

SCC-AO10 ISOLATED ANALOG OUTPUT MODULE

USER GUIDE

The SCC-AO10 is an isolated voltage output module with an output range of ± 10 V. The output voltage level is controlled by the DAC output of an E Series DAQ device. You can increase the output voltage level to ± 20 V by connecting two SCC-AO10 modules in series.

Conventions

The following conventions are used in this guide:

»

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.

bold

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

italic

Italic text denotes variables, emphasis, a cross reference, an introduction to a key concept, or text as it appears on a hardware label. 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, and code excerpts.

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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-AO10, you need the following items:

- SC-2345 with one of the following:
 - SCC-PWR01
 - SCC-PWR02 and PS01 power supply
 - SCC-PWR03 (requires a 7 to 42 VDC power supply, not included)
- One or two SCC-AO10 modules
- SC-2345 User Manual*, available online at ni.com
- SCC-AO10 Isolated Analog Output Module User Guide*
- 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 less than 1.5 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/9x



Note Software scaling of measurements is not supported on the Mac OS.

Unpacking the SCC-AO10

SCC modules are shipped in antistatic envelopes to prevent electrostatic damage to the modules. Electrostatic discharge can damage several components on these products.



Caution *Never* touch the exposed pins of connectors.

To avoid damage from electrostatic discharge when you handle the module, take the following precautions:

- Ground yourself by using a grounding strap or by touching a grounded object.
- Touch the antistatic envelope to a metal part of your computer chassis before removing the module from the packaging.

Remove the module from the envelope and inspect the module for loose components or any sign of damage. Notify NI if the module appears damaged in any way. Do *not* install a damaged module.

Store the module in the antistatic envelope when it is not in use.

Installing the SCC-AO10

A red stripe on the label identifies the SCC-AO10 as an analog output module. The label also displays the icon shown in Figure 1.

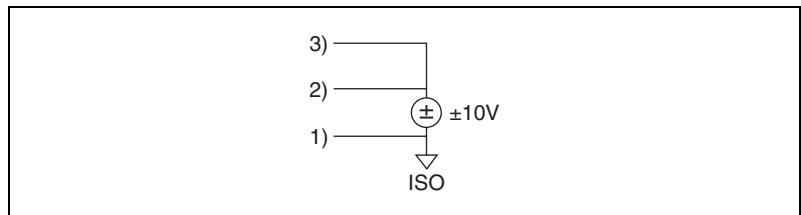


Figure 1. SCC-AO10 icon

Plug the SCC-AO10 into either SC-2345 analog output socket J(X+17), where X is 0 or 1. The SC-2345 routes the voltage output of E Series DAQ device analog output channel DAC(X)OUT to the SCC-AO10.

Connecting the SCC-AO10 to a Load



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

The SCC-AO10 has a fixed screw-terminal receptacle and a removable screw-terminal block, as shown in Figure 2.

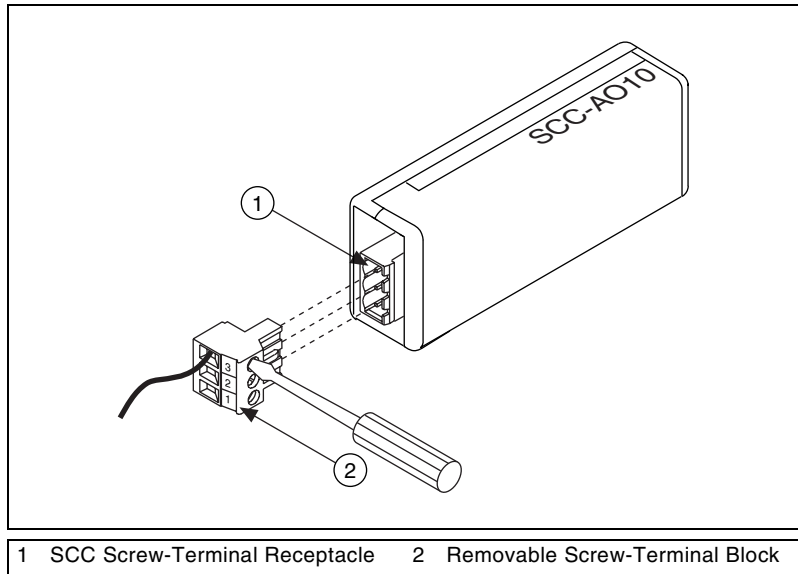


Figure 2. SCC-AO10 Two-Part Screw-Terminal System

The SCC-AO10 has a three-pin screw-terminal connector that accepts 28–16 AWG wires. After you install the SCC-AO10, complete the following steps to connect the module to a load:

1. Remove power from the signal lines.
2. Strip 7 mm (0.28 in.) of insulation from the ends of the signal wires.
3. Insert the wires into the screw terminals.
4. Tighten the screws to 0.5–0.6 N · m (4.4–5.3 lb · in.) of torque.

