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SCC Configuration Guide

SCC – Portable, Low-Cost Signal Conditioning

- Ideal for portable measurement systems
- Wide variety of direct signal and sensor connectivity options
- Wide range of analog and digital conditioning options
- Measurement type selectable on a per-channel basis
- Front-end signal conditioning for M Series, E Series, and some B Series multifunction DAQ devices



Configure Your SCC System in Six Steps

Step 1 – Select Your SCC Modules (Table 1)
Analog input, analog output, and digital I/O modules have dedicated slots. You can select up to eight noncascaded modules for analog input and eight modules for digital I/O. You can install feedthrough modules in any slot, but they are especially useful for accessing counter/timers on your M Series, E Series, or B Series multifunction DAQ device.

Step 2 – Choose an SCC Carrier (Table 2)
SCC carriers are available either with a hinged lid or with configurable connectors using panelettes. Hinged lids provide quick access to the modules. Configurable connectors provide custom signal-interface options.

Step 3 – Select Your Panelettes (Table 3)
If you have chosen an SCC carrier with configurable connectors, you can also select connector and interface panelettes. Different carriers offer different numbers of panelette slots. Also, some panelettes occupy more than one slot.

Step 4 – Determine Your Power Option (Table 4)
You can power an SCC system using a +5 VDC, 120/240 VAC, or 7 to 42 VDC external power source. To indicate the power option for your SCC system, select 01, 02, or 03 as the last two digits of the part number of the SC-2345 or SC-2350 carrier.

Please note that if you choose power option 01, it is possible to power your SCC system using the internal power source of your DAQ device. For DAQCard and DAQPad devices, the total power required by your SCC modules must be less than 800 mW (490 mW of analog power). For PCI or PXI and M Series or E Series multifunction DAQ devices, the total power required by your SCC modules must be less than 4.55 W (1.74 W for analog modules). Additional power modules are sold separately. To determine the power requirements of the modules in your SCC DAQ system, use the online SCC Advisor at **ni.com/advisors**.

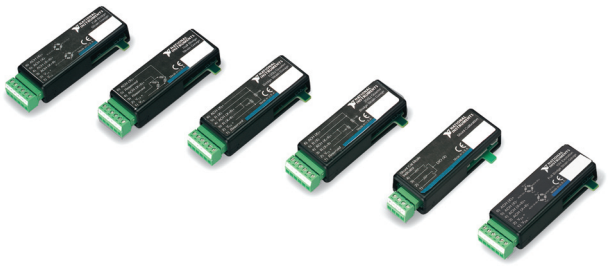
Step 5 – Select Your DAQ Device and Cable (Table 5)
Select the DAQ device to control your system.

Step 6 – Select Your Accessories
Choose from rack/panel-mount kits and stacking kits. You can also select additional power kits separately if your application requires multiple power configurations.

NATIONAL INSTRUMENTS™

SCC Configuration Guide

SCC Modules



			Signal Types															
	Module	Number of Channels	Millivolts/Volts	Current (0 to 20 mA)	Frequency-to-Voltage	Thermocouples	RTD	Strain Gages	Force, Load, Torque, Pressure	Accelerometer	TTL/CMOS	Description	Gain	Signal Range	Filtering	Isolation	Excitation Sources	Excitation Values	Page
Analog Input	SCC-AI0x	2 ISO	✓	–	–	–	–	–	–	–	–	Isolation amplifier	0.2 to 200	±50 mV to ±42 V	10 kHz	✓	–	–	9
	SCC-AI1x	2 ISO	✓	–	–	–	–	–	–	–	–	Isolation amplifier	1.2	±10 V, ±5 V	4 Hz	✓	–	–	9
	SCC-A10	2 DI	✓	–	–	–	–	–	–	–	–	Attenuator	0.1	±60 V	–	✓	–	–	11
	SCC-LP01	2 DI	✓	–	–	–	–	–	–	–	–	Lowpass filter	0.5	±10 V	25 Hz	–	–	–	12
	SCC-LP02	2 DI	✓	–	–	–	–	–	–	–	–	Lowpass filter	0.5	±10 V	50 Hz	–	–	–	12
	SCC-LP03	2 DI	✓	–	–	–	–	–	–	–	–	Lowpass filter	0.5	±10 V	150 Hz	–	–	–	12
	SCC-LP04	2 DI	✓	–	–	–	–	–	–	–	–	Lowpass filter	0.5	±10 V	1 kHz	–	–	–	12
	SCC-FV01	2 RSE	✓	–	✓	–	–	–	–	–	–	Frequency-to-voltage	1	0 to 100 Hz	–	–	–	–	13
	SCC-TC01	1 DI	✓	–	–	✓	–	–	–	–	–	Thermocouple input	100	±100 mV	2 Hz	–	–	–	4
	SCC-TC02	1 DI	✓	–	–	✓	–	–	–	–	–	Thermocouple input	100	±100 mV	2 Hz	–	–	–	4
	SCC-RTD01	2 DI	✓	–	–	–	✓	–	–	–	–	RTD input	25	±400 mV	30 Hz	–	1 current	1 mA	5
	SCC-SG01	2 DI	✓	–	–	–	–	✓	✓	–	–	Strain (1/4-bridge, 120 Ω)	100	±100 mV	1.6 kHz	–	1 voltage	2.5 V	6
	SCC-SG02	2 DI	✓	–	–	–	–	✓	✓	–	–	Strain (1/4-bridge, 350 Ω)	100	±100 mV	1.6 kHz	–	1 voltage	2.5 V	6
	SCC-SG03	2 DI	✓	–	–	–	–	✓	✓	–	–	Strain (1/2-bridge)	100	±100 mV	1.6 kHz	–	1 voltage	2.5 V	6
	SCC-SG04	2 DI	✓	–	–	–	–	✓	✓	–	–	Strain (full-bridge)	100	±100 mV	1.6 kHz	–	1 voltage	2.5 V	6
	SCC-SG11	2 DI	–	–	–	–	–	✓	✓	–	–	Strain shunt calibration	–	–	–	–	–	–	6
	SCC-SG24	2 DI	✓	–	–	–	–	–	✓	–	–	Full bridge input (350 Ω)	100	±100 mV	1.6 kHz	–	1 voltage	10 V	6
	SCC-ACC01	1 DI	✓	–	–	–	–	–	–	✓	–	IEPE accelerometer input	2	±5 V	19 kHz	–	1 current	4 mA	8
	SCC-CI20	2 DI	–	✓	–	–	–	–	–	–	–	Current input	–	0 to 20 mA	–	–	–	–	13
Output	SCC-AO10	1 ISO	✓	–	–	–	–	–	–	–	–	Isolated voltage output	–	±10 V	–	✓	–	–	10
	SCC-CO20	1 ISO	–	✓	–	–	–	–	–	–	–	Isolated current output	–	0 to 20 mA	–	✓	–	–	14
DIO/CTR	SCC-DI01	1 ISO	–	–	–	–	–	–	–	–	✓	Isolated digital input	–	±24 VDC	–	✓	–	–	14
	SCC-DO01	1 ISO	–	–	–	–	–	–	–	–	✓	Isolated digital output	–	30 VDC	–	✓	–	–	15
	SCC-RLY01[1]	1	✓	✓	–	–	–	–	–	–	–	SPDT Relay	–	5 A at 30 VDC 250 VAC	–	–	–	–	15
	SCC-CTR01	1 ISO	–	–	–	–	–	–	–	–	✓	Isolated counter/timer	–	0 to 48 VDC	–	✓	–	–	7
	SCC-FT01	2 SE/1 DI	–	–	–	–	–	–	–	–	–	Feedthrough	–	–	–	–	–	–	16

