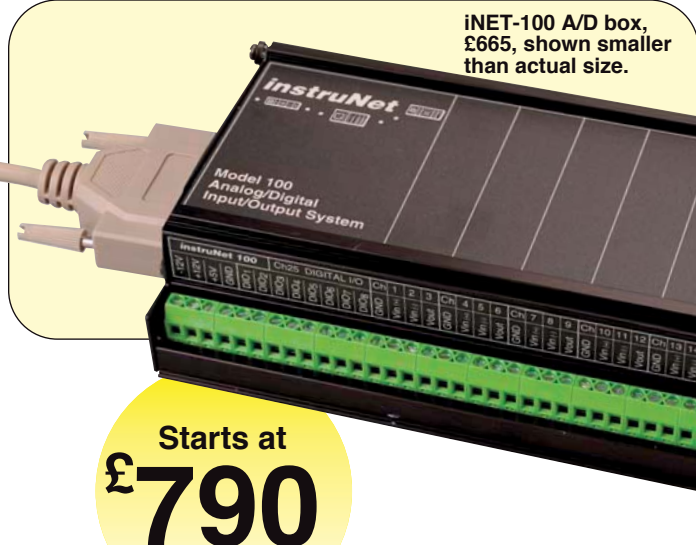# instruNET SERIES DIRECT SENSOR TO DATA ACQUISITION

iNet-100 Series
Basic System with Software

iNET-100 A/D box, £665, shown smaller than actual size.

iNET-240 USB 2.0 controller, £127, shown larger than actual size.

Starts at £790

1 YEAR WARRANTY CE

- ✔ **High-Accuracy Data Acquisition for Windows Computers**
- ✔ **16 Single-Ended/8 Differential 14-Bit Analogue Inputs, 8 Analogue Outputs, and 8 Digital I/O**
- ✔ **iNET-200 Controller Card Includes 10 Counter/Timer Channels**
- ✔ **Direct Connection to RTD, Thermocouple, Voltage, Current, Accelerometer, Potentiometer, Load Cell, Thermistor, Bridge, and Strain Gauge Sensors**
- ✔ **Each Channel Has Independently Programmable Analogue 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 gauges, 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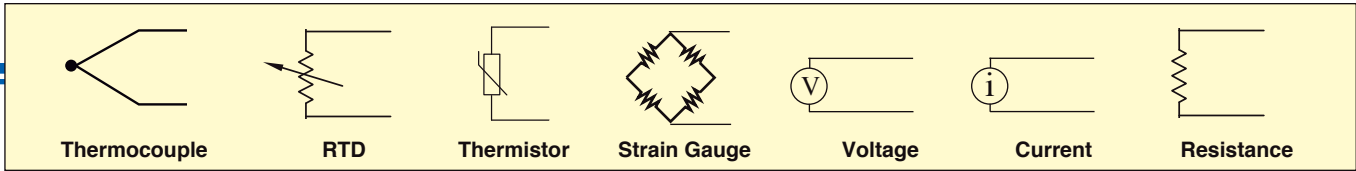 tasks are off-loaded to this processor so that the host computer is not burdened with real-time issues. Each instruNet iNET-100 box provides 16 single-ended/8 differential analog inputs, 8 analog outputs, and 8 digital I/O lines. The iNET-100 includes 44 screw terminals. The iNET-100B version adds 16 BNCs for analogue inputs. The PCI 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.
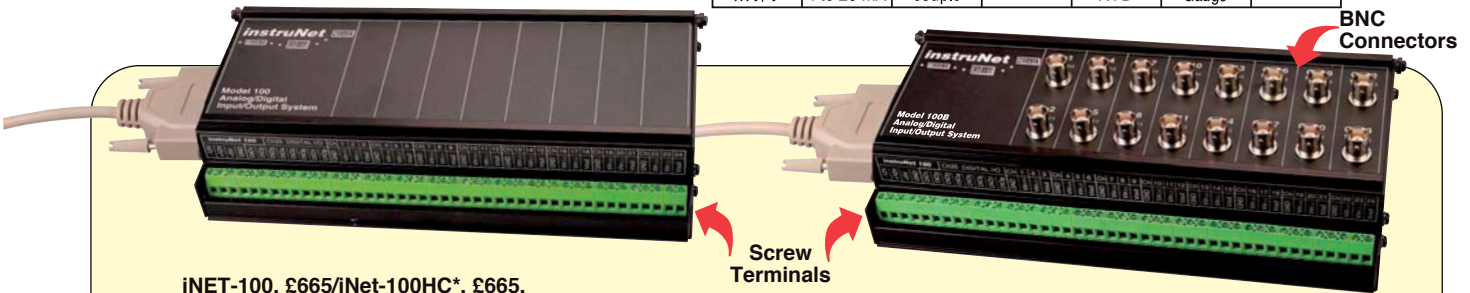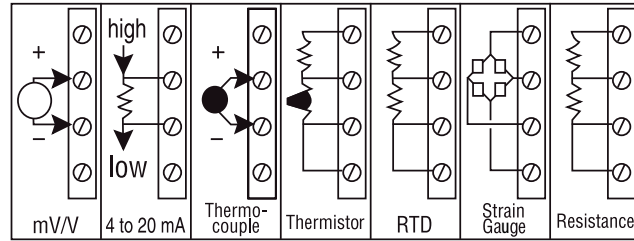
Distributed and Expandable
The instruNet system is ideally suited for distributed measurement and control systems. The network cable can extend up to 300 metres. Each controller card in the PC can connect to up to 8 instruNet boxes for a total of 128 analogue inputs, 64 analogue outputs, and 64 digital 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

