## Modular DC Electronic Load With Built-In Measurements

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>4312</td>
<td>0.6 - 120V</td>
<td>40, 80, &amp; 150A</td>
<td>150, 300, &amp; 600W</td>
</tr>
<tr>
<td>4350</td>
<td>2.3 - 500V</td>
<td>30, 60, &amp; 120A</td>
<td>150, 300, &amp; 600W</td>
</tr>
</tbody>
</table>

## High Performance DC Electronic Load

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>4700</td>
<td>1.0 - 120V</td>
<td>200 - 7200A</td>
<td>1kW - 36kW</td>
</tr>
<tr>
<td>4760</td>
<td>7.0 - 600V</td>
<td>50 - 1800A</td>
<td>1kW - 36kW</td>
</tr>
</tbody>
</table>

## Programmable AC Electronic Load

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>4600</td>
<td>50 - 350VAC</td>
<td>30 - 180A</td>
<td>3kW - 36kW</td>
</tr>
</tbody>
</table>

## Regenerative, Bi-Directional DC Source/Load

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>9210</td>
<td>40, 120 &amp; 600V</td>
<td>Up to 600A</td>
<td>12kW</td>
</tr>
<tr>
<td>9200</td>
<td>40, 120 &amp; 600V</td>
<td>Up to 7200A</td>
<td>12kW-144kW</td>
</tr>
</tbody>
</table>

## AC & DC Regenerative

<table>
<thead>
<tr>
<th>Model</th>
<th>Voltage</th>
<th>Current</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>9410</td>
<td>155 - 400V</td>
<td>Up to 800A</td>
<td>12kW - 96kW</td>
</tr>
</tbody>
</table>
4312 Series
Modular 120V DC Electronic Load

Digitizing DC Load with Built-In Measurements

Features
- 3 Models - 150W, 300W, 600W
- 3 Voltage ranges - 6, 30, & 120V
- 3 Current ranges
- High-resolution waveform capture up to 1M Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 1000 settings
- Advanced Loading - LED, MPPT, & XY loading
- Easy-to-use PC softpanel
- Ethernet (LAN)

Advantages
- Modular load maximizes configuration flexibility
- Simplifies automated test stand development
  - Triggerable set & measurement
  - Short circuit mode & over voltage relay
  - Isolated digital inputs & outputs
  - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
  - PC-based Softpanel GUI with scope display (Fig. 1)
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: DC Load, emoPower®, or Enerchron® test sequencer

Benefits
- Modular - up to 16 loads or combinations in single chassis
- Built in features require fewer test devices
- Front connections simplify wiring
- Safety limits protect UUT
### Model 4312 Modular 120V DC Electronic Load Specifications

#### Overview

<table>
<thead>
<tr>
<th>Power</th>
<th>Slots (16 per Mainframe)</th>
<th>Maximum Current</th>
<th>Maximum Voltage</th>
<th>Voltage &amp; Current Measurements</th>
<th>Other Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 W</td>
<td>1</td>
<td>40A</td>
<td>120V</td>
<td>Overshoot, Undershoot, AC RMS, AC+DC RMS, Positive Peak, Negative Peak, Peak-Peak, High-Frequency Peak - Peak (Noise), Rise Time, Fall Time, Settling Time, Hold-Up Time</td>
<td>Average Power, Peak Power, Resistance, Trigger-In Time, DIN State &amp; Time</td>
</tr>
<tr>
<td>300 W</td>
<td>2</td>
<td>80A</td>
<td>120V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600 W</td>
<td>4</td>
<td>150A</td>
<td>120V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Measurement Instrumentation

<table>
<thead>
<tr>
<th>Current</th>
<th>Range (±)</th>
<th>Accuracy</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Voltage</td>
<td>0 - 0.8, 4, 80A</td>
<td>0.05% Rdg + 0.05% R</td>
<td>0.0015% R</td>
</tr>
<tr>
<td></td>
<td>0 - 0.8, 16, 150A</td>
<td>0.05% Rdg + 0.05% R</td>
<td>0.0015% R</td>
</tr>
<tr>
<td></td>
<td>0.02% Rdg + 0.04% R</td>
<td>0.003% R</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waveform</th>
<th>DC - 500kHz</th>
<th>DC - 10kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>1% R</td>
<td>(1/sample rate) +0.05 % Rdg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Record Length</th>
<th>256K points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trigger</td>
<td>System Trigger, DIN, Voltage</td>
</tr>
</tbody>
</table>

#### Programmable Features

- Constant Current Mode
- Constant Voltage Mode
- Constant Power Mode
- Constant Resistance
- Auto Mode
- LED Driver Mode
- Solar PV Panel with MPPT Mode
- Slew Rate
- Macro
- Triggering

#### Additional Features

- OVPS Relay: Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)
- External Analog Input: 0 - 10V signal input to modulate current
- Digital Outputs (DOUTs) per load: 2 isolated, logic level
- Digital Outputs per Mainframe: 12 isolated, ±100VDC, 300mA
- Calibration: Closed cover; all adjustments are done in software and stored in on-board flash memory

### Model 4312 Panel Overview

**Figure 1** - Front panel (300 W load) & front panel control

**Figure 2** - Mainframe rear panel

**Figure 3** - Constant Power operating envelope

---

R = Range, S = Set Point, Rdg = Readings • Specifications apply at 15° ± 5° C after a 10 minute warm up & are subject to change without notice. accuracies apply when settings and/or measurements >10% of R.
4350 Series
Modular 500V DC Electronic Load

Digitizing DC Load with Built-In Measurements

Features
- 3 Models - 150W, 300W, 600W
- 3 Voltage ranges - 30, 120, & 500V
- 3 Current ranges
- High-resolution waveform capture up to 1 M Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 1000 settings
- Advanced Loading - LED, MPPT, & XY loading
- Easy-to-use PC softpanel
- Ethernet (LAN)

