

# 5501 Analog Input Module

Installation, Operation and Maintenance  
Setup Manual

5/19/2011



The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

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All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed. Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

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## Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

### **DANGER**

**DANGER** indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

### **WARNING**

**WARNING** indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

### **CAUTION**

**CAUTION** indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate.

### **CAUTION**

**CAUTION** used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage..

**PLEASE NOTE**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and the installation, and has received safety training to recognize and avoid the hazards involved.

**BEFORE YOU BEGIN**

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

 **CAUTION****EQUIPMENT OPERATION HAZARD**

Verify that all installation and set up procedures have been completed.

Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.

Remove tools, meters, and debris from equipment.

**Failure to follow these instructions can result in injury or equipment damage.**

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

**Software testing must be done in both simulated and real environments.**

Verify that the completed system is free from all short circuits and grounds, except those grounds installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove ground from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

**OPERATION AND ADJUSTMENTS**

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.

## About The Book

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### At a Glance

#### Document Scope

This manual describes the operation and maintenance of the 5501 Eight Channel Analog Input module.

#### Validity Notes

This document is valid for all versions of the 5501 Eight Channel Analog Input module.

#### Product Related Information

 <b>WARNING</b>
<b>UNINTENDED EQUIPMENT OPERATION</b>
The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise should be allowed to program, install, alter and apply this product.
Follow all local and national safety codes and standards.
Failure to follow these instructions can result in death, serious injury or equipment damage.

#### User Comments

We welcome your comments about this document. You can reach us by e-mail at [technicalsupport@controlmicrosystems.com](mailto:technicalsupport@controlmicrosystems.com).

## Overview

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The model 5501 analog input module adds eight analog inputs to the 5000 input/output system. Up to sixteen model 5501 modules may be connected to the I/O bus, for a total of 128 analog inputs per I/O bus. These inputs are used with devices such as pressure, level, flow, and temperature transmitters; instrumentation such as pH and conductivity sensors; and other high-level analog signal sources.

The 5501 module is configured for either 20mA current loop or 5 volt operation. The current loop has 250 ohm current sense resistors on the inputs. It is otherwise identical to the voltage module.

DIP switches enable or disable a 20% input offset. The module measures 0 to 20mA or 0 to 5 V signals with the offset disabled. The module measures 4 to 20mA or 1 to 5 V signals with the offset enabled.

The 5501 module uses a 12 bit successive approximation analog to digital (A/D) converter. A single chip microcontroller with integral watchdog timer operates the A/D and communicates over the I/O bus.

Inputs are transient protected and optically isolated from the main logic power. The inputs are single ended and share a common return.

## Installation

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The installation of the 5501 module requires mounting the module on the 7.5mm by 35mm DIN rail and connecting the module to the system I/O Bus. Refer to the **System Configuration Guide**, at the beginning of this manual, for complete information on system layout, I/O Bus cable routing and module installation.

## Field Wiring

The 5501 module provides eight single ended analog inputs. Inputs share a common return (SIG COM).

Controller, modem and I/O modules use screw termination style connectors for termination of field wiring. They accommodate solid or stranded wires from 22 to 12 AWG.

The connectors are removable. This allows module replacement without disturbing the field wiring. Leave enough slack in the wiring for the connector to be removed.

Remove power before servicing unit.

To remove the connector:

- Pull the connector upward from the board. Apply even pressure to both ends of the connector.

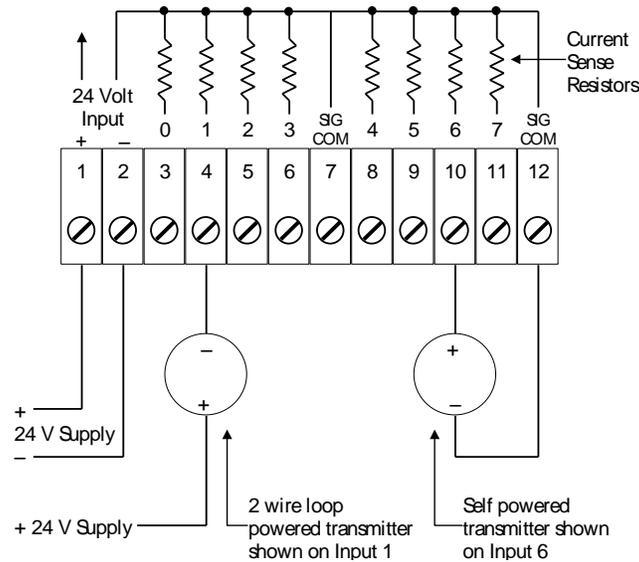
To install the connector:

- Line up the pins on the module with the holes in the connector.
- Push the connector onto the pins. Apply even pressure to both ends on the connector.

Connect an external 11-30V DC power supply to the Power Input terminals. This is to power the isolated analog input circuits. 5V power required for the digital circuitry is available on the I<sup>2</sup>C bus. Refer to the specifications for details.

The 20mA version supports loop powered and self-powered transmitters. Loop powered transmitters connect between the +24 volts and the analog input. The loop current continues to the 24 volt return through a 250 ohm resistor built into the 20mA input circuit. Self-powered transmitters connect to the analog input and to SIG COM.

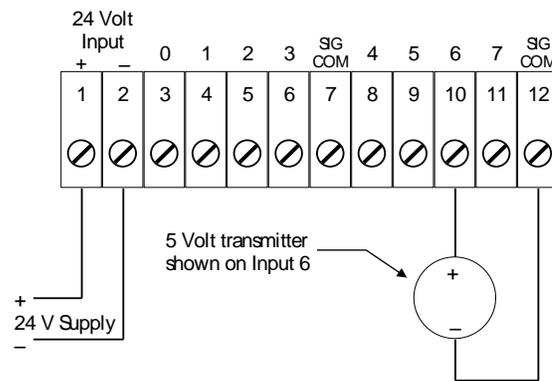
**Figure 1: 5501 Typical 20mA Field Wiring** shows how to wire these transmitters.



**Figure 1: 5501 Typical 20mA Field Wiring**

The 5 volt version is identical to the 20mA version except that the 250 ohm input resistors are not installed. 5 volt signals connect from the analog input to SIG COM.

**Figure 2: 5501 Typical 5 Volt Field Wiring** shows how to wire 5 volt inputs.



**Figure 2: 5501 Typical 5 Volt Field Wiring**

### Address Selection

The 5000 I/O bus will support a maximum of twenty I/O (input/output) modules. 5000 I/O module types may be combined in any manner to the maximum supported by the controller used. The types of input and output modules available are:

- Digital Input modules

- Digital Output modules
- Analog Input modules
- Analog Output modules
- Counter Input modules

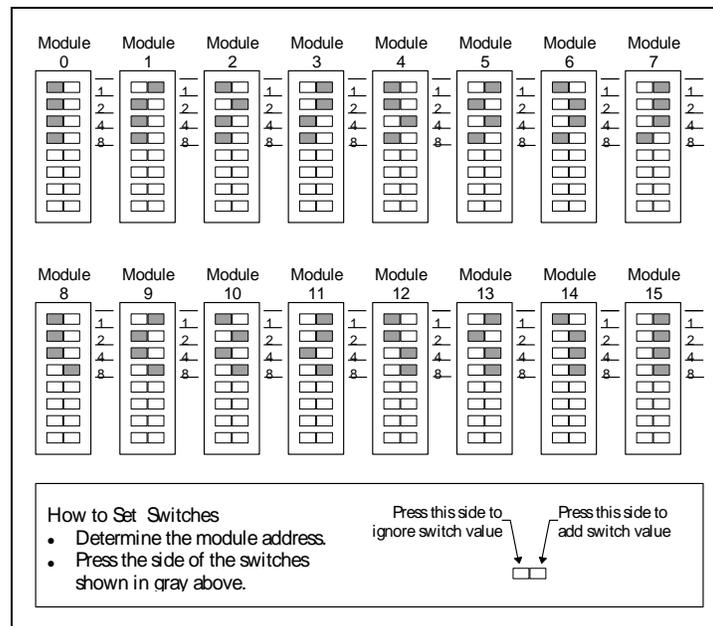
Each type of I/O module, connected to the I/O bus, has a unique I/O module address. Different types of I/O modules may have the same module address.