| Thermocouple | RTD | Thermistor | Strain Gauge | Voltage | Current | Resistance |

iNET-100 hook-up diagram.

mV/V | 4 to 20 mA | Thermo-couple | Thermistor | RTD | Strain Gauge | Resistance

BNC Connectors

Screw Terminals

iNET-100, £665/iNet-100HC*, £665, up to 16 analogue inputs, 8 analogue outputs, 8 digital I/O.

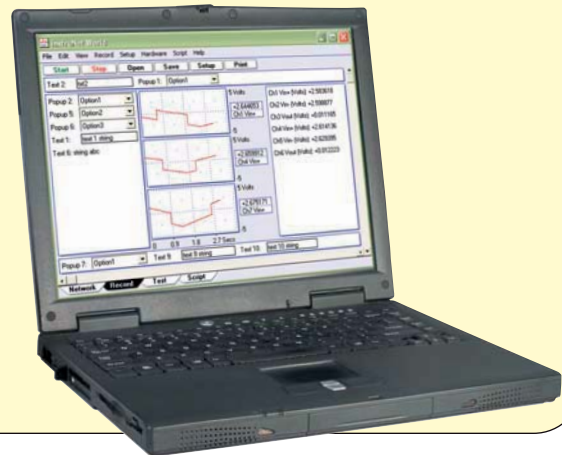***15 mA excitation current per channel.**

iNET-100B, £730, up to 16 analogue inputs with BNC connectors, 8 analogue outputs, 8 digital I/O.

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

iNET-200, £261 instruNET controller card with PC interface for Windows based PCs.

iNET-240, £127 USB 2,0 controller for laptop or desktop PCs.

STRAIN GAGES **E**

instruNET SERIES DIRECT SENSOR TO DATA ACQUISITION

iNET-300 power adaptor, £40, and iNET-330 isolator, £261, shown with iNET-312-8 power supply, £60, all shown smaller than actual size.

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 band-pass filters; the filter specification for each channel is independently set in software. Each channel provides a programmable analogue low-pass filter with programmable A/D measurement integration time. The network can be hundreds of metres 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 μF. The iNET-100 and iNET-100B devices support only 4 mA/0.001 μF 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, analogue 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 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 Analogue and Digital Output Waveforms

Define an analogue 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 analogue or digital output channel as a real-time function of analogue 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 ≥ 8.0, Office ≥ 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 earth loop problems. Both the iNET-300 and iNET-330 require the iNET-312-8EU power supply. This can power 4 additional iNET-100/100B or 3 additional iNET-100HC units.

