SCXI Chassis

NI SCXI-1000, NI SCXI-1000DC, NI SCXI-1001

- Shielded enclosures for SCXI modules
- Low-noise environment for signal conditioning
- Rugged, compact chassis
- Forced air cooling
- Optional rack mounting
- NI-DAQ driver software simplifies configuration and measurement
- 3 internal analog buses
- Timing circuitry for high-speed multiplexing
- AC, DC, or battery-power options

Operating Systems
- Windows 2000/NT/XP/Me/9x
- Mac OS

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio
- Lookout
- VILogger

Driver Software*
- NI-DAQ
- NI-SWITCH

*included with DAQ device or switch

Overview
National Instruments offers rugged, low-noise SCXI chassis to house, power, and control your SCXI modules and conditioned signals. The unique SCXI chassis architecture includes the SCXIbus, which routes analog and digital signals and acts as the communication conduit between modules. Chassis control circuitry manages this bus, synchronizing the timing between each module and the DAQ device. With this architecture, you can scan input channels from several modules in several chassis at rates up to 333 kS/s for every DAQ device.

The versatility of SCXI lies in its various chassis options and expandability. You can choose from a number of different standard AC or DC power options. You can control the system by connecting directly to an E Series or basic multifunction DAQ device. You can even daisy-chain up to eight chassis for control by a single DAQ device. Regardless of your configuration, programming the system does not change. You use the same function calls you use with a DAQ device by itself. NI-DAQ or NI-SWITCH driver software handles all low-level programming.

The SCXIbus
The SCXIbus is a guarded analog and digital bus located in the backplane of the SCXI chassis. Modules inserted into the chassis connect to this backplane automatically. This bus acts as a conduit for signal routing, transferring data, programming modules, and passing timing signals.

Chassis Control Circuitry
Each SCXI chassis includes control circuitry. This circuitry handles all signal routing on the SCXIbus. During high-speed analog input operations, it controls which input signals are connected to the bus and routed back to the DAQ device. It also ensures tight synchronization between the SCXI modules and the DAQ device.

INFO CODES
For more information, or to order products online visit *ni.com/info* and enter:

scxi1000
scxi1000dc
scxi1001

BUY ONLINE!

Expandability
If your initial system requires more SCXI modules than one chassis can hold, or your system requirements change, simply add another chassis. With the SCXI expandable architecture, you can daisy-chain up to eight chassis to a single multifunction DAQ device. Whether you are using a single-chassis or multichassis system, you can still acquire data at rates up to 333 kS/s.

Power Options
These SCXI chassis offer a number of standard AC power options. Simply choose the option for your country or a country compatible with your power specifications. If you move your system to another country, you can easily reconfigure the system for any of the other AC power configurations.

SCXI Chassis

SCXI-1000

The NI SCXI-1000 is a 4-slot chassis available with a number of standard AC power options. This chassis is ideal for single-chassis or low-channel count applications. If your application grows, you can daisy-chain two or more SCXI-1000 chassis. You can also use off-the-shelf true sine wave DC-to-AC power inverters to power AC chassis with a DC power supply.

SCXI-1001

The SCXI-1001 is a 12-slot chassis with a number of standard AC power options. Like the SCXI-1000 Series, you can daisy-chain up to eight chassis to acquire or control up to 3,072 channels with a single DAQ device. This chassis is ideal for high-channel-count systems. You can also use off-the-shelf true sine wave DC-to-AC power inverters to power AC chassis with a DC power supply.

SCXI-1000DC

The SCXI-1000DC is a 4-slot chassis that accepts DC power. You can power it with any 9.5 to 16 VDC power supply, or use the optional SCXI-1382 12 VDC battery pack (shown in the picture). You should also consider the optional SCXI-1383 power supply/float charger to operate the chassis from an AC power outlet when necessary. This chassis is ideal for portable applications or other times when AC power is not always available.

See page 319 for rack mount, panel-mount, and other power accessories.

Ordering Information

NI SCXI-1000 ....776570-0P*
NI SCXI-1000DC 776570-00
NI SCXI-1001 ....776571-0P*

*To choose your power option, replace the "P" with the appropriate number for your country's power:

1 – U.S. 120 VAC
2 – Swiss 220 VAC
3 – Australian 240 VAC
4 – Universal Euro 240 VAC
5 – North American 240 VAC
6 – United Kingdom 240 VAC
7 – Japanese 100 VAC

For information on extended warranty and value added services, see page 20.

Accuracy Specifications for Signal Conditioning

Every Measurement Counts

There is little room for error in your measurements. From sensor to software, your system must deliver accurate results. NI provides detailed specifications for our products so that you do not have to guess how they perform. Along with traditional specifications, our signal conditioning products include accuracy tables to assist you in selecting the appropriate hardware for your application. These tables are found on the specification pages for each product.

Absolute Accuracy

Absolute accuracy is the specification you must use to determine the overall maximum possible error of your measurement. Absolute accuracy does assume your signal conditioning equipment has been calibrated within the last year. There are four main components of an absolute accuracy specification:

- % of Reading is an uncertainty factor that is multiplied by the actual imput voltage for the measurement
- Offset is a constant value applied to all measurements
- System Noise is based on noise and depends on the number of points averaged for each measurement
- Temperature Drift is based on variations in your ambient temperature.

