

AC and DC Power Systems *iX* and *i* Series II Programmable AC and DC Power Source / Analyzer

- **Combination AC and DC Power Source and Power Analyzer**
Replaces multiple instruments with a single multifunction unit
- **3000 VA to 30000 VA of Output Power**
Capable of handling a wide range of loads with 0 to 1 power factor
- **Arbitrary Waveform Generation**
Test products for harmonics immunity
- **Built-in Digital Power Analyzer**
Analyze frequency and time domain of both voltage and current on all phases
- **Scope Capture Capability**
*Built in voltage and current waveform acquisition capability (*iX* Series II)*
- **EN61000-3-2 and EN61000-3-3**
Meets source requirements for IEC Harmonics and Flicker testing
- **Constant Power Mode**



Integrated System

The *iX* Series II represents a new generation of AC and DC power source that addresses increasing demands on test equipment to perform more functions at a lower cost. By combining a flexible AC/DC power source with a high performance power analyzer, the *iX* Series II systems are capable of handling complex applications that have traditionally required multiple instruments.

The sleek integrated approach of the *iX* Series II avoids the cable clutter that is commonly found in AC test systems. The *iiX* Series II is rackmountable with a 4U chassis design. All connections are made internally and the need for external digital multimeters, power harmonics analyzer and current shunts or clamps is completely eliminated.

Using a state of the art digital signal processor in conjunction with precision high resolution A/D converters,

the *iX* Series II provides more accuracy and resolution than can be found in some dedicated harmonic power analyzers. Since many components in the *iX* Series II are shared between the AC/DC source and the power analyzer, the total cost of the integrated system is less than the typical cost of a multiple unit system.

For less demanding applications, the *i* Series II provides similar output and transient capabilities as the *iX* Series II, as well as basic measurements.

Easy To Use Controls

Both the *iX* Series II and *i* Series II are microprocessor controlled and can be operated from an easy to use front panel keypad. Functions are grouped logically and are directly accessible from the keypad. This eliminates the need to search through various levels of menus and/or soft keys.

A large analog control knob can be used to quickly slew output parameters. This knob is controlled by a dynamic rate change algorithm that combines the benefits of precise control over small parameter changes with quick sweeps through the entire range.

Applications

With precise output regulation and accuracy, the *iX* Series II AC and DC sources address many application areas for AC and DC power testing. The *iX* also provides a high load current capability, multi or single phase output modes, and built-in power analyzer measurements. Additional features including line distortion simulation (LDS), arbitrary waveform generation, and programmable output impedance address requirements for product quality and regulatory compliance testing.

iX and i Series II - Multi-Function and Multi-Use

Product Evaluation and Test

Increasingly, manufacturers of electronic equipment and appliances are required to fully evaluate and test their products over a wide range of input line conditions. The built-in output transient generation and readback measurement capability offers the convenience of an easy to use and integrated test system.

Avionics

With an output frequency range to 1000 Hz, at up to 150 VRMS, the *iX* Series II is well suited for aerospace applications. Precise frequency control and accurate load regulation are key requirements in these applications. The standard IEEE-488 control interface and SCPI command language provide for easy integration into existing ATE systems. Since the *iX* Series II can eliminate the need for several additional pieces of test equipment and only occupies 7 inches of rack space (4U), saving both cost and space. Instrument drivers for popular programming environments such as National Instruments LabView™, *DO-160*, *ABD-0100*, *MIL-STD-704A-F*, and *Boeing 7E73B-0147* are available to speed up system integration.

Regulatory Testing

As governments are moving to enforce product quality standards, regulatory compliance testing is becoming a requirement for a growing number of manufacturers. The *iX* Series II is designed to meet AC source requirements for use in Euronorm EN 61000 compliance testing. For flicker testing, the programmable output impedance capability of the 3001*iX*, 5001*iX* and 15003*iX* can be used to create the required IEC 725 reference impedance.

Multi-Box Configurations

For high power applications, two or three 5001*iX* chassis can be combined to provide 10 to 15 kVA of single or three phase power.



MODE-iX Option

A 9003*iX*, 15003*iX* or 15003*i* three phase configuration can be ordered with the MODE-*iX* option. This option allows automatic switching between single or three phase output mode. In single phase mode, all current is available on phase A. The MODE-*iX* option switches the output from all three 5001*iX* amplifiers to a single output connector. Without the MODE-*iX* option, 15003*iX* systems are configured for three phase operation.

