

SCADAPack

5606 Input Output Module

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Table of Contents

1	Legal Information	6
2	Technical Support	7
3	Safety Information	8
4	About the Book	11
5	About the 5606 Input Output Module	14
6	Cybersecurity	16
7	Hardware Overview	18
7.1	Power Supply.....	19
7.2	Digital Inputs.....	19
7.3	Digital Outputs.....	20
7.4	Analog Inputs.....	21
7.4.1	Current or Voltage Mode.....	22
7.4.2	Range and Scaling.....	22
7.5	Analog Outputs.....	23
7.5.1	Current and Voltage Outputs.....	25
7.5.2	Range and Scaling.....	25
7.6	Protection Summary.....	25
8	Installation	29
8.1	ATEX and IECEx Requirements.....	29
8.2	Mounting the I/O Module.....	30
8.3	Power Supply Requirements.....	33
8.4	Power Supply Wiring.....	34
8.4.1	Recommended 24 Vdc Power Supply Configuration.....	35
8.4.2	Recommended Battery Configuration.....	35
8.4.3	Layout Guidelines.....	36
8.4.4	System Grounding.....	37
8.5	Connecting I/O Modules.....	38
8.5.1	Precautions	39
8.5.2	Cabling Guidance.....	40

	8.5.3 Attaching Intermodule Cables.....	42
9	Addressing	45
	9.1 Addressing Rules.....	45
	9.2 Setting the I/O Module Address.....	46
10	Field Wiring	47
	10.1 Wiring Screw-Termination Connectors.....	48
	10.2 Digital Input Wiring.....	50
	10.2.1 Digital Input Wiring Example.....	51
	10.3 Digital Output Wiring.....	52
	10.3.1 Digital Output Wiring Example.....	53
	10.4 Analog Input Wiring.....	55
	10.4.1 Analog Input Wiring Example.....	56
	10.4.2 Configuring Analog Inputs as Current Inputs.....	58
	10.4.3 Helping to Prevent Interruption of the Current Loop.....	58
	10.5 Analog Output Wiring.....	60
	10.5.1 Analog Output Wiring Example.....	60
	10.5.2 Analog Output Power Supply Configuration Options.....	61
11	Configuration	63
12	Diagnostics	64
	12.1 LEDs	64
	12.2 Digital Inputs.....	64
	12.3 Digital Outputs.....	65
	12.4 Analog Inputs.....	65
	12.5 Analog Outputs.....	66
13	Maintenance	67
14	Specifications	68
	14.1 General.....	68
	14.2 Power Supply.....	68
	14.3 Digital Inputs.....	69
	14.4 Digital Outputs.....	70
	14.5 Analog Inputs.....	71
	14.6 Analog Outputs.....	71

15 Standards and Certifications.....73

1 Legal Information

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.

Trademarks

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2 Technical Support

Questions and requests related to any part of this documentation can be directed to one of the following support centers.

Technical support: Americas, Europe, Middle East, Asia

Available Monday to Friday 8:00 am – 6:30 pm Eastern Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: supportTRSS@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Toll free within North America: 1-888-226-6876 • Direct Worldwide: +1-613-591-1943

Technical support: Australia/New Zealand (Pacific)

Available Monday to Friday 8:00 am - 5:00 pm Australian Eastern Standard Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: techsupport.pz@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Inside Australia: 13 73 28 (13 SEAU) • Inside New Zealand: 0800 652 999

3 Safety Information

Important 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 a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, can result in death or serious injury.
⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, can result in minor or moderate injury.
NOTICE
NOTICE is used to address practices not related to physical injury.

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, installation, and operation of electrical equipment 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.

WARNING

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 death or serious injury.

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

Test all software 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 help prevent accidental equipment damage.

Operation and adjustments

The following precautions prevail:

- 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.

Acceptable use

WARNING

UNACCEPTABLE USE

Do not use SCADAPacks or I/O modules as an integral part of a safety system. These devices are not safety products.

Failure to follow these instructions can result in death or serious injury.

CAUTION

EQUIPMENT OPERATION HAZARD

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Use only Schneider Electric software or approved software with Schneider Electric hardware products.

Failure to follow these instructions can result in minor or moderate injury.

4 About the Book

Audience

WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise are 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 or serious injury.

This manual is written for people who need to install, troubleshoot or maintain the 5606 input output module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5606 input output module, including detailed hardware specifications
- Installation, wiring and addressing for the 5606 input output module
- Diagnostics capabilities on the 5606 input output module
- Maintenance recommendations for the 5606 input output module

Validity note

This document is valid for:

- SCADAPack x70 firmware version 9.6.1 and earlier
- SCADAPack RemoteConnect configuration software version 3.9.1 and earlier

Related documents

Use this manual with the other manuals included in your SCADAPack x70 documentation set. The table below describes the manuals available in the documentation set.

Folder	Manual	Content
--------	--------	---------

Getting Started	Getting Started	<ul style="list-style-type: none"> • The SCADAPack x70 family of products available in this release • The basic steps to get your SCADAPack x70 device operational • Where to get more information about configuring, monitoring and managing your SCADAPack x70 device
SCADAPack Software Installation	SCADAPack Software Installation	<ul style="list-style-type: none"> • Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	<ul style="list-style-type: none"> • Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	<ul style="list-style-type: none"> • Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	<ul style="list-style-type: none"> • Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	<ul style="list-style-type: none"> • Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from SCADAPack E to SCADAPack RemoteConnect • Locating SCADAPack E Configurator features in SCADAPack RemoteConnect • Locating SCADAPack Workbench features in SCADAPack RemoteConnect • Compatibility chart
	Porting Guide for Telepace to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	<ul style="list-style-type: none"> • USB, serial and IP communications

Reference Manuals	Communication Interfaces Technical Reference	<ul style="list-style-type: none"> • Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	<ul style="list-style-type: none"> • The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	<ul style="list-style-type: none"> • DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	<ul style="list-style-type: none"> • The differences between EcoStruxure Control Expert (Unity Pro) and the SCADAPack x70 Logic Editor environment • Key programming concepts • Basic procedures needed to use the SCADAPack x70 Logic Editor
	SCADAPack Function Blocks Technical Reference	<ul style="list-style-type: none"> • The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	<ul style="list-style-type: none"> • Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	<ul style="list-style-type: none"> • Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	<ul style="list-style-type: none"> • Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 5606 Input Output Module

The 5606 input output module increases the SCADAPack I/O capacity by providing:

- 32 digital inputs
- 16 relay digital outputs
- 8 analog inputs
- 2 analog outputs (this option is selected when the I/O module is ordered)

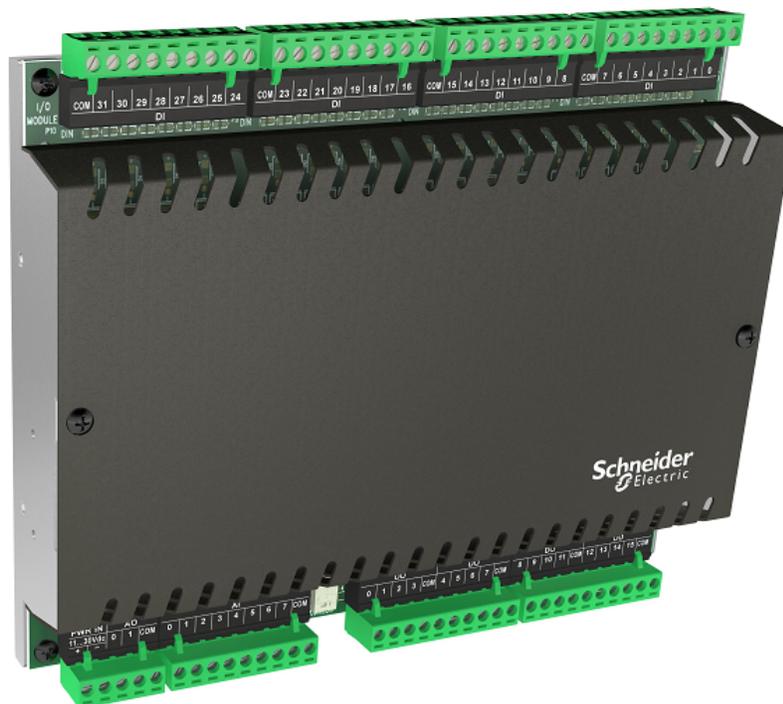
You can connect up to 15 5606 input output modules to the I/O bus, for a total of 870 inputs and outputs.

The 5606 input output module can be added to SCADAPack x70 RTUs.

It is important to consider the power requirements of the 5606 input output module. See the SCADAPack hardware manual for details about I/O module power supply requirements.

This manual covers the powering, wiring and configuration of a 5606 input output module only. It is meant to be used with the hardware manual of the respective SCADAPack to which it is connected.

The 5606 input output module is shown in the image below:



Connections

I/O modules include a short intermodule cable for connecting to a SCADAPack or to another I/O

module. For information about the maximum number of I/O modules supported, see the hardware manual for your SCADAPack. For details on connecting I/O modules, see [Attaching Intermodule Cables](#)^[42].

Screw-termination connectors are provided for connecting the inputs and outputs to the devices you want to monitor or control. For details on wiring input and output connectors, see [Field Wiring](#)^[47].

Configuration

The inputs and outputs can be configured locally or remotely using the SCADAPack RemoteConnect configuration software on a Microsoft Windows-based computer.

6 Cybersecurity

Cybersecurity is a branch of network administration that addresses attacks on or by computer systems and through computer networks that can result in accidental or intentional disruptions. The objective of cybersecurity is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for intended users.

No single cybersecurity approach is adequate. Schneider Electric recommends a defense-in-depth approach. This approach layers the network with security features, appliances, and processes. The basic components of this approach are:

- Risk assessment: A systematic security analysis of the environment and related systems.
- A security plan built on the results of the risk assessment
- A multi-phase training campaign
- Network separation and segmentation: Physical separation of the control network from other networks, and the division of the control network itself into segments and security zones.
- System Access Control: Controlling access to the system with firewalls, authentication, authorization, and other software means, and traditional physical security measures such as video surveillance, fences, locked doors and gates, and locked equipment cabinets.
- Device hardening: The process of configuring a device against communication-based threats. Device hardening measures include disabling unused network ports, password management, access control, and the disabling of all unnecessary protocols and services.
- Network monitoring and maintenance: An effective defense-in-depth campaign requires continual monitoring and system maintenance to meet the challenge of new threats as they develop.
- See Security Considerations in the Security Technical Reference manual

Contact us

For more information, refer to the Schneider Electric Cybersecurity Support Portal at <http://www.se.com/b2b/en/support/cybersecurity/overview.jsp>.

Additional Resources

Industrial Control Systems Cyber Emergency Response Team (ICS-CERT)
<https://ics-cert.us-cert.gov>

ICS-CERT Recommended Practices
<https://ics-cert.us-cert.gov/Recommended-Practices>

Center for Internet Security (CIS) Top 20 Critical Security Controls
<https://www.cisecurity.org/cybersecurity-best-practices>

FBI Cyber Crime
<https://www.fbi.gov/investigate/cyber>

Guide to Industrial Control Systems (ICS) Security

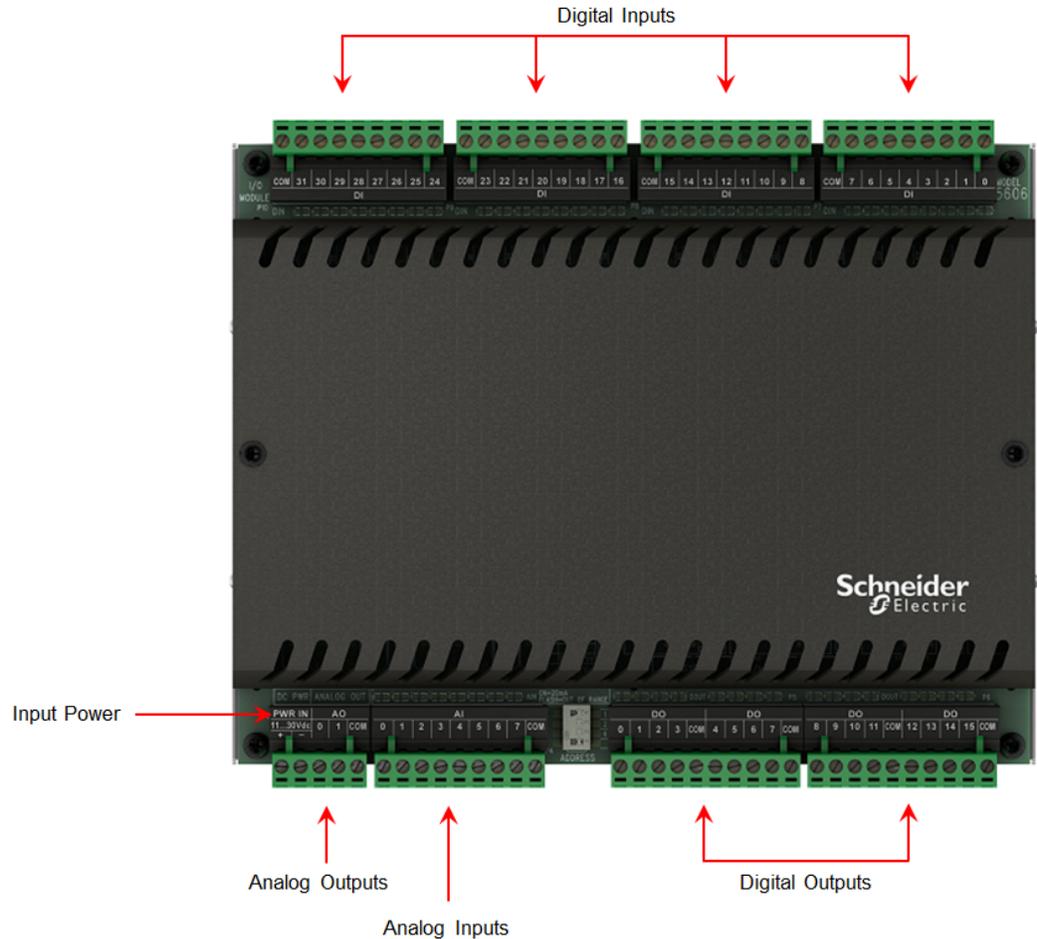
<https://www.nist.gov/publications/guide-industrial-control-systems-ics-security>

WaterISAC Water Security Network

<https://www.waterisac.org>

7 Hardware Overview

The figure below shows the inputs and outputs on the 5606 input output module.



For complete hardware specifications, see [Specifications](#) ^[68].

See also:

- [Power Supply](#) ^[19]
 - 11...30 Vdc input power
 - Wired to connector P3
- [Digital inputs](#) ^[19]
 - 32 digital inputs
 - Optically isolated from logic power
 - Wired to connectors P7, P8, P9, and P10
- [Digital outputs](#) ^[20]
 - 16 dry contact (mechanical) relay or solid state relay (SSR) outputs

- Wired to connectors P5 and P6
- [Analog inputs](#)^[21]
 - 8 analog inputs
 - Wired to connector P4
 - 16-bit successive approximation analog-to-digital converter (ADC)
- [Analog outputs](#)^[23]
 - 2 analog outputs (optional)
 - Wired to connector P3
 - 12-bit, unipolar, digital-to-analog converter (DAC)
- [Protection Summary](#)^[25]
 - Over-voltage protection

7.1 Power Supply

The 5606 input output module is powered primarily by the 11...30 Vdc power supply of the SCADAPack. The analog inputs and optional analog outputs require an external 12 Vdc or 24 Vdc power supply connected to the input power supply of the 5606 input output module. For further information, see the [Power Supply Wiring](#)^[34] section.

7.2 Digital Inputs

The 5606 input output module expands the functionality of the SCADAPack with 32 digital inputs.

Digital inputs are used to monitor the state of devices such as valves, motors and level switches.

Digital inputs are available for nominal 12...24 Vdc operation. A current-limiting resistor on each input determines the voltage range. Light Emitting Diodes (LEDs) on the digital inputs show the status of each input.

To simplify field wiring, the 32 inputs are organized into 4 groups of 8 inputs. Each group shares a common return. These groups of 8 inputs are isolated from each other. Inputs 0 to 7 are in one group. Inputs 8 to 15 are in another group. Inputs 16 to 23 are in a third group. Inputs 24 to 31 are in the final group.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each digital input, including:

- DNP3 parameters
- Modbus parameters
- Event attributes
- Alert notifications

For more information about configuring digital inputs, see the SCADAPack x70 Configuration manual.

Wiring

Digital inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[48].

Specifications

For digital input specifications, see [Specifications](#)^[69].

7.3 Digital Outputs

The 5606 input output module expands the function of the SCADAPack with 16 dry contact (mechanical) relay or solid state relay (SSR) outputs.

Digital outputs are used to control panel lamps, relays, motor starters, solenoid valves and other devices. The relay outputs are well suited to applications that cannot tolerate any off-state leakage current, that require high load currents, or that involve non-standard voltages or current ranges.

Outputs are Form A Normally Open (NO). Loads can be connected to either output terminal and to either the high or the low side of the power source.

The LED for each digital output shows the status of the output.

WARNING

DATA LOSS, APPLICATION LOSS

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the digital outputs, including:

- DNP3 parameters
- Modbus parameters
- Output pulse time
- Event attributes
- Alert notifications

For more information about configuring digital outputs, see the SCADAPack x70 Configuration manual.

Wiring

Digital outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[48].

Specifications

For digital output specifications, see [Specifications](#)^[70].

7.4 Analog Inputs

The 5606 input output module enhances the capacity of a SCADAPack by providing an additional 8 single-ended analog inputs on connector P4 that can be configured for current or voltage mode.

Analog inputs are used to monitor devices such as pressure, level, flow and temperature transmitters, instrumentation such as pH and conductivity sensors, and other high-level analog signal sources.

Each analog input is individually configured for the input type — current or voltage — and range. Refer to [Current or Voltage Mode](#)^[22] for information on how to choose input modes.

The analog inputs use a 16-bit successive approximation analog-to-digital converter (ADC).

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the analog inputs, including:

- DNP3 parameters
- Modbus parameters
- [Range and Scaling](#)^[22]
- Value deviation

- Alert notifications

For more information about configuring analog inputs, see the SCADAPack x70 Configuration manual.

Wiring

Analog inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[48].

Specifications

For analog input specifications, see [Specifications](#)^[71].

7.4.1 Current or Voltage Mode

The analog inputs can be configured for either voltage or current mode via the SCADAPack RemoteConnect configuration software.

- In current mode, a 250 ohm current sense resistor appears across each analog input channel. Measurement range in current mode is 0...20 mA or 4...20 mA, selectable via software. The 250 ohm resistor produces a voltage drop (input reading) of 5 Vdc for 20 mA of current flow.
- In voltage mode, analog inputs are single-ended with a measurement range of 0...5 Vdc, 1...5 Vdc, or 0...10 Vdc.

7.4.2 Range and Scaling

The analog inputs have a 16-bit, unipolar, analog-to-digital converter (ADC) that measures input current ranges from 0...20 mA or 4...20 mA, or input voltage ranges from 0...5 Vdc, 1...5 Vdc, or 0...10 Vdc.

To assign SCADAPack database objects to the analog input channels, use the SCADAPack RemoteConnect configuration software to select the signal range for each analog input channel. Each analog input channel can be configured for one of the following signal ranges:

- 0...5 Vdc
- 1...5 Vdc
- 0...10 Vdc
- 0...20 mA
- 4...20 mA

The following table shows the analog input values and status for several input signals. Out-of-range detection occurs when the measured input is outside of the measurement range as indicated. The out-of-range detection is shown on the module's LED indicator for the affected analog input channel. See [LEDs](#)^[64].

The object database value reported for out-of-range analog channels is shown as a percentage difference of the Raw range, and Engineering range.

- **Example 1:** For a 4...20 mA analog channel with a configured **Engineering Minimum** value

of 0.0 and **Engineering Maximum** value of 100.0, a 0.2% difference reports an under-range value of -0.2 and an over range engineering value of 100.2.

- **Example 2:** For a 0...10 V analog channel with a configured **Raw Minimum** value of 0 and a **Raw Maximum** value of 10000, a 0.048% difference reports an over range raw value of 10005.

Out-of-range quality indication for this module's analog input channel's representation in the SCADAPack object database is dependent on the object's over range and under range configurations.

0...5 Vdc Range	1...5 Vdc Range	0...10 Vdc Range	0...20 mA Range	4...20 mA Range	Object Database Value	Out-of-range LED indication
n/a	< 0.992	n/a	n/a	< 3.968	Raw Minimum - 0.2% Engineering Minimum -0.2%	ON
0	1	0	0	4	Raw Minimum Engineering Minimum	OFF
1.25	2	2.5	5	8	25% of scale	OFF
2.5	3	5.0	10	12	50% of scale	OFF
3.75	4	7.5	15	16	75% of scale	OFF
5	5	10	20	20	Raw Maximum Engineering Maximum	OFF
n/a	> 5.008	n/a	n/a	> 20.032	Raw Maximum + 0.2% Engineering Maximum + 0.2%	ON
> 5.0024	n/a	> 10.0048	> 20.01	n/a	Raw Maximum + 0.048% Engineering Maximum + 0.048%	ON

7.5 Analog Outputs

Analog outputs are used to control remote devices that require varying input information, rather than simply on or off operations.

If the optional analog output module was ordered, two 20 mA analog outputs are available for use.

The analog output channels are powered with an external 12 Vdc or 24 Vdc power supply. They can be configured for 0...20 mA or 4...20 mA current.

WARNING

DATA LOSS, APPLICATION LOSS

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the analog outputs, including:

- DNP3 parameters
- Modbus parameters
- [Range and Scaling](#)^[25]
- Value deviation
- Alert notifications

For more information about configuring analog outputs, see the SCADAPack x70 Configuration manual.

Wiring

Analog outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[48].

Specifications

For analog output specifications, see [Specifications](#)^[71].

7.5.1 Current and Voltage Outputs

Current outputs

The I/O module can be equipped with optional analog outputs that provide two 20 mA analog outputs. Analog output resolution is 12 bits. The outputs provide a level of transient and over-voltage protection. The outputs share a common return with each other and with the analog inputs. See [Analog Output Wiring](#)^[60] for an illustration on how to connect current outputs.

Voltage outputs

To obtain voltage outputs, connect a load resistor as shown in [Analog Output Wiring](#)^[60] and connect the voltage device across the load resistor.

The table below lists resistance values and output range settings for common voltage ranges. The resistance value listed is the parallel resistance of the device and the load resistor.

Resistance	Output Range	Voltage Range
250 ohms	0...20 mA	0...5 Vdc
	4...20 mA	1...5 Vdc
500 ohms	0...20 mA	0...10 Vdc

7.5.2 Range and Scaling

The analog output module has a 12-bit, unipolar, digital-to-analog converter (DAC).

In the SCADAPack RemoteConnect configuration software, you can select one of the following **AO Output Type** ranges. The analog output channels use the same range:

- 0...20 mA
- 4...20 mA

The 0...20 mA output range resolution is 4.88 μ A per DAC count.

Configuration for objects attached to the analog output module channels uses the **Raw Minimum** to **Raw Maximum** and **Engineering Minimum** to **Engineering Maximum** parameters for integer and engineering scaling, respectively.

These scaling ranges are applied automatically to the selected analog output signal range (0...20 mA or 4...20 mA).

7.6 Protection Summary

Over-voltage protection

Over voltage may occur on cables that extend from a cabinet to a remote device or another cabinet. Results can include corrupted data carried on the cable or damage to devices

connected to that cable. Following the guidelines below may reduce the severity and frequency of such events. It is highly recommended that end users determine the proper protection for their industry, application, and environment.

NOTICE

RS232 LOSS OF FUNCTION

- Limit the length to 50 feet (15 m) or less in electrically noisy environments.
- Use commercially available isolators and/or surge suppression if the length limitations (above) are exceeded. These are typically not required if the length limitations (above) are followed.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE

485 LOSS OF FUNCTION

- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE

ANALOG INPUTS AND OUTPUTS LOSS OF FUNCTION

- Avoid connecting 24 Vdc directly across analog inputs.
- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.
- Use an external fuse (63 mA fast blow).

Failure to follow these instructions can result in equipment damage.

NOTICE**EXTERIOR ANTENNA LOSS OF FUNCTION**

- Use a coaxial surge diverter and terminate the ground connection.

Failure to follow these instructions can result in equipment damage.

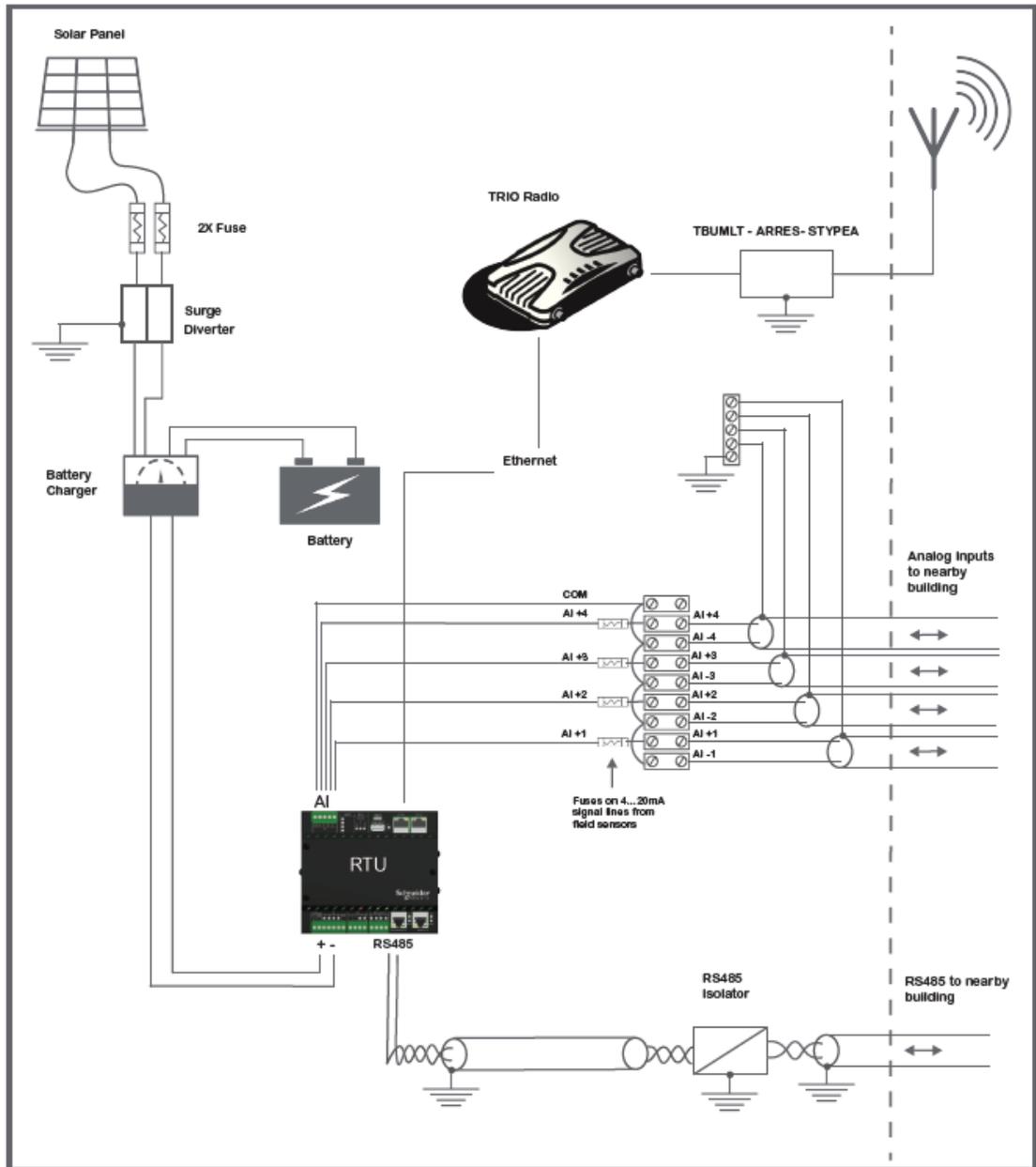
NOTICE**POWER SUPPLY LOSS OF FUNCTION**

- Use an external fuse, as specified in the manual.
- If using solar panels, use commercially available surge suppression.

Failure to follow these instructions can result in equipment damage.

Example

RTU with over-voltage protection on a power supply, analog inputs, RS485 port, and radio antenna.



NOTE:

Every line that enters or leaves a panel in the field or a (building) must have some form of protection. Examples as shown above diagram.

For additional information, refer to the Schneider Electric document [Grounding, Earthing and Lightning Protection](#), Chapter 7 “Grounding and Electromagnetic Compatibility of PLC Systems “ (Doc# 33002439).

8 Installation

The I/O module is factory-configured and under normal conditions does not require removal or insertion of any peripherals or components. The I/O configurations are stored in a combination of battery-backed RAM and flash memory on the SCADAPack.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Installing the I/O module in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the module can lead to unpredictable operation and unexpected results.

Before mounting the I/O module, check the Standards and Certifications topic to verify which EMC standards are supported.

Failure to follow these instructions can result in equipment damage.

The following sections describe specific aspects of installing the I/O module.

For more information see:

- [ATEX and IECEx Requirements](#)^[29]
- [Mounting the 5606 input output module](#)^[30]
- [Power Supply Requirements](#)^[33]
- [Power Supply Wiring](#)^[34]
- [Connecting I/O Modules](#)^[38]

8.1 ATEX and IECEx Requirements

The information in this topic applies when the unit is being used for ATEX and IECEx applications.

Conditions of safe use

Before installing the equipment, consider the instructions in the warning message below.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use this equipment in an area of not more than pollution degree 2, as defined in EN 60664-1.
- Install this equipment in an enclosure that is only tool accessible and that provides a degree of protection not less than IP54 in accordance with EN 60079-15.
- Provide transient protection at a level not exceeding 140% of the peak rated voltage at the supply terminals to the equipment.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.
- For products using solid state relays (5606 and 5607 I/O modules and SCADAPacks using these modules), a T4 rating is acceptable for maximum loads of 1.33 A. When 2 A loads are connected to the solid state relays, the maximum ambient rating is lowered to 50 °C (122 ° F) in order to maintain the T4 rating.

Failure to follow these instructions can result in death or serious injury.

The rated supply cable temperature is ≥ 105 °C.

Product label

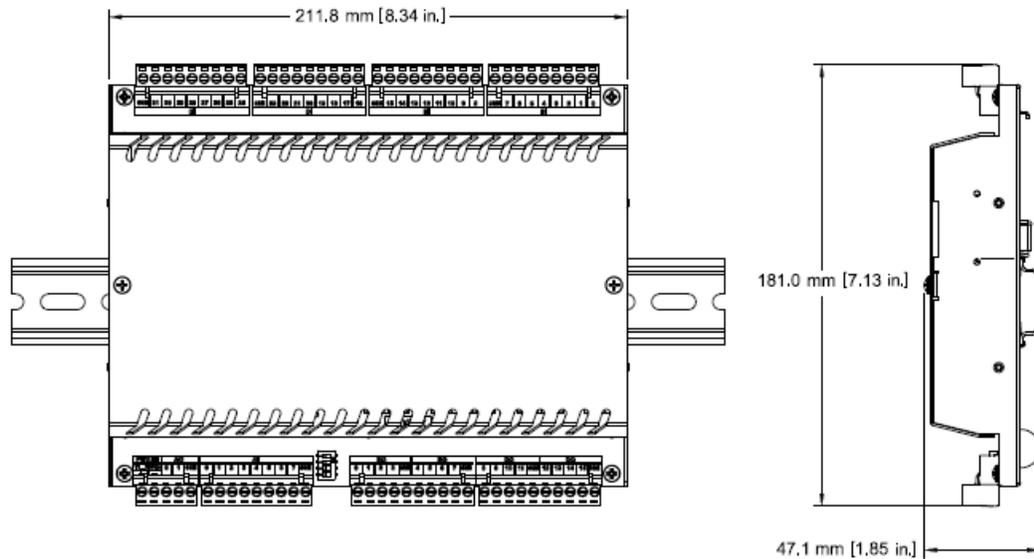
The following product label appears on a 5606 input output module.

<p>MODEL 5606 TBUXYYYYYYX</p> <p></p> <p>Ex nA IIC T4 Gc -40°C ≤ Ta ≤ +70°C Cl. I Zone 2, AEx nA IIC T4 Gc Ex nA IIC T4 Gc DEMKO 16 ATEX 1696X IECEX UL 16.0070 X 415 Legget Dr, Ontario K2K 3R1, Canada</p> <p style="font-size: small;">1050-0509 Rev.1 PID 270715</p>	<div style="text-align: right;">  S/N: B123456 </div> <p>Power Supply: 11...30 Vdc, 1.6 W max Input Ratings: Analog 20mA, 10V. Digital 24Vdc Output Rating: 30Vdc, 2A at 50°C, 1.33A at 70°C</p> <p>DOM: YYWW Warning – Do Not Open When Energized Refer to user manual</p> <div style="text-align: right;">  </div>
---	---

8.2 Mounting the I/O Module

The I/O module is mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail then connected to the SCADAPack or to another I/O module.

The figure below shows the I/O module dimensions when mounted.



⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack and the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before mounting it on a DIN rail.

Do not remove the I/O module cover when mounting the module. The I/O module is designed so that it can be mounted on a DIN rail with the cover in place.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Installing the I/O module in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the I/O module can lead to unpredictable operation and unexpected results.

Before installing the I/O module, check the Standards and Certifications topic to verify which EMC standards are supported.

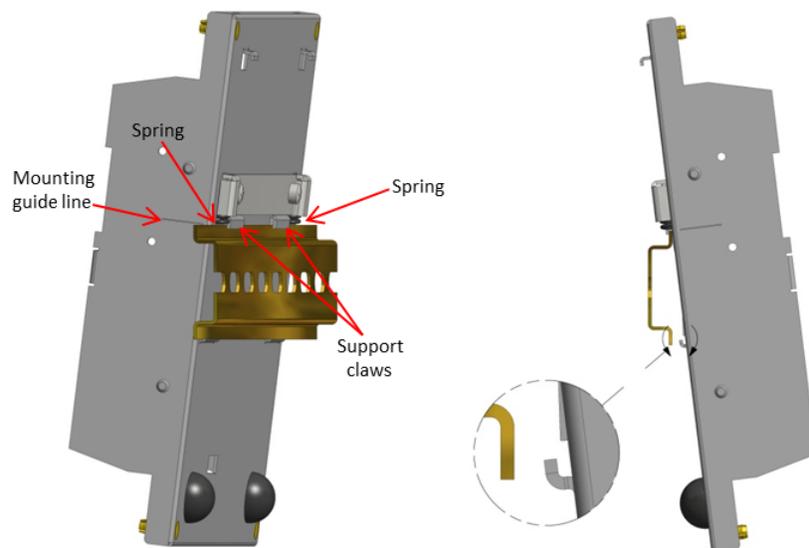
Failure to follow these instructions can result in equipment damage.

To mount the I/O module

The illustrations below show how to mount the I/O module on a horizontally oriented DIN rail. The steps to mount the I/O module on a vertically oriented DIN rail are the same.

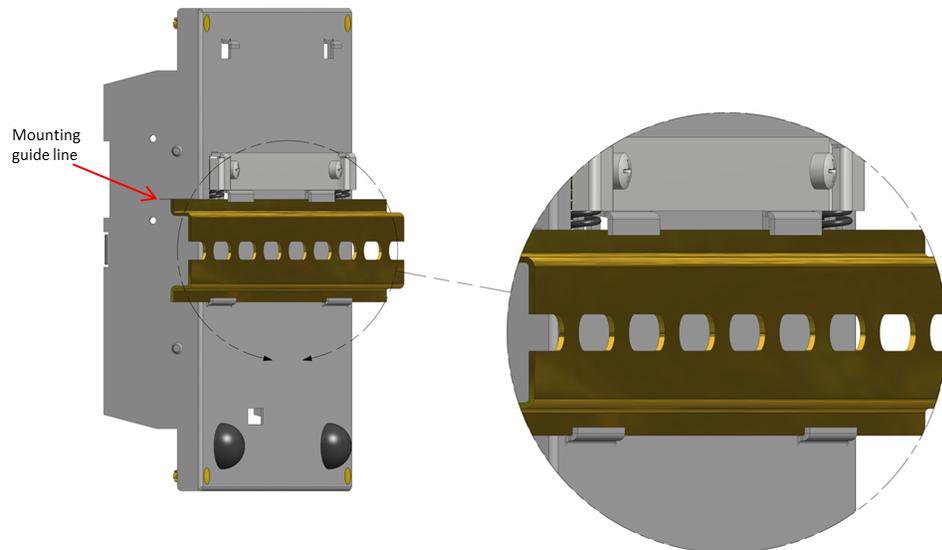
1. With the lower part of the module tilted away from the DIN rail, position the mounting guide line on the side of the module so that it is just above the top edge of the DIN rail.

Verify that the springs on the back of the module rest on the DIN rail and that the edge of the DIN rail is under the support claws that are adjacent to the springs, as shown below.

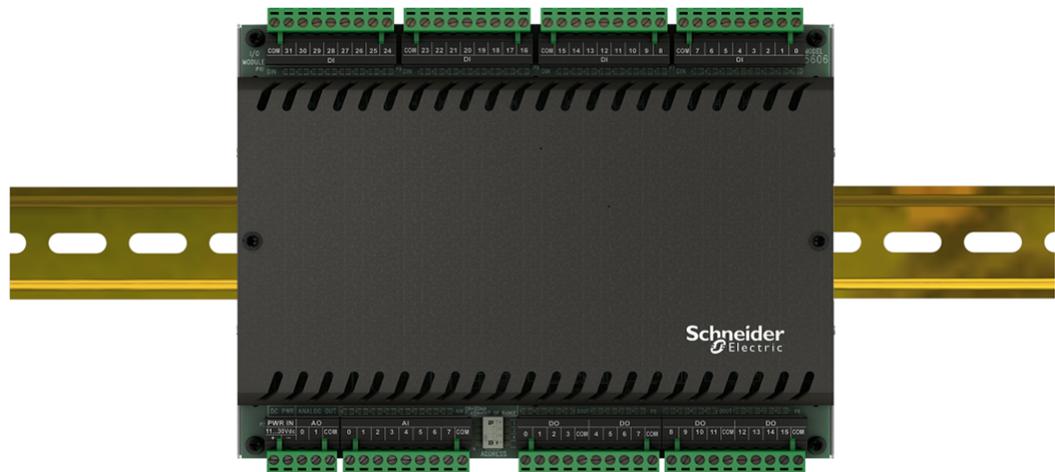


2. Push firmly on the module while tilting it toward the DIN rail until the DIN rail is positioned under both the upper and lower claws on the back of the module.
3. Verify that the mounting guide line is aligned with the edge of the DIN rail, then release the pressure on the springs so that the DIN rail is held firmly in place between the upper and lower claws.