Advantages
- Modular load maximizes configuration flexibility
- Simplifies automated test stand development
  - Triggerable set & measurement
  - Short circuit mode & over voltage relay
  - Isolated digital inputs & outputs
  - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
  - PC-based Softpanel GUI with scope display (Fig. 1)
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: DC Load, emPower or Enerchron test sequencer

Benefits
- Modular - up to 16 loads or combinations in single chassis
- Built in features require fewer test devices
- Front connections simplify wiring
- Safety limits protect UUT

Figure 1 - DC panel graphical user interface
### Model 4350 Digitizing DC Electronic Load Specifications (continued)

<table>
<thead>
<tr>
<th>Overview</th>
<th>(continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power</strong></td>
<td><strong>slots (16 per mainframe)</strong></td>
</tr>
<tr>
<td>150 W</td>
<td>300 W</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Maximum Current</strong></td>
<td><strong>Range IR x VR IR x VR IR x VR</strong></td>
</tr>
<tr>
<td>30 A</td>
<td>60 A</td>
</tr>
<tr>
<td><strong>Maximum Voltage</strong></td>
<td><strong>IR x VR IR x VR IR x VR</strong></td>
</tr>
<tr>
<td>500 V</td>
<td>500 V</td>
</tr>
<tr>
<td><strong>Voltage &amp; Current Measurements</strong></td>
<td><strong>Accuracy I Accuracy + V Accuracy</strong></td>
</tr>
<tr>
<td>IR x VR</td>
<td>IR x VR</td>
</tr>
<tr>
<td><strong>Maximum Current</strong></td>
<td><strong>Resolution 0.0015% R 0.0015% R 0.0015% R</strong></td>
</tr>
<tr>
<td>30 A</td>
<td>60 A</td>
</tr>
<tr>
<td><strong>Ranges</strong></td>
<td><strong>Resolution 0.0015% R 0.0015% R 0.0015% R</strong></td>
</tr>
<tr>
<td>0 - 0.25, 2.5 VAC</td>
<td>100µS to 16 hours</td>
</tr>
<tr>
<td>0.05% R</td>
<td>0.05% R</td>
</tr>
<tr>
<td><strong>Additional Features</strong></td>
<td><strong>Resolution 0.0015% R 0.0015% R 0.0015% R</strong></td>
</tr>
<tr>
<td>OVPS Relay</td>
<td>External Analog Input</td>
</tr>
<tr>
<td>Connects programmable power supply to test UUT for over-voltage protection, relay connected and 5 A limited (Relay only)</td>
<td>0 - 10 V signal input to modulate current</td>
</tr>
<tr>
<td>100µS to 16 hours</td>
<td>100µS to 16 hours</td>
</tr>
<tr>
<td>0.05% R</td>
<td>0.05% R</td>
</tr>
</tbody>
</table>

### Measurement Instrumentation

<table>
<thead>
<tr>
<th>Feature</th>
<th>Range (±)</th>
<th>Accuracy</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current</strong></td>
<td>DC - 500 kHz</td>
<td>0.02% Rdg + 0.04% R</td>
<td>0.003% R</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>DC - 500 kHz</td>
<td>0.003% R</td>
<td>0.003% R</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>DC - 100 kHz</td>
<td>1% R</td>
<td>1% R</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>(1/sample rate) &gt;0.05% Rdg</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>DC - 500 kHz</td>
<td>3% R @MHz</td>
<td></td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>DC - 500 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>DC - 100 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>DC - 100 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analog</strong></td>
<td>DC - 500 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Digitizing Rate</strong></td>
<td>1 Ms/s</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Record Length</strong></td>
<td>256K points</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Trigger</strong></td>
<td>System Trigger, DINS, Voltage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Programmable Features

- Constant Current Mode
- Constant Voltage Mode
- Constant Power Mode
- Constant Resistance
- Auto Mode
- LED Driver Mode
- Solar PV Panel with MPPT Mode
- Slew Rate
- Macro, Triggering

### Additional Features

- High-Frequency PK-PK Noise
- Resolution: 0.0015% R

### Model 4350 Panel Overview

**Figure 1** - Front panel (300 W load) & Front panel control

**Figure 2** - Mainframe rear panel

**Figure 3** - Constant Power operating envelope

R = Range, S = Set Point, Rdg = Readings • Specifications apply at 25°± 5° C after a 10 minute warm up & are subject to change without notice. Accuracies apply when settings and/or measurements >10% of R
High Current DC Electronic Load

Features
- 8 Models - 1kW to 36kW
- 4 Voltage ranges - 6.6, 20, 66, & 120V
- 2 Current ranges
- High accuracy 1kW low power range
- Waveform capture up to 100k Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 100 settings
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages
- Field-proven reliability
- Simplifies automated test stand development
  - Triggerable set & measurement
  - True short circuit mode & over voltage relay
  - Digital inputs & outputs
  - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
  - PC-based Softpanel GUI with scope display
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: DC Load, emPower®, or Enerchron® test sequencer

Benefits
- Field upgradeable (6kW steps)
- Built in features require fewer test devices
- Safety limits protect UUT
# 4700 Series High Performance 120V DC Load Specifications

## Power Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>4700-1-TP</th>
<th>4700-2-TP</th>
<th>4700-3-TP</th>
<th>4700-6-TP</th>
<th>4700-12-TP</th>
<th>4700-18-TP</th>
<th>4700-24-TP</th>
<th>4700-36-TP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>1 kW</td>
<td>2 kW</td>
<td>3 kW</td>
<td>6 kW</td>
<td>12 kW</td>
<td>18 kW</td>
<td>24 kW</td>
<td>36 kW</td>
</tr>
</tbody>
</table>

