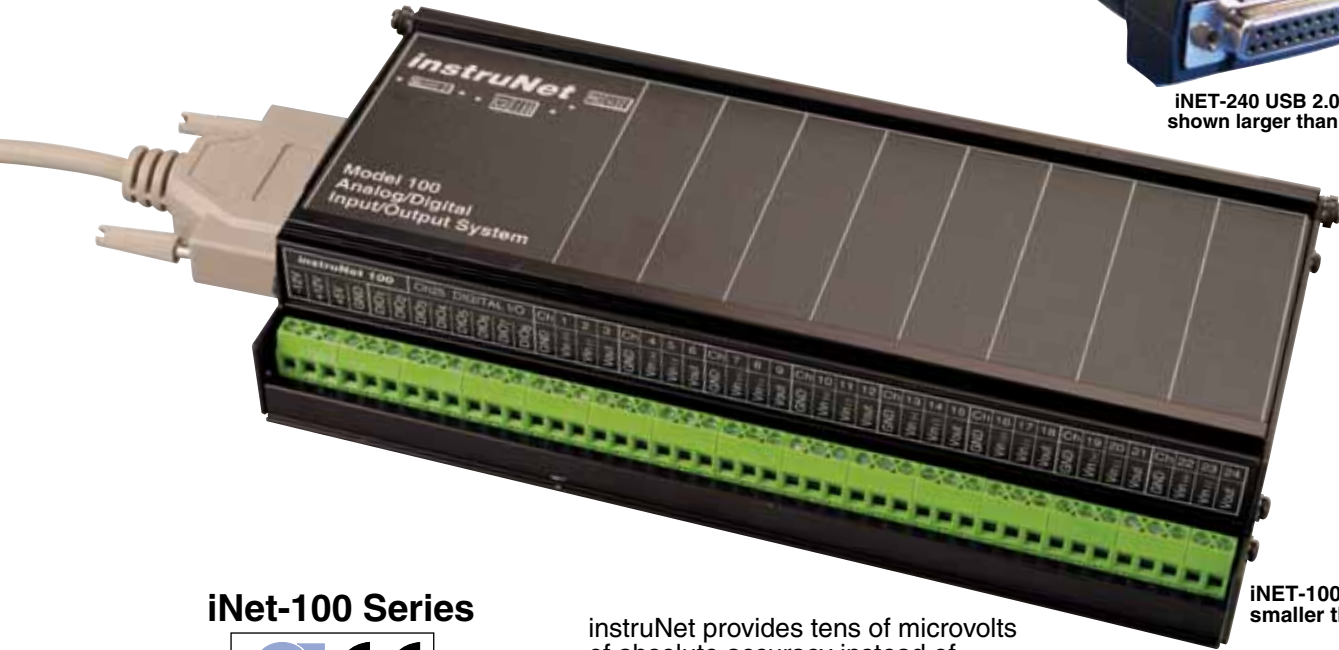


## instruNET Series Direct Sensor to Data Acquisition



iNET-240 USB 2.0 controller, shown larger than actual size.



iNET-100 A/D box, shown smaller than actual size.

### iNet-100 Series



- ✓ High-Accuracy Data Acquisition for Windows Computers
- ✓ 16 Single-Ended/8 Differential 14-Bit Analog Inputs, 8 Analog Outputs, and 8 Digital I/O
- ✓ iNET-240 USB 2.0 Controller
- ✓ Direct Connection to RTD, Thermocouple, Voltage, Current, Accelerometer, Potentiometer, Load Cell, Thermistor, Bridge, and Strain Gage Sensors
- ✓ Each Channel Has Independently Programmable Analog and Digital Filters, Integration Time, Voltage Range, and Sample Rate
- ✓ 166 KS/s Throughput to RAM or Disk
- ✓ Includes Strip Chart Software and Drivers for C, Visual Basic, Net, and TestPoint
- ✓ Optional LabVIEW Drivers are Available
- ✓ Optional DASyLab Software Includes iNET Drivers for Easy-to-Use, Icon-Based Programming

instruNet provides tens of microvolts of absolute accuracy instead of tens of millivolts, at the same cost and at the same throughput rates as typical general purpose data acquisition boards. It does this with a completely different topology in which the analog electronics are close to the sensor in electrically quiet boxes outside the PC, and noisy digital electronics are left inside. The external boxes contain signal conditioning amplifiers for each channel and can attach directly to sensors such as thermocouples, thermistors, RTDs, strain gages, load cells, resistance sources, current sources, and voltage sources. The box returns engineering units to the PC (e.g., °C, volts, amps).

