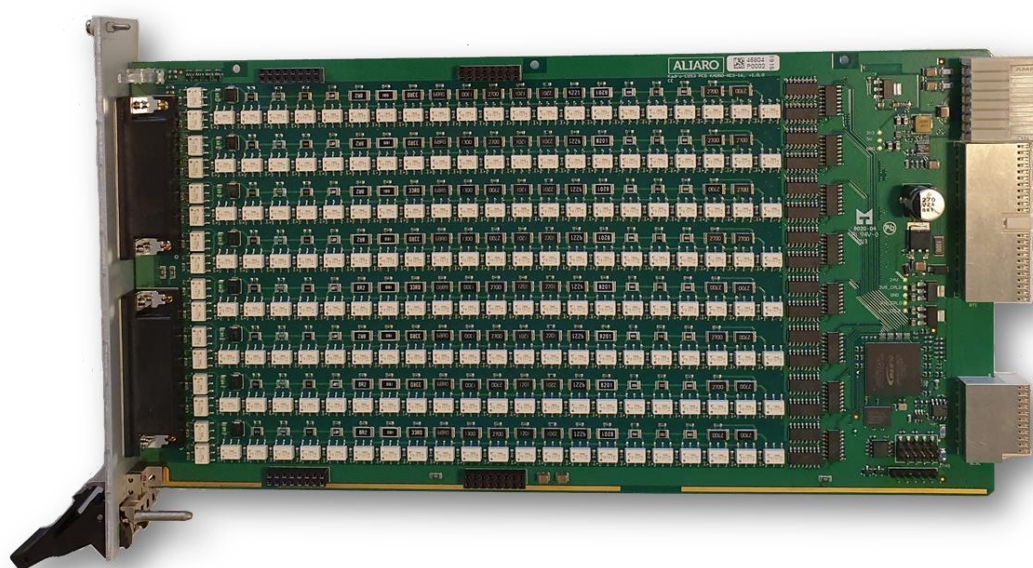


# 16 Channel Resistor Emulation Board

## AL-3010 for SLSC

This document describes how to get started with the SLSC Chassis Fan Controller for National Instruments SLSC-12001 chassis.



## Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

The following characteristic specifications describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- Typical specifications describe the performance met by a majority of models.
- Nominal specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

Specifications are *Typical* unless otherwise noted.

Aliaro reserve the right to vary from the description given in this data sheet and shall not be liable for any errors.

## Conditions

Specifications are valid under the following conditions unless otherwise noted.

The AL-3010 board is mounted in an SLSC chassis with the recommended cooling clearances and using a power supply that meets the specifications provided in the chassis user guide. For the entire temperature range of the chassis.



**Note** These specifications only apply to the product as provided by Aliaro. Modifications to the module may invalidate these. Be certain to verify the performance of modified modules.



**Caution** Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to Aliaro for repair.

## Content

Definitions .....	1
Conditions.....	2
Electromagnetic Compatibility .....	3
Safety .....	3
Environmental Characteristics.....	3
Unpacking the module .....	3
<b>Overview</b> .....	4
Specifications .....	5
What You Need to Get Started.....	6
Installing the AL-3010.....	6
Getting Started with Software.....	7
Connector locations.....	7
Design Standards and Compatibility.....	10
Accessories .....	11
Calibration .....	11
Thermal Consideration .....	11
Physical Characteristics.....	11
Safety Guidelines .....	12
Product Certifications and Declarations .....	12
Environmental Guidelines.....	12

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## Electromagnetic Compatibility

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any modifications to the product not expressly approved by Aliaro could void your authority to operate it under your local regulatory rules.



**Caution** To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

## Safety



**Caution** Observe all instructions and cautions in the user documentation. Using the model in a manner not specified can damage the model and compromise the built-in safety protection. Return damaged models to Aliaro for repair.

## Environmental Characteristics

### Temperature and Humidity

Operating temperature	0 °C to 40 °C <sup>3</sup>
Storage temperature range	-40 °C to 85 °C
Operating relative humidity range	10% to 90%, noncondensing
Storage relative humidity range	5% to 95%, noncondensing

## Unpacking the module

Carefully inspect the shipping container and the module for damage. Check for visible damage to the exterior and interior of the damage. If damage appears to have been caused during shipment file a claim with the carrier. Retain the packing material for possible inspection and/or reshipment. If the chassis is damaged, do not install it and contact Aliaro.

## Overview

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The AL-3010 is a 16-channel resistor emulation board for applications requiring simulation of resistive sensors.

The AL-3010 is designed for the National Instruments (NI) Switch Load Signal Conditioning (SLSC) system, to be used in Hardware-In-the-Loop (HIL) simulators.

