Model 9430
Regenerative 4-Quadrant AC Load

Linear & Non-Linear AC Loading in Several Emulation Modes with User-Defined Waveforms, Power & Crest Factor Control

Key Features

- 8 Sizes – 4 to 96kW
- Single, Split or Three-Phase programmable
- 10 to 350VAC
- 30 to 880Hz
- DC operation to 10 to 400VDC
- Reactive power capability 2.6 x Real Power
- Sink power regenerated back to facility with >90% efficiency
- Power factor range: -1 to +1
- Crest factor range: 1.414 to 4.000
- High-resolution waveform digitizer
- 9” Touch-Panel user interface
- High power density/minimum rack space

Model 9430 36kW *Regenerative AC Load*

Applications

The 9430 is a current-regulated, 4-quadrant AC load with selectable phase inputs/outputs and a built-in waveform digitizing measurement system. In the sink mode, it sends power back to the facility mains rather than dissipated as heat. The 9430 has the capability of simulating almost any linear or non-linear load. Applications include testing of UPSs, AC sources, inverters, rectifiers, switches, circuit breakers and fuses.

4-Quadrant Operation

The most unique feature of the Model 9430 AC Load is its ability to operate in all 4-quadrants. This bi-directional capability significantly expands load simulation relative to 2-quadrant AC loads. More specifically, the 9430 allows creating the reverse current caused by inductive or capacitive loads (low power factors); namely sending power back to the UUT (source) during part of the AC cycle (Fig. 1). In this manner the 9430 accurately duplicates real-world reactive electrical power flows.

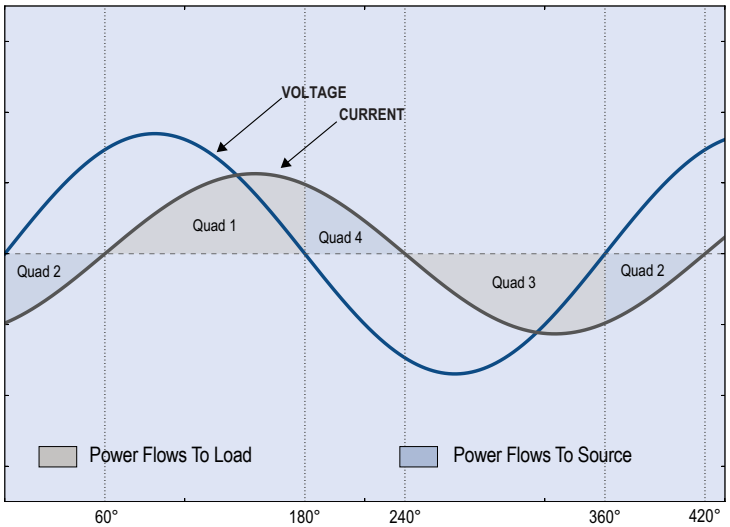


Figure 1 *- 0.5 PF Inductive Load waveform showing bi-directional power flows.*

HIVAR® Design Provides Reactive Loading without Derating True Power

This advanced design feature provides for testing high reactive load input power without the customary reduction of true power (Watts) normally required with conventional loads. The HiVAR design provides testing sources with reactive power (VARs) as large as 2.6 x true power (Watts.) All 9430 Loads are rated both for true power and apparent power. For instance, a 12kW Load is also rated for 31.5kVA.

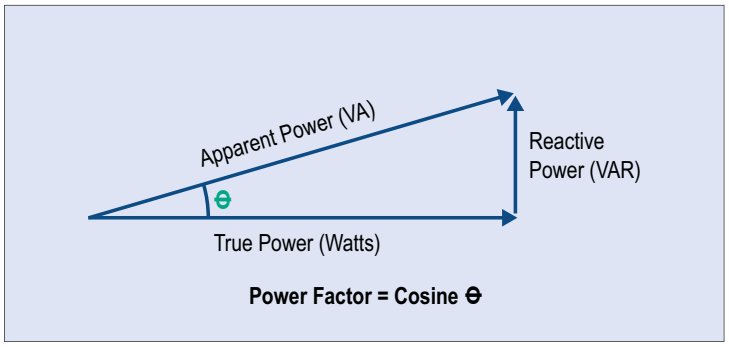


Figure 2 *- The Power Triangle.*

Several Emulation Modes

To provide testing under the broadest range of loading conditions, the 9430 Load will operate in several Emulation Modes. Constant Current (CC) Mode provides current to be drawn constantly, making it suitable for linear, non-linear and regulation loading. Constant Resistance (CR) Mode allows the load to emulate a power resistor with a unity power factor. Constant Power (CP) Mode emulates a load such as a switching power supply. Constant Apparent Power (CS) Mode expressed as VA, is a vector quantity where there is both real power and reactive power (Fig. 2). Constant RL (CRL) Mode emulates a resistive load with an inductive component such as a motor.