At the heart of the real-time system is a PCI card (WIN XP/VISTA (32-bit)/7 (32-bit), PC-card (WIN XP/VISTA (32-bit)/7 (32-bit) or USB 2.0 (WIN XP SP2/VISTA 32-bit or 64-bit/7 32-bit or 64-bit) controller that attaches to a Windows computer. Each controller contains a 32-bit microprocessor with 256 KB of RAM that manages the external "network" of devices. All real-time tasks are off-loaded to this processor so that the host computer is not burdened with real-time issues. Each instruNet iNET-100 box provides 16 single-ended/8 differential analog inputs, 8 analog outputs, and 8 digital I/O lines.

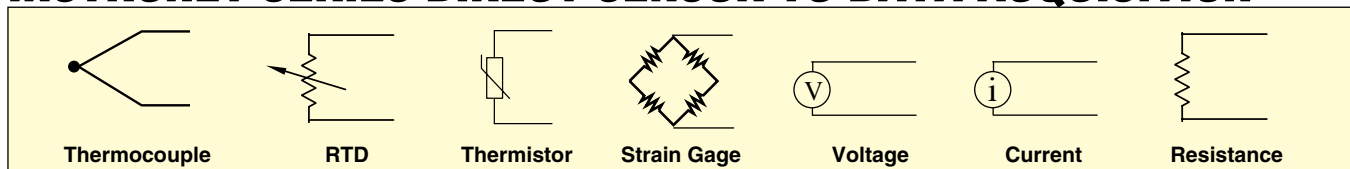
The iNET-100 includes 44 screw terminals. The iNET-100B version adds 16 BNCs for analog inputs. The controllers themselves have 10 counter/timer channels, each of which can function as a digital input bit, a digital output bit, a clock output channel, a pulse counter, a frequency counter, a period measurement input, or a quadrature counter.

### Distributed and Expandable

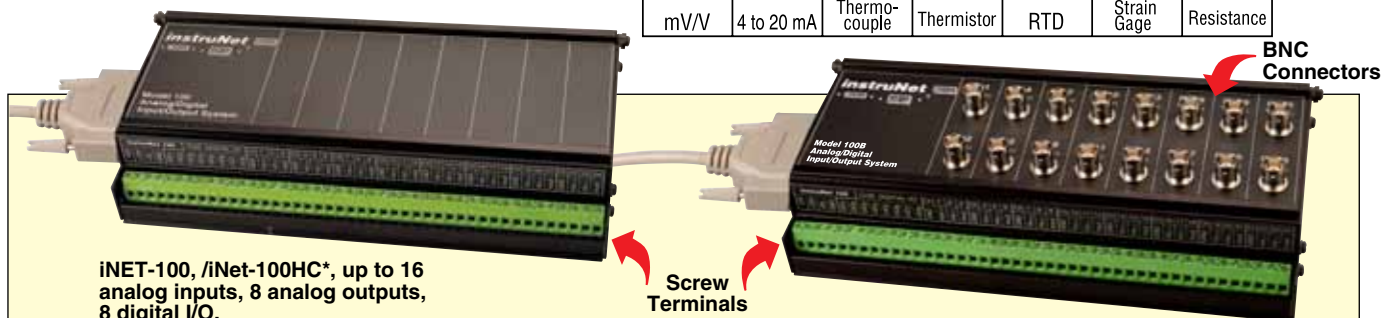
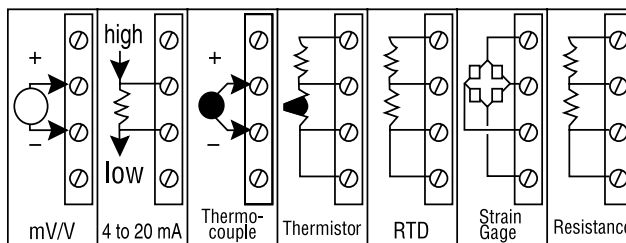
The instruNet system is ideally suited for distributed measurement and control systems. The network cable can extend up to 304.8 m (1000'). Each controller card in the PC can connect to up to 8 instruNet boxes for a total of 128 analog inputs, 64 analog outputs, and 64 digital I/O. For additional inputs, multiple controller cards can be placed in one computer, with the maximum number of controller cards limited only by the number of available slots.

