AZX Series

REGENERATIVE AC & DC Power Sources

Single, Split and Three Phase Mode

Silicon-Carbide Technology

Extensive Features:

- Full Power Source and Sink Capability with Energy Recovery to the Utility Grid
- Available Models 30kVA/kW or 50kVA/kW
- Parellel Configurations for Higher power
- Three Phase, Split Phase and Single Phase Output Modes
- AC, DC and AC+DC Output Capability
- Dual Constant Power Mode Voltage Ranges
- Frequency Range DC, 15 - 1000Hz
- Phase Angle Programming
- Precise Output Voltage and Load Regulation
- Metering of Volts, RMS Current, Peak Current, Apparent Power & True Power on all Phases
- Harmonic Measurements
- Scope Function to capture Voltage & Current waveforms
- Sine, Square, Triangle, Clipped Sine and Arbitrary Waveforms Selections
- Output Transient Programming
- Standard USB, LAN (LXI), RS232 & GPIB Interfaces

30 kVA/kW to 200 kVA/kW

AC: 0-360 $V_{AC\ L\text{-}N}$ / 0-624 $V_{AC\ L\text{-}L}$ 3ø
DC: -510 Vdc to +510 Vdc
Frequency: DC, 15 - 1000 Hz

SiC

"Innovating Solutions for Control and Monitoring of Power"

GPIB RS232 USB LAN LXI

PACIFIC® POWER SOURCE

THE POWER OF EXPERTISE

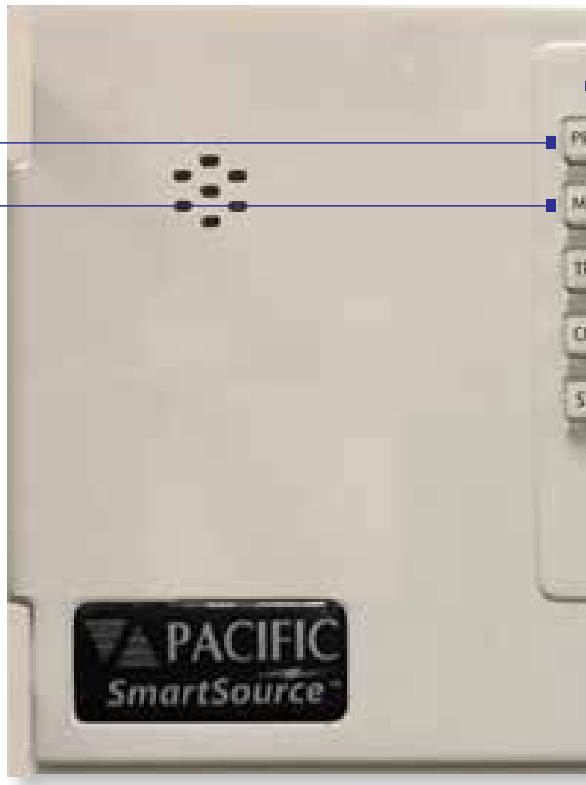
FREQUENCY CONVERSION | AEROSPACE | R & D | MILITARY | MANUFACTURING | CUSTOM

Total Control, Metering and Analysis of AC or DC Power.

