- **Combination AC and DC Power Source and Power Analyzer**
  Replaces several 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
- **Programmable Output Impedance**
  Simulate Line Impedance conditions or use for IEC Flicker testing
- **IEC 1000-3-2 and IEC 1000-3-3**
  Meets source requirements for IEC Harmonics and Flicker testing

AC and DC Power Systems

iX Series

Programmable AC and DC Power Source / Analyzer

CE

Integrated System

The iX Series represents a new type 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 power source with a high end power analyzer, the iX Series systems are capable of handling applications that would traditionally have required multiple instruments.

The sleek integrated approach of the iX Series avoids the cable clutter that is commonly found in AC test setups. 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 provides more accuracy and resolution than can be found in some dedicated harmonic power analyzers. Since many components in the iX Series are shared between the AC source and the power analyzer, the total cost of the integrated system is less than the typical cost of a multiple unit system.

Easy To Use Controls

The iX Series is completely 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 softkeys.

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, high load drive current, multi or single phase output mode and built-in power analyzer measurement capabilities, iX Series AC and DC source/analyzers address all application areas for AC and DC power testing. Additional features like line distortion simulation (LDS), arbitrary waveform generation and programmable output impedance address requirements for product quality and regulatory compliance testing.

Waveform Acquisition

Voltage and current waveform data can be acquired on all three phases and shown on the LCD display. Applications include inrush current measurement and load characterization.

iX Series - 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 Line Distortion Simulation and load measurement system combines all needed source and measurement functions in an easy to use system.

Avionics

With an output frequency range to 500 Hz, the iX Series 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 can eliminate the need for three or four items of instrumentation and only occupies 7 inches of rack space, cost and space savings provide a rapid return on investment. Instrument drivers for popular programming environments such as National Instruments LabViewÒ 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 is designed to meet AC source requirements for use in Euronorm IEC-1000 compliance testing. For flicker testing, the programmable output impedance capability of the 3001iX, 5001iX and 15003iX can be used to create the required IEC 725 reference impedance.

Multi-Box Configurations

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

Mode-iX Option

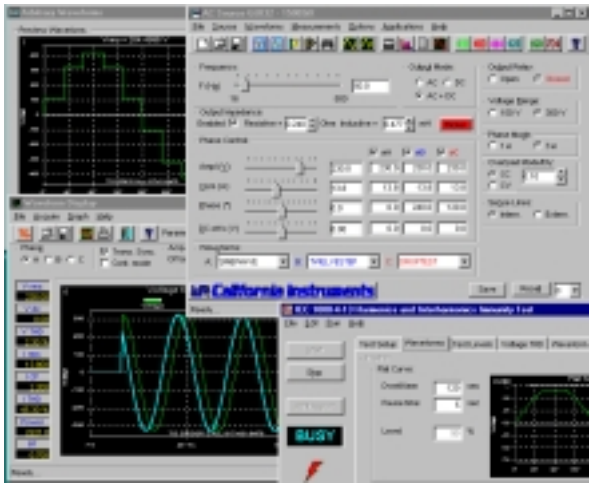
A 15003iX three phase configuration can be ordered with the Mode-iX option. This option allows automatic switching between single or three phase output mode. In single phase mode, all current is available on phase A. The Mode-iX option switches the output from all three 5001iX amplifiers to a single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

High Crest Factor

With a crest factor of up to 5:1, the iX Series AC source / analyzers can drive difficult non-linear loads with ease. Since many modern products use switching power supplies, they have a tendency to pull high repetitive peak currents. If the AC power source used to test these products has insufficient peak current drive capability, the waveform exhibits voltage distortion. The 5001iX can deliver up to 110 Amps of repetitive peak current (low range) to avoid this problem.

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.



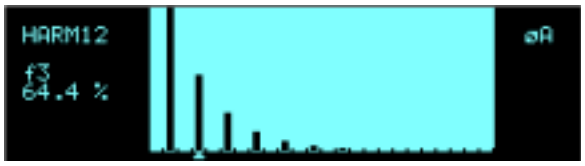
Application Software

Windows® application software is provided free of charge with the iX Series[1]. This software provides easy access to the iX Series' many powerful 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
- Generate and save arbitrary waveforms
- Download data from a digital storage oscilloscope
- Measure and log standard measurements
- Capture and display Voltage and Current waveforms
- Measure, display, print and log harmonic voltage and current measurements
- Run **IEC 1000-4-11, IEC 1000-4-14** and **IEC 1000-4-28** test programs
- Display IEEE-488 or RS232C bus traffic to and from the AC Source to help you develop your own test programs.