The figure below shows a DIN rail correctly positioned in the upper and lower claws on the back of the I/O module.



The figure below shows an I/O module that is mounted horizontally.



8.3 Power Supply Requirements

Analog outputs are not included in this calculation. Add 20 mA for each analog output used.

The power requirement of the I/O module is summarized in the table below:

Relay Digital Outputs	LEDs	Digital Inputs	24 Vdc	5 Vdc Current Required from the SCADAPack
On	On	On	3.9 W	600 mA

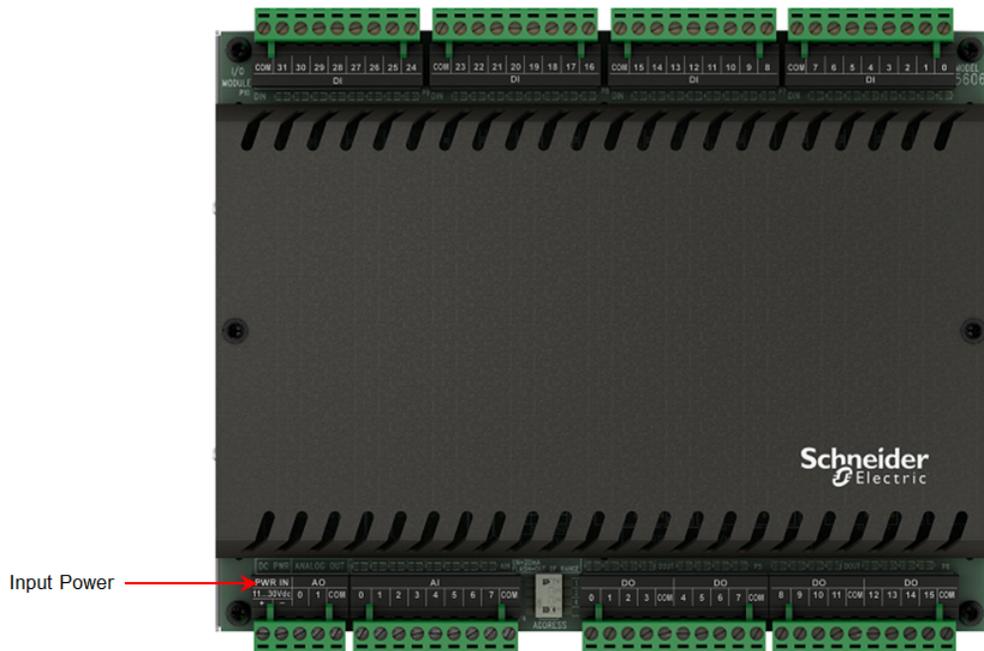
8.4 Power Supply Wiring

The I/O module requires a nominally 12 Vdc or 24 Vdc power supply applied to the terminals labeled 11...30 Vdc on connector P3 to power the analog input and optional analog output circuitry.

The current requirement of the analog portion (input and optional output circuitry) on the I/O module can vary from a minimum of 12 mA for basic operation of the analog circuitry plus an additional 40 mA for the optional analog outputs.

In addition, the system controller or power supply provides 5 Vdc through the I/O bus cable. Refer to the [Specifications](#) section of the SCADAPack manual for its power capabilities. A sample power calculation for a SCADAPack with an integrated I/O module can be found in the manual of the corresponding SCADAPack.

See the image below for the location of the input power connection.



Power for the I/O module can be provided in several ways:

- With a 24 Vdc source connected to the PWR IN terminals on the SCADAPack and on the I/O module in a parallel configuration. See [Recommended 24 Vdc Power Supply Configuration](#) for an example of this wiring configuration.
- With a 12 Vdc source connected to the PWR IN terminals on the SCADAPack and on the I/O module in a parallel configuration. See [Recommended Battery Configuration](#) for an

example of this wiring configuration.

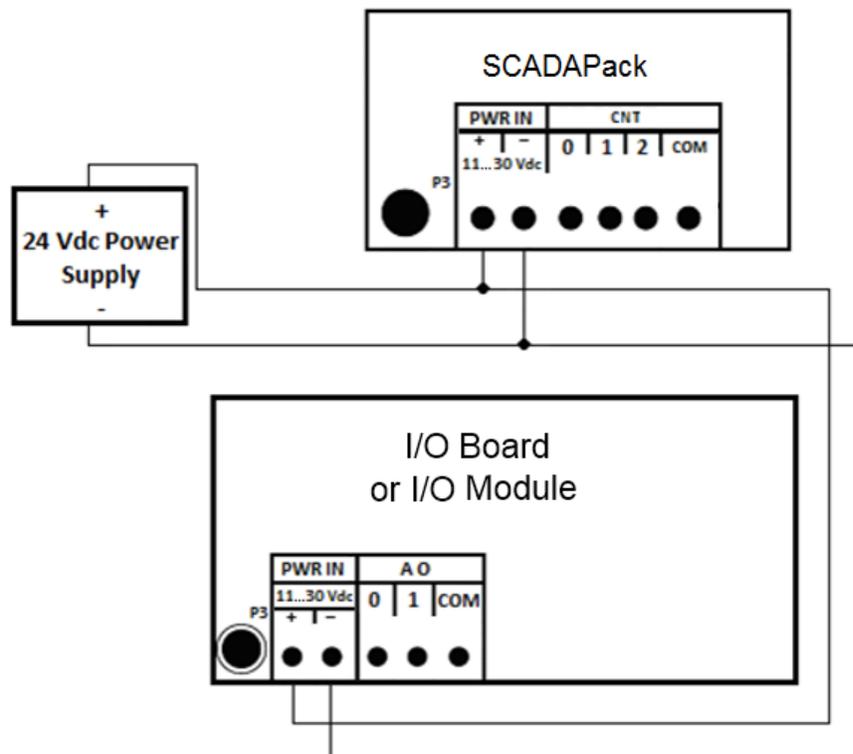
- With a 5103 Uninterruptible Power Supply (UPS) providing 5 Vdc to the SCADAPack through the IMC cable and 24 Vdc to the I/O module through the 24 Vdc output. See [Layout Guidelines](#)^[36] for an example of this wiring configuration.

For information about grounding the system, see [System Grounding](#)^[37].

8.4.1 Recommended 24 Vdc Power Supply Configuration

This configuration uses a 24 Vdc power supply to power the SCADAPack and the I/O board or I/O module. This 24 Vdc is also used to power the analog circuitry on the I/O board or the I/O module.

- This configuration is recommended when a large amount of current is required at 24 Vdc. Refer to the [Specifications](#)^[68] section.
- Connect the SCADAPack **PWR IN** terminal to the same power supply as the I/O board or I/O module **PWR IN** terminal.



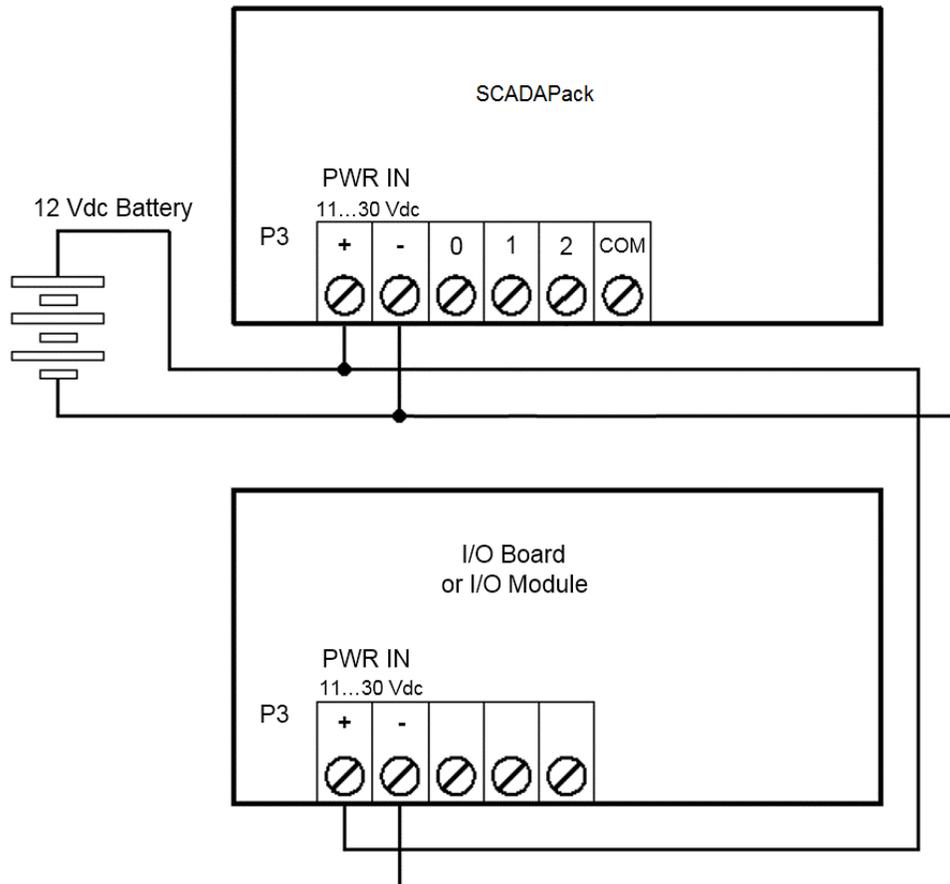
8.4.2 Recommended Battery Configuration

This configuration uses a 12 Vdc battery to power the SCADAPack and the I/O board or I/O module. This 12 Vdc battery is also used to power the analog circuitry for the analog inputs and optional analog outputs.

- This configuration is recommended when a large amount of current is required at 12 Vdc.

Refer to the [Specifications](#) ⁶⁸ section for power requirements from a 12 Vdc battery.

- Connect the SCADAPack **PWR IN** terminal to the same power supply as the I/O board or I/O module **PWR IN** terminal.



8.4.3 Layout Guidelines

When additional I/O or power is required by the system, I/O expansion modules or 5103 power supply modules can be used in combination with the controller. There are several guidelines to keep in mind when adding modules to your SCADAPack x70 control system.

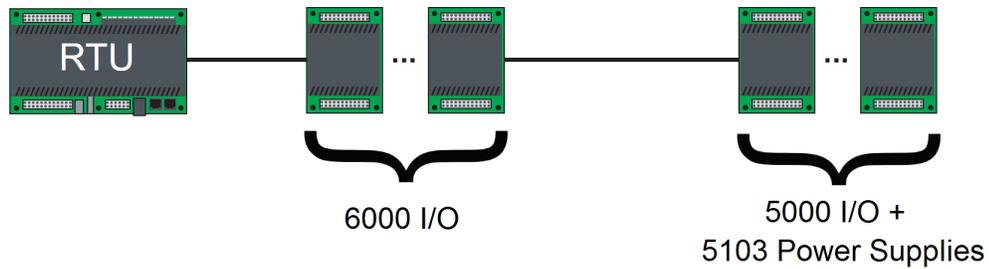
Module location

The 5103 module supplies power to the modules that are downstream from it. I/O modules that are placed to the left of the 5103 are powered by the previous controller or 5103, if there is one. I/O modules that are placed to the right of the 5103 are powered by that 5103.

You can add modules as follows:

- If you are using only 5000 series I/O modules:
 - Connect the 5000 series modules directly to the controller until additional power is needed

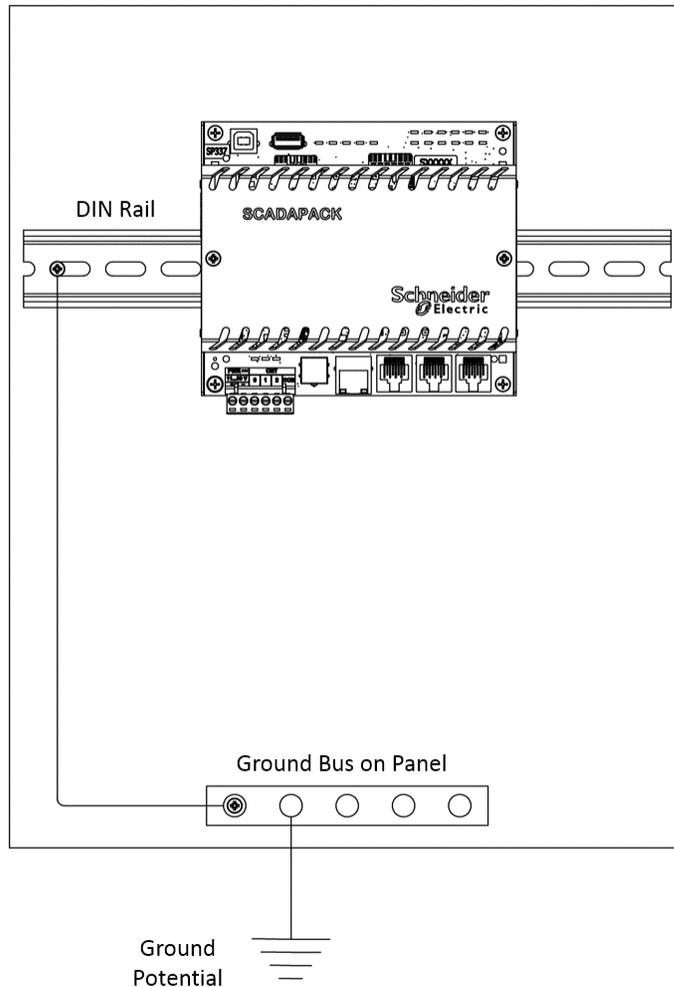
- Connect a 5103 module followed by additional 5000 series I/O modules and 5103 power supply modules, as needed
- If you are using 5000 and 6000 series I/O modules:
 - Connect the 6000 series modules first and then follow the rules for connecting any 5000 modules
 - The 5103 power supply module can only be placed after the 6000 series modules



8.4.4 System Grounding

Ground the system by connecting the system power supply common, to the chassis or panel ground. On the I/O board, the negative (-) terminal of the 11...30 Vdc supply along with terminals labeled GND are isolated from the chassis.

SCADAPack x70 devices and I/O expansion modules are mounted on a DIN rail which is connected to the panel as shown in the illustration below. Connect the panel to ground according to the local electrical code.



8.5 Connecting I/O Modules

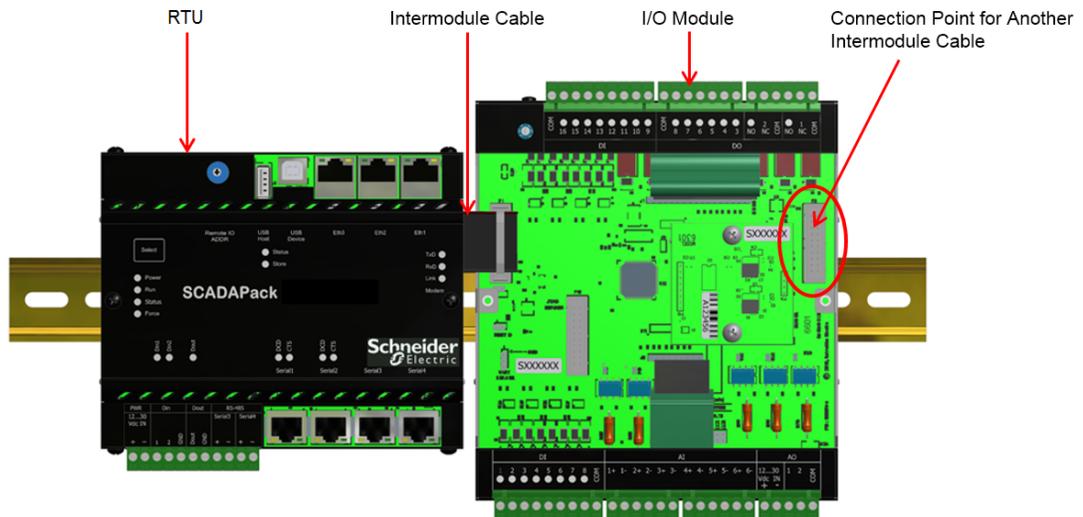
The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

I/O modules are mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to a SCADAPack using intermodule cables. The intermodule cable is a ribbon cable that distributes power (5 Vdc) and communications signals from the SCADAPack to the I/O modules. These power and communication signals are referred to as the I/O bus.

The figure below shows a SCADAPack x70 device with an I/O module connected to it. You can connect multiple I/O modules to a single SCADAPack up to the maximum number of modules supported by the device. See the SCADAPack hardware manual for details.

The illustration below shows a connected intermodule cable. The maximum number of modules may also be limited by the total length of the cable. See [Cabling Guidance](#)^[40] for further details on intermodule cables. While the size and shape of your devices may differ and the color of the

connectors may be different, the location of the intermodule cable is the same on each device type.



Before [attaching intermodule cables](#) ^[42], read the [Precautions](#) ^[39] and the [Cabling Guidance](#) ^[40].

8.5.1 Precautions

Before connecting I/O modules:

- Confirm that the power supply is rated for the total number of modules in the system. Some I/O modules, such as those with analog outputs, require an additional DC power supply to operate. See [Specifications](#) ^[68] for details.
- Confirm that the intermodule cables you are are less than the maximum total cable length. See [Maximum Intermodule Cable Length](#) ^[41].
- Review the recommendations below to help avoid static electricity damage.

NOTICE

STATIC ELECTRICITY DAMAGE

Static electricity damage can cause intermittent or total loss of equipment operation. To help avoid static electricity damage:

- Wear an anti-static wrist strap that is connected to ground if you need to remove the device cover.
- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.
- Do not install intermodule cables in the same cable tray or in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Failure to follow these instructions can result in equipment damage.

8.5.2 Cabling Guidance

This topic summarizes the rules for connecting I/O modules to SCADAPack x70 devices. These rules apply to the following SCADAPack I/O modules:

- 6601 input output module
- 6602 HART module
- 6607 input output module
- 5304 analog output module
- 5405 digital input module
- 5410 high speed counter input module
- 5414 digital input module
- 5415 relay output module
- 5505 RTD input module
- 5506 analog input module
- 5606 input output module
- 5607 input output module

Using only 5000 series I/O modules

If you are using only 5000 series I/O modules with a SCADAPack x70 device, connect the 5000 series module directly to the SCADAPack using a 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual).

Using 5000 and 6000 series I/O modules

If you are using a combination of 5000 series I/O modules and 6000 series I/O modules with a SCADAPack x70 device, connect a 6000 series module to the SCADAPack first, followed by any other 6000 series modules. Then connect the 5000 series modules to the last 6000 series module.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

General guidance

- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.
- Install intermodule cables in separate cable trays from field wiring, and not in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Intermodule cables

When determining the location of your I/O modules, review the following information about shielded intermodule cables and maximum intermodule cable length.

Shielded intermodule cables

Shielded intermodule cables have a foil and braid shielding. Intermodule cables longer than 30 cm (12 in) are shielded for physical protection and for isolation from electrical noise. The shielding is connected to a terminal lug at one end of the cable.

When using a shield for an intermodule cable, fasten the shield only to the module that is closest to the SCADAPack. Connect the shield to the enclosure using the self-tapping screw provided.

You can use up to 3 shielded intermodule cables. The total length of all cables can not exceed 1.82 m (75 in).

Maximum intermodule cable length

I/O modules ship with a short intermodule cable that is used to connect I/O modules to a SCADAPack or to another I/O module.

The maximum total intermodule cable length in a single system is 1.82 m (75 in). This length restriction does not include the short intermodule cable supplied with the I/O module. Schneider

Electric offers several cable lengths that can be combined to reach the 1.82 m (75 in) limit.

Keep the following in mind:

- No more than 1.5 m (60 in) of total expansion cable length can follow a controller or power supply before an additional power supply needs to be added
- 1.14 m (45 in) and 1.82 m (75 in) expansion cables need to be followed by a power supply
- The highest power consumption modules need to be to closest to the controller or power supply with 6000 series modules first, followed by 5000 series modules due to connector limitations
- The maximum number of power supply modules, not including the controller, is 2
- A 30 cm (12 in) or a 76 cm (30 in) cable is typically used to connect modules on separate DIN rails

To purchase additional intermodule cables, contact your Schneider Electric representative.

8.5.3 Attaching Intermodule Cables

This topic describes how to attach an intermodule cable between a SCADAPack and an I/O module. Follow the same steps to connect two I/O modules.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before applying or removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

The I/O bus does not support live-swapping.

Remove power from the SCADAPack and the I/O module before removing the cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

Static electricity damage can cause intermittent or total loss of equipment operation.

Always wear an anti-static wrist strap that is connected to ground when you remove the device cover.

Failure to follow these instructions can result in equipment damage.

5410 High Speed Counter Input Module Considerations

NOTICE

UNEXPECTED COUNTER READINGS

Do not disconnect a 5410 high speed counter input module while the module and RTU are powered.

Do not remove power from a 5410 high speed counter input module while the RTU is powered and communicating with the module.

Failure to follow these instructions can result in unexpected counter readings.

Power off the RTU before connecting or disconnecting the inter-module cable to the 5410 high speed counter input module.

Power off the RTU and 5410 high speed counter input module at the same time. Use a common power supply input for the RTU and I/O modules.

To attach intermodule cables

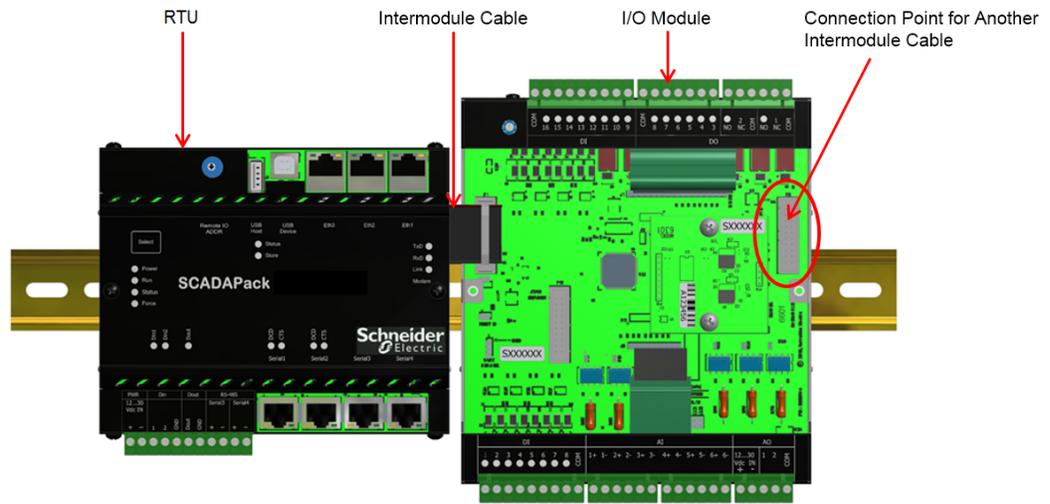
1. Power down each SCADAPack and I/O module that you are connecting.
2. Remove the cover from the device if required to access the intermodule cable.
3. Press one end of the intermodule cable firmly into the I/O bus connector on the SCADAPack.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

The connectors on intermodule cables are keyed so they can only be inserted in one direction. If the connector does not push easily into the I/O bus connector, reverse it and try again.

4. Press the other end of the intermodule cable firmly into the I/O bus connector on the I/O module.

The illustration below shows a connected intermodule cable. While the size and shape of your devices may differ and the color of the connectors may be different, the location of the intermodule cable is the same on each device type.



5. Replace the cover on the I/O module and on the SCADAPack if it was removed, taking care to check that the ribbon cable connecting the I/O module is not pinched.
6. Apply power to the SCADAPack.

You are now ready to configure the I/O module.

9 Addressing

This section describes the addressing rules for an I/O module and the procedure for setting the I/O module address.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Review the power requirements for the I/O modules before combining modules.

Failure to follow these instructions can result in death or serious injury.

I/O modules can be combined in any manner up to the maximum number supported by the SCADAPack. For details about the maximum supported system configuration, see the SCADAPack hardware manual for guidance.

Each I/O module connected to the SCADAPack is assigned a unique I/O module address.

For more information see:

- [Addressing Rules](#)^[45]
- [Setting the I/O Module Address](#)^[46]

9.1 Addressing Rules

I/O modules are shipped from the factory at address 0. If the modules connected to the SCADAPack are different types, for example a digital input module and an analog input module, then no address changes are necessary.

NOTICE

UNDETECTED ADDRESS CONFLICT

SCADAPack x70 devices do not detect address conflicts on 5000 series I/O modules. As a result, addressing conflicts on these modules do not generate a system status code in the SCADAPack RemoteConnect configuration software.

Verify that each 5000 series I/O module is addressed according to the rules below:

Failure to follow these instructions can result in equipment damage.

If you do need to set the hardware address on your I/O module, keep the following in mind:

- No 2 digital input modules can have the same address.
- No 2 digital output modules can have the same address.
- No 2 analog input modules can have the same address.
- No 2 analog output modules can have the same address.
- No 2 5606 or 5607 modules can have the same address.
- The 5606 and 5607 I/O modules can be configured for addresses 0 to 7. As a result, a total of

8 of these modules, in any combination, can be connected to the SCADAPack at one time.

- The 5606 and 5607 I/O modules share the same address numbering; if both these modules are connected to the same SCADAPack, they need to have unique address numbers.
- If you are connecting 1 or more 5606 or 5607 input output modules to a SCADAPack 574, you will need to change the address as the SCADAPack 574 includes an internal 5607 input output module at address 0. Each module requires a unique address.

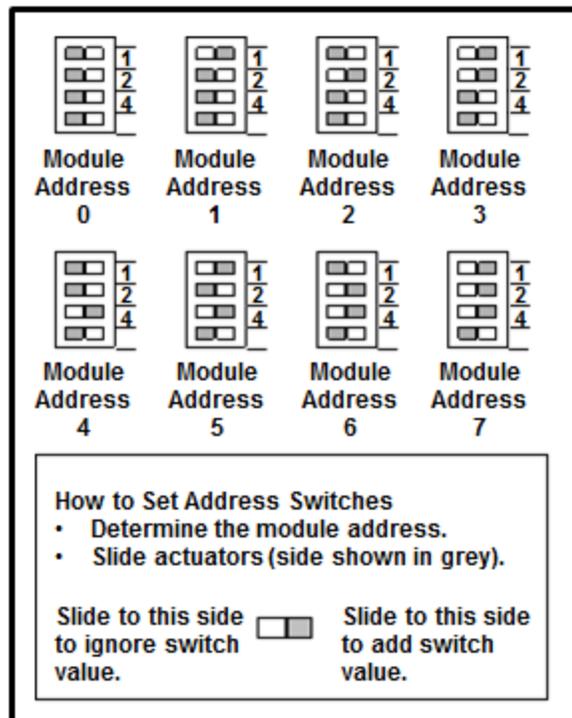
9.2 Setting the I/O Module Address

Three address switches on the I/O module, labeled 4, 2, and 1 set the address. I/O modules are factory set to address 0. Address 0 can be used if there is no other module of the same type connected to the SCADAPack. A second module of the same type is generally set to address 1.

To set the address

1. Open the 3 switches by sliding the actuators to the OFF position.
2. Close the switches that total to the desired address by sliding the actuators to ON.

Switch settings for each of the 8 module addresses are shown in the figure below.



10 Field Wiring

The I/O modules use screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 3.3...0.08 mm² (12...28 AWG). The connectors are removable allowing replacement of the module without disturbing the field wiring. Leave enough slack in the field wiring for the connector to be removed.

For ease of wiring and maintenance, external connections are terminated on removable connectors. If you need to remove the I/O module cover for any reason, first carefully consider the following information.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before removing the I/O module cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

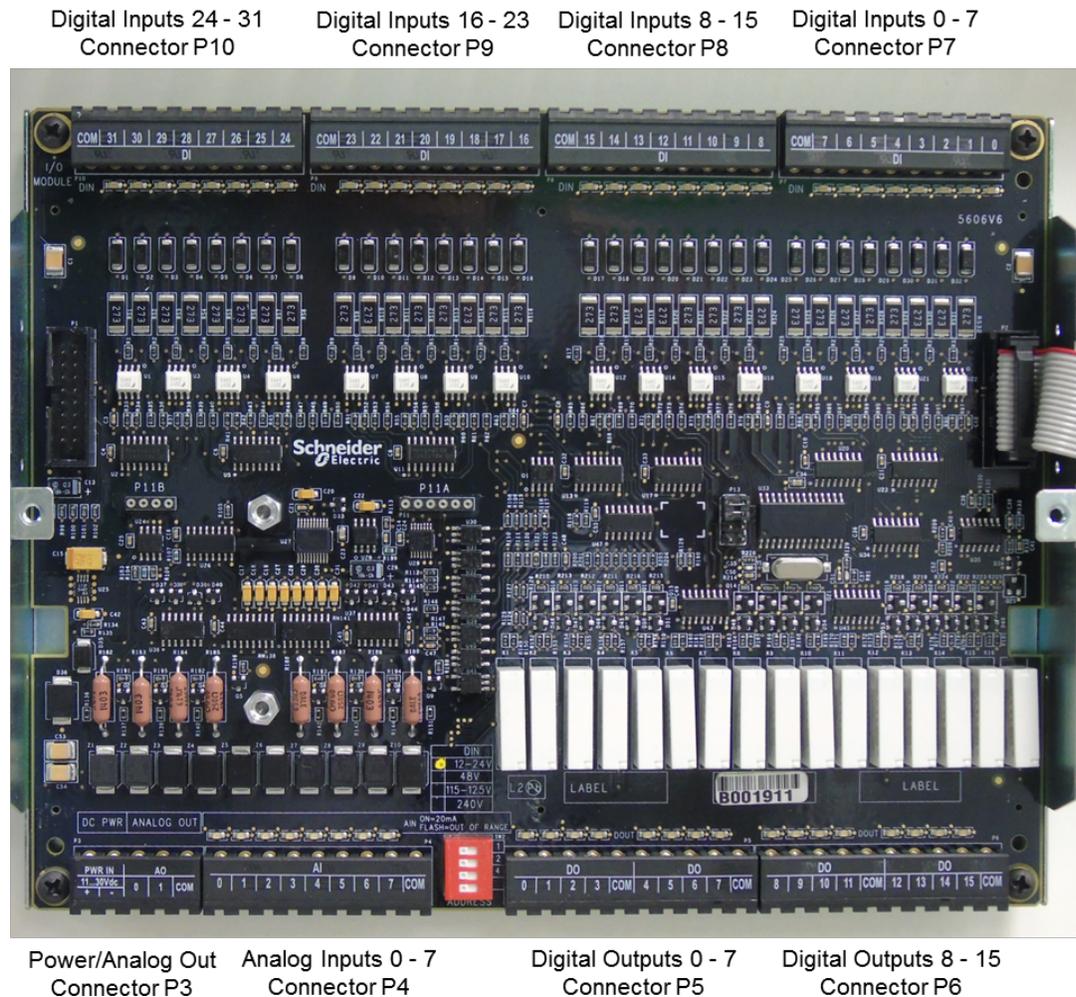
The electronics inside the I/O module can be damaged by static electricity. If you need to remove the I/O module cover, wear an anti-static wrist strap that is connected to ground. Failing to follow this step can cause intermittent or total loss of I/O module operation and will void the warranty.

Failure to follow these instructions can result in equipment damage.

Refer to the image below for wiring connector locations.

- The digital inputs are wired to connectors P7, P8, P9 and P10.
- The digital outputs are wired to connectors P5 and P6.
- The analog inputs are wired to connector P4.
- Primary power input connections and optional analog output connections are wired to connector P3. The loop current will only flow in analog inputs that have been configured for 20 mA and when power is applied to P3.

The rated supply cable temperature is ≥ 105 °C.



For more information, see:

- [Wiring Screw-Termination Connectors](#) ⁴⁸
- [Digital Input Wiring](#) ⁵⁰
- [Digital Output Wiring](#) ⁵²
- [Analog Input Wiring](#) ⁵⁵
- [Analog Output Wiring](#) ⁶⁰

10.1 Wiring Screw-Termination Connectors

Screw-termination style connectors are provided to terminate wiring from:

- Power supplies
- RS485 devices
- Input/output (I/O) modules

These 5 mm (0.197 in) pitch connectors support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before wiring screw-termination connectors.

Failure to follow these instructions can result in death or serious injury.

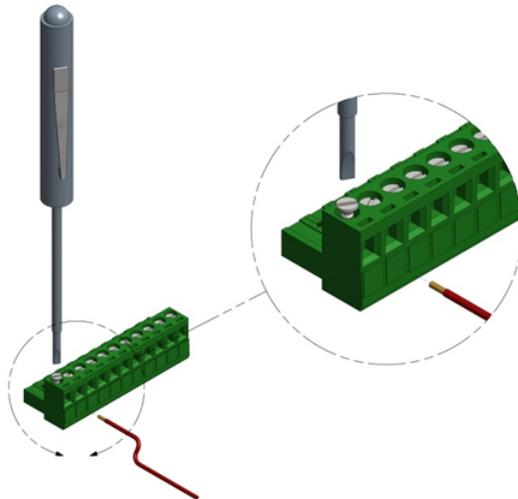
⚠ WARNING**ELECTRICAL HAZARD**

Remove power from all modules and devices before servicing.

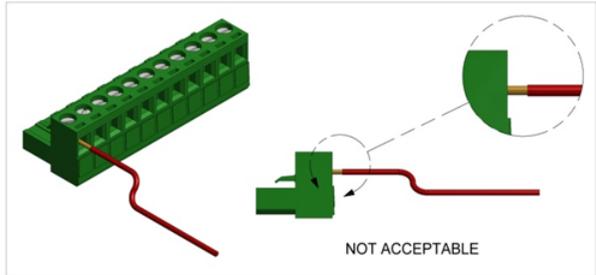
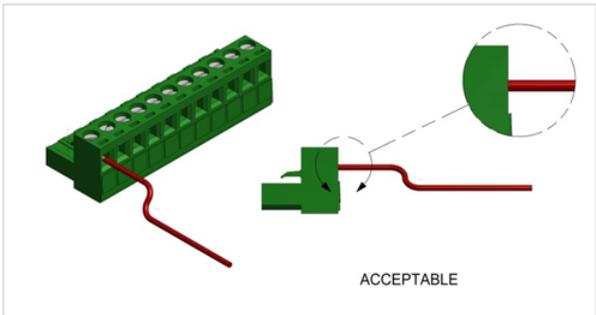
Failure to follow these instructions can result in death or serious injury.

To wire a connector

1. Use a slotted screwdriver to loosen the termination screw.



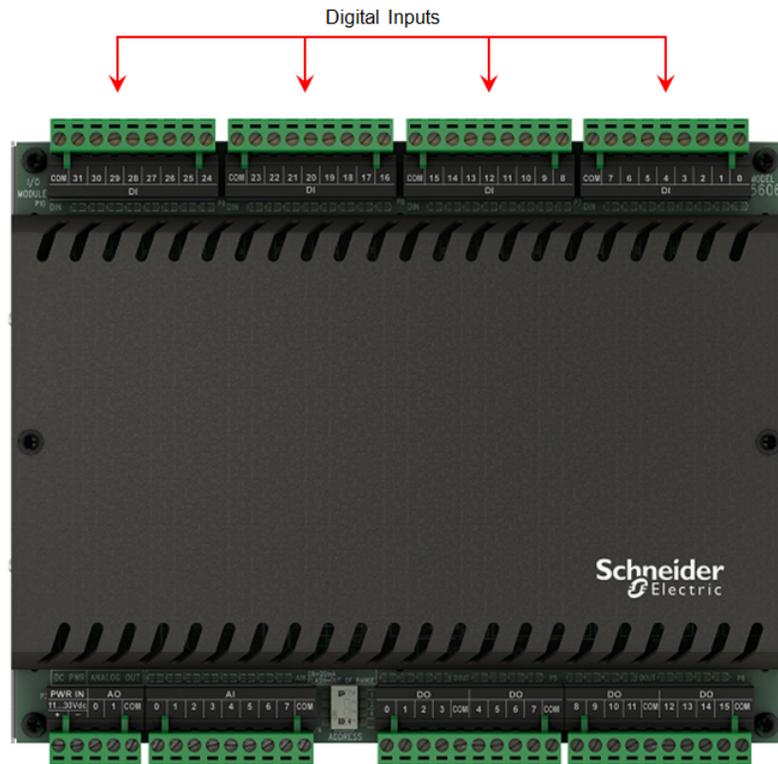
2. Insert the stripped wire into the connector so that the bared wire is located under the screw.
Verify that the bared wire is placed fully within the connector, as illustrated below.



3. Apply 0.5 N•m (4.5 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 Digital Input Wiring

This section describes the wiring for the digital inputs.



For more information, see:

- [Digital Input Wiring Example](#)⁵

10.2.1 Digital Input Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

When wiring digital inputs:

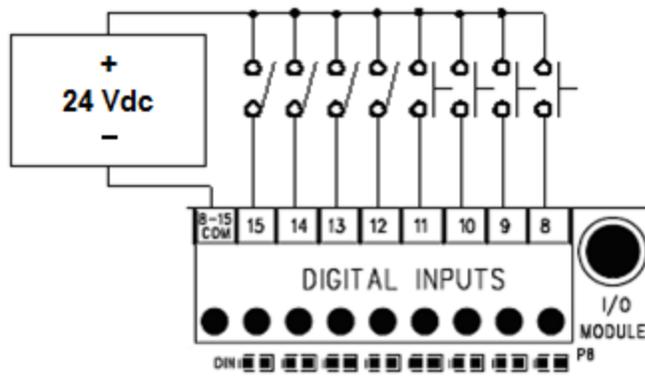
- Confirm that the connection to the digital input does not exceed the ratings for the digital input. See the Specifications topic for details.
- Confirm that the polarity of the connection is correct with the two positive terminals wired together and the two negative terminals wired together.

Failure to follow these instructions can result in equipment damage.

The I/O module accommodates DC inputs.

The voltage range is configured at the factory.

