SCXI 8-Channel Simultaneous-Sampling Analog Input

NI SCXI-1140

- 8 channels
- Switch-selectable gains per channel
- ±30 V maximum overvoltage protection, powered on
- Connections for external timing signal
- Cascade with SCXI-1142 for applications requiring filtering
- NI-DAQ driver software simplifies configuration, measurement, and scaling

Operating Systems
- Windows 2000/NT/XP

Recommended Software
- LabVIEW
- LabWindows/CVI
- Measurement Studio
- VI Logger

Driver Software
- NI-DAQ 7

Module	Signal Compatibility (±20 mV to ±10 V)
SCXI-1140	✓

Table 1. Module Compatibility

Overview

The National Instruments SCXI-1140 is an 8-channel simultaneous-sampling differential amplifier module. Each channel contains a high input impedance instrumentation amplifier with switch-selectable gain followed by a track-and-hold (T/H) amplifier. The T/H amplifiers deliver simultaneous-sample-and-hold functionality, which is useful for preserving interchannel phase relationships. You can run the T/H outputs to eight different input channels on the DAQ device in parallel mode, or you can multiplex the output of two or more modules into one channel of the DAQ device in multiplexed mode.

Analog Input

Each analog input channel of the NI SCXI-1140 has an instrumentation amplifier with differential inputs. Using DIP switches, you can configure each channel independently for a gain of 1, 10, 100, 200, or 500. Each channel has input overvoltage protection of ±30 V powered on and ±15 V powered off. Operates in multiplexed or parallel mode.

Simultaneous Sampling

With the simultaneous-sample-and-hold feature of SCXI-1140, you can sample multiple signals with negligible skew time between channels. In track mode, the outputs of the T/H amplifiers follow their input. When put into hold mode, the amplifier outputs simultaneously freeze, holding the signal levels constant. You can then digitize these held signals with a DAQ device. The DAQ device can provide the hold trigger signal, or you can provide an external hold trigger signal through the front connector of the SCXI-1140, except when using a PXI-1010 or PXI-1011 combination chassis. To determine the maximum sampling, refer to page 795.

Calibration

You can connect the SCXI-1352 to one SCXI-1120, one SCXI-1142, or up to two SCXI-1121 modules configured for parallel mode to an auxiliary 16-pin connector located in the SCXI-1140 module to achieve simultaneous sampling of their parallel outputs. In this configuration, an SCXI terminal block is required only for access to the external hold trigger signal. The SCXI-1140 has offset and gain potentiometers so you can calibrate each channel manually.