The iNET-230 and iNET-240 controllers do not provide power; the iNET-312-8EU power supply must be used with these cards.
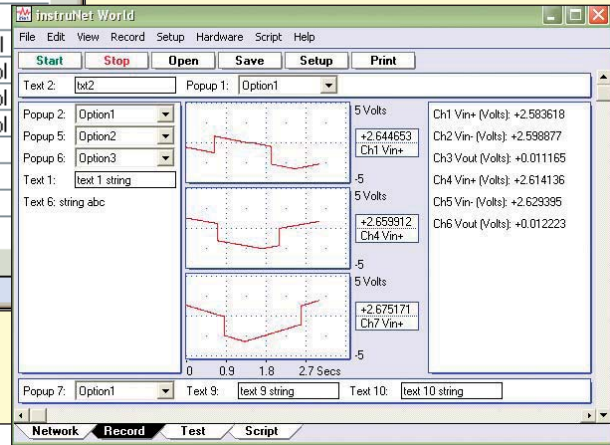
instruNET SERIES DIRECT SENSOR TO DATA ACQUISITION
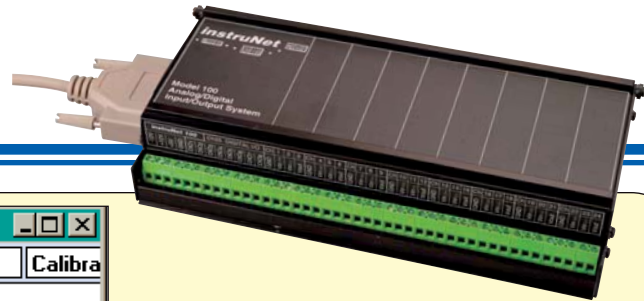
Restore	Store	Open	Save	Clear	Reset	Calibra

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

Network / Record / Test

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

instruNet World Plus Data Acquisition Software below (not included—need to puchase software license), iNET-iWPLUS, £154.

instruNet World
File Edit View Record Setup Hardware Script Help
Start Stop Open Save Setup Print

Text 2: txt2   Popup 1: Option1
Popup 2: Option1
Popup 5: Option2
Popup 6: Option3
Text 1: text 1 string
Text 6: string abc

5 Volts
+2.644653 Ch1 Vin+
-5
5 Volts
+2.659912 Ch4 Vin+
-5
5 Volts
+2.675171 Ch7 Vin+
-5
0 0.9 1.8 2.7 Secs

Ch1 Vin+ (Volts): +2.583618
Ch2 Vin- (Volts): +2.598877
Ch3 Vout (Volts): +0.011165
Ch4 Vin+ (Volts): +2.614136
Ch5 Vin- (Volts): +2.629395
Ch6 Vout (Volts): +0.012223

Popup 7: Option1   Text 9: text 9 string   Text 10: text 10 string

Network / Record / Test / Script

Thermocouple Ranges/Accuracy

Thermocouple	Range	Accuracy
J	-210 to -100°C -100 to 1200°C	±0.8°C ±0.5°C
K	-200 to -50°C -50 to 1360°C	±0.8°C ±0.6°C
T	-200 to -100°C -100 to 400°C	±0.8°C ±0.5°C
E	-200 to -60°C -60 to 1000°C	±0.7°C ±0.5°C
R	-50 to 70°C 70 to 1768°C	±3.5°C ±2.0°C
S	-50 to 150°C 150 to 1768°C	±2.8°C ±1.8°C
B	250 to 600°C 600 to 1300°C	±3.8°C ±2.0°C
N	-200 to -110°C -110 to 1260°C	±1.3°C ±0.8°C
C	0 to 2315°C	±2.4°C
D	0 to 2315°C	±2.2°C
G	0 to 100°C 100 to 300°C 300 to 2315°C	±16.0°C ±3.4°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 α = 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® 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

STRAIN GAGES   E

SPECIFICATIONS

Analogue Inputs:
16 single-ended/8 differential
Resolution: 14-bit
System Throughput:
166K samples/s
A/D Conversion Time: 4 μs min
Signal-to-Noise Ratio: 78 dB
Linearity: Differential ±1.5 LSB;
integral ±2 LSB
Input Overvoltage Protection: ±15V
Input Impedance: >22 MΩ, 3pf
Common-Mode Voltage:
±5V min (CMR ±80 dB)
Gain and Offset Drift: ±5 ppm/°C of
5V FSR; offset self-calibrated to 0