The board interfaces NI PXI and/or Compact-RIO instrumentation devices for the purposes of developing, verifying, and validating electronic control unit software and hardware.

By using software, such as Aliaro Configurator, the pins can easily be configured and deployed in NI VeriStand.

## Application

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- ✓ Hardware in the Loop (HIL) testing
- ✓ Emulation of sensors (loads)
- ✓ Fault insertion i.e. validation of faulty wiring or corrupt sensors
- ✓ Simulation industrial sensors and actuators
- ✓ Simulation of engine temperature sensors

## Features

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- ✓ 60V, 100mA per channel
- ✓ 16 independent and isolated channels
- ✓ 16 programmable channels for resistor emulation
- ✓ 50 seconds programming resistance sequence
- ✓ 2 Expansion Slots for Add-on boards
- ✓ Two common buses per bank with switches to each channel
- ✓ Brake up switch for each channel
- ✓ Short and open circuit simulation
- ✓ Pull up and pull down on each channel
- ✓ Wide resistance range
- ✓ LabVIEW driver included
- ✓ Custom Device Driver for Veristand included

## Specifications

Channels		16
Max Voltage		60 V
Max Current		100mA
Range		20 $\Omega$ to 110 k $\Omega$
Resolution		0,5 $\Omega$
Overall Accuracy		< 2* %
Calibration		The card has an open calibration feature meaning that the customer has access to this feature and can use it for system calibration as well.

\* The accuracy of the module can be tuned for customer application to achieve higher accuracy.

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# What You Need to Get Started

To set up and use the module you need the following items:

## Hardware

- – SLSC-12001 chassis
- – SLSC module(s)
- – Power cable
- – Power input connector
- – Grounding wire
- – Grounding lug

## Tools

- – Screwdriver as needed for your application
- – Wire stripper

## Documentation

- – SLSC-12001 Chassis Getting Started Guide and Specifications

# Installing the AL-3010

1. Caution Do not touch the contacts or remove the I/O boards or cables while the system is energized.
2. Power off the main DC power source or disconnect the power source from the chassis before installing any modules or RTIs.
3. Ensure that the chassis is powered off. The POWER LED should be off. If the POWER LED is not off, do not proceed until it is off.



**Notice** The SLSC chassis and the AL-3010 board do not support hot plug-in. The entire chassis must be powered off when a module is inserted or removed.

4. Loosen the screws on the upper rear panel of the chassis.
5. Position the RTI backplane at the desired slot and insert the securing screws, but do not fully tighten them.
6. Insert a AL-3010 module into the same slot as its corresponding RTI while firmly holding the RTI in place until the RTI is firmly connected to the module.
7. Repeat steps 4 and 5 for all required RTIs.
8. Fully tighten the screws for all RTIs and the upper rear panel of the chassis. Note Waiting until all RTIs and modules are installed to fully tighten the screws ensures proper alignment for future connections between modules and RTIs.

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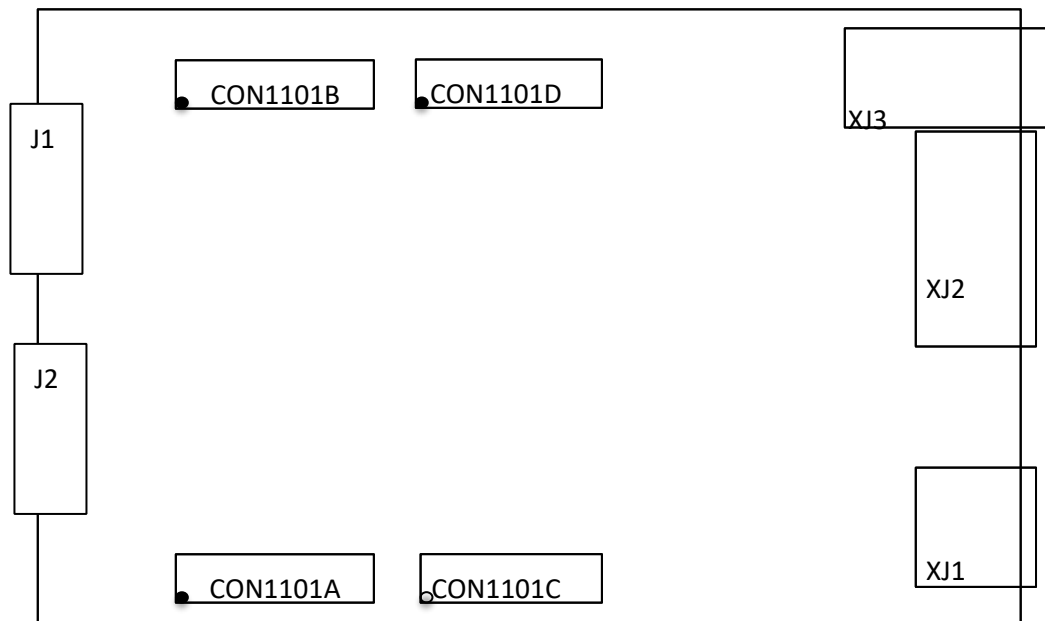
9. Fully tighten the two module mounting screws on each newly installed module.
10. Power on the SLSC chassis