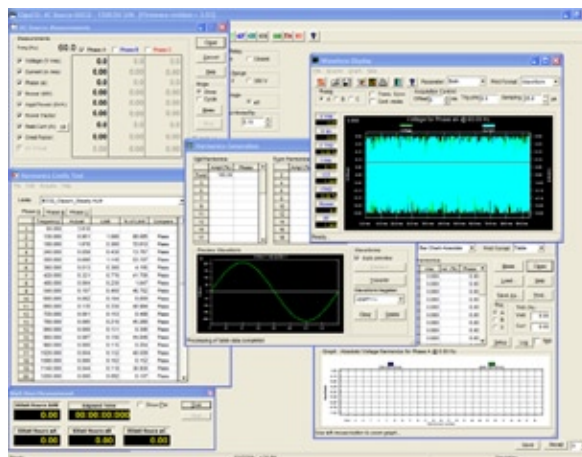
High Crest Factor

With a crest factor of up to 5:1, the *iX* Series II AC source can drive difficult nonlinear loads with ease. Since many modern products use switching power supplies, they have a tendency to pull high repetitive peak currents. The 5001*iX* can deliver up to 110 Amps of repetitive peak current (low range) to handle such loads.

Remote Control

Standard IEEE-488 and RS232C remote control interfaces allow programming of all instrument functions from an external computer. The popular SCPI command protocol is used for programming. Drivers for several popular instrumentation programming environments are available to facilitate systems integration of the *iX* Series II.

Application Software



Windows® application software is provided free of charge with the *iX* and *i* Series II¹. This software provides easy access to the power source's capabilities without the need to develop any custom code. The following functions are available through this GUI program:

- Steady state output control (all parameters)
- Create, run, save, reload and print transient programs
- Generate and save harmonic waveforms [*iX* only]
- Generate and save arbitrary waveforms [*iX* only]
- Download data from a digital storage oscilloscope [*iX* only]
- Measure and log standard measurements
- Capture and display output voltage and current waveforms [*iX* only]
- Measure, display, print and log harmonic voltage and current measurements [*iX* only]
- Run **IEC61000-4-11**, **IEC61000-4-14** and **IEC61000-4-28** test programs
- Display IEEE-488 or RS232C bus traffic to and from the AC Source to help you develop your own test programs.

¹ Requires PC running Windows XP™ or Windows 2000™.

Specifications

Operating Modes

iX Series II: AC, DC or AC+DC
i Series II: AC or DC

AC Mode Output

Frequency

Range: 16 - 1000 Hz

* Note: voltage on 300 V range derates from 300 Vrms max at 500 Hz to 150 Vrms max at 1000 Hz. See V-F rating chart.

Power

Maximum AC power per phase at full scale voltage:

Model	Power
3001 <i>i</i> iX	3000 VA
5001 <i>i</i> iX	5000 VA
9003 <i>i</i> X (with mode- <i>i</i> X)	3000 VA 3 ϕ 9000 VA 1 ϕ
10001 <i>i</i> iX	10000 VA
15001 <i>i</i> iX	15000 VA
15003 <i>i</i> iX (with mode- <i>i</i> X)	5000 VA/ ϕ 3 ϕ 15000 VA/ ϕ 1 ϕ
30003 <i>i</i> iX	10000 VA/ ϕ

Load Power Factor

0 to unity at full output VA

AC Voltage

Voltage Ranges

Low V Range 150 Vrms
High V Range 300 Vrms

Load Regulation (with ALC on)
< 0.2%

Load Regulation (with ALC off)
< 0.5% DC to 100 Hz
< 0.6% 100 Hz to 500 Hz in high voltage range
< 2.2% 100 Hz to 500 Hz in low voltage range
< 3% 500 Hz to 1000 Hz

Line Regulation

< 0.1% for 10 % line change

Output Noise (20 kHz to 1 MHz)

< 250 mV_{rms} typ.
< 500 mV_{rms} max.

