i4xx Series Data Acquisition Cards

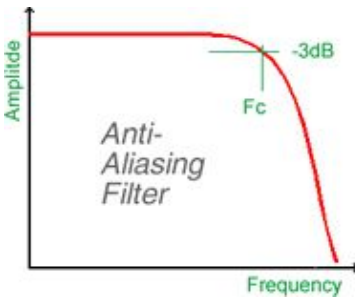




#iNet-410	#iNet-420	#iNet-423	#iNet-430	#iNet-460
Communications card connects an iNet-400 card cage to a Windows computer via an iNet-240 USB controller	Provides 20 single-ended (SE)/10 differential (DI) voltage input channels and 4 universal digital I/O	Provides 6 differential (DI) voltage input channels; each of which has its own amplifier and low pass filter	Provides 16/8 DI/SE voltage input channels with a 16-bit A/D converter, 4 voltage outputs, and 4 digital I/O	Provides 12 universal digital I/O (20 mA sink, -10 to 30 V) and 16 digital I/O (200 mA sink, -10 to 30 V)

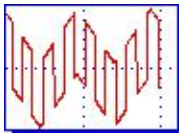
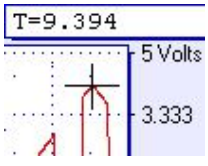
Optional Anti-Aliasing Filter

The optional 8-Pole i500 analog low pass filter daughterboard mounts on an i423 card and is ideal for anti-aliasing. For a summary of aliasing and why you might need an AFS filter, click here. The i500 provides extremely low ±0.01 dB maximum passband ripple for Fin/Fc ≤ 0.5. If one uses further oversampling, digital filtering and desampling; then passband ripple is ±0.002 dB for Fin/Fc ≤ 0.8 due to the accuracy of a 30-pole digital filter. The end user installs between 1 and 6 filter daughterboards onto each i423 card, one per channel. For details, click here.



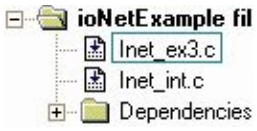
instruNet Software

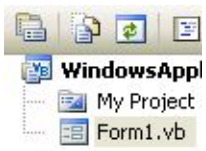
instruNet includes software to interrogate, test, configure, and do I/O with all network channels. This includes an application program called "instruNet World" and interfaces to Visual Basic, C, and C++. instruNet software can configure all I/O channels, store your settings, view digitized data in real time, stream data to disk, and scroll through your waveform post-acquisition. instruNet software runs on Windows computers. Free software and manual updates are available here.

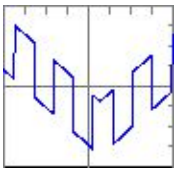



instruNet World *iW+* *DASYLab* *LabVIEW*

	A	B
1	Sec	Ch1 Vir
25	1	1.898
26	2	1.887







Direct To Excel *C/C++* *Visual BASIC* *MATLAB*

Connect Directly To Sensors

The table below shows which sensors directly connect to each hardware product. The numbers in the table refer to number of channels; and if you click on those numbers, you will be redirected to the measurement accuracy for that sensor and product. The following sensors require an external shunt resistor: RTD, thermistor, resistance measurement, current measurement, ¼ bridge strain gage, and ½ bridge strain gage. Thermocouple sensors require an i51x Wiring Box attached to the i4xx/i60x device as noted here. i4xx cards reside in a card cage, whereas the i60x is a tiny standalone device.

Model	Voltage	Current	Resist-ance	Therm-istor	RTD	Thermo-couple	Load Cell	Acceler-ometer	Strain Gage
i60x	16/8	8	8	8	8	8	8		8
i420	20/10	10	10	10	10	10	10		10
i423	6di	6	6	6	6	6	6	6	6
i430	16/8	8	8	8	8	8	8		8
i100	16/8	8	8	8	8	8	8	8	8

Analog and Digital I/O Devices

Below is a list of available hardware products. For more details on each, click on the model number in the below table.

	Voltage Input			Voltage Outputs		Digital I/O	
Model	# of Chan	Range	Low Pass (KHz)	# of Chan	Range	# of Chan	mA Sink
i60x	16se/8di	±10V.. ±20mV				4	4
i420	20se/10di	±10V.. ±20mV				4	20
i423	6di	±5V..±5mV	0.006, 4			4	20
i430	16se/8di	±10V.. ±10mV		2 2	±10V 0-10V	4	20
i460						12 16	20 200
i410	The i410 connects Card Cage to Windows Computer via i2x0 instruNet Controller.						

i555 Starter System

The i555 Starter System, shown to the right, provides the following:

