California Instruments RS Series

90–2160 kVA

Overview

- **High Power AC and DC Power Source**
  Programmable AC and DC power for frequency conversion and product test applications
- **Expandable Power Levels**
  Available output power of 90 kVA per unit and multi-unit configurations for power requirements up to 2160 kVA
- **Arbitrary & Harmonic Waveform Generation**
  User defined voltage waveform and distortion programming
- **Regenerative, bidirectional "Green" Power Solution**
  Automatic crossover between Source and Sink power mode offers regenerative capabilities in AC mode. Regenerate up to 100% of the rated output power back to the utility grid during sink mode operation. (-SNK option)
- **Remote Control**
  Standard IEEE-488 (GPIB), RS232C & USB along with an optional LAN Interface are available for automated test applications

Introduction

The RS Series consists of multiple high-power AC and DC power systems that provide controlled AC and DC output for ATE and product test applications. This high-power AC and DC test system covers a wide spectrum of AC and DC power applications at an affordable cost. Using state-of-the-art PWM switching techniques, the RS series combines compactness, robustness, and functionality in a compact floor-standing chassis, no larger than a typical office copying machine. This higher power density has been accomplished without the need to resort to elaborate cooling schemes or additional installation wiring. Simply roll the RS unit to its designated location (using included casters), plug it in, and the RS series is ready to work for you.

Simple Operation

The RS Series can be operated completely from its menu driven front panel controller. A backlit LCD display shows menus, setup data, and read-back measurements. IEEE-488, RS232C,USB and LAN remote control interfaces and instrument drivers for popular ATE programming environments are available. This allows the RS Series to be easily integrated into an automated test system. For advanced test applications, the programmable controller version offers full arbitrary waveform generation, time and frequency domain measurements, and voltage and current waveform capture.

Configurations

Each RS90 cabinet delivers up to 90 kVA of AC or AC + DC power. In DC mode, 66.6% of the AC powerlevel is available.

For higher power requirements, the RS180, RS270, RS360, and systems up to 2160 kVA are available. Available reconfigurable RS models (-MB designation) provide multiple controllers which allow separation of the high-power systems into individual RS90 units for use in separate applications. This ability to reconfigure the systemprovides an even greater level of flexibility not commonly found in power systems.

Product Evaluation and Test

Increasingly, manufacturers of high-power equipment and appliances are required to fully evaluate and test their products over a wide range of input line conditions.

Output voltage options, such as the -333 option, allow testing of high voltage 480VAC L-L products at 120% of nominal as required by IEEE 1547 (Table 1) "Interconnection system response to abnormal voltages".

The built-in output transient generation and read-back measurement capability of the RS Series offers the convenience of a powerful, and easy to use, integrated test system.

150-400 V

0-4800A/ Phase

≋	208	230	380
	400	480	

ETHERNET USB GPIB RS232

AMETEK

Programmable Power
9250 Brown Deer Road
San Diego, CA 92121-2267 USA

AMETEK®
PROGRAMMABLE POWER

Regenerative, bidirectional "Green" Power Solution
The RS Series features the ability to both source and sink current, i.e., bi-directional current flow. The RS amplifier is designed to reverse the phase relationship between the AC input voltage and current to feed power back onto the utility grid. This mode of operation is particularly useful when testing grid-tied products that feed energy back onto the grid. Static Power Converters such as grid-tied and off-grid photovoltaic inverters are tested for frequency variations and voltage transients.

Programming sink (-SNK) mode operation

Avionics
With an output frequency range to 819 Hz (or 905 Hz with -HF option), the RS Series is well suited for aerospace applications. Precise frequency control and accurate load regulation are key requirements in these applications. The available IEEE-488 remote control interface and SCPI command language provide for easy integration into existing ATE systems. The RS Series eliminates the need for several additional pieces of test equipment, saving cost and space. Instrument drivers for popular programming environments such as National Instruments LabView™ are available to speed up system integration.

Regulatory Testing
As governments are moving to enforce product quality standards, regulatory compliance testing is becoming a requirement for a growing number of manufacturers. The RS Series is designed to meet AC source requirements for use in compliance testing such as IEC 61000, 3-2, 3-3, 3-11, 3-12, to name a few.