Since each controller card has its own microprocessor, multiple cards do not place any additional burden on the computer. It should be noted that multiple instruNet boxes on a single network may degrade the maximum system throughput of 166 KS/s.

## INSTRUNET SERIES DIRECT SENSOR TO DATA ACQUISITION



iNET-100 hook-up diagram.



Daisy chain multiple iNet-100 units for up to 128 analog outputs.

**iNET-200**, instruNET controller card with PC interface for Windows based PCs.



**iNET-240**, USB 2.0 controller for laptop or desktop PCs.



## Performance

The instruNet system supports the digitizing of multiple channels at a maximum aggregate sample rate of 166 KS/s, where each channel can be digitized at its own rate. This maximum rate decreases when the total cable length increases, optical isolation is used, digital filtering or plotting is enabled, more boxes are added, more channels are digitized, amplifier gain is increased, or spooling to disk is added. Each channel can be independently digitally filtered with low-pass, high-pass, band-stop and and-pass filters; the filter specification for each channel is independently set in software. Each channel provides a programmable analog low-pass filter with programmable A/D measurement integration time. The network can be hundreds of feet long and can support multiple hardware devices connected in a daisy-chain configuration. The start of digitizing can be triggered from any channel. There are no jumpers or pots; the system automatically self-calibrates on power-up. Because instruNet is modular, it can easily be expanded as needs evolve. One can easily move the system hardware from one computer family to another, since the various controllers are functionally identical.

## High-Current Version (HC)

The iNET-100HC is similar to the iNET-100, yet the voltage output channels have a higher drive capability, providing up to 15 mA of current to capacitive loads as high as 0.01  $\mu$ F. The iNET-100 and iNET-100B devices support only 4 mA/0.001  $\mu$ F voltage output drive. The iNET-100HC is recommended for use with sensors such as strain gages, RTDs, and thermistors, since these sensors may exceed the current or capacitive drive limits of the iNET-100 or iNET-100B. The iNET-100HC, furthermore, provides greater compatibility with sensors that have capacitive loading on the excitation lines, therefore it is recommended for all sensors requiring excitation, including RTDs and thermistors. Since the HC version has a greater power demand, an external power supply must be used. The iNET-312-8 can be used for three additional iNET-100HC boxes.

## Software

"instruNet World" is a FREE application program that manages, monitors, and operates the instruNet system. It digitizes long continuous waveforms, spools them to disk, views incoming waveforms in real time, and then allows post-acquisition viewing, much like an oscilloscope or strip chart recorder. instruNet World provides a spreadsheet-like environment in which one can set and view channel parameters such as sensor type, integration time, analog filter, and digital filter. Each channel has its own row in the spreadsheet, with the various options in the columns. instruNet is also compatible with a variety of off-the-shelf software products, including TestPoint, Microsoft Excel 8 for Windows, and DASyLab. For users writing their own programs, instruNet includes drivers callable from Visual Studio. Net Basic or C. The driver includes a main routine, called "iNet()", that reads or writes any of the options or channels on the system. Optional drivers are also available for LabVIEW software.

instruNet World Plus (for Windows XP SP2/VISTA/7) software adds valuable features to the standard instruNet World software included with instruNet hardware. It enables the user to digitize, plot, control, analyze, and save to disk A/D, D/A, and digital I/O data from instruNet hardware. In addition, it enables one to define a personal instrument front panel with buttons, pop-up menus, edit fields, dynamic text, text editor regions, and waveform graphs. instruNet World Plus is programmed with a simple script language that can define tasks such as control loops. For example, one can type "Dac1 = OnOff (Ain1, 3)" to define D/A #1 as a function of A/D #1. Below is a list of the additional features available only in instruNet World Plus:

### Generate Analog and Digital Output Waveforms

Define an analog or digital output channel mathematically (e.g., sine wave, square wave, pulse train) that updates in real time (e.g., every 100 ms).

### Run Feedback/Control Loops

Define an analog or digital output channel as a real-time function of analog and/or digital input channels (e.g. PID control, on/off control).



## Create a Custom Instrument

Create buttons, pop-up menus, edit fields, dynamic text fields, text edit regions, and pages to build a custom application program.

## Powerful Script Programming Language

instruNet World Plus is programmed with a simple BASIC-like script language that provides feedback/control, waveform generation, math, file, hardware, and user-interface functions.

