High-Precision Data Acquisition

NI PCI-4351, NI PXI-4351

- Temperature and voltage loggers
- Accuracy – 0.42 °C for J-type thermocouples, 0.03 °C for thermistors, 0.12 °C for RTDs
- 16 voltage or 12 thermocouple inputs; up to 60 readings/s
- 8 digital I/O lines (TTL)
- Autozero and cold-junction compensation

Operating Systems
- Windows XP/2000/NT
- LabVIEW Real-Time

Recommended Software
- LabVIEW
- LabWindows™/CVI
- Measurement Studio

Driver Software (included)
- NI-435x instrument driver
- Traditional NI-DAQ (Legacy)

<table>
<thead>
<tr>
<th>Family</th>
<th>Bus</th>
<th>Voltage/ (Thermocouple) Channels</th>
<th>RTD Accuracy (°C)</th>
<th>Thermistor Accuracy (°C)</th>
<th>Resistance Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI 4351</td>
<td>PCI, PXI</td>
<td>16/(14)</td>
<td>0.12</td>
<td>0.03</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

Table 1. High-Precision DAQ Selection Guide

Overview
The NI PCI-4351 and PXI-4351 are precision computer-based digitizers designed specifically for high-accuracy temperature measurements (thermocouples, RTDs, thermistors), resistance measurements, chromatography measurements, and low-frequency analog signal measurements within ±15 V. Available for PCI and PXI/CompactPCI, these devices feature ±0.42 °C, J-type thermocouple accuracy; ±0.12 °C RTD accuracy; ±0.03 °C thermistor accuracy; 5½-digit voltage measurements; power line noise rejection filters; and precision current source for RTD and thermistor excitation. NI 4351 devices combine the functionality of stand-alone temperature and voltage meters and chromatographs with the flexibility and benefits of your computer, so you can build highly capable computer-based data-logging systems. As with all computer-based digitizers, NI 4351 devices can easily integrate into your Internet-based applications.

Hardware
Precision Analog Input
NI 4351 devices have 16 differential analog inputs. Each device has a 24-bit analog-to-digital converter (ADC) and six possible reading rates – 10, 50, and 60 readings/s in single-channel acquisition mode and 2.8, 8.8, and 9.7 total readings/s in multiple-channel acquisition mode. For channel speed, divide the total readings/s by the number of channels acquired. Digital filters automatically reject 50, 60, and 400 Hz noise, based on the reading rate. The input circuitry delivers ±42 V overvoltage protection and per-channel lowpass, antialiasing filters. An NI 4351 device features software-selectable ground referencing on a channel-by-channel basis, so you can measure both floating and ground-referenced signals together; it also features per-channel open-thermocouple detection. When open-thermocouple detection is enabled, the input channel is connected to +2.5 VDC through a 10 MΩ resistor. When a thermocouple breaks or is disconnected, the reading rapidly increases to 100 mV or more, indicating an open-circuit condition.

Precision Current Excitation
These devices feature a 25 μA precision current source for excitation of RTDs, thermistors, or other resistive devices. The source excites the total system resistance of up to 600 kΩ. An NI 4351 also features an additional 1 mA precision current source for RTDs or other resistive devices for total system resistance of up to 15 kΩ.

Digital I/O and Alarm Outputs
An NI 4351 has eight 5 V/TTL digital lines. You can individually configure each line as an input or an output. You can use the lines as general-purpose digital I/O or as control lines for alarms. Each line sinks or sources 8 mA. With the TBX-68T or CB-68T, you can increase the sinking and sourcing capability of these digital lines to 64 and 15 mA, respectively. With digital signal conditioning accessories, such as the ER-8, SSR Series, and the SC-206x, you can use an NI 4351 to control relays and drive optically isolated digital I/O.
High-Precision Data Acquisition

I/O Connector
NI 4351 devices have a 68-pin shielded latched male connector. ACH±<0..7/15> are the 8/16 differential analog input channels. AGND is the analog ground. IEX±<0..1> are for the current excitation sources (25 μA and 1 mA). DIO<0..3/7> are the TTL lines and are referenced to DGND.