## Maximum Current

<table>
<thead>
<tr>
<th>Model</th>
<th>200 A</th>
<th>400 A</th>
<th>600 A</th>
<th>1200 A</th>
<th>2400 A</th>
<th>3600 A</th>
<th>4800 A</th>
<th>7200 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>3 kW</td>
<td>6 kW</td>
<td>12 kW</td>
<td>18 kW</td>
<td>24 kW</td>
<td>36 kW</td>
<td>48 kW</td>
<td>72 kW</td>
</tr>
</tbody>
</table>

## Voltage Range

<table>
<thead>
<tr>
<th>Model</th>
<th>4700-1-TP</th>
<th>4700-2-TP</th>
<th>4700-3-TP</th>
<th>4700-6-TP</th>
<th>4700-12-TP</th>
<th>4700-18-TP</th>
<th>4700-24-TP</th>
<th>4700-36-TP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
<td>1-120 V</td>
</tr>
</tbody>
</table>

## Ordering Information

<table>
<thead>
<tr>
<th>Model</th>
<th>DC Load P/N</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4700</td>
<td>4700-6-TP</td>
<td>6kW DC Load with standard Touch Panel</td>
</tr>
<tr>
<td>4700</td>
<td>4700-6-TP</td>
<td>6kW DC Load without Touch Panel</td>
</tr>
</tbody>
</table>

## Additional Features

1. Specifications apply at 23°C +/- 5°C after a 10 minute warm up.
2. Accuracies apply when Settings and/or Measurements >10% of Range.
3. Current linearly reduced between 1 & 10 V.
4. Models 2 - 36 kW also have a 20 A/1 kW Range with reduced accuracy.
5. Set 1000% to 6000% of Range = 10% Accuracy.
6. Single channel capture. Simultaneous Voltage and Current captures would have sample rate & memory available.

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**E-mail:** sales@nhresearch.com

**Tel:** 949-474-3900

**16601 Hale Avenue, Irvine, California 92606**
High Voltage DC Electronic Load

**Features**
- 8 Models - 1kW to 36kW
- 3 Voltage ranges - 20, 200, & 600V
- 2 Current ranges
- High accuracy 1kW low power range
- Waveform capture up to 100k Sample/Sec
- Precision voltage, current, power, & timing measurements
- Constant Loads - CV, CC, CP, CR, & in combination
- Dynamic Loading - 100 settings
- Built-in touch-panel user interface
- Ethernet (LAN)

**Advantages**
- Field-proven reliability
- Simplifies automated test stand development
  - Triggerable set & measurement
  - True short circuit mode & over voltage relay
  - Digital inputs & outputs
  - Built-in SW watchdog & safety limits
- Software tools to shorten test development time
  - PC-based Softpanel GUI with scope display
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: DC Load, emPower®, or Enerchron® test sequencer

**Benefits**
- Field upgradeable (6kW steps)
- Built in features require fewer test devices
- Safety limits protect UUT
### 4760 Series High Performance 600V DC Load Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>4760-1-TP</th>
<th>4760-2-TP</th>
<th>4760-3-TP</th>
<th>4760-6-TP</th>
<th>4760-12-TP</th>
<th>4760-18-TP</th>
<th>4760-24-TP</th>
<th>4760-36-TP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>1 kW</td>
<td>2 kW</td>
<td>3 kW</td>
<td>6 kW</td>
<td>12 kW</td>
<td>18 kW</td>
<td>24 kW</td>
<td>36 kW</td>
</tr>
<tr>
<td>Maximum Current</td>
<td>50 A</td>
<td>100 A</td>
<td>150 A</td>
<td>300 A</td>
<td>600 A</td>
<td>900 A</td>
<td>1200 A</td>
<td>1800 A</td>
</tr>
<tr>
<td>Voltage Range</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
<td>7.0 - 600 V</td>
</tr>
</tbody>
</table>

#### Programmable Modes

<table>
<thead>
<tr>
<th>Ranges</th>
<th>5, 50 A</th>
<th>10, 100 A</th>
<th>15, 150 A</th>
<th>30, 300 A</th>
<th>60, 600 A</th>
<th>90, 900 A</th>
<th>120, 1200 A</th>
<th>180, 1800 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
<td>0.12%+0.08%</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Voltage Ranges</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
<td>0.05%+0.05%</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constant Power</th>
<th>0 - 1 kW</th>
<th>0 - 2 kW</th>
<th>0 - 3 kW</th>
<th>0 - 6 kW</th>
<th>0 - 12 kW</th>
<th>0 - 18 kW</th>
<th>0 - 24 kW</th>
<th>0 - 36 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
<td>1%+1%</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
<td>0.025%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constant Resistance</th>
<th>0.2 - 6000 Ω</th>
<th>0.3 - 3000 Ω</th>
<th>0.06 - 2000 Ω</th>
<th>0.03 - 1000 Ω</th>
<th>0.02 - 500 Ω</th>
<th>0.01 - 250 Ω</th>
<th>0.005 - 125 Ω</th>
<th>0.001 - 62 Ω</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Slew Rate (10 - 90%)</th>
<th>Range</th>
<th>0 - 5 A/µs</th>
<th>10 - 40 A/µs</th>
<th>0 - 15 A/µs</th>
<th>10 - 60 A/µs</th>
<th>0 - 60 A/µs</th>
<th>0 - 90 A/µs</th>
<th>0 - 120 A/µs</th>
<th>0 - 180 A/µs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td>0.12%+0.06%</td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DC Voltage Ranges</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>20, 200, 600 V</th>
<th>6.6, 66, 166 V</th>
<th>6.6, 66, 166 V</th>
<th>6.6, 66, 166 V</th>
<th>6.6, 66, 166 V</th>
<th>6.6, 66, 166 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
<td>0.01%+0.02%</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
<td>0.0015%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Ranges</th>
<th>Current Range x Voltage Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Current Accuracy + Voltage Accuracy</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.0015% Range</td>
</tr>
</tbody>
</table>