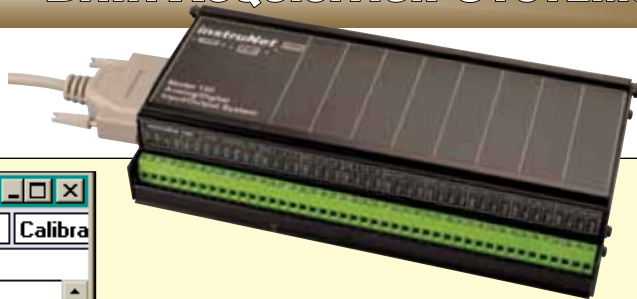
## instruNet World Plus also Includes Digitize Direct to Excel Software

InstruNet World Plus includes the Digitize Direct to Excel program, which populates an Excel (Version  $\geq$  8.0, Office  $\geq$  97) spreadsheet in real time while digitizing.

## Power Requirements

Since instruNet is powered directly from the iNET-200 controller card, it is possible to exceed the power capacity of the controller card if multiple instruNet iNET-100 boxes are attached to a network. For systems using the iNET-200 PCI bus controller card with more than 2 iNET-100/100B boxes or 1 iNET-100HC instruNet box on a network, external power is required. Two power adaptors are available: the iNET-300 power adaptor and the iNET-330 adapter/isolator. Both devices connect in line with the instruNet communications cable; the iNET-300 provides power only, while the iNET-330 provides power and electrical isolation between the iNET-100 boxes and the computer. Isolation helps eliminate ground loop problems. Both the iNET-300 and iNET-330 require either the iNET-312-8 (USA plug) or iNET-312-8EU (Euro plug) power supply. The iNET-312-8 can power 4 additional iNET-100/100B or 3 additional iNET-100HC. The iNET-230 controller card does not provide power; the iNET-312-8 or iNET-312-8EU power; supply must be used with this card.

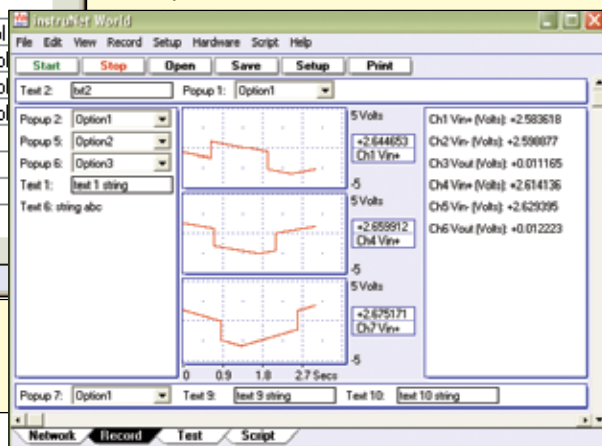
## instruNET Series Direct Sensor to Data Acquisition



instruNet World Plus Data Acquisition Software below (not included—need to purchase software license), iNET-iWPLUS.

Restore	Store	Open	Save	Clear	Reset	Calibra
Channel	Addr	Value Input	Units	% sRate	Sensor	
Ch1 Vin+	1/1/1	-0.000094	Volts	100	Voltage	
Ch4 Vin+	1/1/1	-1.9551e-00	Amps	100	Current	
Ch7 Vin+	1/1/1	1.2205	ohms	100	Resistance	
Ch10 Vin+	1/1/1	-249.95	C	100	RTD	
Ch13 Vin+	1/1/1	28.572	C	100	J Thermocpl	
Ch16 Vin+	1/1/1	36.946	C	100	K Thermocpl	
Ch19 Vin+	1/1/1	27.338	C	100	T Thermocpl	
Ch22 Vin+	1/1/1	41.892	C	100	E Thermocpl	
Ch2 Vin-	1/1/1	+0.000031	Volts	100	Voltage	
Ch5 Vin-	1/1/1	+0.000127	Volts	100	Voltage	
Ch8 Vin-	1/1/1	-0.000948	Volts	100	Voltage	
Ch11 Vin-	1/1/1	-0.000383	Volts	100	Voltage	

instruNet World Data Acquisition Software (included with the instruNet System).



OMEGACARE<sup>SM</sup> extended warranty program is available for models shown on this page. Ask your sales representative for full details when placing an order. OMEGACARE<sup>SM</sup> covers parts, labor and equivalent loaners.