[1]The switching capability of SCC-RLY01 is not 5 A at 250 VAC throughout – it is 5 A at 250 VAC only if it is used with SCC-68, and it is 5 A at 30 VAC if used with SC-2345.

Table 1. SCC Module Selection Guide

SC-2345 and SC-2350 Carriers



Description	Number of Panelette Slots
SCC carrier with a hinged lid	–
SCC carrier with configurable connectors (side 68-pin interface)	18
SCC carrier with configurable connectors (rear 68-pin interface)	15

Table 2. SCC Carriers

Panelettes



Panelette	Description	Connectors/Units per Panelette	Slot Width
Minithermocouple jack	J or K-type or uncompensated	2 2	1 1
Thermocouple jack	J or K-type or uncompensated	1 1	1 1
BNC	BNC connector	2	1
SMB	SMB connector	4	1
Banana jack	Banana jack	2	1
LEMO (B Series)	2-pin female 4, 6-pin female	2 1	1 1
MIL-C-26482	2, 4, or 6-pin female	1	1
9-pin D-Sub	Single (male – female) Dual (male – female)	1 2	2 3
Momentary switch	On – off	2	1
Toggle switch	On – off – on	2	1
Rocker switch	On – off – on	1	1
LED	A red, green, yellow, and orange LED	4	1
Potentiometer	1 turn, 10 kΩ	1	1
Strain relief	Small	1	–
Blank	Filler panel	–	–

Table 3. Panelettes

Power Options

Power Type	Power Supplied By	Power Option
+5 VDC	DAQCard/DAQPad (800 mW maximum) PCI/PXI (4.55 W maximum)	-01
120 VAC, 240 VAC	External[1]	-02
7 to 42 VDC	External[2]	-03

[1]AC transformer included. However, you must purchase a separate power cord to match your country's power requirements.
[2]External power supply not included.

Table 4. SC-2345/SC-2350 Power Options

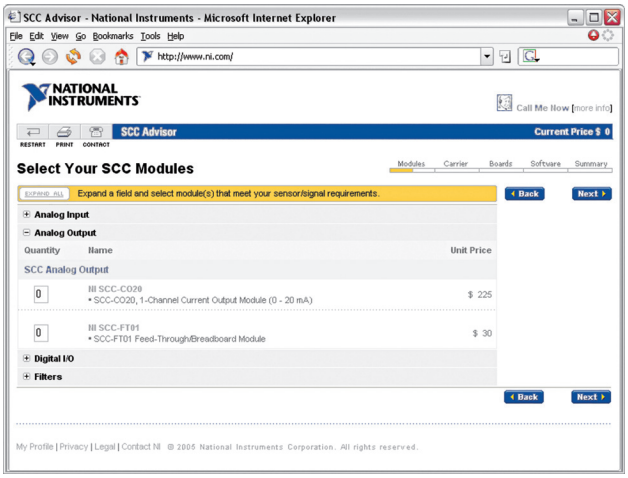
Recommended DAQ Devices



Product	Multifunction I/O Features	Bus	Cabling To
M Series	Multifunction I/O	PCI, PXI	SHC68-68-EP
DAQCard-6036E	16-bit, 200 kHz	PCMCIA	SHC68-68-EP
DAQPad-6020E	12-bit, 100 kHz	USB	SH68-68-EP
DAQPad-6070E	12-bit, 1 MHz	IEEE 1394	SH68-68-EP
68-pin PCI/PXI E Series	Multifunction I/O	PCI, PXI	SH68-68-EP
100-pin PCI/PXI E Series	Multifunction I/O	PCI, PXI	SH1006868
B Series	Multifunction I/O	PCI	SH68-68-EP