Choice of voltage ranges
The RS Series includes 0 - 150V & 0 - 300V or optionally, 0 - 166V & 0 - 333V line to neutral. These models provide a maximum 3 phase output capability of 260 Vac & 520 Vac or 287 & 576V line to line respectively.
For applications requiring more than 333 V L-N (or 576 V L-L), the optional -HV output transformer provides an additional 0 - 400 V L-N and 0 - 693 V L-L output range for use in AC mode only. For custom applications the XV option is available and is user defined and offers up to 600VL-N (1,038VL-L)

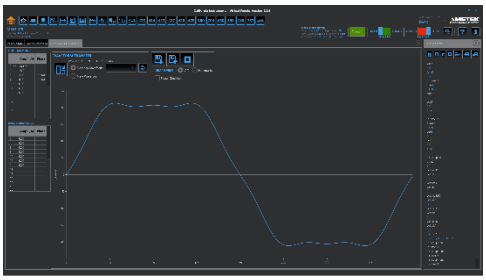
High Crest Factor
With a crest factor of up to 3.0, the RS Series AC source can drive difficult nonlinear loads with ease. Since many modern products use switching power supplies, they tend to pull high repetitive peak currents. The RS90 for example can deliver up to 600 Amps of repetitive peak current (150 V AC range) per phase to handle three phase loads.

Remote Control
Standard RS232C & USB IEEE-488, and USB along with optional LAN remote control interfaces allow programming of all instrument functions from an external computer. The popular SCPI command protocol is used for programming.

Hardware In the Loop
Optional External Drive (-EXTD) allows external analog signal control of the source while in AC operation, essentially turning the source into a high bandwidth amplifier. Most common applications include hardware in the loop (HIL) simulation of power plants, hybrid electric vehicles and most recently renewable energy generation and their effect on the utility grid. Reference EXTD white paper for additional performance details by visiting our website.

Application Software

- Windows® application software (*) is included. This software provides easy access to the power source's capabilities without the need to develop any custom code. The following functions are available through this GUI program:
  * Requires PC running Windows™ 7, 8.x, or 10
- Steady state output control (all parameters)
- Create, run, save, reload and print transient programs
- Generate and save harmonic waveforms.
- Generate and save arbitrary waveforms.
- Measure and log standard measurements
- Capture and display output voltage and current waveforms.
- Measure, display, print and log harmonic voltage and current measurements.
- Display IEEE-488, RS232C, USB and LAN bus traffic to and from the AC Source to help you develop your own test programs.



Windows™ application software.

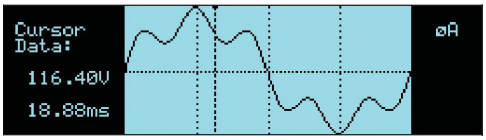
Harmonic Waveform Generation

Using the latest DSP technology, the RS Series programmable controller can generate harmonic waveforms to test for harmonics susceptibility. The Windows Graphical User Interface program can be used to define harmonic waveforms by specifying amplitude and phase for up to 50 harmonics. The waveform data points are generated and downloaded by the GUI to the AC source through the IEEE-488 , USB, or RS232C bus. Up to 200 waveforms can be stored in nonvolatile memory and given a user defined name for easy recall.

All RS Series configurations offer three phase waveform generation, allowing independent phase anomalies to be programmed. It also allows simulation of unbalanced harmonic line conditions.

Arbitrary Waveform Generation

Using the provided GUI program or custom software, the user also can define arbitrary AC waveforms. The arbitrary waveform method of data entry provides an alternative method of specifying AC anomalies by providing specific waveform data points. The GUI program provides a catalog of custom waveforms and allows real-world waveforms captured on a digital oscilloscope to be downloaded to one of the many AC source's waveform memories. Arbitrary waveform capability is a flexible way of simulating the effect of real-world AC power line conditions on a unit under test in both engineering and production environments.



Harmonically distorted waveform.