## Getting Started with Software

Install the following applications to get fully potential of the functionalities:

- AL-3010 Custom Devices
  - Supplied by ALIARO AB
- Aliaro Configurator
  - Supplied by ALIARO AB
  - Install the template configuration to start learning
- National Instrument software
  - SLSC Driver
  - Drivers for VeriStand & HW
  - LabVIEW
  - Version 2017 or higher

## Connector locations



Only connectors CON1101A and CON1101B are described as they are used by the KADRO-AMP-4 amplifier board

## Connector locations - Connector J1

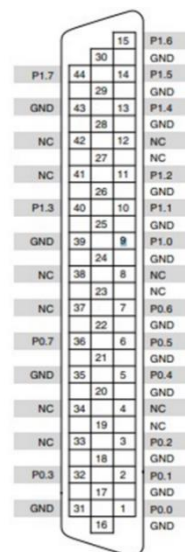
This connector is used for interfacing the test object. In general all 16 channels are input through this connector with the same pinout as the SLSC-12201 module provided by National Instruments (<http://www.ni.com/pdf/manuals/377035b.pdf>).

P0.0 indicated channel 1 while P1.7 indicated channel 16 on the boards.



## Connector locations - Connector J2

This connector is only used as a forward connector meaning all pins in the J1 connector will be routed to this connector. By doing like this the channels may be used for other purposes as well in the SLSC system.





## Connector locations - Connector XJ2

This connector is used to make it possible for forward control voltage (AO) when AMP (Kadro-C023 PCBA Kadro-MPB-12-AMP) is mounted on CON1101-04.

AI is used to make it possible to measure the voltage over the resistor ladder from measurement devices located outside the board via the RTI-backplane.

Figure below describes the SLSC-standard for 32 AO and 32 AI to be used on this board as described in “Switch Load and Signal Conditioning Module Design Specifications”.

### 11.3.5 XJ2 32 Analog Input + 32 Analog Output Pinout

AIx is input to the SLSC module rear I/O. AOx is output from the SLSC module rear I/O.

Table 11-5. XJ2 Mixed Analog Input/Output Pin Assignments

Row	f	e	d	c	b	a
1	GND x	AI 1_3 (1_1-)	AI 1_2 (1_1+)	RSVD0	AI 1_1 (1_0-)	AI 1_0 (1_0+)
2	GND x	AI 1_7 (1_3-)	AI 1_6 (1_3+)	RSVD1	AI 1_5 (1_2-)	AI 1_4 (1_2+)
3	GND x	GND A	GND A	GND A	GND A	GND A
4	GND x	AI 2_3 (2_1-)	AI 2_2 (2_1+)	RSVD2	AI 2_1 (2_0-)	AI 2_0 (2_0+)
5	GND x	AI 2_7 (2_3-)	AI 2_6 (2_3+)	RSVD3	AI 2_5 (2_2-)	AI 2_4 (2_2+)
6	GND x	GND A	GND A	GND A	GND A	GND A
7	GND x	AI 3_3 (3_1-)	AI 3_2 (3_1+)	RSVD4	AI 3_1 (3_0-)	AI 3_0 (3_0+)
8	GND x	AI 3_7 (3_3-)	AI 3_6 (3_3+)	RSVD5	AI 3_5 (3_2-)	AI 3_4 (3_2+)
9	GND x	GND A	GND A	GND A	GND A	GND A
10	GND x	AI 4_3 (4_1-)	AI 4_2 (4_1+)	RSVD6	AI 4_1 (4_0-)	AI 4_0 (4_0+)
11	GND x	AI 4_7 (4_3-)	AI 4_6 (4_3+)	RSVD7	AI 4_5 (4_2-)	AI 4_4 (4_2+)
15	GND x	AO 5_3 (5_1-)	AO 5_2 (5_1+)	RSVD8	AO 5_1 (5_0-)	AO 5_0 (5_0+)
16	GND x	AO 5_7 (5_3-)	AO 5_6 (5_3+)	RSVD9	AO 5_5 (5_2-)	AO 5_4 (5_2+)
17	GND x	GND B	GND B	GND B	GND B	GND B
18	GND x	AO 6_3 (6_1-)	AO 6_2 (6_1+)	RSVD10	AO 6_1 (6_0-)	AO 6_0 (6_0+)
19	GND x	AO 6_7 (6_3-)	AO 6_6 (6_3+)	RSVD11	AO 6_5 (6_2-)	AO 6_4 (6_2+)
20	GND x	GND B	GND B	GND B	GND B	GND B
21	GND x	AO 7_3 (7_1-)	AO 7_2 (7_1+)	RSVD12	AO 7_1 (7_0-)	AO 7_0 (7_0+)
22	GND x	AO 7_7 (7_3-)	AO 7_6 (7_3+)	RSVD13	AO 7_5 (7_2-)	AO 7_4 (7_2+)
23	GND x	GND B	GND B	GND B	GND B	GND B
24	GND x	AO 8_3 (8_1-)	AO 8_2 (8_1+)	RSVD14	AO 8_1 (8_0-)	AO 8_0 (8_0+)
25	GND x	AO 8_7 (8_3-)	AO 8_6 (8_3+)	RSVD15	AO 8_5 (8_2-)	AO 8_4 (8_2+)