### Thermocouple Ranges/Accuracy

Thermocouple	Range	Accuracy
<b>J</b>	-210 to -100°C	±0.8°C
	-100 to 1200°C	±0.5°C
<b>K</b>	-200 to -50°C	±0.8°C
	-50 to 1372°C	±0.6°C
<b>T</b>	-200 to -100°C	±0.8°C
	-100 to 400°C	±0.5°C
<b>E</b>	-200 to -60°C	±0.7°C
	-60 to 1000°C	±0.5°C
<b>R</b>	-50 to 70°C	±3.5°C
	70 to 1768°C	±2.0°C
<b>S</b>	-50 to 150°C	±2.8°C
	150 to 1768°C	±1.8°C
<b>B</b>	250 to 600°C	±3.8°C
	600 to 1820°C	±2.0°C
<b>N</b>	-200 to -110°C	±1.3°C
	-110 to 1300°C	±0.8°C
<b>C</b>	0 to 2315°C	±2.4°C
<b>D</b>	0 to 2315°C	±2.2°C
<b>G</b>	0 to 100°C	±16.0°C
	100 to 300°C	±3.4°C
	300 to 2315°C	±1.8°C

### Voltage Range/Accuracy

Voltage Range	Integration (Seconds)	Accuracy
±5V	1 ms none	±700 µV ±1500 µV
±0.6V	1 ms none	±75 µV ±150 µV
±80 mV*	1 ms none	±15 µV ±45 µV
±10 mV*	1 ms none	±10 µV ±30 µV

\* ±80 mV and ±10 mV are nominal ranges. Actual ranges may be as low as ±78 mV and ±8 mV, respectively

### RTD Accuracy Ranges

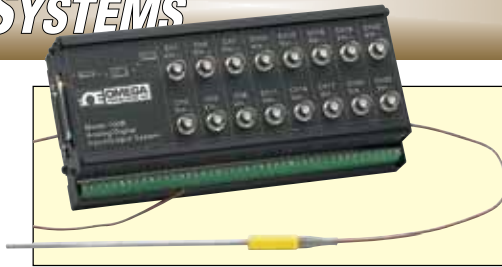
RTDs with  $\alpha = 0.00385$  and  $0.00392$  supported. One user-supplied shunt resistor per RTD channel is required.

RTD	Range	Shunt	Accuracy
100 Ω	0 to 200°C	1 kΩ	±0.37°C
100 Ω	0 to 850°C	2 kΩ	±1.0°C
500 Ω	0 to 200°C	4.7 kΩ	±0.38°C
500 Ω	0 to 850°C	10 kΩ	±0.9°C
1000 Ω	0 to 200°C	10 kΩ	±0.36°C
1000 Ω	0 to 850°C	20 kΩ	±0.85°C

### Thermistor Accuracy/Ranges

All OMEGA<sup>®</sup> 44000 Series thermistors supported. (Consult Sales for other thermistors); one user-supplied shunt resistor per thermistor channel is required.

Range	Shunt	Accuracy
-80 to 40°C	47 kΩ	±0.2°C
0 to 70°C	4.7 kΩ	±0.1°C
0 to 200°C	200 Ω	±0.4°C



iNET-100B, shown smaller than actual size with KMTSS-125U-6 thermocouple probe, sold separately. Visit us online for more thermocouple probes.

## SPECIFICATIONS

### Analog Inputs:

16 single-ended/8 differential

Resolution: 14-bit

### System Throughput:

166K samples/s

A/D Conversion Time: 4  $\mu$ s min

Signal-to-Noise Ratio: 78 dB

Linearity: Differential  $\pm 1.5$  LSB; integral  $\pm 2$  LSB

Input Overvoltage Protection:  $\pm 15$ V

Input Impedance:  $>22$  M $\Omega$ , 3pf

### Common-Mode Voltage:

$\pm 5$ V min (CMR  $\pm 80$  dB)

Gain and Offset Drift:  $\pm 5$  ppm/ $^{\circ}$ C of 5V FSR; offset self-calibrated to 0

Analog Outputs: 8

Resolution: 8-bit

### Output Range:

iNET-100/100B:  $\pm 5$ V @ 5 mA

iNET-100HC:  $\pm 5$ V @ 15 mA

### Output Protection:

Short-to-ground continuous

Output Settling Time: 4  $\mu$ s (to  $\pm 2$  LSB,  $\pm 5$ V step)

Analog Output Accuracy:  $\pm 0.4\%$

Digital Coupling:  $\pm 20$  mV

Gain and Offset Drift:  $\pm 10$  ppm/ $^{\circ}$ C of 5V FSR and  $\pm 5$   $\mu$ V/ $^{\circ}$ C offset drift