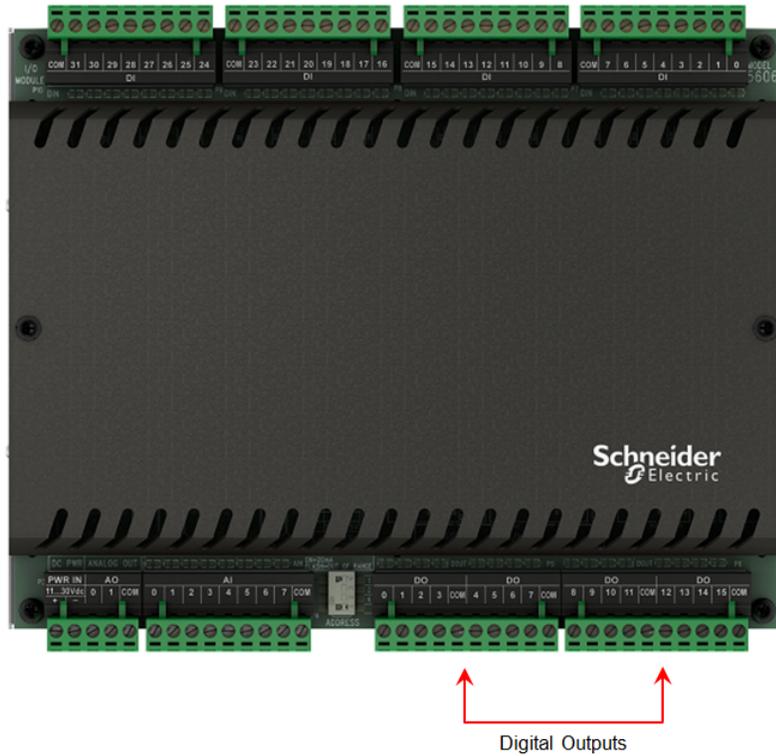
The following diagram shows typical wiring of DC signals to the digital input ports.



P8 – Digital Inputs
Module factory-configured for 12...24 Vdc.

10.3 Digital Output Wiring

This section describes the wiring for the digital outputs.



For more information, see:

- [Digital Output Wiring Example](#) ⁵³

10.3.1 Digital Output Wiring Example

⚠ **WARNING**

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE**RELAY CONTACT DAMAGE**

Incandescent lamps and other loads may have inrush currents that exceed the rated maximum current of the relay contacts. This inrush current may damage the relay contacts. Use interposing relays in these situations.

When controlling inductive loads, the relay contacts on digital outputs must be protected. The energy stored in inductive loads generates electrical noise when the relay contacts are opened.

To suppress the noise in DC circuits, place a diode across the coil.

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

External lightning protection is required if the device being controlled is outside the physical area (cubicle or building) in which the module is located.

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

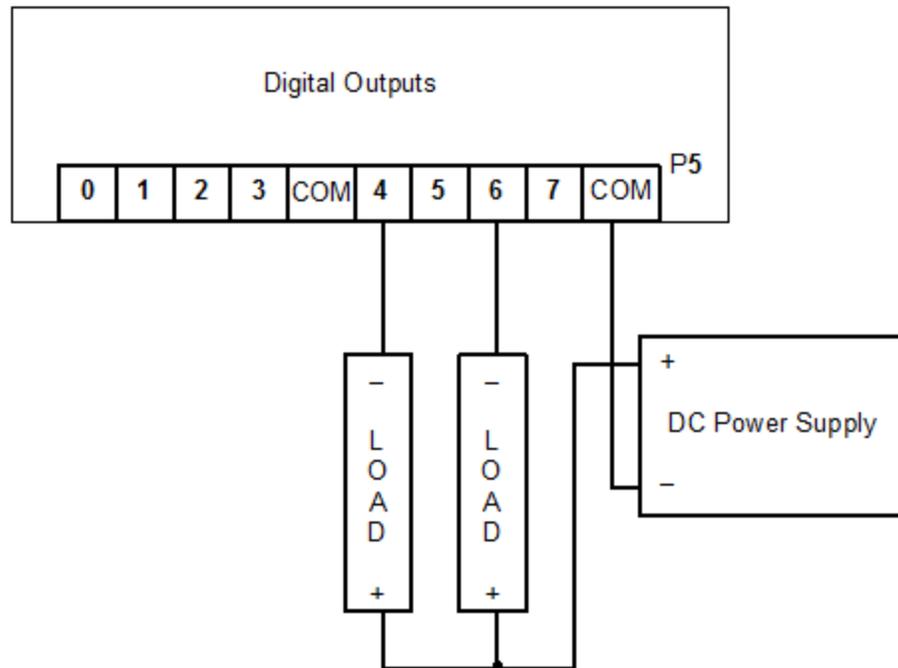
When using the 5606 input output module with solid state relays, confirm that the polarity of the load voltages is correct:

- The loads must be connected to the negative (-) side of the power supply.
- The positive (+) side of the power must be switched through the COM terminal.

Failure to follow these instructions can result in equipment damage.

Wiring example

In the diagram below, relays 4 and 6 are used to switch the DC power to two loads. In this example the negative side of the loads are switched through the common of relays 4 through 7 to the negative side of the DC power supply.



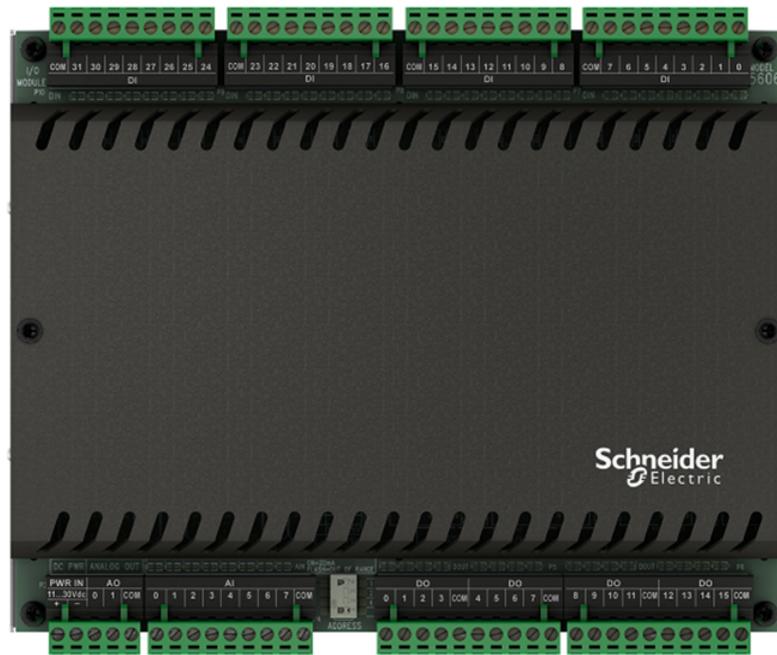
10.4 Analog Input Wiring

This section describes the wiring for the analog inputs.

The analog inputs support loop-powered and self-powered transmitters.

Loop-powered transmitters are two terminal devices that are connected between a power supply and the analog input. The loop current flows from the power supply through the transmitter and to ground through a 250-ohm resistor built into the 20 mA input circuit. Loop current will only flow in analog inputs that have been configured for 20 mA and when power is applied to P3.

Self-powered transmitters can have a current or voltage output. Self-powered transmitters have three terminals: Power In, Signal Out and Common. Power In connects to a power supply; Signal Out connects to the analog input channel and Common connects to COM.



↑
Analog Inputs

For more information, see:

- [Analog Input Wiring Example](#)^[56]
- [Configuring Analog Inputs as Current Inputs](#)^[58]
- [Helping to Prevent Interruption of the Current Loop](#)^[58]

10.4.1 Analog Input Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE**LIGHTNING SURGE THROUGH ANALOG INPUTS**

If a transducer or transmitter connected to an analog channel is placed outside of the building or structure where the SCADAPack or I/O module that provides the analog inputs is installed, there is an increased possibility of extremely severe power surges caused by lightning. In these cases, additional surge protection must be supplied by the user.

Failure to follow these instructions can result in equipment damage.

NOTICE**SIGNAL INTERFERENCE DUE TO NOISE**

Analog input signals must be shielded using Belden 9322 cables or equivalent, when the unit is operating in an electrically noisy environment or to meet the requirements of EN61000-6-2.

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

Do not exceed the maximum voltage specified for each analog input. See the Specifications topic for the maximum voltages.

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

This module must be the only loop current measurement device in the loop when using the analog inputs in the 20 mA measurement mode. If power to the module is removed, the module reverts to voltage mode and results in an open current loop.

Applications that cannot tolerate this possibility require external current sense resistors, with the module input range set to voltage.

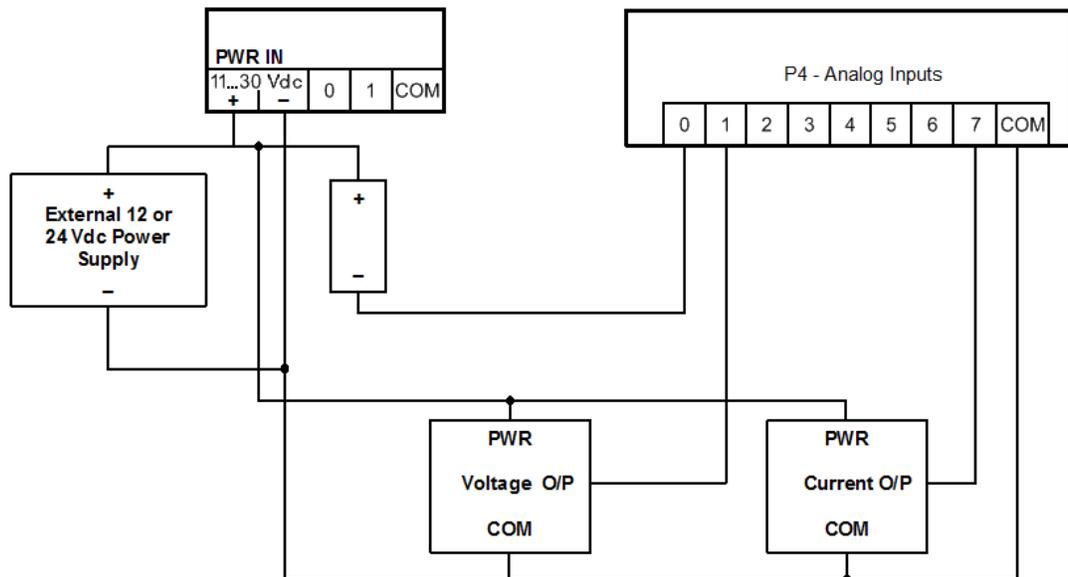
Failure to follow these instructions can result in equipment damage.

Wiring example

The diagram below shows several examples for wiring of loop-powered and self-powered transmitters with the corresponding analog inputs set to voltage mode with a 0...5 Vdc measurement range.

The analog inputs require their own power connection, as shown in the diagram.

- Example 1: Channel 0 has a loop powered current transmitter connected to the external power supply.
- Example 2: Channel 1 has a self-powered voltage transmitter connected to the external power supply.
Channels 2 through 6 are unused.
- Example 3: Channel 7 has a self-powered current transmitter connected to the external power supply.



10.4.2 Configuring Analog Inputs as Current Inputs

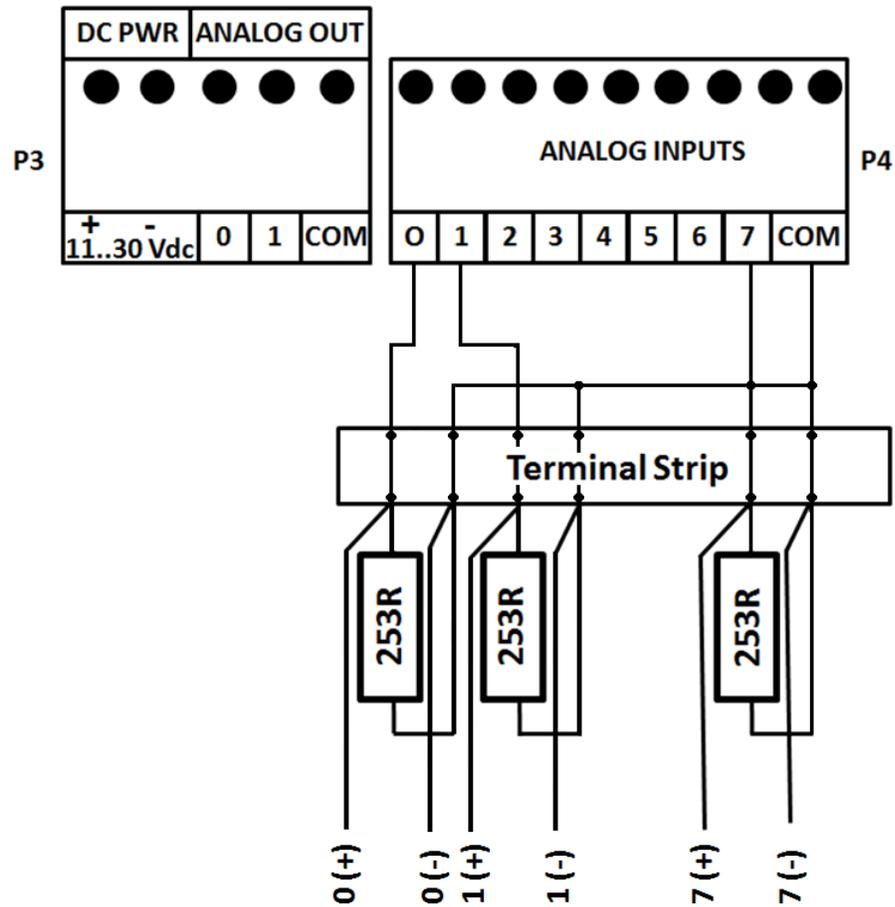
The analog inputs are configured in current input mode and have these possible operating conditions:

- The module is not the only transducer in a particular current loop
- The module is powered down, or reset

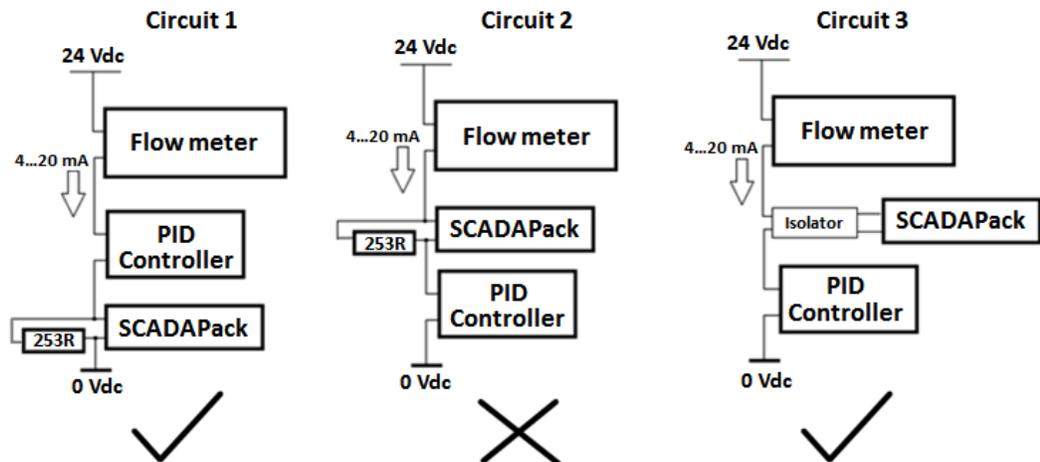
If you power down or reset the module in a multiple device loop, the analog inputs emulate voltage inputs that present a high impedance to the current loop, and effectively break the current loop of the system.

10.4.3 Helping to Prevent Interruption of the Current Loop

This wiring method is preferred if you need to swap the device, as it allows you to remove the device without interrupting the current loop. Configure the analog inputs 0, 1 and 7 as voltage inputs, and add an external 253 ohm precision resistor to the current loop at the terminal strip as shown in the figure below.

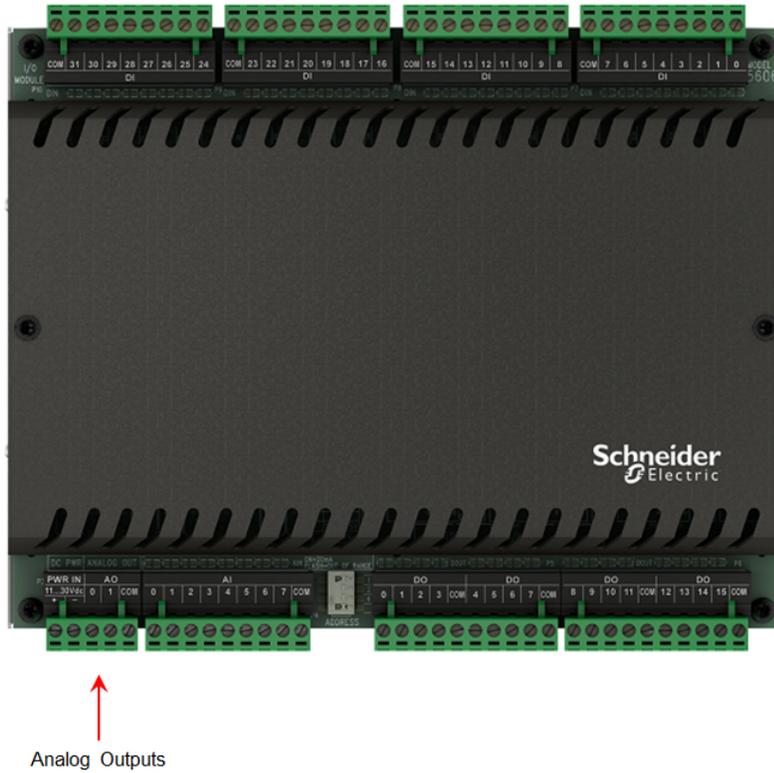


The circuit configurations for the external 253 ohm resistor, or a signal isolator, are shown in the figure below:



10.5 Analog Output Wiring

This section describes the wiring for the analog outputs.



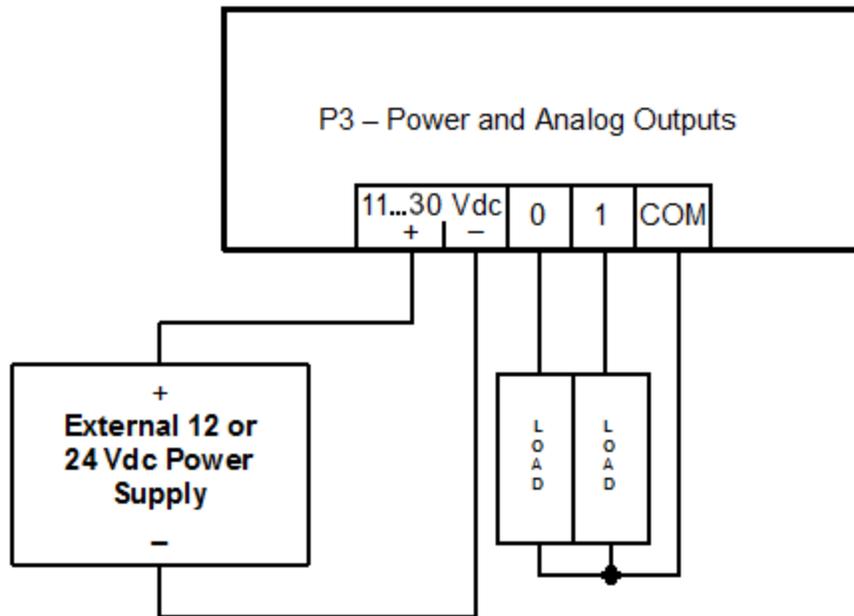
For more information, see:

- [Analog Output Wiring Example](#)^[60]
- [Analog Output Power Supply Configuration Options](#)^[61]

10.5.1 Analog Output Wiring Example

The figure below shows loads connected to the two analog outputs.

The analog outputs require their own power connection, as shown in the diagram.



10.5.2 Analog Output Power Supply Configuration Options

There are two configuration options for the external 24 Vdc power supply that is required when the optional analog outputs are installed:

- The analog outputs and the SCADAPack can each have their own 24 Vdc power supply. In this configuration, the analog outputs are isolated from the system logic.
- The analog outputs can share an external 24 Vdc power supply with the SCADAPack. In this configuration, the analog outputs are not isolated from the system logic.

NOTICE

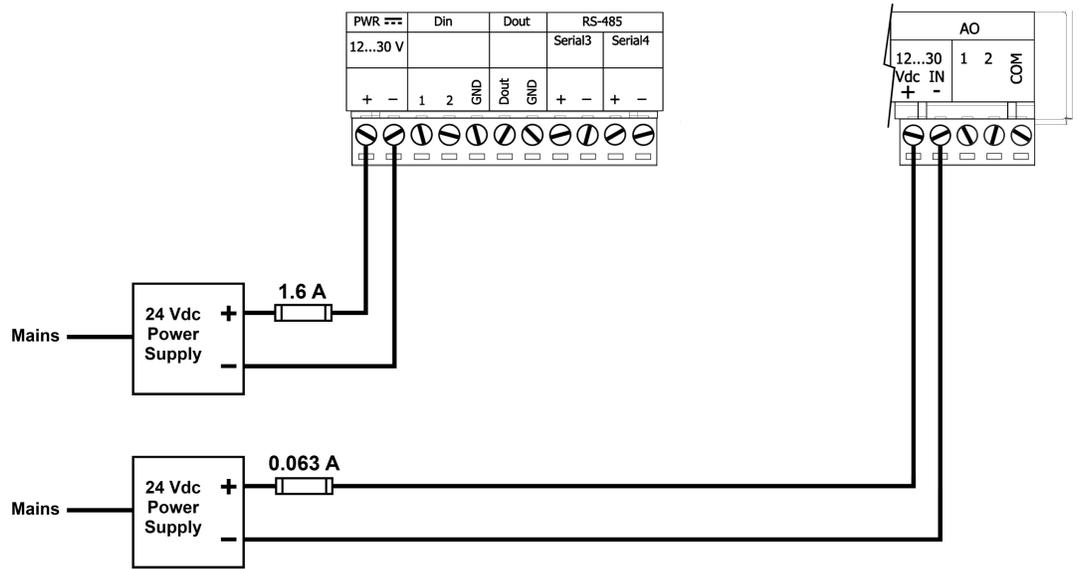
UNINTENDED EQUIPMENT OPERATION

Install an external 1.6 A fast-acting fuse on the input voltage side of the SCADAPack power supply connection.

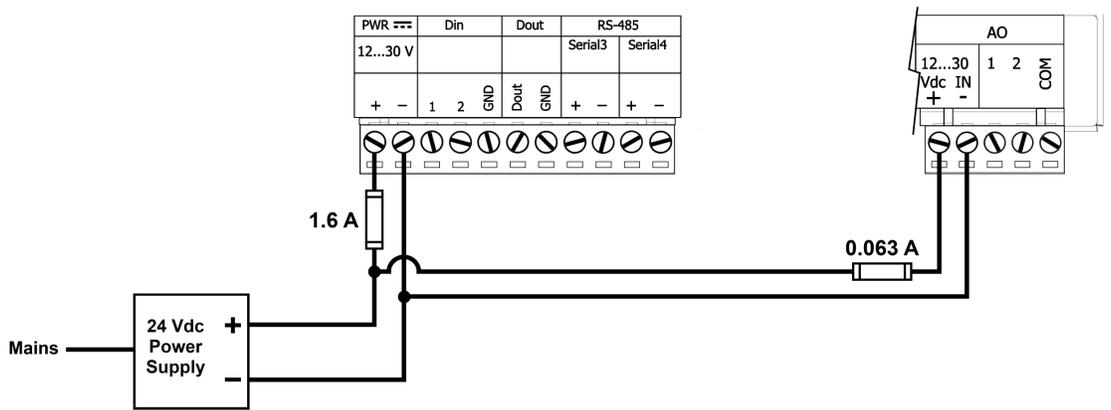
Install an external 0.063 A fast-acting fuse on the input voltage side of the analog output power supply connection.

Failure to follow these instructions can result in equipment damage.

The following figure illustrates the power supply configurations for a SCADAPack 57x device for isolated and non-isolated analog outputs.



Isolated AO



Non-Isolated AO

11 Configuration

The inputs and outputs can be configured locally or remotely using the SCADAPack RemoteConnect configuration software on a Microsoft Windows-based computer.

SCADAPack RemoteConnect configuration software

The configuration software provides a graphical user interface that allows you to:

- Configure parameters for the SCADAPack and any attached I/O modules and then load those parameters into the SCADAPack
- Interact online with the SCADAPack to view status information, diagnostics information and current parameter values for the SCADAPack and any attached I/O modules
- Use the built-in SCADAPack x70 Logic Editor to develop IEC 61131-3 applications that extend and enhance the functionality provided by the SCADAPack and any attached I/O modules

The configuration software is comprised of a frame application that is FDT 2.1, FDT 2.0, and FDT 1.2 compliant and Device Type Managers (DTMs).

For information about	See the following manual
Working with projects and DTMs	SCADAPack RemoteConnect Configuration Software
Configuring communications with the SCADAPack	PC Communication Settings -SCADAPack CommDTM
Configuring device parameters and interacting online with the device	SCADAPack x70 Configuration
Using the SCADAPack x70 Logic Editor	SCADAPack Logic Programming Overview

12 Diagnostics

Input and output modules provide LEDs that indicate the status of inputs and outputs. There are also a number of actions you can take to determine the cause of unexpected activities.

For more information, see:

- [LEDs](#) ⁶⁴
- [Digital Inputs](#) ⁶⁴
- [Digital Outputs](#) ⁶⁵
- [Analog Inputs](#) ⁶⁵
- [Analog Outputs](#) ⁶⁶

12.1 LEDs

The I/O module provides an LED for each input and output. When the LED is on, the input or output is energized, meaning it has an active connection. The table below describes the LEDs on the I/O module.

LED	Function
Digital input (DI)	On when the corresponding digital input is on.
Digital output (DO)	On when the corresponding digital output is on.
Analog input (AI)	<p>On when analog input is configured for a current range</p> <p>Off when analog input is configured for a voltage range</p> <p>Long flashes when the applied current is out of range*</p> <p>Short flashes when the applied voltage is out of range*</p> <p>* See Range and Scaling ²².</p>

12.2 Digital Inputs

Condition	Action
Input LED does not come on when input signal is applied.	<p>Check that the input signal at the termination block is at least 50% of the digital input range.</p> <p>If this is a DC input, check the polarity of the signal.</p>
Input is on when no signal is applied.	Check that the digital inputs are not forced on.

The LED is off.	
Input is off when a signal is applied. The LED is on.	Check that the digital inputs are not forced off.

12.3 Digital Outputs

Condition	Action
Output LED does not come on when output is turned on.	Check the Power LED on the SCADAPack.
Output LED comes on but the output does not close.	Check if the relay is stuck. If so, return the module for repair.
Output LED comes on and output is closed, but the field device is not activated.	Check the field wiring. Check the external device.
Output LED and relay are on when expected to be off.	Check that the output is not forced on.
Output LED and relay are off when expected to be on.	Check that the output is not forced off.

12.4 Analog Inputs

Condition	Action
20 mA inputs read 0.	Check transmitter power.
Reading is at or near 0 for every input signal.	Check whether the input transient suppressors are damaged.
20 mA readings are not accurate.	Check for a damaged 250 ohm current sense resistor.
Reading is constant.	Check that the analog input is not forced.
Reading seems out of calibration for small inputs but improves as input increases.	Check the input range setting.
In Current Loop Mode, there can be an open circuit in the Current Loop.	Refer to the section Configuring Analog Inputs as Current Inputs ⁵⁸ .

Other devices are not functional after installation of the I/O module.

In Current Loop mode, make the I/O module the last device in the loop, or use a signal isolator as discussed in the section [Configuring Analog Inputs as Current Inputs](#)⁵⁸.

12.5 Analog Outputs

Condition	Action
Outputs are 0 mA	<p>Check whether the optional analog outputs were ordered with the I/O module. The analog outputs are installed at the factory prior to delivery.</p> <p>Check the 24 Vdc power supply.</p>
The full-scale output is less than 20 mA	<p>Check the 24 Vdc power supply.</p> <p>Check that the load resistance is within specification.</p>
Output is constant instead of changing	Check that the analog outputs are not forced.

13 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact [Technical Support](#)^[7] for more information and instructions for returning the module for repair.

14 Specifications

Disclaimer: Schneider Electric reserves the right to change product specifications without notice. If you have questions about any of the specifications, contact [Technical Support](#)^[71].

For more information, see:

- [General](#)^[68]
- [Power Supply](#)^[68]
- [Digital Inputs](#)^[69]
- [Digital Outputs](#)^[70]
- [Analog Inputs](#)^[71]
- [Analog Outputs](#)^[71]

14.1 General

Item	Specification
Environment	Conformally coated 5...95% RH, non-condensing -40...70 °C (-40...158 °F) operation -40...85 °C (-40...185 °F) storage
Terminations	3.3...0.08 mm ² (12...28 AWG) Solid or stranded 15 A contacts Screw-termination - 0.5 N•m (4.5 lb-in) torque
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Dimensions	211.8 mm (8.3 in) wide 181 mm (7.1 in) high 47.1 mm (1.9 in) deep

14.2 Power Supply

Item	Specification
11...30 Vdc power requirements	Analog Inputs and Outputs: 12 mA at 11...30 Vdc, plus analog output requirements

5 Vdc power requirements (Dry Contact Relay Version)	600 mA
5 Vdc power requirements (Solid State Relay Version)	400 mA
11...30 Vdc - Connector	Removable, 5-pin
11...30 Vdc - Isolation	Isolation from logic supply and chassis

14.3 Digital Inputs

Item	Specification	
Quantity	32	
Typical operating voltage	12 Vdc 24 Vdc	
Connectors	4 removable, 9-pin	
Indicators	Logic-powered LEDs	
Over-voltage tolerance	36 Vdc	
Input current	0.67 mA typical at 24 Vdc	
Input logic-HI level	OFF to ON transition threshold is typically 6.5 Vdc	
Input voltage	Off – to – On 6.5 Vdc +/- 0.5 Vdc	On – to – Off 6.5 Vdc +/- 0.5 Vdc
Response time	Off – to – On	On – to – Off
@ 50 Hz	15...19 ms	25...29 ms
@ 60 Hz	13.5...18 ms	23...28 ms
Isolation	Isolation is in 4 groups of 8 Isolation from logic supply and chassis: 1500 Vac	

14.4 Digital Outputs

Item	Specification
Quantity	16
Connectors	2 removable, 9-pin
Type	Form A contacts (normally open) 4 contacts share one common
Indicators	Logic-powered LEDs
Inductive loads	Place a diode across the coil to suppress the noise in DC circuits and extend the life of the relay contacts See the Digital Output Wiring Example ⁵¹ topic for further information
Isolation	Isolation is in 4 groups of 4 Chassis to contact: 1500 Vac Logic to contact: 1500 Vac
Operate time	25 ms maximum, 20 ms typical
Release time	30 ms maximum, 25 ms typical
Dry Contact Relay Version	
Contact rating	3 A or 30 Vdc 12 A maximum per common
Switching capacity	5 A, 30 Vdc (150 W resistive)
Service life	2 x 10 ⁷ mechanical 1 x 10 ⁵ at contact rating
Bounce time	1 ms typical
Solid State Relay Version	
Load voltage	30 Vdc maximum
Load current	2 A continuous maximum at 50 °C (122 °F) ambient 1.33 A continuous maximum at 70 °C (158 °F) ambient

14.5 Analog Inputs

Item	Specification
Quantity	8
Connector	Removable, 9-pin
Indicators	Logic-powered LEDs Indicate voltage or current mode and out-of-range input signal
Ranges	Software-configurable 0...5 Vdc 1...5 Vdc 0...10 Vdc 0...20 mA 4...20 mA
Resolution	15 bits over the 0...10 Vdc measurement range 14 bits over the 0...5 Vdc and 0...20 mA measurement range
Accuracy	$\pm 0.1\%$ of full scale at 25 °C (77 °F) $\pm 0.2\%$ over temperature range
Input resistance	250 ohms or 20 kohms in 20 mA or 10 Vdc configurations
Isolation	Isolation from logic supply and chassis: 500 Vac

14.6 Analog Outputs

Item	Specification
Quantity	2 with optional analog outputs
Connector	Removable, 5-pin
Range	0...20 mA sourcing 4...20 mA sourcing
Resolution	12 bits
Maximum load resistance	925 ohms with 24 Vdc input voltage or when internal 24 Vdc

	power supply is on 375 ohms with 12 Vdc input voltage 250 ohms with input voltage at power supply turnoff
Accuracy	Accuracy specified from 0.5...20 mA $\pm 0.15\%$ of full scale at 25 °C (77 °F) $\pm 0.25\%$ of full scale over temperature range
Noise and ripple	0.04% maximum
Logic end-of-scan to signal update latency	With up to 10, 5000 series I/O modules Typical: 18...27 ms
Response time (DAC to signal)	Less than 10 μ s for 10% to 90% signal change
Isolation	Isolation from logic supply and chassis

15 Standards and Certifications

<p>Hazardous Locations - North America</p>	 <p>Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.</p> <p>UL listed and CSA certified to the following standards:</p> <p>CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.</p> <p>ANSI/ISA 12.12.01 - Hazardous (Classified) Locations.</p>
<p>Hazardous Locations - Europe</p>	<p>ATEX II 3G, Ex nA IIC T4 Gc per EN 60079-15, protection type n (Zone 2)</p>
<p>Hazardous Locations - IECEX</p>	<p>IECEX, Ex nA IIC T4 Gc CoC IECEX UL 16.0070 X per IEC 60079-15, protection type n (Zone 2)</p>
<p>Safety</p>	<p>CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL 61010 (Process Control Equipment, Industrial Control Equipment)</p> <p>UL (cULus) certified to the requirements of UL508 and CSA C22.2 No. 142-M1987 (Industrial Control Equipment, Process Control Equipment)</p>
<p>Digital Emissions</p>	<p>FCC Part 15, Subpart B, Class A Verification</p> <p>EN 61000-6-4 Electromagnetic Compatibility (EMC) - Generic Emission Standard for Industrial Environments</p> <p>RCM Compliance</p>
<p>Immunity</p>	<p>EN 61000-6-2 Electromagnetic Compatibility (EMC) - Generic Standards - Immunity for Industrial Environments</p>
<p>CE Marking Compliance</p>	<p>For the latest information regarding product compliance with European Directives for CE marking, refer to the EU Declaration of Conformity issued for your product at www.se.com</p> <p>For the latest information regarding product compliance with RoHS, WEEE directives and REACH regulation, visit the Schneider Electric Check a Product portal at www.reach.schneider-electric.com</p>

SCADAPack

5607 Input Output Module

Version: 3.9.1

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Document Number: 250514



Table of Contents

1	Legal Information	6
2	Technical Support	7
3	Safety Information	8
4	About the 5607 Input Output Module	11
5	About the Book	13
6	Cybersecurity	16
7	Hardware Overview	18
7.1	Power Supply.....	20
7.2	Digital Inputs.....	20
7.3	Digital Outputs.....	21
7.4	Analog Inputs.....	22
7.4.1	Current or Voltage Mode.....	23
7.4.2	Range and Scaling.....	23
7.5	Analog Outputs.....	24
7.5.1	Current and Voltage Outputs.....	26
7.5.2	Range and Scaling.....	26
7.6	Protection Summary.....	26
8	Installation	30
8.1	ATEX and IECEx Requirements.....	31
8.2	Mounting the I/O Module.....	32
8.3	Power Supply Requirements.....	34
8.4	Power Supply Wiring.....	35
8.4.1	Recommended 24 Vdc Power Supply Configuration.....	37
8.4.2	Recommended Battery Configuration.....	37
8.4.3	Layout Guidelines.....	38
8.4.4	System Grounding.....	39
8.5	Connecting I/O Modules.....	40
8.5.1	Precautions	41
8.5.2	Cabling Guidance.....	43

	8.5.3 Attaching Intermodule Cables.....	44
9	Addressing	47
	9.1 Addressing Rules.....	47
	9.2 Setting the I/O Module Address.....	48
10	Field Wiring	49
	10.1 Wiring Screw-Termination Connectors.....	51
	10.2 Digital Input Wiring.....	52
	10.2.1 Digital Input Wiring Example.....	54
	10.3 Digital Output Wiring.....	54
	10.3.1 Digital Output Wiring Example.....	56
	10.4 Analog Input Wiring.....	57
	10.4.1 Analog Input Wiring Example.....	59
	10.4.2 Configuring Analog Inputs as Current Inputs.....	61
	10.4.3 Helping to Prevent Interruption of the Current Loop.....	61
	10.5 Analog Output Wiring.....	62
	10.5.1 Analog Output Wiring Example.....	64
	10.5.2 Analog Output Power Supply Configuration Options.....	64
11	Configuration	66
12	Diagnostics	67
	12.1 LEDs	67
	12.2 Digital Inputs.....	67
	12.3 Digital Outputs.....	68
	12.4 Analog Inputs.....	68
	12.5 Analog Outputs.....	69
13	Calibration	70
14	Maintenance	71
15	Specifications	72
	15.1 General.....	72
	15.2 Power Supply.....	72
	15.3 Digital Inputs.....	73
	15.4 Digital Outputs.....	73
	15.5 Analog Inputs.....	75

15.6	Analog Outputs.....	75
16	Standards and Certifications.....	77

1 Legal Information

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2 Technical Support

Questions and requests related to any part of this documentation can be directed to one of the following support centers.

Technical support: Americas, Europe, Middle East, Asia

Available Monday to Friday 8:00 am – 6:30 pm Eastern Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: supportTRSS@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Toll free within North America: 1-888-226-6876 • Direct Worldwide: +1-613-591-1943

Technical support: Australia/New Zealand (Pacific)

Available Monday to Friday 8:00 am - 5:00 pm Australian Eastern Standard Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: techsupport.pz@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Inside Australia: 13 73 28 (13 SEAU) • Inside New Zealand: 0800 652 999

3 Safety Information

Important 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 a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, can result in death or serious injury.
⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, can result in minor or moderate injury.
NOTICE
NOTICE is used to address practices not related to physical injury.

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, installation, and operation of electrical equipment 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.

WARNING

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 death or serious injury.

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

Test all software 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 help prevent accidental equipment damage.

Operation and adjustments

The following precautions prevail:

- 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.

Acceptable use

WARNING

UNACCEPTABLE USE

Do not use SCADAPacks or I/O modules as an integral part of a safety system. These devices are not safety products.

Failure to follow these instructions can result in death or serious injury.

CAUTION

EQUIPMENT OPERATION HAZARD

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Use only Schneider Electric software or approved software with Schneider Electric hardware products.

Failure to follow these instructions can result in minor or moderate injury.

4 About the 5607 Input Output Module

The 5607 input output module increases the SCADAPack I/O capacity by providing:

- 16 digital inputs
- 10 relay digital outputs
- 8 analog inputs
- 2 analog outputs (this option is selected when the module is ordered)

You can connect up to 15 5607 input output modules to the I/O bus, for a total of 540 inputs and outputs.