Harmonic Distortion

< 1% from 16 - 66 Hz
< 2% at 400 Hz
< 3% at 800 Hz
(Full resistive load)

DC Offset

< 20 mV

External Amplitude Modulation

Depth: 0 - 10 %
Frequency: DC - 2 KHz

Isolation Voltage

300 V_{RMS} output to chassis

AC Current

Steady State AC Current

Note: Constant power mode provides increased current at reduced voltage. Maximum available current shown below.

Model	300V rng	150V rng
3001 <i>i</i> iX	11.1	22.2
5001 <i>i</i> iX	18.5	37.0
9003 <i>i</i> X 1 ϕ per phs 3 ϕ	33.3 11.1	66.6 22.2
10001 <i>i</i> iX	37.0	74.0
15001 <i>i</i> iX	55.5	111.0
15003 <i>i</i> iX 1 ϕ per phs 3 ϕ	55.5 18.5	111.0 37.0
30003 <i>i</i> iX 3 ϕ	37.5	74.0

Peak Repetitive AC Current

Model	High rng	Low rng
3001 <i>i</i> iX	96.0	110.0
5001 <i>i</i> iX	96.0	110.0
9003 <i>i</i> X 1 ϕ per phs 3 ϕ	288.0 96.0	330.0 110.0
10001 <i>i</i> iX	192.0	220.0
15001 <i>i</i> iX	288.0	330.0
15003 <i>i</i> iX 1 ϕ per phs 3 ϕ	288.0 96.0	330.0 110.0
30003 <i>i</i> iX 3 ϕ	192.0	220.0

Programming Accuracy

Voltage (rms): $\pm 0.2\%$ of range, 16 to 1000 Hz

Frequency: $\pm 0.01\%$ of programmed value

Current Limit: $\pm 0.5\%$ of programmed value

Phase: < 1.5° with balanced load @ 50/60 Hz.

Programming Resolution

Voltage (rms): 100 mV

Frequency:

0.01 Hz from 16 to 81.91 Hz

0.1 Hz from 82.0 to 819.1 Hz

1 Hz from 820 to 1000 Hz

Current Limit:

0.1 A.

Phase: 0.1°

Output Relay

Push button controlled or bus controlled output relay

Output impedance [*i*X only]

Programmable Z on 3001*i*X, 5001*i*X, 9003*i*X and 15003*i*X (3 ϕ mode only) for 50 Hz fundamental.

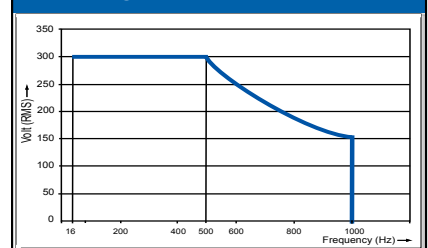
Resistive:

range
17 - 1000 mOhm
resolution
4 mOhm
accuracy
2 % FS

Inductive:

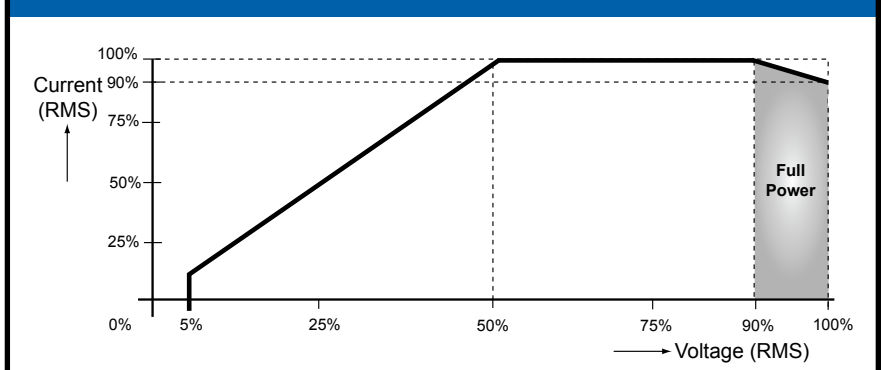
range: 230 - 1000 μ H
resolution: 4 μ H
accuracy: 2 % FS

V-F Rating Chart



Note: 300V Range shown

Constant Power Chart



Note: Specifications are warranted over an ambient temperature range of 25 \pm 5° C. Unless otherwise noted, specifications are per phase for a sine-wave with a resistive load and apply after a 30 minute warm-up period. For three phase configurations, all specifications are for L-N. Phase angle specifications are valid under balanced load conditions only.