The address range supported by the SCADAPack controller module may restrict the I/O module address range. Refer to the controller manual for the maximum address supported.

Four address switches labeled 1, 2, 4 and 8 set the module address. To set the address:

- Open the four switches by pressing down the left side of the switch.
- Close the switches that total to the desired address.

**Figure 3: 5501 Analog Input Module Address Switches** shows the switch setting for each of the 16 module addresses.



**Figure 3: 5501 Analog Input Module Address Switches**

## Input Offset Selection

The 5501 module can apply 20% input offset to the signals measured. With the offset enabled, the module reads 4-20mA signals or 1-5 V signals. With the offset disabled the module reads 0-20mA signals or 0-5 V signals.

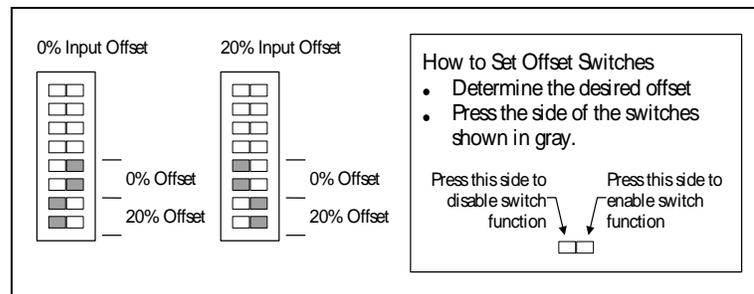
To enable the 20% offset:

- Open the two switches labeled 0% by pressing down the left side of the switches.
- Close the two switches labeled 20% by pressing down the right side of the switches.

To disable the 20% offset (and select 0% offset):

- Open the two switches labeled 20% by pressing down the left side of the switches.
- Close the two switches labeled 0% by pressing down the right side of the switches.

**Figure 4: 5501 Input Offset Switches** shows the switch settings for enabling and disabling the offset.



**Figure 4: 5501 Input Offset Switches**

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## Operation and Maintenance

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### Data Format

5000 analog input and output modules use 16 bit signed numbers (15 bits plus sign). Modules with less than 16 bit resolution normalize the data into the 16 bit format.

The 5501 module has a 12 bit, unipolar, analog to digital (A/D) converter. There are 4096 A/D counts in the input signal range. The module can be configured to use 0% or 20% input offset. The input resolution is better with the 20% input offset, due to the smaller input range.

### 0% Input Offset

The 0% input offset configuration measures 0-20mA or 0-5V signals. The input resolution is:

- 4.88uA/count on 20mA version
- 1.22mV/count on the 5 V version

The table below shows the A/D output value for several input signals.

Current(mA)	Voltage(V)	A/D Output
0	0	0
5	1.25	8192
10	2.5	16384
15	3.75	24576
19.995	4.999	32760

### 20% Input Offset

The 20% input offset configuration measures 4-20mA or 1-5V signals. The input resolution is:

- 3.91uA/count on the 20mA version
- 0.976mV/count on the 5 V version

The table below shows the A/D output value for several input signals.

Current(mA)	Voltage(V)	A/D Output
< 4	< 1	0
4	1	0
8	2	8192
12	3	16384

Current(mA)	Voltage(V)	A/D Output
16	4	24576
19.996	4.999	32760

## Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Control Microsystems Technical Support for more information and instructions for returning the module for repair.

## Troubleshooting

Condition	Action
20mA inputs read 0.	Check transmitter power.
Reading is at or near 0 for input signals.	Check if the input transient suppressers are damaged.
Reading is constant.	Check that the analog input is not forced.
20mA readings are not accurate.	Check for a damaged 250 $\Omega$ current sense resistor.

## Calibration

The 5501 module is calibrated and burned in at the factory. It does not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage.

There are three potentiometers for calibration of the analog inputs.

