

## Overview

## 150–400 V

- 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 540 kVA and above
- 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, AC+DC and DC modes. Regenerate up to 100% of the rated output power back to the utility grid during sink mode operation. ( -SNK option )
- Remote Control**  
 Standard RS232, USB, IEEE with optional LAN and External Drive interfaces are available for automated and hardware in-the-loop test applications.



## 0–1500 / Phase

|  |     |     |     |
|--|-----|-----|-----|
|  | 208 | 230 | 400 |
|  | 480 |     |     |

ETHERNET RS232

### 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

The RS90 delivers up to 90 kVA of AC or AC + DC power. In DC mode, 50% of the AC power level is available.

For higher power requirements, the RS180, RS270, RS360, RS450 and RS540 models are available. Available reconfigurable RS models (-MB designation) provide multiple controllers which allow separation of the high power system into individual RS90 units for use in separate applications. This ability to reconfigure the system provides 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. 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.

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 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 in order 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, voltage transients, DC injection and harmonic susceptibility.

```

REGENERATE CONTROL
UNDER VOLT= 100.0VAC  dFREQ = 0.50Hz
OVER VOLT = 270.0VAC  DELAY F= 5.000S
PREVIOUS SCREEN     DELAY R= 5.000S
    
```

Programming sink (-SNK) mode operation

## Avionics

With an output frequency range to 819 Hz (or 1000 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 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 150V and 300V line to neutral. These models provide 3 phase output capability of 260 Vac or 520 Vac line to line respectively.

For applications requiring more than 300 V

L-N (or 520 V L-L), the optional -HV output transformer provides an additional 400 V L-N and 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 600V-L-N (1,038V-L-L)

## High Crest Factor

With a crest factor of up to 3.6, the RS Series AC source can drive difficult nonlinear loads with ease. Since many modern products use switching power supplies, they have a tendency to pull high repetitive peak currents. The RS90 can deliver up to 720 Amps of repetitive peak current (150 V AC range) per phase to handle high crest factor three phase loads.

## Remote Control

Standard RS232C USB & IEEE-488 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.

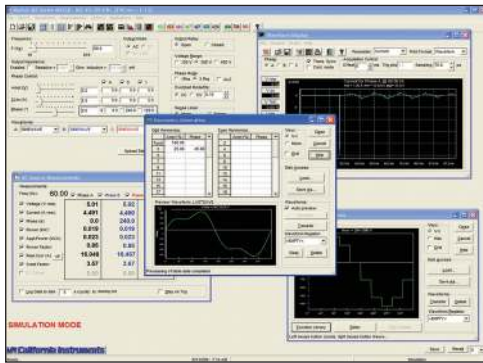
Optional External Drive (EXTD) allows external analog signal control of the source while in AC operation, essentially turning the source into a high bandwidth amplifier. Most common applications include hardware in the loop (HIL) simulation of power plants, hybrid electric vehicles and most recently 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:

- 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.

1.Requires PC running Windows 7, XP™ or Windows 2000™ / 2007.



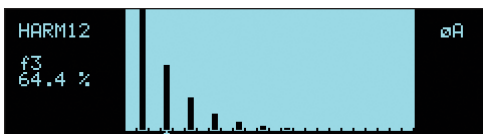
**Harmonic Waveform Generation**

Using the latest DSP technology, the RS Series programmable controller is capable of generating 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 remote interface. Up to 200 waveforms can be stored in nonvolatile memory and given a user defined name for easy recall.

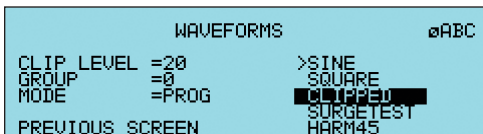
All RS Series configurations offer three phase waveform generation, allowing independent phase anomalies to be programmed. It also allows simulation of unbalanced harmonic line conditions.

**Arbitrary Waveform Generation**

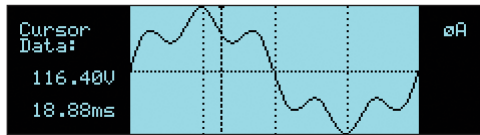
Using the provided GUI program or custom software, the user also has the ability to define arbitrary AC waveforms. The arbitrary waveform method of data entry provides an alternative method of specifying AC anomalies by providing specific waveform data points. The GUI program provides a catalog of custom waveforms and also 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.