DC Mode Output

Maximum DC power at full scale of DC voltage range:

Model	Power
3001 <i>i</i> / <i>iX</i>	2100 W
5001 <i>i</i> / <i>iX</i>	3500 W
9003 <i>iX</i>	2100 W/ \emptyset 3 \emptyset 6300 W/ \emptyset 1 \emptyset
10001 <i>i</i> / <i>iX</i>	7000 W
15001 <i>i</i> / <i>iX</i>	10500 W
15003 <i>i</i> / <i>iX</i>	3500 W/ \emptyset 3 \emptyset 10500 W/ \emptyset 1 \emptyset
30003 <i>i</i> / <i>iX</i>	21000 W/ \emptyset 3 \emptyset

Voltage Ranges:

Low V Range 200 Vdc
High V Range 400 Vdc

Line Regulation

< 0.1% for 10 % line change

Output Noise:

< 250 mV_{rms} typ.
< 500 mV_{rms} max.
(20 kHz to 1 MHz)

Max. DC Current Capability:

Maximum DC current at 65% of V Range

Model	400V Rng	200V Rng
3001 <i>i</i> / <i>iX</i>	7.8	15.6
5001 <i>i</i> / <i>iX</i>	13	26
9003 <i>iX</i> 1 \emptyset	23.4	46.8
3 \emptyset	7.8	15.6
10001 <i>i</i> / <i>iX</i>	26	52
15001 <i>i</i> / <i>iX</i>	39	78
15003 <i>i</i> / <i>iX</i> 1 \emptyset	39	78
3 \emptyset	13	26
30001 <i>i</i> / <i>iX</i> 3 \emptyset	26	52

Current Limit:

Programmable from 0 A to max. current for selected range.

AC+DC Mode Output [*iX* only]

Power:

Full AC power if DC component is less than 20% of full scale voltage. Full DC power if DC component is above 20%.

System

Non Volatile Memory storage:

16 instrument setups
200 user-defined waveforms

Waveforms

Waveform Types:

i Series II: Sine
iX Series II: Sine, Square, Clipped sine, User defined

User defined waveform storage:

Four groups of 50 user defined arbitrary waveforms of 1024 points for a total of 200. One group can be active at a time.

Transient Programming

Transient Types:

Voltage: drop, step, sag, surge, sweep
Frequency: step, sag, surge, sweep
Voltage and Frequency: step, sweep

Transient List Parameters:

Voltage, Frequency, Time or Cycles, Slew rate, Waveform shape, Phase angle, Repeat

Transient lists storage:

up to 100 transient steps per list

Time resolution / range:

1 ms / 1 ms - 90000 s

Maximum slew rate:

200 μ s for 10% to 90% of full scale change into resistive load.

Waveform Acquisition [*iX* only]

Channels:

Voltage and Current for each phase

Memory Depth:

4096 samples/channel.

Maximum Sample Rate:

96 Ks/S.
Programmable from 96 Ks/S to 9.6 Ks/S over the bus.

Triggering:

Auto, Phase, Transient.

Trigger Delay:

Pre-trigger 0 - 42 ms 1 \emptyset
0 - 128 ms 3 \emptyset
Post-trigger 0 - 1000 msec.
(at max. sample rates)

Display:

Front panel Graphics Display with cursors.

Bus Interface:

Full bus access to waveform acquisition system.

Remote Control

IEEE-488 Interface:

IEEE-488 (GPIB) talker listener.
Subset:
AH1, C0, DC1, DT1, L3, PP0, RL2, SH1, SR1, T6
IEEE-488.2 SCPI Syntax

RS232C Interface:

9 pin D-shell connector
Handshake: CTS, RTS
Data bits: 7,8
Stop bits: 1,2
Baud rate: 9600, 19200, 38400, 57600, 115200
IEEE-488.2 SCPI Syntax
Supplied with RS232C cable

System Interface

Inputs:

Remote shutdown
External Sync
Clock/Lock (option)

Outputs:

Function Strobe
Clock/Lock (option)

Specifications - Continued

AC Input

Voltage:

Models 3001 and 9003:

208-240 ± 10% V_{AC} (L-N, 1 ϕ)

All other models:

Standard:

208-240 ± 10% V_{AC} (L-L, 3 ϕ)