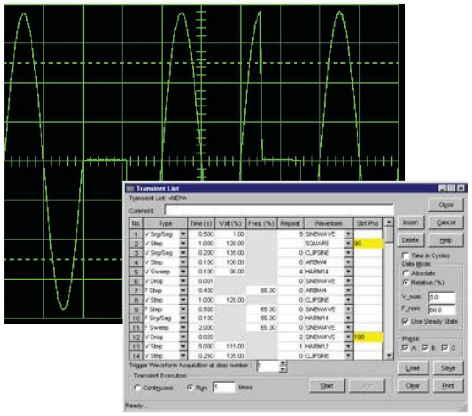
RS Series - AC and DC Transient Generation

The RS Series controller has a powerful AC and DC transient generation system that allows complex sequences of voltage, frequency and waveshapes to be generated. This further enhances the RS's capability to simulate AC line conditions or DC disturbances. When combined with the multiphase arbitrary waveform capabilities, the AC and DC output possibilities are truly exceptional. Transient generation is controlled independently yet time synchronized on all three phases. Accurate phase angle control and synchronized transient list execution provide unparalleled accuracy in positioning AC output events.

Transient programming is easily accomplished from the front panel where clearly laid out menu's guide the user through the transient definition process.

The front panel provides a convenient listing of the programmed transient sequence and allows for transient execution Start, Stop, Abort and Resume operations. User defined transient sequences can be saved to non-volatile memory for instant recall and execution later. The included Graphical User Interface program supports transient definitions using a spreadsheet-like data entry grid. A library of frequently used transient programs can be created on disk using this GUI program

Transient List Data Entry from the front panel.



Transient List Data Entry in GUI program.

RS Series - Measurement and Analysis

The RS Series is much more than a programmable AC, DC or AC+DC power source. It also incorporates an advanced digital signal processor-based data acquisition system that continuously monitors all AC source and load parameters.

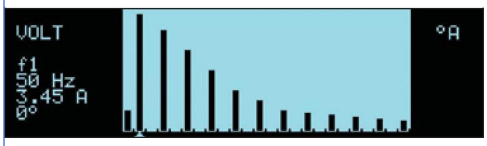
This data acquisition system forms the basis for all measurement and analysis functions. These functions are accessible from the front panel and the remote-control interface for the RS Series.

Conventional Measurements [All controllers]

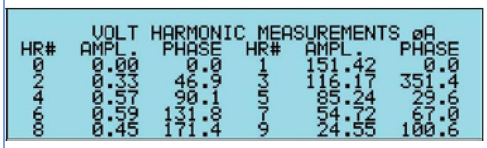
Common AC and DC measurement parameters are automatically provided by the data acquisition system. These values are displayed in numeric form on the front panel LCD display. The following measurements are available: Frequency, Vrms, Irms, Ipk, Crest Factor, Real Power (Watts), Apparent Power (VA) and Power Factor.

Harmonic Analysis

The RS Series provides detailed amplitude and phase information on up to 50 harmonics of the fundamental voltage and current (up to 16 kHz in three phase mode) for either one or three phases. Harmonic content can be displayed in both tabular and graphical formats on the front panel LCD for immediate feedback to the operator. Alternatively, the included GUI program can be used to display, print and save harmonic measurement data. Total harmonic distortion of both voltage and current is calculated from the harmonic data.



Absolute amplitude bar graph display of current harmonics with cursor positioned at the fundamental .

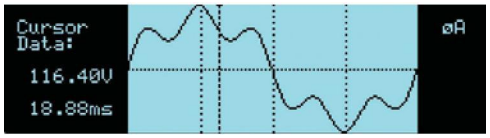


Voltage harmonic measurement table display in absolute values.

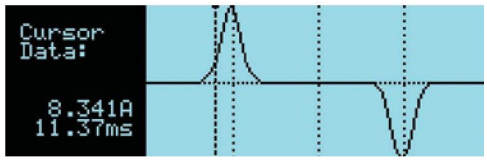
Waveform Acquisition

The measurement system is based on real-time digitization of the voltage and current waveforms using a 4K deep sample buffer. This time domain information provides detailed information on both voltage and current waveshapes. Waveform acquisitions can be triggered at a specific phase angle or from a transient program to allow precise positioning of the captured waveform with respect to the AC source output.