Programming

Metering

Menu Keys



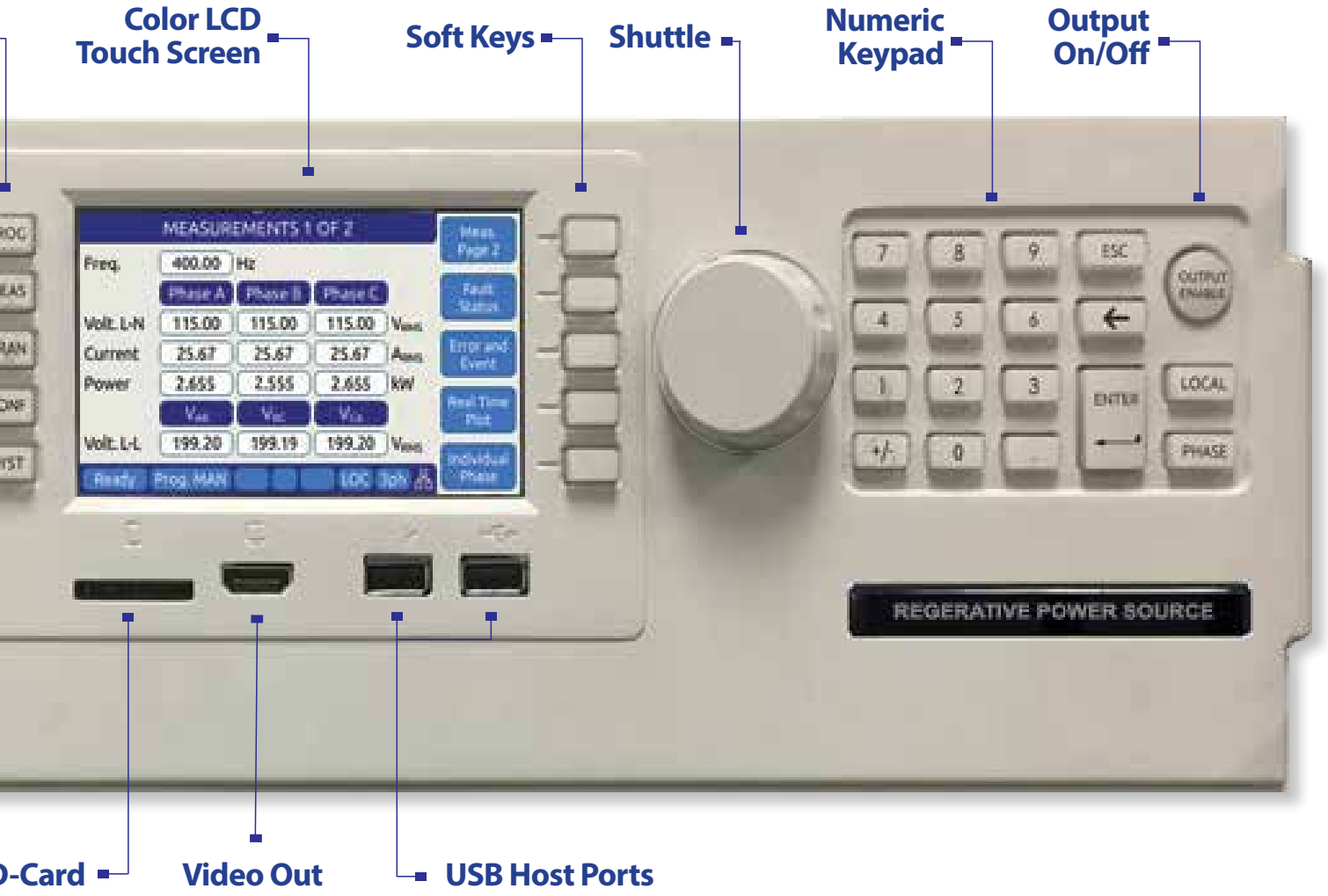
SD

Regenerative Grid Simulation Application Support

Growing demand for renewable energy sources is fueling the need to test AC and DC products and systems that can recycle energy back to the grid. Regulatory and performance test requirements of these systems require an AZX Power Source for grid simulation.

With extensive control over voltage, current, frequency, phase angles and transients, the AZX series supports testing of solar inverters (PV), energy storage systems (ESS), EV Batteries and Traction Systems as well as on-line UPS equipment with both AC and DC source and sink capabilities.

Simple, Intuitive Operation



Avionics and Defense Power Test

The wide output frequency range of the AZX Series Power Source allows its application to avionics and defense power applications requiring either 400Hz fixed or 360Hz to 800Hz wild frequency output. For emerging battery backed DC avionics power systems, multiple 270Vdc outputs can be used to simulate a split 540Vdc aviation DC power bus.

High power, three-phase configurations are available to meet regenerative or conventional power test demands. As needs change over time, additional units can be added easily to keep up with your test needs while protecting your original investment.

Powerful yet Easy to Use

Although AZX Series sources offer a wide range of operating modes and features, they are easy to operate through a large full color LCD display and soft key driven menus.

Top level menus are always available directly by pressing any of the five menu keys on the left of the display. Entering setup data is accomplished using the numeric keypad or the shuttle. Operating status is shown on screen using various colors to distinguish between setting, measurements and operator warnings, or error messages.

The built-in web server provides access to a large computer touch monitor based user interface with complete control over all AZX Functions and features without the need for any special software. The web browser based program and measurement screen is shown to the right.

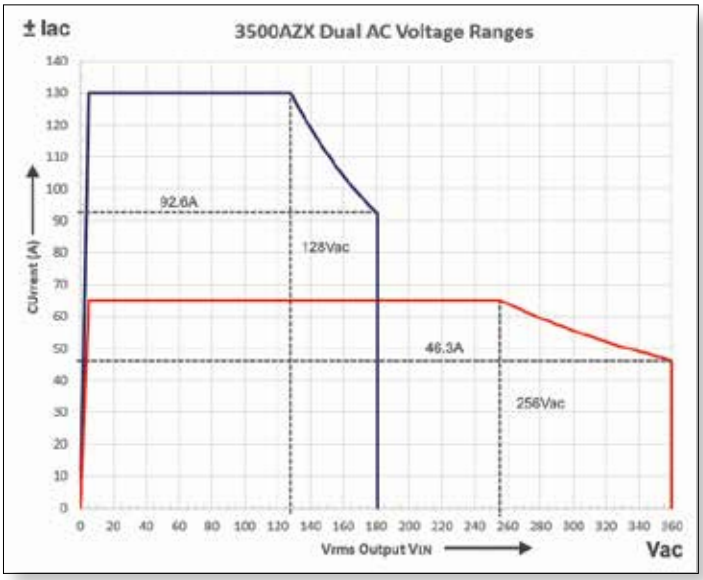
Dual Voltage Ranges with Constant Power Profiles

The 3500AZX support both low and high voltage ranges for either AC or DC mode. In AC mode, constant power is available from 71% of full scale voltage to 100% of full scale voltage as shown in the graph below on the left.

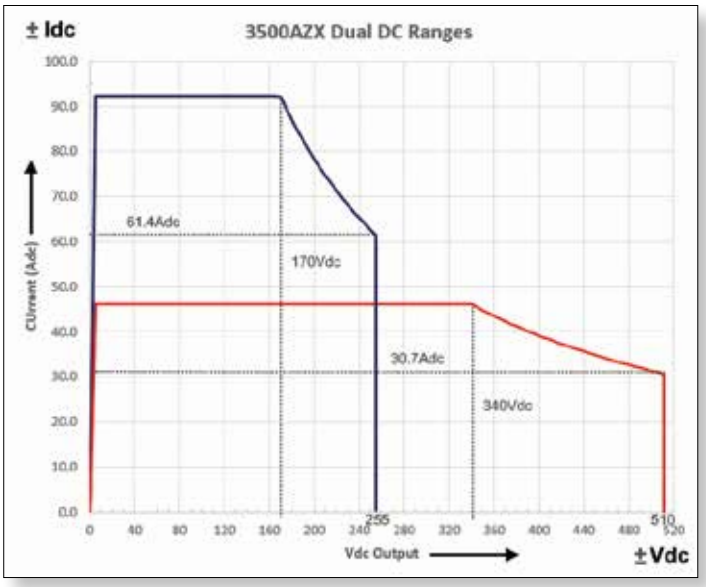
This allows more current to be delivered to the EUT at less than full scale voltages than would otherwise be possible. For voltage settings below 71% of full scale range, current remains at max. rated current. An overload mode allows maximum output power (+20%) or current (+10%) to be exceeded for up to one minute before protection kicks in.