Option -400:

400-480 ± 10% V_{AC} (L-L, 3 ϕ)
(Input range must be specified when ordering)

Current:

Input Line Current (per phase)

Model:	187-264V	360-528V
3001i/iX	25 A	N/A
5001i/iX	23 A	12 A
9003iX	75 A	N/A
10001i/iX	46 A	24 A
15001i/iX	69 A	36 A
15003i/iX	69 A	36 A
30003i/iX	138 A	72 A

Inrush Current per chassis:

< 100 Apk for 100 μ s at 208-240 V

< 50 Apk for 100 μ s at 400-480 V

Frequency: 50-60 Hz ± 10 %

Efficiency: 75 % typical

Power Factor: 0.6 typical

Hold-up Time: At least 10 ms

Protection

Over Load:

Constant Current or Constant Voltage mode

Over Temperature:

Automatic shutdown

Regulatory:

IEC1010, EN50081-2, EN50082-2, CE EMC and Safety Mark requirements

RFI Suppression:

CISPR 11, Group1 , Class A

Rear Panel Connectors

- AC Input terminal block with cover
- AC output terminal block with cover
- IEEE-488 (GPIB) connector

- 9 pin D-Shell RS232C connector*
- Remote voltage sense terminal block
- System Interface Connector (*RS232 DB9 to DB9 cable supplied)

Physical

Dimensions per 5001iX unit

Height : 7" (178 mm)

Width : 19" (483 mm)

Depth : 24" (610 mm)

(Depth includes rear panel connectors)

Weight per 5001iX chassis

61 lbs / 28 Kg net

115 lbs / 52 Kg shipping

Vibration and Shock:

Designed to meet NSTA project 1A transportation levels

Air Intake/Exhaust:

Forced air cooling, side air intake, rear exhaust

Operating Humidity:

0 to 95 % RAH, non condensing.

Operating Temperature:

0 to 40° C

Storage Temperature:

-40 to +85° C

Measurements - Standard

Parameter	Range	Accuracy* (\pm)	Resolution	
AC Measurements				
Frequency	16-500 Hz	0.01% + 0.01 Hz	0.01 Hz	
		< 100 Hz	100 - 500 Hz	
RMS Voltage	0 - 300 V	0.05 V + 0.02%	0.1 V + 0.02%	10 mV
RMS Current	0 - 40 A	0.05 A + 0.02%	0.1 A + 0.02%	1 mA
Peak Current	0 - 120 A	0.05 A + 0.02%	0.1 A + 0.02%	1 mA
Crest Factor	0.00 - 6.00	0.05	0.05	0.01
Real Power	0 - 6 kW	10 W + 0.1%	20 W + 0.1%	1 W
Apparent Power	0 - 6 kVA	10 VA + 0.1%	20 VA + 0.1%	1 VA
Power Factor	0.00 - 1.00	0.01	0.02	0.01
DC Measurements				
DC Voltage	0 - 300 V	150 mV	10 mV	
DC Current	0 - 40 A	70 mA	1 mA	
Power	0 - 6 kW	15 W	1 W	

* Measurement system bandwidth = DC to 48 kHz. Accuracy specifications are valid above 100 counts. Current and Power Accuracy specifications are times two for 10001i/iX /30003i/iX and times three for 15001i/iX and 9003iX and 15003i/iX with MODE-iX option when in single phase mode. For 10001i/iX, 15001i/iX and 30003i/iX, resolution decreases by factor of 10, ranges for current and power increases by factor of three. PF accuracy applies for PF > 0.5 and VA > 50 % of range.

Measurements - Harmonics

Parameter	Range	Accuracy* (\pm)	Resolution
Frequency			
Fundamental	16.00-500.0 Hz	0.01% + 0.01 Hz	0.01 Hz
Harmonics	32.00 Hz - 48.00 kHz		0.01 Hz
Phase	0.0 - 360.0°	2° typ.	0.5°
Voltage	Fundamental	250 mV	10 mV
	Harmonics 2 - 50	0.1% + 250 mV+0.1% /1 kHz	10 mV
Current	Fundamental	50 mA	10 mA
	Harmonics 2 - 50	0.1% + 50 mA +0.1% /1 kHz	10 mA

* Accuracy specifications are valid above 100 counts. Accuracy specifications are times three for three phase mode. Harmonics frequency range in three phase mode is 32 Hz - 16 kHz. Resolution decreases by factor of 10 for 9003iX and 15003iX with Mode-iX option in 1 phase mode and for 10001iX, 15001iX and 30003iX.

