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USER GUIDE

SCC-FT01 Feedthrough Module

The SCC-FT01 is a feedthrough module that connects directly to the analog input (AI) and analog output (AO) channels of a data acquisition (DAQ) device. You can use the breadboard area of the SCC-FT01 to develop custom signal-conditioning circuitry that can connect to and condition any of the analog, digital (P0.), and general-purpose counter/timer (CTR) channels of E Series DAQ devices.

Conventions

The following conventions are used in this guide:

<> — Angle brackets that contain numbers separated by an ellipsis represent a range of values associated with a bit or signal name—for example, AI <0..7>.

» — The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.

 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. When this symbol is marked on the product, refer to the *Read Me First: Safety and Radio-Frequency Interference* document, shipped with the product, for precautions to take.

 When symbol is marked on a product it denotes a warning advising you to take precautions to avoid electrical shock.

 When symbol is marked on a product it denotes a component that may be hot. Touching this component may result in bodily injury.

bold — Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

NATIONAL INSTRUMENTS

italic	Italic text denotes variables, emphasis, a cross reference, a hardware label, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
`monospace`	Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.
SC-2345	SC-2345 refers to both the SC-2345 connector block and the SC-2345 with configurable connectors.
SCC	SCC refers to any SCC series signal conditioning module.

What You Need to Get Started

To set up and use the SCC-FT01, you need the following items:

- ❑ SC-2345/2350 with one of the following:
  - SCC-PWR01
  - SCC-PWR02 and the PS01 power supply
  - SCC-PWR03 (requires a 7 to 42 VDC power supply, not included)
- ❑ One or more SCC-FT01 modules
- ❑ *SCC-FT01 Feedthrough Module User Guide*
- ❑ *SC-2345/2350 User Manual*, available at `ni.com`
- ❑ *SCC Quick Start Guide*, available at `ni.com`
- ❑ *Read Me First: Safety and Radio-Frequency Interference*
- ❑ SC-2345 Quick Reference Label
- ❑ 68-pin E Series DAQ device, documentation, and 68-pin cable of 1 or 2 m length
- ❑ 1/8 in. flathead screwdriver
- ❑ Numbers 1 and 2 Phillips screwdrivers

- ❑ Wire insulation strippers
- ❑ NI-DAQ (current version) for Windows 2000/NT/XP/Me

If you do not have the current version of NI-DAQ or one of the documents, you can download them from `ni.com`, or contact an NI sales representative.

Note Software scaling of measurements is not supported on the Macintosh operating system.

Device Specific Information

Note For general SCC module installation and signal connection information, and information about the SC-2350 carrier, refer to the *SCC Quick Start Guide*, available for download at `ni.com/manuals`.

Installing the Module

Caution Refer to the *Read Me First: Safety and Radio-Frequency Interference* document before removing equipment covers or connecting/disconnecting any signal wires.

Caution If you plug the unmodified SCC-FT01 into any SCC socket other than single-stage AI (sockets J1 through J8) or AO (sockets J17 and J18), you can damage the E Series DAQ device.

You can plug the SCC-FT01, as shipped, into an AI or AO socket on the SC-2345. When used as a prototyping module, the SCC-FT01 plugs into any socket on the SC-2345 except the power socket.

Five 0 Ω resistors on the printed circuit board (PCB) connect a set of default signals listed on the module label. To modify the SCC-FT01 to perform custom signal conditioning, refer to the *Customizing the SCC-FT01* section.

Connecting the Input Signals

Note The signal names have changed. Refer to `ni.com/info` and enter `rdtntg` to confirm the signal names.

The screw terminals are labeled by pin number <1..6>. The module label lists the signal names beside the pin numbers. Pins 2 through 6 accept the following signals: CH+, CH–, AI GND, AI SENSE, and EXT REF. Pin 1 does not connect to anything. Connect the wires accordingly.

Table 1 shows the signals available if you plug the SCC-FT01 into AI single-stage SCC sockets J1–J8 or AO SCC sockets J17 and J18.

Table 1. SCC-FT01 Signals

Screw Terminal Number	Screw Terminal Label	AI Single-Stage SCC Socket J1–J8	AO SCC Socket J17	AO SCC Socket J18
6	CH+	AI	AO 0	AO 1
5	CH–	AI +8	AO GND	AO GND
4	AI GND	AI GND	PFI 5	PFI 5
3	AI SENSE	AI SENSE	AO 1	AO 0
2	EXT REF	—	EXT REF	EXT REF
1	NO CONNECT	—	—	—

When you plug the SCC-FT01 into a single-stage AI SCC socket, the following conditions are true for the labeled screw terminals:

- CH+ connects to the lower AI channel number CH(*X*), where *X* is 0 to 7.
- CH– connects to the higher AI channel number CH(*X*+8), where *X* is 0 to 7.
- AI GND connects to AI ground.
- AI SENSE connects to AI SENSE.
- EXT REF does not connect—do not use it.