SCXI 8-Channel Simultaneous-Sampling Analog Input

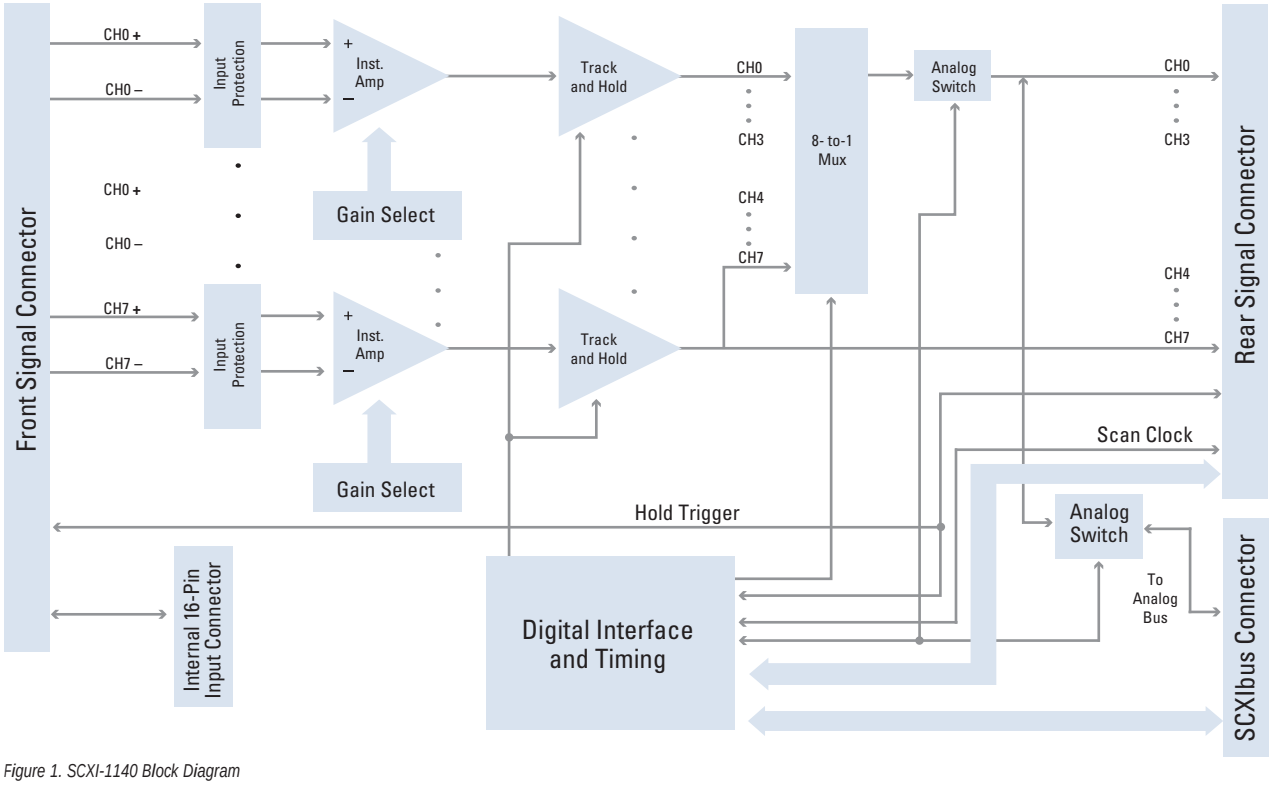

Figure 1. SCXI-1140 Block Diagram

Terminal Block	Part Number	Type	Special Functions	Page
SCXI-1301	777687-01	Screw terminals/front-mounting	–	328
SCXI-1304	777687-04	Screw terminals/front-mounting	AC coupling signal ground referencing	328
SCXI-1305	777687-05	BNC Connectors/front-mounting	BNC connectors/AC coupling ground referencing	328
SCXI-1310	777687-10	Solder pins	Low-cost connector and shell assembly	328

Figure 2. Terminal Block Options for SCXI-1140

Ordering Information

NI SCXI-1140 776572-40

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

BUY ONLINE!

Visit ni.com/info and enter scxi1140.

See page 276 for more information on a complete SCXI system.

SCXI Simultaneous-Sampling Analog Input and Lowpass Filter Specifications

Specifications

Maximum for 25 °C unless otherwise noted

Complete Accuracy Table

Module	Nominal Range*	Percent of Reading* Typical	Percent of Reading* Maximum	Offset	System Noise (peak, 3 sigma)* Single Point	System Noise (peak, 3 sigma)* Average	Temperature Drift Percent of Reading/°C	Temperature Drift Offset (µV/°C)
SCXI-1140	±10 V	±0.03	±0.075	±3.90 mV	600 µV	60 µV	±0.0025	±180
	±1 V	±0.06	±0.125	±0.55 mV	60 µV	6 µV	±0.0025	±25
	±100 mV	±0.1	±0.25	±0.24 mV	15 µV	1.5 µV	±0.0045	±12
	±50 mV	±0.5	±1.1	±0.22 mV	8 µV	0.8 µV	±0.01	±11
	±20 mV	±0.5	±1.1	±0.22 mV	8 µV	0.8 µV	±0.01	±11
SCXI-1141	±5 V	±0.02	±0.6	±0.60 mV	1420 µV	235 µV	±0.002	±10
SCXI-1142	±2.5 V	±0.02	±0.6	±0.60 mV	708 µV	117 µV	±0.002	±10
SCXI-1143	±1 V	±0.02	±0.6	±0.60 mV	280 µV	46.9 µV	±0.002	±10
	±500 mV	±0.02	±0.6	±0.60 mV	149 µV	23.5 µV	±0.002	±10
	±250 mV	±0.02	±0.6	±0.60 mV	71 µV	11.7 µV	±0.002	±10
	±100 mV	±0.02	±0.6	±0.60 mV	25 µV	4.69 µV	±0.002	±10
	±50 mV	±0.02	±0.6	±0.60 mV	15 µV	2.33 µV	±0.002	±10

*Absolute Accuracy (15 to 35 °C). To calculate the absolute accuracy for the SCXI-1100/1102/1102B/1102C/1104/1104C and or 1112 refer to page 194 or visit ***ni.com/accuracy***

Input Characteristics

Input coupling DC..... (AC with SCXI-1304 or SCXI-1305)

Maximum working voltage

Module	Signal + Common-mode
SCXI-1140	Average of two inputs should remain within ±7 V of ground
SCXI-1141, SCXI-1142, SCXI-1143	Each of two inputs should remain within ±5 V of ground

Overvoltage protection

Inputs protected..... CH<0..7>

Module	Powered On	Powered Off
SCXI-1140, SCXI-1141, SCXI-1142, SCXI-1143	±30 V	±15 V

Transfer Characteristics

Nonlinearity

Module	Input Range	Percent of Full Scale Range
SCXI-1140	±10 V to ±1 V	±0.01
	±100 V to ±50 V	±0.02
	±20 mV	±0.04

Offset Error..... See accuracy table

Gain Error..... See accuracy table

Amplifier Characteristics

Input Impedance

Module	Normal Powered On	Powered Off/Overload
SCXI-1140	100 G in parallel with 20 pF	10 k
SCXI-1141, SCXI-1142, SCXI-1143	10 G in parallel with 40 pF	2.4 k