User-Defined Waveforms

In addition to programmable power and crest factors, one of the tools used by the 9430 AC Load for creating non-linear waveforms is a graphics editor. This editor allows 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 9430. It also supports waveform smoothing, symmetrical and asymmetrical waveform manipulation. With this graphics editor, waveforms can be quickly created to duplicate waveform distortions or transient events such as spikes, dropouts or any other anomaly that can be drawn as a single cycle (Fig. 3).

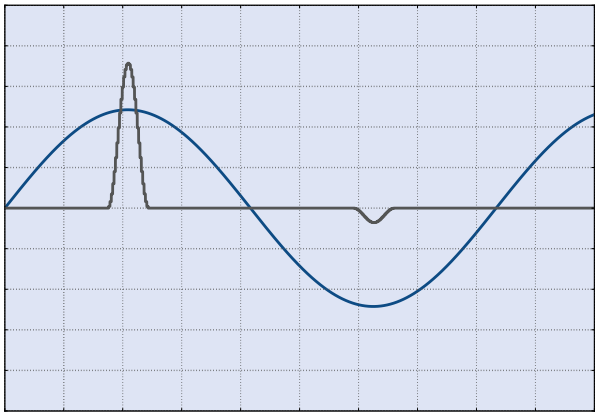


Figure 3 *- User-Defined Asymmetrical Current*

Macros

A second powerful user-defined waveform tool are Macros. These are a pre-programmed sequence of settings where each new setting is effective 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 AC Load where it is executed at high speeds to provide precise control of any phase. Macros can be stored for use on other test programs (Fig. 4).

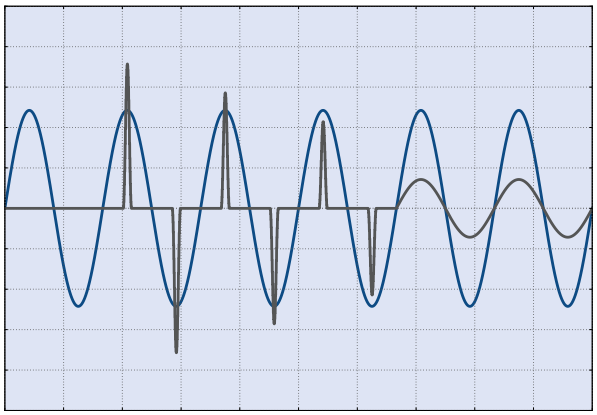


Figure 4 *- Start-Up Inrush Current Macro*

Regenerative Return of Load Power to Facility Line

The 9430 Load returns greater than 90% of power to the facility thereby providing significant electrical savings. It certain continuous loading testing, it has been shown that the load will recover its purchase cost in 2 - 3 years. Even for intermittent load usage, the savings from regenerative return to the facility is substantial and worth evaluating. Additional benefits are a more comfortable work environment, less air conditioning required and an elimination of facility power upgrades.

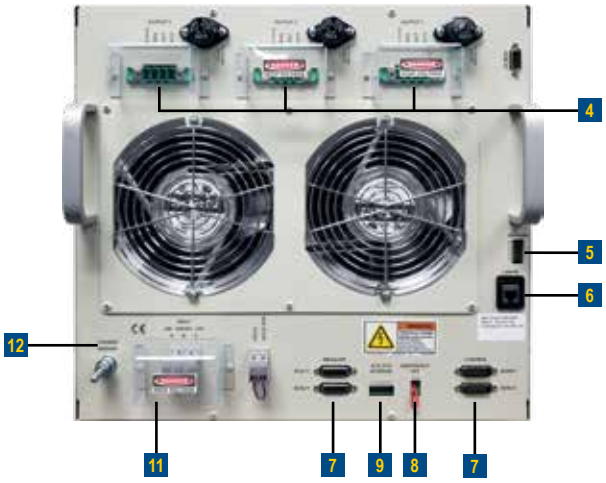
Built-In Digital Measurement

Model 9430 Loads include a digital measurement system that features a high-resolution waveform digitizer. This provides the power analysis tools typically found in test systems that include digital multi-meters, oscilloscopes, and power analyzers. Having such a comprehensive measurement system built into the 9430 eliminates the integration complexity, prolonged start-up time, extra cabinet space and cost for those additional measurement instruments often required. The user is ready to begin testing the day the 9430 is delivered.