Table 5. National Instruments DAQ Devices

SCC Advisor



For more assistance in configuring your SCC system, visit the SCC Advisor at ni.com/advisors.

Portable, Modular Signal Conditioning Modules

NI SCC-TC Series Thermocouple Input



Model	Channel	Description	Part Number
SCC-TC01	1	Thermocouple, spade connector	777459-03
SCC-TC02	1	Thermocouple, screw terminals	777459-04

The National Instruments SCC-TC01 and SCC-TC02 are single-input modules for conditioning signals from a variety of thermocouple types, including J, K, T, B, E, N, R, and S, and millivolt inputs with a range of ±100 mV. The NI SCC-TC modules include a 2 Hz lowpass filter, an instrumentation amplifier with a gain of 100, and buffered outputs for maximum scanning rates by the multifunction DAQ device. The input circuitry of the SCC-TC modules also includes high-impedance bias resistors for open-thermocouple detection as well as handling both floating and ground-referenced thermocouples. The SCC-TC modules include an onboard thermistor for cold-junction compensation.

Two versions of the SCC-TC are available. The SCC-TC01 includes a 2-prong uncompensated thermocouple jack that accepts any miniature or subminiature 2-prong male thermocouple plug. The SCC-TC02 includes a removable screw-terminal plug that features an additional connection for grounding thermocouple shields.

Specifications

SCC-TC Series

Typical for 25 °C unless otherwise noted.

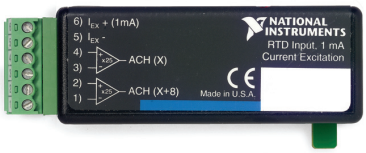
Input Characteristics

Number of channels	1 differential
Input signals	Thermocouples of type J, K, T, B, E, N, R, and S, ±100 mV
Input signal gain	100
Maximum input working voltage	±12 V of chassis ground
Overvoltage protection	
to DAQ device	±42 V_{pk} (powered on or off)
Nonlinearity	±0.004% maximum
Gain error	±0.08% of reading, maximum
Input impedance	
Normal powered on	10 MΩ
Powered off or overload	10 kΩ
Open thermocouple detection current	250 nA maximum
Common-mode rejection ratio	110 dB minimum
Bandwidth	2 Hz, dual-pole RC filter
Offset error	5 μV_{rms}, referred to input
Stability	
Offset temperature coefficient	±0.6 µV/°C maximum
Gain temperature coefficient	±0.0005%/°C
Cold-junction sensor (thermistor)	
Output	1.91 V (at 0 °C) to 0.58 V (at 55 °C)
Accuracy (15 to 35 °C)	±0.4 °C maximum

Power Requirements

Analog	60 mW

NI SCC-RTD01 RTD Input



Model	Channel	Description	Part Number
SCC-RTD01	2	2, 3, or 4-wire Pt RTD	777459-18

The National Instruments SCC-RTD01 is a dual-channel module that accepts 2, 3, or 4-wire platinum RTDs. Each channel of the NI SCC-RTD01 has an amplifier with a gain of 25 and a 30 Hz lowpass filter. In addition, the module has a 1 mA excitation source for powering the RTDs.

Specifications

SCC-RTD01

Analog Input

Number of input channels	2 differential
Input range	±400 mVDC (fixed gain of 25 on each channel)
Maximum working voltage (signal + common mode)	Each input should remain within ±12 V of ground
Overvoltage protection	±42 V_{pk}/25 VDC (powered on or off)
Input impedance	2 MΩ in parallel with 4.7 nF powered on; 20 kΩ min powered off
Filter type	Lowpass 3-pole Butterworth filter
-3 dB cutoff frequency	30 Hz
System noise	4.5 μV_{rms} (referred to input)

Transfer Characteristics

Gain	25
Gain error	±1.2%
Gain-error temperature coefficient	±10 ppm/°C
Offset error	±250 µV RTI
Offset-error temperature coefficient	±1.6 µV/°C
Nonlinearity	10 ppm of full scale
Recommended warm-up time	5 minutes (SCC system only)

Amplifier Characteristics

CMRR	110 dB at 60 Hz
Output range	±10 V

Excitation

Number of channels	1
Constant-current source	1 mA
Maximum voltage level without losing regulation	24 V
Drift	±127 ppm/°C