#### Waveform Capture

<table>
<thead>
<tr>
<th>Bandwidth</th>
<th>25 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>1%R</td>
</tr>
<tr>
<td>Channels</td>
<td>Voltage, Current or bothMUX'd Triggering System or External</td>
</tr>
<tr>
<td>Digitizing Rate</td>
<td>100 - 100K Samples/s</td>
</tr>
<tr>
<td>Waveform Analysis</td>
<td>Voltage, Current, Power, Overshoot, Undershoot, Rise/Fall Time, Turn-On Time, Settling Time, Hold-Up Time, AC RMS, AC+DC RMS</td>
</tr>
</tbody>
</table>

#### Control

<table>
<thead>
<tr>
<th>User Interface</th>
<th>PC soft panel or manual touch-panel</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC Required/OS</td>
<td>3 GHz µP with 512 MB RAM, SVGa display, 80 GB HDD/Windows XP, Vista/ Active X</td>
</tr>
<tr>
<td>Test Executive</td>
<td>NLabVIEW, enPower™ with integrated datalog/test report support</td>
</tr>
<tr>
<td>Communications</td>
<td>Ethernet (LX), RS232, NHR R5495</td>
</tr>
</tbody>
</table>

#### Physical

<table>
<thead>
<tr>
<th>Load Connectors</th>
<th>Bus bars with lugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>0 - 40° C at full power and &lt;75% duty cycle</td>
</tr>
<tr>
<td>Input Power</td>
<td>115/230 ± 10% VAC, 47 - 63 Hz</td>
</tr>
<tr>
<td>Dimensions (HxWxD)</td>
<td>5 1/4 x 19 x 22 in</td>
</tr>
<tr>
<td>Weight</td>
<td>40 lbs</td>
</tr>
</tbody>
</table>

#### Additional Features

| Remote Voltage Sense | 2 VDC max drop between sense and load input |
| Self Test | Power-up self test of all major functions including status of input, output, control and protection circuits |
| Performance Monitoring | Continuous checking of parameters including status of input, output, control and protection circuits |
| Calibration | Closed cover, all adjustments made in software and stored in EEPROM |
| Protection | OP, OC, OV, OT, Reverse Voltage and Undervoltage Lockout |
| Trigger Output/Input | Synchronizes external device to programmed load step/Synchronizes programmed load step to an external device |
| Current Monitor | 0 - 10 V external signal appropriate to 100% current for the selected range |
| Analog Control | 0 - 10 V external signal appropriate to 100% current for the selected range |

Specifications apply at 23° ±/− 5° C after a 10 minute warm up.

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Linear & Non-Linear AC Loading

Features
- 10 Models - 3kW to 36kW
- Operating frequency - 45 to 440Hz
- Waveform capture up to 100k Sample/Sec
- Precision AC power measurement system
- Constant Loads - CV, CC, CP, or CR
- Dynamic Loading - 100 per-cycle settings
- User definable current waveshape
- Easy-to-use PC softpanel
- Serial (RS-2332) & Ethernet (LAN)

Advantages
- Field-proven reliability
- Simplifies automated test stand development
  - Triggerable set & measurement
  - True short circuit mode
  - Built-in SW watchdog
- Software tools to shorten test development time
  - PC-based Softpanel GUI with scope display (Fig. 1)
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: AC Load or emPower® test sequencers

Benefits
- Field upgradeable (3kW/ф steps)
- Built in features reduce cost & simplifies setup
  - Requires fewer additional test devices
  - Fewer devices simplifies test stand wiring
- Sizable for 1ф & 3ф Configurations
### 4600 Series Programmable AC Electronic Load Specifications

#### Power
- **4600-3**: 3 kW
- **4600-6**: 6 kW
- **4600-12**: 12 kW
- **4600-18**: 18 kW
- **4600-24**: 24 kW
- **4600-36**: 36 kW

#### Maximum Current
- **4600-3**: 0 - 30 A
- **4600-6**: 0 - 60 A
- **4600-12**: 0 - 120 A
- **4600-18**: 0 - 180 A
- **4600-24**: 0 - 240 A
- **4600-36**: 0 - 360 A

#### Voltage Range
- **4600-3**: 50 - 350 V
- **4600-6**: 50 - 350 V
- **4600-12**: 50 - 350 V
- **4600-18**: 50 - 350 V
- **4600-24**: 50 - 350 V
- **4600-36**: 50 - 350 V

### Programmable Modes

#### Constant Current
- **Range (RMS)**: 0 - 30 A, 0 - 60 A, 0 - 120 A, 0 - 180 A, 0 - 240 A, 0 - 360 A
- **Accuracy**: 0.2%, 0.2%, 0.2%, 0.2%, 0.2%, 0.2%
- **Resolution**: 0.05%, 0.05%, 0.05%, 0.05%, 0.05%, 0.05%

#### Constant Voltage
- **Range**: 50 - 350 V
- **Accuracy**: 0.5%, 0.5%, 0.5%, 0.5%, 0.5%, 0.5%
- **Resolution**: 0.05%, 0.05%, 0.05%, 0.05%, 0.05%, 0.05%

#### Constant Power
- **Range**: 300 W - 3 kW
- **Accuracy**: 1.414 - 4
- **Resolution**: 0.2%

#### Constant Resistance
- **Range**: 2.5-100, 100-1000Ω
- **Accuracy**: 2.5 - 100, 100 - 1000Ω
- **Resolution**: 0.2%

#### Current
- **Range**: 0 - 90 A
- **Accuracy**: 1%
- **Resolution**: 0.05%

#### Voltage
- **Range**: 50 - 350 V
- **Accuracy**: 0.1%
- **Resolution**: 0.01%

#### Power Factor
- **Resolution**: 1.414 - 4
- **Accuracy**: 1.414 - 4

#### Crest Factor
- **Resolution**: 1%, 5%
- **Accuracy**: 1%, 1%

#### Resistance
- **Range**: 0.25Ω - 100kΩ
- **Accuracy**: 1.0%
- **Resolution**: 1.0%

#### Weight
- **Chassis**: 77 lbs/35 kg
- **Chassis (C)**: 154 lbs/70 kg
- **Chassis (2)**: 440 lbs/200 kg
- **Cabinet**: 650 lbs/295 kg
- **Cabinet, 2-Bay**: 860 lbs/391 kg
- **Cabinet, 2-Bay**: 1250 lbs/568 kg