In DC mode, constant power is available from 65% of full scale voltage to 100% of full scale as shown in the graph below on the right.

Like AC mode, this allows full power at lower programmed voltage than would be possible otherwise.



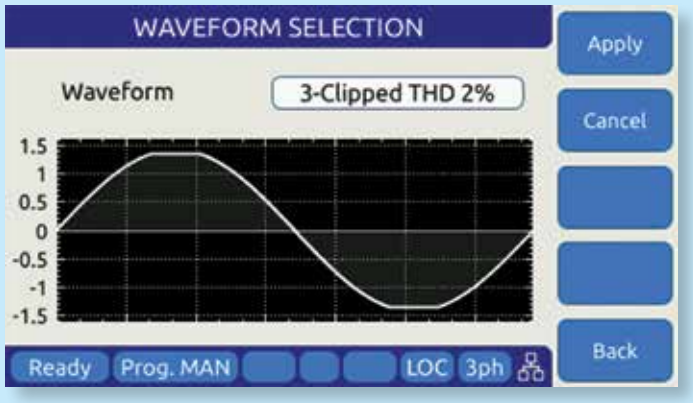
High and Low AC Voltage Range Constant Power Profiles - 50kW Model.



High and Low DC Voltage Range Constant Power Prfoiles - 50kW Model.

200 Selectable Arbitrary Waveforms

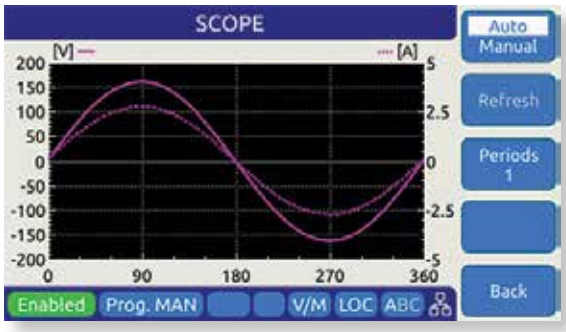
In addition to sine wave, the AZX Series offers multiple selectable AC waveforms such as clipped sine wave at various distortion levels, square, triangle and stepped squares. The operator can create arbitrary waveforms using Pacific Power's PPSC Studio Windows software or using a web browser and download these to the power source. A graphical representation (preview) of each waveform is shown on screen and a waveform name alias can be assigned to each so the operator can be sure the correct waveform is applied to the unit under test.



Clipped Sine Waveform Selection - Vthd = 2%

Capture Voltage & Current Waveforms

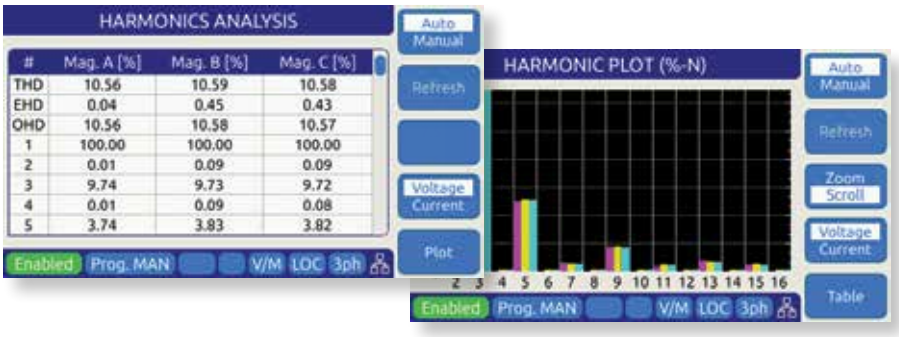
Built-in digital scope function captures voltage and current time domain signals, perfectly synchronized to the output frequency. Voltage and current displayed with accurate phase relationship. Display output waveforms on front panel or in Web browser.



Harmonics Measurements

Eliminate the need for an external power analyzer by measuring voltage and current harmonics. Harmonics information is displayed in either bar charts or detailed table format for easy viewing and analysis.

Data is displayed for individual phase or all three phase simultanously.



Touch Screen and WiFi Connection

The standard external HDMI Monitor interface supports the use of an external flat panel touch monitor for display and control of the power source. This allows measurements to be monitored from across the lab or factory floor as needed.

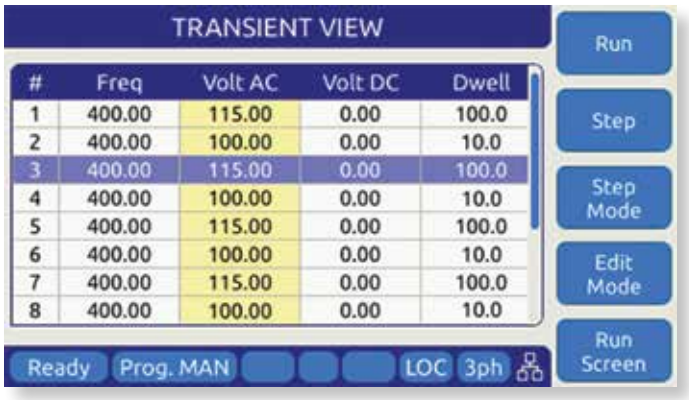
Alternatively, a tablet or smart phone can be used to operate the power source using the built-in LXI browser interface. Of course, extensive safety protocols are in place to prevent unauthorized access via WiFi or LAN connections.