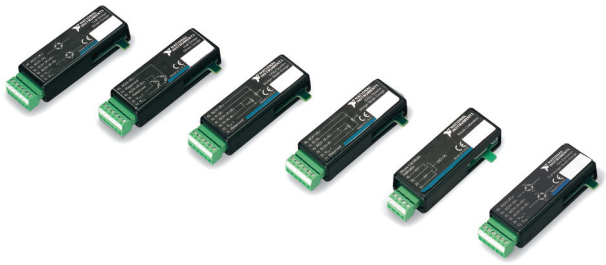
Environment

Operating temperature	0 to 50 °C
Relative humidity	5 to 90% noncondensing

Power Requirements

Analog	135 mW maximum
Digital	153 mW maximum

NI SCC-SG Series Strain Gage Input/Excitation



Model	Channel	Description	Part Number
SCC-SG01	2	120 Ω, quarter-bridge strain gages	777459-13
SCC-SG02	2	350 Ω, quarter-bridge strain gages	777459-14
SCC-SG03	2	Half-bridge strain gages	777459-15
SCC-SG04	2	Full-bridge strain gages	777459-16
SCC-SG11	2	Shunt calibration	777459-17
SCC-SG24	2	Full-bridge strain gages, load cells, pressure sensors, torque sensors	777459-37

The National Instruments SCC-SG Series consists of dual-channel strain gage modules for conditioning quarter, half, and full-bridge strain gages and a calibration module. Each module is designed for a specific type of bridge configuration. Each channel of an NI SCC-SG module (except SCC-SG11) includes an instrumentation amplifier, a 1.6 kHz lowpass filter, and a potentiometer for bridge-offset nulling. Each SCC-SG0x module also includes a single 2.5 V excitation source. The SCC-SG24 has a 10 V excitation source for load cells and pressure sensors.

The SCC-SG11 is a dual-channel shunt calibration module for use with the SCC-SG0x and SCC-SG24 modules. Each channel includes two terminals for wiring a switched 301 kΩ, 1 percent, 1/4 W resistor across any two points of your bridge. You enable shunt calibration for both channels of a module by writing a logic high to the digital line controlling the SCC-SG11. You disable shunt calibration by writing a logic low to the same digital line.

When you install an SCC-SG module in the SC-2345, the carrier routes the strain gage signals to two input channels of the multifunction DAQ device, channels x and x+8, where x is 0 through 7.

Specifications

SCC-SG0x

Input Characteristics

Number of channels ..... 2 differential
Input signal range ..... ±100 mV
Output signal range ..... ±10 V
Gain 100
Overvoltage protection ..... ±28 V_p (powered on or off)
Input impedance ..... 10 MΩ powered on, 10 kΩ powered off or overload
Gain error ..... ±0.8% of reading maximum
Offset error ..... ±5 µV
Bandwidth ..... 1.6 kHz (single-pole RC filter)
Excitation voltage ..... 2.5 V ±0.4%

Excitation Current Drive

SG01, SG02 ..... 42 mA (with 2 120 Ω gages)
SG03, SG04 ..... 60 mA (with 2 350 Ω gages)
Excitation drift ..... 13 mV/°C

Power Requirements

Analog ..... 143 mW
Digital ..... 210 mW

SCC-SG11

Number of channels 2
Control signal ..... 1 DIO channel
Resistor for each channel ..... 301 kΩ ±1%, socketed
Resistor temperature coefficient ..... ±100 ppm/°C

Power Requirements

Digital ..... 25 µW

SCC-SG24

Input Characteristics

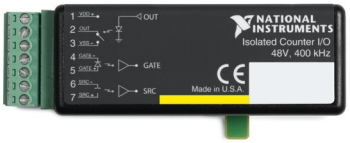
Number of channels ..... 2 differential
Input signal range ..... ±100 mV
Output signal range ..... ±10 V
Gain 100
Overvoltage protection ..... ±42 VDC powered on and powered off
Input impedance ..... 20 MΩ powered on >60 kΩ powered off or overload
Gain error ..... ±0.20% of reading max
Offset error ..... ±50 µV typ, 325 µV max before calibration[1]
Bandwidth ..... 1.6 kHz single-pole buffered RC filter
Excitation voltage ..... 10 V ±0.05%
Excitation current drive ..... 60 mA, based on two full-bridge 350 Ω strain gages
Excitation drift ..... 10 ppm/°C

Power Requirements

Analog ..... 340 mW
Digital ..... 930 mW

[1]By factory default, the nulling resistors are not installed in the SCC-SG24. See the user manual for information on installing the nulling resistors.

NI SCC-CTR01 Counter/Timer Isolation



Model	Channel	Description	Part Number
SCC-CTR01	1	0 to 48 V isolated counter/timer	779474-01

The National Instruments SCC-CTR01 is an isolated general-purpose counter/timer module for the SCC platform. This module performs in a wide variety of counter/timer tasks, including quadrature encoder measurement, edge counting, frequency measurement, pulse-width-modulation (PWM) generation, and pulse-train generation.

With optical isolation, the test system and UUT are protected from transient voltage spikes when the signals are connected to the SCC-CTR01. The SCC-CTR01 also features short-circuit protection that disables the outputs if current limits are reached.

Specifications

SCC-CTR01

Number of inputs ..... 2 (CTR_SRC, CTR_GATE)
Number of outputs ..... 1 (CTR_OUT)
Voltage range ..... 0 to 48 VDC
Isolation voltage ..... 60 VDC
Maximum input frequency ..... 400 kHz
Minimum pulse width ..... 1 µs

NI SCC-ACC01 Accelerometer Input



Model	Channel	Description	Part Number
SCC-ACC01	1	Accelerometer input	777459-19

The National Instruments SCC-ACC01 is a single-channel module that accepts Integrated Electronic Piezoelectric (IEPE) compatible sensors such as accelerometers and microphones. The NI SCC-ACC01 has an amplifier with a gain of two, a 0.8 Hz highpass filter, and a 19 kHz 3-pole Bessel lowpass filter. The maximum input range is ±5 V. In addition, this module has a 4 mA current source to power an accelerometer or microphone.

