SC-2075 Signal Conditioning Accessory

The SC-2075 is a desktop signal conditioner that you can connect directly to National Instruments E Series or 1200 Series devices. The SC-2075 has the following features:

- Binding posts
  - Three for ±15 V outputs
  - Two for 0 to 5 V outputs
  - Two for measuring analog signals or DC voltages
- BNC connectors
  - Two for analog inputs
  - Two for analog outputs
  - One for triggering
- Spring terminals
  - Eleven for analog inputs
  - Seven for analog controls
  - Seven for counter controls
  - Two for TTL-level power and ground signals
  - Eight for digital input/output (DIO) signals

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What You Need to Get Started

To set up and use your SC-2075, you need the following items:

- ❑ SC-2075 signal conditioner
- ❑ *SC-2075 Signal Conditioning Accessory User Guide*
- ❑ 68-pin E Series device and 68-pin cable
  or 50-pin 1200 Series device and 50-pin ribbon cable
- ❑ BNC cables
- ❑ Banana plug cables
- ❑ Wire no larger than 24 AWG
- ❑ Wire strippers
- ❑ Safety glasses

Conventions

The following conventions are used in this guide:

This icon denotes a note, which alerts you to important information.

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

This icon, which is found on the SC-2075 signal conditioning accessory, denotes a hot surface hazard. It advises you to take precautions to avoid burns.

bold Bold text denotes E Series signal names.

italic Italic text denotes emphasis, a cross reference, a label name, or a 1200 Series signal name

Safety Information

Cautions *Do not operate the device in an explosive atmosphere or where there may be flammable gases or fumes.*

Do not operate damaged equipment. The safety protection features built into this device can become impaired if the device becomes damaged in any way. If the device is damaged, turn the device off and do *not* use until service-trained personnel can check its safety. If necessary, return the device to National Instruments for service and repair to ensure that its safety is not compromised.

Do *not* operate this equipment in a manner that contradicts the information specified in this document.

Do not substitute parts or modify equipment. Because of the danger of introducing additional hazards, do *not* install unauthorized parts or modify the device. Return the device to National Instruments for service and repair to ensure that its safety features are not compromised.

Connections, including power signals to ground and vice versa, that exceed any of the maximum signal ratings on the device can create a shock or fire hazard or can damage any or all of the devices connected to the SC-2075 and the host computer. National Instruments is *not liable for any damages or injuries* resulting from incorrect signal connections.

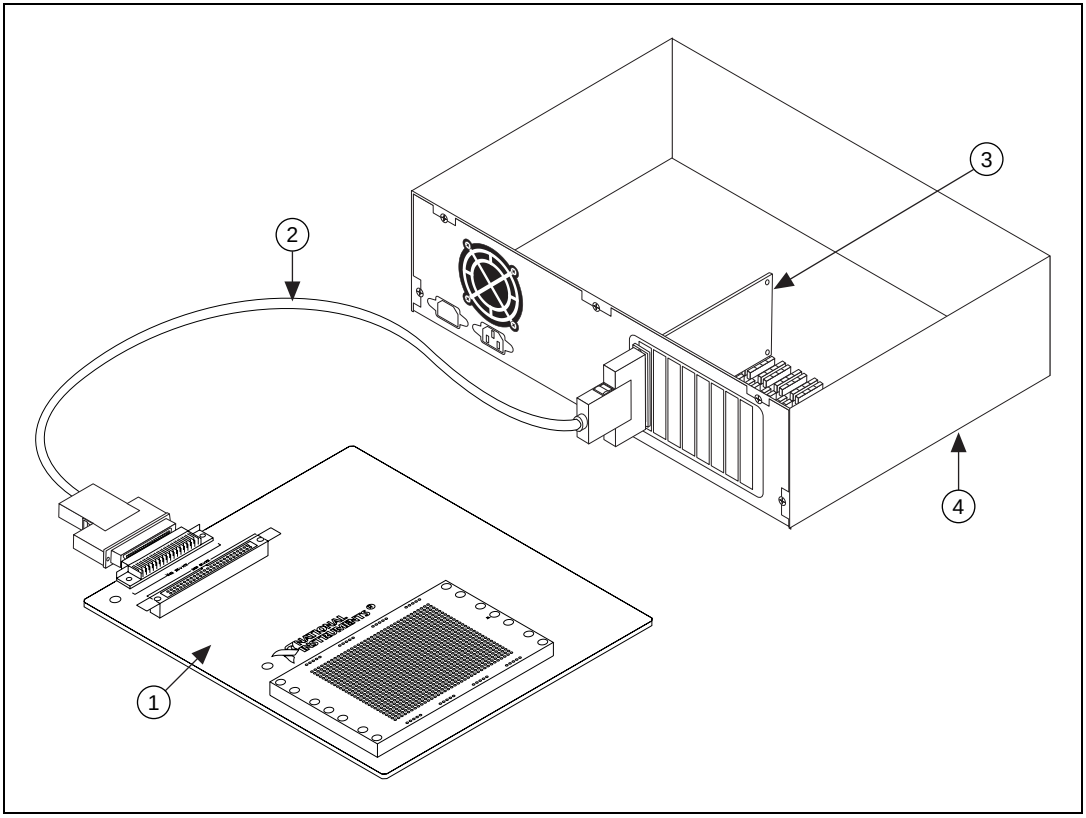
Clean the device by brushing off light dust with a soft, nonmetallic brush. Remove other contaminants with deionized water and a stiff nonmetallic brush. The unit must be completely dry and free from contaminants before returning to service.