Software
Instrument Driver
Use the NI-435x instrument driver to integrate a device into your test software. The instrument driver works with:
- NI LabVIEW
- NI Measurement Studio
- Visual C/C++
- Visual Basic

With a computer-based NI 4351 device, you can create distributed measurement systems with ease, taking full advantage of the Web.

Recommended Accessories
You can choose from several accessories, shown in Table 2, to accurately measure temperature, voltage, or resistance.

<table>
<thead>
<tr>
<th>Measurement Type</th>
<th>NI 435x Platforms</th>
<th>Accessory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermocouple only</td>
<td>PCI, PXI</td>
<td>TC-2190 and SH6868 cable</td>
</tr>
<tr>
<td>Voltage, resistance, chromatography only</td>
<td>PCI, PXI</td>
<td>TBX-68 and SH6868 cable</td>
</tr>
<tr>
<td>Temperature, voltage, resistance, chromatography</td>
<td>PCI, PXI</td>
<td>TBX-68T and SH6868 cable; CB-68T with CA-1000 and SH6868 cable</td>
</tr>
</tbody>
</table>

Table 2. NI 435x Accessory Selection Guide

Ordering Information
NI PCI-4351 .................................................................777789-01
NI PXI-4351 .................................................................777790-01
Includes instrument driver.
For more information on extended warranty and value-added services, visit ni.com/services.

BUY NOW
For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to ni.com/daq.
High-Precision Data Acquisition

**TC-2190** – Shielded, rack-mount adapter with 14 thermocouple miniconnectors, spring terminals for four digital I/O lines, isothermal construction, a cold-junction sensor on channel 0, and autozeroing circuitry on channel 1. Use with the SH6868 shielded cable.

TC-2190..................................................777510-01

**TBX-68T, CB-68T** – 68-pin, DIN-rail mountable terminal block with screw terminals for 14 unconditioned temperature, voltage, or resistance signals as well as for excitation. The TBX-68T also has eight digital I/O lines, isothermal design for cold-junction compensation, and autozeroing circuitry on channel 1.

The CB-68T is similar to the TBX-68T but is designed to mount inside the CA-1000 custom connectivity enclosure.

Both the TBX-68T and CB-68T provide circuitry to increase your sinking and sourcing capabilities to 64 and 15 mA, respectively. They also have two 26-pin connectors to which you can connect digital signal conditioning accessories such as the SSR-8, ER-8, and the SC-206x.

TBX-68T..................................................777232-01

CB-68T....................................................777926-01

**TBX-68** – General-purpose terminal block to which you can connect up to 16 unconditioned analog signals as well as excitation and digital signals. Use the TBX-68 with the SH6868 shielded cable.

TBX-68......................................................777141-01

**SH6868** – 68-pin shielded cable terminated with two 68-pin 0.050 series D-type connectors. The cable is used to connect an NI 4351 device to 68-pin accessories such as the TC-2190, TBX-68T, TBX-68, and CB-68T.

1 m ......................................................182419-01
2 m ......................................................182419-02

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TC-2190

TBX-68T

CB-68T and CA-1000

TBX-68
## Specifications

For complete specifications, see the NI 435x User Manual at [ni.com/manuals](https://ni.com/manuals).