When you install the SCC-ACC01 into the SC-2345, the carrier routes the single output voltage to one input channel of the multifunction DAQ device, channel x, where x is 0 through 7. For example, if installed into the J1 socket of the SC-2345, the output voltage is routed to input channel 0 of the DAQ device.

Specifications

SCC-ACC01

Analog Input

Number of input channels	1 differential
Input range	±5 VAC (fixed gain of 2)
Input coupling	AC
-3 dB cutoff frequency	0.8 Hz
Filter type	Lowpass 3-pole Bessel
-3 dB cutoff frequency	19 kHz
Passband flatness	±0.3 dB, 10 Hz to 5 kHz ±1 dB, 5 Hz to 10 kHz
Maximum working voltage (signal + common mode)	Each input should remain within ±12 V of ground
Overvoltage protection	±40 VAC + DC (powered on or off)
Input impedance	5 MΩ in series with 0.39 µF (powered on or off)
System noise	130 μV_{rms} (referred to input)

Transfer Characteristics

Gain	2
Gain error	±1%
Gain-error temperature coefficient	±10 ppm/°C
Offset error	±3 mV (referred to input)
Offset-error temperature coefficient	±1.6 µV/°C
Nonlinearity	10 ppm of full scale
Recommended warm-up time	5 minutes

Amplifier Characteristics

CMRR	80 dB at 60 Hz
Output range	±10 V

Excitation

Number of channels	1
Constant-current source	4 mA
Maximum voltage level without losing regulation	24 V
Drift	±127 ppm/°C

Environment

Operating temperature	0 to 50 °C
Relative humidity	5 to 90% noncondensing

Power Requirements

Analog	89 mW
Digital	420 mW

NI SCC-AI Series Isolated Analog Input



Model	Channel	Input Range	Bandwidth	Part Number
SCC-AI01	2	±42 V	10 kHz	777459-20
SCC-AI02	2	±20 V	10 kHz	777459-21
SCC-AI03	2	±10 V	10 kHz	777459-22
SCC-AI04	2	±5 V	10 kHz	777459-23
SCC-AI05	2	±1 V	10 kHz	777459-24
SCC-AI06	2	±100 mV	10 kHz	777459-25
SCC-AI07	2	±50 mV	10 kHz	777459-26
SCC-AI13	2	±10 V	4 Hz	777459-27
SCC-AI14	2	±5 V	4 Hz	777459-28

National Instruments SCC-AI Series modules are dual-channel bank-isolated analog input modules for reading input voltages from ±50 mV to ±42 V. Each channel of an NI SCC-AI module includes an instrumentation amplifier, a lowpass filter, and a potentiometer for calibration. These modules are installation rated for CAT I, and provide safety working isolation of 60 VDC per module.

Specifications

SCC-AI Series

Input Characteristics

Number of channels..... 2 differential, isolation per module

Input impedance ..... 1 MΩ (SCC-AI01, SCC-AI02)
100 MΩ (all others)

Safety Isolation

Working common-mode voltage..... 60 VDC, CAT I[1]

Gain error ..... Adjustable to 0

Offset error..... Adjustable to 0

Power Requirements

Analog..... 410 mW

Digital ..... 610 mW

[1]Test isolation voltage is 2,350 VAC for 2 s.

Module	Input Range	Output Range	Gain	Filter Bandwidth
SCC-AI01	±42 V	±8.4 V	0.2	10 kHz
SCC-AI02	±20 V	±10 V	0.5	10 kHz
SCC-AI03	±10 V	±10 V	1	10 kHz
SCC-AI04	±5 V	±10 V	2	10 kHz
SCC-AI05	±1 V	±10 V	10	10 kHz
SCC-AI06	±100 mV	±10 V	100	10 kHz
SCC-AI07	±50 mV	±10 V	200	10 kHz
SCC-AI13	±10 V	±10 V	1	4 Hz
SCC-AI14	±5 V	±10 V	2	4 Hz

NI SCC-AO10 Isolated Analog Output



Model	Channel	Description	Part Number
SCC-AO10	1	±10 V isolated voltage output	777459-50

The National Instruments SCC-AO10 is a single-channel isolated analog voltage output module with an output range of ±10 V. Each channel of the NI SCC-AO10 is referenced to its own isolated ground, allowing up to 60 VDC of common-mode voltage between grounds (channel-to-channel or channel-to-chassis). In addition, the SCC-AO10 increases the output current drive capacity of an M Series, E Series, or B Series multifunction DAQ device to ±30 mA. Because the modules are isolated, you can cascade two SCC-AO10 modules for an output range of ±20 V. There is a maximum of two SCC-AO10 modules per carrier.

Note: Use the SCC-AO10 with only multifunction DAQ devices that have analog outputs.