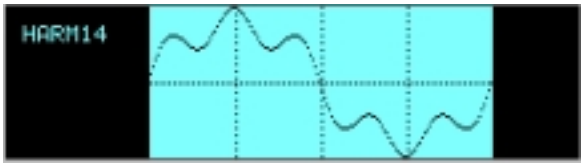
1 Requires PC running Windows Win98™ or Win 2000™. Recommended Pentium 233 MHz or better.

iX Series - Waveform Generation



Harmonic waveform, Fund., 3rd, 5th, 7th, 9th,11th and 13th.

Two hundred user defined waveforms.



Transient List Data Entry from the front panel.

Harmonic Waveform Generation

Using the latest DSP (Digital Signal Processing) technology, the iX Series controller is capable of generating harmonic waveforms to test for harmonics susceptibility of a unit under test. Included is a Graphical User Interface program that can be used to define harmonic waveforms by specifying amplitude and phase for up to 50 harmonics. The waveform data points are generated and downloaded by the GUI to the AC source through either the IEEE-488 or RS232C bus and remain in nonvolatile memory. Up to 200 waveforms can be stored and given a user defined name for easy recall.

The three phase configuration iX Series offers independent waveform generation on each phase allowing three phase anomalies to be programmed. It also allows simulation of unbalanced harmonic line conditions.

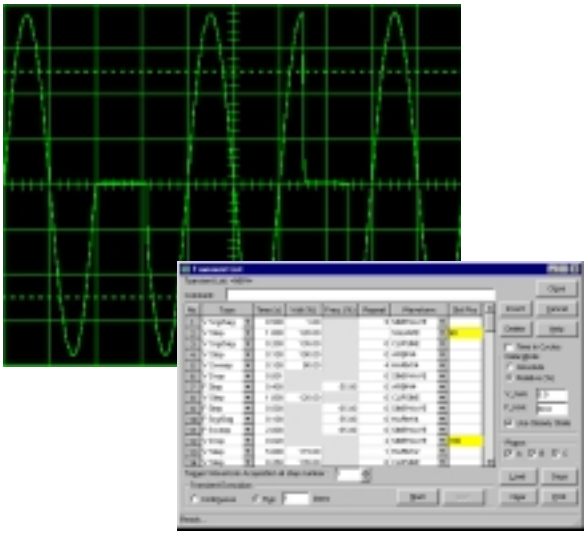
Arbitrary Waveform Generation

Using the provided GUI program or custom software, the user also has the ability to define arbitrary AC waveforms. The arbitrary waveform method of data entry provides an alternative method of specifying AC anomalies by providing specific waveform data points. The GUI program provides a catalog of custom waveforms and also allows real-world waveforms captured on a digital oscilloscope to be downloaded to one of the many AC source's waveform memories.

Arbitrary waveform capability is a flexible way of simulating the effect of real-world AC power line conditions on a unit under test in both engineering and production environments.

iX Series - AC and DC Transient Generation

Transient List Data Entry from the front panel.



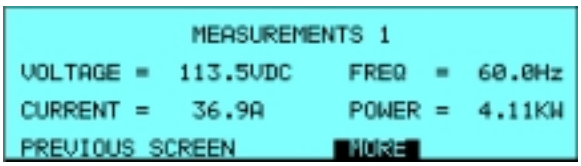
Transient List Data Entry in GUI program.

The iX Series controller has a powerful AC and DC transient generation system that allows complex sequences of voltage, frequency and waveshapes to be generated. This further enhances the iX's capability to simulate AC line conditions or DC disturbances. When combined with the multiphase arbitrary waveform capabilities, the AC and DC output possibilities are truly exceptional. In three phase iX system configurations, transient generation is controlled independently yet time synchronized on all three phases. Accurate phase angle control and synchronized transient list execution provide unparalleled accuracy in positioning AC output events.