### Additional Features
- **3-Phase Operation**: Provides full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.
- **NI LabVIEW**: Supports full control of 3 individual units with AC Logic and AC Load Sequencer.
- **RS-232, LAN**: Provides full control of 3 individual units with AC Logic and AC Load Sequencer.
- **NI LabVIEW**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.
- **RS-232, LAN**: Provides full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Communications
- **RS-232, LAN**: Provides full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.
- **RS-232, LAN**: Provides full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Drive Control
- **Drivers**: NI LabVIEW, IVI, Active X

### User Interface
- **PC soft panel**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Test Executive
- **Optional emPower™ LE & AC Load Sequencer**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Hardware
- **Remote Voltage Sense**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Protection
- **Trigger Output**: Initiates an external measurement device and synchronizes to programmed load current step through AC Logic and AC Load Sequencer.

### Software
- **Windows XP, Windows 7**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Operating Temp.
- **50 - 100° C**: Continuous and peak powers denoted 20% above 58° C

### Input Power
- **115V/230V ± 10%**

### Communication Protocols
- **RS-232, LAN**: Provides full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Weight
- **77 lbs/35 kg**: Supports full control of 3 individual units (for example, 3kW units for a total of 9kW, 6kW units for a total of 18kW) to simulate a 3-phase load through AC Logic and AC Load Sequencer.

### Dimensions
- **Chassis**: 8" x 19" x 23" in
- **Chassis (C)**: 17" x 19" x 25" in
- **Chassis (2)**: 57" x 23" x 30" in
- **Cabinet**: 57" x 46" x 30" in
- **Cabinet, 2-Bay**: 72" x 46" x 30" in

### Specifications
- **All rights reserved. Specifications subject to change without notice.**

---

1 Specifications apply at 23°C ± 5°C after a 10 minute warm up.

2 Higher power and custom configurations available.

3 Accuracies apply when Settings and/or Measurements are programmed load current step.

4imonials apply when Settings and/or Measurements are programmed load current step.

5 Programs and/or Measurements are programmed load current step.

6 Programs and/or Measurements are programmed load current step.

7 Programs and/or Measurements are programmed load current step.

8 Programs and/or Measurements are programmed load current step.
Automated Characterization, Cycling, & Emulation of Batteries

Features
- 3 Modular voltage options 40, 120, & 600V
- Parallels with other 9200 & 9210 systems
- High-resolution waveform capture up to 1.2M Sample/Sec
- Precision voltage, current, power, & energy measurements
- Cycle batteries (charge/discharge) & drive cycles
- Fast dynamic patterns - 1000 step sequence
- State of the art battery emulation mode
- Built-in controller with touch-compatible interface
- Ethernet (LAN)

Advantages
- Battery emulation using OCV & series resistance
- Designed for testing & emulating all battery chemistries
  - Automatic energy integration (full & 1/2 cycle)
  - Multiple safety layers to protect UUT
- Software tools to shorten test development time
  - PC-based Softpanel GUI with charting
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: Enerchron® test sequencer

Benefits
- Modular - full function tester per channel design
- Parallels for high power testing (up to 252kW)
- Safely simulate and emulate “Real World” conditions
  - Sub-mS voltage, current, & mode transition times
  - Emulate over/under charged batteries
  - Safely emulate BMS & battery failures
- Small footprint for easy movement
**Model 9210 Individual Power Module Specifications**

<table>
<thead>
<tr>
<th>Programming Capability</th>
<th>Model 9210-4904</th>
<th>Model 9210-4912</th>
<th>Model 9210-4960</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating States</strong></td>
<td>Charge (Source), Discharge (Load), Standby, Battery</td>
<td>Charge (Source), Discharge (Load), Standby, Battery</td>
<td>Charge (Source), Discharge (Load), Standby, Battery</td>
</tr>
<tr>
<td><strong>Charge/Discharge Modes</strong></td>
<td>Constant-Voltage (CV), Current (CC), Power (CP), Resistance (CR)</td>
<td>Constant-Voltage (CV), Current (CC), Power (CP), Resistance (CR)</td>
<td>Constant-Voltage (CV), Current (CC), Power (CP), Resistance (CR)</td>
</tr>
<tr>
<td><strong>Charging Envelope</strong></td>
<td>0 - 40 V, 8 kW, 600 A</td>
<td>0 - 120 V, 8 kW, 200 A</td>
<td>0 - 600 V, 8 kW, 40 A</td>
</tr>
<tr>
<td><strong>Discharging Envelope</strong></td>
<td>1 - 40 V, 12 kW, 600 A</td>
<td>4 - 120 V, 12 kW, 200 A</td>
<td>10 - 600 V, 12 kW, 40 A</td>
</tr>
<tr>
<td><strong>Programming</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>Range</td>
<td>Accuracy¹</td>
<td>Resolution¹</td>
</tr>
<tr>
<td></td>
<td>0 - 40 V</td>
<td>0.1% + 0.1%</td>
<td>0.005%</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>±600 A</td>
<td>0.2% + 0.2%</td>
<td>0.005%</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>±8/-12 kW</td>
<td>0.4% + 0.4%</td>
<td>0.005%</td>
</tr>
<tr>
<td><strong>Resistance</strong></td>
<td>0 - 34 Ω</td>
<td>2%</td>
<td>0.005%</td>
</tr>
<tr>
<td><strong>Slew Rate</strong></td>
<td>Voltage</td>
<td>0.011 V/s – 80 V/ms</td>
<td>0.033 V/s – 240 V/ms</td>
</tr>
<tr>
<td></td>
<td>Current</td>
<td>0.17 A/s – 3000 A/ms</td>
<td>0.055 A/s – 1000 A/ms</td>
</tr>
<tr>
<td></td>
<td>Resistance</td>
<td>0.01 Ω/s – 34 Ω/ ms</td>
<td>0.028 Ω/s – 100 Ω/ ms</td>
</tr>
<tr>
<td><strong>Test Measurement (4-Wire)</strong></td>
<td>Voltage, DC Average</td>
<td>Range</td>
<td>Accuracy¹</td>
</tr>
<tr>
<td></td>
<td>0 - 40 V</td>
<td>0.05% + 0.05%</td>
<td>0.005%</td>
</tr>
<tr>
<td></td>
<td>Current, DC Average, Amp-Hr</td>
<td>Range</td>
<td>Accuracy¹</td>
</tr>
<tr>
<td></td>
<td>0 - 600 A</td>
<td>0.1% + 0.1%</td>
<td>0.005%</td>
</tr>
<tr>
<td></td>
<td>± 12 kW</td>
<td>0.2% + 0.2%</td>
<td>0.005%</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>1ms - 1 Yr</td>
<td>0.1%</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test Channel Connectors</strong></td>
<td>Buss Bars</td>
<td>Anderson EBC A32</td>
<td>Anderson SBS75X</td>
</tr>
<tr>
<td><strong>Cabinet Dim. (HxWxD)</strong></td>
<td>43.5 x 28 x 31'1/105 x 711 x 787 mm (including casters)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cabinet Weight</strong></td>
<td>500 lbs/227 kg</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>0 - 35°C full power</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input Power³ per Module</strong></td>
<td>3 Ø, 50 - 60 Hz, 200 VAC/30 A, 208 VAC/29 A, 220 VAC/28 A, 380 VAC/21 A or 480 VAC/17 A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ All Accuracies are % of Set + % of Range, All Resolutions are % of Range unless otherwise indicated, ² Input Voltage set at placement of order

