Model 9420
AC Power Source

Programmable AC & DC Power with HiVAR®

Key Features

- Voltage Ranges – 175/350VRMS, 200/400VDC
- 7 models – 8kW/21kVA to 96kW/252kVA
- Unique configuration flexibility provides for single, split, three-phase operation plus full-power DC
- HiVAR® design eliminates derating nominal power due to reactive loads
- Frequency – 30 to 880Hz
- High-resolution waveform digitizer & scope display
- Precision ultra-low current measurements
- Seamless, constant-power operating envelope
- Built-in 9” touch-panel user interface for manual control & measurement display
- Graphical waveform editor for user-defined waveforms
- High-level line disturbance programming Macros
- External PC option to host NHR emPower® Test Sequencer
- Alternate programming in LabVIEW, native SCPI, & other IVI-compliant languages
- Improved power density results in half the panel height of traditional AC power sources

HiVAR®: More Than Twice the Apparent Power Capability per Kilowatt

The Model 9420 redefines selection of an AC Power Source by addressing how to compensate for reactive power from capacitive or inductive elements in the load. Often overlooked when sizing a source, reactive power negates some portion of nominal VA power in order to arrive at true power (Watts) that does the real work. Traditional AC sources list only their VA rating leaving it up to the user to figure out how much true power remains after reactive power reductions. In many cases that reduction is substantial and then requires selecting a much larger VA-rated source than originally anticipated. The increased cost and size penalties are often considerable.

The Model 9420 AC Source utilizing HiVAR® technology avoids this VA derating penalty by allowing the source to be specified in true power while providing more than twice the reactive power capability for loads with capacitive or inductive elements. To make the AC source selection process more transparent, NHR

Figure 1 - The Model 9420 12kW in single-phase mode Operating Envelope significantly extends the envelope of similarly sized AC sources especially where reactive power is encountered. Even without reactive power derating, the constant-power envelope results in substantially more usable true power.
list both kW and kVA for each model thereby assuring that an adequately-rated source is considered at the outset.

**Exceptional Configuration Flexibility**

Independent power modules are the internal building blocks of the Model 9420 AC Power Source that provide unique configuration flexibility. That independence allows each power module to be programmed as all or part of a single-phase, split-phase or three-phase instrument. See Figure 2 for a graphic illustration of this feature. Additional flexibility is provided through the scalability from 8 to 96 kW of power, which allows starting with a source configured for today’s power requirements and having the option to add modules in the future should the need ever arise.

**Comprehensive Built-In Measurement System**

The 9420 AC Power Source includes a built-in measurement system providing the essential power-related measurement functions of a voltage meter, current meter, power analyzer, and oscilloscope. This is accomplished by digitizing voltage and current for each phase in real-time to calculate 35 measurements including a time-stamp at the end of each cycle. Called Background Measurements, these values include the following: AC/DC Voltage and Current, True and Apparent Power, Crest and Power Factor, Frequency and Phase-Angle plus related Peak measurements.

This digitization technique is also used in capturing measurements during a user-specified time window. Called Aperture Measurements, up to 13 common power measurements are captured and available for immediate access. In addition up to 64,000 digitized values are stored, which may be downloaded for further analysis making it possible to derive almost any measurement conceivable. In this manner the 9420 is typically used without any supporting measurement instruments thereby making the test setup simpler and less expensive. In addition, built-in measurements provide a test system that is capable of higher test throughput due to eliminating the switching times necessary to access external measurement instruments.

**EnergyStar Measurements**

The 9420 AC Source includes 2 precision low-current measurement ranges to measure lightly-loaded, no-load and standby power current draw as required by the many energy efficiency standards. These measurement ranges eliminate the need for additional specialized equipment, routing, and additional test time.

**Power Line Disturbance Simulation**

The 9420 AC Source is able to simulate power line disturbances through the combination of user-definable waveshapes and Macros. User-defined waveshapes permit generation of non-sinusoidal voltages including asymmetrical inflections, transient anomalies, voltage harmonics (Fig. 3) or any other irregularity which can be drawn as a single cycle. These waveshapes are created through a Graphical Waveshape Editor and downloaded to the Source where they are automatically scaled to the programmed voltage/frequency. Waveshapes may be applied at any phase angle similar to any other programmable setting.