Note For information on AI modes, refer to the *SC-2345 User Manual*. For information on AI configuration modes, refer to the DAQ device documentation.

When you plug the SCC-FT01 into an AO SCC socket, the following conditions are true for the labeled screw terminals:

- CH+ connects to AO 0 for AO SCC socket J17, AO1 for AO SCC socket J18.
- CH– connects to AO ground.
- AI GND connects to PFI 5.
- AI SENSE connects to AO 1 for AO SCC socket J17, AO 0 for AO SCC socket J18.
- EXT REF connects to EXT REF.

When you configure the SC-2345 as an accessory to the E Series DAQ device in Measurement & Automation Explorer (MAX), the program automatically configures the SC-2345 in nonreferenced single-ended (NRSE) mode. Connect the signal source to single-ended channels on the SCC-FT01 while the SC-2345 is configured in the NRSE AI configuration.

You can configure the E Series DAQ device to read signals from the SCC-FT01 in differential mode. Use a virtual channel in MAX or application software to configure the E Series DAQ device to read the signal in differential mode. When you read a signal in differential mode, you use two channels for one measurement, but you avoid ground loops and get a better signal by rejecting common-mode signal noise.

You can configure the E Series DAQ device on a per channel basis with application software or virtual channels. For example, you can have channels 0 and 8 in differential mode and 1 to 7 and 9 to 15 in NRSE mode. Refer to the *Measurement & Automation Explorer Help* for more information and instructions on configuring channels.

For more information about configuring the SCC-FT01 using NI-DAQmx, refer to the *SCC Quick Start Guide*.

Customizing the SCC-FT01

You can customize the SCC-FT01 to connect to any of the AI, AO, digital input/output, or counter signals of the E Series DAQ device. After you customize the SCC-FT01, you can plug it into any SCC socket on the SC-2345 except the SCC power socket. The SCC-FT01 PCB contains 2.54 sq cm (1 sq in.) of prototyping breadboard area. This area accommodates as many as four 8-pin integrated circuits and other discrete components such as resistors and capacitors.

Place the SCC-FT01 prototyping module label, which is included in the kit, over the SCC-FT01 feedthrough module label on the SCC enclosure. This label does not contain signal names, so you can customize the assignment of the screw terminals.

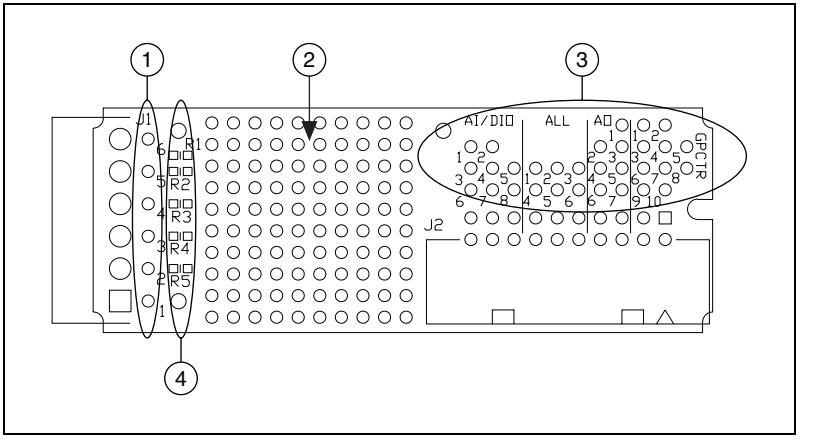
Circuit Design

You must disassemble the SCC-FT01 to install custom circuitry. Complete the following steps to open the module.

1. Remove the screw from the back (wide unlabeled side).
2. Turn the front (wide labeled side) toward you.
3. Place the screw terminal receptacle on the left.

4. Slide the top cover to the right.
5. Lift off the cover.

You *must* remove resistors R1 through R5, shown in Figure 1, before you develop custom circuitry. The signal connection pads above connector J2, represented by item 1 in Figure 1, connect to different signals on the E Series DAQ device, depending on where you install the SCC-FT01 on the SC-2345.



1	I/O Pads	3	Signal Connection Pads
2	Prototyping Breadboard Area	4	R1 through R5

Figure 1. SCC-FT01 Parts Locator Diagram

Table 2 shows the signals available for circuit design when you plug the SCC-FT01 into each type of SCC socket on the SC-2345. The pad numbers correspond to the number next to each pad on the SCC-FT01.

