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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)



| Family | Bus | Voltage/ (Thermocouple) Channels | RTD Accuracy (°C) | Thermistor Accuracy (°C) | Resistance Measurement |
|---------|----------|--|-------------------------|--------------------------------|---------------------------|
| NI 4351 | PCI, PXI | 16/(14) | 0.12 | 0.03 | Excellent |

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 M Ω 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 μ A precision current source for excitation of RTDs, thermistors, or other resistive devices. The source excites the total system resistance of up to 600 k Ω . 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 k Ω .

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..37> 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.

| Measurement Type | NI 435x Platforms | Accessory |
|--|-------------------|--|
| Thermocouple only | PCI, PXI | TC-2190 and SH6868 cable |
| Voltage, resistance, chromatography only | PCI, PXI | TBX-68 and SH6868 cable |
| Temperature, voltage, resistance, chromatography | PCI, PXI | TBX-68T and SH6868 cable; CB-68T with CA-1000 and SH6868 cable |

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.

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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-2190777510-01

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-68T777232-01

CB-68T777926-01

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-68777141-01

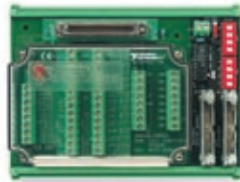
SH6868 – 68-pin shielded cable terminated with two 68-pin 0.050 series D-type connectors. The cable is used to connect an NI 4351 device to 68-pin accessories such as the TC-2190, TBX-68T, TBX-68, and CB-68T.

1 m182419-01

2 m182419-02



TC-2190



TBX-68T



CB-68T and CA-1000



TBX-68

High-Precision Data Acquisition

Specifications

» For complete specifications, see the *NI 435x User Manual* at ni.com/manuals.

Thermocouple Accuracy

| TC Type | Error (°C) | | | | Temperature Coefficient (°C/°C) | Accessory Error (°C) |
|---------|------------|-------|-------|-------|---------------------------------|----------------------|
| | °C | 10 Hz | 50 Hz | 60 Hz | | |
| J | -100 | 0.53 | 0.61 | 0.74 | 0.02 | 0.25 |
| | 0 | 0.42 | 0.49 | 0.59 | | |
| | 760 | 0.42 | 0.47 | 0.55 | | |
| K | -100 | 0.60 | 0.72 | 0.89 | 0.03 | 0.27 |
| | 0 | 0.45 | 0.54 | 0.67 | | |
| | 1,000 | 0.60 | 0.69 | 0.81 | | |
| | 1,372 | 0.74 | 0.84 | 0.99 | | |
| N | -100 | 0.68 | 0.84 | 1.08 | 0.03 | 0.26 |
| | 0 | 0.54 | 0.67 | 0.86 | | |
| | 400 | 0.42 | 0.51 | 0.65 | | |
| | 1,300 | 0.57 | 0.66 | 0.80 | | |
| E | -100 | 0.55 | 0.62 | 0.74 | 0.02 | 0.28 |
| | 0 | 0.41 | 0.46 | 0.55 | | |
| | 500 | 0.35 | 0.40 | 0.46 | | |
| | 1,000 | 0.46 | 0.50 | 0.57 | | |
| | T | -150 | 0.81 | 0.96 | | |
| 0 | 0.46 | 0.55 | 0.68 | | | |
| 400 | 0.33 | 0.39 | 0.47 | | | |
| R | 250 | 0.82 | 1.16 | 1.65 | 0.06 | 0.12 |
| | 1,000 | 0.72 | 0.99 | 1.37 | | |
| | 1,767 | 0.91 | 1.19 | 1.60 | | |
| S | 250 | 0.91 | 1.28 | 1.83 | 0.07 | 0.13 |
| | 1,000 | 0.77 | 1.05 | 1.47 | | |
| | 1,767 | 0.96 | 1.27 | 1.72 | | |
| B | 600 | 1.08 | 1.64 | 2.47 | 0.11 | 0.00 |
| | 1,000 | 0.76 | 1.14 | 1.69 | | |
| | 1,820 | 0.74 | 1.05 | 1.50 | | |

RTD Accuracy

| °C | Error (°C) (100 Ω RTD) | | | | | | Temperature Coefficient (°C/°C) |
|------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|
| | 10 Hz | | 50 Hz | | 60 Hz | | |
| | I _{EX1} ¹ | I _{EX0} ² | I _{EX1} ¹ | I _{EX0} ² | I _{EX1} ¹ | I _{EX0} ² | |
| -200 | 0.05 | 1.00 | 0.06 | 1.33 | 0.07 | 1.81 | 0.02 |
| 0 | 0.12 | 1.14 | 0.13 | 1.49 | 0.14 | 2.00 | – |
| 100 | 0.16 | 1.22 | 0.17 | 1.58 | 0.18 | 2.10 | – |
| 300 | 0.23 | 1.38 | 0.24 | 1.76 | 0.26 | 2.32 | – |
| 600 | 0.36 | 1.66 | 0.37 | 2.08 | 0.39 | 2.69 | – |

¹With 100 Ω RTD, 25 μA current source. ²With 100 Ω RTD, 1 mA current source (NI 4351 only).

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.

Analog Input

Input characteristics

| | |
|--------------------------|-----------------------------------|
| 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 |

| Mode | Reading Rate (Readings/s) | Power Line Noise Rejection (Hz) |
|--|---------------------------|---------------------------------|
| Single channel | 10 | 50, 60, 400 |
| | 50 | 50, 400 |
| | 60 | 60 |
| Multiple-channel ² scanning | 2.8 (1.4 ¹) | 50, 60, 400 |
| | 8.8 (2.1 ¹) | 50, 400 |
| | 9.7 (2.1 ¹) | 60 |

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 |
|----------------------------------|-------------------------------------|

Data transfers

Warm-up time

Amplifier Characteristics

Input impedance

| | |
|------------------------|--------------------------------|
| Normal powered on..... | >1 GΩ in parallel with 0.39 μF |
| Powered off | 10 kΩ |
| Overload..... | 10 kΩ |

High-Precision Data Acquisition

| | |
|-----------------------------------|---|
| Open-thermocouple detection | 10 M Ω between CH+ and +2.5 V (software selectable) |
| Ground-referencing | 10 M Ω between CH- and ground (software selectable) |
| Input bias current | <500 pA |
| CMR (DC, 50 Hz, 60 Hz, 400 Hz) | |
| Range \geq 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

| Parameter | Level | Maximum Load Resistance | Temperature Coefficient |
|-----------|------------|-------------------------|-------------------------|
| \pm Ex0 | 25 μ A | 600 k Ω | \pm 15 ppm |
| \pm Ex1 | 1 mA | 15 k Ω | \pm 15 ppm |

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 $^{\circ}$ C |
| Storage temperature | -20 to 70 $^{\circ}$ 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)

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