Transient Programming for AC Power Test Applications

Voltage, Waveform and Frequency output transients are easily created from the front panel using an intuitive spreadsheet style data entry method. Data may be entered for a specific phase or for all three phases at the same time.

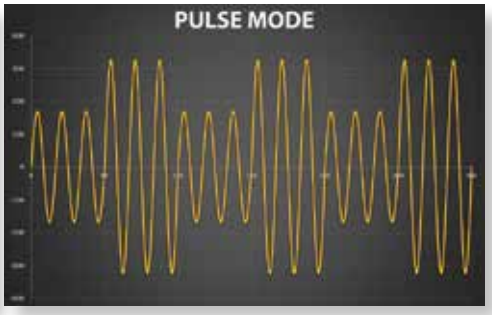
The AZX Series supports LIST, PULSE and STEP Mode Transient Types. The user can select the most appropriate type from the front panel or the web server interface. The image below illustrates the three modes graphically. Transients can be stored in non-volatile memory and easily edited as needed on screen.

If preferred, transient programming and execution can be also be accomplished using the available Windows control software.

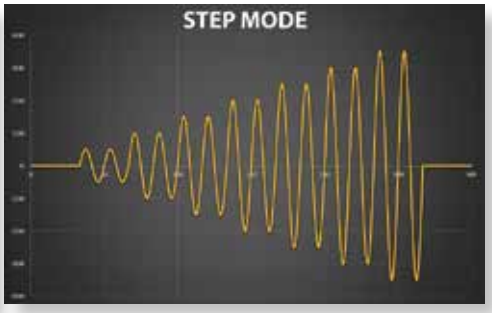


Transient Executing in View Mode

TRANSIENT LIST MODE

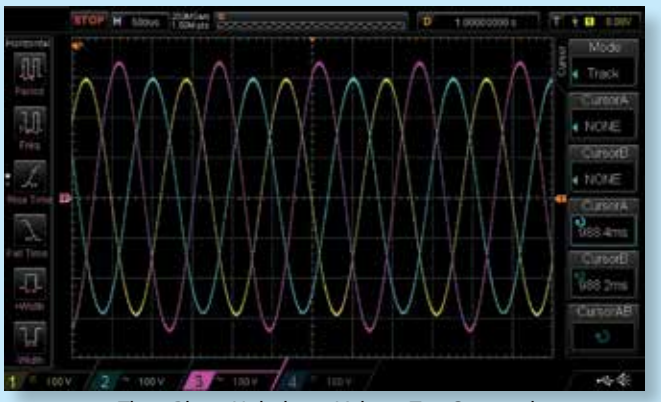


TRANSIENT PULSE MODE

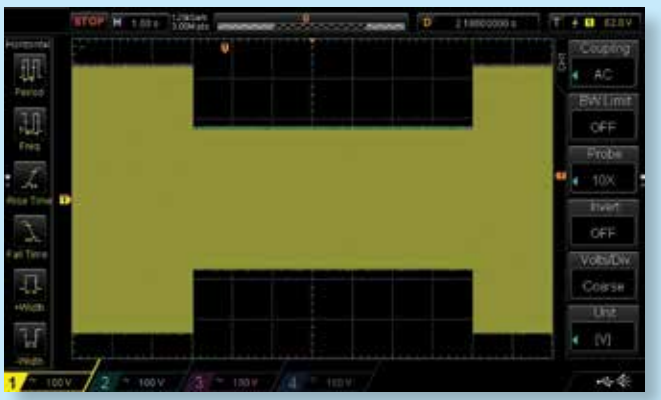


TRANSIENT STEP MODE

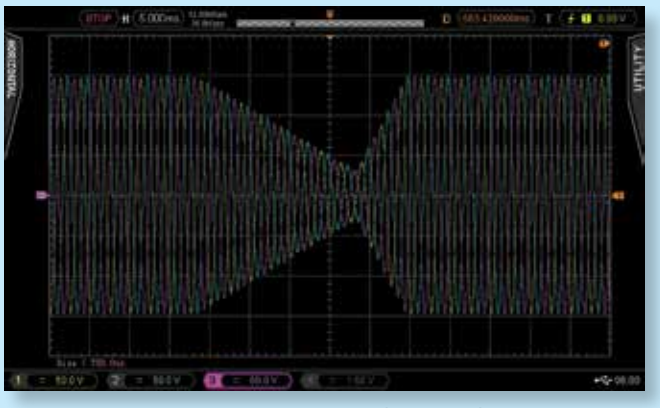
The AZX Series' rich feature set supports a wide variety of AC power test applications. With full control over voltage, current, frequency, power, slew rates and phase angles, no test requirement is too challenging for the AZX to handle. This includes AC power compliance testing, transformer testing, appliance testing, DC charger testing, UPS testing and more. With scalable power configurations, test needs can grow over time without having to re-invest in new AC power sources as auxiliary units can be added to an existing AZX system at any time. The scope images shown here capture several examples of AC power test waveforms generated by an AZX.