Digital I/O Number: 8 non-latching inputs and 8 latching outputs at 8 bidirectional screw terminals

### Input Levels:

$V_{in} = 3.2$ V min to 12V max

$V_{in} = 1.0$ V max to -12V min

$I_{in} = -200$   $\mu$ A,  $V^{\circ} = 3.2$ V

$I_{in} = -0.5$  mA max

### Output Levels:

$V_{out} = 2$ V min to 5V max

$I_{out} = -0.5$  mA max

$I_{out} = 500$  mA max,  $V^{\circ} = 1.7$ V

$I_{out} = 50$  mA max,  $V^{\circ} = 0.7$ V

## To Order

Model No.	Description
iNET-100	instruNet external A/D box with screw terminal connections
iNET-100B	instruNet external A/D box with screw terminal and BNC connections
iNET-100HC	Same as iNET-100 with 15 mA excitation current per channel
iNET-240	USB 2.0 controller for Windows XP SP2/VISTA (32-bit or 64-bit)/7 (32-bit or 64-bit); requires iNET-312-8 power supply
iNET-200	PCI-Bus controller card for Windows XP/VISTA (32-bit)/7 (32-bit) computers (controls up to 8 iNET-100s)
iNET-230 <sup>†</sup>	PC-Card controller, type II for Windows XP/VISTA (32-bit)/7 (32-bit) (does not provide power, requires iNET-312-8 power supply)

Comes complete with operator's manual, instruNet World data acquisition software, driver software and network terminator.

The iNET-100/100B/100HC include a 3 m (10') cable for connecting the iNET-100/100B/100HC to the controllerAcard or other iNET-100/100B/100HCs.

<sup>†</sup> iNET-230 is not supported under Windows NT.

Ordering Examples: iNET-100 external A/D box, OCW-1, OMEGACARE<sup>SM</sup> 1-year extended warranty (adds 1-year to standard 1-year warranty), iNET-240, USB 2.0 controller and OCW-1, OMEGACARE<sup>SM</sup> 1-year extended warranty for (adds 1 year to standard 1-year warranty)

iNET-100, external A/D box, and iNET-240 USB 2.0 controller

## Accessories

Model No.	Description
iNET-300	Power adaptor, required if using more than 2 iNET-100/100B boxes or one iNET-100HC box with the iNET-200 PCI controller card; the iNET-230 PC card controller provides its own power adaptor
iNET-330	Optical isolator, isolates signal and power lines (replaces iNET-300, requires iNET-312-8 power supply)
iNET-312-8	Power supply; 110/220 Vac, 5 V/2 A, $\pm 12$ V/0.8 A; USA plug used with iNET-300/330/230, iNET-300 included (powers 3 additional iNET-100HC or 4 additional iNET-100/100B); includes iNET-300 power adaptor
iNET-312-8EU	Power supply; 110/220 Vac, 5 V/2 A, $\pm 12$ V/0.8 A; 2-prong Euro plug, used with iNET-300/330/230 (powers 3 additional iNET-100HC or 4 additional iNET-100/100B); includes iNET-300 power adaptor
iNET-340	DIN rail mounting brackets for one iNET-100
iNET-CABLE-10FT	instruNet cable, 3.0 m (10') length
iNET-CABLE-25FT	instruNet cable, 7.6 m (25') length
iNET-CABLE-50FT	instruNet cable, 15.2 m (50') length
iNET-CABLE-100FT	instruNet cable, 30.5 m (100') length
iNET-iWPLUS	instruNet World Plus software license for one controller card (includes CD and license certificate for Windows XP SP2/VISTA/7)
iNET-380	LabVIEW drivers (LabVIEW versions 4 to 6 currently supported on Windows XP SP2/VISTA/7)
OMX-R250	Precision 250 $\Omega$ shunt resistor (1% tolerance)
OMX-R(*)	Precision shunt resistor, specify resistance code (200, 2K, 10K or 20K)
OMX-R1K	Precision shunt resistor, 1 k $\Omega$
OMX-R4.7K	Precision shunt resistor, 4.7 k $\Omega$
OMX-R47K	Precision shunt resistor, 47 k $\Omega$

\* Note: Insert resistance code in ohms. Available resistance codes are 200, 2K, 10K or 20K.

Ordering Example: iNET-312-8, power supply, 110/220 Vac.