OVERVIEW

The ADAPTIVE POWER 3A Series of Programmable AC and DC Electronic Load Modules are ideally suited for testing both AC and DC power supplies, providing greater test flexibility compared to DC loads only.

Target applications for these loads are research & development, production test, incoming inspection, quality control and service.

The high power density of the 3A Series allows up to 4 loads to be installed in a single 19" wide rack-mount mainframe. For lower load input count demands, a single slot mainframe is available as well.

The 3A Series consists of a total of three different modules types providing a choice of voltage, current and power ranges. All modules support 300 Watt or 300VA of loading and offer a high and low current range for optimal accuracy and resolution. Voltage ranges are either 60V, 150V or 300V, either AC or DC.

All 3A Series modules provide protection against over-voltage (OV), over-current, OC), over-power (OP) and over-temperature (OT) to safeguard the loads from any damage.

AC MODE LOAD TESTING

In AC load mode of operation, the 3A Series supports various crest factor and power factor settings to simulate real world AC load conditions. This includes simulated bridge rectified AC input load simulation. In addition to supporting common sinusoidal AC voltage waveform inputs, the high bandwidth control loops of the 3A Series also support Square wave AC input and Stepped sine wave AC input as found on DC/AC inverters and UPS products.

For split or three phase AC load applications, synchronized operation of multiple AC loads is provided. Multiphase mode allows phase and voltage imbalance testing of multi-phase AC sources or transformers.
**OPERATING MODES**

All 3A Series load modules support several modes of operation to accommodate different test requirements. Voltage sources like AC or DC power supplies are best tested using Constant Current (CC) or Constant Resistance mode.

The available operating modes are Constant Current, Linear Constant Current and Constant Resistance. A graphical representation of these modes of operation is shown here.

**LINEAR CONSTANT CURRENT MODE**

The Linear Constant Current mode differs from conventional CC load mode in that it uses a high bandwidth automatic gain control circuit to track changes in peak input voltage and provides near instantaneous load response. This mode of operation is particularly useful when working with voltage square waves, step waveforms or pulse shaped DC waveforms or with distorted AC sine waves resulting from high current crest factor load settings. The Linear CC mode greatly improves AC load current control compared to typical AC loads that lack this capability.

**MULTI-PHASE APPLICATIONS**

For multi-phase applications such as split-phase or three-phase AC power source testing, two or three AC load modules may be used to create a Split, Delta or Wye AC load. Each phase is individually programmable and synchronized to its respective input voltage and the load current will be zero phase referenced. Note that for Delta load applications, the load modules are sensing line-to-line voltage so sufficiently high-voltage input range load modules are required.

**WIDE OPERATING RANGE**

3A Series load modules are designed to accommodate a wide range of voltage and current input combinations within their maximum power capability. This allows the same load modules to be used for higher voltage and low current requirements as well as low voltage higher current applications. The V-I operating curve for the 3A Series load modules is shown on the right.

Each load module continuously tracks its input voltage current and power and safeguards against any operation outside of its operating limits. This flexible operating range allows the same load module to be used for a wide range of EUTs and provides great flexibility in configuring high channel count load test systems.
NON LINEAR AC LOAD SIMULATION

Many real world AC loads draw non-sinusoidal load currents. Typical examples are bridge rectified input circuits that convert AC voltage into DC. These are called non-linear load and the AC current resulting from these circuits has a crest factor higher than that of a pure sinusoidal current. The 3A Series load modules can simulate these load conditions using a non-sinusoidal current waveform in CC mode. The phase angle between voltage and current in this mode of operation can be shifted to simulate leading or lagging displacement power factor conditions. The higher the crest factor of the current waveform selected, the wider the power factor can be varied. The waveforms on the right illustrate these load conditions.

STORED CF AND PF SETTINGS

Current crest factor and displacement power factor can be selected easily from the front panel or over bus by recalling preset combinations of CF and PF as function of waveform type. The table below shows these available settings.