Three Phase Unbalance Voltage Test Captured



Three Phase Voltage Drop Test Captured



AC Transient Output Captured on Digital Scope

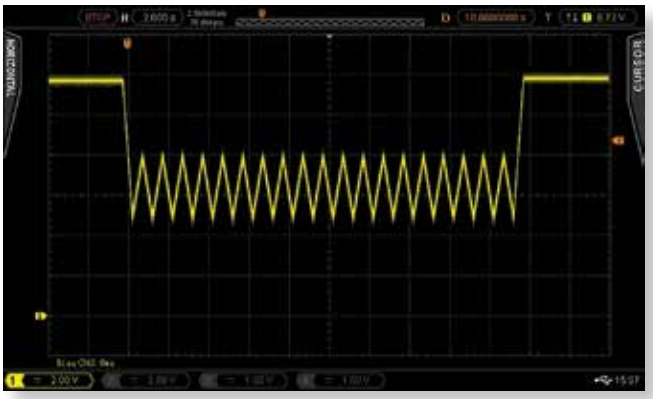
Transient Programming for DC Power Test Applications

The AZX Series doubles as a DC power supply with either a single DC output (FORM1) or up to three individual bipolar (4-Quadrant) DC outputs. Available voltage ranges are 255Vdc, 510Vdc and the same constant power range technology is used to provide a wide operating range for diverse DC voltage and current requirements. See Volt/Current Chart on page 4.

Transient programming covers DC levels and slew rates as is the case for AC applications but there is no frequency to program.

Programmable voltage slew rate settings may be used to control the rise and fall time of any DC voltage change. The scope images shown here capture examples of DC voltage ramps performed at a specific slew rate set on the AZX.

DC Voltage Ramp Up @ 100Vdc/ms programmed slew rate Captured



DC Voltage Transient Output Captured

Unique AZX Features & Benefits

The AZX Series is based on an advanced Silicon-Carbide technology platform that enables functionality not previously found on regenerative AC and DC source products from other manufacturers. These features help address a wide range of applications while at the same time providing a higher level of protection for the unit under test.

Regenerative 4-Quadrant Operation

The AZX Series is a full, four-quadrant AC and DC power source, targeted at renewable energy, Electric Vehicles and energy storage product development and test. Regenerative operation is available in both AC and DC mode or any combination of AC and DC power.

Scalable power from 50kVA to 200kVA using one to four AZX units covers a wide range of power applications.

Enhanced Protection Modes

Not only does the AZX offer programmable current limit protection mode, it goes beyond this by adding:

- Programmable Real Power Protection
- Programmable Apparent Power Protection
- Over Voltage Protection
- Over Temperature Protection

Legacy Software Support

To ensure our customers retain their investment in test software, the AZX Series supports a UPC controller compatibility mode that allows legacy test software to run with a new AZX power source. This includes the ability to use the existing UPC Studio Windows control software and UPC Test Manager as well as the AZX specific PPSC Studio software.

Parallel Configurations

Multiple AZX units can be configured for parallel operation to meet higher power and current requirements.

Cost Savings

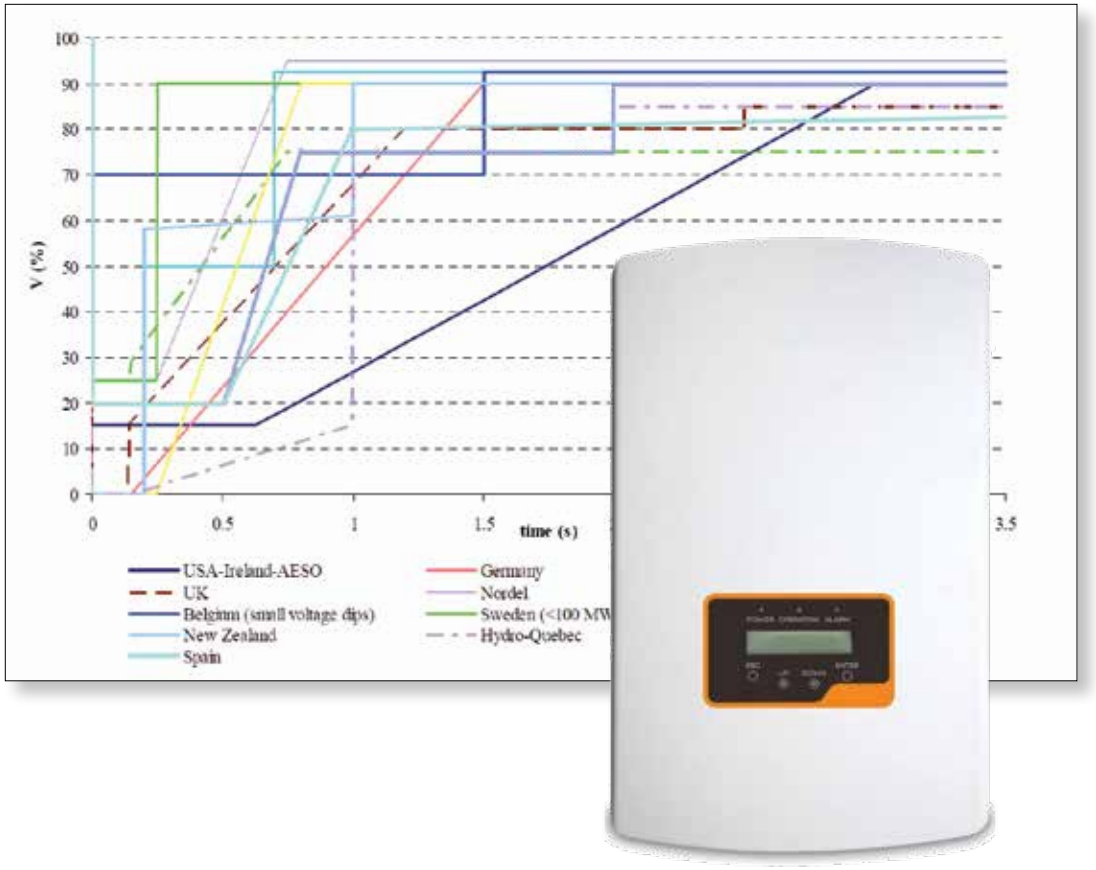
When sinking AC or DC power, all power is returned to the AC Utility Grid rather then dissipated. This allows large power systems to be tested without the need for a high power utility connection, lower utility bills and lower HVAC cost, all saving both money and the environment.