Transient programming is easily accomplished from the front panel where clearly laid out menu's guide the user through the transient definition process.

The front panel provides a convenient listing of the programmed transient sequence and allows for transient The included Graphical User Interface program supports transient definitions using a spreadsheet-like data execution Start, Stop, Abort and Resume operations. User defined transient sequences can be saved to non-volatile memory for instant recall and execution at a later time.entry grid. A library of frequently used transient programs can be created on disk using this GUI program.

iX Series - Measurement and Analysis



Measurement data for a single phase.

Measurement data for all three phases.

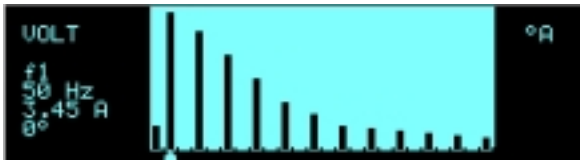
The iX Series is much more than a programmable AC and DC power source. It also incorporates an advanced digital signal processor based data acquisition system that continuously monitors all AC source and load parameters. This data acquisition system forms the basis for all measurement and analysis functions. These functions are accessible from the front panel and the remote control interface.

Conventional Measurements

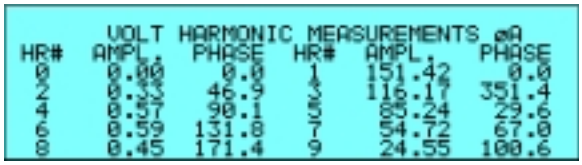
Common AC and DC measurement parameters are automatically provided by the data acquisition system. These values are displayed in numeric form on the front panel LCD display. The following measurements are available:

Frequency, V_{rms}, I_{rms},, I_{pk}, Crest Factor, Real Power, VA Power, Power Factor.

Harmonic Analysis



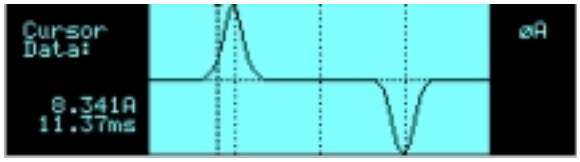
Absolute amplitude bar graph display of current harmonics with cursor positioned at the fundamental



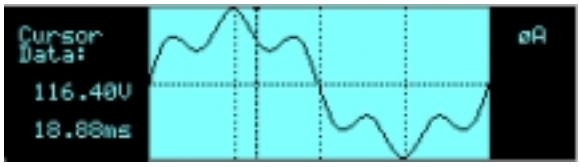
Voltage harmonic measurement table display in absolute values

The iX Series provides detailed amplitude and phase information on up to 50 harmonics of the fundamental voltage and current for either one or three phases. Harmonic content can be displayed in both tabular and graphical formats on the front panel LCD for immediate feedback to the operator. Alternatively, the included GUI program can be used to display, print and save harmonic measurement data. Total harmonic distortion of both voltage and current is calculated from the harmonic data.

Waveform Acquisition



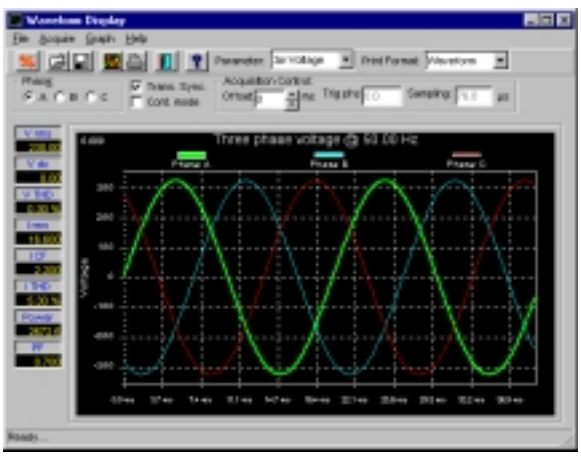
Acquired Current waveform



Acquired Voltage waveform

The measurement system is based on real-time digitization of the voltage and current waveforms using a 4K deep sample buffer. This time domain information provides detailed information on both voltage and current waveshapes. Waveform acquisitions can be triggered at a specific phase angle or from a transient program to allow precise positioning of the captured waveform with respect to the AC source output.