### Thermocouple Accuracy

<table>
<thead>
<tr>
<th>TC Type</th>
<th>Error (°C)</th>
<th>Temperature Coefficient (°C/°C)</th>
<th>Accessory Error (°C)</th>
</tr>
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<tr>
<td></td>
<td>°C</td>
<td>10 Hz</td>
<td>50 Hz</td>
</tr>
<tr>
<td>J</td>
<td>-100</td>
<td>0.53</td>
<td>0.61</td>
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<tr>
<td></td>
<td>0</td>
<td>0.42</td>
<td>0.49</td>
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<td></td>
<td>760</td>
<td>0.42</td>
<td>0.47</td>
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<tr>
<td>K</td>
<td>-100</td>
<td>0.60</td>
<td>0.72</td>
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<tr>
<td></td>
<td>0</td>
<td>0.45</td>
<td>0.54</td>
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<tr>
<td></td>
<td>1,000</td>
<td>0.60</td>
<td>0.69</td>
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<tr>
<td></td>
<td>1,372</td>
<td>0.74</td>
<td>0.84</td>
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<tr>
<td>N</td>
<td>-100</td>
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<td>0.84</td>
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<tr>
<td></td>
<td>0</td>
<td>0.54</td>
<td>0.67</td>
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<tr>
<td></td>
<td>400</td>
<td>0.42</td>
<td>0.51</td>
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<td></td>
<td>1,300</td>
<td>0.57</td>
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<td>E</td>
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<td>0.62</td>
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<td>0.40</td>
</tr>
<tr>
<td></td>
<td>1,000</td>
<td>0.46</td>
<td>0.50</td>
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<tr>
<td>T</td>
<td>-150</td>
<td>0.81</td>
<td>0.96</td>
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<tr>
<td></td>
<td>0</td>
<td>0.46</td>
<td>0.55</td>
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<tr>
<td></td>
<td>400</td>
<td>0.33</td>
<td>0.39</td>
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<tr>
<td></td>
<td>1,000</td>
<td>0.72</td>
<td>0.99</td>
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<tr>
<td></td>
<td>1,767</td>
<td>0.91</td>
<td>1.19</td>
</tr>
<tr>
<td>R</td>
<td>250</td>
<td>0.82</td>
<td>1.16</td>
</tr>
<tr>
<td></td>
<td>1,000</td>
<td>0.72</td>
<td>0.99</td>
</tr>
<tr>
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<td>1,767</td>
<td>0.91</td>
<td>1.19</td>
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<tr>
<td>S</td>
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<td>0.91</td>
<td>1.28</td>
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<td>0.77</td>
<td>1.05</td>
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<td>1,767</td>
<td>0.96</td>
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<td></td>
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<td>1.08</td>
<td>1.24</td>
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<tr>
<td>B</td>
<td>1,000</td>
<td>0.76</td>
<td>1.14</td>
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<tr>
<td></td>
<td>1,020</td>
<td>0.74</td>
<td>1.05</td>
</tr>
</tbody>
</table>

### RTD Accuracy

<table>
<thead>
<tr>
<th>°C</th>
<th>10 Hz</th>
<th>50 Hz</th>
<th>60 Hz</th>
<th>Temperature Coefficient (°C/°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-200</td>
<td>0.05</td>
<td>1.00</td>
<td>1.33</td>
<td>1.81</td>
</tr>
<tr>
<td>0</td>
<td>0.12</td>
<td>1.14</td>
<td>1.49</td>
<td>2.00</td>
</tr>
<tr>
<td>100</td>
<td>0.16</td>
<td>1.22</td>
<td>1.58</td>
<td>2.10</td>
</tr>
<tr>
<td>300</td>
<td>0.23</td>
<td>1.38</td>
<td>1.76</td>
<td>2.32</td>
</tr>
<tr>
<td>600</td>
<td>0.36</td>
<td>1.68</td>
<td>2.08</td>
<td>2.69</td>
</tr>
</tbody>
</table>

### Thermistor Accuracy

- Temperature: 0 to 50 °C
- Error: 0.03 °C
- Temperature coefficient: 0.001 °C/°C

### Resistance Accuracy and DC Voltage Accuracy

For detailed resistance accuracy and DC voltage accuracy specifications, see the NI 435x User Manual at [ni.com/manuals](https://ni.com/manuals).