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Automated Characterization, Cycling, & Emulation of Batteries

Features
- 3 Modular voltage options 40, 120, & 600V
- Parallels with other 9200 & 9210 systems
- High-resolution waveform capture up to 1.2M Sample/Sec
- Precision voltage, current, power, & energy measurements
- Cycle batteries (charge/discharge) & drive cycles
- Fast dynamic patterns - 1000 step sequence
- State of the art battery emulation mode
- Built-in touch-panel user interface
- Ethernet (LAN)

Advantages
- Battery emulation using OCV & series resistance
- Designed for testing & emulating all battery chemistries
  - Automatic energy integration (full & 1/2 cycle)
  - Multiple safety layers to protect UUT
- Software tools to shorten test development time
  - PC-based Softpanel GUI with charting
  - Supplied LabVIEW & IVI-C/IVI-COM drivers
  - Optional: Enerchron® test sequencer

Benefits
- Modular - full function tester per channel design
- Parallels for high power testing (up to 144kW)
- Safely simulate and emulate “Real World” conditions
  - Sub-mS voltage, current, & mode transition times
  - Emulate over/under charged batteries
  - Safely emulate BMS & battery failures
- Flexible configuration (any 3 modules per system)
## Model 9200 Individual Power Module Specifications

### Functional Capability

<table>
<thead>
<tr>
<th>Model 4904</th>
<th>Model 4912</th>
<th>Model 4924</th>
<th>Model 4960</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating States</td>
<td>Charge (Source), Discharge (Load), Standby, Battery</td>
<td>Constant-Voltage (CV), Current (CC), Power (CP), Resistance (CR)</td>
<td></td>
</tr>
<tr>
<td>Charging Envelope</td>
<td>0 - 40V, 8kW, 600A</td>
<td>0-120V, 8kW, 200A</td>
<td>0-240V, 8kW, 100A</td>
</tr>
<tr>
<td>Discharging Envelope</td>
<td>1 - 40V, 12kW, 600A</td>
<td>4-120V, 12kW, 200A</td>
<td>6-240V, 12kW, 100A</td>
</tr>
<tr>
<td>Slew Rate</td>
<td>0.011V/s - 30kV/s, 0.0165A - 600kA/s</td>
<td>0.033V/s - 120kV/s, 0.055A - 200kA/s</td>
<td>0.066V/s - 240kV/s, 0.027A - 100kA/s</td>
</tr>
</tbody>
</table>

### Charging Envelope
- **0-40V, 8kW, 600A**
- **0-120V, 8kW, 200A**
- **0-240V, 8kW, 100A**
- **0-600V, 8kW, 40A**

### Discharging Envelope
- **1-40V, 12kW, 600A**
- **4-120V, 12kW, 200A**
- **6-240V, 12kW, 100A**
- **10-600V, 12kW, 40A**

### Parallelability
Synchronous control for up to 12 channels (144kW)

### Macro Test Profiles
- **Development Source**: Touch-Panel, Import from Excel or User’s System Controller
- **Maximum Steps**: 1000
- **Minimum Time Delay**: 50µS
- **Maximum Step Delay**: 1mS - 7 Days

### Programming
- **Range**: 0-40V
- **Accuracy**: 0.1% + 0.1%
- **Resolution**: 0.005%
- **Range**: 0-120V
- **Accuracy**: 0.1% + 0.1%
- **Resolution**: 0.005%
- **Range**: 0-240V
- **Accuracy**: 0.1% + 0.1%
- **Resolution**: 0.005%
- **Range**: 0-600V
- **Accuracy**: 0.1% + 0.1%
- **Resolution**: 0.005%

### Test Measurement (4-Wire)
- **Voltage, DC Average**: 0 - 40V
- **Accuracy**: 0.05% + 0.05%
- **Resolution**: 0.005%
- **Current, DC Average, Amp-Hr**: 0 - 600A
- **Accuracy**: 0.1% + 0.1%
- **Resolution**: 0.005%
- **Power, Ah, kWh**: ± 12kW
- **Accuracy**: 0.2% + 0.2%
- **Resolution**: 0.005%