The front panel LCD displays captured waveforms with cursor readouts. The included GUI program also allows acquired waveform data to be displayed, printed and saved to disk.



Acquired three phase voltage waveforms display on PC.

Specifications

Operating Modes

AC, DC or AC + DC

AC Mode Output

Frequency

16.00 Hz - 500.0 Hz

Power

Maximum AC power per phase at full scale voltage:

Model:	Power
3001iX	3000 VA
5001iX	5000 VA
9003iX (with mode-iX)	3000 VA 3ø 9000 VA 1ø
10001iX	10000 VA
15001iX	15000 VA
15003iX (with mode-iX)	5000 VA/ø 3ø 15000 VA/ø 1ø
30003iX	10000 VA/ø

Power Factor

0 to unity at full output VA

AC Voltage

Ranges

User selectable voltage range pairs:

Range:	Low	High
Max Vrms	135 V	270 V
Max Vrms	150 V	300 V

Load Regulation

± 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

Line Regulation

< ± 0.1% for 10 % line change

Output Noise

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

Harmonic Distortion

Less than 1% from 16 - 66 Hz
Less than 2% at 400 Hz
(into linear load)

DC Offset

< 20 mV

External Modulation

depth: 0 - 10 %

Isolation Voltage

300 V_{RMS} output to chassis

AC Current

Peak Repetitive AC Current

Model	High rng	Low rng
3001iX	96.0	110.0
5001iX	96.0	110.0
9003iX 1ø	288.0	330.0
3ø	96.0	110.0
10001iX	192.0	220.0
15001iX	288.0	330.0
15003iX 1ø	288.0	330.0
3ø	96.0	110.0
30003iX 3ø	192.0	220.0

Steady State AC Current

Model	270V rng	135V rng
3001iX	11.1	22.2
5001iX	18.5	37.0
9003iX 1ø	33.3	66.6
3ø	11.1	22.2
10001iX	37.0	74.0
15001iX	55.5	111.0
15003iX 1ø	55.5	111.0
3ø	18.5	37.0
30003iX 1ø	37.5	74.0

Model	300V rng	150V rng
3001iX	10.0	20.0
5001iX	16.7	33.3
903iX 1ø	50.0	100.0
3ø	16.7	33.3
10001iX	33.3	66.7
15001iX	50.0	100.0
15003iX 1ø	50.0	100.0
3ø	16.7	33.3
30003iX 3ø	33.3	66.7

Programming Accuracy

Voltage (rms): ± 0.5 % of range, 16 to 400 Hz
Frequency: ± 0.01 % of programmed value.
Current Limit: - 0 % to + 7 % of programmed value + 0.5 A.
Phase: < 1.5° with balanced load @ 50/60 Hz.

Programming Resolution

Voltage (rms): 100 mV
Frequency:
0.01 Hz from 16 Hz to 81.91 Hz
0.1 Hz from 82.0 Hz to 500.0 Hz
Current Limit:
0.1 A for 5001iX, 9003iX and 15003iX. 1.0 A for 10001iX, 15001iX and 30003iX.
Phase: 0.1°

Output Relay

Push button controlled or bus controlled output relay

Output impedance

Programmable Z on 3001iX, 5001iX, 9003iX and 15003iX (3ø mode only) for 50 Hz fundamental.

Resistive:

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

Inductive:

range	230 - 1000 mH
resolution	4 mH
accuracy	2 % FS

Measurements - Standard

Parameter	Range	Accuracy* (±)		Resolution*
AC Measurements				
Frequency	16.00 - 500.0 Hz	0.01% + 0.01 Hz < 100 Hz		0.01 Hz 100 - 500 Hz
RMS Voltage	0 -330 V	50 mV	100 mV	10 mV
RMS Current	0 - 40 A	50 mA	100 mA	1 mA
Peak Current	0 - 119 A	50 mA	100 mA	1 mA
Crest Factor	0.000 - 6.000	0.05	0.05	0.01
Real Power	0 - 6 kW	5 W	5 W	1 W
Apparent Power	0 - 6 kVA	10 VA	20 VA	1 VA
Power Factor	0.00 - 1.00	0.01	0.01	0.01
DC Measurements				
DC Voltage	0 - 420 V	500 mV		10 mV
DC Current	0 - 120 A	500 mA		1 mA
Power	0 - 6 kW	50 W		1 W