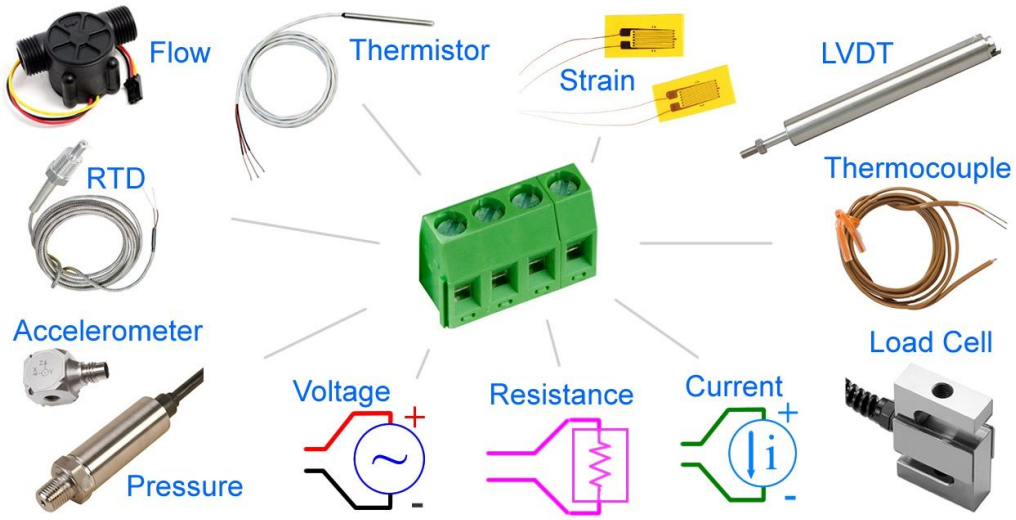
- USB 2.0 High Speed Data Acquisition Hardware for Windows ≥ Xp Sp3 (Xp/Vs/7/8/10)
- instruNet Software
- 16se/8di Voltage Inputs with 16-bit A/D Converter
- 2x Precision Voltage Outputs (±10V, 14bit D/A)
- 2x Voltage Outputs (0..+10V, 8bit D/A)
- 4x Universal Digital I/O (20mA sink, -10V..30V)
- Connect Directly To Sensors via i430 card: Voltage, Thermocouple, Thermistor, RTD, Load Cell, Strain Gage, Potentiometer, Current, Resistance
- Easily expand via 2 free slots in 4 slot i4xx Card Cage
- The i555 includes the following products: i240, i430, i510, i400, i410, i312.

Click to Enlarge

For details on the i555 Starter System, click here.

Connect a Specific Sensor to Specific Software

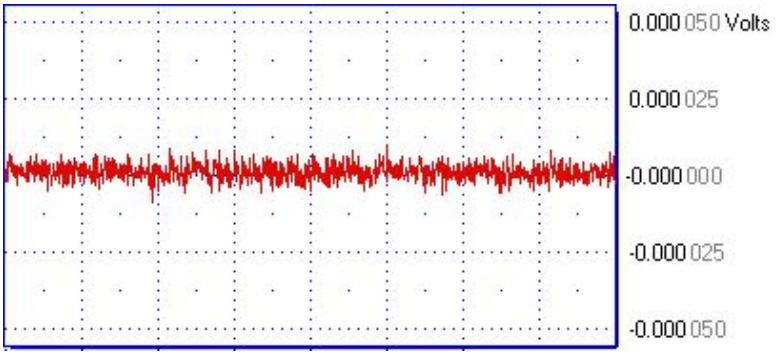
To learn how to connect a specific sensor to specific software, click here.



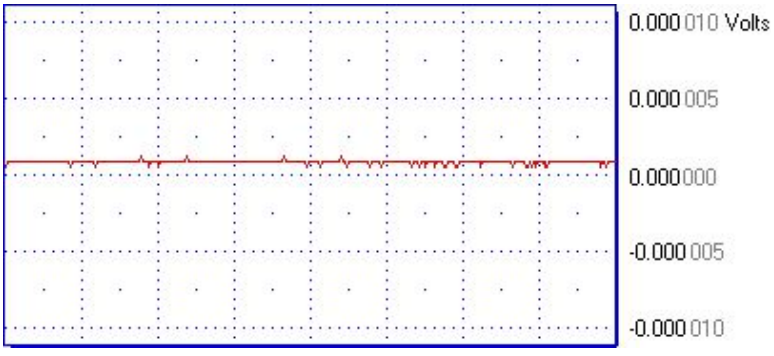
Low Noise facilitates High Accuracy

The i4xx card cage obtains high accuracy by placing the noisy microprocessor in an external box, away from the signa conditioning amplifiers in the card cage; as illustrated below.

The below picture shows the i430 card digitizing 0 Volts at a 1K sample-per-second rate on it's +-10mV range with 2.5 microvolts RMS of internal noise (no integration).



To further reduce noise, one can digitize more slowly and integrate each point. The below scenario is similar to the above, yet with 16 mSec integration per point at 60 samples-per-second resulting in 0.2 microvolts RMS of noise.



Maximum Sample Rates

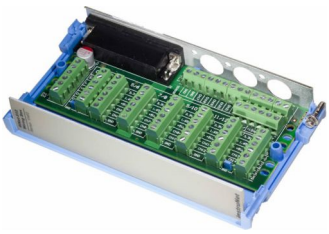
The following table shows maximum aggregate sample rates. To calculate the sample rate for each channel, divide by the number of channels attached to the i240/i60x controller. For example, if the maximum aggregate sample rate is 166Ksamples/sec/controller, and you digitize 4 channels, then you could digitize each channel at 41Ks/sec/channel. For more details on this table, click here. One can attach up to four i240/i60x controllers to a computer to increase total system throughput.