The 5607 input output module can be added to SCADAPack x70 RTUs.

It is important to consider the power requirements of the 5607 input output module. See the SCADAPack hardware manual for details about I/O module power supply requirements.

This manual covers the powering, wiring and configuration of a 5607 input output module only. It is meant to be used with the hardware manual of the respective SCADAPack to which it is connected.

The 5607 input output module is shown in the image below:



Connections

I/O modules include a short intermodule cable for connecting to a SCADAPack or to another I/O module. For information about the maximum number of I/O modules supported, see the hardware manual for your SCADAPack. For details on connecting I/O modules, see [Attaching Intermodule Cables](#)^[44].

Screw-termination connectors are provided for connecting the inputs and outputs to the devices you want to monitor or control. For details on wiring input and output connectors, see [Field Wiring](#)^[49].

Configuration

The inputs and outputs can be configured locally or remotely using the SCADAPack RemoteConnect configuration software on a Microsoft Windows-based computer.

5 About the Book

Audience

WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise are 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 or serious injury.

This manual is written for people who need to install, troubleshoot or maintain the 5607 input output module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5607 input output module, including detailed hardware specifications
- Installation, wiring and addressing for the 5607 input output module
- Diagnostics capabilities on the 5607 input output module
- Maintenance recommendations for the 5607 input output module

Validity note

This document is valid for:

- SCADAPack x70 firmware version 9.6.1 and earlier
- SCADAPack RemoteConnect configuration software version 3.9.1 and earlier

Related documents

Use this manual with the other manuals included in your SCADAPack x70 documentation set. The table below describes the manuals available in the documentation set.

Folder	Manual	Content
--------	--------	---------

Getting Started	Getting Started	<ul style="list-style-type: none"> • The SCADAPack x70 family of products available in this release • The basic steps to get your SCADAPack x70 device operational • Where to get more information about configuring, monitoring and managing your SCADAPack x70 device
SCADAPack Software Installation	SCADAPack Software Installation	<ul style="list-style-type: none"> • Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	<ul style="list-style-type: none"> • Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	<ul style="list-style-type: none"> • Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	<ul style="list-style-type: none"> • Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	<ul style="list-style-type: none"> • Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from SCADAPack E to SCADAPack RemoteConnect • Locating SCADAPack E Configurator features in SCADAPack RemoteConnect • Locating SCADAPack Workbench features in SCADAPack RemoteConnect • Compatibility chart
	Porting Guide for Telepace to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	<ul style="list-style-type: none"> • USB, serial and IP communications

Reference Manuals	Communication Interfaces Technical Reference	<ul style="list-style-type: none"> • Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	<ul style="list-style-type: none"> • The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	<ul style="list-style-type: none"> • DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	<ul style="list-style-type: none"> • The differences between EcoStruxure Control Expert (Unity Pro) and the SCADAPack x70 Logic Editor environment • Key programming concepts • Basic procedures needed to use the SCADAPack x70 Logic Editor
	SCADAPack Function Blocks Technical Reference	<ul style="list-style-type: none"> • The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	<ul style="list-style-type: none"> • Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	<ul style="list-style-type: none"> • Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	<ul style="list-style-type: none"> • Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

6 Cybersecurity

Cybersecurity is a branch of network administration that addresses attacks on or by computer systems and through computer networks that can result in accidental or intentional disruptions. The objective of cybersecurity is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for intended users.

No single cybersecurity approach is adequate. Schneider Electric recommends a defense-in-depth approach. This approach layers the network with security features, appliances, and processes. The basic components of this approach are:

- Risk assessment: A systematic security analysis of the environment and related systems.
- A security plan built on the results of the risk assessment
- A multi-phase training campaign
- Network separation and segmentation: Physical separation of the control network from other networks, and the division of the control network itself into segments and security zones.
- System Access Control: Controlling access to the system with firewalls, authentication, authorization, and other software means, and traditional physical security measures such as video surveillance, fences, locked doors and gates, and locked equipment cabinets.
- Device hardening: The process of configuring a device against communication-based threats. Device hardening measures include disabling unused network ports, password management, access control, and the disabling of all unnecessary protocols and services.
- Network monitoring and maintenance: An effective defense-in-depth campaign requires continual monitoring and system maintenance to meet the challenge of new threats as they develop.
- See Security Considerations in the Security Technical Reference manual

Contact us

For more information, refer to the Schneider Electric Cybersecurity Support Portal at <http://www.se.com/b2b/en/support/cybersecurity/overview.jsp>.

Additional Resources

Industrial Control Systems Cyber Emergency Response Team (ICS-CERT)
<https://ics-cert.us-cert.gov>

ICS-CERT Recommended Practices
<https://ics-cert.us-cert.gov/Recommended-Practices>

Center for Internet Security (CIS) Top 20 Critical Security Controls
<https://www.cisecurity.org/cybersecurity-best-practices>

FBI Cyber Crime
<https://www.fbi.gov/investigate/cyber>

Guide to Industrial Control Systems (ICS) Security

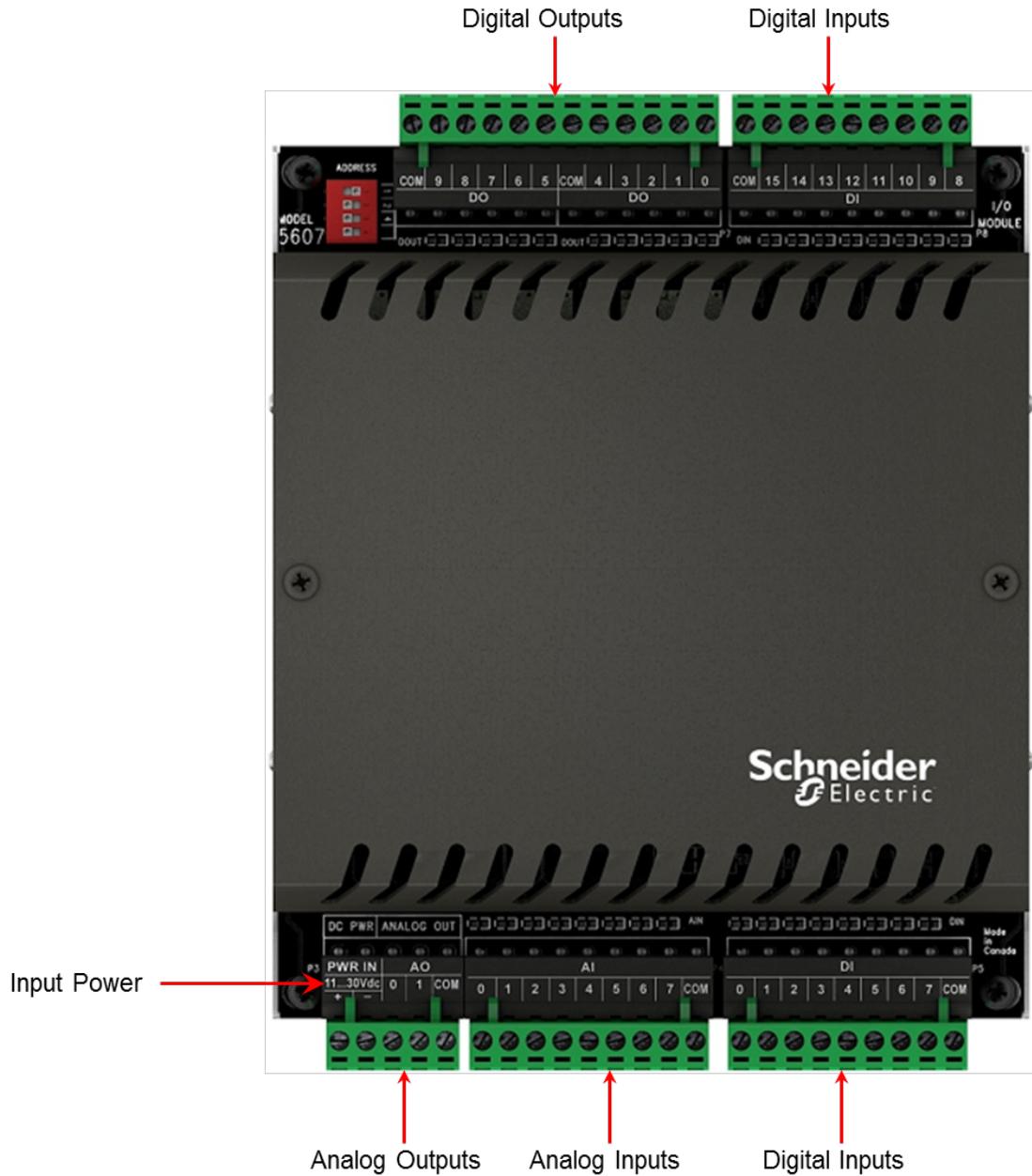
<https://www.nist.gov/publications/guide-industrial-control-systems-ics-security>

WaterISAC Water Security Network

<https://www.waterisac.org>

7 Hardware Overview

The figure below shows the inputs and outputs on the 5607 input output module.



For complete hardware specifications, see [Specifications](#)^[72].

See also:

- [Power Supply](#)^[20]
 - 11...30 Vdc input power
 - Wired to connector P3

- [Digital inputs](#)^[20]
 - 16 digital inputs
 - Optically isolated from logic power
 - Wired to connectors P5 and P8
- [Digital outputs](#)^[21]
 - 10 dry contact (mechanical) relay or solid state relay (SSR) outputs
 - Wired to connector P7
- [Analog inputs](#)^[22]
 - 8 analog inputs
 - Wired to connector P4
 - 16-bit successive approximation analog-to-digital converter (ADC)
- [Analog outputs](#)^[24]
 - 2 analog outputs (optional)
 - Wired to connector P3
 - 12-bit, unipolar, digital-to-analog converter (DAC)
- [Protection Summary](#)^[26]
 - Over-voltage protection

7.1 Power Supply

The 5607 input output module is powered primarily by the 11...30 Vdc power supply of the SCADAPack. The analog inputs and optional analog outputs require an external 12 Vdc or 24 Vdc power supply connected to the input power supply of the 5607 input output module. For further information, see the [Power Supply Wiring](#)^[35] section.

7.2 Digital Inputs

The 5607 input output module expands the function of the SCADAPack with 16 digital inputs.

Digital inputs are used to monitor the state of devices such as valves, motors and level switches.

Wetting voltage for the volt-free contacts is usually provided by the DC power used with the SCADAPack.

The LED for each digital input is lit when the input is active.

Digital inputs are available for nominal 12...24 Vdc operation. A current-limiting resistor on each input determines the voltage range. Light Emitting Diodes (LEDs) on the digital inputs show the status of each input.

To simplify field wiring, the 16 inputs are organized into 2 groups of 8 inputs. Each group shares a common return. These groups of 8 inputs are isolated from each other. Inputs 0 to 7 are in one group. Inputs 8 to 15 are in another group.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each digital input, including:

- DNP3 parameters
- Modbus parameters
- Event attributes
- Alert notifications

For more information about configuring digital inputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Digital inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[51].

Specifications

For digital input specifications, see [Specifications](#)^[73].

7.3 Digital Outputs

The I/O module expands the function of the SCADAPack with 10 dry contact (mechanical) relay or solid state relay (SSR) outputs.

Digital outputs are used to control panel lamps, relays, motor starters, solenoid valves and other devices. The relay outputs are well suited to applications that cannot tolerate any off-state leakage current, that require high load currents, or that involve non-standard voltages or current ranges.

Outputs are Form A Normally Open (NO). Loads can be connected to either output terminal and to either the high or the low side of the power source. The LED for each digital output is lit when the NO contact is closed, or activated, and the circuit is continuous.

The LED for each digital output shows the status of the output.

WARNING

DATA LOSS, APPLICATION LOSS

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the digital outputs, including:

- DNP3 parameters
- Modbus parameters
- Output pulse time
- Event attributes
- Alert notifications

For more information about configuring digital outputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Digital outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[51].

Specifications

For digital output specifications, see [Specifications](#)^[73].

7.4 Analog Inputs

The I/O module enhances the capacity of a SCADAPack by providing 8 additional single-ended analog inputs on connector P4 that can be configured for current or voltage mode.

Analog inputs are used to monitor devices such as pressure, level, flow and temperature transmitters, instrumentation such as pH and conductivity sensors, and other high-level analog signal sources.

Each analog input is individually configured for the input type — current or voltage — and range. Refer to [Current or Voltage Mode](#)^[23] for information on how to choose input modes.

The analog inputs use a 16-bit successive approximation analog-to-digital converter (ADC).

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the analog inputs, including:

- DNP3 parameters
- Modbus parameters
- [Range and Scaling](#)^[23]
- Value deviation
- Alert notifications

For more information about configuring analog inputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Analog inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[51].

Specifications

For analog input specifications, see [Specifications](#)^[75].

7.4.1 Current or Voltage Mode

The analog inputs can be configured for either voltage or current mode via the SCADAPack RemoteConnect configuration software.

- In current mode, a 250 ohm current sense resistor appears across each analog input channel. Measurement range in current mode is 0...20 mA or 4...20 mA, selectable via software. The 250 ohm resistor produces a voltage drop (input reading) of 5 Vdc for 20 mA of current flow.
- In voltage mode, analog inputs are single-ended with a measurement range of 0...5 Vdc, 1...5 Vdc, or 0...10 Vdc.

7.4.2 Range and Scaling

The analog inputs have a 16-bit, unipolar, analog-to-digital converter (ADC) that measures input current ranges from 0...20 mA or 4...20 mA, or input voltage ranges from 0...5 Vdc, 1...5 Vdc, or 0...10 Vdc.

To assign SCADAPack database objects to the analog input channels, use the SCADAPack RemoteConnect configuration software to select the signal range for each analog input channel. Each analog input channel can be configured for one of the following signal ranges:

- 0...5 Vdc
- 1...5 Vdc
- 0...10 Vdc
- 0...20 mA
- 4...20 mA

The following table shows the analog input values and status for several input signals. Out-of-range detection occurs when the measured input is outside of the measurement range as indicated. The out-of-range detection is shown on the module's LED indicator for the affected analog input channel. See [LEDs](#) [67].

The object database value reported for out-of-range analog channels is shown as a percentage difference of the Raw range, and Engineering range.

- **Example 1:** For a 4...20 mA analog channel with a configured **Engineering Minimum** value of 0.0 and **Engineering Maximum** value of 100.0, a 0.2% difference reports an under-range value of -0.2 and an over range engineering value of 100.2.
- **Example 2:** For a 0...10 V analog channel with a configured **Raw Minimum** value of 0 and a **Raw Maximum** value of 10000, a 0.048% difference reports an over range raw value of 10005.

Out-of-range quality indication for this module's analog input channel's representation in the SCADAPack object database is dependent on the object's over range and under range configurations.

0...5 Vdc Range	1...5 Vdc Range	0...10 Vdc Range	0...20 mA Range	4...20 mA Range	Object Database Value	Out-of-range LED indication
n/a	< 0.992	n/a	n/a	< 3.968	Raw Minimum - 0.2%	ON

					Engineering Minimum -0.2%	
0	1	0	0	4	Raw Minimum Engineering Minimum	OFF
1.25	2	2.5	5	8	25% of scale	OFF
2.5	3	5.0	10	12	50% of scale	OFF
3.75	4	7.5	15	16	75% of scale	OFF
5	5	10	20	20	Raw Maximum Engineering Maximum	OFF
n/a	> 5.008	n/a	n/a	> 20.032	Raw Maximum + 0.2% Engineering Maximum + 0.2%	ON
> 5.0024	n/a	> 10.0048	> 20.01	n/a	Raw Maximum + 0.048% Engineering Maximum + 0.048%	ON

7.5 Analog Outputs

Analog outputs are used to control remote devices that require varying input information, rather than simply on or off operations.

If the optional analog output module was ordered, two 20 mA analog outputs are available for use.

The analog output channels are powered with an external 12...30 Vdc (nominally 12 Vdc or 24 Vdc) power supply. They can be configured for 4...20 mA current or 0...20 mA current. The outputs provide a level of transient and over-voltage protection. Analog output resolution is 12 bits. The outputs share a common return with each other and with the analog inputs.

⚠ WARNING

DATA LOSS, APPLICATION LOSS

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the analog outputs, including:

- DNP3 parameters
- Modbus parameters
- [Range and Scaling](#)^[26]
- Value deviation
- Alert notifications

For more information about configuring analog outputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Analog outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[51].

Specifications

For analog output specifications, see [Specifications](#)^[75].

7.5.1 Current and Voltage Outputs

Current outputs

The I/O module can be equipped with optional analog outputs that provide two 20 mA analog outputs. Analog output resolution is 12 bits. The outputs provide a level of transient and over-voltage protection. The outputs share a common return with each other and with the analog inputs. See [Analog Output Wiring](#)^[62] for an illustration on how to connect current outputs.

Voltage outputs

To obtain voltage outputs, connect a load resistor as shown in [Analog Output Wiring](#)^[62] and connect the voltage device across the load resistor.

The table below lists resistance values and output range settings for common voltage ranges. The resistance value listed is the parallel resistance of the device and the load resistor.

Resistance	Output Range	Voltage Range
250 ohms	0...20 mA	0...5 Vdc
	4...20 mA	1...5 Vdc
500 ohms	0...20 mA	0...10 Vdc

7.5.2 Range and Scaling

The analog output module has a 12-bit, unipolar, digital-to-analog converter (DAC).

In the SCADAPack RemoteConnect configuration software, you can select one of the following **AO Output Type** ranges. The analog output channels use the same range:

- 0...20 mA
- 4...20 mA

The 0...20 mA output range resolution is 4.88 μ A per DAC count.

Configuration for objects attached to the analog output module channels uses the **Raw Minimum** to **Raw Maximum** and **Engineering Minimum** to **Engineering Maximum** parameters for integer and engineering scaling, respectively.

These scaling ranges are applied automatically to the selected analog output signal range (0...20 mA or 4...20 mA).

7.6 Protection Summary

Over-voltage protection

Over voltage may occur on cables that extend from a cabinet to a remote device or another cabinet. Results can include corrupted data carried on the cable or damage to devices

connected to that cable. Following the guidelines below may reduce the severity and frequency of such events. It is highly recommended that end users determine the proper protection for their industry, application, and environment.

NOTICE

RS232 LOSS OF FUNCTION

- Limit the length to 50 feet (15 m) or less in electrically noisy environments.
- Use commercially available isolators and/or surge suppression if the length limitations (above) are exceeded. These are typically not required if the length limitations (above) are followed.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE

485 LOSS OF FUNCTION

- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE

ANALOG INPUTS AND OUTPUTS LOSS OF FUNCTION

- Avoid connecting 24 Vdc directly across analog inputs.
- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.
- Use an external fuse (63 mA fast blow).

Failure to follow these instructions can result in equipment damage.

NOTICE**EXTERIOR ANTENNA LOSS OF FUNCTION**

- Use a coaxial surge diverter and terminate the ground connection.

Failure to follow these instructions can result in equipment damage.

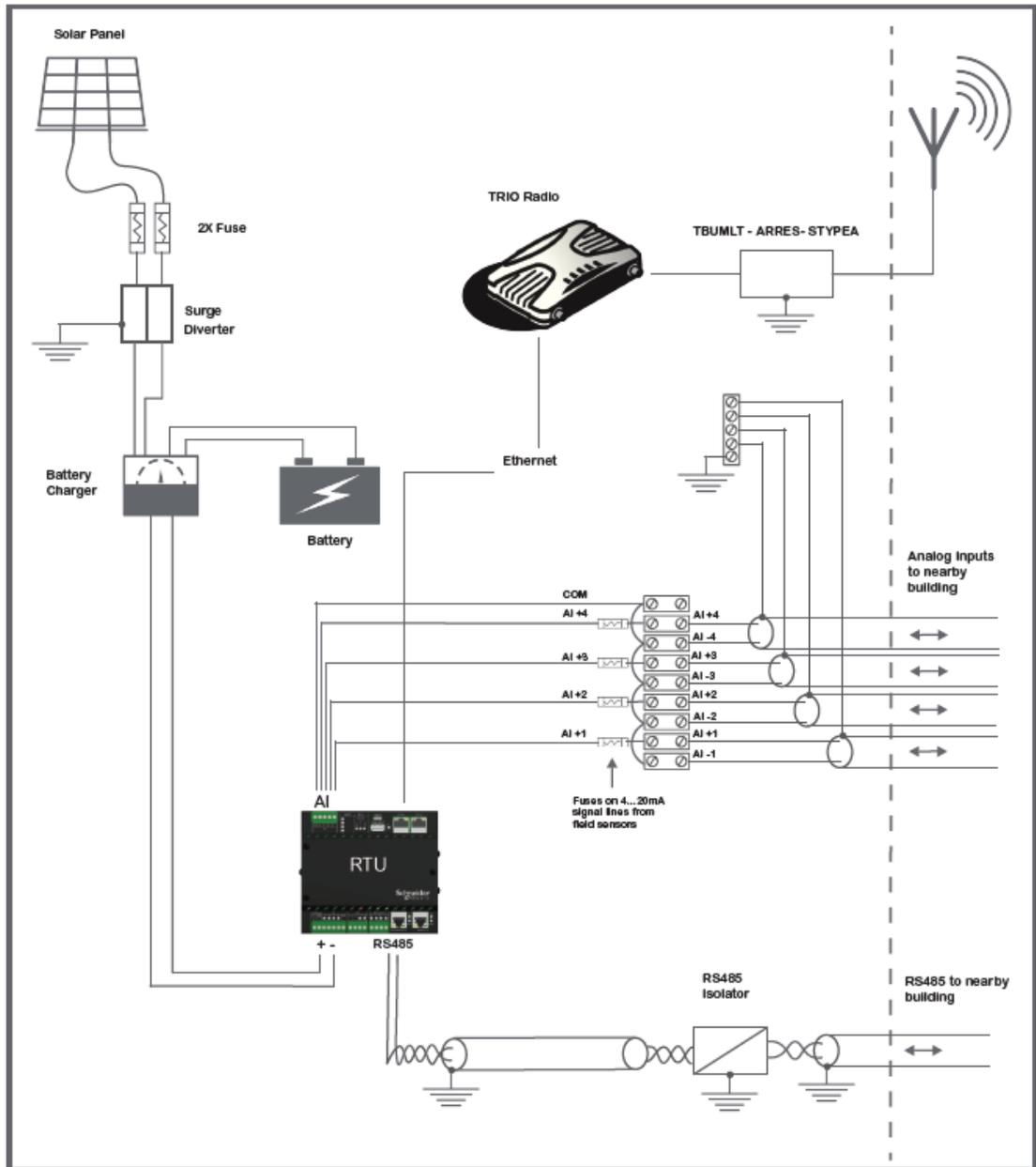
NOTICE**POWER SUPPLY LOSS OF FUNCTION**

- Use an external fuse, as specified in the manual.
- If using solar panels, use commercially available surge suppression.

Failure to follow these instructions can result in equipment damage.

Example

RTU with over-voltage protection on a power supply, analog inputs, RS485 port, and radio antenna.



NOTE:

Every line that enters or leaves a panel in the field or a (building) must have some form of protection. Examples as shown above diagram.

For additional information, refer to the Schneider Electric document [Grounding, Earthing and Lightning Protection](#), Chapter 7 “Grounding and Electromagnetic Compatibility of PLC Systems “ (Doc# 33002439).

8 Installation

The I/O module is factory-configured and under normal conditions does not require removal or insertion of any peripherals or components. The I/O configurations are stored in a combination of battery-backed RAM and flash memory on the SCADAPack.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Installing the I/O module in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the module can lead to unpredictable operation and unexpected results.

Before mounting the I/O module, check the Standards and Certifications topic to verify which EMC standards are supported.

Failure to follow these instructions can result in equipment damage.

The following sections describe specific aspects of installing the I/O module.

For more information see:

- [ATEX and IECEx Requirements](#)^[31]
- [Mounting the I/O Module](#)^[32]
- [Power Supply Requirements](#)^[34]
- [Power Supply Wiring](#)^[35]
- [Connecting I/O Modules](#)^[40]

8.1 ATEX and IECEx Requirements

The information in this topic applies when the unit is being used for ATEX and IECEx applications.

Conditions of safe use

Before installing the equipment, consider the instructions in the warning message below.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

- Use this equipment in an area of not more than pollution degree 2, as defined in EN 60664-1.
- Install this equipment in an enclosure that is only tool accessible and that provides a degree of protection not less than IP54 in accordance with EN 60079-15.
- Provide transient protection at a level not exceeding 140% of the peak rated voltage at the supply terminals to the equipment.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.
- For products using solid state relays (5606 and 5607 I/O modules and SCADAPacks using these modules), a T4 rating is acceptable for maximum loads of 1.33 A. When 2 A loads are connected to the solid state relays, the maximum ambient rating is lowered to 50 °C (122 ° F) in order to maintain the T4 rating.

Failure to follow these instructions can result in death or serious injury.

The rated supply cable temperature is ≥ 105 °C.

Product label

The following product label appears on a 5607 input output module.

MODEL 5607
TBUXYYYYYYX

 II 3 G

Ex nA IIC T4 Gc -40°C ≤ Ta ≤ +70°C
Cl. I Zone 2, AEx nA IIC T4 Gc
Ex nA IIC T4 Gc
DEMKO 16 ATEX 1696X
IECEX UL 16.0070 X
415 Legget Dr, Ontario
K2K 3R1, Canada

1050-0509 Rev.1 PID 270715

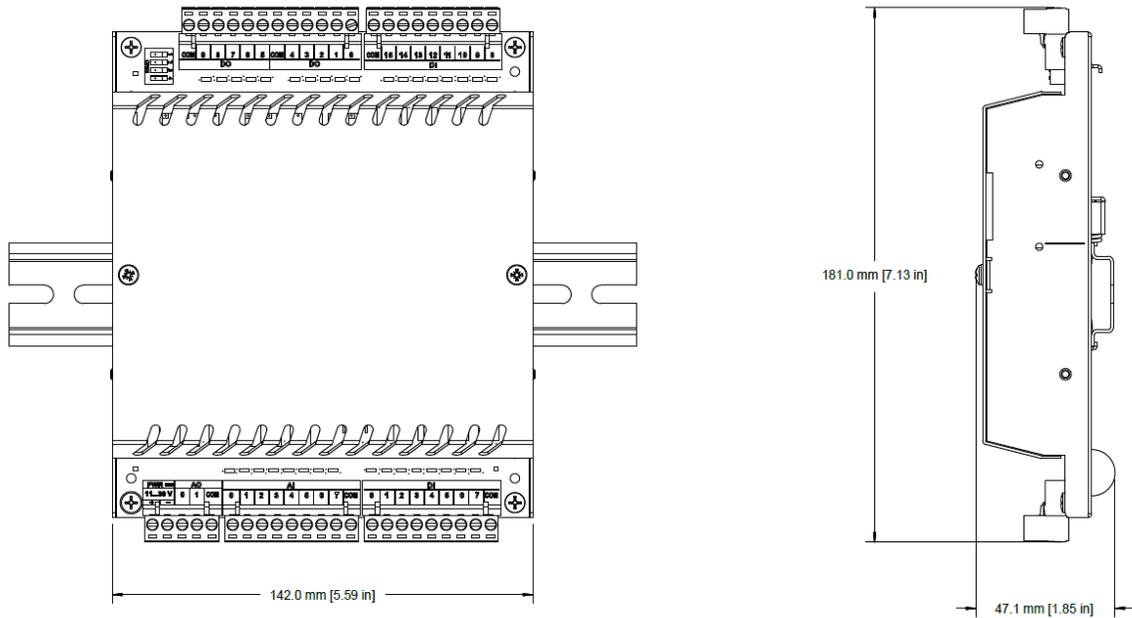

S/N: B123456
Power Supply: 11...30 Vdc, 1.6 W max
Input Ratings: Analog 20mA, 10V. Digital 24Vdc
Output Rating: 30Vdc, 2A at 50°C, 1.33A at 70°C
DOM: YYWW
Warning – Do Not Open When Energized
Refer to user manual



8.2 Mounting the I/O Module

The I/O module is mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail then connected to the SCADAPack or to another I/O module.

The figure below shows the I/O module dimensions when mounted.



⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack and the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before mounting it on a DIN rail.

Do not remove the I/O module cover when mounting the module. The I/O module is designed so that it can be mounted on a DIN rail with the cover in place.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Installing the I/O module in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the I/O module can lead to unpredictable operation and unexpected results.

Before installing the I/O module, check the Standards and Certifications topic to verify which EMC standards are supported.

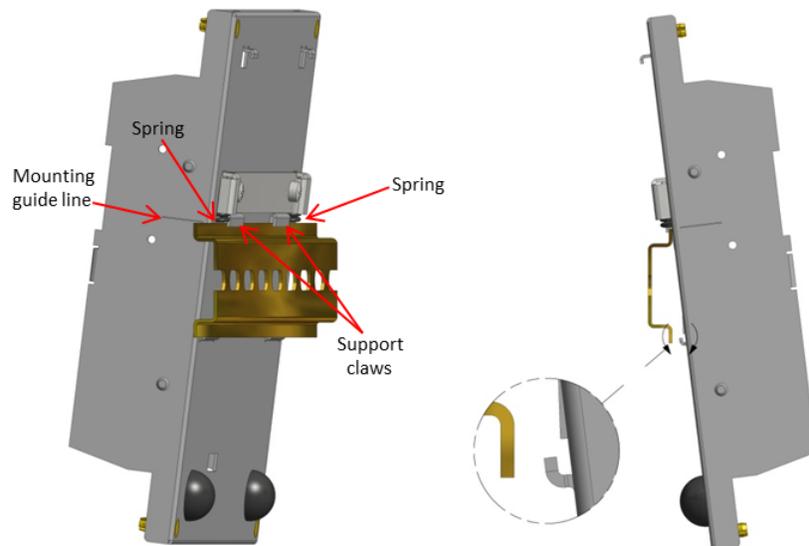
Failure to follow these instructions can result in equipment damage.

To mount the I/O module

The illustrations below show how to mount the I/O module on a horizontally oriented DIN rail. The steps to mount the I/O module on a vertically oriented DIN rail are the same.

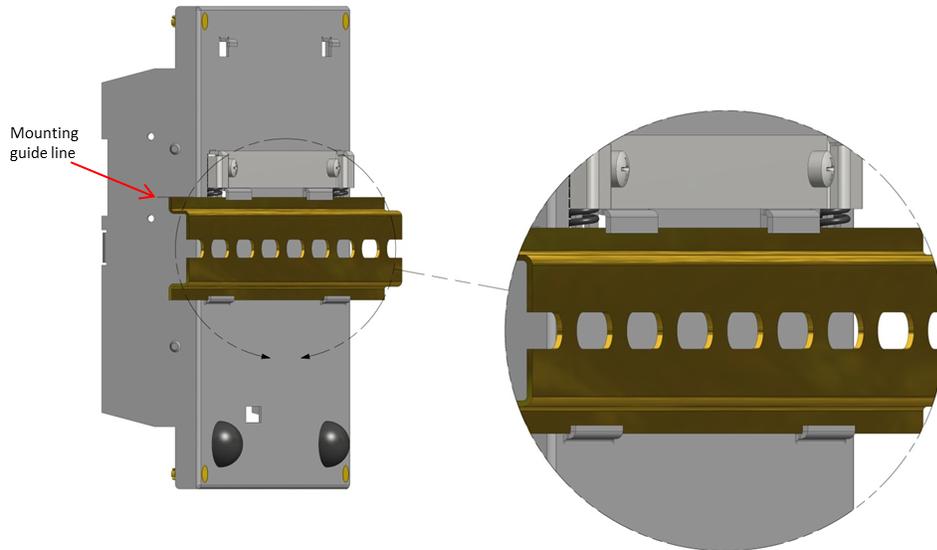
1. With the lower part of the module tilted away from the DIN rail, position the mounting guide line on the side of the module so that it is just above the top edge of the DIN rail.

Verify that the springs on the back of the module rest on the DIN rail and that the edge of the DIN rail is under the support claws that are adjacent to the springs, as shown below.

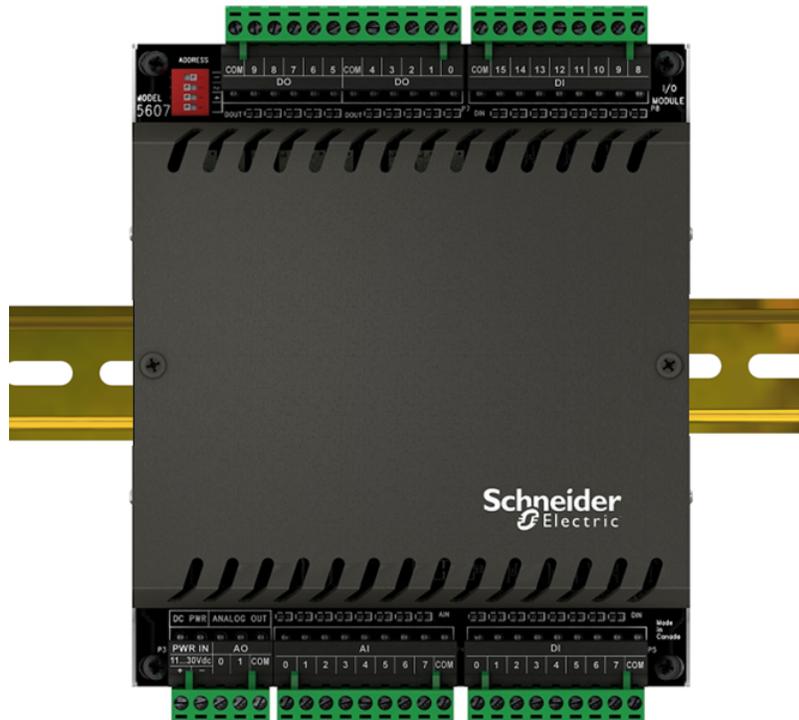


2. Push firmly on the module while tilting it toward the DIN rail until the DIN rail is positioned under both the upper and lower claws on the back of the module.
3. Verify that the mounting guide line is aligned with the edge of the DIN rail, then release the pressure on the springs so that the DIN rail is held firmly in place between the upper and lower claws.

The figure below shows a DIN rail correctly positioned in the upper and lower claws on the back of the I/O module.



The figure below shows an I/O module that is mounted horizontally.



8.3 Power Supply Requirements

Analog outputs are not included in this calculation. Add 20 mA for each analog output used.

The power requirement of the I/O module is summarized in the table below:

Digital Output Relays	LEDs	Digital Inputs	24 Vdc	5 Vdc Current Required from the SCADAPack
On	On	On	2.6 W	400 mA

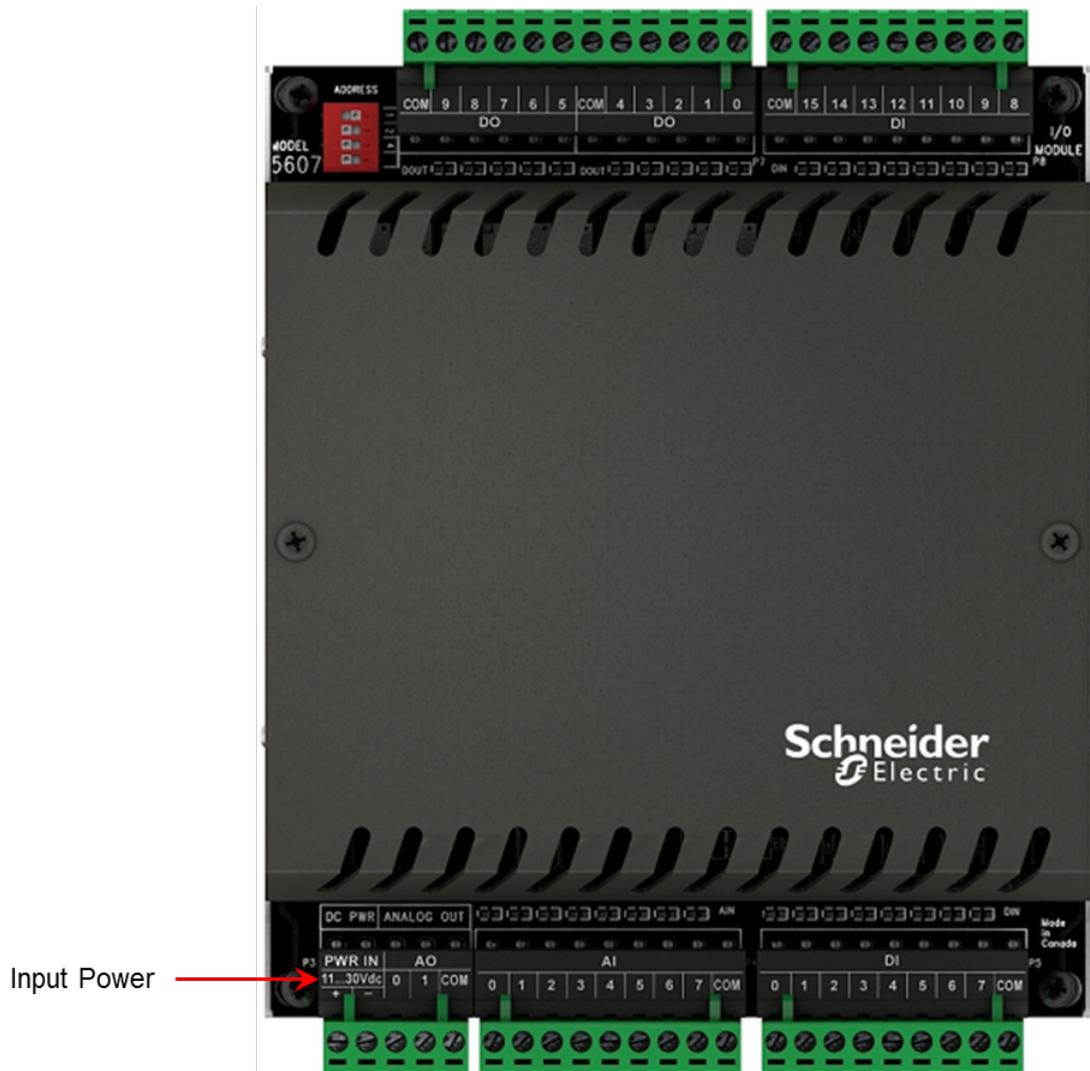
8.4 Power Supply Wiring

The I/O module requires a nominally 12 Vdc or 24 Vdc power supply applied to the terminals labeled 11...30 Vdc on connector P3 to power the analog input and optional analog output circuitry.