The types of measurements are broad and include almost any type of voltage, current, power and timing. In a 3-phase 9430, all six channels of voltage and current measurements are digitized simultaneously at 125kSamples/sec to be displayed, recorded or further processed to yield a custom measurement. Specialized measurements such as abnormal grid detection thresholds, disconnection timing, power ramp-up timing, and generated harmonic current limits are possible.

Physical Connections & Controls

Model 9430 - 12



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

Model 9430 AC Load Specifications

MODEL NUMBER	9430-4	9430-8	9430-12	9430-24	9430-36	9430-48	9430-72	9430-96
AC Loading Programmability								
Phases/Output Channels	Single	Single, Split-Phase	Single, Split or 3-Phase					
Input Voltage (LR,HR)	10 - 175, 350VRMS L-N (30Hz - 880Hz)							
Current Limit Set Ranges[1] (per Φ)	6, 30A (1Φ)	6, 30A (2Φ)	6, 30A (3Φ)	12, 60A (3Φ)	18, 90A (3Φ)	24, 120A (3Φ)	36, 180A (3Φ)	48, 240A (3Φ)
Current Limit Set Max[1] (per Load)	6, 30A (1Φ)	12, 60A (1Φ)	18, 90A (1Φ)	36, 180A (1Φ)	54, 270A (1Φ)	72, 360A (1Φ)	108, 540A (1Φ)	144, 720A (1Φ)
Power Limit Set Max[2] (1, Split, 3Φ)	4kW	8, 8kW	12, 8, 12kW	24, 16, 24kW	36, 24, 36kW	48, 36, 48kW	72, 48, 72kW	96, 64, 96kW
Maximum Apparent Power[2]	10.5kVA	21kVA	31.5kVA	63kVA	94.5kVA	126kVA	189kVA	252kVA
Normal Mode (CC/CP/CS)			Resistance Mode (CR/CC/CP)			RL Mode (Series CR & CL)		
Crest Factor	1.414 - 4.0 (up to 3x MAX ARMS)		Constant Resistance	-4Ω to -1000Ω / 1.5Ω to 1000Ω		Constant Series-RL	1.5Ω to 1000Ω / 0H to 1H	
Power Factor	-1.0 - +1.0		Resolution	10mΩ		Resolution	10mΩ / 1μH	
Slew Rate	10%-90% Range in < 500μs		Resultant Current1	Vin / Rset		Resultant Current	Vin / $\sqrt{R2 + (2\pi fL)2}$	
DC Loading Programmability								
Input Voltage	10 - 200, 400VDC							
DC Loading Modes	Constant Voltage (CV), Constant Current (CC), Constant Power (CP), Constant Resistance (CR) in any combination							
Current Limit Set Ranges[1]	0 - 6, 30A	0 - 12, 60A	0 - 18, 90A	0 - 36, 180A	0 - 54, 270A	0 - 72, 360A	0 - 108, 540A	0 - 144, 720A
Power Limit Set Max[2]	0 - 4kW	0 - 8kW	0 - 12kW	0 - 24kW	0 - 36kW	0 - 48kW	0 - 72kW	0 - 96kW

Measurements *(Accuracies apply when the settings and/or measurements are greater than 10% of Range and input voltage is above 50VRMS.)*	Range	Accuracy	Resolution
Voltage (LR, HR)	260, 520V Pk		
AC RMS	260, 520V Pk	±(0.1% Rdg + 0.06% Rng) @<100Hz, ±(0.2% Rdg + 0.12% Rng) @>100Hz	0.005% Rng
DC	260, 520V Pk	±(0.1% Rdg + 0.1% Rng)	0.005% Rng
Peak Voltage	260, 520V Pk	±(0.5% Rdg + 0.2% Rng) @<100Hz, ±(1.0% Rdg + 0.4% Rng) @>100Hz	0.005% Rng
Frequency	30-1000Hz	0.1% (Sinusoidal Voltage)	0.01Hz
Current per Phase (LR, HR)	0 - 20, 100A Pk / 20, 100A Pk / 20, 100A Pk	40, 200A Pk / 60, 300A Pk / 80, 400A Pk / 120, 600A Pk	160, 800A Pk
AC Current	Model Number Dependent	±(0.1% Rdg + 0.1% Rng) @<100Hz, ±(0.2% Rdg + 0.2% Rng) @>100Hz	0.005% Rng
DC Current	Model Number Dependent	±(0.2% Rdg + 0.1% Rng)	0.005% Rng
Peak Current	Model Number Dependent	±(0.5% Rdg + 0.2% Rng) @<100Hz, ±(1.0% Rdg + 0.4% Rng) @>100Hz	0.005% Rng
Power (kW, kVA)	Voltage Range X Current Range	±(0.2% Rdg + 0.1% Rng) @<100Hz, ±(0.2% Rdg + 0.2% Rng) @>100Hz	0.005% Rng
Energy (AH, kWH, kVAH)	Time dependent	0.3% Reading + 0.3% Rng	0.005% Rng
Power Factor	-1.0 to +1.0	±(0.25% Rdg + 0.25% Rng)	0.005% Rng
Crest Factor		±(0.6% Rdg + 0.6% Reading Pk)	0.005% Rng
Phase Angle (ΦX-ΦA)	0 to 360°	+-2 deg @ < 100Hz, 6 deg @ < 400Hz, 15 deg @ < 880Hz	1 deg