	Max Aggregate Sample Rate per Controller (K samples/second/controller)			
Model	±10V range	±5V range	±1.2V range	±10mV..±80mV range
i60x	33	33	25	3.6
i430	166	166	129	1.4
i420	94	90	83	1.4
i423		113	98	68
i100		166	133	1

i51x Wiring Boxes

#iNet-510

#iNet-511



#iNet-512

i51x wiring boxes easily bolt to i4xx/i60x devices. The i510 is the simplest and is included with the i555 starter system. The i511 includes 8 bnc connectors. The i512 has a vRef/2 source that is used to help complete ¼ bridge and ½ bridge strain gage circuits. If you are measuring thermocouples, then the i510 is the only wiring box that will work, since it contains an internal temperature sensor that measures the temperature of the i510 screw terminals. For more details on each, click on the model number in the below table.

Model	Bnc Connectors	Thermocouple Support	1/4 and 1/2 Bridge Strain Gage vRef/2 Support	Individual Banks of Screw Terminals for each sensor
i510	0	yes	no	no
i511	8	no	no	yes
i512	0	no	yes	yes

Low Cost 4/8/12/16 Slot i4xx Card Cage

The i400 product provides 4 slots, and multiple i400's can be bolted together by the end user, side-by-side, to create an 8, 12, or 16 slot system. In many applications, one i400 with 4 slots is sufficient. In order to do i4xx voltage measurements, at least one i43x A/D card is required; and only one i43x a/d card is needed for each card cage. Alternatively, the i60x are standalone tiny devices that require no additional components. instruNet i4xx cards are installed by the end user into an i4xx card cage. Each card is 13 x 2.5 x 13 cm in size.

4 Slots

16 Slots

8 Slots

12 Slots

Theory Of Operation

instruNet is a low-cost hardware card cage that attaches to Windows computers via high speed USB. The advantage of an i4xx card cage is one can mix and match modules as needed, to build exactly what they need. The advantage of the instruNet card cage is cost. For example, instruNet 4 to 16 slot chassis sell for $100 per slot, whereas comparable chassis are 2x to 4x more costly.

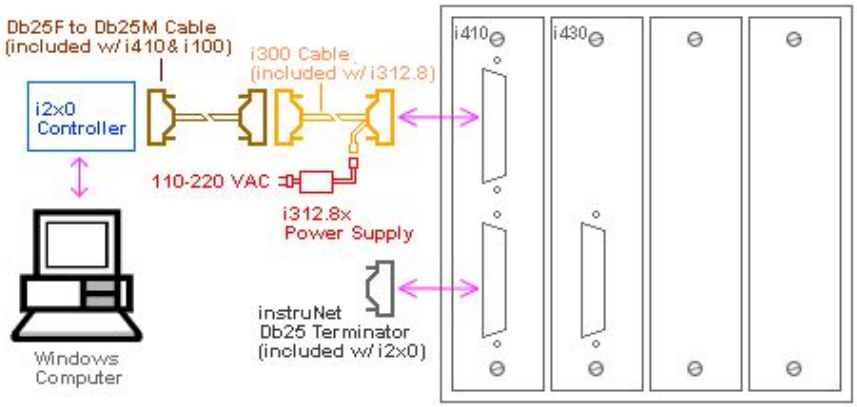
The instruNet card cage typically has one A/D measurement module; additional modules provide signal conditioning The conditioned analog signal is routed to the A/D module via the backplane. This is dramatically different from comparable systems, which place A/D measurement electronics on each module. The advantage of the instruNet topology is cost. After the first module is installed, additional instruNet channels are conditioned at approximately $40 per channel, whereas comparable systems typically cost 2x to 8x more.

instruNet measurement modules have universal inputs that enable one to directly connect each channel to one of: Thermocouple, Thermistor, Strain Gage, Load Cell, Counter/Timer, RTD, Voltage, Current, Resistance and Accelerometer. Absolute accuracy for all of these sensor types is specified. In some cases, the end user adds an external shunt resistor. The advantage of universal inputs is cost.

The optional 8-pole i500 analog low-pass filter daughterboard provides very accurate anti-aliased data at low cost.

Connect to Computer Via USB

Each instruNet Network is controlled by an instruNet i240/i60x DSP controller device that attaches to a Microsoft 32bit or 64bit Windows ≥ Xp Sp3, Vista, 7, 8 or 10 computer via High Speed USB at 480mbit/sec. Each i240/i60x Controller is an independent computer in itself that utilizes a powerful 32-bit DSP processor and onboard RAM to control all aspects of data acquisition along its network. All real-time tasks are off-loaded to this processor, therefore the host computer is not burdened with real-time issues. Each instruNet network supports up to 4 instruNet iNET-400 card cages.



Further Reading

- List of Instrunet Products
- Compatible Computers & Operating Systems
- Specifications: i60x, i420, i423, i430