The current requirement of the analog portion (input and optional output circuitry) on the I/O module can vary from a minimum of 12 mA for basic operation of the analog circuitry plus an additional 40 mA for the optional analog outputs.

In addition, the system controller or power supply provides 5 Vdc through the I/O bus cable. Refer to the [Specifications](#) ^[72] section of the SCADAPack manual for its power capabilities. A sample power calculation for a SCADAPack with an integrated I/O module can be found in the manual of the corresponding SCADAPack.

See the image below for the location of the input power connection.



Power for the I/O module can be provided in several ways:

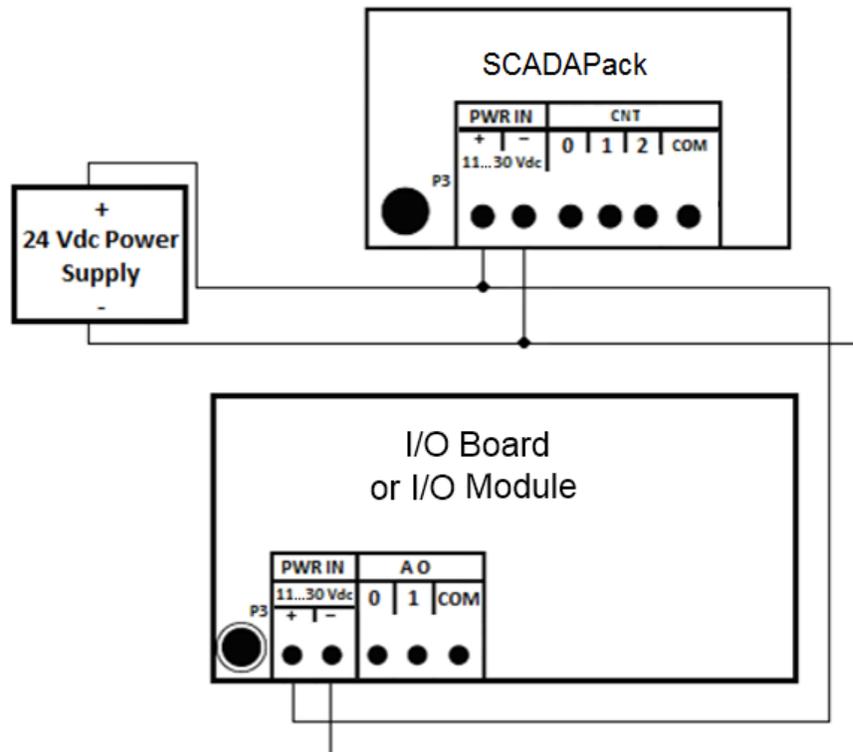
- With a 24 Vdc source connected to the PWR IN terminals on the SCADAPack and on the I/O module in a parallel configuration. See [Recommended 24 Vdc Power Supply Configuration](#)^[37] for an example of this wiring configuration.
- With a 12 Vdc source connected to the PWR IN terminals on the SCADAPack and on the I/O module in a parallel configuration. See [Recommended Battery Configuration](#)^[37] for an example of this wiring configuration.
- With a 5103 Uninterruptible Power Supply (UPS) providing 5 Vdc to the SCADAPack through the IMC cable and 24 Vdc to the I/O module through the 24 Vdc output. See [Layout Guidelines](#)^[38] for an example of this wiring configuration.

For information about grounding the system, see [System Grounding](#)^[39].

8.4.1 Recommended 24 Vdc Power Supply Configuration

This configuration uses a 24 Vdc power supply to power the SCADAPack and the I/O board or I/O module. This 24 Vdc is also used to power the analog circuitry on the I/O board or the I/O module.

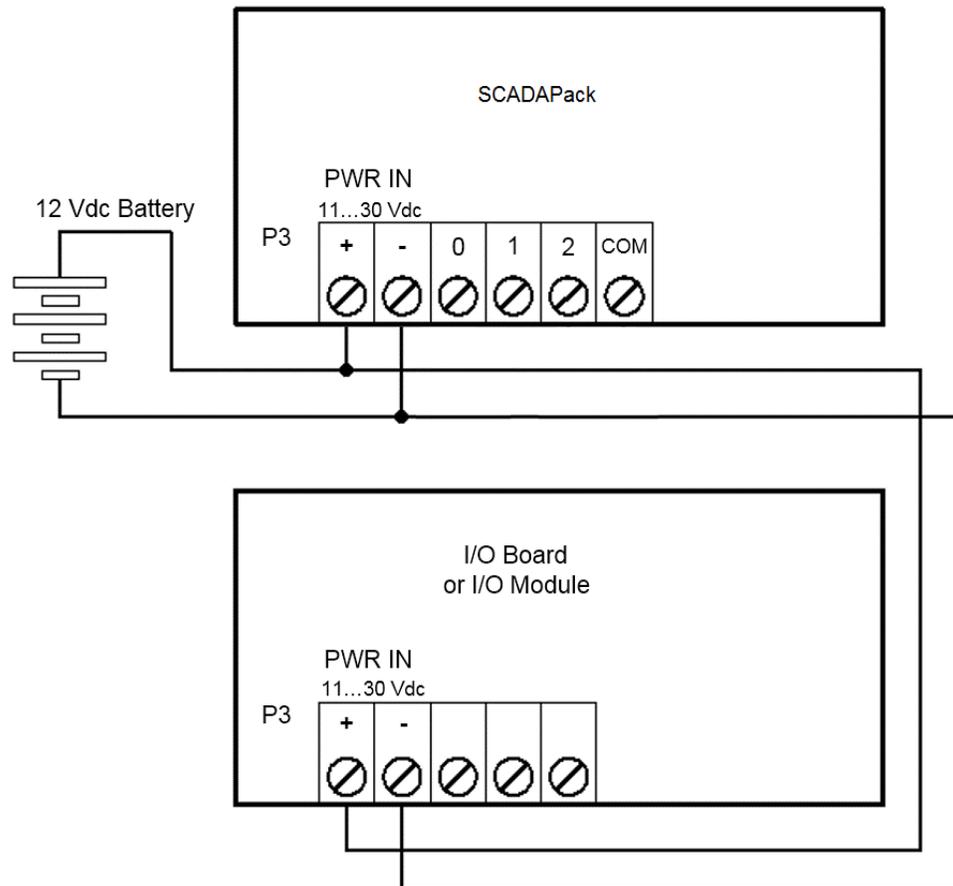
- This configuration is recommended when a large amount of current is required at 24 Vdc. Refer to the [Specifications](#) ^[72] section.
- Connect the SCADAPack **PWR IN** terminal to the same power supply as the I/O board or I/O module **PWR IN** terminal.



8.4.2 Recommended Battery Configuration

This configuration uses a 12 Vdc battery to power the SCADAPack and the I/O board or I/O module. This 12 Vdc battery is also used to power the analog circuitry for the analog inputs and optional analog outputs.

- This configuration is recommended when a large amount of current is required at 12 Vdc. Refer to the [Specifications](#) ^[72] section for power requirements from a 12 Vdc battery.
- Connect the SCADAPack **PWR IN** terminal to the same power supply as the I/O board or I/O module **PWR IN** terminal.



8.4.3 Layout Guidelines

When additional I/O or power is required by the system, I/O expansion modules or 5103 power supply modules can be used in combination with the controller. There are several guidelines to keep in mind when adding modules to your SCADAPack x70 control system.

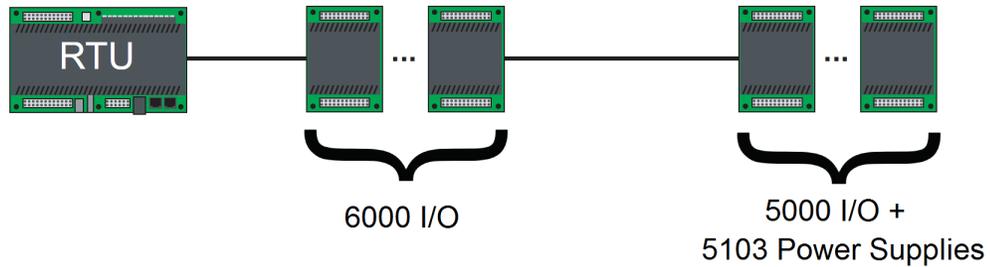
Module location

The 5103 module supplies power to the modules that are downstream from it. I/O modules that are placed to the left of the 5103 are powered by the previous controller or 5103, if there is one. I/O modules that are placed to the right of the 5103 are powered by that 5103.

You can add modules as follows:

- If you are using only 5000 series I/O modules:
 - Connect the 5000 series modules directly to the controller until additional power is needed
 - Connect a 5103 module followed by additional 5000 series I/O modules and 5103 power supply modules, as needed
- If you are using 5000 and 6000 series I/O modules:

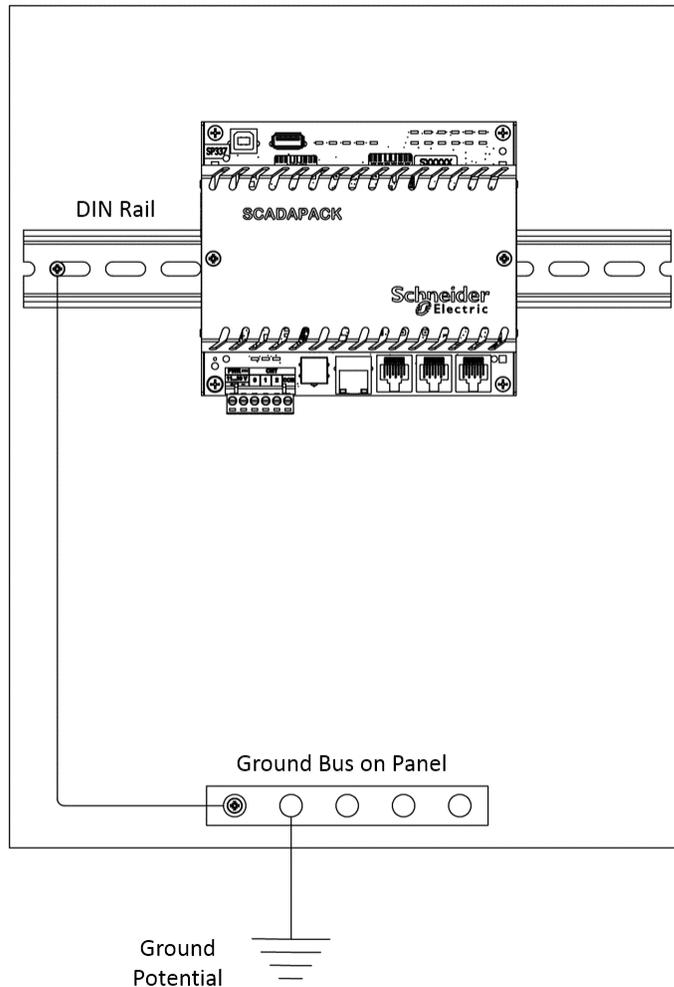
- Connect the 6000 series modules first and then follow the rules for connecting any 5000 modules
- The 5103 power supply module can only be placed after the 6000 series modules



8.4.4 System Grounding

Ground the system by connecting the system power supply common, to the chassis or panel ground. On the I/O board, the negative (-) terminal of the 11...30 Vdc supply along with terminals labeled GND are isolated from the chassis.

SCADAPack x70 devices and I/O expansion modules are mounted on a DIN rail which is connected to the panel as shown in the illustration below. Connect the panel to ground according to the local electrical code.



8.5 Connecting I/O Modules

The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

I/O modules are mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to a SCADAPack using intermodule cables. The intermodule cable is a ribbon cable that distributes power (5 Vdc) and communications signals from the SCADAPack to the I/O modules. These power and communication signals are referred to as the I/O bus.

The figure below shows a SCADAPack x70 device with an I/O module connected to it. You can connect multiple I/O modules to a single SCADAPack up to the maximum number of modules supported by the device. See the SCADAPack hardware manual for details.

The illustration below shows a connected intermodule cable. The maximum number of modules may also be limited by the total length of the cable. See [Cabling Guidance](#) ⁴³ for further details on intermodule cables. While the size and shape of your devices may differ and the color of the

NOTICE**STATIC ELECTRICITY DAMAGE**

Static electricity damage can cause intermittent or total loss of equipment operation. To help avoid static electricity damage:

- Wear an anti-static wrist strap that is connected to ground if you need to remove the device cover.
- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.
- Do not install intermodule cables in the same cable tray or in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Failure to follow these instructions can result in equipment damage.

8.5.2 Cabling Guidance

This topic summarizes the rules for connecting I/O modules to SCADAPack x70 devices. These rules apply to the following SCADAPack I/O modules:

- 6601 input output module
- 6602 HART module
- 6607 input output module
- 5304 analog output module
- 5405 digital input module
- 5410 high speed counter input module
- 5414 digital input module
- 5415 relay output module
- 5505 RTD input module
- 5506 analog input module
- 5606 input output module
- 5607 input output module

Using only 5000 series I/O modules

If you are using only 5000 series I/O modules with a SCADAPack x70 device, connect the 5000 series module directly to the SCADAPack using a 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual).

Using 5000 and 6000 series I/O modules

If you are using a combination of 5000 series I/O modules and 6000 series I/O modules with a SCADAPack x70 device, connect a 6000 series module to the SCADAPack first, followed by any other 6000 series modules. Then connect the 5000 series modules to the last 6000 series module.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

General guidance

- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.

- Install intermodule cables in separate cable trays from field wiring, and not in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Intermodule cables

When determining the location of your I/O modules, review the following information about shielded intermodule cables and maximum intermodule cable length.

Shielded intermodule cables

Shielded intermodule cables have a foil and braid shielding. Intermodule cables longer than 30 cm (12 in) are shielded for physical protection and for isolation from electrical noise. The shielding is connected to a terminal lug at one end of the cable.

When using a shield for an intermodule cable, fasten the shield only to the module that is closest to the SCADAPack. Connect the shield to the enclosure using the self-tapping screw provided.

You can use up to 3 shielded intermodule cables. The total length of all cables can not exceed 1.82 m (75 in).

Maximum intermodule cable length

I/O modules ship with a short intermodule cable that is used to connect I/O modules to a SCADAPack or to another I/O module.

The maximum total intermodule cable length in a single system is 1.82 m (75 in). This length restriction does not include the short intermodule cable supplied with the I/O module. Schneider Electric offers several cable lengths that can be combined to reach the 1.82 m (75 in) limit.

Keep the following in mind:

- No more than 1.5 m (60 in) of total expansion cable length can follow a controller or power supply before an additional power supply needs to be added
- 1.14 m (45 in) and 1.82 m (75 in) expansion cables need to be followed by a power supply
- The highest power consumption modules need to be to closest to the controller or power supply with 6000 series modules first, followed by 5000 series modules due to connector limitations
- The maximum number of power supply modules, not including the controller, is 2
- A 30 cm (12 in) or a 76 cm (30 in) cable is typically used to connect modules on separate DIN rails

To purchase additional intermodule cables, contact your Schneider Electric representative.

8.5.3 Attaching Intermodule Cables

This topic describes how to attach an intermodule cable between a SCADAPack and an I/O module. Follow the same steps to connect two I/O modules.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before applying or removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**ELECTRICAL HAZARD**

The I/O bus does not support live-swapping.

Remove power from the SCADAPack and the I/O module before removing the cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE**STATIC ELECTRICITY DAMAGE**

Static electricity damage can cause intermittent or total loss of equipment operation.

Always wear an anti-static wrist strap that is connected to ground when you remove the device cover.

Failure to follow these instructions can result in equipment damage.

5410 High Speed Counter Input Module Considerations

NOTICE**UNEXPECTED COUNTER READINGS**

Do not disconnect a 5410 high speed counter input module while the module and RTU are powered.

Do not remove power from a 5410 high speed counter input module while the RTU is powered and communicating with the module.

Failure to follow these instructions can result in unexpected counter readings.

Power off the RTU before connecting or disconnecting the inter-module cable to the 5410 high speed counter input module.

Power off the RTU and 5410 high speed counter input module at the same time. Use a common power supply input for the RTU and I/O modules.

To attach intermodule cables

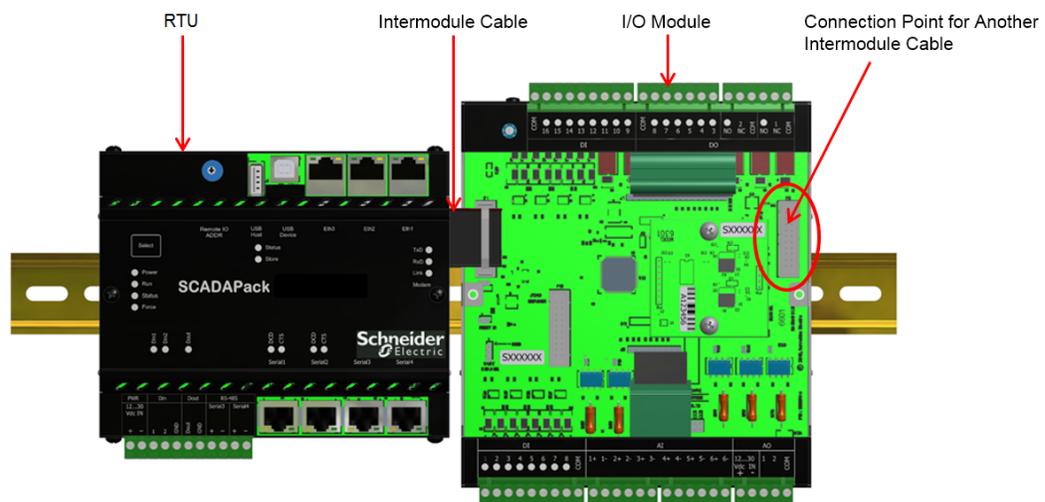
1. Power down each SCADAPack and I/O module that you are connecting.
2. Remove the cover from the device if required to access the intermodule cable.
3. Press one end of the intermodule cable firmly into the I/O bus connector on the SCADAPack.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

The connectors on intermodule cables are keyed so they can only be inserted in one direction. If the connector does not push easily into the I/O bus connector, reverse it and try again.

4. Press the other end of the intermodule cable firmly into the I/O bus connector on the I/O module.

The illustration below shows a connected intermodule cable. While the size and shape of your devices may differ and the color of the connectors may be different, the location of the intermodule cable is the same on each device type.



5. Replace the cover on the I/O module and on the SCADAPack if it was removed, taking care to check that the ribbon cable connecting the I/O module is not pinched.
6. Apply power to the SCADAPack.

You are now ready to configure the I/O module.

9 Addressing

This section describes the addressing rules for an I/O module and the procedure for setting the I/O module address.

WARNING

UNINTENDED EQUIPMENT OPERATION

Review the power requirements for the I/O modules before combining modules.

Failure to follow these instructions can result in death or serious injury.

I/O modules can be combined in any manner up to the maximum number supported by the SCADAPack. For details about the maximum supported system configuration, see the SCADAPack hardware manual for guidance.

Each I/O module connected to the SCADAPack is assigned a unique I/O module address.

For more information see:

- [Addressing Rules](#)^[47]
- [Setting the I/O Module Address](#)^[48]

9.1 Addressing Rules

I/O modules are shipped from the factory at address 0. If the modules connected to the SCADAPack are different types, for example a digital input module and an analog input module, then no address changes are necessary.

NOTICE

UNDETECTED ADDRESS CONFLICT

SCADAPack x70 devices do not detect address conflicts on 5000 series I/O modules. As a result, addressing conflicts on these modules do not generate a system status code in the SCADAPack RemoteConnect configuration software.

Verify that each 5000 series I/O module is addressed according to the rules below:

Failure to follow these instructions can result in equipment damage.

If you do need to set the hardware address on your I/O module, keep the following in mind:

- No 2 digital input modules can have the same address.
- No 2 digital output modules can have the same address.
- No 2 analog input modules can have the same address.
- No 2 analog output modules can have the same address.
- No 2 5606 or 5607 modules can have the same address.
- The 5606 and 5607 I/O modules can be configured for addresses 0 to 7. As a result, a total of

8 of these modules, in any combination, can be connected to the SCADAPack at one time.

- The 5606 and 5607 I/O modules share the same address numbering; if both these modules are connected to the same SCADAPack, they need to have unique address numbers.
- If you are connecting 1 or more 5606 or 5607 input output modules to a SCADAPack 574, you will need to change the address as the SCADAPack 574 includes an internal 5607 input output module at address 0. Each module requires a unique address.

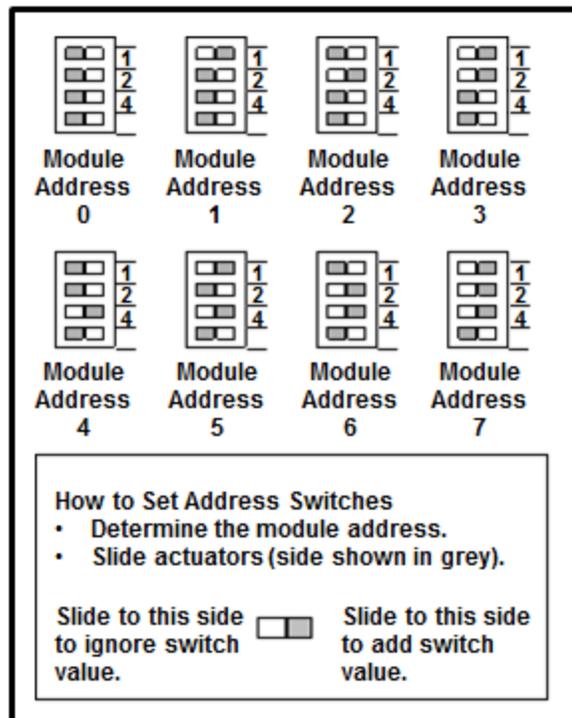
9.2 Setting the I/O Module Address

Three address switches on the I/O module, labeled 4, 2, and 1 set the address. I/O modules are factory set to address 0. Address 0 can be used if there is no other module of the same type connected to the SCADAPack. A second module of the same type is generally set to address 1.

To set the address

1. Open the 3 switches by sliding the actuators to the OFF position.
2. Close the switches that total to the desired address by sliding the actuators to ON.

Switch settings for each of the 8 module addresses are shown in the figure below.



10 Field Wiring

The I/O modules use screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 3.3...0.08 mm² (12...28 AWG). The connectors are removable allowing replacement of the module without disturbing the field wiring. Leave enough slack in the field wiring for the connector to be removed.

For ease of wiring and maintenance, external connections are terminated on removable connectors. If you need to remove the I/O module cover for any reason, first carefully consider the following information.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before removing the I/O module cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

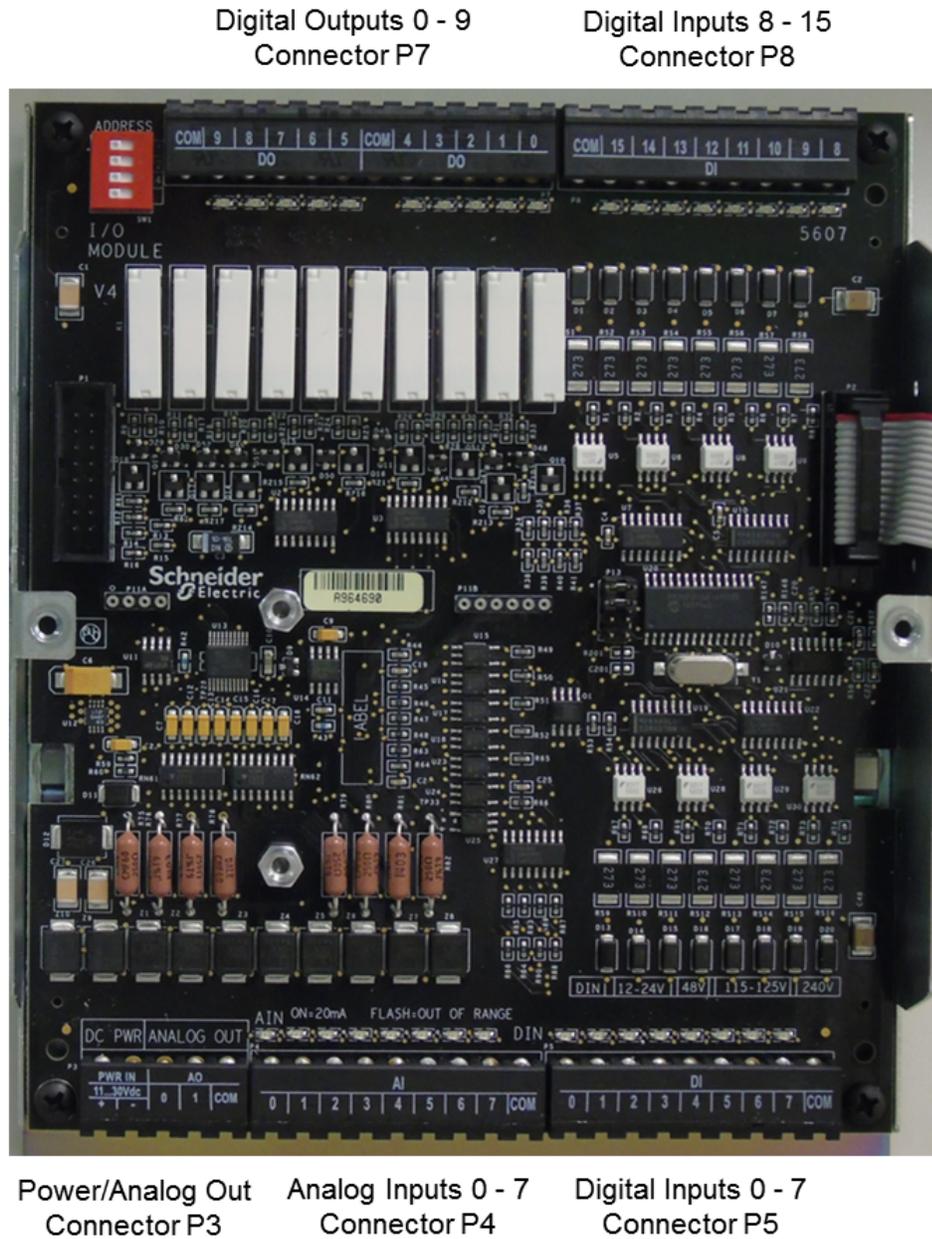
The electronics inside the I/O module can be damaged by static electricity. If you need to remove the I/O module cover, wear an anti-static wrist strap that is connected to ground. Failing to follow this step can cause intermittent or total loss of I/O module operation and will void the warranty.

Failure to follow these instructions can result in equipment damage.

The I/O module has termination connectors for the connection of field wiring. Refer to the board image below for wiring connector locations.

- The digital inputs are wired to connectors P5 and P8.
- The digital outputs are wired to connector P7.
- The analog inputs are wired to connector P4.
- Primary power input connections and optional analog output connections are wired to connector P3. The loop current will only flow in analog inputs that have been configured for 20 mA and when power is applied to P3.

The rated supply cable temperature is ≥ 105 °C.



For more information, see:

- [Wiring Screw-Termination Connectors](#) ^[51]
- [Digital Input Wiring](#) ^[52]
- [Digital Output Wiring](#) ^[54]
- [Analog Input Wiring](#) ^[57]
- [Analog Output Wiring](#) ^[62]

10.1 Wiring Screw-Termination Connectors

Screw-termination style connectors are provided to terminate wiring from:

- Power supplies
- RS485 devices
- Input/output (I/O) modules

These 5 mm (0.197 in) pitch connectors support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before wiring screw-termination connectors.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

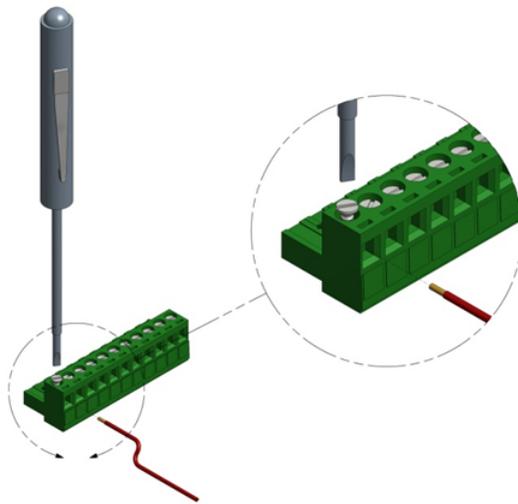
ELECTRICAL HAZARD

Remove power from all modules and devices before servicing.

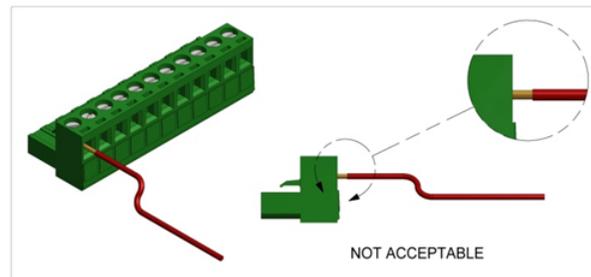
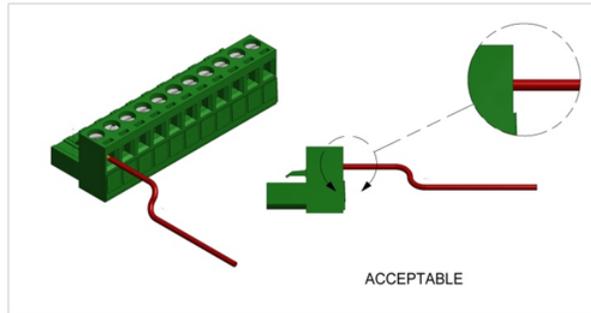
Failure to follow these instructions can result in death or serious injury.

To wire a connector

1. Use a slotted screwdriver to loosen the termination screw.



2. Insert the stripped wire into the connector so that the bared wire is located under the screw.
Verify that the bared wire is placed fully within the connector, as illustrated below.



3. Apply 0.5 N•m (4.5 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 Digital Input Wiring

This section describes the wiring for the digital inputs.



For more information, see:

- [Digital Input Wiring Example](#)⁵⁴

10.2.1 Digital Input Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

When wiring digital inputs:

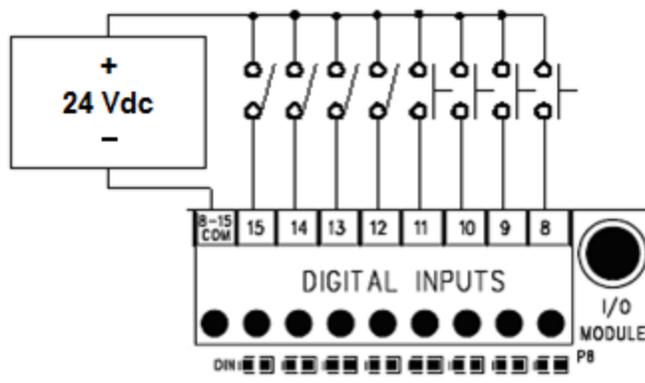
- Confirm that the connection to the digital input does not exceed the ratings for the digital input. See the Specifications topic for details.
- Confirm that the polarity of the connection is correct with the two positive terminals wired together and the two negative terminals wired together.

Failure to follow these instructions can result in equipment damage.

The I/O module accommodates DC inputs.

The voltage range is configured at the factory.

The following diagram shows typical wiring of DC signals to the digital input ports.



P8 – Digital Inputs
Module factory-configured for 12...24 Vdc.

10.3 Digital Output Wiring

This section describes the wiring for the digital outputs.



For more information, see:

- [Digital Output Wiring Example](#)^[56]

10.3.1 Digital Output Wiring Example

WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

RELAY CONTACT DAMAGE

Incandescent lamps and other loads may have inrush currents that exceed the rated maximum current of the relay contacts. This inrush current may damage the relay contacts. Use interposing relays in these situations.

When controlling inductive loads, the relay contacts on digital outputs must be protected. The energy stored in inductive loads generates electrical noise when the relay contacts are opened.

To suppress the noise in DC circuits, place a diode across the coil.

Failure to follow these instructions can result in equipment damage.

NOTICE

UNINTENDED EQUIPMENT OPERATION

External lightning protection is required if the device being controlled is outside the physical area (cubicle or building) in which the module is located.

Failure to follow these instructions can result in equipment damage.

NOTICE

UNINTENDED EQUIPMENT OPERATION

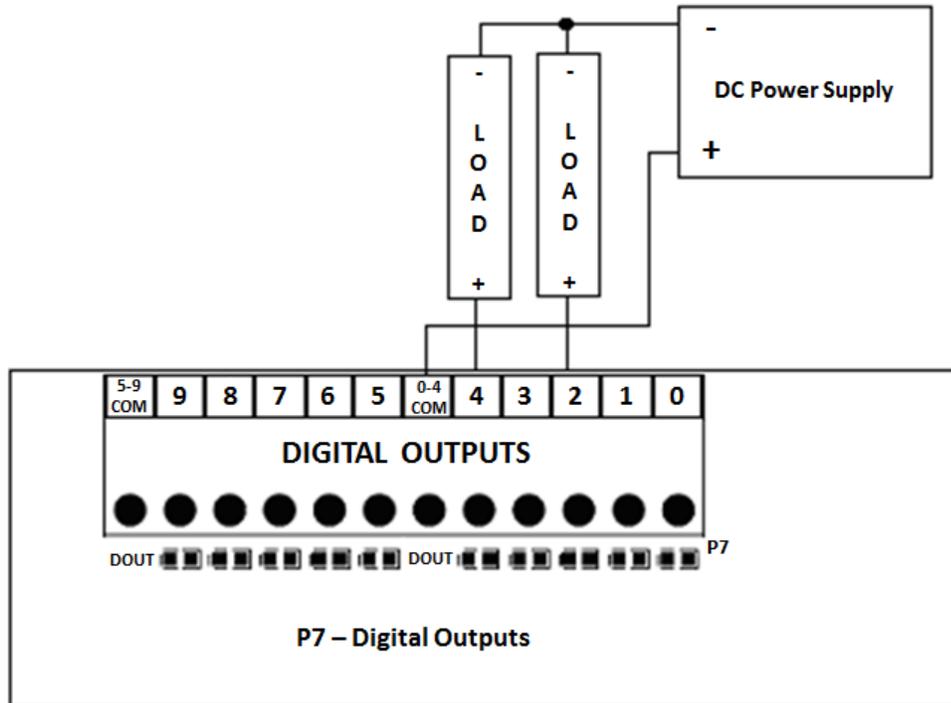
When using the 5607 input output module with solid state relays, confirm that the polarity of the load voltages is correct:

- The loads must be connected to the negative (-) side of the power supply.
- The positive (+) side of the power must be switched through the COM terminal.

Failure to follow these instructions can result in equipment damage.

Wiring example

In the example below, relays 2 and 4 are used to switch the DC power to two loads. In this example the positive side of the loads are switched through the common of relays 0 - 4 to the positive side of the DC power supply.



10.4 Analog Input Wiring

This section describes the wiring for the analog inputs.



Analog Inputs

For more information, see:

- [Analog Input Wiring Example](#) ^[59]
- [Configuring Analog Inputs as Current Inputs](#) ^[61]
- [Helping to Prevent Interruption of the Current Loop](#) ^[61]

10.4.1 Analog Input Wiring Example

WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

LIGHTNING SURGE THROUGH ANALOG INPUTS

If a transducer or transmitter connected to an analog channel is placed outside of the building or structure where the SCADAPack or I/O module that provides the analog inputs is installed, there is an increased possibility of extremely severe power surges caused by lightning. In these cases, additional surge protection must be supplied by the user.

Failure to follow these instructions can result in equipment damage.

NOTICE

SIGNAL INTERFERENCE DUE TO NOISE

Analog input signals must be shielded using Belden 9322 cables or equivalent, when the unit is operating in an electrically noisy environment or to meet the requirements of EN61000-6-2.

Failure to follow these instructions can result in equipment damage.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Do not exceed the maximum voltage specified for each analog input. See the Specifications topic for the maximum voltages.

Failure to follow these instructions can result in equipment damage.

NOTICE

UNINTENDED EQUIPMENT OPERATION

This module must be the only loop current measurement device in the loop when using the analog inputs in the 20 mA measurement mode. If power to the module is removed, the module reverts to voltage mode and results in an open current loop.

Applications that cannot tolerate this possibility require external current sense resistors, with the module input range set to voltage.

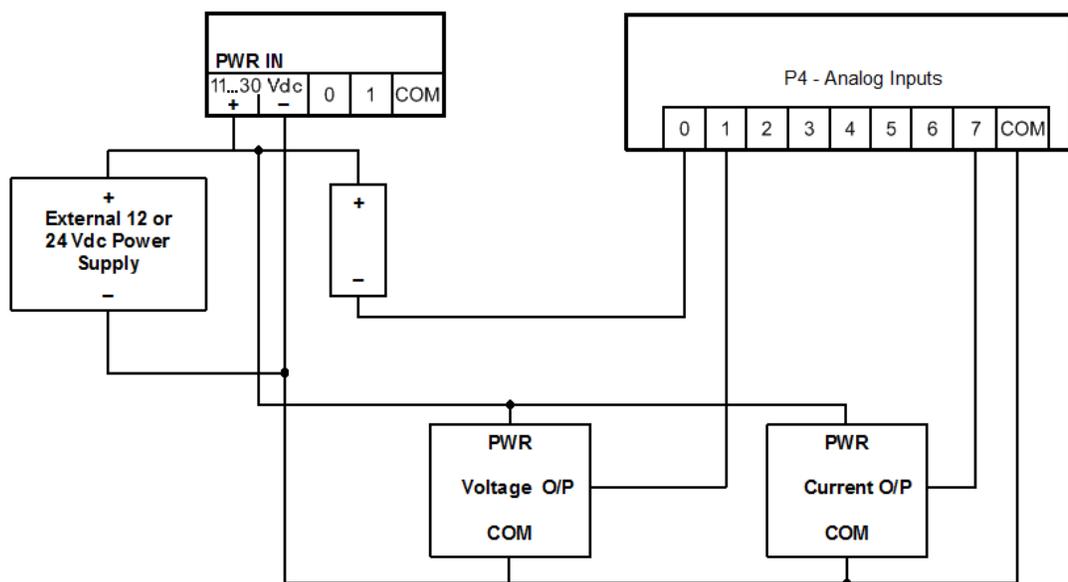
Failure to follow these instructions can result in equipment damage.

Wiring example

The diagram below shows several examples for wiring of loop-powered and self-powered transmitters with the corresponding analog inputs set to voltage mode with a 0...5 Vdc measurement range.

The analog inputs require their own power connection, as shown in the diagram.