The SC-2075 can have sharp edges. To avoid injury, use caution when handling the device

When your SC-2075 is powered on, always wear safety glasses when working with prototype circuits you design.The SC-2075 can have sharp edges.

Installing Your SC-2075

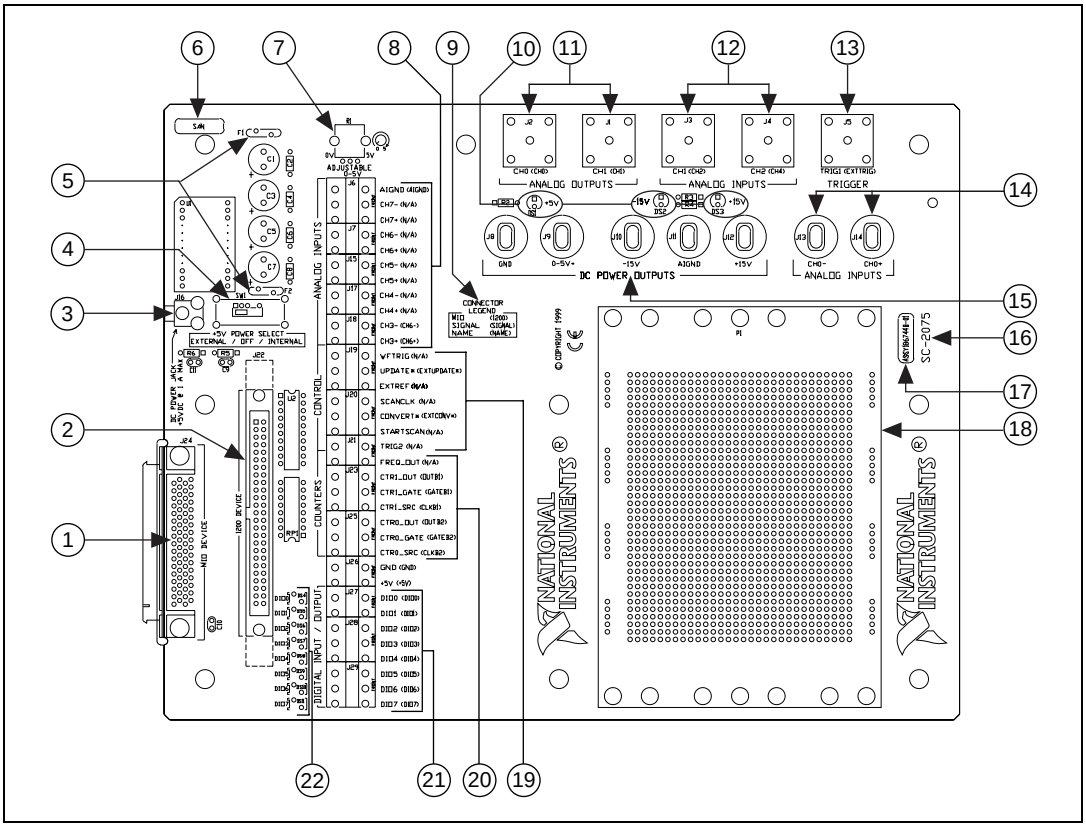
To connect your SC-2075 signal conditioner to an E Series or 1200 Series device, connect one end of the cable to your device and the other end to the SC-2075 signal conditioner. Figure 1 shows a typical SC-2075 setup using an E Series device.