Grid Connected Power Generator Test Support

Testing wind or solar inverters for compliance with international regulations requires testing to both UL and IEC safety and EMI standard.

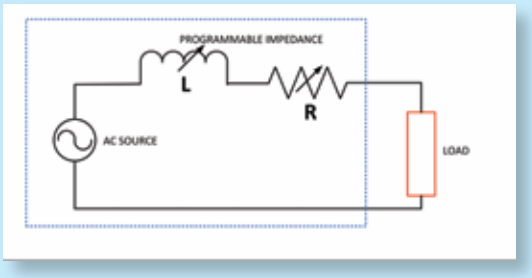
The PPSC Manager Test Sequencer option provides standard test sequences to address several of these tests such as Low Voltage Ride Through (LVRT) and anti-islanding. The chart shown here shows requirements for various European countries.

With the available PPST Test Manager Windows software, creating country specific LVTR and other energy generating equipment tests is quick and easy.



Programmable Impedance

Available programmable Output Impedance allows programming of output R and L components. User selectable modes are either Real-time for fast response or RMS for extended programming range. This allows optimal use of programmable output impedance for different applications.



Auxiliary I/O Functions & Options

To support integrated test system design and interaction with the load or other equipment, the AZX Series offers a standard suite of analog and digital I/O functions.

The user can assign command macros or setting parameters to analog or digital I/O pins as needed. This provides a unique level of customization for putting together sophisticated test stations.

H Option
For real-time hardware in the loop (HIL) applications, a high speed analog input option (H) is available.

S Option
For some applications, isolated sense may be required provided by the Isolated Sense Board, option S.

Parallel Configurations for Higher Current & Power

The AZX Series was designed to allow paralleling of multiple units to create larger power systems. Up to four 3500AZX Cabinets can be paralleled and synchronized to create regenerative power systems to 200kVA/kW.

Parallel systems auto-detect any connected Slave cabinets and automatically configure for control through the master unit (First cabinet on the parallel system bus).

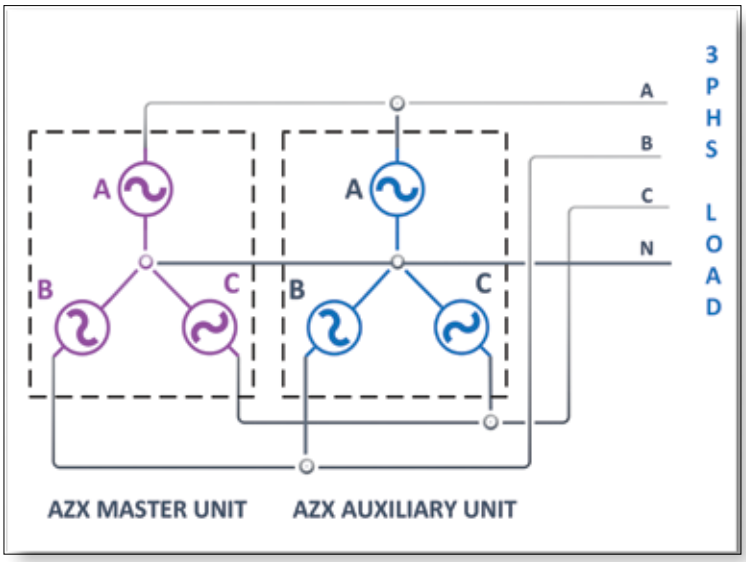
All programming is performed from the master cabinet front panel or remote control interfaces. Consolidated current and power measurements are reported on the master unit. Slave cabinets front panel controller are automatically de-activated to avoid operator confusion.

The table below shows supported parallel AZX configurations.

MODEL	Output Phase Modes	Rated Power[1] AC / DC mode	High Voltage Range Vac L-N / Vdc	Max. Current[2] High Vrange	Low Voltage Range Vac L-N / Vdc	Max. Current[2] Low Vrange	No. of Cabinets
3300AZX	3, 2 & 1	30 kVA 30 kW	0-360 Vac 0-510 Vdc	50 Arms 35 Adc	0-180 Vac 0-255 Vdc	100 Arms 70 Adc	One
3500AZX	3, 2 & 1	50 kVA 50 kW		65 Arms 46 Adc		130 Arms 92 Adc	One
31000AZX	3, 2 & 1	100 kVA 100 kW		130 Arms 92 Adc		260 Arms 184 Adc	Two
31500AZX	3, 2 & 1	150 kVA 150 kW		195 Arms 138 Adc		390 Arms 276 Adc	Three
32000AZX	3, 2 & 1	200 kVA 200 kW		260 Arms 184 Adc		520 Arms 368 Adc	Four
Higher	For parallel system configurations above 200kVA/kW, contact factory						

Note 1: Rated power shown is for Three Phase or Single Phase mode operation. For Split Phase mode, rated power is 2/3.

Note 1: Rated current shown is for per phase in Three or Two Phase mode operation.