- Example 1: Channel 0 has a loop powered current transmitter connected to the external power supply.
- Example 2: Channel 1 has a self-powered voltage transmitter connected to the external power supply.
Channels 2 through 6 are unused.
- Example 3: Channel 7 has a self-powered current transmitter connected to the external power supply.



10.4.2 Configuring Analog Inputs as Current Inputs

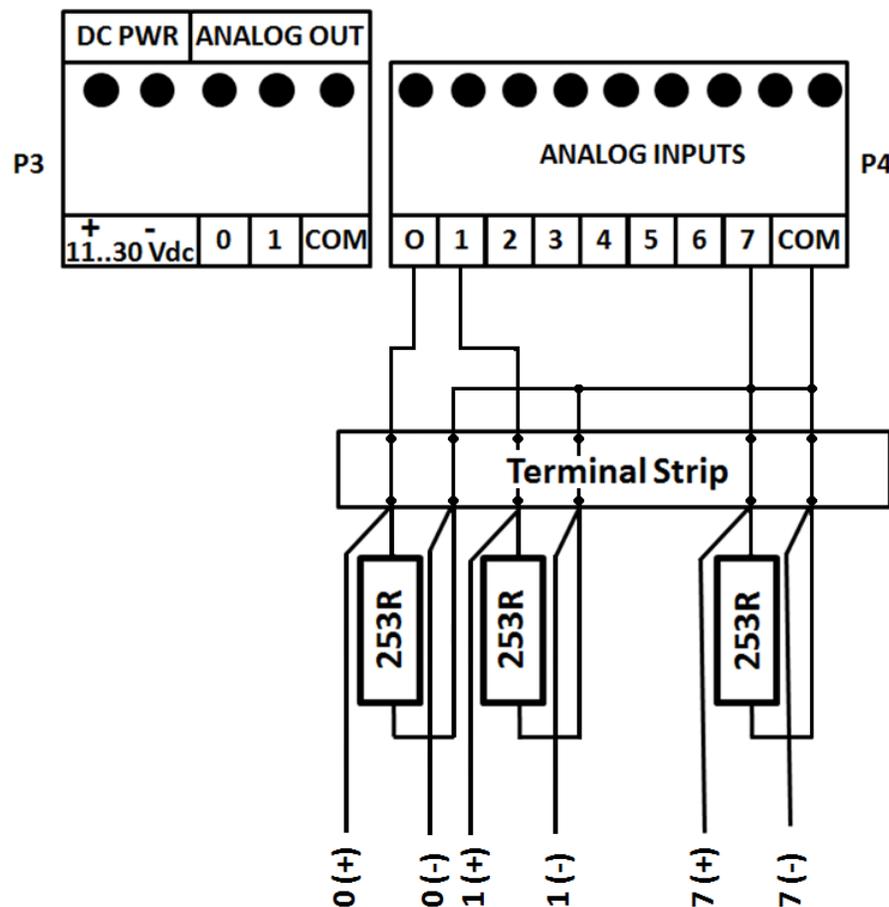
The analog inputs are configured in current input mode and have these possible operating conditions:

- The module is not the only transducer in a particular current loop
- The module is powered down, or reset

If you power down or reset the module in a multiple device loop, the analog inputs emulate voltage inputs that present a high impedance to the current loop, and effectively break the current loop of the system.

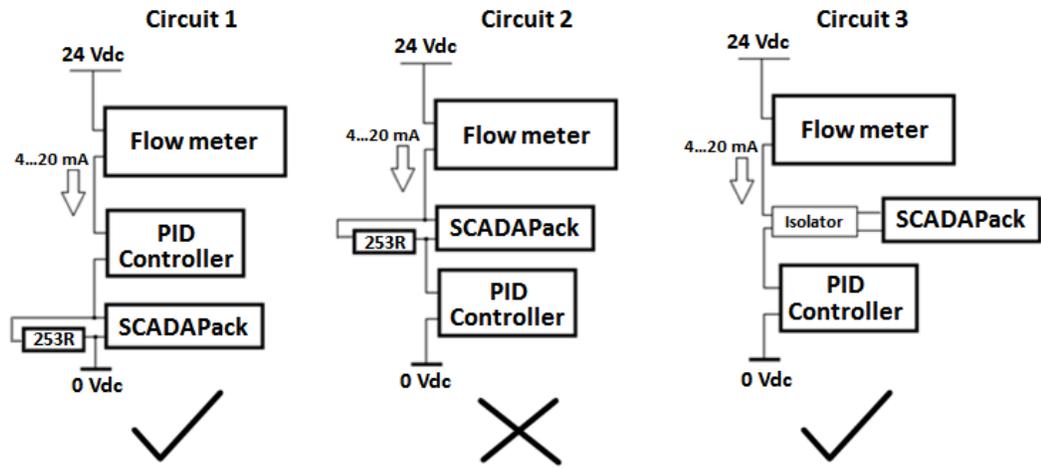
10.4.3 Helping to Prevent Interruption of the Current Loop

This wiring method is preferred if you need to swap the device, as it allows you to remove the device without interrupting the current loop. Configure the analog inputs 0, 1 and 7 as voltage inputs, and add an external 253 ohm precision resistor to the current loop at the terminal strip as shown in the figure below.



The circuit configurations for the external 253 ohm resistor, or a signal isolator, are shown in the

figure below:



10.5 Analog Output Wiring

This section describes the wiring for the analog outputs.



Analog Outputs

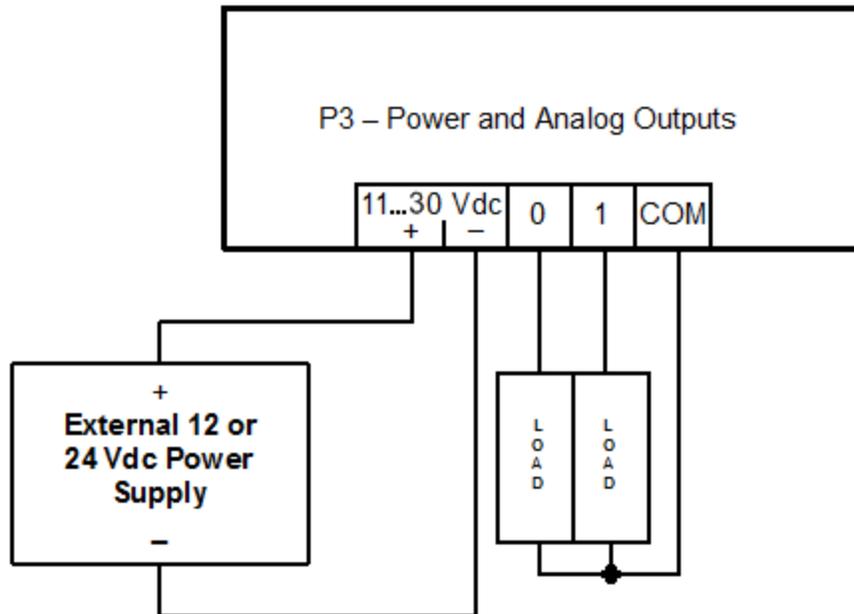
For more information, see:

- [Analog Output Wiring Example](#)^[64]
- [Analog Output Power Supply Configuration Options](#)^[64]

10.5.1 Analog Output Wiring Example

The figure below shows loads connected to the two analog outputs.

The analog outputs require their own power connection, as shown in the diagram.



10.5.2 Analog Output Power Supply Configuration Options

There are two configuration options for the external 24 Vdc power supply that is required when the optional analog outputs are installed:

- The analog outputs and the SCADAPack can each have their own 24 Vdc power supply. In this configuration, the analog outputs are isolated from the system logic.
- The analog outputs can share an external 24 Vdc power supply with the SCADAPack. In this configuration, the analog outputs are not isolated from the system logic.

NOTICE

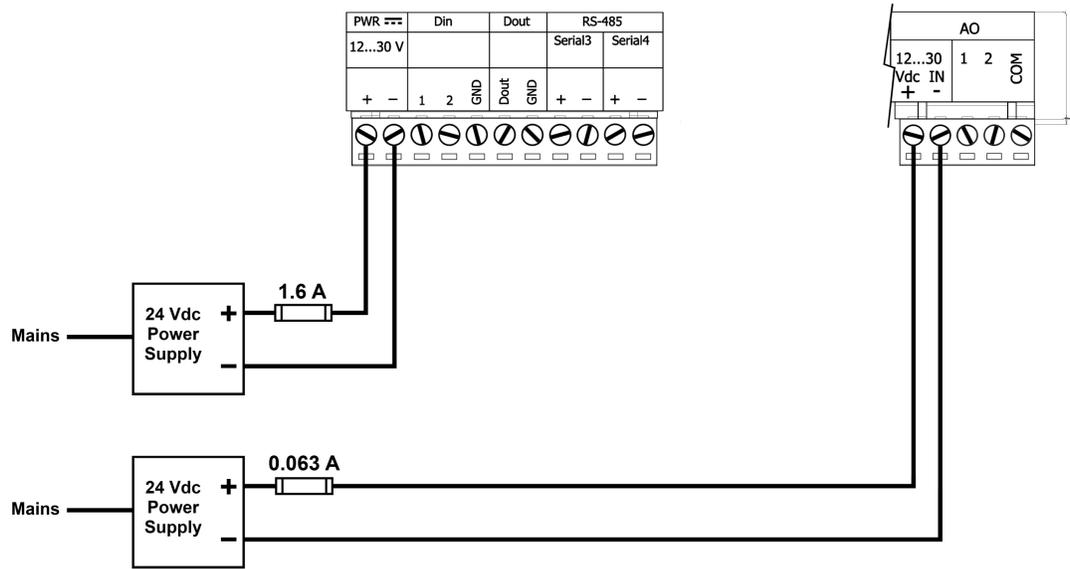
UNINTENDED EQUIPMENT OPERATION

Install an external 1.6 A fast-acting fuse on the input voltage side of the SCADAPack power supply connection.

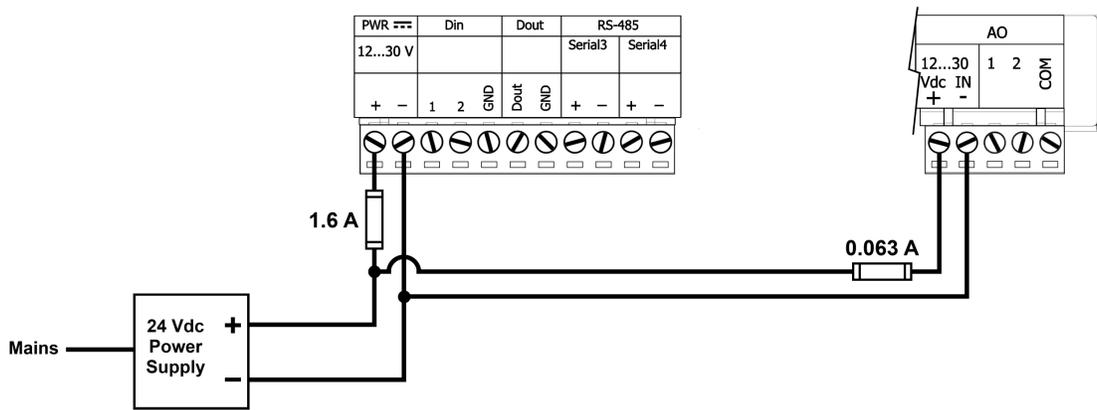
Install an external 0.063 A fast-acting fuse on the input voltage side of the analog output power supply connection.

Failure to follow these instructions can result in equipment damage.

The following figure illustrates the power supply configurations for a SCADAPack 57x device for isolated and non-isolated analog outputs.



Isolated AO



Non-Isolated AO

11 Configuration

The inputs and outputs can be configured locally or remotely using the SCADAPack RemoteConnect configuration software on a Microsoft Windows-based computer.

SCADAPack RemoteConnect configuration software

The configuration software provides a graphical user interface that allows you to:

- Configure parameters for the SCADAPack and any attached I/O modules and then load those parameters into the SCADAPack
- Interact online with the SCADAPack to view status information, diagnostics information and current parameter values for the SCADAPack and any attached I/O modules
- Use the built-in SCADAPack x70 Logic Editor to develop IEC 61131-3 applications that extend and enhance the functionality provided by the SCADAPack and any attached I/O modules

The configuration software is comprised of a frame application that is FDT 2.1, FDT 2.0, and FDT 1.2 compliant and Device Type Managers (DTMs).

For information about	See the following manual
Working with projects and DTMs	SCADAPack RemoteConnect Configuration Software
Configuring communications with the SCADAPack	PC Communication Settings -SCADAPack CommDTM
Configuring device parameters and interacting online with the device	SCADAPack x70 Configuration
Using the SCADAPack x70 Logic Editor	SCADAPack Logic Programming Overview

12 Diagnostics

Input and output modules provide LEDs that indicate the status of inputs and outputs. There are also a number of actions you can take to determine the cause of unexpected activities.

For more information, see:

- [LEDs](#) ^[67]
- [Digital Inputs](#) ^[67]
- [Digital Outputs](#) ^[68]
- [Analog Inputs](#) ^[68]
- [Analog Outputs](#) ^[69]

12.1 LEDs

The I/O module provides an LED for each input and output. When the LED is on, the input or output is energized, meaning it has an active connection. The table below describes the LEDs on the I/O module.

LED	Function
Digital input (DI)	On when the corresponding digital input is on.
Digital output (DO)	On when the corresponding digital output is on.
Analog input (AI)	<p>On when analog input is configured for a current range</p> <p>Off when analog input is configured for a voltage range</p> <p>Long flashes when the applied current is out of range*</p> <p>Short flashes when the applied voltage is out of range*</p> <p>* See Range and Scaling ^[23].</p>

12.2 Digital Inputs

Condition	Action
Input LED does not come on when input signal is applied.	<p>Check that the input signal at the termination block is at least 50% of the digital input range.</p> <p>If this is a DC input, check the polarity of the signal.</p>
Input is on when no signal is applied. The LED is off.	Check that the digital inputs are not forced on.

Input is off when a signal is applied. The LED is on.	Check that the digital inputs are not forced off.
---	---

12.3 Digital Outputs

Condition	Action
Output LED does not come on when output is turned on.	Check the Power LED on the SCADAPack.
Output LED comes on but the output does not close.	Check if the relay is stuck. If so, return the module for repair.
Output LED comes on and output is closed, but the field device is not activated.	Check the field wiring. Check the external device.
Output LED and relay are on when expected to be off.	Check that the output is not forced on.
Output LED and relay are off when expected to be on.	Check that the output is not forced off.

12.4 Analog Inputs

Condition	Action
20 mA inputs read 0.	Check transmitter power.
Reading is at or near 0 for every input signal.	Check whether the input transient suppressors are damaged.
20 mA readings are not accurate.	Check for a damaged 250 ohm current sense resistor.
Reading is constant.	Check that the analog input is not forced.
Reading seems out of calibration for small inputs but improves as input increases.	Check the input range setting.
In Current Loop Mode, there can be an open circuit in the Current Loop.	Refer to the section Configuring Analog Inputs as Current Inputs ^[61] .
Other devices are not functional after installation of the I/O module.	In Current Loop mode, make the I/O module the last device in the loop, or use a signal isolator as discussed in the section Configuring Analog

	Inputs as Current Inputs 
--	--

12.5 Analog Outputs

Condition	Action
Outputs are 0 mA	<p>Check whether the optional analog outputs were ordered with the I/O module. The analog outputs are installed at the factory prior to delivery.</p> <p>Check the 24 Vdc power supply.</p>
The full-scale output is less than 20 mA	<p>Check the 24 Vdc power supply.</p> <p>Check that the load resistance is within specification.</p>
Output is constant instead of changing	Check that the analog outputs are not forced.

13 Calibration

The device is electronically calibrated at the factory during the manufacturing process and after any repair procedures.

There are no user calibration procedures.

14 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact [Technical Support](#)^[7] for more information and instructions for returning the module for repair.

15 Specifications

Disclaimer: Schneider Electric reserves the right to change product specifications without notice. If you have questions about any of the specifications, contact [Technical Support](#)^[72].

For more information, see:

- [General](#)^[72]
- [Power Supply](#)^[72]
- [Digital Inputs](#)^[73]
- [Digital Outputs](#)^[73]
- [Analog Inputs](#)^[75]
- [Analog Outputs](#)^[75]

15.1 General

Item	Specification
Terminations	3.3...0.08 mm ² (12...28 AWG) 15 A contacts Screw termination - 0.5 N•m (4.5 lb-in) torque
Dimensions	142 mm (5.6 in) wide 181 mm (7.2 in) high 47 mm (1.9 in) deep
Enclosure	Corrosion-resistant zinc-plated steel with black enamel paint
Environment	5...95% relative humidity, non-condensing -40...70 °C (-40...158 °F) operating temperature when the unit is mounted horizontally on a vertical surface -40...85 °C (-40...185 °F) storage temperature

15.2 Power Supply

Item	Specification
5 Vdc power requirements (Dry Contact Relay Version)	400 mA
5 Vdc power requirements	280 mA

(Solid State Relay Version)	
11...30 Vdc power requirements	12 mA at 11...30 Vdc, plus analog output requirements UL508 rated 13.75...28 Vdc
11...30 Vdc - Connector	Removable, 5-pin
11...30 Vdc - Isolation	Isolation from logic supply and chassis

15.3 Digital Inputs

Item	Specification	
Quantity	16	
Typical operating voltage	12 Vdc 24 Vdc	
Connectors	2 removable, 8-pin	
Indicators	Logic-powered LEDs	
Over-voltage tolerance	36 Vdc	
Input current	0.83 mA typical at 24 Vdc, 0.39 mA typical at 12 Vdc	
Input logic-HI level	OFF to ON transition threshold is typically 6.5 Vdc	
Input voltage	Off – to – On 6.5 Vdc +/- 0.5 Vdc	On – to – Off 6.5 Vdc +/- 0.5 Vdc
Response time	Off – to – On	On – to – Off
@ 50 Hz	15...19 ms	25...29 ms
@ 60 Hz	13.5...18 ms	23...28 ms
Isolation	Isolation is in 2 groups of 8 Isolation from logic supply and chassis: 250 Vac/1000 Vdc	

15.4 Digital Outputs

Item	Specification
------	---------------

Quantity	10
Connector	Removable, 12-pin
Type	Form A Contacts (normally open) 5 contacts share one common
Indicators	Logic-powered LEDs
Inductive loads	Place a diode across the coil to suppress the noise in DC circuits and extend the life of the relay contacts See Digital Output Wiring Example ^[56] for further information
Isolation	Isolation is in 2 groups of 5 Chassis to contact: 1500 Vac (1 min) Logic to contact: 1500 Vac (1 min) Output group to output group: 1500 Vac (1 min)
Operate time	25 ms maximum, 20 ms typical
Release time	30 ms maximum, 25 ms typical
Dry Contact Relay Version	
Contact rating	3 A, 30 Vdc 12 A maximum per common
Switching capacity	5 A, 30 Vdc (150 W Resistive)
Service life	2 x 10 ⁷ mechanical 1 x 10 ⁵ at contact rating
Bounce time	1 ms typical
Solid State Relay Version	
Load voltage	30 Vdc maximum
Load current	2 A continuous maximum at 50 °C (122 °F) ambient 1.33 A continuous maximum at 70 °C (158 °F) ambient
On resistance	0.09 ohms
Off state leakage current	10 µA

Service life	Unlimited
Bounce time	None

15.5 Analog Inputs

Item	Specification
Quantity	8
Connector	Removable, 9-pin
Indicators	Logic-powered LEDs Indicate voltage or current mode and out-of-range input signal
Ranges	Software-configurable 0...5 Vdc 1...5 Vdc 0...10 Vdc 0...20 mA 4...20 mA
Resolution	15 bits over the 0...10 Vdc measurement range 14 bits over the 0...5 Vdc and 0...20 mA measurement range
Accuracy	$\pm 0.1\%$ of full scale at 25 °C (77 °F) $\pm 0.2\%$ over temperature range
Input resistance	250 ohms or 20 kohms in 20 mA or 10 Vdc configurations
Isolation	Isolation from logic supply and chassis: 500 Vac

15.6 Analog Outputs

Item	Specification
Quantity	2 with optional analog outputs
Connector	Removable, 5-pin
Range	0...20 mA sourcing

	4...20 mA sourcing
Resolution	12 bits
Maximum load resistance	925 ohms with 24 Vdc input voltage or when internal 24 Vdc power supply is on 375 ohms with 12 Vdc input voltage 250 ohms with input voltage at power supply turnoff
Accuracy	Accuracy specified from 0.5...20 mA $\pm 0.15\%$ of full scale at 25 °C (77 °F) $\pm 0.25\%$ of full scale over temperature range
Noise and ripple	0.04% maximum
Logic end-of-scan to signal update latency	With up to 10, 5000 series I/O modules Typical: 18...27 ms
Response time (DAC to signal)	Less than 10 μ s for 10% to 90% signal change
Isolation	Isolation from logic supply and chassis

16 Standards and Certifications

<p>Hazardous Locations - North America</p>	 <p>Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.</p> <p>UL listed and CSA certified to the following standards:</p> <p>CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.</p> <p>ANSI/ISA 12.12.01 - Hazardous (Classified) Locations.</p>
<p>Hazardous Locations - Europe</p>	<p>ATEX II 3G, Ex nA IIC T4 Gc per EN 60079-15, protection type n (Zone 2)</p>
<p>Hazardous Locations - IECEX</p>	<p>IECEX, Ex nA IIC T4 Gc CoC IECEX UL 16.0070 X per IEC 60079-15, protection type n (Zone 2)</p>
<p>Safety</p>	<p>CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL 61010 (Process Control Equipment, Industrial Control Equipment)</p> <p>UL (cULus) certified to the requirements of UL508 and CSA C22.2 No. 142-M1987 (Industrial Control Equipment, Process Control Equipment)</p>
<p>Digital Emissions</p>	<p>FCC Part 15, Subpart B, Class A Verification</p> <p>EN 61000-6-4 Electromagnetic Compatibility (EMC) - Generic Emission Standard for Industrial Environments</p> <p>RCM Compliance</p>
<p>Immunity</p>	<p>EN 61000-6-2 Electromagnetic Compatibility (EMC) - Generic Standards - Immunity for Industrial Environments</p>
<p>CE Marking Compliance</p>	<p>For the latest information regarding product compliance with European Directives for CE marking, refer to the EU Declaration of Conformity issued for your product at www.se.com</p> <p>For the latest information regarding product compliance with RoHS, WEEE directives and REACH regulation, visit the Schneider Electric Check a Product portal at www.reach.schneider-electric.com</p>

SCADAPack

6601 Input Output Module

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Table of Contents

1	Legal Information	6
2	Technical Support	7
3	Safety Information	8
4	About the Book	12
5	About the 6601 Input Output Module	15
6	Cybersecurity	17
7	Hardware Overview	19
	7.1 Digital Inputs.....	21
	7.2 Counter Inputs.....	22
	7.3 Digital Outputs.....	23
	7.4 Analog Inputs.....	24
	7.4.1 Range and Scaling.....	25
	7.5 Analog Outputs.....	29
	7.5.1 Range and Scaling.....	30
	7.5.2 Load Resistance Requirements.....	30
	7.6 Isolation and Protection Summary.....	31
8	Installation	34
	8.1 ATEX and IECEx Requirements.....	34
	8.2 Mounting the I/O Module.....	35
	8.3 Power Supply Requirements.....	38
	8.3.1 Analog Output Power Supply Wiring.....	41
	8.4 Connecting I/O Modules.....	42
	8.4.1 Precautions	43
	8.4.2 Cabling Guidance.....	44
	8.4.3 Attaching Intermodule Cables.....	46
9	Addressing	49
	9.1 Addressing Rules.....	49
	9.2 Setting the I/O Module Address.....	49

10	Field Wiring	52
10.1	Wiring Screw-Termination Connectors	53
10.2	Digital and Counter Input Wiring	54
10.2.1	Digital and Counter Input Wiring Example	55
10.3	Digital Output Wiring	56
10.3.1	Digital Output Wiring Examples	57
10.4	Analog Input Wiring	59
10.4.1	Analog Input Wiring Example	60
10.4.2	Supporting a Mix of Current and Voltage Inputs	62
10.4.3	Helping to Prevent Interruption of the Current Loop	67
10.5	Analog Output Wiring	69
10.5.1	Analog Output Wiring Example	69
10.5.2	Supporting Current and Voltage Outputs	71
11	Configuration	72
12	Diagnostics	73
12.1	LEDs	73
12.2	Digital Inputs	73
12.3	Digital Outputs	73
12.4	Analog Inputs	74
12.5	Analog Outputs	74
13	Maintenance	76
13.1	Calibration	76
13.2	Updating Module Firmware	76
13.3	Updating Bootloader Firmware	78
14	Specifications	81
14.1	General	81
14.2	Power Supply	82
14.3	Communications	82
14.4	Digital Inputs	83
14.5	Counter Inputs	83
14.6	Digital Outputs	84
14.7	Analog Inputs	85

14.8	Analog Outputs.....	86
15	Standards and Certifications.....	88

1 Legal Information

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.

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2 Technical Support

Questions and requests related to any part of this documentation can be directed to one of the following support centers.

Technical support: Americas, Europe, Middle East, Asia

Available Monday to Friday 8:00 am – 6:30 pm Eastern Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: supportTRSS@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Toll free within North America: 1-888-226-6876 • Direct Worldwide: +1-613-591-1943

Technical support: Australia/New Zealand (Pacific)

Available Monday to Friday 8:00 am - 5:00 pm Australian Eastern Standard Time

	Check our FAQs	Explore our extensive knowledge database and FAQ videos to find answers quickly: https://se.com/faq
	Email us	Save time by emailing us your inquiry and an expert will contact you: techsupport.pz@se.com Send us an email anytime.
	Call us	Need someone to provide some technical support? <ul style="list-style-type: none"> • Inside Australia: 13 73 28 (13 SEAU) • Inside New Zealand: 0800 652 999

3 Safety Information

Important 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 a hazardous situation which, if not avoided, will result in death or serious injury.
⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, can result in death or serious injury.
⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, can result in minor or moderate injury.
NOTICE
NOTICE is used to address practices not related to physical injury.

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, installation, and operation of electrical equipment 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.

WARNING

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 death or serious injury.

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

Test all software 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 help prevent accidental equipment damage.

Operation and adjustments

The following precautions prevail:

- 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.

Acceptable use

WARNING

UNACCEPTABLE USE

Do not use SCADAPacks or I/O modules as an integral part of a safety system. These devices are not safety products.

Failure to follow these instructions can result in death or serious injury.

CAUTION

EQUIPMENT OPERATION HAZARD

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Use only Schneider Electric software or approved software with Schneider Electric hardware products.

Failure to follow these instructions can result in minor or moderate injury.

Important notices for hazardous locations

- Class I Division 2, Groups A, B, C and D
- Ex nA IIC T4 Gc
- Class I Zone 2 AEx nA IIC T4 Gc
-  II 3 G

Applies to SCADAPack products, models TBUP570, TBUP575 and connected expansion modules

Those products are available for use in Class I, Division 2, Groups A, B, C & D and Class I Zone 2 Hazardous Locations. Such locations are defined in Article 500 and 505 of the US National Fire Protection Association (NFPA) publication NFPA 70, otherwise known as the National Electrical Code, in Section 18 of the Canadian Standards Association C22.1 (Canadian Electrical Code) and in IEC/EN 60079-10.

The products have been recognized for use in these hazardous locations by the Canadian Standards Association (CSA) International.

CSA certification is in accordance with Standards CSA C22.2 No. 213, CSA C22.2 60079-0, CSA C22.2 60079-15, ANSI/ISA 60079-0, ANSI/ISA 60079-15, ANSI/ISA 12.12.01, FM 3600 and FM 3611 subject to the following conditions of approval:

1. Install the product in a protective enclosure providing at least IP54 protection.

2. Confirm that the location is free from explosively hazardous gases before wiring, connecting or disconnecting the product, using any USB connection or replacing any fuses.

 **WARNING****EXPLOSION HAZARD**

Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Substitution of components may impair suitability for Class I, Division 2.

Refer to Articles 500 through 502 of the National Electrical Code (NFPA 70) and Appendix J of CSA C22.1 for further information on hazardous locations and approved Division 2 wiring methods.

Refer to Articles 505 of the National Electrical Code (NFPA 70) and Section 18 of CSA C22.1 for further information on hazardous locations and approved Zone 2 wiring methods.

Failure to follow these instructions can result in death or serious injury.

 **WARNING****ELECTRICAL HAZARD**

Do not disconnect while circuit is live unless area is known to be non-hazardous.

AVERTISSEMENT - Ne pas débrancher tant que le circuit est sous tension, à moins qu'il ne s'agisse d'un emplacement non dangereux.

Failure to follow these instructions can result in death or serious injury.

4 About the Book

Audience

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise are 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 or serious injury.

This manual is written for people who need to install, troubleshoot or maintain the 6601 input output module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 6601 input output module, including detailed hardware specifications
- Installation, wiring and addressing for the 6601 input output module
- Diagnostics capabilities on the 6601 input output module
- Maintenance recommendations for the 6601 input output module

Validity note

This document is valid for:

- SCADAPack x70 firmware version 9.6.1 and earlier
- SCADAPack RemoteConnect configuration software version 3.9.1 and earlier

Related documents

Use this manual with the other manuals included in your SCADAPack x70 documentation set. The table below describes the manuals available in the documentation set.

Folder	Manual	Content

Getting Started	Getting Started	<ul style="list-style-type: none"> • The SCADAPack x70 family of products available in this release • The basic steps to get your SCADAPack x70 device operational • Where to get more information about configuring, monitoring and managing your SCADAPack x70 device
SCADAPack Software Installation	SCADAPack Software Installation	<ul style="list-style-type: none"> • Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	<ul style="list-style-type: none"> • Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	<ul style="list-style-type: none"> • Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	<ul style="list-style-type: none"> • Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	<ul style="list-style-type: none"> • Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from SCADAPack E to SCADAPack RemoteConnect • Locating SCADAPack E Configurator features in SCADAPack RemoteConnect • Locating SCADAPack Workbench features in SCADAPack RemoteConnect • Compatibility chart
	Porting Guide for Telepace to SCADAPack RemoteConnect	<ul style="list-style-type: none"> • Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	<ul style="list-style-type: none"> • USB, serial and IP communications

Reference Manuals	Communication Interfaces Technical Reference	<ul style="list-style-type: none"> • Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	<ul style="list-style-type: none"> • The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	<ul style="list-style-type: none"> • DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	<ul style="list-style-type: none"> • The differences between EcoStruxure Control Expert (Unity Pro) and the SCADAPack x70 Logic Editor environment • Key programming concepts • Basic procedures needed to use the SCADAPack x70 Logic Editor
	SCADAPack Function Blocks Technical Reference	<ul style="list-style-type: none"> • The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	<ul style="list-style-type: none"> • Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	<ul style="list-style-type: none"> • Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	<ul style="list-style-type: none"> • Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 6601 Input Output Module

The I/O module increases the SCADAPack I/O capacity by providing:

- 16 digital inputs
- 8 digital outputs
- 6 analog inputs
- 2 analog outputs (this option is selected when the 6601 input output module is ordered)

The 6601 input output module can be used with the following SCADAPacks:

- SCADAPack 530E
- SCADAPack 535E
- SCADAPack x70 RTUs

This document describes how to use the 6601 input output module with the SCADAPack x70 RTUs.



Connections

The I/O module includes a short intermodule cable for connecting to a SCADAPack or to another I/O module. For information about the maximum number of 6601 input output modules supported, see the hardware manual for your SCADAPack. For details on connecting I/O modules, see [Intermodule Cabling](#)^[46].

Screw-termination connectors are provided for connecting the inputs and outputs to the devices you want to monitor or control. For details on wiring input and output connectors, see [Field Wiring](#)^[52].

Configuration

You can configure the I/O module inputs and outputs in the following ways:

- Locally or remotely using the SCADAPack RemoteConnect configuration software on a desktop or laptop computer connected to the SCADAPack through the USB Device port or through any of the available serial or Ethernet ports.
- Remotely as part of an end-to-end SCADA system using the EcoStruxure Geo SCADA Expert (ClearSCADA) software.

Before you begin configuring the inputs and outputs on the I/O module, determine whether the Geo SCADA Expert software will be used for any configuration tasks. This documentation assumes you are using the SCADAPack RemoteConnect configuration software to configure the I/O module. For information about using the Geo SCADA Expert software, see the Geo SCADA Expert documentation.

6 Cybersecurity

Cybersecurity is a branch of network administration that addresses attacks on or by computer systems and through computer networks that can result in accidental or intentional disruptions. The objective of cybersecurity is to help provide increased levels of protection for information and physical assets from theft, corruption, misuse, or accidents while maintaining access for intended users.

No single cybersecurity approach is adequate. Schneider Electric recommends a defense-in-depth approach. This approach layers the network with security features, appliances, and processes. The basic components of this approach are:

- Risk assessment: A systematic security analysis of the environment and related systems.
- A security plan built on the results of the risk assessment
- A multi-phase training campaign
- Network separation and segmentation: Physical separation of the control network from other networks, and the division of the control network itself into segments and security zones.
- System Access Control: Controlling access to the system with firewalls, authentication, authorization, and other software means, and traditional physical security measures such as video surveillance, fences, locked doors and gates, and locked equipment cabinets.
- Device hardening: The process of configuring a device against communication-based threats. Device hardening measures include disabling unused network ports, password management, access control, and the disabling of all unnecessary protocols and services.
- Network monitoring and maintenance: An effective defense-in-depth campaign requires continual monitoring and system maintenance to meet the challenge of new threats as they develop.
- See Security Considerations in the Security Technical Reference manual

Contact us

For more information, refer to the Schneider Electric Cybersecurity Support Portal at <http://www.se.com/b2b/en/support/cybersecurity/overview.jsp>.

Additional Resources

Industrial Control Systems Cyber Emergency Response Team (ICS-CERT)
<https://ics-cert.us-cert.gov>

ICS-CERT Recommended Practices
<https://ics-cert.us-cert.gov/Recommended-Practices>

Center for Internet Security (CIS) Top 20 Critical Security Controls
<https://www.cisecurity.org/cybersecurity-best-practices>

FBI Cyber Crime
<https://www.fbi.gov/investigate/cyber>

Guide to Industrial Control Systems (ICS) Security

<https://www.nist.gov/publications/guide-industrial-control-systems-ics-security>

WaterISAC Water Security Network

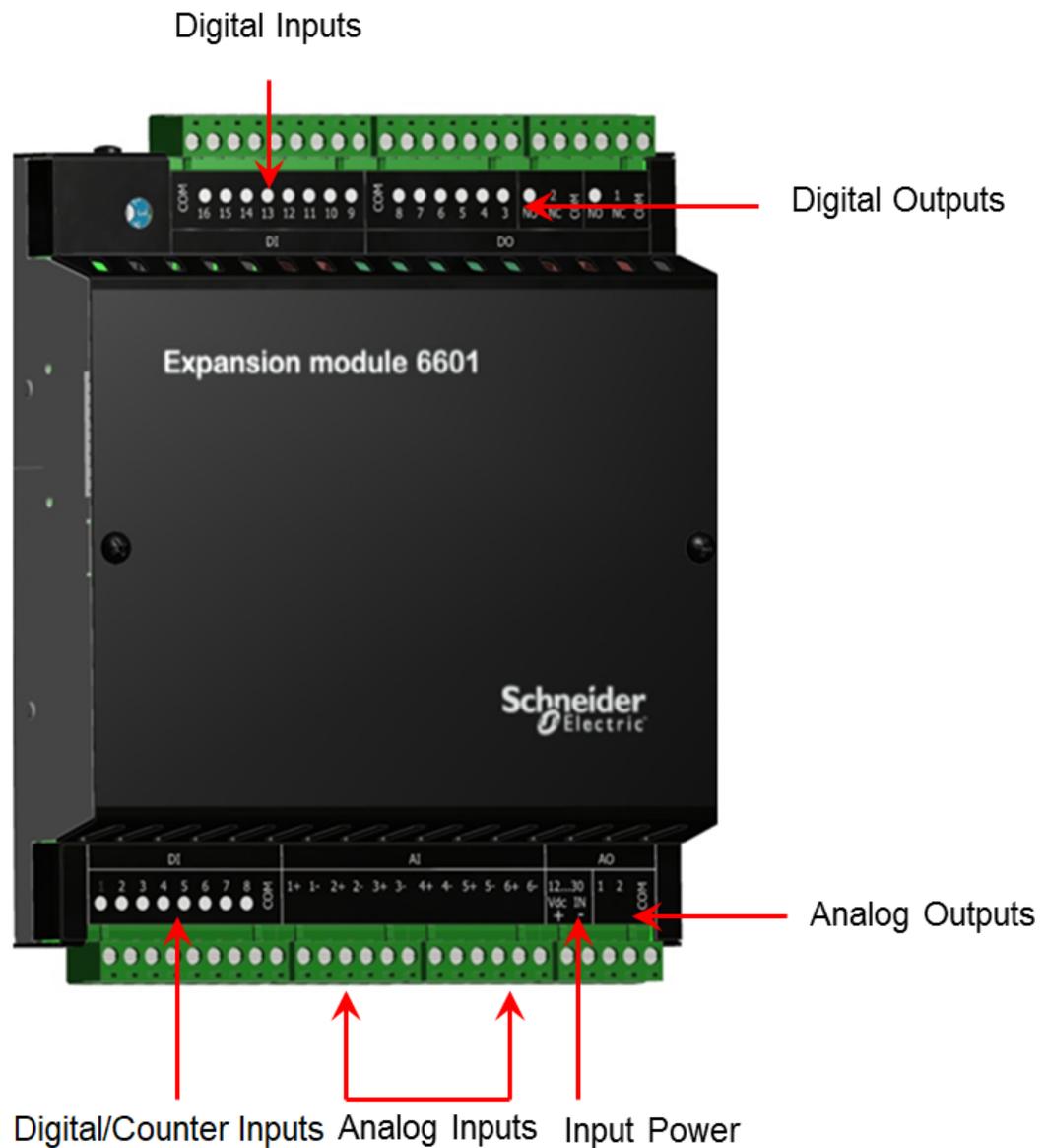
<https://www.waterisac.org>

7 Hardware Overview

The I/O module increases the SCADAPack I/O capacity by providing:

- 16 digital inputs
- 8 digital outputs
- 6 analog inputs
- 2 analog outputs (this option is selected when the 6601 input output module is ordered)

The figure below shows the inputs and outputs on the I/O module.