### Analog Input

- Number of channels: 16 differential or 14 temperature
- Digits: 5½
- Type of ADC: Delta-sigma
- ADC resolution: 24 bits, no missing codes
- Calibration cycle: 1 year

#### Analog Input Characteristics

<table>
<thead>
<tr>
<th>Mode</th>
<th>Reading Rate (Readings/s)</th>
<th>Power Line Noise Rejection (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single channel</td>
<td>10</td>
<td>50, 60, 400</td>
</tr>
<tr>
<td>50</td>
<td>50, 400</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Multiple-channel scanning</td>
<td>2.8 (1.4)</td>
<td>50, 60, 400</td>
</tr>
<tr>
<td>8.8 (2.1)</td>
<td>50, 400</td>
<td></td>
</tr>
<tr>
<td>9.7 (2.1)</td>
<td>50, 400</td>
<td></td>
</tr>
</tbody>
</table>

1Resistance ranges >50 k

2Total number of readings per second (for single-channel speed, divide by the number of channels acquired)

### Reading Rates

- Input coupling: DC
- Maximum working voltage (signal + common mode):
  - Range >2.5 V: Each input should remain within ±15 V of ground
  - Range ≤2.5 V: Each input should remain within ±2.5 V of ground
- Overvoltage protection:
  - (ACH<0..8/15>, IEX± <0..1>) ±42 V powered on, ±17 V powered off

### Amplifier Characteristics

- Input impedance:
  - Normal powered on: >1 GΩ in parallel with 0.39 µF
  - Powered off: 10 kΩ
  - Overload: 10 kΩ
Open-thermocouple detection .......................... 10 MΩ between CH+ and +2.5 V (software selectable)
Ground-referencing ........................................ 10 MΩ between CH- and ground (software selectable)
Input bias current ................................................ <500 pA
CMR (DC, 50 Hz, 60 Hz, 400 Hz)
Range ≥2.5 V .................................................. 80 dB
Range <2.5 V .................................................. 100 dB
NMR (50 Hz, 60 Hz, 400 Hz) ................................. >100 dB
Dynamic Characteristics
Bandwidth ......................................................... 20 Hz
Excitation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Level</th>
<th>Maximum Load Resistance</th>
<th>Temperature Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>±Ex0</td>
<td>±25 µA</td>
<td>600 kΩ</td>
<td>±15 ppm</td>
</tr>
<tr>
<td>±Ex1</td>
<td>±1 mA</td>
<td>15 kΩ</td>
<td>±15 ppm</td>
</tr>
</tbody>
</table>

Digital I/O and Alarm Outputs
Number of lines ............................................. 8
Compatibility ............................................... TTL

Digital Logic Levels
Power-on state .............................................. Tristate (weak pull-up)
Data transfers .............................................. Programmed I/O
Bus interface .............................................. PCI, PXI, USB

Power Requirements
+5 VDC
PCI-4351 .................................................... 480 mA
PXI-4351 .................................................... 480 mA

Physical
Dimensions
PCI ............................................................ 11.2 by 18.8 cm (4.4 by 7.4 in.)
PXI ............................................................ 10.0 by 16.0 cm (3.9 by 6.3 in.), 3U
I/O connector .............................................. 68-pin male, shielded and latched

Environment
Operating temperature ................................. 0 to 55 °C
Storage temperature ................................ -20 to 70 °C
Relative humidity ...................................... 10 to 90%, noncondensing

Safety and Compliance
Safety
This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:
- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility
This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:
- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note: For EMC compliance, operate this device according to product documentation.

CE Compliance
This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:
- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note: Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit ni.com/certification, search by model number or product line, and click the appropriate link in the Certification column.

Waste Electrical and Electronic Equipment (WEEE)
EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.
NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit ni.com/services.

Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit ni.com/training.

Professional Services

Our NI Professional Services team is composed of NI applications and systems engineers and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

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In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at ni.com/support.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit ni.com/ssp.

Hardware Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit ni.com/calibration.

Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit ni.com/services.