Harmonic waveform, Fund., 3rd, 5th, 7th, 9th, 11th and 13th.



Two hundred user defined waveforms.



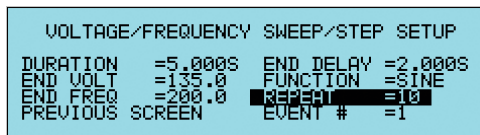
Harmonically distorted waveform.

**RS Series - AC and DC Transient Generation**

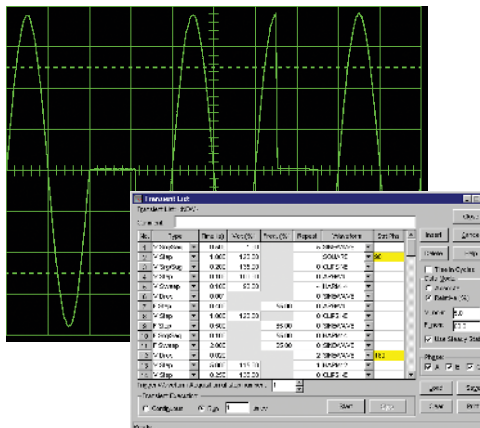
The RS Series controller has a powerful AC and DC transient generation system that allows complex sequences of voltage, frequency and waveshapes to be generated. This further enhances the RS's capability to simulate AC line conditions or DC disturbances. When combined with the multiphase arbitrary waveform 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 at a later time. 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

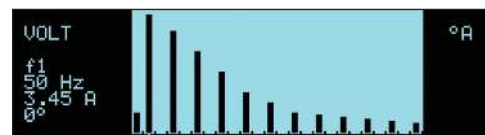
The RS Series is much more than a programmable AC, DC or AC+DC power source. It also incorporates an advanced digital signal processor based data acquisition system that continuously monitors all AC source and load parameters. This data acquisition system forms the basis for all measurement and analysis 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). 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 (RS90 Display).

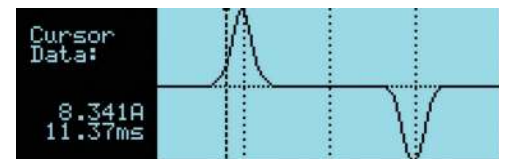
| HR# | AMPL.  | PHASE | HR# | AMPL.  | PHASE |
|-----|--------|-------|-----|--------|-------|
| 1   | 151.42 | 0.0   | 1   | 151.42 | 0.0   |
| 2   | 0.33   | 46.9  | 3   | 116.17 | 351.4 |
| 4   | 0.57   | 90.1  | 5   | 85.24  | 29.6  |
| 6   | 0.59   | 131.8 | 7   | 54.72  | 67.0  |
| 8   | 0.45   | 171.4 | 9   | 24.55  | 100.6 |

Voltage harmonic measurement table display in absolute values (RS90 Display)

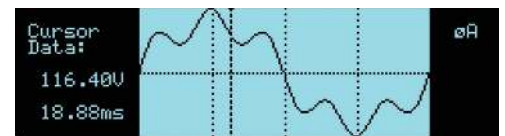
## Waveform Acquisition

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 (RS90 Display).



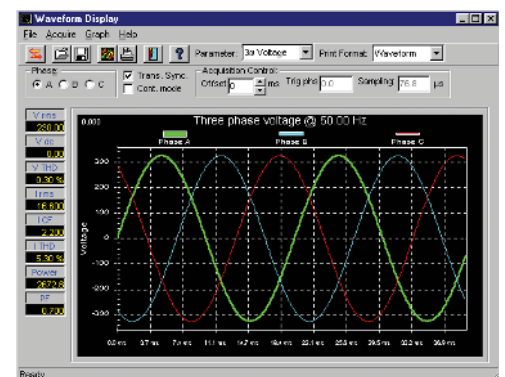
Acquired Voltage waveform (RS90 Display).

| MEASUREMENTS 1  |          |         |        |
|-----------------|----------|---------|--------|
| VOLTAGE =       | 113.5VAC | FREQ =  | 60.0Hz |
| CURRENT =       | 36.9A    | POWER = | 4.11KW |
| PREVIOUS SCREEN |          | MORE    |        |

Measurement data for single phase (RS90 Display).