Parallel AZX System

Technical Specifications

OUTPUT	SPECIFICATION	
Power		
Single Phase Mode Three, Split Phase Mode	See Model table page 9	
Voltage		
Modes	AC, DC, AC+DC, DC+AC	
	AC Mode	**DC Mode**
Low Voltage Range	0-180 V_{LN}/ 0-312V $_{LL}$	0 - 255 V_{dc}
High Voltage Range	0-360 V_{LN} / 0-624 V_{LL}	0 - 510 V_{dc}
Programming Resolution	0.01 V	
Accuracy	±0.1% (CSC mode)	
Waveforms (200 Max.)	Sine, Square, Triangle, Clipped (THD), Arbitrary	
DC Offset	< 20 mV	
Harmonic Distortion (Vthd) *(full, resistive load, up to 360Vrms L-N)*	< 100 Hz: < 0.2% 100~1000 Hz: < 0.2% + 0.125%/100Hz	
Output Noise - Low V Range High V Range	< 250 mV RMS < 500 mV RMS	
Load Regulation	± 0.02% (CSC Mode)	
Line Regulation	< 0.1% for 10% Line Change	
Voltage Sense	External Sense, max. voltage drop 5% F.S.	
Voltage Slew Rate	Programmable, 1.0V/us max.	
Isolation		
Input to Output	3000 Vac	
Input to Chassis	3000 Vac	
Output to Chassis	1400 Vpk	
Frequency		
Range	DC, 15.00 – 1000.0 Hz	
Programming Resolution	0.01 Hz	
Accuracy	± 0.005% / 50 ppm	
Current *(see charts page 4, table page 9)*		
Ranges	See Model table page 9	
Max. AC Peak Current	360 A / 180 A each phase	
Programming Resolution	0.01 Arms	
Accuracy	0.5% F.S.	
Current Protection (CP) Modes	Constant Current (CC) or Output Trip (CV)	
Current Overload Mode	Allows 110% of max. RMS current for up to 1 min	
Phase Angle *(In 3 and 2 Phase Mode)*		
Programmable Phase (B, C)	0 - 359.9°	
Resolution	0.1°	
Accuracy	±0.35° / ±0.1° Phase Reg. Mode	
Programmable Impedance - 3 Phase Mode, Single Cabinet		
Resistance (R) RT / RMS Modes	±1.000 Ohm / ±10.0 Ohm	
Inductance (L) RT / RMS Modes	0 to 50 µH / 0 to 2000 µH	

PROTECTION	SPECIFICATION
Types	AC or DC Current, True Power, Apparent Power, Over Voltage, Over Temperature

TRANSIENTS	Specification
Programming	
No. of Entries	200 Steps / 400 segments
Modes	LIST, PULSE, STEP
Parameters	Frequency, Volt AC, Volt DC, Waveform, Ramp Time, Dwell Time
Dwell Time Range	0.1 - 10000000.0 msec
Time Resolution	0.1 msec
Edit Modes	Add at end, Insert before, Delete
Execution	
Run Control	Run from step # to step # Run, Step, Restart, Stop
Execution Modes	Normal, Debug
Program Storage	
Non-volatile	100 Programs + Transients

MEASUREMENTS	SPECIFICATION
AC Voltage (Vrms)	
Single or Parallel Cab: Range	0 – 360 VLN / 0-625 VLL
Resolution	0.01 V
Accuracy	± 0.1% F.S.
Frequency (Hz)	
Fundamental Range	15 - 1000 Hz
Resolution	0.01 Hz
Accuracy	± 0.1% Rdg
AC Current (Arms)	
Range	0 - 150 Arms
Resolution	0.01 Arms
Accuracy[1]	± (0.5% + f (kHz) * 0.5%) F.S.
Current Crest Factor	
Range	1.00 - 5.00
Resolution	0.01
Accuracy[1]	± 2.0% F.S.
AC or DC Power (W)	
Range	0 - 50 kW
Resolution	0.01 kW
Accuracy[1]	± 0.75 % F.S.
Apparent Power (VA)	
Range	0 - 50 kVA
Resolution	0.01 kVA
Accuracy[1]	± 0.75 % F.S.
Power Factor	
Range[1]	0.00 - 1.00
Resolution	0.01
DC Voltage (Vdc)	
Range[3]	0 – 520 Vdc
Resolution	0.01 V
Accuracy	± 0.1% F.S.
DC Current (Adc)	
Range	0 - 95 Adc
Resolution	0.01 Adc
Accuracy[3]	± 0.5% F.S.

Footnotes:
1: For RMS Currents above 2.0 A
2: Range = 0 - 1040 Vdc in Split phase mode
3: For DC current levels above 1.0 A

Technical Specifications (continued)

WAVEFORM CAPTURE	SPECIFICATION
Parameters	VLN-A, VLN-B, VLN-C, VLL AB ,VLL AC ,VLL BC ,IA, IB, IC
Max. Sample Rate	500 ksps
Samples/cycle	1024 (512 in UPC Compatibility mode)
Record Length	1 Period of fundamental Frequency
Bandwidth	100 kHz @ 500 ksps

HARMONICS MEAS.	SPECIFICATION
Parameters	VLN-A, VLN-B, VLN-C, VLL AB ,VLL AC ,VLL BC ,IA, IB, IC
Harmonics Range	H1 ~ H50
Accuracy – Amplitude	± 1.0 % of RMS Reading
Phase Angle Range	0 ~ 359.9
Accuracy - Phase Angle	< 8 µsec
Bandwidth	100 kHz @ 500 ksps
Display Modes	Table format, Graph Format

AC INPUT (Per Cabinet)	SPECIFICATION	
Mains Voltage Form	4 Wire, L1, L2, L3 and PE	
Frequency	47 - 63 Hz	
400V Input Setting	**3300AZX**	**3500AZX**
Input Voltage Range	400Vac ± 10%	
Nominal Phase Current[1]	56 Arms	92 Arms
Max Current @ Low Line[1]	62 Arms	102 Arms
Peak Inrush Current[2]	< 78 Apk	< 130 Apk
Input Power Factor	> 0.9	
Efficiency	> 87%	
480V Input Setting	**3300AZX**	**3500AZX**
Input Voltage Range	480Vac ± 10%	
Nominal Phase Current[3]	46 Arms	76 Arms
Max Current @ Low Line[3]	52 Arms	85 Arms
Peak Inrush Current[2]	< 65 Apk	< 110 Apk
Input Power Factor	> 0.9	
Efficiency	> 87%	