Analogue Outputs: 8
Resolution: 8-bit
Output Range:
   iNET-100/100B: ±5V @ 5 mA
   iNET-100HC: ±5V @ 15 mA
Output Protection:
Short-to-ground continuous
Output Settling Time: 4 μs (to ±2 LSB,
±5V step)
Analogue Output Accuracy: ±0.4%
Digital Coupling: ±20 mV
Gain and Offset Drift: ±10 ppm/°C of
5V FSR and ±5 μV/°C offset drift

Digital I/O Number: 8 non-latching
inputs and 8 latching outputs at
8 bidirectional screw terminals
Input Levels:
   V_{IH} = 3.2V min to 12V max
   V_{IL} = 1.0V max to -12V min
   I_{IH} = -200 μA, V^i = 3.2V
   I_{IL} = -0.5 mA max
Output Levels:
   V_{OH} = 2V min to 5V max
   I_{OH} = -0.5 mA max
   I_{OL} = 500 mA max, V^O =1.7V
   I_{OL} = 50 mA max, V^O = 0.7V

iNET-100B, £730, shown smaller than actual size with KMTSS-125U-6 thermocouple probe, sold separately, £17.50.

MOST POPULAR MODELS HIGHLIGHTED!

To Order *(Specify Model Number)*

Model No.	Price	Description
iNET-100	£665	instruNet external A/D box with screw terminal connections
iNET-100B	730	instruNet external A/D box with screw terminal and BNC connections
iNET-100HC	730	Same as INET-100 with 15 mA excitation current per channel
iNET-240	127	USB 2.0 controller for Windows XP SP2//VISTA (32-bit of 64-bit)/7 (32-bit or 64-bit); requires inet-312-8 power supply
iNET-200	261	PCI-Bus controller card for Windows XP/VISTA (32-bit)/7 (32-bit) computers (controls up to 8 iNET-100s)
iNET-230†	261	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 controller card or other iNET-100/100B/100HCs.
Ordering Example: *iNET-100* external A/D box, **OMEGACARE**℠ *1-year extended warranty for* **iNET-100** *(adds 1-year to standard 1-year warranty),*
iNET-200 controller card and **OMEGACARE**℠ *1-year extended warranty for* **iNET-200** *(adds 1 year to standard 1-year warranty), £665 + 66 + 261 + 26 =* **£1018.**
† *iNET-230 is not supported under Windows NT.*

Accessories

Model No.	Price	Description
iNET-300	£40	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	261	Optical isolator, isolates signal and power lines (replaces iNET-300, requires iNET-312-8 power supply)
iNET-312-8EU	60	Power supply; 110/240 Vac, 5 V/2 A, ±12 V/0.8 A; used with iNET-300/330/230 (powers 3 additional iNET-100HC or 4 additional iNET-100/100B); includes iNET-3000 power adaptor
iNET-340	33.50	DIN rail mounting brackets for one iNET-100
iNET-CABLE-10FT	16	instruNet cable, 3.0 m (10') length
iNET-CABLE-25FT	25.50	instruNet cable, 7.6 m (25') length
iNET-CABLE-50FT	36	instruNet cable, 15.2 m (50') length
iNET-CABLE-100FT	66	instruNet cable, 30.5 m (100') length
iNET-iWPLUS	154	instruNet World Plus software license for one controller card (includes CD and license certificate for Windows 95/98/NT/2000/XP)
iNET-380	131	LabVIEW drivers (LabVIEW versions 4 to 6 currently supported on Windows 98/NT/XP)
OMX-R250	0.65	Precision 250 Ω shunt resistor (1% tolerance)
OMX-R(*)	6.70	Precision shunt resistor, specify resistance code (200, 2K, 10K or 20K)
OMX-R1K	12.75	Precision shunt resistor, 1 kΩ
OMX-R4.7K	8	Precision shunt resistor, 4.7 kΩ
OMX-R47K	12.75	Precision shunt resistor, 47 kΩ

* 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, £60.*