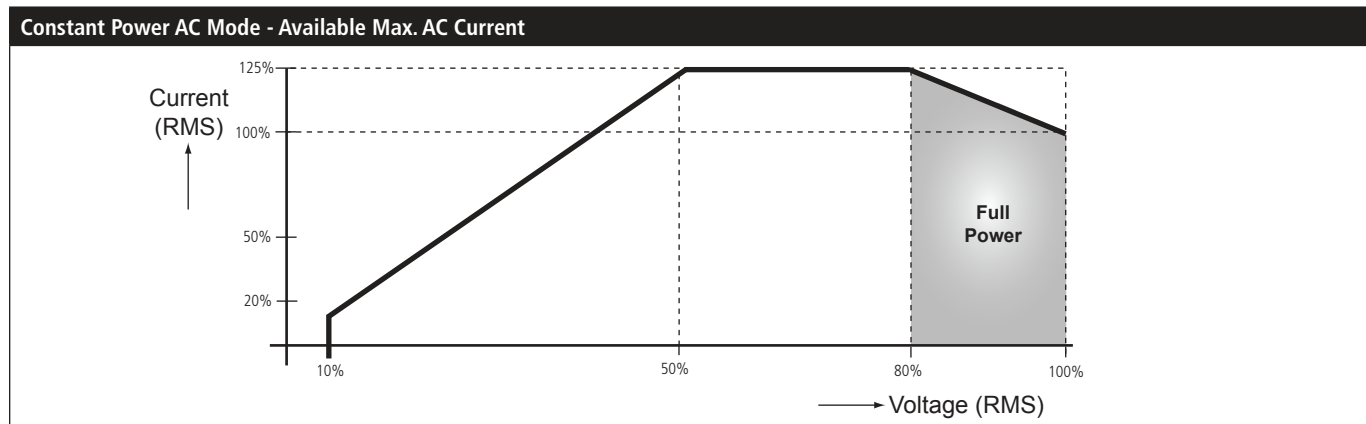
| MEASUREMENTS1   |          |          |          | oA | oB | oABC |
|-----------------|----------|----------|----------|----|----|------|
| FREQ =          | 60.0 Hz  |          |          |    |    |      |
| VOLT AC =       | 120.51 U | 119.92 U | 120.31 U |    |    |      |
| CURR =          | 9.342 A  | 8.453 A  | 9.129 A  |    |    |      |
| POWER =         | 0.782 KW | 0.763 KW | 0.734 K  |    |    |      |
| PREVIOUS SCREEN |          | MORE     |          |    |    |      |

Measurement data for all three phases (RS90 Display).



Acquired three phase voltage waveforms display on PC.