Waveform Capture			
Data Channels	6 channels (3 phases of voltage and current)	Accuracy/Resolution	0.5% Range/0.005% Range
Bandwidth	DC to 50kHz	Background Measurements	35 total including AC/DC Voltage, Current, True Pwr, Apparent Pwr, Freq., Pwr Factor, Crest Factor, Energy, Phase Angle, Pk V, Pk I, Pk Pwr
Sample Rate	to 125 kSample/sec		
Memory	64k samples for each of 6 channels		
Aperture	1 cycle to 64 sec	Aperture Measurements	13 total including AC/DC Voltage, Current, True Pwr
Custom Current Waveforms			
Standard	Sine, n-step Sine, Triangle, Clipped Sine, Notched Sine, Arbitrary (User Def.)	User Defined	Graphical wave shape editor or downloaded Excel table
Control			
User Interface	Built-In Touch Panel &/or external PC w/ Windows software tools including GUI	External System Communication	LAN (Ethernet) supporting SCPI or VXI-II
		Drivers	Ni-Compliant LabVIEW Drivers, Enerchron (opt.)
Safety			
UUT Programmable Limits	V Min/Max, I Max, W Max, each with time delay values	Watchdog	A continuous communication verification program controlled by a test executive
Physical	User Interlock, Emergency Stop & Remote e-Stop connection		
Internal Protection	Over-Voltage, Over-Current, Over-Power, Over-Temperature	Self Test	An automatic hardware check upon power-up
Isolation	Facility to Chassis - 1kV, Facility to Output - 2kV, Output to Chassis - 1kV	EMC	CE Mark

Physical								
Connectors	Terminal blocks			Terminal blocks and bus bars				
Form	Chassis	Chassis	Chassis	Single Cabinet	Single Cabinet	Single Cabinet	Double Cabinet	Double Cabinet
Dimensions (HxWxD)	15¾x19x24"/ 400x483x610mm	15¾x19x24"/ 400x483x610mm	15¾x19x24"/ 400x483x610mm	49x23x30"/ 1245x584x762mm	61x23x30"/ 1549x584x762mm	78x23x30"/ 1981x584x762mm	78x46x30"/ 1981x1168x762mm	78x46x30"/ 1981x1168x762mm
Weight	145lbs/66kg	150lbs/68kg	155lbs/70kg	480lbs/218kg	640lbs/290kg	780lbs/354kg	1280lbs/581kg	1560lbs/708kg
Operating Temp.	0° - 35°C, Non-Condensing							
Input Power								
Voltage / Frequency	Universal Input - 380 to 480VAC ±10% (L-L, 3-Phase, 50/60Hz) / 49 - 51Hz or 59.3 - 60.5Hz							
Current/phase @ 380, 400, 480V	15, 15, 12A		22, 20, 17A	44, 40, 34A	66, 60, 51A	88, 80, 68A	132, 120, 102A	176, 160, 136A
Efficiency	92% @ 480V Facility Input measured at full power when loading 480VRMS (L-L) / 60Hz							
Power Factor	Unity PF > 99% measured at full power when loading 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 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) @ < 100Hz and ±(0.8% Set+0.8% Range) @ > 100Hz.
*[3] Programming Accuracies for RL Mode are +-(1% * ILoad +300mA) @ < 100Hz & +-(1% * ILoad +600mA) @ > 100Hz.*

ORDERING INFORMATION			
AC Load P/N	9430	kW Rating	-12

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