ENVIRONMENTAL	SPECIFICATION
Cooling	Variable speed fan cooled, front and bottom intake, top exhaust
Temperature	
Operating	0 to 40 °C / 32 to 104 °F
Storage	-20 to 70 °C / -4 to 158 °F
Humidity	< 80%, non-condensing
Altitude	2000 m / 6500 feet

INTERFACES	DESCRIPTION
Remote Control	
USB	Device Type B
RS232	1200 - 921600 baud
LXI LAN eXtensions for Instrumentation LAN	LXI compliant, Ethernet, RJ45, TCP/IP Protocol, Telnet Protocol Command Line
GPIB	IEEE488,1, IEEE488.2 (2003 incl., NI HS488) IEC 60488-1, IEC 60488-2 (2004)
	Functions: SH1, AH1, T6, L3, SR1, RL1, DC1, DT1
WiFi	Optional USB WiFi adaptor available

Footnotes:
1: For nominal 3ø, 400V input voltage. Low line voltage is 360V.
2: Ipeak Inrush = @ nominal input voltage
3: For nominal 480V input voltage. Low line voltage is 432V.

SYSTEM FEATURES	DESCRIPTION
DISPLAY	
Type	Full Color, Touch LCD Display
Size	4.3" Diagonal
Resolution	480 x 272 pixels
USB Ports	2 Front Panel, 1 Rear Panel, Type A
SD Card	32 GB max. Capacity
Video Output	Monitor Out, Front Panel

ANALOG I/O	SPECIFICATION
Analog Inputs (4)	
Modes	Amplifier, Amplitude Modulation, Int + Ext Input Summing
AI1, AI2, AI3	Programmable setting phs A, B, C
AI4	Frequency
Range	0 -10 Vdc for 0 - F.S.
Accuracy	± 0.1% F.S.
Impedance	10 kOhm
Analog Outputs (4)	
AO1, AO2, AO3	Voltage Meas. phs A, B, C
AO4	Power Measurement Total
Range	0 - 10Vdc for 0 - F.S.
Accuracy	± 0.1% F.S. into > 5 kOhm load
Impedance	5 kOhm
Connector Type	DB25, Rear Panel

DIGITAL I/O	SPECIFICATION
Digital Inputs (6)	
Fixed (3)	Remote Inhibit, Transient Trigger, Phase Sync
User Programmable (3)	DI1, DI2, DI3
Input Levels	Low < 0.4V, High > 2.0V
Digital Outputs (6)	
Open Collector, Fixed (2)	Relay Control FORM, Relay Control T Option
TTL, Fixed (2)	Output Relay/Transient /Function Strobe Phase Sync
User Programmable (2)	DO1, DO2
Output Levels	Low < 0.4V, High > 4.6V
Connector Type	DB25, Rear Panel

MECHANICAL	SPECIFICATION
Dimensions	
H x W x D	59.8" x 24.0" x 31.9" 1520 x 610 x 810 mm
Shipping H x W x D	71" x 32" x 44" 1800 x 810 x 1120 mm
Weight	
Net	517 Kg / 1140 lbs
Shipping	592 Kg / 1305 lbs

REGULATORY	SPECIFICATION
Safety	IEC 61010-1:2010 (Edition 3)
EMC	
Emissions Standard	EN 55011:2009+A1:2010
Immunity Standard	EN 61000-4-2, -3, -4, -5, -6, -8, -11
Product Category	EN 61326-1:2013 (Measurement, Laboratory and Control Equipment)
Approvals	CE Mark
RoHS (DIRECTIVE 2011/65/EU)	
Product Category	EN50581:2012

Ordering Information

Standard Cabinet Systems

Single Cabinet Systems

- ☐ 3300AZX
- ☐ 3500AZX

Parallel Cabinet Systems

- ☐ 31000AZX
- ☐ 32000AZX
- ☐ 31500AZX

Selectable Input Voltages (V_{IN})

- ☐ 400Vac, 3Ø ± 10%, 47-63Hz
- ☐ 480Vac, 3Ø ± 10%, 47-63Hz

Export Version

- ☐ E Append "E" postfix

Options

- ☐ H Real Time I/O Append "H"
- ☐ S Isolated Sense Append "S" postfix

Order Example

3500AZX
- Cabinet, 50 kVA, 3-Phase, AC & DC Regenerative Power Source with USB, RS232, LAN, GPIB & AUX I/O
- 400Vac or 480Vac 3 Phase Input Voltage

Typical Delivery Items

- AC & DC Power Source
- English Manuals in PDF Format
- Certificate of Compliance

Software Options

Windows 10 Software - 64 Bit

- ☐ PPSC Studio Control Software
- ☐ PPSC Test Manager

Test Sequences - Avionics

- ☐ ABD0100.1.8 - Airbus A380, AC & DC Power Groups
- ☐ ABD0100.1.8.1 - Airbus A350, AC & DC Power Groups
- ☐ AMD24C - Airbus A400M, AC & DC Power Groups
- ☐ Boeing 787B3-0147 - B787, AC & DC Power Groups
- ☐ MIL-STD704 - US DoD, AC & DC Power Groups
- ☐ RTCA-DO160 Section 16, AC & DC Power Groups

Test Sequences - Other

- ☐ IEC Test Suite - Includes IEC 61000-4-11, IEC 61000-4-13, IEC 61000-4-14, IEC 61000-4-17, IEC 61000-4-27, IEC 61000-4-28, IEC 61000-4-29 and IEC 61000-4-34
- ☐ MIL-STD 1399-300B - US DoD, Shipboard Power, AC Power Groups

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. 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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