Ordering Information

Model	Output Power AC	Phase Output	Max. current per phase				Input Voltage ²
			Low V range AC	DC	High V range AC	DC	
3001 <i>i</i> /iX	3 kVA	1	22	15.6	11	7.8	208-240V
5001 <i>i</i> /iX	5 kVA	1	37	26	18.5	13	208-240V
5001 <i>i</i> /iX-400	5 kVA	1	37	26	18.5	13	400-480V
9003iX ¹	9 kVA	3	22	15.6	11	7.8	208-240V
10001 <i>i</i> /iX ¹	10 kVA	1	74	52	37	26	208-240V
10001 <i>i</i> /iX-400 ¹	10 kVA	1	74	52	37	26	400-480V
10002 <i>i</i> /iX ¹	10 kVA	2	37	26	18.5	13	208-240V
10002 <i>i</i> /iX-400 ¹	10 kVA	2	37	26	18.5	13	400-480V
15001 <i>i</i> /iX ¹	15 kVA	1	111	78	55.5	39	208-240V
15001 <i>i</i> /iX-400 ¹	15 kVA	1	111	78	55.5	39	400-480V
15003 <i>i</i> /iX ¹	15 kVA	3	37	26	18.5	13	208-240V
15003 <i>i</i> /iX-400 ¹	15 kVA	3	37	26	18.5	13	400-480V
30003 <i>i</i> /iX ¹	30 kVA	3	74	52	37	26	208-240V
30003 <i>i</i> /iX-400 ¹	30 kVA	3	74	52	37	26	400-480V

Note (1): Supplied with System Interface cable(s). Controller in master unit only.

Note (2): All input voltage specifications are for Line to Line three phase except 3001iX and 9003iX which require single phase input only.

Note (3): For 10002iX split phase system specifications, refer to 5001iX for each phase.

Model

Refer to table shown for model numbers and configurations.

Supplied with

User Manual, Programming Manual, Software (all on CD ROM) and RS232C serial cable.

Options

-160	RTCA/DO-160D and EUROCAE test firmware. Refer to -160 option data sheet for details.
-400	400-480 Volt Line to Line AC input.
-411	IEC61000-4-11 test firmware. See also EOS1/3.
-413	IEC61000-4-13 Harmonics and Interharmonics test firmware.
-704	Mil Std 704D/E test firmware. Refer to -704 option data sheet for details.
-EOS-1	IEC61000-4-11 Electronic Output Switch (1 phase) Includes -411 option. Refer to EOS data sheet for details.
-EOS-3	IEC61000-4-11 Electronic Output

Switch (3 phase)	Includes -411 option. Refer to EOS data sheet for details.
-LKM	Clock/Lock Master
-LKS	Clock/Lock Auxiliary
-LNS	Internal AC Line Sync.
-MODE-iX	Switches between 1 and 3 phz output modes, for 9003iX or 15003iX only.
OMNI-1-18i	Impedance matching network for single phase 3001iX or 5001iX to support IEC-1000-3-3 flicker tests.
OMNI-3-18i	Impedance matching network for three phase 9003iX or 15003iX systems to support IEC-1000-3-3 flicker tests.
OMNI-3-37i	Impedance matching network for three phase 30003iX systems to support IEC-1000-3-3 flicker tests.
-RMS	Rackmount Slides.
-WHM	Watt-Hour Measurement option.
-XLS	External AC Line Sync adaptor. (-LNS and XLS are mutually exclusive)

Cabinet Systems



Multi box *i*X Series II systems can be factory installed and wired in 19 inch cabinets. Cabinet configurations can be ordered by preceeding the model number with a "C1-C4" prefix. Contact factory for pricing and details.

Feature Comparison

Series:	<i>i</i>	<i>i</i> X
AC mode	x	x
DC mode	x	x
AC+DC mode		x
Transient programming	x	x
Arbitrary waveforms		x
Measurements	x	x
Harmonic measurements		x
Waveform acquisition		x
Programmable Impedance		x
IEEE/RS232	x	x



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