Specifications

SCC-AO10

Output Characteristics

Number of output channels	1 nonreferenced single ended
Input range	±10 V
Output range	±10 V
Current drive	±30 mA
Gain nonlinearity	0.5% of full-scale output range
Propagation delay	10 µs
Output noise	2.5 mV_{rms} typ; 4 mV_{rms} max
Bandwidth	>23 kHz
Slew rate	1 V/µs

Safety Isolation

Channel-to-earth (signal + common mode)	60 VDC, CAT I

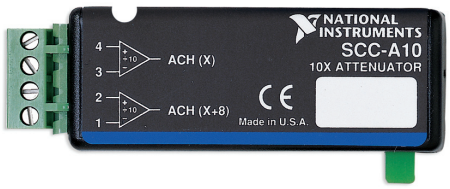
Environment

Operating temperature	0 to 50 °C
Relative humidity	10 to 90% noncondensing
Stability	
Output offset temperature coefficient	300 µV/°C
Gain temperature coefficient	300 ppm/°C

Power Requirements

Analog	180 mW
Digital	1.15 W

NI SCC-A10 Voltage Attenuator



Model	Channel	Description	Part Number
SCC-A10	2	Attenuator input	777459-06

The National Instruments SCC-A10 is a dual-channel module that accepts input voltage sources up to 60 VDC. Each channel of the NI SCC-A10 includes a 10:1 attenuation circuit and differential instrumentation amplifier with low-impedance outputs for maximum scanning rates by the multifunction DAQ device. The attenuation circuit includes high-impedance bias resistors, so you can connect floating or ground-referenced inputs to the SCC-A10 without adding external bias resistors. The SCC-A10 also provides overvoltage protection (up to 250 V_{rms}) for your DAQ system.

When you install an SCC-A10 module in the SC-2345, the carrier routes the attenuated input signals to two input channels of the DAQ device, channels x and x+8, where x is 0 through 7.

Specifications

SCC-A10

Input Characteristics

Number of channels..... 2 differential
Input range..... ±60 VDC
Output range..... ±6 VDC
Gain error..... ±0.14% of reading, maximum
Offset error..... ±6.5 mV maximum (referred to input)

Input impedance
  Normal powered on or off..... 1 MΩ
Full power bandwidth..... 10 kHz

Power Requirements

Analog..... 90 mW

NI SCC-LP Series Lowpass Filters



Model	Channel	Description	Part Number
SCC-LP01	2	Lowpass filter (25 Hz)	777459-07
SCC-LP02	2	Lowpass filter (50 Hz)	777459-08
SCC-LP03	2	Lowpass filter (150 Hz)	777459-09
SCC-LP04	2	Lowpass filter (1 kHz)	777459-10

The National Instruments SCC-LP Series consists of dual-channel lowpass filter modules that accept two ±10 V signals. Each channel has a 4th-order Butterworth filter. The cutoff frequency is specific to the module and applies to both channels of the module.

Specifications

SCC-LP Series

Amplifier Characteristics

Number of input channels ..... 2 differential
Input signal range ..... ±10 V
Output signal range ..... ±5 V
Gain 0.5
Overvoltage protection ..... ±40 V
Input impedance ..... 10 GΩ in parallel with 10 pF powered on 10 kΩ powered off or overload
Gain error ..... Adjustable to 0%
Offset error (RTI) ..... 350 µV typical, 1.5 mV maximum

Filter Characteristics

Filter type ..... 4th-order Butterworth
Stop-band attenuation rate ..... 80 dB/decade
Cutoff frequency ..... SCC-LP01 = 25 Hz
SCC-LP02 = 50 Hz
SCC-LP03 = 150 Hz
SCC-LP04 = 1 kHz

Passband Ripple

F_c = cutoff frequency

Passband	Typical	Maximum
DC to ½F_c	0 ± 0.04 dB max	0 ± 0.1 dB max
DC to ½F_c	0 ± 0.06 dB max	0 ± 0.2 dB max
DC to ⅔F_c	-0.2 ± 0.25 dB max	-0.2 ± 0.4 dB max
DC to F_c	-3 ± 0.3 dB max	-3 ± 0.5 dB max

System Noise

THD at F_c ..... <-90 dB
Wide band noise
(DC to 1 MHz, referred to input)..... 100 μV_{rms}
Narrow band noise
(DC to 33 kHz, referred to input) .... 6 μV_{rms}

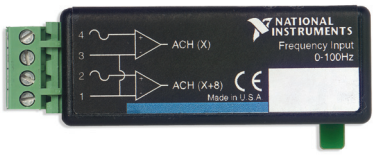
Stability

Gain temperature coefficient..... 10 ppm/°C typical, 20 ppm/°C maximum
Offset drift (RTI) ..... 3.4 µV/°C typical, 27 µV/°C maximum

Power Requirements

SCC-LP01, LP02
Analog..... 135 mW
SCC-LP03, LP04
Analog..... 475 mW

NI SCC-FV01 Frequency Input Module



Model	Channel	Description	Part Number
SCC-FV01	2	Frequency-to-voltage conversion (0 to 100 Hz)	777459-32

The National Instruments SCC-FV01 is a dual-channel frequency-to-voltage conversion module that accepts ±10 V signals up to 100 Hz. The output scales linearly with the input frequency, and goes to 0 V with a DC input signal. Each channel triggers on the incoming signal using a threshold of 0 V and a hysteresis of 200 mV. For isolated solutions, consider using the SCC-AI03 cascaded with the NI SCC-FV01.