<table>
<thead>
<tr>
<th>Waveform</th>
<th>Setting</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>Phase Shift</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sine wave</td>
<td>0</td>
<td>√2</td>
<td>2.0</td>
<td>2.5</td>
<td>3.0</td>
<td>3.5</td>
<td>Lagging PF</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1.5</td>
<td>1.6</td>
<td>1.7</td>
<td>1.8</td>
<td>1.9</td>
<td>Leading PF</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.0</td>
<td>3.1</td>
<td>3.2</td>
<td>3.3</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>C.F. = 2</td>
<td>3</td>
<td>PF. = -0.85</td>
<td>PF. = -0.80</td>
<td>PF. = -0.75</td>
<td>PF. = -0.70</td>
<td>PF. = -0.65</td>
<td></td>
</tr>
<tr>
<td>C.F. = 2.5</td>
<td>4</td>
<td>PF. = -0.75</td>
<td>PF. = -0.70</td>
<td>PF. = -0.65</td>
<td>PF. = -0.50</td>
<td>PF. = -0.40</td>
<td></td>
</tr>
<tr>
<td>C.F. = 3.5</td>
<td>5</td>
<td>PF. = -0.50</td>
<td>PF. = -0.45</td>
<td>PF. = -0.40</td>
<td>PF. = -0.35</td>
<td>PF. = -0.30</td>
<td></td>
</tr>
<tr>
<td>C.F. = 2</td>
<td>6</td>
<td>PF. = +0.85</td>
<td>PF. = +0.80</td>
<td>PF. = +0.75</td>
<td>PF. = +0.70</td>
<td>PF. = +0.65</td>
<td></td>
</tr>
<tr>
<td>C.F. = 2.5</td>
<td>7</td>
<td>PF. = +0.75</td>
<td>PF. = +0.70</td>
<td>PF. = +0.65</td>
<td>PF. = +0.50</td>
<td>PF. = +0.40</td>
<td></td>
</tr>
<tr>
<td>C.F. = 3.5</td>
<td>8</td>
<td>PF. = +0.50</td>
<td>PF. = +0.45</td>
<td>PF. = +0.40</td>
<td>PF. = +0.35</td>
<td>PF. = +0.30</td>
<td></td>
</tr>
<tr>
<td>Square</td>
<td>9</td>
<td>1.0</td>
<td>1.1</td>
<td>1.2</td>
<td>1.3</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>DC</td>
<td>10</td>
<td>√2 dc</td>
<td>2 dc</td>
<td>2.5 dc</td>
<td>3.0 dc</td>
<td>3.5 dc</td>
<td></td>
</tr>
</tbody>
</table>

MAINFRAMES

The 34M04 mainframe provides the necessary bias supplies and forced air cooling to the load modules installed. It also isolates modules from each other so each load is floating and can be used to test multi-output or multi-phase power supplies.

Mainframes are available with either one or four slot positions accommodating up to 4 independent AC and DC load channels and 1200 VA/W of power dissipation. Common controls on the mainframe allow synchronous operation of 2 or more loads and store 5 setting configurations.

The single slot 34M01 mainframe is well suited for bench operation while the 34M04 four slot mainframe can be used on the bench or installed in a 19” cabinet. Rack ears and handles are including for rack mount use. The 34M01 mainframe has tilt stands for an optimal viewing angle during bench use.
LOAD MODULE FRONT PANEL OPERATION

Each load module has its own front panel keypad and bright red LED displays for easy of operation. Keys are clearly marked and settings are shown using LED indicators right next to their corresponding keys.

1. Model Number and ranges
2. Go/NoGo indicator illuminates if upper or lower limit settings are exceeded.
3. Operating Mode Indicators
4. REMOTE state indicator
5. Multi-purpose 4½ digit display - Voltage or Power
6. Multi-purpose 4½ digit display - Current or Apparent Power
7. Preset Mode ON/OFF Key Controls Readouts Shown on LED Display
8. LOAD ON/OFF button and indicator
9. WATT Display Mode ON/OFF Key
10. Level A/B Setting Toggle Key
11. Limit Mode ON/OFF and LED Readout Key
12. Internal or External Voltage Sense Mode Selection Key
13. Rough and Fine Setting Adjustment UP/DOWN Keys
14. Crest Factor Selection Keys
15. Frequency, BANK and SYNC Settings Key
16. Load Input Terminals
17. External Voltage Sense Connector
18. Current Monitor Output BNC