| Operating Modes  |  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|--|--|-----------|-----------|-----------------|---|---|-------|---------|---------|-----------------|--------------------------------|-------|---------|---------|-------|--------|------|------|------|------|------|------|--|-----------|-----------|-----------|-----------|-----------|-----------|
| RS90 Version   | 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, 1 Hz: 820-905 Hz, SNK 16-500Hz, EXTEND 16-819Hz   |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Phase Outputs  | 3 Phase, Neutral Floating, Coupling DC (except -HV and -XV Option)   |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Total Power  | RS90: 90kVA, RS180: 180kVA, RS270: 270kVA, RS360: 360kVA, RS450: 450kVA, RS540: 540kVA. Please consult factor for power levels above 540kVA  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Load Power Factor  | 0 to unity at full output current  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| AC Mode Voltage  |  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Voltage Ranges   | <table border="1"> <thead> <tr> <th>Range</th> <th>V Low</th> <th>V High</th> <th>Load Regulation</th> <th>&lt; 0.25 % FS DC to 100 Hz, &lt; 0.5 % FS 100 Hz to 819 Hz</th> </tr> </thead> <tbody> <tr> <td>AC</td> <td>0-150 V</td> <td>0-300 V</td> <td>Line Regulation</td> <td>&lt; 0.1% FS for 10 % line change</td> </tr> <tr> <td>AC+DC</td> <td>0-150 V</td> <td>0-300 V</td> <td></td> <td></td> </tr> </tbody> </table>  | Range     | V Low     | V High          | Load Regulation                                       | < 0.25 % FS DC to 100 Hz, < 0.5 % FS 100 Hz to 819 Hz | AC    | 0-150 V | 0-300 V | Line Regulation | < 0.1% FS for 10 % line change | AC+DC | 0-150 V | 0-300 V |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|  | Range  | V Low     | V High    | Load Regulation | < 0.25 % FS DC to 100 Hz, < 0.5 % FS 100 Hz to 819 Hz |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|  | AC   | 0-150 V   | 0-300 V   | Line Regulation | < 0.1% FS for 10 % line change                        |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| AC+DC  | 0-150 V  | 0-300 V   |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| 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 1.25% 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 $\mu$ s for 10% to 90% of full scale change into resistive load, 0.5V / $\mu$ Sec  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| AC Mode Current  |  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Steady State AC Current @ FS V   | <table border="1"> <thead> <tr> <th>Model</th> <th>RS90</th> <th>RS180</th> <th>RS270</th> <th>RS360</th> <th>RS450</th> <th>RS540</th> </tr> </thead> <tbody> <tr> <td>V Low</td> <td>200A</td> <td>400A</td> <td>600A</td> <td>800A</td> <td>1000A</td> <td>1200A</td> </tr> <tr> <td>V High</td> <td>100A</td> <td>200A</td> <td>300A</td> <td>400A</td> <td>500A</td> <td>600A</td> </tr> <tr> <td></td> <td>per phase</td> <td>per phase</td> <td>per phase</td> <td>per phase</td> <td>per phase</td> <td>per phase</td> </tr> </tbody> </table> | Model     | RS90      | RS180           | RS270   | RS360   | RS450 | RS540   | V Low   | 200A            | 400A                           | 600A  | 800A    | 1000A   | 1200A | V High | 100A | 200A | 300A | 400A | 500A | 600A |  | per phase | per phase | per phase | per phase | per phase | per phase |
|  | Model  | RS90      | RS180     | RS270           | RS360   | RS450   | RS540 |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|  | V Low  | 200A      | 400A      | 600A            | 800A  | 1000A   | 1200A |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|  | V High   | 100A      | 200A      | 300A            | 400A  | 500A  | 600A  |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
|  | per phase  | per phase | per phase | per phase       | per phase   | per phase   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Note: Constant power mode provides increased current at reduced voltage. See chart below |  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Peak Repetitive AC Current   | Up to 3.6 x rms current at full scale voltage  |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |
| Programming Accuracy   | Voltage (rms): $\pm 0.3$ Vrms, Frequency: $\pm 0.01$ % of programmed value, Current Limit: - 0 % to + 5 % of programmed value + 1A, Phase: $< 0.5^\circ + 0.2^\circ / 100$ Hz 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: 0.1 A, 3 phase mode, 1.0 A, 1 phase mode, Phase: $0.1^\circ$   |           |           |                 |   |   |       |         |         |                 |                                |       |         |         |       |        |      |      |      |      |      |      |  |           |           |           |           |           |           |



Note: Specifications are subject to change without notice. Specifications are warranted over an ambient temperature range of  $25^\circ \pm 5^\circ$  C. Unless otherwise noted, specifications are per phase for a sine wave 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.

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# RS Series : Specifications