1 SC-2075, for Orientation Reference Only	2 SH6868 Cable	4 Computer
	3 E Series Device	

Figure 1. Typical SC-2075 Setup with an E Series Device

Figure 2 shows the location of all SC-2075 connections.



1	E Series Connector	9	Legend	16	Product Name
2	1200 Series Connector	10	Power LED Status Indicators	17	Assembly Number
3	DC Power Jack	11	Analog Output BNCs	18	Prototyping Breadboard Area
4	+5 V Power Select Switch SW1	12	Analog Input BNCs	19	Control Spring Terminals
5	Fuses	13	Trigger BNC	29	Counter Spring Terminals
6	Serial Number	14	Analog Input Banana Plugs	21	DIO Spring Terminals
7	0–5 V Potentiometer	15	DC Power Output Banana Plugs	22	DIO LED Status Indicators
8	Analog Input Spring Terminals				

Figure 2. SC-2075 Connection Location Diagram

The three power indicator LEDs should be lit when switch SW1 is in the *External* or *Internal* position. When SW1 is in the *External* position, a +5 VDC external power source supplies power to the DC Power Jack. When SW1 is in the *Internal* position, the E Series or 1200 Series device supplies the power. When SW1 is in the *Off* position, all power is off and all LEDs should be off. Table 1 shows the power source, switch position, and LED status of possible SC-2075 power configurations. If any of the LEDs are not lit in a configuration in which they should be lit, verify that

the powered device cable is properly connected. Figure 3 shows a diagram of the SC-2075 power switch.

Table 1. SC-2075 Power Configurations

SW1 Switch Position	Power Source	LED Status
Off	None	Off
Internal	Device	On
External	DC Power Jack J16[1]	On

[1] When using an external power source make sure the power cord is attached and plugged into a power outlet.

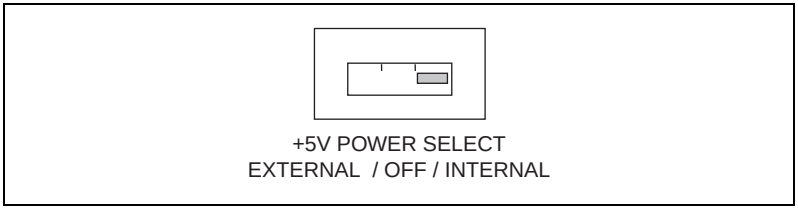


Figure 3. SC-2075 Switch SW1 Diagram

Analog Input

You can use the SC-2075 to measure either of the following analog inputs:

- Up to eight differential analog input channels when used with an E Series device
- Up to four differential analog input channels when used with a 1200 Series device

Note You must configure your E Series or 1200 Series device for *differential* analog input mode before making connections to the SC-2075.

Each connector on the SC-2075 has a channel name label corresponding to both an E Series device and a 1200 Series device. The channel name in bold text corresponds to an E Series device channel and the italicized text corresponds to a 1200 Series device channel. For example, the BNC connector labeled **CH1***(CH2)* means that this BNC connector connects to CH1 of the E Series device or CH2 of the 1200 Series device.

Analog Output

The SC-2075 allows access to two analog outputs through BNC connectors of the E Series and 1200 Series devices. The analog output BNC connectors labeled **CH0***(CH0)* and **CH1***(CH1)* connect to DAC0 and DAC1, respectively, on your device.

DC Power Outputs

The SC-2075 contains the following DC power supplies for your circuit design:

- +5 V
- 0 to +5 V variable output
- ±15 V

To power on the SC-2075, +5 V is required. This power supply comes from either the E Series or 1200 Series device, or from an external +5 V source you supply. A switch on the SC-2075 allows you to select the source of the +5 V supply. Set the switch to INTERNAL to select the E Series or 1200 Series +5 V supply. Set the switch to EXTERNAL to select your +5 V supply through the DC power jack on the SC-2075. This +5 V is accessible at the SC-2075 terminal block.

The 0 to +5 V variable output supply is created from the +5 V supply that powers the SC-2075. This supply is adjustable using R1, an adjustable 100 kΩ linear potentiometer. The 0 to +5 V variable output supply is accessible at the two binding posts labeled 0-5V+ and GND.

The ±15 V supply is created onboard the SC-2075 using a DC-DC converter. The DC-DC converter uses the +5 V supply to create ±15 V. The ±15 V supply is accessible at the three binding posts labeled +15V, AIGND, and –15V. AIGND is the ground-reference signal for the ±15 V supplies.

Table 2 details the maximum output power available from the +5 V and ±15 V supplies when used with the E Series or 1200 Series devices.