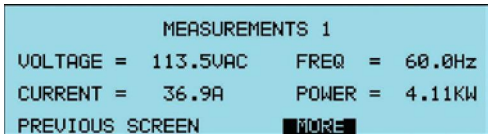
The front panel LCD displays captured waveforms with cursor readouts. The included GUI program also allows acquired waveform data to be displayed, printed, and saved to disk.



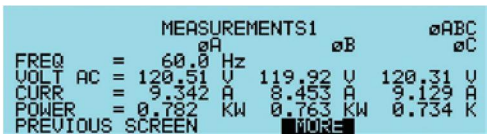
Acquired Current waveform.



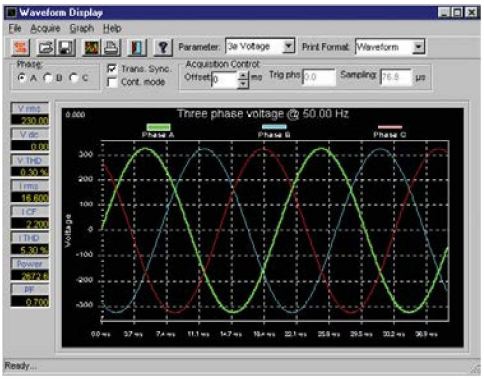
Acquired Voltage waveform.



Measurement data for single phase.



Measurement data for all three phases.



Acquired three phase voltage waveforms display on PC.

Model
Refer to tables shown for model numbers and configurations

Supplied with
User/Programming Manual and Software on CD ROM. RS232C serial cable.

Input Voltage Settings
Specify input voltage (L-L) setting for each RS system at time of order:

208 Configured for 208 V ±10 % L-L, 4 wire input.

230 Configured for 230 V ±10 % L-L, 4 wire input.

380 Configured for 380V +/- 10% L-L, 4 Wire Input

400 Configured for 400 V ±10 % L-L, 4 wire input.

480 Configured for 480 V ±10 % L-L, 4 wire input

Model Options

-333 Configured for 166VAC and 333VAC L-N and 220/440 V DC output ranges.

-ES Emergency Stop with Key Release

-411 IEC 61000-4-11 test firmware.

-413 IEC 61000-4-13 Harmonics & Interharmonics test firmware.

-LF Limits maximum frequency to 500 Hz.

-FC Modifies output frequency control to ± 0.25%

-LAN Ethernet Interface.

-HF Increases max frequency to 905 Hz.

-HV Adds 400 V L-N AC-only output range.

-HVC Adds 0-400V L-N AC only output range with constant power mode.

-XV Adds other AC-only output range. Consult factory for details.

-XVC Adds other AC only output range with constant power mode. Consult Factory for details

-LKM Clock/Lock Master

-LKS Clock/Lock Auxiliary

-WHM Watt-Hour Measurement option.

-SNK Bidirectional auto source and sink mode. Offers up to 100% power sink capability in AC mode of operation..

-SNK-DC Sink DC current mode.

-EXTD External Drive allows external signal control.

Avionics& Shipboard Test Routine Options*

-ABD ABD0100.1.8 Test Option.

-AMD Airbus AMD24 Test

-A350 Airbus Test Software

-B787 Boeing 787 Test Software

-160 RTCA/DO-160D, DO-160E, DO-160G, and EUROCAE test firmware.

-704 MIL-STD-704 A - F test - firmware/software.

-1399 MIL-STD-1399-300B shipboard power test software.

* Note: Reference the Avionics Test User Manual P/N 4994-971 for a complete listing of performance capabilities.

Packaging and Shipment
All RS systems are packaged in re-usable protective wooden crates for shipment.