** Measurement system bandwidth = DC to 19.5 kHz. Accuracy specifications are valid above 100 counts. Current and Power Accuracy specifications are times two for 10001iX /30003iX and times three for 15001iX and 9003iX and 15003iX with MODE-iX option when in single phase mode. For 10001iX, 15001iX and 30003iX, resolution decreases by factor of 10, ranges for current and power increases by factor of three.*

Note 1: Specifications are warranted over an ambient temperature range of 25°± 5° C. Unless otherwise noted, specifications are per phase for a sinewave 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
3001iX	2100 W
5001iX	3500 W
9003iX	2100 W/ø 3ø 6300 W/ø 1ø
10001iX	7000 W
15001iX	10500 W
15003iX	3500 W/ø 3ø 10500 W/ø 1ø
30003iX	21000 W/ø 3ø

Voltage Ranges:

User selectable voltage range combinations:

Range:	High	Low
	270 V	135 V
	300 V	150 V

Load Regulation:

see AC mode

Line Regulation:

see AC mode

Output Noise:

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

Max. DC Current Capability:

Maximum DC current in lowest DC range pair:

Model	270Vrng	135Vrng
3001iX	7.7	15.4
5001iX	13	26
9003iX 1ø	23.1	46.2
3ø	7.7	15.4
10001iX	26	52
15001iX	39	78
15003iX 1ø	39	78
3ø	13	26
30001iX 3ø	26	52

Current Limit:

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

AC + DC Mode Output

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 complete instrument setups
200 user defined waveforms

Waveforms

Waveform Types:

- Sine
- Square
- Clipped Sine, 0 - 20 % THD
- 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 32 transient steps per list

Time resolution / range:

1 msec / 1 msec - 9999 sec

Maximum slew rate:

200 µsec for 10% to 90% of full scale change into resistive load

Waveform Acquisition

Channels:

Voltage and Current for each phase.

Memory Depth:

4096 samples/channel.

Maximum Sample Rate:

39.0625 Ks/s.

Triggering:

Auto, Phase, Transient.

Trigger Delay:

Pre-trigger 0 - 104 msec 1ø
0 - 312 msec 3ø
Post-trigger 0 - 1000 msec.

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
Databits: 7,8
Stopbits: 1,2
Baud rate: 9600, 19200, 38400
IEEE-488.2 SCPI Syntax
Supplied with RS232C cable

System Interface

Inputs:

Remote shutdown
External Sync

Outputs:

Function Strobe

Measurements - Harmonics

Parameter	Range	Accuracy* (±)	Resolution
Frequency			
Fundamental	16.00-500.0 Hz	0.01% + 0.01 Hz	0.01 Hz
Harmonics	32.00 Hz - 19.5 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 - 6.67 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.*

Specifications - Continued

AC Input

Voltage:

Models 3001iX and 9003iX:
187 - 264 V_{AC},(L-N, 1 Phase)
All other models:
Standard:
187 - 264 V_{AC},(L-L, 3 Phase)
Option -400:
360 - 528V_{AC},(L-L, 3 Phase)
(Input range must be specified when ordering)

Current:

Input Line Current (per phase)

Model:	187-264V	360-528V
3001iX	30 A	N/A
5001iX	24 A	12 A
9003iX	90 A	N/A
10001iX	48 A	24 A
15001iX	72 A	36 A
15003iX	72 A	36 A
30003iX	144 A	72 A

Inrush Current per chassis:

< 14 A rms. / 84 A_{PEAK} for 200 ms @ 187-264 V
< 8 A rms. / 36 A_{PEAK} for 400 ms @ 360-528 V

Line Frequency: 47 - 63 Hz

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
80 lbs / 36 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.