Table 2. Maximum Output Power Available

Device Type	Power Source	+5 VDC[1]	+15 VDC[2]	–15 VDC[2]
E Series Device	AT/PCI	4.2 W (835 mA)	1.5 W (100 mA)	1.5 W (100 mA)
	DAQCard/DAQPad	0.43 W (85 mA)	0.15 W (10 mA)	0.15 W (10 mA)
1200 Series Device	AT/PCI/DAQPad	1.2 W (235 mA)	0.59 W (28 mA)	0.59 W (28 mA)
	DAQCard	1.7 W (335 mA)	0.84 W (40 mA)	0.84 W (40 mA)

[1] +5 VDC specs in table assume no load on the ±15 VDC supply.
[2] ±15 VDC specs in table assume no load on +5 VDC supply

A power calculation is given in the following example.

Given that you are using a PCI E Series device and the SC-2075, and your prototype circuit requires +5 V at 100 mA and ±15 V at 20 mA. Will the PCI E Series device supply the needed power?

1. Determine your power requirements:
   - +5 V × 100 mA = 0.5 W (+5 V power required)
   - +15 V × 20 mA = 0.3 W (+15 V power required)
   - –15 V × 20mA = 0.3 W (–15 V power required)
2. Determine if this setup will work:
   a. 4.2 W – 0.5 W = 3.7 W (+5 V power remaining for DC-DC converter)
   b. 3.7 W × 72% (efficiency of DC-DC) = 2.7 W (±15 V power available)
   c. 2.7 W / 2 supplies = 1.35 W (+15 V or –15 V power available)

Since 1.35 W > 0.3 W is true, the PCI E Series device will supply the needed power.

The SC-2075 contains two, 1.1 A, self-resetting fuses—one on the DC power jack and one on the +5 V output of the power selection switch. If either fuse trips, it resets after the SC-2075 is powered off for 15 seconds. To power off the SC-2075, set the power switch, SW1, on the SC-2075 to the OFF position for 15 seconds.

Digital I/O

The SC-2075 contains spring terminal access to the DIO channels of the E Series or 1200 Series device. Eight LEDs correlating to the eight DIO lines indicate the state of each digital channel. If the LED is lit, the channel is either pulled high (high > 2.6 V) or driven high. If the LED is off, the channel is either pulled low (low < 0.4 V) or driven low.

A ground is available at the spring terminal labeled GND and is the reference for the DIO lines.

Timing and Control I/O

The SC-2075 contains spring terminal access to the timing I/O signals of an E Series or 1200 Series device.

Each connector on the SC-2075 has a channel name label corresponding to both an E Series device and a 1200 Series device. The channel name in bold plain text corresponds to an E Series device channel and the italicized text corresponds to a 1200 Series device channel. For example, the spring terminal connector labeled **CONVERT*** *(EXTCONV*)* indicates that this terminal connects to PFI2/CONVERT* of the E Series device or EXTCONV* of the 1200 Series device.

Specifications

This section lists the SC-2075 specifications and are typical at 25 °C unless otherwise specified.

Analog Input

Number of channels

E Series.....8 differential

1200 Series .....4 differential

Connector types and signals

SC-2075 Connector/Signal Name	E Series Signal Name	1200 Series Signal Name
Binding Posts / **CH0+***(CH0+)*	ACH0	ACH0
Binding Posts / **CH0–***(CH0–)*	ACH8	ACH1
BNC / **CH1***(CH2)*	ACH1/9	ACH2/3
BNC / **CH2***(CH4)*	ACH2/10	ACH4/5
BNC / **TRIG1***(EXTTRIG)*	PFI0/TRIG1	TRIG1/EXTTRIG
Spring Terminals / **CH3+***(CH6+)*	ACH3	ACH6
Spring Terminals / **CH3–***(CH6–)*	ACH11	ACH7
Spring Terminals / **CH4+***(N/A)*	ACH4	N/A
Spring Terminals / **CH4–***(N/A)*	ACH12	N/A
Spring Terminals / **CH5+***(N/A)*	ACH5	N/A
Spring Terminals / **CH5–***(N/A)*	ACH13	N/A
Spring Terminals / **CH6+***(N/A)*	ACH6	N/A
Spring Terminals / **CH6–***(N/A)*	ACH14	N/A
Spring Terminals / **CH7+***(N/A)*	ACH7	N/A
Spring Terminals / **CH7–***(N/A)*	ACH15	N/A

Analog Output

Connector types and signals

SC-2075 Connector/Signal Name	E Series Signal Name	1200 Series Signal Name
BNC / **CH0***(CH0)*	DAC0	DACOUT0
BNC / **CH1***(CH1)*	DAC1	DACOUT1

Digital I/O

Note Use wire no larger than 24 AWG.