The screw terminals are labeled by pin numbers 1 to 3. Pin 1 is the isolated ground. Pins 2 and 3 both connect to the isolated voltage output for flexibility in field wiring.



Caution Connecting an external voltage source to the output terminals of the SCC-AO10 may damage the module.

Figures 3 and 4 show the SCC-AO10 connected to a nonreferenced load and to a load with a high common-mode voltage.

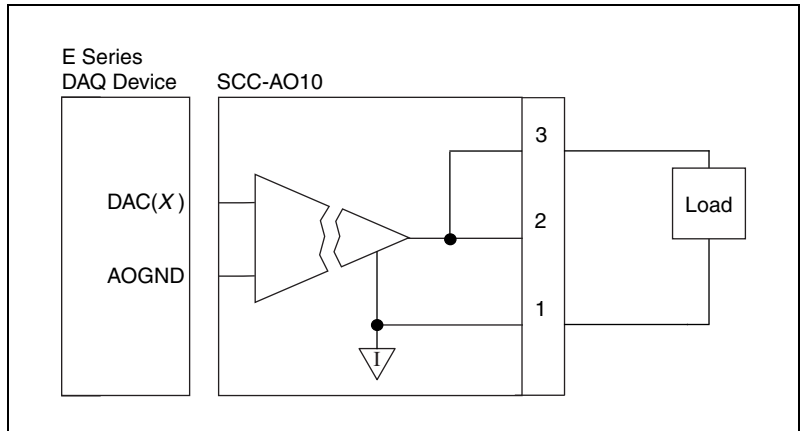


Figure 3. SCC-AO10 Connected to a Nonreferenced Load

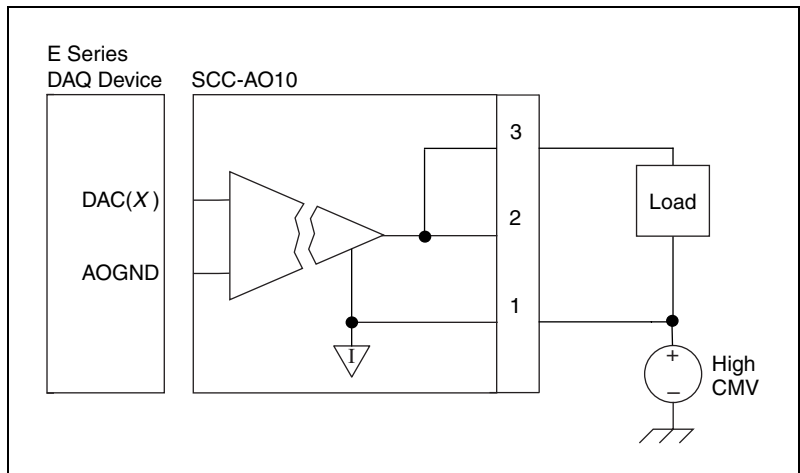


Figure 4. SCC-AO10 Connected to a Load with a High Common-Mode Voltage

Connecting Two SCC-AO10 Modules in Series

You can increase the maximum total output voltage to ± 20 V by connecting two SCC-AO10 modules in series. Plug the two modules into sockets J17 and J18 of the SC-2345, and wire the modules to a load as shown in Figure 5.