| Measurement   |  |                 |   |  |   |  |   |                                 |  |
|---|--|-----------------|---|--|---|--|---|---------------------------------|--|
| Measurements - Standard (AC Measurements)   | Parameter  | Frequency       | RMS Voltage                                 | RMS Current  | Peak Current  | VA Power   | Real Power  | Power Factor (>0.2kVA)          |  |
|   | Range  | 16.00 - 820.0Hz | 0-400V                                      | 0 - 300A   | 0 - 800 Amps  | 0-90kVA  | 0-90KW  | 0.00-1.00                       |  |
|   | Accuracy* (±)  | 0.01% +0.01Hz   | 0.05V+0.02%, <100Hz<br>0.1V+.02%, 100-820Hz | 0.5A+0.2%, <100Hz<br>0.5A+0.5%, 100-500Hz<br>0.5A+1.0%, >500Hz | 0.5A+0.2%, <100Hz<br>0.5A+0.5%, 100-500Hz<br>0.5A+1.0%, > 500Hz | 90VA+0.2%, <100Hz<br>90VA+0.5%, 100-500Hz<br>90VA+1.0%, >500Hz | 90W+0.2%, <100Hz<br>90W+0.5%, 100-500Hz<br>90W+1.0%, >500Hz | 0.01, <100Hz<br>0.02, 100-820Hz |  |
| Resolution*   | 0.01 to 81.91Hz<br>0.1 to 500Hz<br>1Hz above 500Hz   | 0.01V           | 0.01A                                       | 0.01A  | 10VA  | 10W  | 0.01  |                                 |  |
| * Note: Accuracy specifications are valid above 100 counts. For current and power measurements, specifications apply from 2% to 100% of measurement range. Current and Power range and accuracy specifications are two times for RS180. |  |                 |   |  |   |  |   |                                 |  |
| Measurements - Harmonics  | Parameter  | Range           | Accuracy* (±)                               |  | Resolution  |  |   |                                 |  |
|   | Frequency Fundamental  | 16.00 - 820 Hz  | 0.03% + 0.03 Hz                             |  | 0.01 Hz   |  |   |                                 |  |
|   | Frequency harmonics  |                 |   |  |   |  |   |                                 |  |
|   | RS90 RS180 RS270 RS360 RS450 RS540   |                 |   |  |   |  |   |                                 |  |
|   | 32.00 Hz – 16 KHz  |                 |   | 0.03% + 0.03 Hz  |   | 0.01 Hz  |   |                                 |  |
|   | RS90-3Pi   |                 |   |  |   |  |   |                                 |  |
|   | 32.00 Hz – 48 KHz  |                 |   | 0.03% + 0.03 Hz  |   | 0.01 Hz  |   |                                 |  |
|   | Phase  | 0.0 - 360.0°    |   | 2° typ.  |   | 0.5°   |   |                                 |  |
|   | Voltage  | Fundamental     |   | 0.75V  |   | 0.01V  |   |                                 |  |
|   | Harmonic 2 - 50  |                 |   | 0.75V + 0.3% + 0.3%/kHz  |   | 0.01V  |   |                                 |  |
| Current   | Fundamental  |                 | 0.5A  |  | 0.1A  |  |   |                                 |  |
| Harmonic 2 - 50   |  |                 | 0.15A + 0.3% + 0.3%/kHz                     |  | 0.1A  |  |   |                                 |  |
| Note: For current measurements, specifications apply from 2% to 100% of measurement range.  |  |                 |   |  |   |  |   |                                 |  |
| DC Mode Output  |  |                 |   |  |   |  |   |                                 |  |
| Power   | Maximum DC Power at full scale of DC voltage range.<br>RS90: 45kW, RS180: 90kW, RS270: 135kW, RS360: 180kW, RS450: 225kW, RS540: 270kW |                 |   |  |   |  |   |                                 |  |
| Voltage Ranges  | Range: Low (0 - 200 V), High (0 - 400 V)   |                 |   |  |   |  |   |                                 |  |
| Output Accuracy   | ± 1 Vdc  |                 |   |  |   |  |   |                                 |  |
| Load Regulation   | < 0.25 % FS  |                 |   |  |   |  |   |                                 |  |
| Line Regulation   | < 0.1% FS or 10 % line change  |                 |   |  |   |  |   |                                 |  |
| Ripple  | < 2 Vrms Lo Range, < 3 Vrms Hi Range   |                 |   |  |   |  |   |                                 |  |
| DC Mode AC+DC Mode  | Model  | RS90            | RS180                                       | RS270  | RS360   | RS450  | RS540   |                                 |  |
|   | V Low  | 100A            | 200A  | 300A   | 400A  | 500A   | 600A  |                                 |  |
|   | V High   | 50A             | 100A  | 150A   | 200A  | 250A   | 300A  |                                 |  |
|   |  | per phase       | per phase                                   | per phase  | per phase   | per phase  | per phase   |                                 |  |
| Note: Constant power mode provides increased current at reduced voltage. See chart on previous page   |  |                 |   |  |   |  |   |                                 |  |
| 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   |                 |   |  |   |  |   |                                 |  |
| System Interface  |  |                 |   |  |   |  |   |                                 |  |
| Inputs  | Remote shutdown, External Sync, Clock/Lock   |                 |   |  |   |  |   |                                 |  |
| Outputs   | Function Strobe / Trigger out, Clock/Lock  |                 |   |  |   |  |   |                                 |  |
| 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 D-shell connector (Supplied with RS232C cable)   |                 |   |  |   |  |   |                                 |  |
| LAN (option)  | 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  |                 |   |  |   |  |   |                                 |  |
| 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                |                 |   |  |   |  |   |                                 |  |