For ease of wiring and maintenance, external connections are terminated on removable connectors. If you need to remove the I/O module cover for any reason, first carefully consider the following information.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before removing the I/O module cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

The electronics inside the I/O module can be damaged by static electricity. If you need to remove the I/O module cover, wear an anti-static wrist strap that is connected to ground. Failing to follow this step can cause intermittent or total loss of I/O module operation and will void the warranty.

Failure to follow these instructions can result in equipment damage.

For complete hardware specifications, see [Specifications](#)^[21]^[81].

Input/Output Type	Label	Polarity Sensitivity	Description
Digital inputs ^[21] Counter inputs ^[22]	DI 1 to 8 DI 9 to 16	Yes	<ul style="list-style-type: none"> • Digital inputs, the first eight (DI 1-8) of which have associated counters • Organized into two groups of eight inputs: DI 1-8 and DI 9-16 • Each group shares a common return • The two groups are optically isolated from one another and from the SCADAPack RTU circuitry

Input/Output Type	Label	Polarity Sensitive	Description
Digital outputs ^[23]	DO 1 to 2	Yes	<ul style="list-style-type: none"> • Dry contact Form C mechanical relay outputs • Three voltage-free terminals for one relay pole: Normally Open (NO), Normally Closed (NC) and Common (COM) • Electrical isolation is provided between the digital outputs and between each digital output and the device being controlled
	DO 3 to 8	Yes	<ul style="list-style-type: none"> • Dry contact Form A mechanical relay outputs • Voltage-free NO contacts that share a common return • Electrical isolation is provided between each digital output and the device being controlled
Analog inputs ^[24]	AI 1+ and 1- to 6+ and 6-	Yes	<ul style="list-style-type: none"> • Analog inputs. Single-ended. Configurable using DIP switches • Electrical isolation is provided from each channel to SCADAPack RTU circuitry and between channels
Analog outputs ^[29]	AO 1 to 2	Yes	<ul style="list-style-type: none"> • Analog outputs provided by the optional analog outputs • Electrical isolation is provided from each channel to SCADAPack RTU circuitry, but not between channels

7.1 Digital Inputs

There are 16 digital inputs provided.

The digital inputs:

- Provide Sequence of Event (SOE) timestamping to support SOE applications
- Support state debouncing

Digital inputs are used to monitor the state of devices such as valves, motors and level switches.

Wetting voltage for the volt-free contacts is usually provided by the DC power used with the SCADAPack.

The LED for each digital input is lit when the input is active.

Digital inputs are available for nominal 12...24 Vdc operation. A current-limiting resistor on each

input determines the voltage range.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each digital input, including:

- DNP3 parameters
- Modbus parameters
- Event attributes
- Alert notifications
- Physical I/O performance

For more information about configuring digital inputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Digital inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[53].

Specifications

For digital input specifications, see [Specifications](#)^[83].

7.2 Counter Inputs

In the 6601 input output module, digital inputs 1 to 8 have an associated counter. The counter inputs are represented as 32-bit counters.

The corresponding digital input invert settings are applied prior to counting transitions of the input.

- If configured as non-inverting (default configuration), counter input objects count OFF to ON transitions.
- If configured as inverted, ON to OFF transitions are counted on the corresponding counter channel.

The LED for each counter input is lit when the input is active.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each counter input, including:

- DNP3 parameters
- Modbus parameters

- Event attributes
- Alert notifications

For more information about configuring counter inputs, see the Configuring Counter I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Counter inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[53].

Specifications

For counter input specifications, see [Specifications](#)^[83].

7.3 Digital Outputs

The I/O module expands the function of the SCADAPack with 8 dry contact (mechanical) relay outputs.

Digital outputs are used to control panel lamps, relays, motor starters, solenoid valves and other devices. The relay outputs are well suited to applications that cannot tolerate any off-state leakage current, that require high load currents, or that involve non-standard voltages or current ranges.

For Form A digital outputs that have a single Normally Open (NO) contact, loads can be connected to either the high or the low side of the power source.

For Form C digital outputs that have a NO contact, a Normally Closed (NC) contact and a Common (COM) contact, loads can be connected to either the NO or the NC terminal, and to either the high or the low side of the power source. A signal from the second pole on each relay provides feedback to the software to verify the correct relay activation for each operation.

The LED for each digital output is lit when the NO contact is closed, or activated, and the circuit is continuous. For Form C digital outputs, this means the NC contact is open.

⚠ WARNING**DATA LOSS, APPLICATION LOSS**

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each digital output, including:

- DNP3 parameters
- Modbus parameters
- Event attributes
- Alert notifications

For more information about configuring digital outputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Digital outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[53].

Specifications

For digital output specifications, see [Specifications](#)^[84].

7.4 Analog Inputs

Analog inputs are used to monitor devices such as pressure, level, flow and temperature transmitters, instrumentation such as pH and conductivity sensors, and other high-level analog signal sources.

The analog inputs are factory-calibrated for 0...20 mA and 4...20 mA current operation and for 0...5 Vdc and 1...5 Vdc operation. A default mode of operation — current mode or voltage mode — is selected when the module is purchased. The input type can be changed using DIP switches on the back of the unit. The input range is selected using the SCADAPack RemoteConnect configuration software. The SCADAPack and the I/O module use a 24-bit delta-sigma analog-to-digital converter (ADC).

- In current mode, a 250 ohm current sense resistor is used across each analog input channel. The measurement range in current mode is 0...20 mA or 4...20 mA, selectable through the SCADAPack RemoteConnect configuration software. The 250 ohm resistor produces a voltage drop (input reading) of 5 Vdc for 20 mA of current flow. Loop current will only flow in analog inputs that have been configured for 20 mA.
- In voltage mode, the analog inputs are high-impedance and single-ended with a measurement range of 0...5 Vdc or 1...5 Vdc, selectable through the SCADAPack RemoteConnect configuration software.

The SCADAPack supports using a mix of current mode and voltage mode analog inputs if required. For details, see [Supporting a Mix of Current and Voltage Inputs](#)^[62].

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each analog input, including:

- DNP3 parameters
- Modbus parameters
- Alert notifications
- [Range and Scaling](#)^[25]
- Value deviation

For more information about configuring analog inputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Analog inputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information see, [Wiring Screw-Termination Connectors](#)^[53].

Specifications

For analog input specifications, see [Specifications](#)^[85].

7.4.1 Range and Scaling

The 6601 input output module analog inputs use dual 24-bit, isolated, differential, unipolar analog-to-digital converters (ADC) that measure input currents from 0...20 mA or input voltages from 0...5 Vdc including under range and over range capability. For more information, see [Analog Inputs](#)^[85] under Specifications.

To assign SCADAPack database objects to the analog input channels, use the SCADAPack RemoteConnect configuration software to select the signal range for each analog input channel. Each analog input channel can be configured for one of the following signal ranges:

- 0...20 mA
- 4...20 mA
- 0...5 Vdc
- 1...5 Vdc

The signal range selected is used in conjunction with the **Raw Minimum** and **Raw Maximum** configuration for each analog object to present an integer value for the analog input. See tables below.

Engineering Minimum and **Engineering Maximum** configurations are also available for each analog object to scale from the analog object's integer value to its **Engineering Floating Point** object value. Analog objects simultaneously provide both integer and engineering values. The SCADAPack configuration can independently choose either value type for logic, protocol reporting, and other applications.

An **Under Range Limit** and **Over Range Limit** can also be configured on each analog object. These are configured in Engineering Floating Point units. Depending on the configuration values chosen, Under Range Limit and Over Range Limit can be configured to report an out of range physical analog input signal, or an unexpected process signal.

Under range status on an analog object is indicated through an object quality flag. The under range quality flag is set when the engineering value of an object is lower than the under range limit configured in SCADAPack RemoteConnect. Over range status on an analog object is indicated through an object quality flag. The over range quality flag is set when the engineering value of an object is higher than the Over Range Limit configured in SCADAPack RemoteConnect.

The under range and over range flags are visible in the SCADAPack RemoteConnect object browser, via protocols such as DNP3, in logic variable quality fields, and in other applications.

The default attributes for analog objects for SCADAPack x70 device analog input channels are:

- Raw Minimum = 0, Raw Maximum = 10000
- Engineering Minimum = 0, Engineering Maximum = 100
- Under Range Limit = -1
- Over Range Limit = disabled

In their default configuration, analog input channel over range detection is disabled.

Analog input channels configured for 0..20 mA or 0..5 Vdc do not indicate under range conditions.

NOTICE

UNINTENDED EQUIPMENT OPERATION

6601 I/O modules running firmware version 1.77 and lower always activate the over range property at 20.05 mA, even if you have configured a higher over range value in SCADAPack RemoteConnect.

6601 I/O modules that have been upgraded to firmware version 1.80 and higher activate the over range property at 20.05 mA, unless the analog inputs have been recalibrated. To have your analog inputs recalibrated, contact your Schneider Electric representative.

6601 I/O modules that ship from the factory with firmware version 1.80 and higher are already calibrated to support the over range values listed in the tables below.

Failure to follow these instructions can result in equipment damage.

Current signals

The following table shows the relationship between analog input channel current range, analog signal, and the analog object's reported integer and engineering values.

Input	0...20 mA Range			4...20 mA Range		
Current (mA)	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value
0.00	0%	Raw Minimum	Engineering Minimum	-25% of range	Less than Raw Minimum	Less than Engineering Minimum
4.00	20% of range			0%	Raw Minimum	Engineering Minimum
8.00	40% of range			25% of range		
12.00	60% of range			50% of range		
16.00	80% of range			75% of range		
20.00	100% of range	Raw Maximum	Engineering Maximum	100% of range	Raw Maximum	Engineering Maximum

22.00	110% of range	More than Raw Maximum	More than Engineering Maximum	112.5% of range	More than Raw Maximum	More than Engineering Maximum
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Values above 22 mA cannot be accurately measured by the analog inputs.

Voltage signals

The following table shows the relationship between analog input channel voltage range, analog signal and the analog object's reported integer and engineering values.

Input	0...5 Vdc Range			1...5 Vdc Range		
Voltage (Vdc)	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value
0.00	0%	Raw Minimum	Engineering Minimum	-25% of range	Less than Raw Minimum	Less than Engineering Minimum
1.00	20% of range			0%	Raw Minimum	Engineering Minimum
2.00	40% of range			25% of range		
3.00	60% of range			50% of range		
4.00	80% of range			75% of range		
5.00	100% of range	Raw Maximum	Engineering Maximum	100% of range	Raw Maximum	Engineering Maximum
5.50	110% of range	More than Raw Maximum	More than Engineering Maximum	112.5% of range	More than Raw Maximum	More than Engineering Maximum

Values above 5.50 V cannot be accurately measured by the analog inputs.

7.5 Analog Outputs

Analog outputs are used to control remote devices that require varying input information, rather than simply on or off operations.

If the optional analog outputs were ordered, two 20 mA analog outputs are available for use.

The analog output channels are powered with an external 12...30 Vdc (nominally 12 Vdc or 24 Vdc) power supply. They can be configured for 4...20 mA current or 0...20 mA current. The outputs provide a level of transient and over-voltage protection. Analog output resolution is 12 bits. The outputs share a common return with each other and with the analog inputs.

WARNING

DATA LOSS, APPLICATION LOSS

When the logic application running in the SCADAPack x70 devices stops unexpectedly, the SCADAPack x70 firmware turns OFF all physical digital outputs and sets all physical analog outputs to a value of zero. This can occur in the following situations:

- Logic application unexpectedly HALTs
- Logic application is put into a STOP state by the user
- Logic application restarts from a user initiated SCADAPack RemoteConnect command
- SCADAPack x70 device is restarted
- Logic application is removed

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the logic application before resuming operation.

Failure to follow these instructions can result in death or serious injury.

Configuration

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each analog output, including:

- DNP3 parameters
- Modbus parameters
- Alert notifications
- [Range and Scaling](#)³⁰⁾
- Value deviation

For more information about configuring analog outputs, see the Configuring Analog and Digital I/O Channels topic in the SCADAPack x70 Configuration manual.

Wiring

Analog outputs support solid or stranded wires from 3.3...0.08 mm² (12...28 AWG).

For more information see, [Wiring Screw-Termination Connectors](#)^[53].

Specifications

For analog output specifications, see [Specifications](#)^[86].

7.5.1 Range and Scaling

The analog output module has a 12-bit, unipolar, digital-to-analog converter (DAC).

In the SCADAPack RemoteConnect configuration software, you can select one of the following **AO Output Type** ranges. The analog output channels use the same range:

- 0...20 mA
- 4...20 mA

The 0...20 mA output range resolution is 4.88 µA per DAC count.

Configuration for objects attached to the analog output module channels uses the **Raw Minimum** to **Raw Maximum** and **Engineering Minimum** to **Engineering Maximum** parameters for integer and engineering scaling, respectively.

These scaling ranges are applied automatically to the selected analog output signal range (0...20 mA or 4...20 mA).

7.5.2 Load Resistance Requirements

The load resistance for any given power supply voltage is limited:

- On the high resistance end by the requirement for proper operation of the analog output circuit
- On the low resistance end by the power dissipation in the analog output

The table below lists the analog output load resistance range. The operating range is within the area defined as resistance limits.

Power Supply	Load Resistance Required
12 Vdc	0...475 ohms
24 Vdc	0...1075 ohms
30 Vdc	250...1375 ohms

7.6 Isolation and Protection Summary

The 6601 input output module provides isolation and protection from external connections as described in the table below.

Connections	Isolation	Protection
Digital inputs	Optical	Current-limiting resistor and reverse polarity diode
Digital outputs	Relay	None
Analog inputs	Optical (channel-to-channel and channel-to-SCADAPack)	TVS diode
Analog outputs ¹	Optical (channel-to-SCADAPack)	TVS diode

¹ The optional analog outputs are selected when the 6601 input output module is ordered.

Over-voltage protection

Over voltage may occur on cables that extend from a cabinet to a remote device or another cabinet. Results can include corrupted data carried on the cable or damage to devices connected to that cable. Following the guidelines below may reduce the severity and frequency of such events. It is highly recommended that end users determine the proper protection for their industry, application, and environment.

NOTICE

RS232 LOSS OF FUNCTION

- Limit the length to 50 feet (15 m) or less in electrically noisy environments.
- Use commercially available isolators and/or surge suppression if the length limitations (above) are exceeded. These are typically not required if the length limitations (above) are followed.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE**485 LOSS OF FUNCTION**

- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.

Failure to follow these instructions can result in equipment damage.

NOTICE**ANALOG INPUTS AND OUTPUTS LOSS OF FUNCTION**

- Avoid connecting 24 Vdc directly across analog inputs.
- Use commercially available isolators and/or surge suppression.
- Use shielded cable and terminate the shield connection.
- Route away from (i.e. not parallel to) high voltages and switch loads.
- Use an external fuse (63 mA fast blow).

Failure to follow these instructions can result in equipment damage.

NOTICE**EXTERIOR ANTENNA LOSS OF FUNCTION**

- Use a coaxial surge diverter and terminate the ground connection.

Failure to follow these instructions can result in equipment damage.

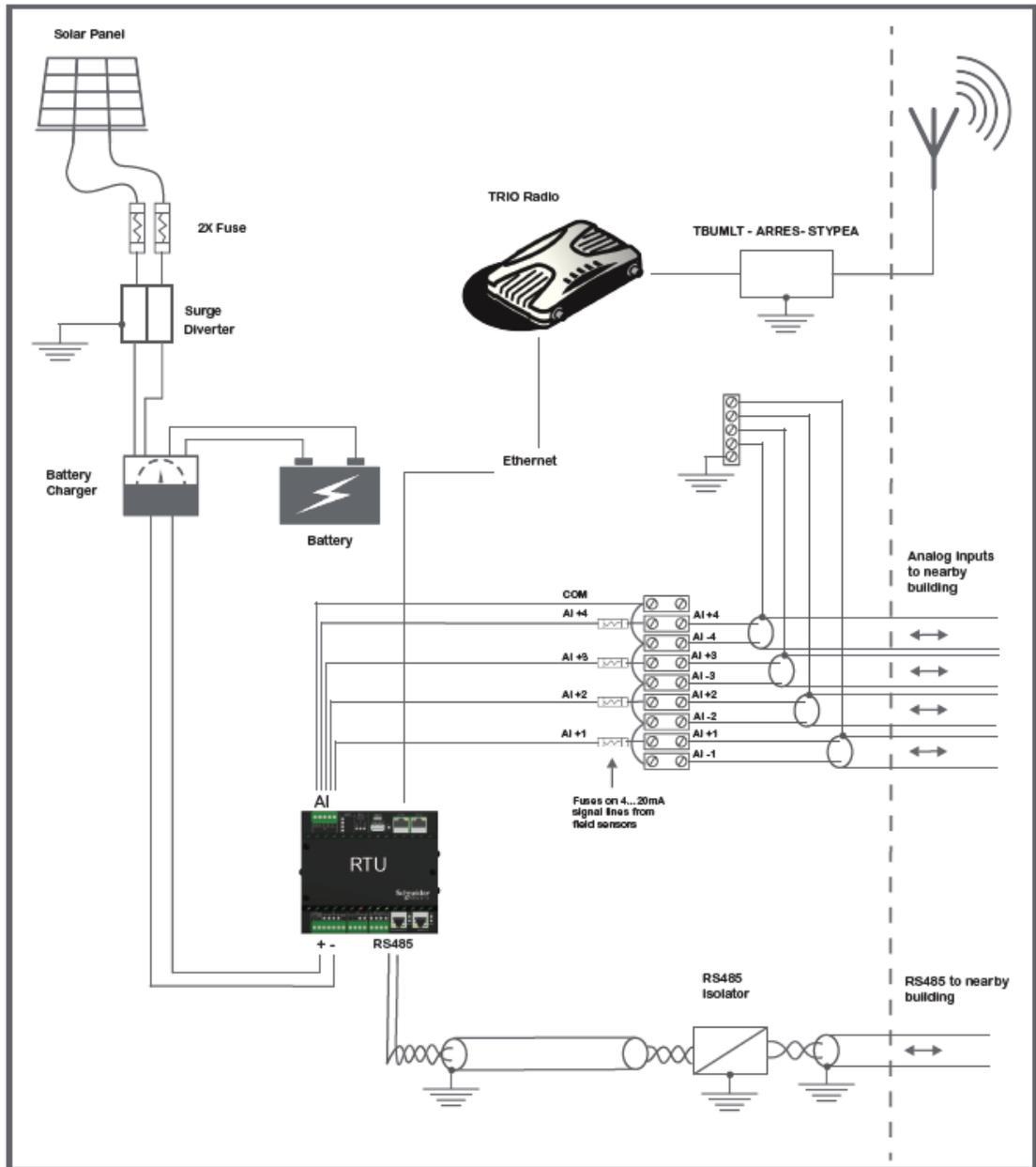
NOTICE**POWER SUPPLY LOSS OF FUNCTION**

- Use an external fuse, as specified in the manual.
- If using solar panels, use commercially available surge suppression.

Failure to follow these instructions can result in equipment damage.

Example

RTU with over-voltage protection on a power supply, analog inputs, RS485 port, and radio antenna.



NOTE:

Every line that enters or leaves a panel in the field or a (building) must have some form of protection. Examples as shown above diagram.

For additional information, refer to the Schneider Electric document [Grounding, Earthing and Lightning Protection](#), Chapter 7 “Grounding and Electromagnetic Compatibility of PLC Systems “ (Doc# 33002439).

8 Installation

The I/O module is factory-configured and under normal conditions does not require removal or insertion of any peripherals or components. The I/O configurations are stored in a combination of battery-backed RAM and flash memory on the SCADAPack.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Installing the I/O module in an environment where the electromagnetic compatibility (EMC) rating exceeds the certified EMC rating for the module can lead to unpredictable operation and unexpected results.

Before mounting the I/O module, check the Standards and Certifications topic to verify which EMC standards are supported.

Failure to follow these instructions can result in equipment damage.

The following sections describe specific aspects of installing the I/O module.

- [Mounting the 6601 input output module](#)^[35]
- [Power Supply Requirements](#)^[38]
- [Connecting I/O modules](#)^[42]

8.1 ATEX and IECEx Requirements

The information in this topic applies when the unit is being used for ATEX and IECEx applications.

Conditions of safe use

Before installing the equipment, consider the instructions in the warning message below.

⚠ WARNING

EXPLOSION HAZARD

Only connect this equipment to a SCADAPack when the following conditions are met:

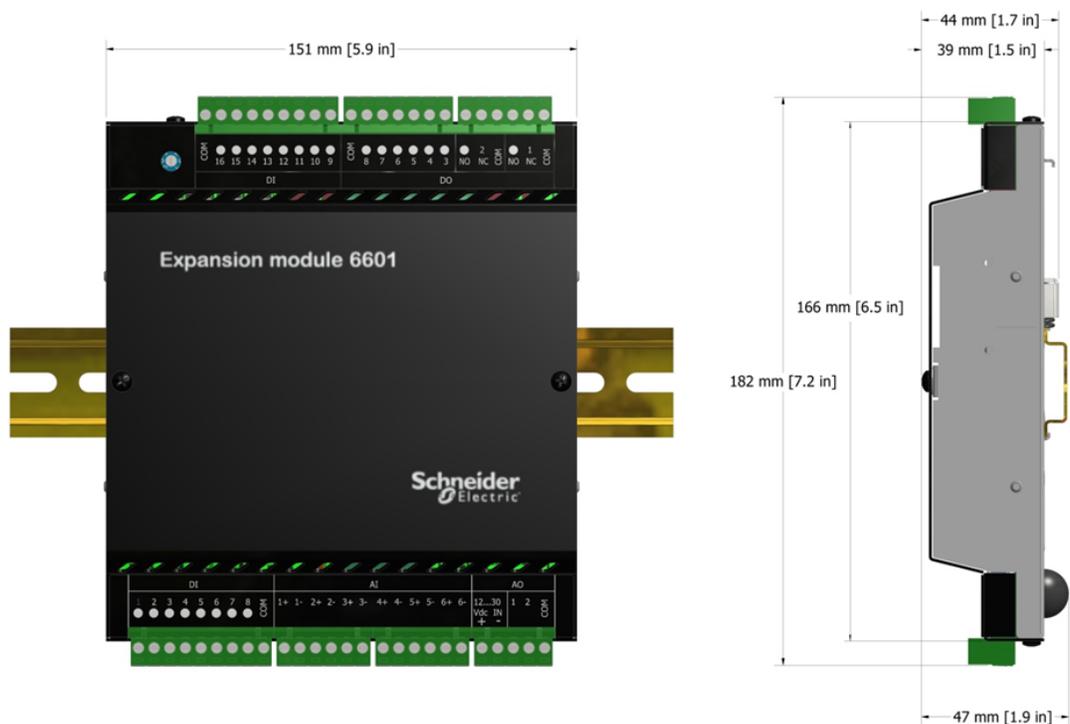
- USB, Ethernet and Serial sockets only have connectors fitted within them during service or maintenance when an explosive atmosphere is not present.
- The SCADAPack is provided with external transient protection of up to 40% (42 Vdc) of the maximum supply voltage ($30 \text{ Vdc} \times 1.4 < 42 \text{ Vdc}$).
- The address switch is not to be operated in a hazardous area or when an explosive atmosphere is present.
- The SCADAPack is installed in a certified Control Panel or enclosure, in conformity with type of protection Ex n or Ex e, providing a degree of protection of at least IP54 as defined in IEC 60529 and in an area of Pollution Degree 2 or better as defined in IEC 60664-1.

Failure to follow these instructions can result in death or serious injury.

8.2 Mounting the I/O Module

The I/O module is mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail then connected to the SCADAPack or to another I/O module.

The figure below shows the I/O module dimensions when mounted.



⚠ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Carefully review and follow all instructions in the Important Notices for Hazardous Locations topic for information when installing the I/O module in a hazardous location.

Failure to follow these instructions will result in death or serious injury.

See [Important Notices for Hazardous Locations](#) ⁸.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack and the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**ELECTRICAL HAZARD**

Remove power from the I/O module before mounting it on a DIN rail.

Do not remove the I/O module cover when mounting the module. The I/O module is designed so that it can be mounted on a DIN rail with the cover in place.

Failure to follow these instructions can result in death or serious injury.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

The mounting position can affect the maximum operating temperature for the I/O module and the current rating for the digital outputs.

Before mounting the I/O module, check the Specifications topic to confirm the maximum operating temperature and digital output current rating for your mounting position.

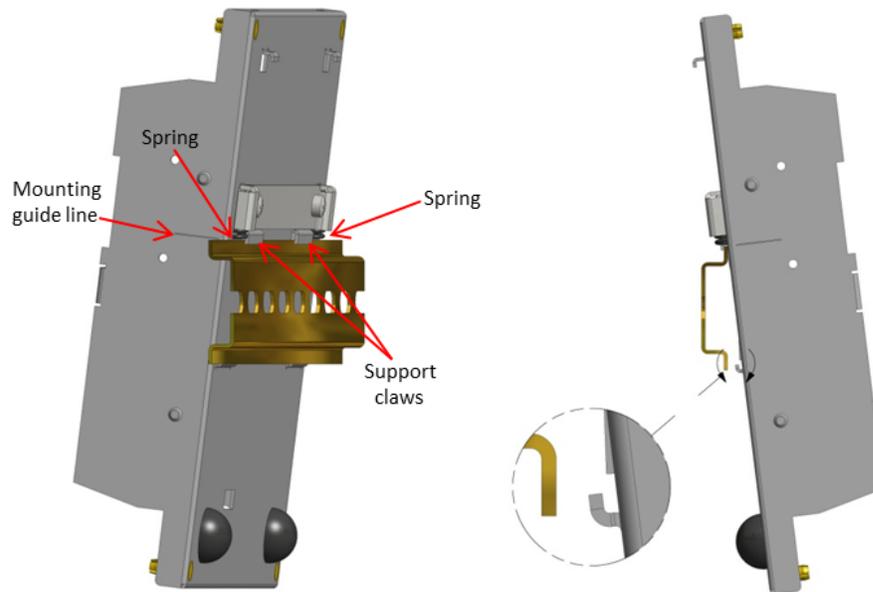
Failure to follow these instructions can result in equipment damage.

To mount the I/O module

The illustrations below show how to mount the I/O module on a horizontally oriented DIN rail. The steps to mount the I/O module on a vertically oriented DIN rail are the same.

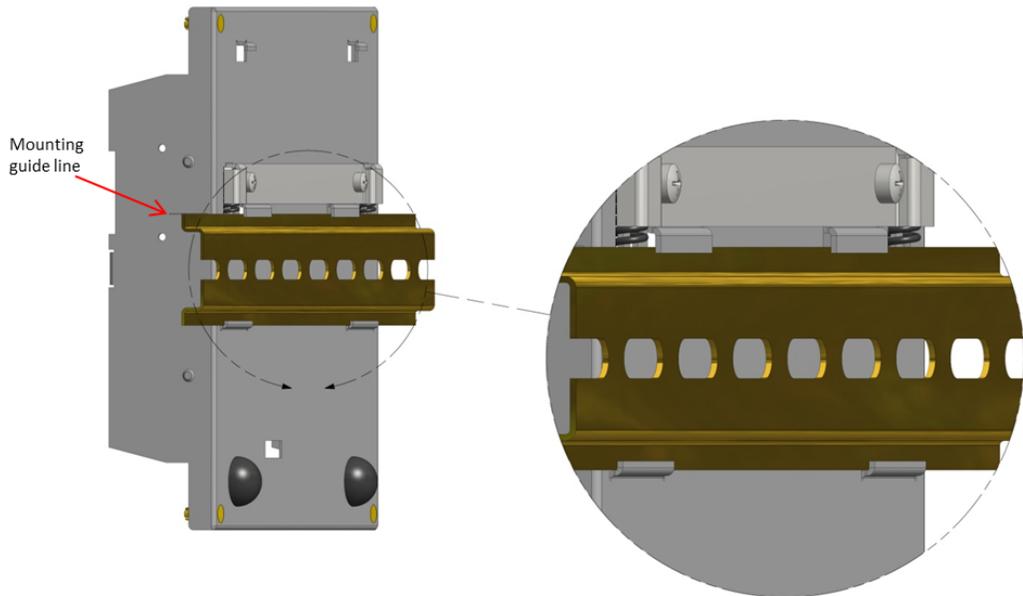
1. With the lower part of the module tilted away from the DIN rail, position the mounting guide line on the side of the module so that it is just above the top edge of the DIN rail.

Verify that the springs on the back of the module rest on the DIN rail and that the edge of the DIN rail is under the support claws that are adjacent to the springs, as shown below.

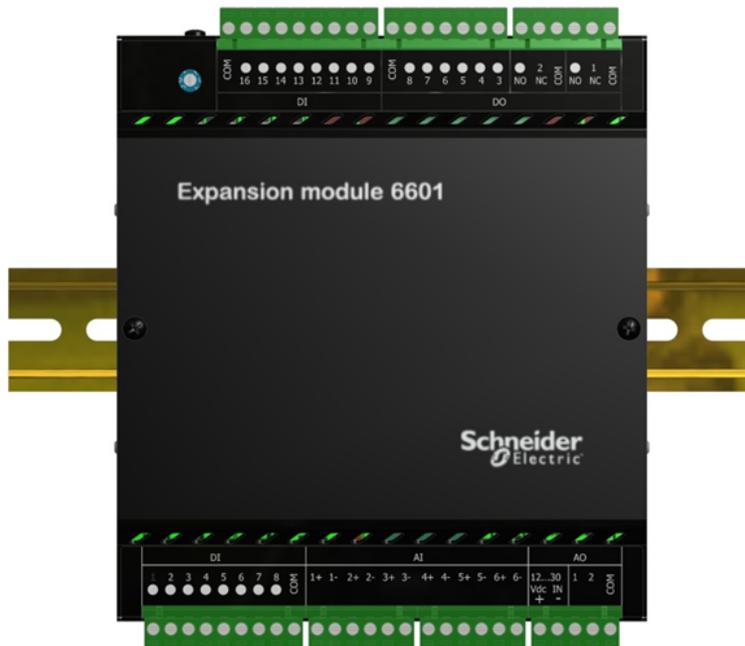


2. Push firmly on the module while tilting it toward the DIN rail until the DIN rail is positioned under both the upper and lower claws on the back of the module.
3. Verify that the mounting guide line is aligned with the edge of the DIN rail, then release the pressure on the springs so that the DIN rail is held firmly in place between the upper and lower claws.

The figure below shows a DIN rail correctly positioned in the upper and lower claws on the back of the I/O module.



The figure below shows an I/O module that is mounted horizontally.



8.3 Power Supply Requirements

The I/O module is powered by the SCADAPack through the I/O bus cable that connects the units. The 6601 input output module requires 1.1 W at 5 Vdc from the SCADAPack. You can combine base power, USB Host port, serial port and 6601 input output module power

requirements to a maximum of 9.1 W. For maximum system configurations, see [Power Supply Specifications](#) ^[82].

If the optional analog outputs were selected when the I/O module was ordered, an additional 24 Vdc power supply is required to power the field-side circuitry. The analog outputs require 50 mA current regardless of the system voltage. For information on the configuration options for the analog output power supply, see [Analog Output Power Supply Wiring](#) ^[41].

The tables below summarize the power requirements for the SCADAPack 570, SCADAPack 574, and SCADAPack 575.

6601 input output module with a SCADAPack 570

Volts In	SCADAPack 570			6601 input output module
Volts (Vdc)	Base Power (W)	USB Host Port (W) (5 Vdc at 100 mA)	Serial port (W) (5 Vdc at 250 mA)	Per Module (W)
11.5	3.0	0.6	1.5	1.1
13.8	3.0	0.6	1.5	1.1
24	3.4	0.6	1.5	1.1
30	3.7	0.6	1.5	1.1

6601 input output module with a SCADAPack 574 and dry contact relays

Volts In	SCADAPack 574			6601 input output module
Volts (Vdc)	Base Power (W)	USB Host Port (W) (5 Vdc at 100 mA)	Serial port (W) (5 Vdc at 250 mA)	Per Module (W)
11.5	5.3	0.6	1.5	1.1
13.8	5.3	0.6	1.5	1.1
24	5.6	0.6	1.5	1.1
30	5.9	0.6	1.5	1.1

6601 input output module with a SCADAPack 574 and solid state relays

Volts In	SCADAPack 574			6601 input output module
Volts (Vdc)	Base Power (W)	USB Host Port (W) (5 Vdc at 100 mA)	Serial port (W) (5 Vdc at 250 mA)	Per Module (W)
11.5	4.6	0.6	1.5	1.1
13.8	4.6	0.6	1.5	1.1
24	5.0	0.6	1.5	1.1
30	5.3	0.6	1.5	1.1

6601 input output module with a SCADAPack 575

Volts In	SCADAPack 575			6601 input output module
Volts (Vdc)	Base Power (W)	USB Host Port (W) (5 Vdc at 100 mA)	Serial port (W) (5 Vdc at 250 mA)	Per Module (W)
11.5	4.1	0.6	1.5	1.1
13.8	4.1	0.6	1.5	1.1
24	4.5	0.6	1.5	1.1
30	4.8	0.6	1.5	1.1

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

The input power supply must be a filtered DC supply.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) power supplies are required on the power input and I/O points. Power supplies with 100...240 Vac inputs that comply with safety standard IEC/EN 60950 generally have SELV outputs. Check with the manufacturer or the agency certification listing to confirm that they have SELV outputs.

Failure to follow these instructions can result in death or serious injury.

The following Schneider Electric power supply can be used:

- Schneider Electric Phaseo regulated power supply providing 100...240 Vac in and 24 Vdc, 2.5 A out. See the SCADAPack Part Ordering List manual.

System grounding

Ground the system by connecting the system power supply common to the chassis or panel ground. On the I/O module, the power supply common (the “-“ connector for the 12...30 Vdc supply) is connected to the chassis internally within the CPU card. As a result, it is not isolated.

None of the I/O module pins, including any of the commons, are connected to chassis ground. As a result, they are isolated.

8.3.1 Analog Output Power Supply Wiring

There are two configuration options for the external 24 Vdc power supply that is required when the optional analog outputs are installed:

- The analog outputs and the SCADAPack can each have their own 24 Vdc power supply. In this configuration, the analog outputs are isolated from the system logic.
- The analog outputs can share an external 24 Vdc power supply with the SCADAPack. In this configuration, the analog outputs are not isolated from the system logic.

NOTICE

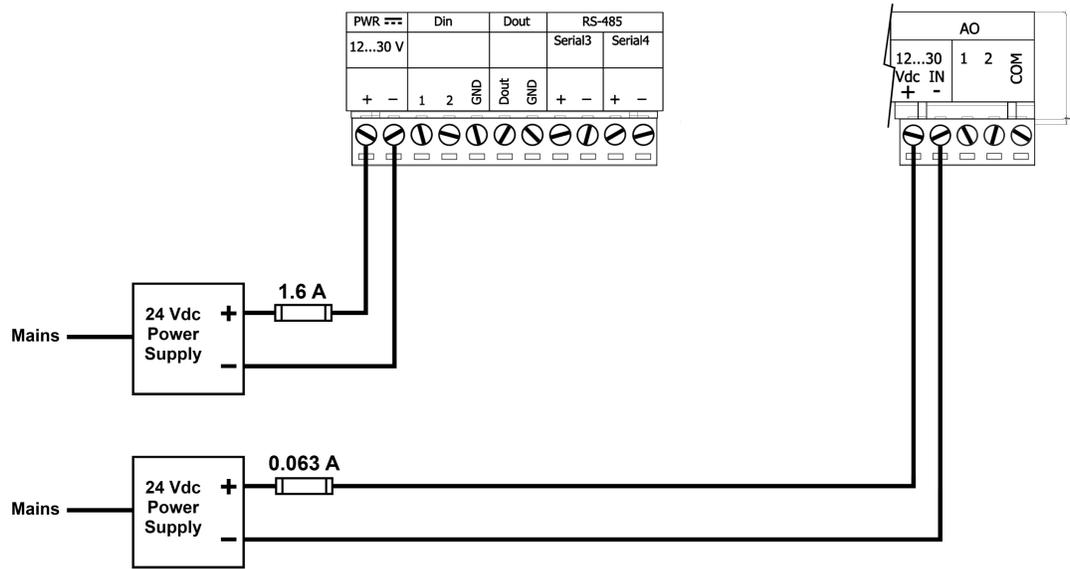
UNINTENDED EQUIPMENT OPERATION

Install an external 1.6 A fast-acting fuse on the input voltage side of the SCADAPack power supply connection.

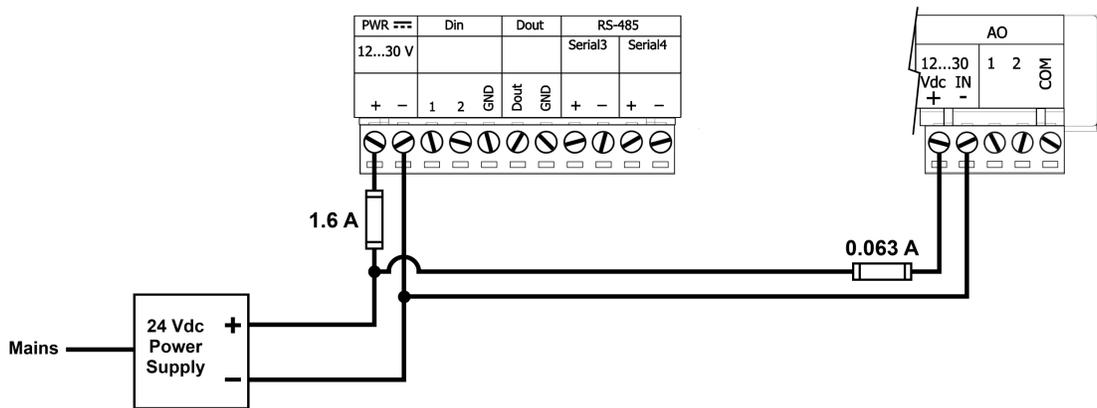
Install an external 0.063 A fast-acting fuse on the input voltage side of the analog output power supply connection.

Failure to follow these instructions can result in equipment damage.

The following figure illustrates the power supply configurations for a SCADAPack 57x device for isolated and non-isolated analog outputs.



Isolated AO



Non-Isolated AO

For details about wiring the power supply connectors, see [Wiring Screw-Termination Connectors](#) 53.