### Control
- **Local User Interface**: Touch-Panel with graphic meters and controls plus Macro development/execution screens
- **Ext. System Communication**: LAN (Ethernet)
- **Drivers**: LabVIEW, IVI-COM, IVI-C
- **Analog Current Monitor**: 0 to +100V charge/0 to -100V discharge
- **Analog Voltage Monitor**: 0 to +10V full scale voltage

### Safety
- **Isolation AC Input**: 1000V AC to DC Output / 1000V AC Input to chassis
- **Isolation UUT Input**: Over-Voltage (OV) / Under-Voltage (UV), Over-Current (OC), Over-Power (OP)
- **Internal Protection**: Over/Under-Voltage, Over-Current, Over-Power, Internal Over-Temperature
- **Interlocks**: External user input, emergency stop, and rear service door
- **Watchdog Timer**: Continuously monitors control communications

### Physical
- **Test Channel Connectors**: Buss Bars
- **Cabinet1 Dimensions (HxWxD)**
  - **One**: 72 x 28 x 31’’/1829 x 711 x 787mm
  - **Two**: 56 x 28 x 31’’/1422 x 711 x 787mm
  - **Three**: 84 x 28 x 31’’/2134 x 711 x 787mm
  - **Four**: 112 x 28 x 31’’/2845 x 711 x 787mm
- **Cabinet Weight (3 Channels)**: 1475lbs/669kg
- **Operation Temperature**: 0 - 35°C full power
- **Input Power1 per Module**
  - **3 @ 12kW**: 3Ø, 50 - 60Hz, 200VAC/30A, 208VAC/29A, 220VAC/28A, 380VAC/21A or 480VAC/17A
- **Calibration**: Semi-Automatic, closed cover with standard lab equipment

### Ordering Information
- **Typical Configurations**
  - **Model 9200-4904-36**: 3 @ 12kW
  - **Model 9200-4912-36-2**: 6 @ 12kW
  - **Model 9200-4924-36-3**: 9 @ 12kW
  - **Model 9200-4960-36-3**: 9 @ 12kW
  - **Model 9200-4960-36-4**: 12 @ 12kW

- **Power Modules**
  - **Voltage**: 4904, 4912, 4924
  - **Maximum Current**: 1800A, 1200A, 700A

- **Number of Cabinets**
  - **Floor Space Required (WxD)**
    - **One**: 28 x 31’’/711 x 877mm
    - **Two**: 56 x 31’’/1422 x 877mm
    - **Three**: 84 x 31’’/2134 x 877mm
    - **Four**: 112 x 31’’/2845 x 787mm

- **Part Number Construction**
  - 4912 – Power Module Selection
  - 36 – kW per cabinet (1 module = 12kW, 2 modules = 24kW, 3 modules = 36kW)

### Notes
1. All Accuracies are % of Set + % of Range, All Resolutions are % of Range unless otherwise indicated.
2. Standard cabinet contains 1, 2 or 3 Modules.
3. Input Voltage set at placement of order.
AC/DC Grid Simulator with HiVARTM

Features
- 8 models - 4kW/10.5kVA to 96kW/252kVA
- Two AC Voltage ranges 175, 350VRMS (l-n)
- Two DC Voltage ranges 200, 400VDC
- Two high-accuracy current measurement ranges
- Operating frequency – DC, 30 to 100Hz
- Precision voltage, current, power & energy measurements
- Waveform digitization (capture) up to 125kSamples/sec
- Powerful line disturbance creation tools
- Sink power regenerated back to facility
- Built-in 9” Touch-Panel user Interface
- Programmable via SCPI & NI LabVIEW compliant drivers

Advantages
- Voltage Ranges matched to Interconnection Standards
  - 175VRMS (l-n) ideal for 120VAC (1Ф) & 240VAC (2Ф)
  - 350VRMS (l-n) ideal for 380 - 480VAC (3Ф)
- Fully programmable & Bi-Directional AC/DC
  - Independent phase voltage & phase angle relationships
  - Phase angle & timed triggerable set controls
  - Sinusoidal or arbitrary voltage waveshapes (harmonics)
- HiVAR: More Reactive Power & current per kW
  - Additional VAR capability supports Volt-VAR testing
  - Crest factor support upto 3x Max IRMS
- Software selectable for 1, 2 or 3 phase operation
- Built-in SW watchdog & safety limits

Benefits
- Field upgradeable to higher power
- Fully emulate any utility/grid condition
- Simulate non-ideal Phase angle relationship (A-B & A-C)
## Model 9410 Regenerative Grid Simulator Specifications

### AC Output Ratings

<table>
<thead>
<tr>
<th>Model Number</th>
<th>9410-4</th>
<th>9410-8</th>
<th>9410-12</th>
<th>9410-24</th>
<th>9410-36</th>
<th>9410-48</th>
<th>9410-72</th>
<th>9410-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phases/Output Channels</td>
<td>1</td>
<td>1 or 2</td>
<td>1, 2, or 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power, Max (1Φ or 3Φ)</td>
<td>4kW/10.5kVA</td>
<td>8kW/21kVA</td>
<td>12kW/31.5kVA</td>
<td>24kW/63kVA</td>
<td>36kW/94.5kVA</td>
<td>48kW/126kVA</td>
<td>72kW/189kVA</td>
<td>96kW/252kVA</td>
</tr>
<tr>
<td>Current Ranges (RMS per Φ)</td>
<td>6, 30A/Φ</td>
<td>6, 30A/Φ</td>
<td>12, 60A/Φ</td>
<td>18, 90A/Φ</td>
<td>36, 180A/Φ</td>
<td>54, 270A</td>
<td>72, 360A</td>
<td>108, 540A</td>
</tr>
<tr>
<td>Peak Current</td>
<td>3 X Max RMS</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>30 – 100Hz</td>
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</tr>
<tr>
<td>Voltage Ranges, L-N</td>
<td>175, 350V (Split Phase 250V Max)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.005% Rng</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Distortion (THD)</td>
<td>&lt;1% @ 50/60Hz (Full power into resistive load at 480VRMS (L-L) )</td>
<td></td>
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</tr>
<tr>
<td>Custom Waveforms</td>
<td>Sine, n-Step Sine, Triangle, Clipped-Sine, Arbitrary (user defined)</td>
<td></td>
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</tr>
<tr>
<td>Phase Angle Control</td>
<td>0 to 359 degrees / 1 degree resolution</td>
<td></td>
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</tr>
</tbody>
</table>

