Features
- 6 sizes – 3 to 36kW, 30 – 360A, 50 – 350V RMS (L-N)
- Sizable for single and 3-phase configurations
- CC, CR, CV, CP, SC, UPF & CNL emulation modes
- Programmable crest factor and power factor
- 12 high-accuracy internal measurements
- User-defined waveforms
- 100-step macro for per cycle loading changes
- PC softpanel GUI with current, voltage & power waveform display
- PC control using Lab VIEW & IVI drivers
- LAN & RS232 communication interfaces
- True short circuit operation

Applications
The 4600 Series AC Electronic Loads are designed for test applications that require linear and non-linear AC loading in several emulation modes with Power (Fig. 1-4) and Crest Factor control (Fig. 1-4). This programmable versatility allows testing with a wide variety of potential field operating conditions to assure unit-under-test (UUT) reliability. Products tested include uninterruptible power supplies (UPS), AC sources, inverters, switches, circuit breakers, fuses, and connectors.

Emulation Modes
To provide testing under the broadest range of loading conditions, the 4600 Series AC Electronic Load offers 7 different emulation modes. Constant Current (CC) mode provides current to be drawn constantly, making it suitable for non-linear, linear, and regulation loading. Constant Resistance (CR) mode allows the electronic load to emulate a power resistor. Constant Voltage (CV) allows emulating a shunt regulator. Constant Power (CP) mode emulates a constant-power load such as a switching power supply. Short Circuit (SC) mode allows the electronic load to test the UUT’s short circuit protection capability. Unity Power Factor (UPF) (Fig. 1) mode brings power factor to unity, useful when the input voltage is non-sinusoidal. The new Complex Non-Linear Waveform (CNL) mode allows the user to define the waveform to prevent UUT current over-stressing in the event of a voltage collapse. These comprehensive capabilities provide the user almost every conceivable AC loading condition possible.
High Accuracy Measurements

The 4600 Series AC Electronic Load provides high-accuracy frequency, voltage, peak voltage, current, peak current, crest factor, apparent power, true power, peak power, reactive power, power factor, and resistance measurements by combining high-resolution measurements with precision ranging. The ability to make measurements internally eliminates multiple external measurement instruments plus associated signal matrixing. In this manner, the 4600 Series AC Electronic Load provides for a more compact, less costly, and considerably faster test system.

User-Defined Waveforms

The 4600 Series AC Electronic Load has the ability to control current through a user defined waveform (Fig. 5). The waveform is created by a powerful graphical editor that facilitates starting with a straight line or modifying a generated waveform based on current, power, and crest factor. The graphical editor includes an auto-check feature to ensure the settings are compatible with each other and within the capabilities of the electronic load. It also supports waveform smoothing, symmetrical, and asymmetrical waveform creation.

With this editor, waveforms can be quickly created to duplicate complex transient conditions. This would include adding asymmetrical inflections, inserting transient anomalies such as spikes and dropouts, and any shape else that can be drawn as a single-cycle waveform.

100-Step Multi-Mode Macros

Macros are queues of up to 100 steps that can be triggered locally, thereby providing very fast current, power, and crest factor changes, up to every cycle (Fig. 6). Further, a Macro can be executed as a single shot or looped.

emPower® LE Test Executive Option

The 4600 Series AC Electronic Load is supplied with software for a PC softpanel that provides complete instrument control, measurement, and waveform display. Upgrading to a full test executive with drivers for all NH Research, Inc. (NHR) power instruments is also possible through emPower® LE (Fig. 7), which adds a test sequencer, basic test routines, and reporting.
Wide Range of Power Levels

The 4600 Series AC Electronic Load is now offered in 6 power levels between 3 and 36kW (Fig. 8). Any unit can be field expandable in 3kW increments to address future higher power needs. Contact NHR for any loads higher than 36kW.

Graphic User Interface

A PC-hosted graphic user interface eclipses the traditional front panel clutter of knobs, dials, keypads, and digital displays. This traditional clutter is a carry-over from a time in which test instrumentation had a far more limited set of features. In addition to a more comprehensive presentation of operation, measurement, and status information, softpanel advantages include the ability to program and recall Macros, editing user-defined waveforms, along with display of real-time current, voltage, and power waveforms without an oscilloscope.

PC Softpanel

PC softpanel provides complete instrument control, measurement and waveform display.

Panel Overview

1. Control Power switch
2. Fault indicator light
3. Circuit breaker
4. LAN port
5. Address switch
6. Status indicators
7. Trig In/Out connectors
8. Chassis GND stud
9. Load Power Input connector
10. LAN/RS 232 switch
11. RS 232 connector
12. COMM In/Out connectors
13. Hold In/Out connectors
14. AC input connector

Fig. 8 - Operating Envelopes
# 4600 Series Programmable AC Electronic Load Specifications

## Programmable Modes

| Specification | 4600-3 | 4600-6 | 4600-12 | 4600-18 | 4600-24 | 4600-36
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>3kW</td>
<td>6kW</td>
<td>12kW</td>
<td>18kW</td>
<td>24kW</td>
<td>36kW</td>
</tr>
<tr>
<td>Maximum Current</td>
<td>60A</td>
<td>120A</td>
<td>180A</td>
<td>240A</td>
<td>360A</td>
<td></td>
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</table>