Macros are a pre-programmed sequence of settings where each new setting is present for a sub-cycle, any number of cycles, or for a fixed amount of time. This sequence is entered using a menu-driven, programming-free interface. The sequence is then downloaded to the Source where it is executed to providing precise control of any phase. This combination of user-definable waveshapes and Macros insures the 9420 can simulate notches (Fig. 4), sags/swells (Fig. 5), ramps (Fig. 6), or any other real-world line condition which may be experienced in the field.
Waveforms

**Figure 3 - Voltage harmonics**

**Figure 4 - Notch**

**Figure 5 - Sag dropout swell**

**Figure 6 - Ramp**

Physical Connections & Controls

1. Touch Panel Based Control & Display
2. Status Lights & Trigger
3. Circuit Breakers
4. Output Power Connectors & External Sense
5. Options Switch
6. LAN (Ethernet) Port
7. Parallel Connections
8. Remote Emergency Off
9. Auxiliary Configuration
10. Safety Interlock
11. Input AC Power Terminal
12. Chassis Ground
**AC Output Programmability**

- **Phases/Output Channels**: Single, Single, Split-Phase, Single, Split or 3-Phase
- **Voltage (LR, HR)**: 10 - 175, 350V RMS L-N (split-phase limited to 250V max)
- **Current Limit Set Ranges¹ (per Source)**: 6, 30A (10) 6, 30A (20) 6, 30A (30) 12, 60A (30) 12, 90A (30) 18, 90A (30) 24, 120A (30) 36, 180A (30) 36, 270A (30) 54, 270A (30) 72, 360A (30) 72, 480A (30) 108, 540A (30) 144, 720A (30)
- **Power Limit Set Max¹ (1, Split, 3Ф)**: 6, 30A 12, 60A 18, 90A 24, 120A 36, 180A 54, 270A 72, 360A 108, 540A 144, 720A
- **Maximum Apparent Power²**: 10.5kVA 21kVA 31.5kVA 63kVA 94.5kVA 126kVA 189kVA 252kVA
- **Frequency**: 30 - 880Hz with ± (0.1% Set) Accuracy
- **Distortion**: <1% @ 60Hz (Full power into resistive load at 480VRMS)

**DC Output Programmability**

- **Voltage Ranges¹ (LR, HR)**: 10 - 200, 400VDC (< 800mV RMS Ripple)
- **Current Limit Set, Max¹ (per Source)**: 0 - 6, 30A 0 - 12, 60A 0 - 18, 90A 0 - 24, 120A 0 - 36, 180A 0 - 54, 270A 0 - 72, 360A 0 - 108, 540A 0 - 144, 720A
- **Power Limit Set, Max² (per Source)**: 0 - 4kW 0 - 8kW 0 - 12kW 0 - 24kW 0 - 36kW 0 - 48kW 0 - 72kW 0 - 96kW
- **Power Factor @ Full Power**: Unity PF > 99% at full power into a resistive load at 480VRMS (L-L)/60Hz

**Measurements**

- **Voltage (LR, HR)**: ±(0.1% Rdg + 0.06% Rng) @ <100Hz, ±(0.2% Rdg + 0.12% Rng) @ >100Hz
- **DC**: ±(0.1% Rdg + 0.1% Rng)
- **Peak Voltage**: ±(0.5% Rdg + 0.2% Rng) @ <100Hz, ±(1.0% Rdg + 0.4% Rng) @ >100Hz
- **Current per Phase (LR, HR)**: ±(0.1% Rdg + 0.1% Rng) @ <100Hz, ±(0.2% Rdg + 0.2% Rng) @ >100Hz
- **Peak Current**: ±(0.5% Rdg + 0.2% Rng) @ <100Hz, ±(1.0% Rdg + 0.4% Rng) @ >100Hz
- **Voltage Range X Current Range**: ±(0.2% Rdg + 0.2% Rng) @ <100Hz, ±(0.2% Rdg + 0.2% Rng) @ >100Hz
- **Time-dependent**: 0.3% Reading + 0.3% Rng
- **Peak Current**: ±(0.25% Rdg + 0.25% Rng)
- **Crest Factor**: ±(0.6% Rdg + 0.6% Reading Pk)
- **Ultra-Low Current Measurement**: ±(0.1% Rdg + 0.1% Rng)
- **AC Current Accuracy**: ±1% Range @ < 100Hz, ± 2 % Range @ > 100Hz
- **DC Current Accuracy**: ±1% Range
- **Aperture Measurements**: 13 total including AC/DC Voltage, Current, True Pwr, plus min/max Pks