RS Series Specifications

Operating Modes	
AC, DC and AC+DC	
AC Mode Output	
Frequency	Range: 16.00-819.0 Hz, -LF Option: 16.00-500.0 Hz, -HF Option: 16.00-905 Hz (supplemental specifications apply above 819 Hz). Resolution: 0.01 Hz: 16.00 - 81.91 Hz, 0.1 Hz: 82.0 Hz - 819.1 Hz, SNK 16-500Hz, EXTD 16-819Hz
Phase Outputs	3 Phase, Neutral: Floating, Coupling: DC (except for -HV , -XV, -HVC, and -XVC options that are transformer coupled.)
Total Power	90 to 2160 kVA in multiples of 90 kVA
Load Power Factor	0 to unity at full output current

Mode Voltage				
Voltage Ranges (Std Unit has 150 and 300VAC , 333 Option has 166 and 333VAC)	**Range**	**V Low**	**V High**	**Regulation**
	AC	0-150V 0-166V	0-300V 0-333 V	Load Regulation < 0.25 % FS DC to 100 Hz, < 0.5 % FS 100 Hz to 819 Hz
	AC+DC	0-150V 0-166V	0-300V 0-333V	Line Regulation < 0.1% FS for a 10 % line change
External Sense	Voltage drop compensation (5% Full Scale).			
Harmonic Distortion (Linear)	Less than 0.5% from 16 - 66 Hz; Less than 1% from 66 - 500 Hz; Less than 1.5% above 500 Hz.			
DC Offset	< 20 mV			
Load Regulation	0.25% FS @ DC - 100 Hz, 0.5% FS > 100 Hz			
External Amplitude Modulation	Depth: 0 - 10 %, Frequency: DC - 2 KHz			
Voltage slew rate	200 µs for 10% to 90% of full scale change into resistive load, 0.5V / µSec.			

AC Mode Current

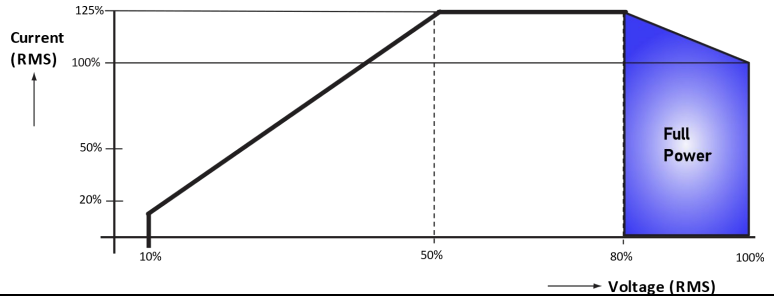
Steady State AC Current @ FS V (Std Unit has 150 and 300VAC -333 Option has 166 and 333VAC)

Model Range	Std/Option	RS90	RS180	RS270	RS360	RS450	RS540	RS630	RS720
150V Range	Standard	200 A/Ø	400 A/Ø	600 A/Ø	800 A/Ø	1000 A/Ø	1200 A/Ø	1400 A/Ø	1600 A/Ø
300V Range	Standard	100 A/Ø	200 A/Ø	300 A/Ø	400 A/ Ø	500 A/Ø	600 A/Ø	700 A/Ø	800 A/Ø
166V Range	-333 Option	180.2 A/Ø	360.4 A/ Ø	540.6 A/Ø	720.8 A/ Ø	901 A/ Ø	1081.2 A/ Ø	1261.4 A/ Ø	1441.6 A/ Ø
333V Range	-333 Option	90.1 A/Ø	180.2 A/Ø	270.3 A/Ø	360.4 A/ Ø	451A/ Ø	540.6 A/ Ø	630.7 A/ Ø	720.8 A/ Ø
Model Range	**Std/Option**	**RS810**	**RS900**	**RS990**	**RS1080**	**RS1170**	**RS1260**	**RS1350**	**RS1440**
150V Range	Standard	1800 A/Ø	2000 A/Ø	2200 A/Ø	2400 A/Ø	2600 A/Ø	2800 A/Ø	3000 A/Ø	3200 A/Ø
300V Range	Standard	900 A/Ø	1000 A/Ø	1100 A/Ø	1200 A/Ø	1300 A/Ø	1400 A/Ø	1500 A/Ø	1600 A/Ø
166V Range	-333 Option	1621.8 A/Ø	1802 A/Ø	1982.2A/Ø	2162.4 A/Ø	2342.6 A/Ø	2522.8 A/Ø	2703 A/Ø	2883.2 A/Ø
333V Range	-333 Option	810.9 A/Ø	901 A/Ø	991.1 A/Ø	1081.2 A/Ø	1171.3 A/Ø	1261.4 A/Ø	1352 A/Ø	1441.6 A/Ø
Model Range	**Std/Option**	**RS1530**	**RS1620**	**RS1710**	**RS1800**	**RS1890**	**RS1980**	**RS2070**	**RS2160**
150V Range	Standard	3400 A/Ø	3600 A/Ø	3800 A/Ø	4000 A/Ø	4200 A/Ø	4400 A/Ø	4600 A/Ø	4800 A/Ø
300V Range	Standard	1700 A/Ø	1800 A/Ø	1900 A/Ø	2000 A/Ø	2100 A/Ø	2200 A/Ø	2300 A/Ø	2400 A/Ø
166V Range	-333 Option	3063.4 A/Ø	3243.6 A/Ø	3423.8 A/Ø	3604 A/Ø	3784.2 A/Ø	3964.4 A/Ø	4144.6A/Ø	4324.8 A/Ø
333V Range	-333 Option	1531.7 A/Ø	1621.8 A/Ø	1711.9 A/Ø	1802 A/Ø	1892 A/Ø	1982.2 A/Ø	2072.3 A/Ø	2162.4 A/Ø