Specifications

SCC-FV01

Input Characteristics

Number of input channels ..... 2 referenced single ended
Input range ..... 200 mV[1] to 10 V
Input coupling ..... DC
Minimum input frequency ..... 0 Hz
Minimum input pulse width
(5 V pulse train) ..... 1.5 µs
Overvoltage protection ..... ±40 VAC + DC (powered on or off)

Input impedance
Signal > threshold ..... 400 kΩ
Signal < threshold ..... 10 MΩ
Threshold ..... Zero crossing
Hysteresis ..... 200 mV

Transfer Characteristics

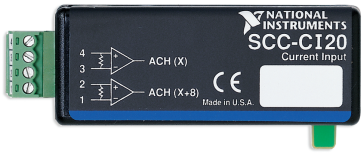
Rise/fall time ..... 80 ms (0 to +63%)
Step response ..... 220 ms at 90%; 360 ms at 99%
Output offset ..... 5 mV max
Output offset temperature coefficient ..... 10 ppm/°C
Gain error temperature coefficient ..... 100 ppm/°C
Nonlinearity ..... 0.015% full scale
Output ripple ..... 30 mV_{pp} at 10 Hz
Output range ..... 0 to +10 V
Recommended warm-up time ..... 5 minutes

Power Requirements

Analog ..... 100 mW

[1]Recommended; minimum 100 mV.

NI SCC-CI20 Current Input



Model	Channel	Description	Part Number
SCC-CI20	2	0 to 20 mA current input	777459-05

The National Instruments SCC-CI20 is a dual-channel module that accepts two 0 to 20 mA or 4 to 20 mA current loop inputs. Each independent channel of the NI SCC-CI20 includes a precision 249 Ω current conversion resistor that converts a 0 to 20 mA signal into a 0 to 5 V signal. Each channel includes a differential instrumentation amplifier with low-impedance outputs for maximum scanning rates by the multifunction DAQ device, and bias resistors for handling both floating and ground-referenced current sources. The SCC-CI20 also includes two spare 249 Ω resistors.

When you install the SCC-CI20 in the SC-2345, the carrier routes the two output voltages to two input channels of the DAQ device, channels x and x+8, where x is 0 through 7. For example, if you install the module in the J1 socket of the SC-2345, the output voltages are routed to input channels 0 and 8 of the DAQ device.

Specifications

SCC-CI20

Input Characteristics

Number of channels ..... 2 differential
Input range ..... 0 to 20 mA
Output range ..... 0 to 5 V
Gain error ..... ±0.1% of reading maximum
Offset error ..... ±0.6 mV maximum
Input resistor ..... 249 Ω, 0.05%, 0.25 W
Full power bandwidth ..... 10 kHz

Power Requirements

Analog ..... 100 mW

NI SCC-CO20 Isolated Current Output



Model	Channel	Description	Part Number
SCC-CO20	1	Isolated current output	777459-33

The National Instruments SCC-CO20 is a single-channel isolated current output module that can provide up to 20 mA. This module is installation rated for CAT I, and provides a safe working voltage of 60 VDC. Because the modules are isolated, you can connect two NI SCC-CO20 modules in parallel to provide up to 40 mA.

The SCC-CO20 plugs into either analog output socket, J17 or J18. The voltage applied to the module from an analog output channel of a multifunction DAQ device sets the current output. Because there are two output channels on DAQ devices, there are a maximum of two SCC-CO20 modules per carrier.

Note: Use the SCC-CO20 with only multifunction DAQ devices that have analog outputs.

Specifications

SCC-CO20

Output Characteristics

Number of channels..... 1
Output referencing..... Nonreferenced (floating)
Input range..... 0 to 10 V
Output range..... 0 to 20 mA
Voltage compliance..... 12.5 V

Safety Isolation

Working common-mode voltage..... 60 VDC, CAT I

Environment

Operating temperature..... 0 to 50 °C
Relative humidity..... 10 to 90%, noncondensing

Power Requirements

Analog..... 175 mW
Digital..... 645 mW

NI SCC-DI01 Optically Isolated Digital Input



Model	Channel	Description	Part Number
SCC-DI01	1	Isolated digital input	777459-11

The National Instruments SCC-DI01 is a single-channel, optically isolated digital input module for sensing digital signals up to 30 VDC, including TTL. This digital input module can sense both AC and DC signals and has a status LED for visual verification of the module input status.

The NI SCC-DI01 fits in any SC-2345 socket J9 through J16. When you install an SCC-DI01 in one of these sockets, the digital signal is automatically routed to a DIO line of the multifunction DAQ device. For example, socket J9 connects to digital line 0 of the data acquisition device. Because you can configure multifunction DAQ devices for input or output on a line-by-line basis, you can have between one and eight SCC-DI01 modules per carrier.

Specifications

SCC-DI01

Input Characteristics

Number of channels..... 1
Input range..... 30 VDC or 30 VAC

Digital Logic Levels

Input current
5 V input..... 1.5 mA
24 V input..... 7.0 mA
Isolation..... 42 VDC from computer ground

Power Requirements

Digital..... 61 mW

SCC-DO01 Optically Isolated Digital Output



Model	Channel	Description	Part Number
SCC-DO01	1	Isolated digital output	777459-12

The National Instruments SCC-DO01 is a single-channel, optically isolated digital output module for switching external devices. The NI SCC-DO01 optical isolation circuitry handles up to 24 VDC and includes a status LED for visual verification of the module output status. The SCC-DO01 includes an external switch with which you can configure the power-up state of the module either high or low.