REAR PANEL
## Specifications

### Operating Ranges

<table>
<thead>
<tr>
<th>Power Ranges</th>
<th>0 - 300 VA</th>
<th>0 - 300 VA</th>
<th>0 - 300 VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Ranges</td>
<td>0 -10 Arms/Adc</td>
<td>0 - 2 Arms /Adc</td>
<td>0 - 4 Arms /Adc</td>
</tr>
<tr>
<td>Voltage Range</td>
<td>10 - 60 Vrms/Vdc</td>
<td>15 - 150 Vrms/Vdc</td>
<td>30 - 300 Vrms/Vdc</td>
</tr>
<tr>
<td>Frequency</td>
<td>DC, 40 - 400Hz (CC Mode) / DC - 400Hz (LIN,CR Mode)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Operating Modes

#### CC Mode

- **High Range**
  - Resolution: 2.5 mA, 5 mA, 1 mA, 2 mA, 0.5 mA, 1 mA
  - Accuracy: 50Hz & 60Hz: ± 0.5% OF (SETTING + RANGE) / > 60 Hz: ±(0.5% OF SETTING + 1% OF RANGE)
- **Low Range**
  - Resolution: 2.5 mA, 5 mA, 1 mA, 2 mA, 0.5 mA, 1 mA
  - Accuracy: ±2% OF (SETTING + RANGE)

#### CC Linear Mode

- Refer to CC Mode data

#### Crest Factor Mode

- **Range**
  - √2 - 3.5 / 1.5 - 1.9 / 3.0 - 3.4
- **Resolution**
  - 0.5 / 0.1 / 0.1
- **Lagging**
  - -0.30 to -0.85 for CF 2.0 to 3.5
- **Leading**
  - +0.30 to +0.85 for CF 2.0 to 3.5

#### CR Mode

- **Range**
  - 0.3 - 1.2 KΩ, 12.3 - 4.8 KΩ, 1.875 - 7.5 KΩ, 7.5 - 30 KΩ, 7.5 - 30 KΩ, 30 - 120 KΩ
- **Resolution**
  - 0.83 mS, 0.2083 mS, 0.13 mS, 0.033 mS, 0.033 mS, 0.0083 mS
- **Accuracy**
  - 50Hz & 60Hz: ± 0.5% OF (SETTING + RANGE) / > 60 Hz: ±(0.5% OF SETTING + 2% OF RANGE)

### Protection

<table>
<thead>
<tr>
<th>Over Power (OP)</th>
<th>315 VA</th>
<th>315 VA</th>
<th>315 VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over Current (OC)</td>
<td>10.5 A</td>
<td>21 A</td>
<td>4.2 A</td>
</tr>
<tr>
<td>Over Voltage (OV)</td>
<td>63 V</td>
<td>157.5 V</td>
<td>315 V</td>
</tr>
<tr>
<td>Over Temperature (OT)</td>
<td>+85°C / +185°F</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Power Factor Range

- **Lagging PF**
  - CF: √2 to 3.5, PF: -0.30 to -0.85
- **Leading PF**
  - CF: √2 to 3.5, PF: +0.30 to +0.85 or 1.00

### Metering

<table>
<thead>
<tr>
<th>Voltage Range</th>
<th>0 - 60 V</th>
<th>0 - 150 V</th>
<th>0 - 300 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>0.01 V</td>
<td>0.01 V</td>
<td>0.1 V</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±(0.5% OF SETTING + 0.2% OF RANGE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Range</td>
<td>0 - 20 A</td>
<td>0 - 8 A</td>
<td>0 - 4 A</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 A</td>
<td>0.001 A</td>
<td>0.001 A</td>
</tr>
<tr>
<td>Accuracy</td>
<td>50Hz &amp; 60Hz: ± 0.5% OF (READING + RANGE) / &gt; 60 Hz: ±(0.5% OF READING + 2% OF RANGE)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Range</td>
<td>0 - 300 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 W</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>50Hz &amp; 60Hz: ± 0.5% OF (READING + RANGE) / &gt; 60 Hz: ±(0.5% OF READING + 2% OF RANGE)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analog I/O