Note: Constant power mode provides increased current at reduced voltage. See chart below.

Peak Repetitive AC Current	Up to 3.0 x rms current at full scale voltage.
Programming Accuracy	Voltage (rms): ± 0.3 Vrms, Frequency: ± 0.01 % of programmed value, Current Limit: - 0 % to + 5 % of programmed value + 1A, Phase: <0.5°+0.2°/100Hz with balanced load.
Programming Resolution	Voltage (rms): 100 mV, Frequency:0.01 Hz from 16 - 81.91 Hz, 0.1 Hz from 82.0 - 819 Hz, Current Limit: 0.1A, 3 phase mode, 1.0A, 1 phase mode, Phase: 0.1°

Constant Power AC Mode - Available Max. AC Current



Measurement

Measurements (per output phase)

Parameter	Frequency	RMS Voltage	RMS Current	Peak Current	Crest Factor	Real Power	Apparent Power	Power Factor	Phase	DC Voltage	DC Current	DC Power
Range	16 - 820 Hz	300 V	0-250 A	0-750 A	0.00-6.00	0-90 kW	0-30 kVA	0.00-1.00	0.0-360.0	0-400 V	0-200 A	0-20kW
Accuracy* (±)	0.01% + 0.01 Hz, ±0.25 % for the FC option	0.1% FS, < 100 Hz 0.2% FS, > 100 Hz	0.5% FS, < 100 Hz 1.0% FS, > 100 Hz	2% FS, < 100 Hz 4% FS, > 100 Hz	0.05 0.05	1% FS , < 100 Hz 2% FS, > 100 Hz	1% FS , < 100 Hz 2% FS, > 100 Hz	0.01, <100Hz 0.02, 100-820Hz	2.0° typ.	0.25% FS	0.5% FS	1% FS
Resolution*	0.01 to 81.91Hz, 0.1 to 500Hz, 1Hz above 500Hz	0.01 V	0.1 A	0.1 A	0.01	10 W	10 VA	0.01	0.5°	0.1 V	0.01 A	10 W

* Measurement system bandwidth = DC to 6.7 kHz. Accuracy specifications are valid above 100 counts. Current and Power Accuracy and Range specifications are multiplied by the number of 90 kVA cabinets in the system. PF accuracy applies for PF > 0.5 and VA > 50 % of range
** Power Factor measurements valid >0.5 and VA > 50% of full scale.)

Measurements - Harmonics

Parameter	Frequency Fundamental / Harmonics	Phase	Voltage	Current
Range	16.00-820 Hz / 32.00 Hz - 16 kHz	0.0 - 360.0°	Fundamental / Harmonics 2-50	Fundamental Harmonics 2-50
Accuracy* (±)	0.03% + 0.03 Hz / 0.01 Hz ±0.25 % for the FC option	2° typ.	0.1% FS /0.1% + 0.1%/kHz FS	0.5% FS, < 100 Hz 1.0% FS, > 100 Hz / 1.0% + 0.5%/kHz FS
Resolution	0.01 Hz	0.5°	10 mV / 10 mV	0.1 A / 0.1 A

* Accuracy specifications are valid above 100 counts. Accuracy specifications are for three phase mode.