# RS Series : Specifications

# 90–540 kVA

| AC Input  |   |  |  |  |  |  |           |
|---|---|--|--|--|--|--|-----------|
| Voltage   | Must be specified at time of order. All inputs are L-L, 3ø, 3 wire + Gnd. 208 ± 10% VAC, 230 ± 10% VAC, 400 ± 10% VAC, 480 ± 10% VAC  |  |  |  |  |  |           |
| Line Voltage<br>(3 phase, 3 wire + ground (PE))   | 208 VLL ±10%, 230 VLL ±10%, 400 VLL ±10%, 480 VLL ±10%  |  |  |  |  |  |           |
| Line VA   | <b>RS90</b>   | <b>RS180</b>                                   | <b>RS270</b>                                   | <b>RS360</b>                                   | <b>RS450</b>                                   | <b>RS540</b>                                   |           |
|   | 112 KVA   | 225 KVA  | 300 KVA  | 412KVA   | 525 KVA  | 637 KVA  |           |
|   | 350 ARMS @ 187 VLL  | Each RS90 chassis requires its own AC service. |  |  |  |  |           |
|   | 314 ARMS @ 207 VLL  | Total Line currents are<br>2 x RS90            | Total Line currents are<br>3 x RS90            | Total Line currents are<br>4 x RS90            | Total Line currents are<br>5 x RS90            | Total Line currents are<br>6 x RS90            |           |
|   | 180 ARMS @ 360 VLL  |  |  |  |  |  |           |
| 150 ARMS @ 432 VLL  |   |  |  |  |  |  |           |
| Line Frequency  | 47 - 63 Hz  |  |  |  |  |  |           |
| Efficiency  | 85 % (typical) depending on line and load   |  |  |  |  |  |           |
| Power Factor  | 0.95 (typical) / 0.99 at full power.  |  |  |  |  |  |           |
| Inrush Current  | <b>RS90</b>   | <b>RS180</b>                                   | <b>RS270</b>                                   | <b>RS360</b>                                   | <b>RS450</b>                                   | <b>RS540</b>                                   |           |
|   | 460 Apk @ 208 VLL   | Each RS90 chassis requires its own AC service. | Each RS90 chassis requires its own AC service. | Each RS90 chassis requires its own AC service. | Each RS90 chassis requires its own AC service. | Each RS90 chassis requires its own AC service. |           |
|   | 440 Apk @ 230 VLL   |  |  |  |  |  |           |
|   | 264 Apk @ 400 VLL   |  |  |  |  |  |           |
|   | 220 Apk @ 480 VLL   | Total Line currents are<br>2 x RS90            | Total Line currents are<br>3 x RS90            | Total Line currents are<br>4 x RS90            | Total Line currents are<br>5 x RS90            | Total Line currents are<br>6 x RS90            |           |
| Hold-Up Time  | >10ms   |  |  |  |  |  |           |
| Isolation Voltage   | 2200 VAC input to output, 1350 VAC input to chassis   |  |  |  |  |  |           |
| AC Service  |   |  |  |  |  |  |           |
| Inputs/Outputs  | Rear Panel Access   |  |  |  |  |  |           |
| Regulatory  | IEC61010, EN50081-2, EN50082-2, CE EMC and Safety Mark requirements   |  |  |  |  |  |           |
| EMI   | CISPR 11, Group1 , Class A  |  |  |  |  |  |           |
| Connectors  | AC Input and Output terminal blocks behind rear panel access cover. IEEE-488 (GPIB) connector behind rear panel access cover. 9 pin D-Shell RS232C connector*, behind rear panel access cover. Remote voltage sense terminal block behind rear panel access cover. System Interface Connector, DB-37 behind rear panel access cover. *RS232 DB9 to DB9 cable supplied |  |  |  |  |  |           |
| Physical Dimensions   |   |  |  |  |  |  |           |
| RS90 Dimensions   | Height: 76" (1930 mm) , Width: 32.0" (812mm), Depth: 40.0" (1016mm),  |  |  |  |  |  |           |
| RS90 Weight   | Net: 2250 lbs / 748 Kg approximately, Shipping: 2500 lbs / 785 Kg approximately   |  |  |  |  |  |           |
| Chassis   | RS90: 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: 0-35* (30°C max is CP mode), Storage -20 tp +85°C  |  |  |  |  |  |           |
| -MB Option  |   |  |  |  |  |  |           |
| Model   | AC Output Power   | Phase Outputs                                  | AC/DC Voltage Range                            | Controller                                     |  |  |           |
| RS180-3Pi-MB  | 180kVA  | 3  | 150/200 & 300/400                              | 2 x RS90                                       |  |  |           |
| RS270-3Pi-MB  | 270kVA  | 3  | 150/200 & 300/400                              | 3 x RS90                                       |  |  |           |
| RS360-3Pi-MB  | 360kVA  | 3  | 150/200 & 300/400                              | 4 x RS90                                       |  |  |           |
| RS450-3Pi-MB  | 450kVA  | 3  | 150/200 & 300/400                              | 5 x RS90                                       |  |  |           |
| RS540-3Pi-MB  | 540kVA  | 3  | 150/200 & 300/400                              | 6 x RS90                                       |  |  |           |
| Reconfigurable systems can be separated into stand-alone MX45-3Pi models or combined for higher power levels. |   |  |  |  |  |  |           |
| Steady State AC RMS Current in Regeneration Mode ( -SNK Option )  |   |  |  |  |  |  |           |
| Model   | RS90  | RS180  | RS270  | RS360  | RS450  | RS540  |           |
| AC Mode   | V Lo  | 200A   | 400A   | 600A   | 500A   | 1000A  | 1200A     |
|   | V Hi  | 100A   | 200A   | 300A   | 400A   | 500A   | 600A      |
|   |   | per phase                                      | per phase                                      | per phase                                      | per phase                                      | per phase                                      | per phase |
| V High  | V Lo  | 100A   | 200A   | 300A   | 400A   | 500A   | 600A      |
|   | V Hi  | 50A  | 100A   | 150A   | 200A   | 250A   | 300A      |
|   |   | per phase                                      | per phase                                      | per phase                                      | per phase                                      | per phase                                      | per phase |
| Storage   |   |  |  |  |  |  |           |
| Non Volatile Mem. storage   | 16 instrument setups, 200 user defined waveforms  |  |  |  |  |  |           |