### DC Output Ratings

<table>
<thead>
<tr>
<th>Model Number</th>
<th>9410-4</th>
<th>9410-8</th>
<th>9410-12</th>
<th>9410-24</th>
<th>9410-36</th>
<th>9410-48</th>
<th>9410-72</th>
<th>9410-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Max (1ch or 3ch)</td>
<td>4kW</td>
<td>8kW</td>
<td>12kW</td>
<td>24kW</td>
<td>36kW</td>
<td>48kW</td>
<td>72kW</td>
<td>96kW</td>
</tr>
<tr>
<td>Current Ranges (Per Ch.)</td>
<td>6, 30A/CH</td>
<td>6, 30A/CH</td>
<td>6, 30A/CH</td>
<td>12, 60A/CH</td>
<td>18, 90A/CH</td>
<td>36, 180A/CH</td>
<td>54, 270A</td>
<td>72, 360A</td>
</tr>
<tr>
<td>Current Ranges (Per System)</td>
<td>6, 30A</td>
<td>12, 60A</td>
<td>18, 90A</td>
<td>36, 180A</td>
<td>54, 270A</td>
<td>72, 360A</td>
<td>108, 540A</td>
<td>144, 720A</td>
</tr>
<tr>
<td>DC Ranges</td>
<td>200, 400VDC</td>
<td></td>
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</tr>
<tr>
<td>Accuracy</td>
<td>0.2% Set + 0.2% Rng</td>
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<tr>
<td>Ripple</td>
<td>&lt; 800mV RMS</td>
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</tr>
</tbody>
</table>

### AC & DC Measurements

<table>
<thead>
<tr>
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<th>9410-4</th>
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<th>9410-48</th>
<th>9410-72</th>
<th>9410-96</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Voltage</td>
<td>250, 500V</td>
<td></td>
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<tr>
<td>Accuracy (AC RMS)</td>
<td>0.1% Rdg + 0.06% Rng</td>
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<tr>
<td>Accuracy (DC)</td>
<td>0.1% Rdg + 0.1% Rng</td>
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<tr>
<td>Accuracy (Peak)</td>
<td>0.5% Rdg + 0.2% Rng</td>
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</tr>
<tr>
<td>Resolution</td>
<td>0.005% Rng</td>
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<td></td>
</tr>
<tr>
<td>Peak Current (per Ch.)</td>
<td>20, 100A</td>
<td>20, 100A</td>
<td>20, 100A</td>
<td>40, 200A</td>
<td>60, 300A</td>
<td>80, 400A</td>
<td>120, 600A</td>
<td>180, 800A</td>
</tr>
<tr>
<td>Accuracy (AC RMS)</td>
<td>0.2% Rdg + 0.06% Rng</td>
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<tr>
<td>Accuracy (DC)</td>
<td>0.2% Rdg + 0.06% Rng</td>
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<tr>
<td>Accuracy (Peak)</td>
<td>0.5% Rdg + 0.2% Rng</td>
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</tr>
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<td>Resolution</td>
<td>0.005% Rng</td>
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<tr>
<td>Peak Power</td>
<td>V Range x I Range</td>
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</tr>
<tr>
<td>Accuracy (kW or kVA)</td>
<td>0.3% Rdg + 0.025% Rng</td>
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<tr>
<td>Resolution</td>
<td>0.005% Rng</td>
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</tbody>
</table>

### Additional Measurements

- Energy (Ah, kWh, kVAh), AC Crest Factor, AC Power Factor, Waveform Capture

### Waveform Digitizer

- Output Voltage and Current
- Aperture Time
- 1 cycle to 64s
- Accuracy/Resolution
- 0.5% Rng / 0.05%

### Control

- Local User Interface: Built-in Touch-Panel and PC-Based software tools including graphical user interface
- External System Comm: LAN (Ethernet) supporting SCPI or VXI-11
- Drivers: NI-Compliant LabVIEW Drivers, IVI-C, IVI-COM

### Safety

- Module Protection: Self-protecting for over-voltage, over-current, over-power, and over-temperature
- Emergency Stop and remote E-Stop connection
- Programmable Limits: Min/Max Voltage, Current (per direction), and Power (per direction) with separate limits and time delay values
- Software Watchdog: Programmable

### Physical

- Connectors: Terminal Block
- Form: Chassis
- Dimensions (HxWxD): 15¾ x 19 x 24” / 400 x 483 x 610mm
- Weight: 105lbs/48kg
- Operating Temp: 35°C
- Isolation Facility to Chassis – 1,000V, Output to Chassis – 500 V, Facility to Output Internal Isolation – 2,000 V

### Input Power

- Voltage: Universal Input – 380V to 480V ± 10% (L-L, 3 Phase, 50/60Hz)
- Efficiency/Power Factor: > 85% / > 0.95
- Current per Φ @ 380 V | 9A | 17A | 25A | 49A | 73A | 97A | 144A | 192A
- Current per Φ @ 400 V | 9A | 17A | 24A | 47A | 69A | 92A | 137A | 183A
- Current per Φ @ 480 V | 8A | 14A | 20A | 39A | 58A | 77A | 114A | 152A

### Ordering Information

- Model | kW Rating |
- Grid Emulator P/N | 9410 | -12