## Programmed Current

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range (RMS)</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Constant Voltage</th>
<th>Range (RMS)</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Constant Power</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Constant Resistance</th>
<th>Ranges</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Range</th>
<th>Accuracy</th>
<th>Resolution</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>0 - 30A</td>
<td>0.2%</td>
<td>0.05%</td>
<td>0 - 120A</td>
<td>0 - 180A</td>
<td>0 - 240A</td>
<td>0 - 360A</td>
<td>3000V - 3kW</td>
<td>6000V - 6kW</td>
<td>1.2 - 12kW</td>
<td>1.8 - 18kW</td>
<td>2.4 - 24kW</td>
<td>3.6 - 36kW</td>
<td>2.5-100, 100-1000D</td>
<td>0.5%</td>
<td>0.05%</td>
<td>0.05%</td>
<td>1.414 - 4</td>
<td>1.414 - 4</td>
</tr>
<tr>
<td></td>
<td>0 - 60A</td>
<td>0.2%</td>
<td>0.05%</td>
<td>0 - 120A</td>
<td>0 - 180A</td>
<td>0 - 240A</td>
<td>0 - 360A</td>
<td>600V - 30A</td>
<td>1200V - 60A</td>
<td>1.5 - 30A</td>
<td>1.5 - 60A</td>
<td>1.5 - 120A</td>
<td>1.5 - 240A</td>
<td>1.5 - 480A</td>
<td>0.5%</td>
<td>0.05%</td>
<td>0.05%</td>
<td>0.5%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>0 - 120A</td>
<td>0.2%</td>
<td>0.05%</td>
<td>0 - 180A</td>
<td>0 - 240A</td>
<td>0 - 360A</td>
<td>300A</td>
<td>600A</td>
<td>1200A</td>
<td>1800A</td>
<td>2400A</td>
<td>3600A</td>
<td>3000V - 30A</td>
<td>0.5%</td>
<td>0.05%</td>
<td>0.05%</td>
<td>0.5%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

## Additional Features

- **User Interface**: PC soft panel
- **Windows**: Windows 10 with SVGA or better display
- **OS**: Windows 10
- **Test Executive**: Optional emPower™ LE & AC Load Sequencer
- **Communications**: RS-232, LAN
- **Drivers**: NI LabVIEW, IVI

**Additional Specifications**

- **Remote Value**: 1 MegaOhm impedance, 2VDC
- **Sense**: 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**: Continuous checking of performance parameters and appropriate error messages and/or LED fault indicators
- **Calibration**: Closed cover, all adjustments made in software and stored in FLASH
- **Protection**: OP, OCOV, OT, and Undervoltage Lockout
- **Trigger Output**: To initiate an external measurement device and synchronized to programmed load current step
- **Fan Noise Reduction**: Automatic fan speed control
- **Load Connectors**: ITT Cannon DCM-21W44/DM 53745-1 plug & socket
- **Operating Temperature**: 0 - 50°C, maximum. Continuous and peak power derated 20% above 38°C
- **Input Power**: 115/230 ± 10% VAC, 47 - 63Hz

### Measurements

- **Current** (Ranges (RMS))
  - 0 - 30A: 0.2%
  - 0 - 60A: 0.2%
  - 0 - 120A: 0.2%
  - 0 - 180A: 0.2%
  - 0 - 240A: 0.2%
  - 0 - 360A: 0.2%
- **Resolution**: 0.05%
- **Peak Current** (Ranges)
  - 0 - 90A: 0.5%
  - 0 - 180A: 0.5%
  - 0 - 360A: 0.5%
  - 0 - 540A: 1%
  - 0 - 720A: 1%
  - 0 - 1080A: 1%
- **Resolution**: 0.05%
- **Voltage** (Ranges)
  - 50 - 350V: 0.5%
  - 50 - 350V: 0.5%
  - 50 - 350V: 0.5%
  - 50 - 350V: 0.5%
  - 50 - 350V: 0.5%
  - 50 - 350V: 0.5%
- **Resolution**: 0.05%
- **Frequency** (Ranges)
  - 45 - 440Hz: 0.1%
  - 45 - 440Hz: 0.1%
  - 45 - 440Hz: 0.1%
  - 45 - 440Hz: 0.1%
  - 45 - 440Hz: 0.1%
  - 45 - 440Hz: 0.1%
- **Resolution**: 0.05%
- **True Power** (Ranges)
  - 0 - 10.5kW: 0.2% + 0.03%
  - 0 - 21kW: 0.2% + 0.03%
  - 0 - 42kW: 0.2% + 0.03%
  - 0 - 63kW: 0.2% + 0.03%
  - 0 - 84kVA: 0.2% + 0.03%
  - 0 - 128kVA: 0.2% + 0.03%
- **Resolution**: 0.01%
- **Apparent Power** (Ranges)
  - 0 - 10.5kVA: 0.3%
  - 0 - 21kVA: 0.3%
  - 0 - 42kVA: 0.3%
  - 0 - 63kVA: 0.3%
  - 0 - 84kVA: 0.3%
  - 0 - 128kVA: 0.3%
- **Resolution**: 0.01%
- **Reactive Power** (Ranges)
  - 0 - 10.5kVAR: 0.3%
  - 0 - 21kVAR: 0.3%
  - 0 - 42kVAR: 0.3%
  - 0 - 63kVAR: 0.3%
  - 0 - 84kVAR: 0.3%
  - 0 - 128kVAR: 0.3%
- **Resolution**: 0.01%
- **Input Power**: 115/230 ± 10% VAC, 47 - 63Hz

### Physical

- **Enclosure**: Chassis (2) (2) (2) (2)
  - Cabinet: 2-Bay: 57x46x30”
  - Cabinet: 2-Bay: 72x46x30”

### Control

- **User Interface**: PC soft panel
- **Windows**: Windows 10 with SVGA or better display
- **OS**: Windows 10
- **Test Executive**: Optional emPower™ LE & AC Load Sequencer
- **Communications**: RS-232, LAN
- **Drivers**: NI LabVIEW, IVI

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