Aliaro reserve the right to vary from the description given in this data sheet and shall not be liable for any errors.

## Connector locations - Connector XJ3

This connector will use the predefined setting as used in the SLSC-12201 module.

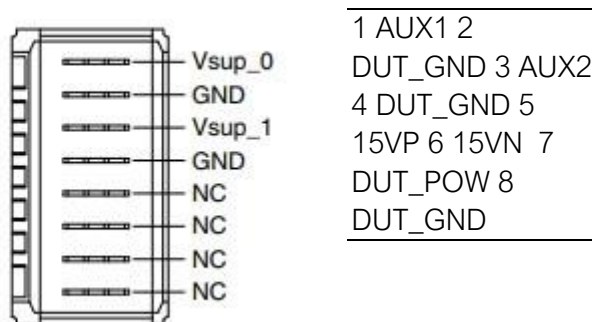
See section 2.2 for reference and figure below.

Vsup\_0 corresponds in this document to AUX1 while Vsup\_2 corresponds to AUX2.

The GND-pins shall be connected to correspond pins on the front connector – J1 and J2. 15VP

and 15VN shall be connected to CON1101 and CON1103

**XJ3 Connector Pinout**



## Design Standards and Compatibility

Switch Load and Signal Conditioning Module Design Specifications Version	1.2
SLSC Compliance Level	1
Rear I/O Compatibility Category	1
Required RTI	Any Compliance Level 1
Earliest driver version	NI-SLSC 18.6

## Accessories

The AL-3010 card has one (1) expansion slots for add-on boards for adding additional functionality for enabling more flexibility in the system.

### KADRO-AMP-4 Amplifier Board

The KADRO-AMP-4 add-on board amplifies voltage and current making it possible to use standard I/O instrumentation devices for operation. The board supplies four (4) independent channels (bank) with amplifier functionality (enables Analogue and Digital Out).

Visit [aliaro.com](http://aliaro.com) for more information about AL-3010 accessories. You must install mating connectors according to local safety codes and standards and according to the specifications provided by the manufacturer.

You are responsible for verifying the safety compliance of third-party connectors and their usage according to the relevant standard(s).

## Calibration

Recommended warm-up time	1 hour
Calibration interval	2 years

## Thermal Consideration

All components on the AL-3010 are rated for an ambient temperature of at least 85 °C. The components do not exceed 85 °C when the module is dissipating the maximum allowed power using resistors spread out over the prototyping areas. However, large components or grouped placement of very hot components may negatively affect airflow and heat dissipation, resulting in higher component temperatures.

Whenever possible, thorough thermal testing should be conducted in order to ensure the components remain within proper operational temperature ranges. Because chassis airflow characteristics may vary greatly from slot to slot, module testing should be repeated in a variety of slots

## Physical Characteristics

SLSC slots	1
Dimensions	144.32mm x 30.48mm x 281 mm (H x W x D)
Weight	More info shortly
Front I/O Connector	2 x DSUB44
Rear I/O Connectors	1x 110-pin Hard Metric Type A, 1x 8-blade Universal Power Module (UPM), capable of implementing Fully Compatible Rear I/O

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## Safety Guidelines



**Caution** Ensure that hazardous voltage wiring is performed only by qualified personnel adhering to local electrical standards.



**Caution** Do not mix hazardous voltage circuits and human-accessible circuits on the same module



**Caution** When device terminals are hazardous voltage LIVE, you must ensure that devices and circuits connected to the device are properly insulated from human contact.



**Caution** All wiring must be insulated for the highest voltage used.

## Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for Aliaro products, visit [aliaro.com/](http://aliaro.com/).

## Environmental Guidelines



**Notice** This model is intended for use in indoor applications only