DC Mode Output

Power	Max DC power at full scale of DC voltage range. 20 kW each phase, 60 kW total for each RS90 system, multiply by the number of 90 kVA cabinets in the system
Voltage Ranges	Range: Low (0 - 200 V), High (0 - 400 V) -333 Option has 0 - 220 and 0 - 440VDC in place of these ranges.
Output Accuracy	± 1 Vdc
Load Regulation	< 0.25 % FS
Line Regulation	< 0.1% FS for 10 % input line change
Ripple	< 2 Vrms Lo Range, < 3 Vrms Hi Range

Max DC Current @ Full Scale Voltage per output. (Std. Unit has 0 - 200 and 0 - 400VDC, -333 Option has 0 - 220 and 0 - 440VDC ranges)

Model Range	Std/Option	RS90	RS180	RS270	RS360	RS450	RS540	RS630	RS720
200V Range	Standard	100 A/Ø	200 A/Ø	300 A/Ø	400 A/Ø	500 A/Ø	600 A/Ø	700 A/Ø	800 A/Ø
400V Range	Standard	50 A/Ø	100 A/Ø	150 A/Ø	200 A/ Ø	250 A/Ø	300 A/Ø	350 A/Ø	400 A/Ø
220V Range	-333 Option	90.8 A/Ø	181.6 A/ Ø	272.4 A/Ø	363.2 A/ Ø	454 A/ Ø	544.8 A/ Ø	635.6 A/ Ø	726.4 A/ Ø
440V Range	-333 Option	45.4 A/Ø	90.8 A/Ø	136.2 A/Ø	181.6 A/ Ø	227A/ Ø	272.4 A/ Ø	317.8 A/ Ø	363.2 A/ Ø
Model Range	**Std/Option**	**RS810**	**RS900**	**RS990**	**RS1080**	**RS1170**	**RS1260**	**RS1350**	**RS1440**
200V Range	Standard	900 A/Ø	1000 A/Ø	1100 A/Ø	1200 A/Ø	1300 A/Ø	1400 A/Ø	1500 A/Ø	1600 A/Ø
400V Range	Standard	450 A/Ø	500 A/Ø	550 A/Ø	600 A/Ø	650 A/Ø	700 A/Ø	750 A/Ø	800 A/Ø
220V Range	-333 Option	817.2 A/Ø	908 A/Ø	998.8A/Ø	1089.6 A/Ø	1180.4 A/Ø	1271.2 A/Ø	1362 A/Ø	1452.8 A/Ø
440V Range	-333 Option	408.6 A/Ø	454 A/Ø	499.4 A/Ø	544.8 A/Ø	590.2 A/Ø	635.6 A/Ø	681 A/Ø	726.4 A/Ø
Model Range	**Std/Option**	**RS1530**	**RS1620**	**RS1710**	**RS1800**	**RS1890**	**RS1980**	**RS2070**	**RS2160**
200V Range	Standard	1700 A/Ø	1800 A/Ø	1900 A/Ø	2000 A/Ø	2100 A/Ø	2200 A/Ø	2300 A/Ø	2400 A/Ø
400V Range	Standard	850 A/Ø	900 A/Ø	9500 A/Ø	1000 A/Ø	1050 A/Ø	1100 A/Ø	1150 A/Ø	1200 A/Ø
220V Range	-333 Option	1543.6 A/Ø	1634.4 A/Ø	1725.2 A/Ø	1816 A/Ø	1906.8 A/Ø	1997.6 A/Ø	2088.4A/Ø	2179.2 A/Ø
440V Range	-333 Option	771.8 A/Ø	817.2 A/Ø	862.6 A/Ø	908 A/Ø	953.4 A/Ø	998.8 A/Ø	1044.2 A/Ø	1089.6 A/Ø

Note: Constant power mode provides increased current at reduced voltage. See chart below

Current Limit	Programmable from 0 A to max. current for selected range

AC+DC Mode Output

Output Power	Maximum current and power in AC+DC mode is same as DC mode

Protection

Over Load	Constant Current or Constant Voltage mode
Over Temperature	Automatic shutdown