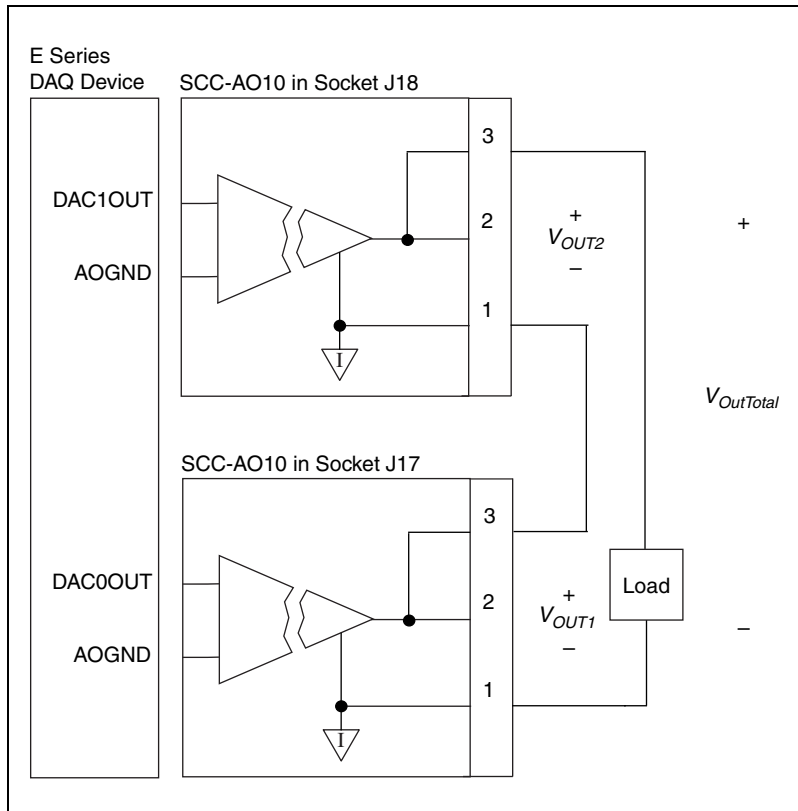


Figure 5. Connecting Two SCC-AO10 Modules in Series

The SC-2345 routes the E Series DAQ device analog output channels DAC0OUT and DAC1OUT to the SCC-AO10 modules, and the resulting maximum output voltage range is ± 20 V. Refer to Figure 5 and use the following formula to calculate the total output voltage from both SCC-AO10 modules:

$$V_{OutTotal} = V_{OUT1} + V_{OUT2}$$

where

$V_{OutTotal}$ is the total output voltage from both SCC-AO10 modules

V_{OUT1} is the voltage across terminals 1 and 3 of the SCC-AO10 module in socket J17

V_{OUT2} is the voltage across terminals 1 and 3 of the SCC-AO10 module in socket J18

Configuring the SCC System

To configure the SCC system with the SCC-AO10, complete the following steps:

1. Launch **Measurement & Automation Explorer (MAX)**.
2. Right-click **Data Neighborhood**.
3. Select **Create New**.
4. Select **Virtual Channel** and click **Finish**.
5. In the Create New Channel dialog box that appears, select **Analog Output** in the pull-down list and click **Next**.
6. Enter a name and description for the channel and click **Next**.
7. Choose **Voltage** and click **Next**.
8. Enter v in the **Units** field.
9. For **Range min** and **Range max**, select the smallest range that fits the requirements of your application.
10. Select **No Scaling** from the pull-down list and click **Next**.
11. Select the E Series DAQ device connected to the SC-2345.
12. Select the analog output channel to control the SCC-AO10: DAC0OUT for socket J17 and DAC1OUT for socket J18.
13. Click **Finish**.
14. Repeat steps 3 to 13 for each module you want to configure.
15. Close MAX.

Theory of Operation

The SCC-AO10 is a ± 10 V isolated analog output module. The output voltage is controlled by an E Series DAQ device DAC output channel, DAC(X)OUT. The relationship between the DAC(X)OUT voltage level and the output voltage level of the SCC-AO10 is a one-to-one linear relationship. That is,

$$V_{\text{DAC}(X)} = V_{\text{AO10}}$$

where

$V_{\text{DAC}(X)}$ is the DAC(X)OUT voltage level

and V_{AO10} is the SCC-AO10 voltage output in volts.

Isolated Ground Reference

Each SCC-AO10 module is referenced to its own isolated ground. Each isolated ground can have up to 300 V of common-mode voltage between itself and any other channel ground or chassis ground. Refer to the [Connecting the SCC-AO10 to a Load](#) section for ways to use the isolated ground in signal connections.

Calibrating Gain and Offset Errors

The SCC-AO10 is calibrated at the factory before shipment. To adjust the gain and offset of the SCC-AO10 in your system using an E Series DAQ device, you need a voltage meter and a 1/8 in. flathead screwdriver. Before adjusting the SCC-AO10, allow 30 minutes for the DAQ device to warm up to its nominal operating temperature.

To adjust the gain and offset of the SCC-AO10, complete the following procedure:

1. Disconnect the load from the SCC-AO10 you want to calibrate.
2. Set an output range of -10 to $+10$ V for DAC(X)OUT, the E Series DAQ device channel connected to the SCC-AO10.
3. Connect the negative lead of the voltmeter to the isolated ground terminal (pin 1) and the positive lead to the voltage output terminal (pin 2 or 3) of the SCC-AO10.
4. Using your software, set DAC(X)OUT to output 0 VDC.
5. Adjust the offset potentiometer on the top of the SCC-AO10 until the voltmeter reads $0 \text{ VDC} \pm 100 \mu\text{V}$. The offset is now calibrated.
6. Using your software, have DAC(X)OUT output 9.9 VDC.
7. Adjust the gain potentiometer on the top of the SCC-AO10 until the voltmeter reads 9.9 VDC. The gain is now calibrated.