Connector types and signals

SC-2075 Connector/Signal Name	E Series Signal Name	1200 Series Signal Name
Spring Terminal / **DIO0***(DIO0)*	DIO0	PA0
Spring Terminal / **DIO1***(DIO1)*	DIO1	PA1
Spring Terminal / **DIO2***(DIO2)*	DIO2	PA2
Spring Terminal / **DIO3***(DIO3)*	DIO3	PA3
Spring Terminal / **DIO4***(DIO4)*	DIO4	PA4
Spring Terminal / **DIO5***(DIO5)*	DIO5	PA5
Spring Terminal / **DIO6***(DIO6)*	DIO6	PA6
Spring Terminal / **DIO7***(DIO7)*	DIO7	PA7

LED state indicators..... 8, one per DIO line

Timing and Control I/O

Connector types and signals

SC-2075 Connector/Signal Name	E Series Signal Name	1200 Series Signal Name
Spring Terminal / **CTR0_SRC***(CLKB2)*	PFI8/GPCTR0_SRC	CLKB2
Spring Terminal / **CTR0_GATE***(GATEB2)*	PFI9/GPCTR0_GATE	GATEB2
Spring Terminal / **CTR0_OUT***(OUTB2)*	GPCTR0_OUT	OUTB2
Spring Terminal / **CTR1_SRC***(CLKB1)*	PFI3/GPCTR1_SRC	CLKB1
Spring Terminal / **CTR1_GATE***(GATEB1)*	PFI4/GPCTR1_GATE	GATEB1
Spring Terminal / **CTR1_OUT***(OUTB1)*	GPCTR1_OUT	OUTB1
Spring Terminal / **FREQ_OUT***(N/A)*	FREQ_OUT	N/A
Spring Terminal / **TRIG1***(EXTTRIG)*	PFI0/TRIG1	EXTTRIG
Spring Terminal / **TRIG2***(N/A)*	PFI1/TRIG2	N/A
Spring Terminal / **STARTSCAN***(N/A)*	PFI7/STARTSCAN	N/A
Spring Terminal / **CONVERT*** *(EXTCONV*)*	PFI2/CONVERT*	EXTCONV*
Spring Terminal / **SCANCLK***(N/A)*	SCANCLK	N/A
Spring Terminal / **EXTREF***(N/A)*	EXTREF	N/A
Spring Terminal / **UPDATE*** *(EXTUPDATE*)*	PFI5/UPDATE*	EXTUPDATE*
Spring Terminal / **WFTRIG***(N/A)*	PFI6/WFTRING	N/A

Power Requirements

Input Power Requirements

DC input voltage.....+5 VDC ±5% (from an external power source)
or
+5 VDC from an E Series or a 1200 Series device

DC input fuses .....two, 1.1 A, resettable

DC input power .....825 mW with no load (165 mA)
(120 mA for DC-DC supply,
45 mA for remaining components)

Recommended external power source

Condor model WP05050I

Input ..... 100-240 VAC, 50-60 Hz, 0.2 A

Output ..... +5 VDC, 1 A

Input supply selection ..... SP3T switch SW1 (EXTERNAL/OFF/INTERNAL)

Output Power Supplies

+5VDC ..... +4.65 VDC to +5.25 VDC
Available at terminal block

Power available ..... (device power – SC-2075 power), see Table 2 for details

0 to +5 V variable output ..... adjustable using R1, a 100 kΩ linear potentiometer

±15 VDC ..... DC-DC converter, converts +5 VDC to ±15 VDC, ±15 VDC at ±100 mA max

DC-DC converter requires ..... 120 mA at no load
1000 mA at full load

DC-DC converter ..... 60% efficient at full load, approximately 72% factoring in power on, see Table 2 for details

Physical

External input connector ..... DC power jack

Dimensions ..... 26.72 by 20.70 by 4.37 cm (10.52 by 8.15 by 1.72 in.)

I/O connectors ..... 68-pos male SCSI-II type
50-pos male ribbon cable type

BNC connectors 5

Binding posts 7

Spring terminals 35

Environment

Operating temperature .....0 to 40 °C

Safety

Designed in accordance with IEC 61010-1, UL 3111-1, and CAN/CSA C22.2 No. 1010.1 for electrical measuring and test equipment

Approved at altitudes up to 2000 m

Installation Category II

Pollution Degree 2

Technical Support Resources

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