**Waveform Capture**

- **Data Channels**: 6 channels (3 phases of voltage and current)
- **Bandwidth**: DC to 10kHz
- **Sample Rate**: to 125 kSamples/sec
- **Memory**: 64k samples for each of 6 channels
- **Aperture**: 1 cycle to 64 sec (longer apertures will reduce the sample rate)
- **Accuracy/Resolution**: ±0.5% Rdg + 0.2% Rng @ <100Hz, ±1% Rdg + 0.4% Rng @ >100Hz
- **Background Measurements**: 35 total including AC/DC Voltage, Current, True Pwr, Apparent Pwr, Freq., Phase Factor, Crest Factor, Energy, Phase Angle, Pk V, Pk I, Pk Pwr
- **Aperture Measurements**: 13 total including AC/DC Voltage, Current, True Pwr, plus min/max Pks

**Custom Waveforms**

- **Standard**: Sine, n-step Sine, Triangle, Notched Sine, Arbitrary (User Def.)
- **User Defined**: User Defined
- **Graphical wave shape editor or downloaded Excel table**: Graphical wave shape editor or downloaded Excel table

**Safety**

- **UUT Programmable Limits**: V Min/Max, I Max, W Min/Max, each with time delay values
- **Physical**: User Interlock, Emergency Stop & remote e-stop connection
- **Internal Protection**: Over-Voltage, Over-Current, Over-Power, Over-Temperature
- **Isolation**: Facility to Chassis - 1kV, Facility to Output - 2kV, Output to Chassis - 1kV
- **Emc**: CE Mark
- **Software Compliant**: LAN (Ethernet) supporting SCPI or VXI-11
- **Drivers**: NI-Compliant LabVIEW Drivers, IVI-C, IVI-COM

**Physical Connectors**

- **Form**: Phoenix Contact, Terminal blocks and bus bars
- **Dimensions (HexxWxD)**: 5in x 566x or 566x 5in x 19 x 28” 400 x 483 x 711mm 15% x 19 x 28” 400 x 483 x 711mm 46x23x30” 116x84x384mm 49x23x30” 198x116x476mm 51x23x30” 198x116x476mm 78x46x30” 198x116x476mm 87x46x30” 198x116x476mm
- **Weight**: 150lbs/68kg 155lbs/70kg 480lbs/218kg 640lbs/290kg 780lbs/353kg 1280lbs/581kg 1560lbs/708kg
- **Operating Temp.**: 0° - 35°C, Non-Condensing

**Input Power**

- **Voltage**: 200 - 240 1, 12 3Ф Universal Input - 380 to 480VAC ±10% (L-L), 3-Phase, 50/60Hz
- **Frequency**: 49 - 51Hz or 59.5 - 60Hz
- **Current/phase @ 380, 400, 480V**: 15A@380, 20A@400 17, 17, 14A 25, 24, 20A 49, 47, 39A 73, 69, 58A 97, 92, 77A 144, 137, 114A 192, 183, 152A
- **Power Factor @ Full Power**: Unity PF > 99% at full power into a resistive load at 480VRMS (L-L)/60Hz
- **Cooling**: Air Cooled 35°C Max Ambient, reduced power from 35 to 50°C

**Calibration**

- **Method**: Closed-cover with standard lab equipment capable of measuring to 0.25 % of device specifications
- **1 Programming Accuracies for Voltage and Current are ±(0.2% Set+0.2% Range) @ < 100Hz & ±(0.4% Set+0.4% Range) @ > 100Hz
- **2 Programming Accuracies for Power are ±(0.4% Set+0.4% Range) @ < 100 Hz and ±(0.8% Set+0.8% Range) @ > 100Hz

**ORDERING INFORMATION**

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<tr>
<th>AC Power Source P/N</th>
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<th>kW Rating</th>
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