# RS Series

| Unit Protection               |   |
|-------------------------------|---|
| Input Over current            | In-line fast acting fuses. Circuit breaker for LV supply.   |
| Input Over voltage            | Automatic shutdown.   |
| Input Over voltage Transients | Surge protection to withstand EN50082-1 (IEC 801-4, 5) levels.  |
| Output Over current           | Adjustable level constant current mode with programmable set point.   |
| Output Short Circuit          | Peak and RMS current limit.   |
| Over temperature              | Automatic shutdown  |
| System Specification          |   |
| External Modulation           | 0 to 10%  |
| Synchronization Input         | Isolated TTL input for external frequency control.  |
| Trigger Input                 | External trigger source input.  |
| Trigger Output                | 400 µs pulse for voltage or frequency change Isolated TTL output Output reverts to Function strobe frequency change. Isolated TTL output. Output reverts to Function strobe when not uses as Trig Out. This function is mutually exclusive with the Function Strobe output. |
| Function Strobe               | Active for any voltage or frequency program change. 400 µs pulse for voltage or frequency change.   |
| Output Status                 | Monitors status of output relay. SELV Isolated TTL output.  |

### Model

Refer to table 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

### Standard Model Options

Specify output range on standard models. All range values shown are Line to Neutral.

-150 Configured for 150 V AC and 200 V DC output ranges.

-300 Configured for 300 V AC and 400 V DC output ranges.

-411 \*IEC 1000-4-11 test firmware.

-LF Limits maximum frequency to 500

-FC Hz. Modifies output frequency control to ± 0.25%

-LAN EthernetInterface.

-413 \*IEC 1000-4-13 Harmonics & Interharmonics test firmware.

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

-HF Increases max. frequency to 905 Hz.

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

-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.

-SNK-DC Sink DC current mode.

-EXTD External Drive allows external signal control.

### Avionics Test Routine Options

-ABD ABD0100.1.8 Test Option. -Rev. D-E

-AMD Airbus AMD24 Test -Rev. A-C

-A350 Airbus Test Software -Rev A-C

-B787 Boeing 787 Test Software -Rev A-C additional

-704 Mil Std 704 A - F test - firmware/ software.

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

\* 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.