- **Current Monitor Out**
  - 5 A/V
  - 2 A/V
  - 1 A/V

### General

<table>
<thead>
<tr>
<th>Power &amp; Cooling</th>
<th>Supplied by 34M00 Mainframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (H x W x D)</td>
<td>143 x 108 x 405 mm / 5.6” x 4.25” x 15.9</td>
</tr>
<tr>
<td>Module Weight (Net)</td>
<td>3.5 kg / 7.7 lbs</td>
</tr>
<tr>
<td>Power Temperature Range</td>
<td>0 - 40°C / 32 - 104°F</td>
</tr>
<tr>
<td>Apparent Power Range</td>
<td>0 - 300 VA</td>
</tr>
<tr>
<td>Resolutions</td>
<td>0.1 VA</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Derived from Volt and Current Measurement</td>
</tr>
<tr>
<td>EMC &amp; Safety</td>
<td>CE Mark</td>
</tr>
</tbody>
</table>

Note: 1 S = Siemens or mho, unit of conductance. 1 S = 1/Ω = A/V.
3A SERIES MODULAR AC & DC LOADS

ORDERING INFORMATION:

Line 1: Specify Mainframe Model and Interface:

<table>
<thead>
<tr>
<th>Model</th>
<th>No. of Slots</th>
<th>Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>34M01</td>
<td>1</td>
<td>RS232</td>
</tr>
<tr>
<td>34M01-01</td>
<td>1</td>
<td>GPIB &amp; RS232</td>
</tr>
<tr>
<td>34M04</td>
<td>4</td>
<td>RS232</td>
</tr>
<tr>
<td>34M04-01</td>
<td>4</td>
<td>GPIB &amp; RS232</td>
</tr>
</tbody>
</table>

Line 2: Specify up to four Load Modules:

<table>
<thead>
<tr>
<th>AC &amp; DC Load</th>
<th>Power</th>
<th>Voltage</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>3A060-20</td>
<td>300 VA</td>
<td>60 V</td>
<td>20 A</td>
</tr>
<tr>
<td>3A150-08</td>
<td>300 VA</td>
<td>150 V</td>
<td>8 A</td>
</tr>
<tr>
<td>3A300-04</td>
<td>300 VA</td>
<td>300 V</td>
<td>4 A</td>
</tr>
</tbody>
</table>

AC Input Voltage
Please specify AC Line input voltage at the ship to location on the order as either 120Vac or 230Vac.

Included in Mainframe Ship kit:
- User Manuals in PDF Format on CD ROM
- AC Line Cord.
- Certificate of Conformance

Included with each 3A Series Load Module:
- 1 Monitor BNC Cable (1 meter/39.4”)
- Voltage Sense alligator clip lead cable, Red/Black (1 meter, 39.4”)
- M6 Mounting screw (qty 2)

Service and Support

Adaptive Power Systems’ customer support is second to none. Our Customer Support Program provides the training, repair, calibration, and technical support services that our customers value. So, in addition to receiving the right test equipment, our customers can count on excellent support before, during and after the sale. With company owned support and service centers around the world, support is never far away.

Complete calibration and repair services are offered at our US, European and Chinese manufacturing facilities (see contact info below). Calibrations are to original factory specifications and are traceable to NIST (National Institute of Standards and Technology).

**NORTH AMERICA**
Adaptive Power Systems
Irvine, USA
Phone: +1(949) 752-8400
Fax: +1 (949) 756-0838
Email: support@adaptivepower.com

**EUROPE**
Caltest Instruments Ltd.
Guildford, United Kingdom
Phone: +44(0)1483 302 700
Fax: +44(0)1483 300 562
Email: support@adaptivepower.com

**CHINA**
PPST Shanghai Co. Ltd.
Shanghai, China
Phone: +86-21-6763-9223
Fax: +86-21-5763-8240
Email: support@adaptivepower.com

©2014 ADAPTIVE POWER SYSTEMS, Irvine, CA, U.S.A. Subject to change without notice.

Proudly Represented by:

Caltest Instruments GmbH
Kohlmattstrasse 7
D-77876 KAPPELRODECK
info@caltest.de
Tel: +49(0)7842-99722-00
Fax: +49(0)7842-99722-29
www.caltest.de