Input bias current

SCXI-1140..... ±50 pA

SCXI-1141, SCXI-1142, SCXI-1143..... ±500 pA

Input offset current

SCXI-1140..... ±10 pA

SCXI-1141, SCXI-1142, SCXI-1143..... ±250 pA

CMRR (DC to 60 Hz)

Module	Input Range	Percent of Full Scale Range
SCXI-1140	±10 V	90 dB
	±1 V	104 dB
	±100 to ±20 mV	110 dB
SCXI-1141, SCXI-1142, SCXI-1143	±5 V	60 dB

Output range

SCXI-1140..... ±10 V

SCXI-1141, SCXI-1142, SCXI-1143..... ±5 V

Output impedance

Module	Multiplexed Mode	Parallel Mode
SCXI-1140	100	100
SCXI-1141, SCXI-1142, SCXI-1143	500	500

Dynamic Characteristics

Input signal bandwidth

Module	Input Range	Bandwidth (-3 dB)
SCXI-1140 (switch selectable)	±10 V	2 MHz
	±1 V	800 kHz
	±100 mV	500 kHz
	±50 mV	300 kHz
	±20 mV	120 kHz
SCXI-1141, SCXI-1142, SCXI-1143	±5 V to ±50 mV	Dependent on filter setting

Scan interval

Module	Scan Interval (Per Channel, Any Gain and Filter Setting) ±0.012%[1]	±0.006%[2]	±0.0015%[2]
SCXI-1141, SCXI-1142, SCXI-1143	3 µs	10 µs	20 µs

[1]Includes effects of PCI-6070E with 1 m or 2 m SCXI cable assembly.

[2]Includes effects of PCI-6032E SCXI cable assembly.

For a definition of specific terms, please visit *ni.com/glossary*

SCXI Simultaneous-Sampling Analog Input and Lowpass Filter Specifications

Specifications

System noise (See Accuracy Table)
THD (SCXI-1141,1142,1143)
- 1 kHz ..... -70 dB
- 0 to 25 kHz ..... -60 dB

Step response (10 V step) ..... Dependent on filter setting
Track time

	Accuracy		
Module	±0.012%	±0.003%	±0.0015%
SCXI-1140	7 µs	10 µs	50 µs

Droop rate ..... ±10 mV/s
Interchannel skew ..... ±50 ns
Intermodule skew ..... ±100 ns
Aperture delay time
- (from external sample check) ..... ±50 ns
- Hold step ..... - 5 mV

Filter Characteristics (SCXI-1141, 1142, 1143 Only)

Filter type
Cutoff frequency fc (-3 dB)
SCXI-1141 ..... 8th order Elliptic
SCXI-1142 ..... 8th order Bessel
SCXI-1143 ..... 8th order Butterworth
Range ..... 10 Hz to 25 kHz

Programmable values

Internal clock ..... 100 kHz/n, n 4
External clock ..... fext/(100n), n 1
Passband ripple

Module	To 85% of f_c
SCXI-1141	0.2 dB

Stopband attenuation

Module	80 dB
SCXI-1141	1.5 x fc
SCXI-1142	6 x fc
SCXI-1143	3.2 x fc

Attenuation rate
SCXI-1141 ..... 135 dB/octave
SCXI-1142 ..... 135 dB/octave
SCXI-1143 ..... 135 dB/octave

Maximum external clock frequency ..... 10 MHz

Stability

Recommended warm-up time ..... 20 minutes

Module	Range	Gain Temperature Coefficient	Offset Temperature Coefficient
SCXI-1140	±10 V to ±1 V	25 ppm/°C	±(10 + 150/gain) µV/°C
	±100 mV	45 ppm/°C	±(10 + 150/gain) µV/°C
	±50 mV	60 ppm/°C	±(10 + 150/gain) µV/°C
	±20 mV	100 ppm/°C	±(10 + 150/gain) µV/°C
SCXI-1141	All ranges	20 ppm/°C	±(10 + 200/gain) µV/°C
SCXI-1142			
SCXI-1143			

Physical

Dimensions ..... 3.0 by 17.3 by 24.4 cm (1.2 by 6.8 by 8.0 in.)

I/O Connector

Rear ..... 50-pin male ribbon cable connector
Front ..... 96-pin male DIN C connector
Internal ..... 16-pin male

Environment

Operating temperature ..... 0 to 50 °C
Storage temperature ..... -55 to 150 °C
Relative humidity ..... 5 to 90% noncondensing

Certification and Compliance

European Compliance CE

EMC ..... EN 61326-1, Group I Class A, 10 m, Table 1 Immunity
Safety ..... EN 61010-1

North American Compliance

EMC ..... FCC Part 15 Class A using CISPR

Australia & New Zealand Compliance

EMC ..... AS/NZS 2064.1/2 (CISPR-11)

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