- The 5V ADJ. potentiometer (R5) adjusts the gain in the 0% offset configuration.
- The 4V ADJ. potentiometer (R29) adjusts the gain in the 20% offset configuration.
- The 1V ADJ. potentiometer (R9) adjusts the zero in the 20% offset configuration.

Adjustment of the zero in the 0% offset configuration is not necessary.

Calibration requires that you read the converted value from the module using a communication or SCADA controller module. Refer to the controller module manual for details.

To calibrate the module:

1. Apply input signals to as many channels as possible.
2. Measure voltage between U14, pin 6 and U14, pin 4. Adjust the 5V ADJ. potentiometer for 5.000 V.

3. Measure voltage between U3, pin 1 and U14, pin 4. Adjust the 4V ADJ. potentiometer for 4.000 V.
4. Measure voltage between U3, pin 7 and U14, pin 4. Adjust the 1V ADJ. potentiometer for 1.000 V.
5. Set offset dip-switches to 0%. Close both 0% dip-switches (press down on the right). Open both 20% dip-switches (press down on the left).
6. Apply 4.9982 V (for 5 V version) or 19.993mA (for 20mA version).
7. Read the converted signal from the communication controller. Adjust the 5V ADJ. potentiometer for readings that alternate between 32752 and 32760 on each channel.
8. Set offset dip-switches to 20%. Close both 20% dip-switches (press down on the right). Open both 0% dip-switches (press down on the left).
9. Apply 1.0005 V (for 5 V versions) or 4.002mA (for 20mA version).
10. Read the converted signal from the communication controller. Adjust the 1V ADJ. potentiometer for readings that alternate between 0 and 8 on each channel.
11. Apply 4.9985 V (for 5 V versions) or 19.994mA (for 20mA version).
12. Read the converted signal from the communication controller. Adjust the 4V ADJ. potentiometer for readings that alternate between 32752 and 32760 on each channel.

Repeat steps 8 through 12 if necessary.

## Specifications

**Disclaimer:** Control Microsystems reserves the right to change product specifications. For more information visit [www.controlmicrosystems.com](http://www.controlmicrosystems.com).

<b>Input Points</b>	8
<b>Resolution</b>	12 bits
<b>Input Resistance</b>	100k $\Omega$ nominal for 5V inputs 250 $\Omega$ for 20mA inputs
<b>Converter type</b>	Successive approximation
<b>Accuracy</b>	+/- 0.1% of full scale at 25°C (77°F) +/- 0.2% of full scale over temperature range
<b>Input Offset</b>	DIP switch configurable for 20% offset
<b>Type</b>	Single ended
<b>Normal mode rejection</b>	60dB at 50 / 60 Hz.
<b>Over-scale Input Capacity (without damage)</b>	Continuous: 60% over scale sustained input signal. 0.25A maximum current and 8.2V maximum voltage. Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
<b>Isolation</b>	500VAC from the logic power
<b>Reading Update Time</b>	100ms
<b>Response Time</b>	20ms typical for 10% to 90% signal change
<b>Power Requirements</b>	5V at 20mA 11 to 28V at 10mA (loop power extra at 20mA maximum per loop)
<b>Terminations</b>	12 pole, removable terminal block 12 to 22 AWG 15 amp contacts
<b>Dimensions</b>	4.25 inch (108mm) wide 4.625 inch (118mm) high 1.75 inch (44mm) deep
<b>Mounting</b>	7.5 x 35 DIN rail
<b>Packaging</b>	Corrosion resistant zinc plated steel with black enamel paint
<b>Environment</b>	5% RH to 95% RH, non-condensing -40°C to 60°C -40°F to 140°F

## Approvals and Certifications

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| <p><b>Safety</b> Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.<br/>UL Listed to the following standards:</p> <ul style="list-style-type: none"><li>• CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.</li><li>• CSA Std. C22.2 No. 142-M1987 - Process Control Equipment.</li><li>• UL Std. No. 1604 - Hazardous (Classified) Locations.</li><li>• UL Std. No. 508 - Industrial Control Equipment.</li></ul> |
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