Table 2. Signals Available by SCC Socket Type

Pad Number	Signal Name				
	AI/P0.	All	AO	CTR CH0	CTR CH1
1	AI SENSE	–15 V	EXT REF	PFI 8/ CT R0 SOURCE	PFI 3/ CTR 1 SOURCE
2	AI +	REF 5 V	J17—AO 1 J18—AO 0	PFI 6/ AO START TRIG or AI – Cascaded REF[1]	EXTSTROBE* or AI – Cascaded REF[1]

Table 2. Signals Available by SCC Socket Type (Continued)

Pad Number	Signal Name				
	AI/P0.	**All**	**AO**	**CTR CH0**	**CTR CH1**
3	AI GND	GND (+5 V)	AO GND(B)	N/A or AI + Cascaded REF[1]	PFI 1/AI REF TRIG or AI + Cascaded REF[1]
4	PFI 7/ AI SAMPLE C LK or P0.(*X*)[2]	+15 V	AO GND(A)	FREQ OUT	FREQ OUT
5	AI –	GND (15 V and REF 5 V)	J17—AO 0 J18—AO 1	PFI 5/ AO SAMP CLOCK	AI HOLD COMP
6	AI + Cascaded[3]	+5 V	PFI 6/ AO START TRIG	P0.6	P0.7
7	AI – Cascaded[3]	—	PFI 5/ AO SAMP CLOCK	PFI 0/ AI START TRIG	PFI 0/ AI START TRIG
8	AI SENSE Cascaded[3]	—	—	—	PFI 7/ AI SAMP CLK
9	—	—	—	PFI 9/ CTR 0 GATE	PFI 4/ CTR 1 GATE
10	—	—	—	CTR 0 OUT	CTR 1 OUT

[1] Not a counter signal name. Available on any AI SCC socket J1 to J8.
[2] Available on digital SCC sockets (J9 to J16) only.
[3] Available on final-stage AI SCC sockets (J1 to J8) only.

Note AO GND (A) and AO GND (B) are both in the table, but both connect to the one AO GND signal on the E Series DAQ device.

An SCC-FT01 signal connection label, which defines the pad numbers on the SCC-FT01 board, is attached to the inside of the enclosure of the SCC module.

Whether you plug the SCC-FT01 into an SCC socket for AI, AO, digital, or counter conditioning, the pads listed under the *All* column in Table 2 are connected, and you can use them.

Wiring the SCC-FT01

The signal names in the following sections refer to the signals listed in Table 2.

Note When you plug the SCC-FT01 into the first-stage AI sockets on the SC-2345, you do *not* connect the outputs of the circuitry to the pads labeled *Cascaded*. Use pads labeled *Cascaded* only when you plug the SCC-FT01 into the second-stage (final-stage) socket to get the input signals through the SC-2345 from the first-stage socket. Refer to Figures 2a and 2b.

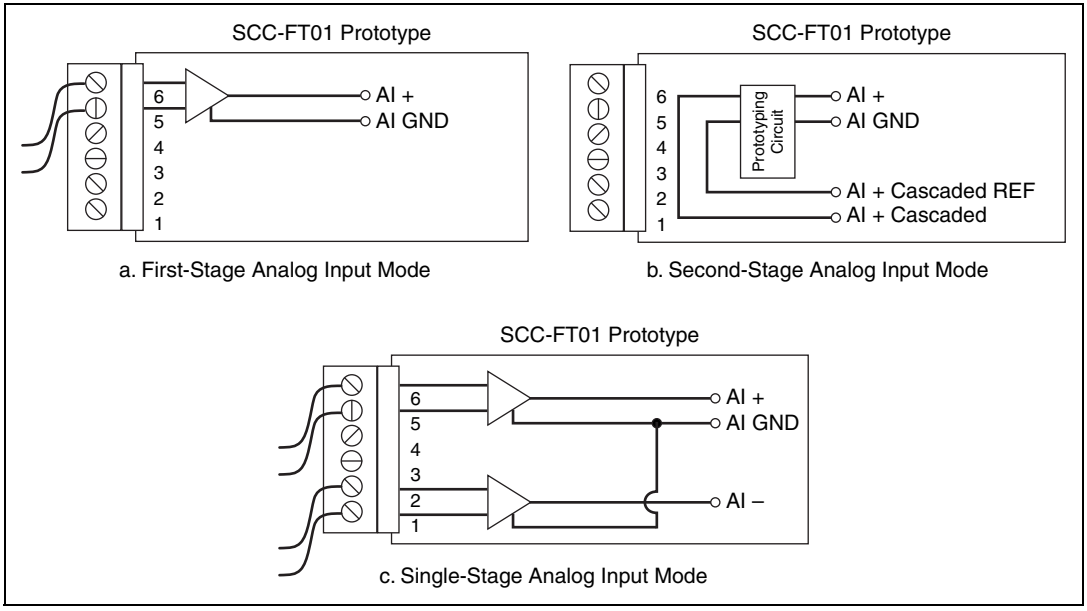


Figure 2. SCC-FT01 Prototyping Module AI Configurations

Figures 2a and 2b illustrate example wiring for the SCC-FT01 prototyping module used in dual-stage AI configuration. Figure 2c illustrates single-stage AI configuration.