Specifications

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

Electrical

Number of output channels	One nonreferenced (floating)
Input range	± 10 V
Output range	± 10 V
Current drive	± 30 mA
Gain nonlinearity	0.5% of full-scale output range
Output noise	2.5 mV _{rms} typ; 4 mV _{rms} max
Bandwidth	>23 kHz
Slew rate	1 V/ μ s
Short circuit protection	
Short circuit current	37 mA max
Short circuit duration	unlimited
Load impedance	10,000 pF max

Power Requirement

Analog power	180 mW max at full load 172 mW max with no load
+15 V	6 mA max at full load 5.73 mA max with no load
-15 V	6 mA max at full load 5.73 mA max with no load
Digital power (+5 V)	1.15 W max at full load 600 mW max with no load
+5 V	230 mA max 120 mA max with no load

Physical

Dimensions	8.89 by 2.92 by 1.85 cm (3.50 by 1.15 by 0.73 in.)
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Mass	37 g
I/O connectors.....	One 20-pin right-angle male connector; one 3-pin screw terminal
Field-wiring diameter	28 to 16 AWG

Maximum Working Voltage

Maximum working voltage refers to the output signal voltage plus the common-mode voltage.

Module to earth..... ± 300 V, Installation Category II

Environmental

Operating temperature0 to 50 °C

Storage temperature-20 to 70 °C

Humidity10 to 90% RH, noncondensing

Maximum altitude.....2,000 m

Pollution Degree (indoor use only)2

Stability

Recommended warm-up time.....10 minutes (30 minutes for connected E Series DAQ device)

Output offset drift300 $\mu\text{V}/^\circ\text{C}$

Gain temperature coefficient300 ppm/ $^\circ\text{C}$

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

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



Note For UL and other safety certifications, refer to the product label or to ni.com.

Electromagnetic Compatibility

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

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

Immunity EN 61326:1997+A1:1998,
Table 1



Note For EMC compliance, operate this device with shielded cabling.

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, click **Declarations of Conformity Information** at ni.com/hardref.nsf/.

I/O Connector Pin Assignments

Figure 6 shows the I/O connector pins on the bottom of the SCC-AO10.

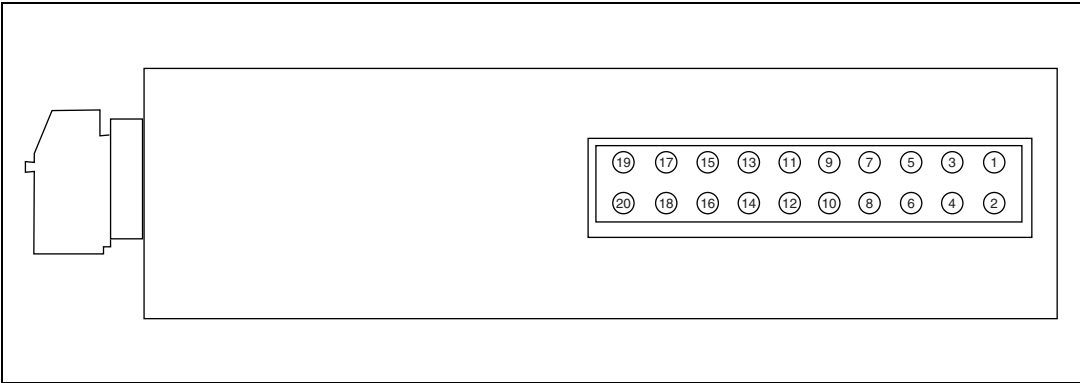


Figure 6. SCC-AO10 Module Bottom View

Table 1 lists the signal connection corresponding to each pin. AGND is the reference for the ± 15 V supplies and REF5V. AGND connects to the SC-2345 at the SCC-PWR connector. GND is the reference for the +5 V supply.

Table 1. SCC-AO10 I/O Connector Signal Assignments

Pin Number	Signal
1	E Series DAC(X)OUT
2	E Series AOGND
3	—
4	—
5	—
6	—
7	—
8	—
9	+5 V
10	GND
11	AGND
12	—
13	+15 V
14	-15 V
15	—
16	—
17	—
18	—
19	—
20	—