | 1 to 5 usec for currents < 100 A<br>1 to 50 usec for currents > 100 A |
| Phase error (3 phase) | < ± 10° | ± 0.5° (EPTS-100A-3) |
| Zero crossing control | ± 10° | ± 0.5° |

| IEC 61000-4-29 | IEC REQUIREMENT | EPTS-100A-1 / EPTS-100A-3 |
|---|---|---|
| Output Voltage Range | Up to 360Vdc | Up to 425Vdc |
| Output Voltage Change with load: | < 5% of $U_T$ | < 0.25% of $U_T$ |
| Ripple Content | < 1% of output voltage | < 1% of output voltage |
| Voltage Rise & Fall Time into 100 Ohm R Load | Between 1 and 50 usec | 1 to 50 usec |
| Voltage Over / Undershoot into 100 Ohm R Load | < 10% of $U_T$ | < 1% of $U_T$ |
| Output Current, Steady State | Up to 25A | Up to 100A |

*ECTS2 Series 90kVA Harmonics & Flicker Test System with integrated EPTS-3-100A Voltage Dips Module (left cabinet, top)*

## ORDERING INFORMATION:

EPTS units are available in either single or three phase version and at different max. current ratings as shown in the table here.
**Note:** AC input voltage for 2U EPTS-16A-x is universal 100V~240Vac. AC input voltage for all 5U models must be specified at time of order as either 120Vac or 230Vac. (fixed setting).

## Available Models:

| *Model* | *Description* |
|---|---|
| EPTS-16A-1 | Electronic Power Transfer Switch, 16A, Single Phase (2U) |
| EPTS-16A-3 | Electronic Power Transfer Switch, 16A/phase, Three Phase (2U) |
| EPTS-32A-1 | Electronic Power Transfer Switch, 32A, Single Phase (5U) |
| EPTS-32A-3 | Electronic Power Transfer Switch, 32A/phase, Three Phase (5U) |
| EPTS-75A-1 | Electronic Power Transfer Switch, 75A, Single Phase (5U) |
| EPTS-75A-3 | Electronic Power Transfer Switch, 75A/phase, Three Phase (5U) |
| EPTS-100A-1 | Electronic Power Transfer Switch, 100A, Single Phase (5U) |
| EPTS-100A-3 | Electronic Power Transfer Switch, 100A/phase, Three Phase (5U) |

## Service and Support

Pacific Power Source's customer support is second to none. Our Customer Support Program provides the training, repair, calibration, and technical support services that our customers value. So, in addition to receiving the right test equipment, our customers can also count on excellent support before, during and after the sale. With company owned support and service centers around the world, support is never far away.
Complete calibration and repair services are offered at our US, European and Chinese manufacturing facilities (see contact info below). Calibrations are to original factory specifications and are traceable to NIST (National Institute of Standards and Technology).

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