Absolute Acuracy RTI stands for relative to the input

Based on these components, the formula for calculating absolute accuracy for a given module is:

$$\text{Absolute Accuracy} = (\text{Actual Input Voltage} \times \%\text{ of Reading}) + \text{Offset} + \text{System Noise} + \text{Temperature Drift}$$

$$\text{Absolute Accuracy RTI} = \pm(\text{Absolute Accuracy}/\text{Actual Input Voltage})$$

Temperature effects are already taken into account unless your ambient temperature is outside of the 15 to 35 °C range. For instance, if your ambient temperature is at 45 °C, you must account for 10 °C of drift. This is calculated by:

$$\text{Temperature Drift} = \pm(\text{Actual Input Voltage} \times \%\text{ of Reading}/°\text{C} + \text{Offset}/°\text{C}) \times \text{Temperature Difference}$$

Below is an example for calculating the absolute accuracy for the SCXI-1102 using the ±100 mV input range while averaging 100 samples of a 14 mV input signal. In this calculation, we assume the ambient temperature is between 15 and 35 °C, so Temperature Drift = 0. Using the accuracy table on pge 262, you find the following numbers for the calculation:

Actual Input Voltage = 0.014

Percent of Reading Max = 0.02% = 0.0002

Offset = 0.000025 V

System Noise = 0.000005 V

$$\text{Absolute Accuracy} = \pm[(0.014 \times 0.0002) + 0.000025 + 0.000005]\ \text{V} = \pm 32.8\ \mu\text{V}$$

$$\text{Absolute Accuracy RTI} = \pm(0.0000328 / 0.014) = \pm 0.234\ \%$$

The following example assumes the same conditions, except the ambient temperature is 40 °C. You can begin with the Absolute Accuracy calculation above and add in the Temperature Drift.

$$\text{Absolute Accuracy} = 32.8\ \mu\text{V} + (0.014 \times 0.000005 + 0.000001) \times 5 = \pm 38.15\ \mu\text{V}$$

Accuracy Specifications for Signal Conditioning

In many cases, it is helpful to calculate this value relative to the input (RTI). Therefore, you do not have to account for different input ranges at different stages of your system.

Absolute Accuracy RTI = ±(0.00003815 / 0.014) = ±0.273 %

If you are making single-point measurements, use the Single-Point System Noise specification from the accuracy table. If you are averaging multiple points for each measurement, the value for System Noise changes. The Average System Noise provided in the accuracy table assumes that you average 100 points per measurement. If you are averaging a different number of points, use the following equation to determine your system noise:

System Noise = Average System Noise from table x SQRT(100/number of points)

For example, if you are averaging 1,000 points per measurement with the SCXI-1102 in the ±100 mV range, the system noise is determined by:

System Noise = 5 μV x SQRT (100/1000) = 1.58 μV

Absolute System Accuracy

Absolute System Accuracy represents the end-to-end accuracy including the signal conditioning and DAQ device. Because absolute system accuracy includes components set for different input ranges, it is important to use Absolute Accuracy RTI numbers for each component. See page 194 for information on how to calculate the Absolute Accuracy RTI for your particular DAQ device.

Total System Accuracy RTI = ±SQRT [(Module Absolute Accuracy RTI)^2 + (DAQ Device Absolute Accuracy RTI)^2]

The following example calculates the Absolute System Accuracy for the SCXI-1102 described in the first example, and a PCI-MIO-16XE-50 with an Absolute Accuracy RTI of 0.00368%.

Total System Accuracy RTI = ±SQRT [(0.00273)2 + (0.00003682)] = ±0.273%

Units of Measure

In many applications, you are measuring some physical phenomenon, such as temperature. To determine the absolute accuracy in terms of your unit of measure, you must perform three steps:

(1) Convert a typical expected value from the unit of measure to voltage
(2) Calculate absolute accuracy for that voltage
(3) Convert absolute accuracy from voltage to the unit of measure

Note, it is important to use a typical measurement value in this process, because many conversion algorithms are not linearized. You may want to perform conversions for several different values in your probable range of inputs.

For an example calculation, we want to determine the absolute system accuracy of an SCXI-1102 system with a PCI-MIO-16XE-50, measuring a J-type thermocouple at 100 °C.

(1) A J-type thermocouple at 100 °C generates 5.268 mV (from a standard conversion table or formula)
(2) The absolute accuracy for the system at 5.268 mV is ±0.59%. This means the possible voltage reading is anywhere from 5.237 to 5.299 mV.
(3) Using the same thermocouple conversion table, these values represent a temperature spread of 99.4 to 100.6 °C.

Therefore, the absolute system accuracy is ±0.6 °C at 100 °C.

Benchmarks

The calculations described above represent the maximum error you should receive from any given component in your system, and a method for determining the overall system error. However, you typically have much better accuracy values than what you obtain from these tables.

If you need an extremely accurate system, you can perform an end-to-end calibration of your system to reduce all system errors. However, you must calibrate this system with your particular input type over the full range of expected use. Accuracy depends on the quality and precision of your source.

We have performed some end-to-end calibrations for some typical configurations and achieved the results below:

Module	Empirical Accuracy
SCXI-1102	±0.25 °C at 250 °C ±24 mV at 9.5 V
SCXI-1112	±0.21 °C at 300 °C
SCXI-1125	±2.2 mV at 2 V

Table 1. Possible Empirical Accuracy with System Calibration

To maintain your measurement accuracy, you must calibrate your measurement device at set intervals. Calibration improves your accuracy and ensures that your end product meets its required specifications. We are continually updating the calibration services available for our products. For a current list of SCXI signal conditioning products with calibration services, please visit ***ni.com/calibration***