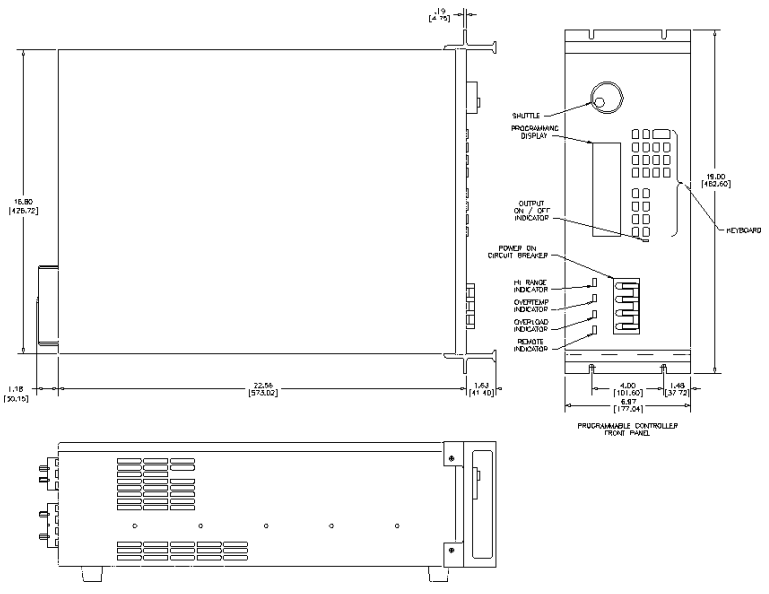
Operating Temperature:

0 to 40° C

Storage Temperature:

-40 to +85° C

3001iX/5001iX Dimensions - single chassis



Ordering Information

Model	Output Power AC	Phase Output	Max. current per phase 135 V range AC	135 V range DC	270 V range AC	270 V range DC	Input Voltage[2]
3001iX	3 kVA	1	22	11	11	5.5	208-240V
5001iX	5 kVA	1	37	18.5	18.5	9.3	208-240V
5001i X-400	5 kVA	1	37	18.5	18.5	9.3	400-480V
9003iX[1]	9 kVA	3	22	11	11	5.5	208-240V
10001iX[1]	10 kVA	1	74	37	37	18.5	208-240V
10001i X-400[1]	10 kVA	1	74	37	37	18.5	400-480V
10002iX[1]	10 kVA	2	37	18.5	18.5	9.3	208-240V
10002i X-400[1]	10 kVA	2	37	18.5	18.5	9.3	400-480V
15001iX[1]	15 kVA	1	111	55.5	55.5	27.8	208-240V
15001i X-400[1]	15 kVA	1	111	55.5	55.5	27.8	400-480V
15003iX[1]	15 kVA	3	37	18.5	18.5	9.3	208-240V
15003i X-400[1]	15 kVA	3	37	18.5	18.5	9.3	400-480V
30003iX[1]	30 kVA	3	74	37	37	18.5	208-240V
30003i X-400[1]	30 kVA	3	74	37	37	18.5	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.

Ordering Information

Model

Refer to table shown for model numbers and configurations.

Supplied with

User Manual, Programming Manual, Software and RS232C serial cable.

Options

-160 RTCA/DO-160D test firmware.

-400 360-480 Volt Line to Line AC input.

-411 IEC 1000-4-11 test firmware.

-413 IEC 1000-4-13 Harmonics and Interharmonics test firmware.

-704 Mil Std 704E test firmware.

-EOS-1 IEC 1000-4-11 Electronic Output Switch (1 phase) Includes -411 option.

-EOS-3 IEC 1000-4-11 Electronic Output Switch (3 phase) Includes -411 option.

-LNS Internal AC Line Sync.

-Mode-iX Switches between 1 and 3 phase modes, for 9003iX or 15003iX only.

-OMNI-1-18i Impedance matching network for single phase 300i1X 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.

-XLS External AC Line Sync.

-WHM Watt-Hour Measurement option.

Cabinet Systems

Multi box iX Series systems can be factory installed and wired in 19 inch cabinets. Cabinet configurations can be ordered by preceeding the model number with a “C” prefix. Contact factory for pricing and details

Contact California Instruments:
TEL: 858 677-9040
FAX: 858 677-0940
Email: sales@calinst.com
Web URL: http://www.calinst.com