Analog Input and Digital Input/Output

To use the SCC-FT01 for AI or digital signal conditioning, use the pads above connector J2 labeled *AI/P0.* for connections to the breadboard area. You then can plug the module into any AI SCC socket J1 to J16 on the SC-2345. The signals available are slightly different when the module is plugged into the first-stage AI (also known as digital) than when plugged into the second-stage AI (also known as single-stage AI). Use SCC sockets J9 to J16 for first-stage AI. Use SCC sockets J1 to J8 for second-stage AI.

PFI 7/AI SAMP CLK, AI + Cascaded, AI + Cascaded REF, AI – Cascaded, AI – Cascaded REF, and AI SENSE Cascaded signals are available for the second-stage AI SCC sockets only. The P0.(*X*) signal is available for the first-stage AI SCC sockets only. Refer to Table 2 for pad definitions.

When the E Series DAQ device is configured in NRSE AI mode, design your prototype circuitry so that the output of the SCC-FT01 to the E Series DAQ device is referenced single-ended to AI GND on the SC-2345.

Note On the SC-2345, the AI GND and AI SENSE signals join at connector J24.

Analog Output

To use the SCC-FT01 for AO signal conditioning, use the pads above connector J2 labeled *AO* for connections to the breadboard area. The *AO* column in Table 2 lists the signals available to each pad. Plug the SCC-FT01 into any AO socket on the SC-2345.

The AO 0 and AO 1 signals depend on which AO SCC socket you use. If you plug the SCC-FT01 into the AO SCC socket J17, the DAC (A) pad connects to AO 0 and the DAC (B) pad to AO 1 on the E Series DAQ device. These pad connections are reversed when the SCC-FT01 is plugged into AO SCC socket J18, and the DAC (A) pad connects to AO 1 and DAC (B) pad to AO 0 on the E Series DAQ device.

Counter

To use the SCC-FT01 for CTR functions, use the pads above connector J2 labeled *CTR* for connections to the breadboard area. The *CTR CH0* and *CTR CH1* columns in Table 2 list the signals available to each pad. The signals available depend on which SCC socket you use.

If you plug the SCC-FT01 into the CTR CH0 socket J19, the pads under CTR CH0 on the board connect to signals associated with CTR channel 0 and AO of the E Series DAQ device. When the SCC-FT01 is plugged into the CTR CH1 socket J20, the pads under CTR CH1 on the board connect to signals associated with CTR channel 1 and AI of the E Series DAQ device.

Connecting the Screw Terminals

The pads next to connector J1 connect to each input of the screw terminal connector. Use these pads to connect the external signals to the circuitry you added in the breadboard area. The numbers next to each hole correspond to the screw terminal numbers. Space is available on the SCC-FT01 prototyping module label for custom signal names.

For information about how to configure the SCC-FT01 module using NI-DAQmx, refer to the *SCC Quick Start Guide*.

Specifications

These ratings are typical at 25 °C unless otherwise stated.

Analog

Number of input channels.....1 DIFF or 2 SE (when plugged into an AI socket on the SC-2345)

Number of output channels.....1 (when plugged into an AO socket on the SC-2345)

Power Requirement

No power required (if unmodified)

Physical

Dimensions .....8.89 cm × 2.92 cm × 1.85 cm (3.50 in. × 1.15 in. × 0.73 in.)

I/O connectors.....20-pin right-angle male connector
6-pin screw terminal system

Screw terminal.....28 to 16 AWG

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 3111-1, UL 61010B-1
- CAN/CSA C22.2 No. 1010.1

Note For UL and other safety certifications, refer to the product label, or visit `ni.com/hardref.nsf`, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

Emissions.....EN 55011 Class A at 10 m
FCC Part 15A above 1 GHz

Immunity .....EN 61326:1997/ + A2:2001, Table 1

CE, C-Tick, and FCC Part 15 (Class A) Compliant

Note For full EMC compliance, operate this device with shielded cabling. In addition, all covers and filler panels must be installed.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

Low-Voltage Directive (safety).....73/23/EEC

Electromagnetic Compatibility Directive (EMC) 89/336/EEC

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/hardref.nsf`, search by model number or product line, and click the appropriate link in the Certification column.

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