The SCC-DO01 plugs into any SC-2345 socket between J9 and J16. When you install the module in one of these sockets, the digital signal is controlled by a DIO line of the multifunction DAQ device. For example, socket J9 connects to digital line 0 of the DAQ device. Because you can configure DAQ devices for input or output on a line-by-line basis, you can have from one to eight SCC-DO01 modules per carrier.

Specifications

SCC-DO01

Output Characteristics

Number of channels..... 1
Compatibility..... TTL-compatible
Supply voltage range..... 5 to 24 VDC

Digital Logic Levels

Configuration 1

Logic Level	Output Voltage Level between V_{out} and V_{com}
Low (I_{01} = 0 mA)	0 V
High (I_{01} = 25 mA)	22 VDC at V_{ss} = 24 V 3 VDC at V_{ss} = 5 V

Configuration 2

Logic Level	Output Voltage Level between V_{out} and V_{com}
Low (I_{02} = 25 mA)	0.4 V
High (I_{02} = 0 mA)	V_{ss}

Maximum continuous load current (I_O)
  Configuration 1..... 86 mA
  Configuration 2..... 120 mA
Minimum load resistance (at V_{ss} = 24 V)
  RLOAD1..... 196 Ω
  RLOAD2..... 184 Ω

Power Requirements

Digital..... 69 mW

NI SCC-RLY01 SPDT Relay



Model	Channel	Description	Part Number
SCC-RLY01	1	SPDT relay	777459-34

The National Instruments SCC-RLY01 is a single-channel relay module for switching external devices. It contains one single-pole, double-throw (SPDT) relay capable of switching 5 A at 30 VDC or 250 VAC when used with the SCC-68 and 5 A at 30 VDC or 30 VAC when used with the SC-2345. The NI SCC-RLY01 uses positive logic. A digital high sets the relay, and a digital low resets it.

The SCC-RLY01 plugs into any SC-2345 socket between J9 and J16. When inserting an SCC-RLY01, a DIO line of the multifunction DAQ device controls the digital signal. For example, socket J9 connects to digital line 0 of the data acquisition device. Because you can configure the DAQ devices for input or output on a line-by-line basis, you can have from one to eight SCC-RLY01 modules per carrier.

Specifications

SCC-RLY01

Number of channels..... 1
Nominal switching capacity..... 5 A at 250 VAC[1], 5 A at 30 VDC
Contact resistance..... 30 mΩ
Switching time
  Operate time (NC to NO)..... 5 ms (10 ms max)
  Release time (NO to NC)..... 4 ms (5 ms max)
Maximum speed..... 30 operations/s at rated load
Contact lifetime..... 5 x 10^7 operations at 180 operations/minute (minimum)

[1]The nominal switching voltage is 250 VAC when using a high-voltage backshell in an NI SCC-68 carrier. Otherwise the module is rated for only 30 VAC.

NI SCC-FT01 Feedthrough



Model	Channel	Description	Part Number
SCC-FT01	2 SE/1 DI	Feedthrough	777459-01

The National Instruments SCC-FT01 is a feedthrough module that offers direct connection to analog input, analog output, digital I/O, and GPCTR channels of the DAQ device. For analog input channels, you can connect to either two single-ended or one differential channel. The NI SCC-FT01 includes a breadboard area for development of custom signal conditioning circuitry.

If you install the SCC-FT01 in an analog input socket (J1 through J8, SC-2345 or SC-2350) or analog output socket (J17 or J18, SC-2345 only) then you have direct connection to the corresponding channels of the DAQ device. You can add custom conditioning to the SCC-FT01 for these analog inputs or outputs. In any socket, the SCC-FT01 module has access to 5 and ±15 VDC power. If you use the breadboard area for custom conditioning, you can cascade the SCC-FT01 with other SCC modules for dual-stage conditioning.

Specifications

SCC-PWR Series

SCC-PWR01

Input	+5 VDC ±5% from an external source, or +5 VDC from DAQ device
Output	+5 VDC, 100% efficiency, ±15 VDC, 62% efficiency

SCC-PWR02

Input	90 to 264 VAC, 1 A maximum
Output	+5 VDC, 1 A, ±15 VDC, ±0.3 A

SCC-PWR03

Input	7 to 42 VDC
Output	+5 VDC, 75% efficiency, ±15 VDC, 46% efficiency

Physical

Dimensions	
SCC modules	8.9 by 2.9 by 1.9 cm (3.5 by 1.2 by 0.7 in.)
SC-2345 connector block	24.1 by 26.2 by 3.94 cm (9.5 by 10.3 by 1.6 in.)
SC-2345 with configurable connectors	30.7 by 25.4 by 4.3 cm (12.1 by 10 by 1.7 in.)
External AC adapter (for SCC-PWR02)	15.5 by 8.5 by 4.8 cm (6.1 by 3.3 by 1.9 in.)
Connectors	
SC-2345 cable	68-pin male SCSI II
SCC input	Removable screw terminal or minithermocouple connector
SCC output	20-pin right-angle male connector

Certification and Compliance

SCC-AIxx	300 V, CAT II working voltage
SCC-AO10	300 V, CAT II working voltage

European Compliance

EMC	EN 61326 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 and New Zealand Compliance

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

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