Storage

Non Volatile Mem. Storage	16 instrument setups, 200 user defined waveforms

Waveforms

Waveform Types	Std: Sine, Pi: Sine, Square, Clipped sine, User defined
User defined waveform storage	Four groups of 50 user defined arbitrary waveforms of 1024 points for a total of 200. One group can be active at a time

System Interface

Inputs	Remote shutdown, External Sync, Clock/Lock
Outputs	Function Strobe / Trigger out, Clock/Lock

RS Series Specifications

Remote Control						
IEEE-488 Interface	IEEE-488 (GPIB) talker listener. Subset: AH1, C0, DC1, DT1, L3, PP0, RL2, SH1, SR1, T6, IEEE-488.2 SCPI Syntax					
RS232C Interface	9 pin Sub-D connector (Supplied with RS232C cable)					
LAN (-LAN Opt.)	Ethernet Interface: 10BaseT, 100BaseT, RJ45					
USB	Version: USB 1.1; Speed: 460 Kb/s maximum					
Output Relay	Push button controlled or bus controlled output relay					
AC Input						
Voltage	Must be specified at time of order. All inputs are specified as VAC Line to Line, ± 10%, 3ø, , 3 wire + Ground. 208 VAC, 230 VAC, 380 VAC, 400 VAC, 480 VAC, 600 VAC.					
Input Line Current (per phase) Steady State at full power load	**Current Per RS90 Cabinet (Input Selection)**					**Systems 180 kVA to 2160 kVA**
	208 VAC	**230VAC**	**380VAC**	**400VAC**	**480VAC**	
	350 ARMS	314 ARMS	177 ARMS	180 ARMS	150 ARMS	Multiply the rated input line currents by the number of 90 kVA cabinets in the system
Inrush Current	460 Apk @ 208V LL	440 Apk @ 230V LL	277 Apk @ 380V LL	264 Apk @ 400V LL	220 Apk @ 480V LL	Multiply the rated peak inrush currents by the number of 90 kVA cabinets in the system
Input VA	112 kVA per 90kVA cabinet, multiply by the number of cabinets for systems above 90 kvA					
NOTE Each 90 kVA cabinet requires its own AC service						
Distortion	< 8% at full power, <20% below 35% of power					
Line Frequency	47 - 63 Hz					
Efficiency	85 % typical					
Power Factor	0.95 typical /0.99 at full power					
Hold Up Time	> 10mS					
Isolation Voltage	2200 VAC Input to Output, 1350 VAC Input to Chassis					
AC Service						
Inputs/Outputs	Rear panel access					
Regulatory	IEC/EN 61010-1					
EMI	CISPR 11 / EN 55011, Class A, , EN 61326-1, CE EMC (400 V input only -400 option)					
Connectors	AC Input & Output terminal block behind rear access cover. Rear Panel Connections: IEEE-488 (GPIB) connector Option, 9 pin Sub-D RS232C connector*, Remote voltage sense terminal block , System Interface Connector, DB-37, Ethernet connector Option. *RS232 DB9 to DB9 cable supplied,					
Physical Dimensions / Environmental						
RS90 Dimensions	Height: 76” (1930 mm) Width: 32.0” (812mm) Depth: 40.0” (1016mm)					
RS90 Net Weight	2250 lbs 1020 Kg approximately					
RS90 Shipping Weight	2500 lbs 1020 Kg approximately					
Chassis	Casters and forklift openings					
Vibration and Shock	Designed to meet NSTA project 1A transportation levels. Units are shipped in wooden crate with forklift slots					
Air Intake/Exhaust	Forced air cooling, front air intake, rear exhaust					
Operating Humidity	0 to 95 % RAH, non-condensing					
Temperature	Operating 0 to 35° C (30° max in CP mode), Storage: -20 to +85° C					

Note: Specifications are subject to change without notice. Specifications are warranted over an ambient temperature range of 25°± 5° C. Unless otherwise noted, specifications are per phase for a sinewave with a resistive load and apply after a 30 minute warm-up period. For three phase configurations, all specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.