8.4 Connecting I/O Modules

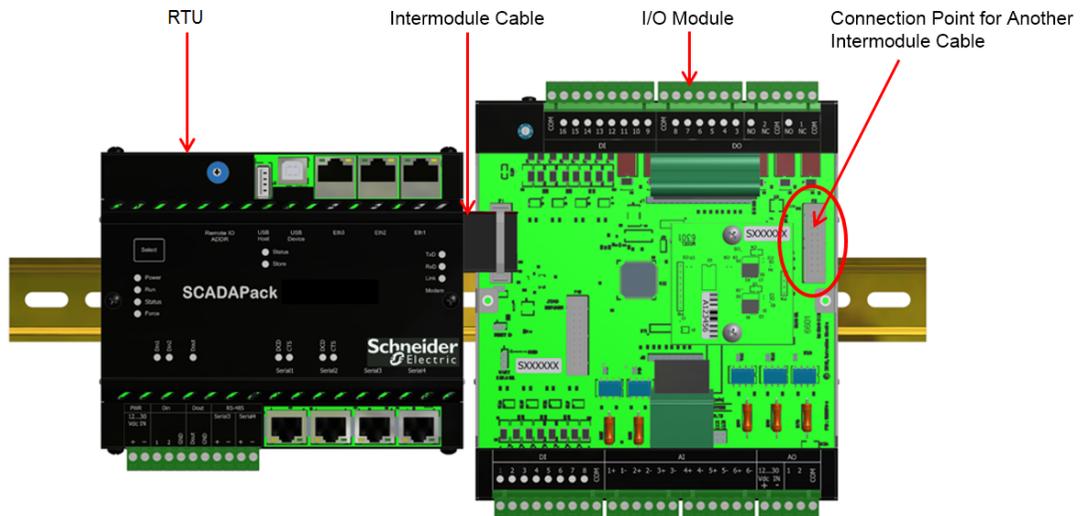
The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

I/O modules are mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to a SCADAPack using intermodule cables. The intermodule cable is a ribbon cable that distributes power (5 Vdc) and communications signals from the SCADAPack to the I/O modules. These power and communication signals are referred to as the I/O bus.

The figure below shows a SCADAPack x70 device with an I/O module connected to it. You can

connect multiple I/O modules to a single SCADAPack up to the maximum number of modules supported by the device. See the SCADAPack hardware manual for details.

The illustration below shows a connected intermodule cable. The maximum number of modules may also be limited by the total length of the cable. See [Cabling Guidance](#)^[44] for further details on intermodule cables. While the size and shape of your devices may differ and the color of the connectors may be different, the location of the intermodule cable is the same on each device type.



Before [attaching intermodule cables](#)^[46], read the [Precautions](#)^[43] and the [Cabling Guidance](#)^[44].

8.4.1 Precautions

Before connecting I/O modules:

- Confirm that the power supply is rated for the total number of modules in the system. Some I/O modules, such as those with analog outputs, require an additional DC power supply to operate. See [Specifications](#)^[82] for details.
- Confirm that the intermodule cables you are are less than the maximum total cable length. See [Maximum Intermodule Cable Length](#)^[45].
- Review the recommendations below to help avoid static electricity damage.

NOTICE

STATIC ELECTRICITY DAMAGE

Static electricity damage can cause intermittent or total loss of equipment operation. To help avoid static electricity damage:

- Wear an anti-static wrist strap that is connected to ground if you need to remove the device cover.
- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.
- Do not install intermodule cables in the same cable tray or in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Failure to follow these instructions can result in equipment damage.

8.4.2 Cabling Guidance

This topic summarizes the rules for connecting I/O modules to SCADAPack x70 devices. These rules apply to the following SCADAPack I/O modules:

- 6601 input output module
- 6602 HART module
- 6607 input output module
- 5304 analog output module
- 5405 digital input module
- 5410 high speed counter input module
- 5414 digital input module
- 5415 relay output module
- 5505 RTD input module
- 5506 analog input module
- 5606 input output module
- 5607 input output module

Using only 5000 series I/O modules

If you are using only 5000 series I/O modules with a SCADAPack x70 device, connect the 5000 series module directly to the SCADAPack using a 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual).

Using 5000 and 6000 series I/O modules

If you are using a combination of 5000 series I/O modules and 6000 series I/O modules with a SCADAPack x70 device, connect a 6000 series module to the SCADAPack first, followed by any other 6000 series modules. Then connect the 5000 series modules to the last 6000 series module.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

General guidance

- Use the shortest length intermodule cable that is practical. This helps to minimize voltage drops and interference from electrical noise.
- Keep the intermodule cable away from electrical noise sources such as inductive load switching and variable frequency drives.
- If you are using a shielded cable, connect the shielding wire on the intermodule cable to a convenient chassis ground point. There is a small hole in the I/O module for grounding the shielding wire.
- Install intermodule cables in separate cable trays from field wiring, and not in parallel with field wiring. Intermodule cables can cross field wiring at 90° if necessary.

Intermodule cables

When determining the location of your I/O modules, review the following information about shielded intermodule cables and maximum intermodule cable length.

Shielded intermodule cables

Shielded intermodule cables have a foil and braid shielding. Intermodule cables longer than 30 cm (12 in) are shielded for physical protection and for isolation from electrical noise. The shielding is connected to a terminal lug at one end of the cable.

When using a shield for an intermodule cable, fasten the shield only to the module that is closest to the SCADAPack. Connect the shield to the enclosure using the self-tapping screw provided.

You can use up to 3 shielded intermodule cables. The total length of all cables can not exceed 1.82 m (75 in).

Maximum intermodule cable length

I/O modules ship with a short intermodule cable that is used to connect I/O modules to a SCADAPack or to another I/O module.

The maximum total intermodule cable length in a single system is 1.82 m (75 in). This length restriction does not include the short intermodule cable supplied with the I/O module. Schneider

Electric offers several cable lengths that can be combined to reach the 1.82 m (75 in) limit.

Keep the following in mind:

- No more than 1.5 m (60 in) of total expansion cable length can follow a controller or power supply before an additional power supply needs to be added
- 1.14 m (45 in) and 1.82 m (75 in) expansion cables need to be followed by a power supply
- The highest power consumption modules need to be to closest to the controller or power supply with 6000 series modules first, followed by 5000 series modules due to connector limitations
- The maximum number of power supply modules, not including the controller, is 2
- A 30 cm (12 in) or a 76 cm (30 in) cable is typically used to connect modules on separate DIN rails

To purchase additional intermodule cables, contact your Schneider Electric representative.

8.4.3 Attaching Intermodule Cables

This topic describes how to attach an intermodule cable between a SCADAPack and an I/O module. Follow the same steps to connect two I/O modules.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before applying or removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

The I/O bus does not support live-swapping.

Remove power from the SCADAPack and the I/O module before removing the cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

Static electricity damage can cause intermittent or total loss of equipment operation.

Always wear an anti-static wrist strap that is connected to ground when you remove the device cover.

Failure to follow these instructions can result in equipment damage.

5410 High Speed Counter Input Module Considerations

NOTICE

UNEXPECTED COUNTER READINGS

Do not disconnect a 5410 high speed counter input module while the module and RTU are powered.

Do not remove power from a 5410 high speed counter input module while the RTU is powered and communicating with the module.

Failure to follow these instructions can result in unexpected counter readings.

Power off the RTU before connecting or disconnecting the inter-module cable to the 5410 high speed counter input module.

Power off the RTU and 5410 high speed counter input module at the same time. Use a common power supply input for the RTU and I/O modules.

To attach intermodule cables

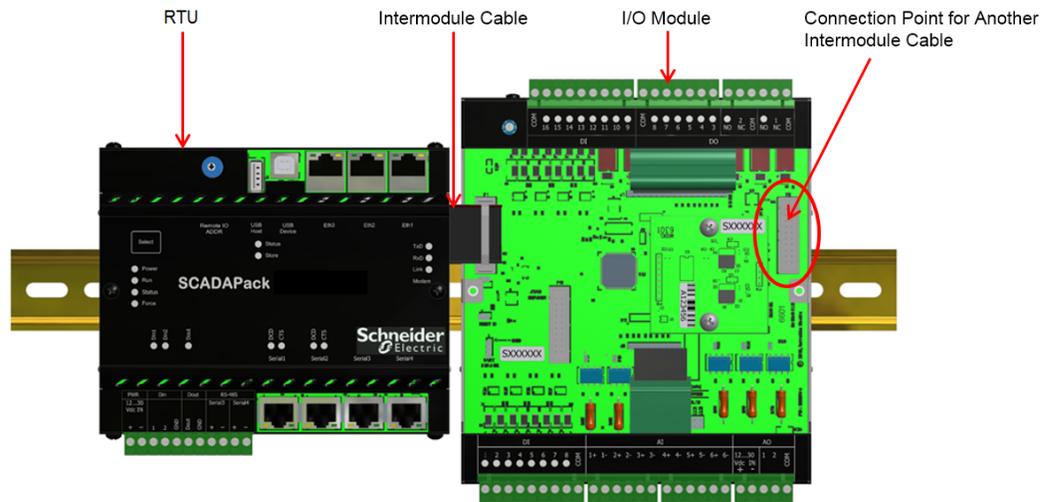
1. Power down each SCADAPack and I/O module that you are connecting.
2. Remove the cover from the device if required to access the intermodule cable.
3. Press one end of the intermodule cable firmly into the I/O bus connector on the SCADAPack.

SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while 5000 series modules provide a 16-pin connector. Use the 20-pin to 16-pin adapter cable (sold separately, see the SCADAPack Part Ordering List manual) to transition from a 20-pin connector to a 16-pin connector.

The connectors on intermodule cables are keyed so they can only be inserted in one direction. If the connector does not push easily into the I/O bus connector, reverse it and try again.

4. Press the other end of the intermodule cable firmly into the I/O bus connector on the I/O module.

The illustration below shows a connected intermodule cable. While the size and shape of your devices may differ and the color of the connectors may be different, the location of the intermodule cable is the same on each device type.



5. Replace the cover on the I/O module and on the SCADAPack if it was removed, taking care to check that the ribbon cable connecting the I/O module is not pinched.
6. Apply power to the SCADAPack.

You are now ready to configure the I/O module.

9 Addressing

This section describes the addressing rules for an I/O module and the procedure for setting the I/O module address.

WARNING

UNINTENDED EQUIPMENT OPERATION

Review the power requirements for the I/O modules before combining modules.

Failure to follow these instructions can result in death or serious injury.

I/O modules can be combined in any manner up to the maximum number supported by the SCADAPack. For details about the maximum supported system configuration, see the SCADAPack hardware manual for guidance.

Each I/O module connected to the SCADAPack is assigned a unique I/O module address.

For more information see

- [Addressing Rules](#)^[49]
- [Setting the I/O Module Address](#)^[49]

9.1 Addressing Rules

I/O modules are shipped from the factory at address 0.

- If you are connecting only 1 external 6601 input output module to a SCADAPack 470, SCADAPack 570, or SCADAPack 574, you can leave the address at 0.
- If you are connecting 1 or more external 6601 input output modules to a SCADAPack 474 or SCADAPack 575, you will need to change the address. The SCADAPack 474 includes an internal 6607 input output module at address 0 and the SCADAPack 575 includes an internal 6601 input output module at address 0.
- If you are connecting more than 1 external 6000 series I/O module to your SCADAPack x70, each module requires a unique address.

9.2 Setting the I/O Module Address

By default, the I/O module physical address is set to 0. To avoid conflict with the addresses of other I/O modules connected to the same SCADAPack, the address can be set anywhere in the range 0 to F. This is a selected value in hexadecimal (0 to 9, A to F). The equivalent software configuration of the module address is set in decimal (0 to 15).

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack and the I/O module before applying or removing power.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Remove power from the I/O module before initially setting the I/O module address and before changing the I/O module address.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Be very careful that you do not set the I/O module address to an address that is assigned to another I/O module connected to the same SCADAPack.

If 2 I/O modules have the same address, you will lose communications with both modules.

Failure to follow these instructions can result in death or serious injury.

To set or change an I/O module address

1. Remove power from the I/O module.
2. Insert a 2.4 mm (3/32 in) slotted screwdriver into the inner circle of the rotary hex switch.



- 3. Slowly turn the screwdriver until the small arrowhead points to the correct address.
- 4. Reconnect power to the I/O module.

10 Field Wiring

The I/O modules use screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 3.3...0.05 mm² (12...30 AWG). The connectors are removable allowing replacement of the module without disturbing the field wiring. Leave enough slack in the field wiring for the connector to be removed.

For ease of wiring and maintenance, external connections are terminated on removable connectors. If you need to remove the I/O module cover for any reason, first carefully consider the following information.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

Remove power from the I/O module before removing the I/O module cover.

Failure to follow these instructions can result in death or serious injury.

NOTICE

STATIC ELECTRICITY DAMAGE

The electronics inside the I/O module can be damaged by static electricity. If you need to remove the I/O module cover, wear an anti-static wrist strap that is connected to ground. Failing to follow this step can cause intermittent or total loss of I/O module operation and will void the warranty.

Failure to follow these instructions can result in equipment damage.

For more information see

- [Wiring Screw-Termination Connectors](#)^[53]
- [Digital and Counter Input Wiring](#)^[54]
- [Digital Output Wiring](#)^[56]
- [Analog Input Wiring](#)^[59]
- [Analog Output Wiring](#)^[69]

10.1 Wiring Screw-Termination Connectors

Screw-termination style connectors are provided to terminate wiring from:

- Power supplies
- RS485 devices
- Input/output (I/O) modules

These 5 mm (0.197 in) pitch connectors support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack or the I/O module before wiring screw-termination connectors.

Failure to follow these instructions can result in death or serious injury.

WARNING

ELECTRICAL HAZARD

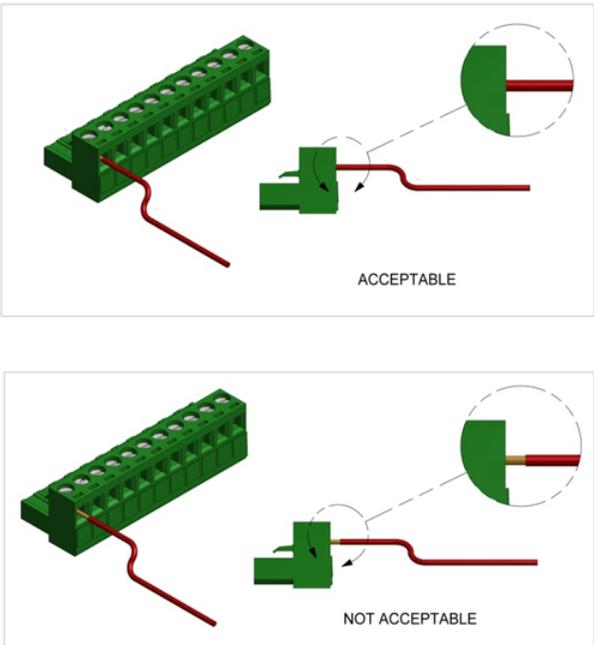
Remove power from all modules and devices before servicing.

Failure to follow these instructions can result in death or serious injury.

To wire a connector

1. Use a slotted screwdriver to loosen the termination screw.
2. Insert the stripped wire into the connector so that the bared wire is located under the screw.

Verify that the bared wire is placed fully within the connector, as illustrated below.



3. Apply 0.5 N•m (4.5 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 Digital and Counter Input Wiring

This section describes the wiring for the digital and counter inputs.



For more information see:

- [Digital and Counter Input Wiring Example](#)^[55]

10.2.1 Digital and Counter Input Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

When wiring digital and counter inputs:

- Confirm that the connection to the digital or counter input does not exceed the ratings for the input. See the Specifications topic for details.
- Confirm that the polarity of the connection is correct with the two positive terminals wired together and the two negative terminals wired together.

Failure to follow these instructions can result in equipment damage.

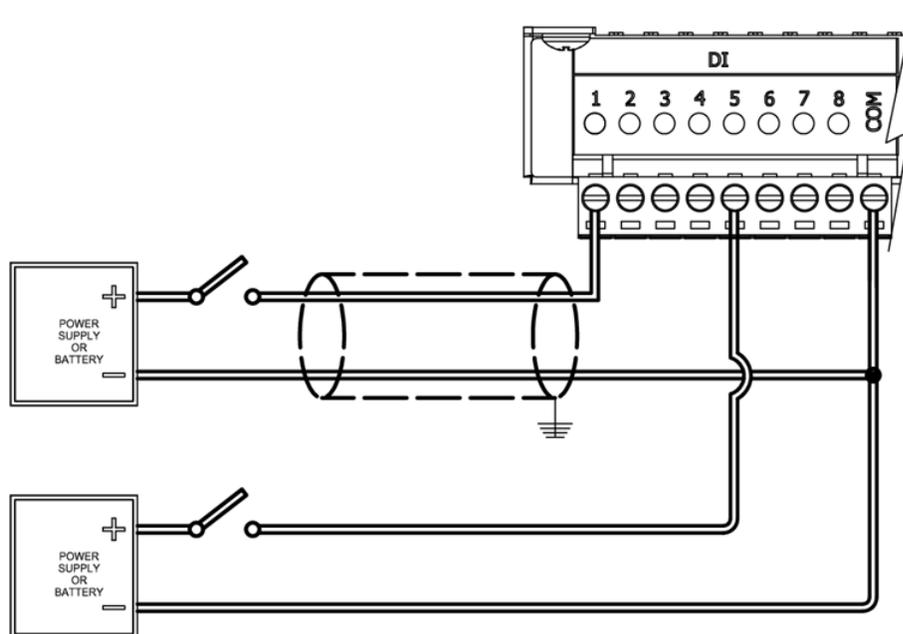
NOTICE

SIGNAL INTERFERENCE DUE TO NOISE

When the unit is operating in an electrically noisy environment use shielded wires on connections to digital and counter inputs.

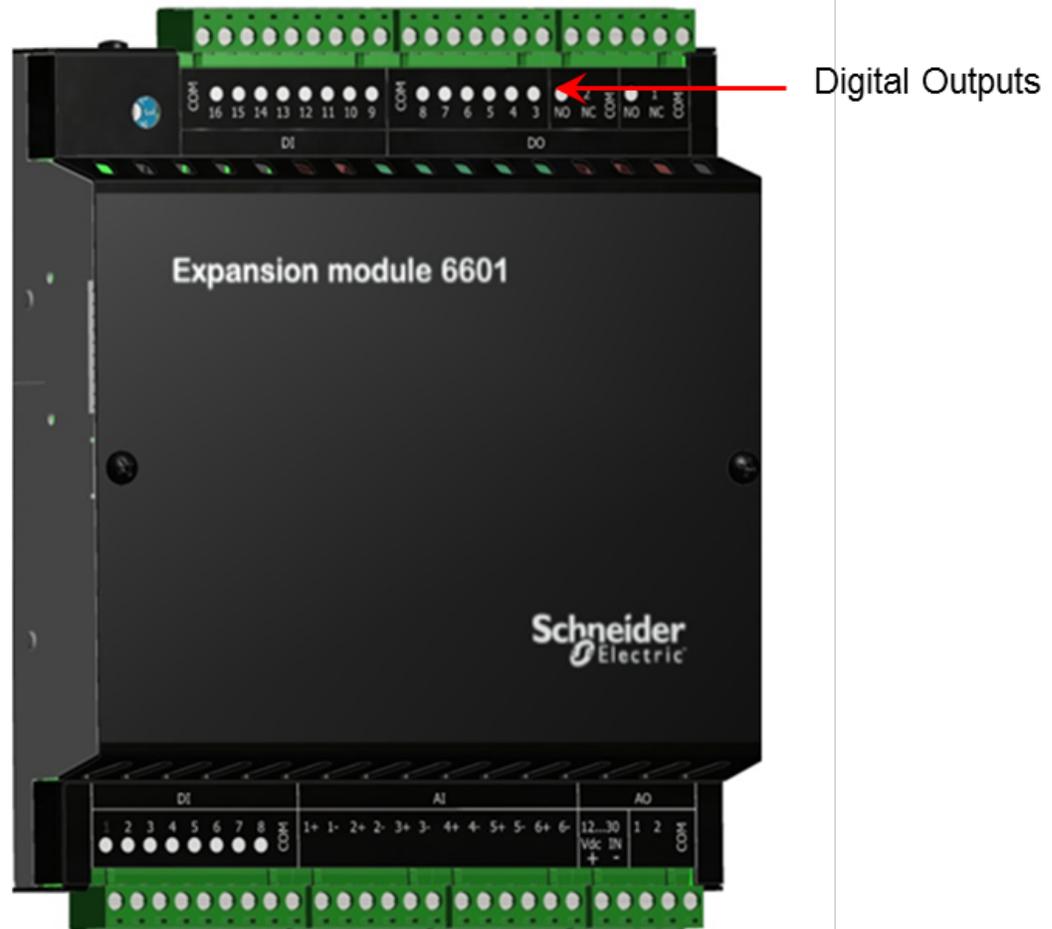
Failure to follow these instructions can result in equipment damage.

The figure below shows a shielded connection to DI 1 and an unshielded connection to DI 5. Both connections are wired to the common for digital inputs 1-8 and to a power supply or battery.



10.3 Digital Output Wiring

This section describes the wiring for the digital outputs.



For more information see:

- [Digital Output Wiring Example](#)^[57]

10.3.1 Digital Output Wiring Examples

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

RELAY CONTACT DAMAGE

Incandescent lamps and other loads may have inrush currents that will exceed the rated maximum current of the relay contacts. This inrush current may damage the relay contacts. Use interposing relays in these situations.

When controlling inductive loads, the relay contacts on digital outputs must be protected. The energy stored in the coil can generate significant electrical noise when the relay contacts are opened.

- To suppress the noise in DC circuits, place a diode across the coil

Failure to follow these instructions can result in equipment damage.

NOTICE

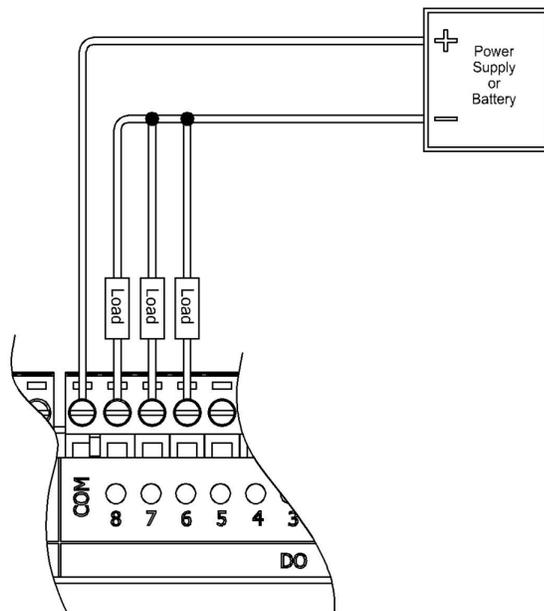
UNINTENDED EQUIPMENT OPERATION

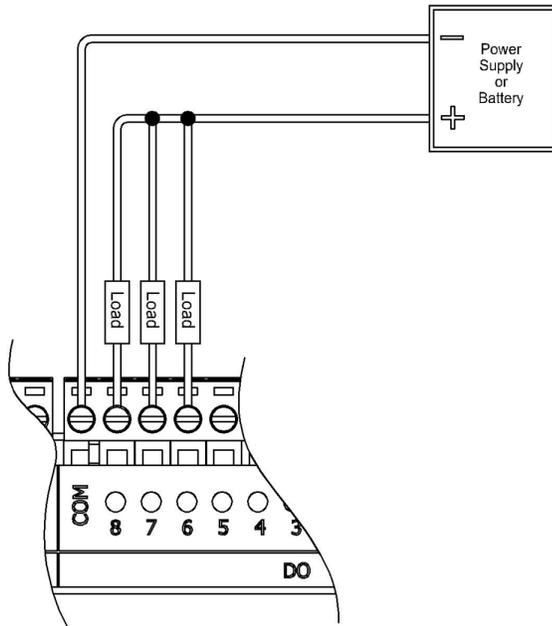
External lightning protection is required if the device being controlled is outside the physical area (cubicle or building) in which the SCADAPack is located.

Failure to follow these instructions can result in equipment damage.

Form A digital output wiring

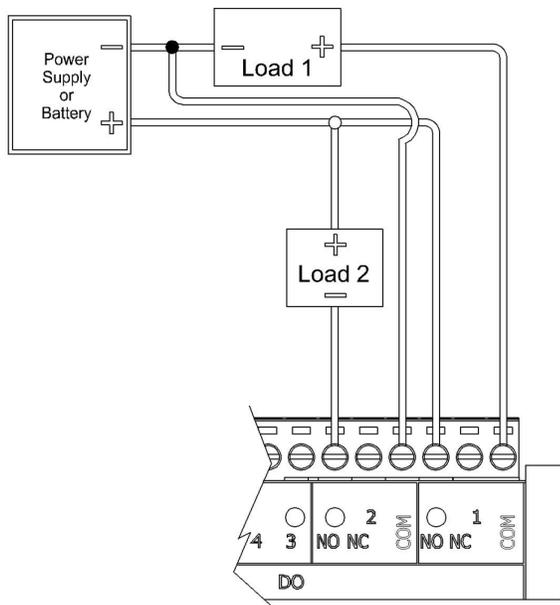
The figure below show wiring examples for the I/O board Form A digital outputs (DO 3-8).





Form C digital output wiring

The figure below shows a wiring example for the I/O board Form C digital outputs (DO 1-2).



10.4 Analog Input Wiring

This section describes the wiring for the analog inputs.



For more information see:

- [Analog Input Wiring Example](#)^[60]
- [Supporting a Mix of Current and Voltage Inputs](#)^[62]
- [Helping to Prevent Interruption of the Current Loop](#)^[67]

10.4.1 Analog Input Wiring Example

The analog inputs support loop-powered and self-powered transmitters.

⚠ WARNING**ELECTRICAL HAZARD**

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE**LIGHTNING SURGE THROUGH ANALOG INPUTS**

If a transducer or transmitter connected to an analog channel is placed outside of the building or structure where the SCADAPack or I/O module that provides the analog inputs is installed, there is an increased possibility of extremely severe power surges caused by lightning. In these cases, additional surge protection must be supplied by the user.

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

Do not exceed the maximum input range specified for each analog input. For details, see the Specifications topic for details.

Failure to follow these instructions can result in equipment damage.

Self-powered transmitters

Self-powered transmitters have three terminals:

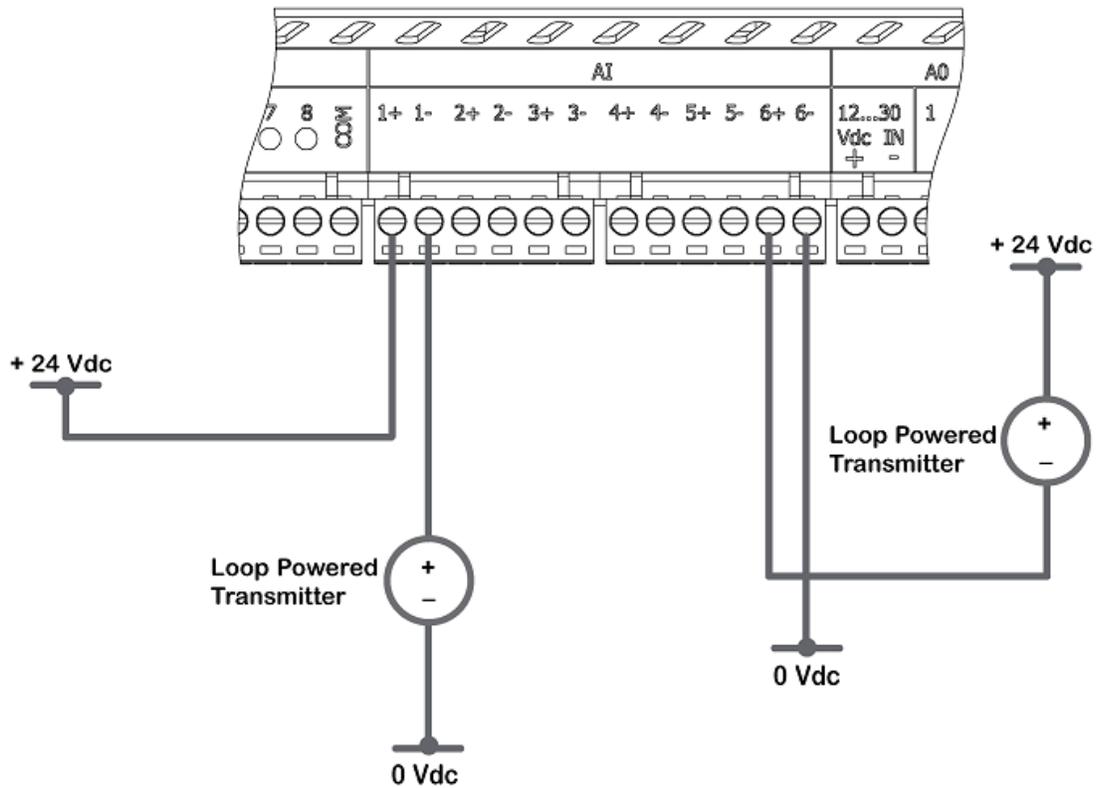
- Power In connects to a power supply
- Signal Out connects to the analog input channel
- Common connects to COM

Self-powered transmitters can have a current or voltage output.

Loop-powered transmitters

Loop-powered transmitters are two-terminal devices that are connected between a power supply and the analog input. The loop current from the power supply passes through the transmitter and returns to the power supply through a 250 ohm resistor in the 20 mA input circuit.

There are 2 ways to wire a loop-powered transmitter. In the wiring example below, Transmitter 1 is connected to AI 1-. Transmitter 6 is connected to the positive power supply and to AI 6+. These two connections are possible because the analog inputs are isolated.



10.4.2 Supporting a Mix of Current and Voltage Inputs

The unit is shipped with the six analog inputs configured for DC Current or DC Voltage. However, you can change the input mode for individual analog inputs to support a mix of current and voltage analog inputs if needed.

The unit is factory-calibrated for 0...20 mA and 4...20 mA current inputs and for 0...5 Vdc and 1...5 Vdc operation so there is no need to adjust the calibration when you change the input mode for an analog input.

The table below summarizes the options for supporting a mix of current and voltage analog inputs.

Analog Inputs Configured For	Ways to Support a Mix of Current and Voltage Inputs	Considerations	Instructions
DC Voltage	Add an external resistor to measure current	<ul style="list-style-type: none"> You do not need to remove the unit from the DIN rail or disconnect the wiring. The current loop can be configured so it is not interrupted if you need to 	Converting Current Input to Voltage Input ⁶³

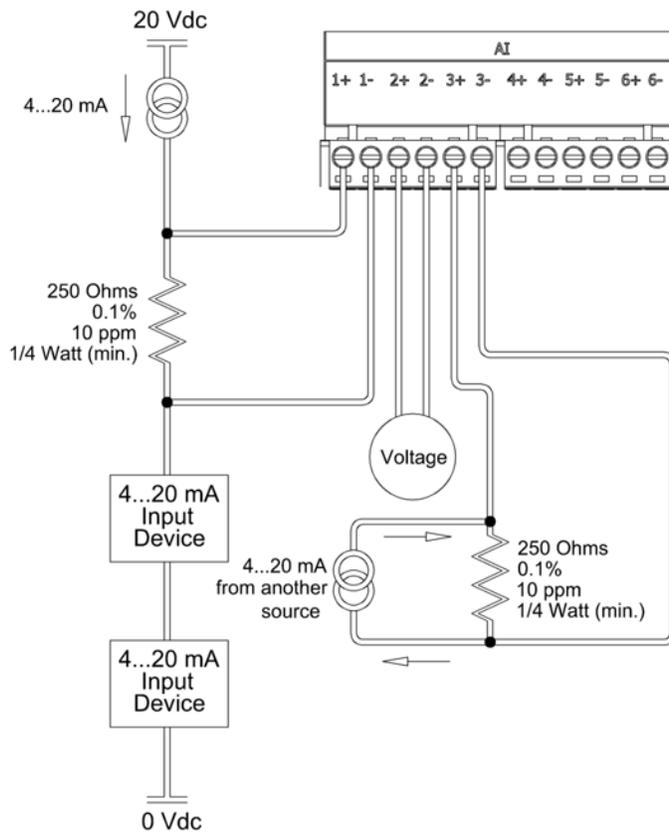
		service the unit.	
	Move the DIP switch for one or more analog inputs to DC Current.	<ul style="list-style-type: none"> Typically, you need to remove the unit from the DIN rail and disconnect the wiring. The current loop is interrupted if you need to service the unit. <p>If you choose this approach, carefully consider the precautions below before proceeding.</p>	Changing the Input Mode for an Analog Input ⁶⁴
DC Current	Move the DIP switch for one or more analog inputs to DC Voltage.	<ul style="list-style-type: none"> Typically, you need to remove the unit from the DIN rail and disconnect the wiring. The current loop is interrupted if you need to service the unit. <p>If you choose this approach, carefully consider the precautions below before proceeding.</p>	Changing the Input Mode for an Analog Input ⁶⁴

Converting current input to voltage input

In following illustration, the six analog inputs are configured for DC Voltage, but a mix of current and voltages inputs are supported:

- On analog inputs 1 and 3, an external resistor is used to convert current input to voltage input before it reaches the physical input.
- On analog input 2, the voltage input flows directly into the physical input.

This wiring approach allows you to configure the current loop so it is not interrupted if the unit requires servicing. For details, see [Helping to Prevent Interruption of the Current Loop](#)⁶⁷.



Changing the input mode for an analog input

The procedure below describes how to move the DIP switches on the back of the unit to change the analog input mode from DC Voltage to DC Current, or from DC Current to DC Voltage mode.

If you have open access to the back of the unit, where the DIP switches are located, you do not need to remove the unit from the DIN rail or the wiring from the unit to access the DIP switches. In this case, skip to step 4 in the procedure below.

If you do not have open access to the back of the unit, you need to remove the unit from the DIN rail and you will likely need to remove the wiring from the unit to access the DIP switches. In this case, follow the procedure below from step 1. Carefully consider the precautions below before proceeding.

To change the input mode for an analog input

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device and the I/O module before removing power.

Failure to follow these instructions can result in death or serious injury.

WARNING

UNINTENDED EQUIPMENT OPERATION

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

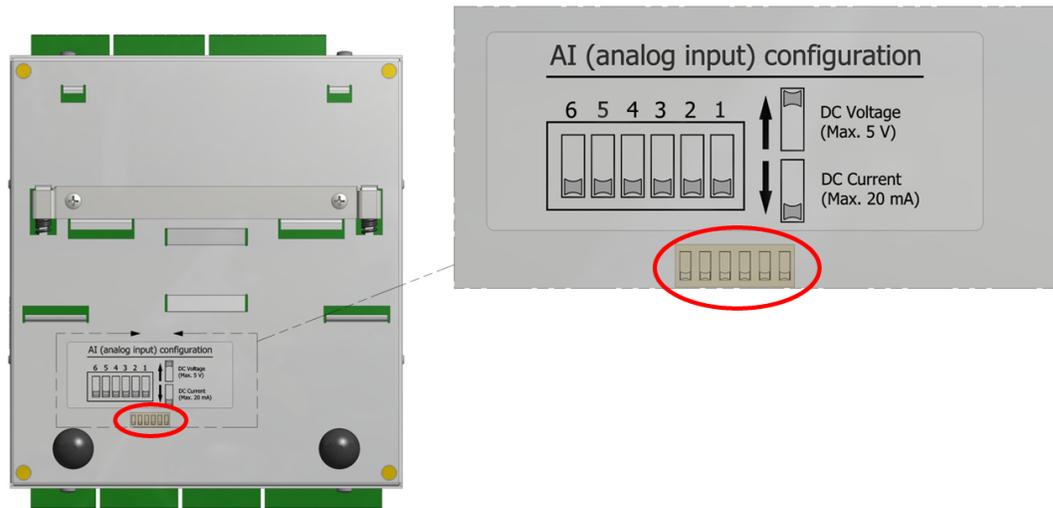
Failure to follow these instructions can result in death or serious injury.

1. Remove power from the unit.
2. Disconnect power, I/O and serial port wiring.
3. Remove the unit from the DIN rail.

To remove the unit from the DIN rail, press down on the top of the unit to compress the mounting springs while tilting the bottom of the unit toward you. When the DIN rail is free of the lower claws on the back of the SCADAPack, gently lift the unit away from the DIN rail.

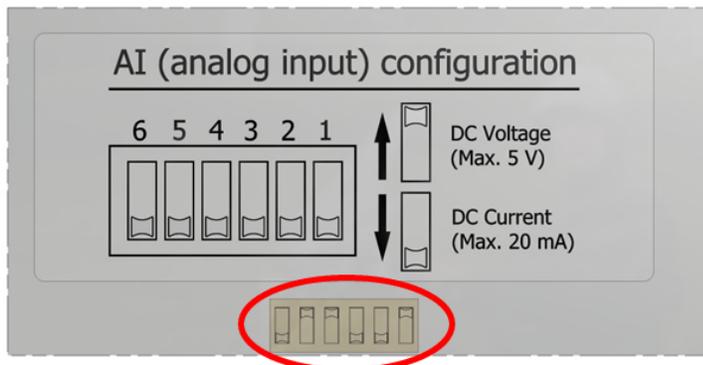
4. On the back of the unit, locate the DIP switch for the analog input that you want to reconfigure.

The DIP switch numbers correspond to the analog input numbers. For example, to change the input mode for analog input 1, move DIP switch 1. The figure below shows the DIP switches configured for DC Current.



5. Move the DIP switch to the alternate mode of operation:
 - For DC Current (mA), slide the DIP switch to the lower position.
 - For DC Voltage (Vdc), slide the DIP switch to the upper position.

In the figure below, analog inputs 1, 4, and 5 are configured for DC Voltage while analog inputs 2, 3, and 6 are configured for DC Current.



6. Remount the unit on the DIN rail.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Do not connect I/O devices that exceed the maximum current or voltage for an analog input.

The maximum DC current for an analog input is 20 mA.

The maximum DC voltage for an analog input is 5 Vdc.

Failure to follow these instructions can result in equipment damage.

7. Reconnect the inputs and outputs.

8. Reconnect the power connectors and reapply power to the unit.
9. In the SCADAPack RemoteConnect configuration software, go to **SCADAPack x70 Controller Settings -DeviceDTM > Configuration > Physical I/O > Local** and in the **Channel Configuration** section, change the **Type** for the analog inputs that were reconfigured.

10.4.3 Helping to Prevent Interruption of the Current Loop

WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

Failure to follow these instructions can result in death or serious injury.

NOTICE

UNINTENDED EQUIPMENT OPERATION

Do not exceed the maximum voltage specified for each analog input.

Failure to follow these instructions can result in equipment damage.

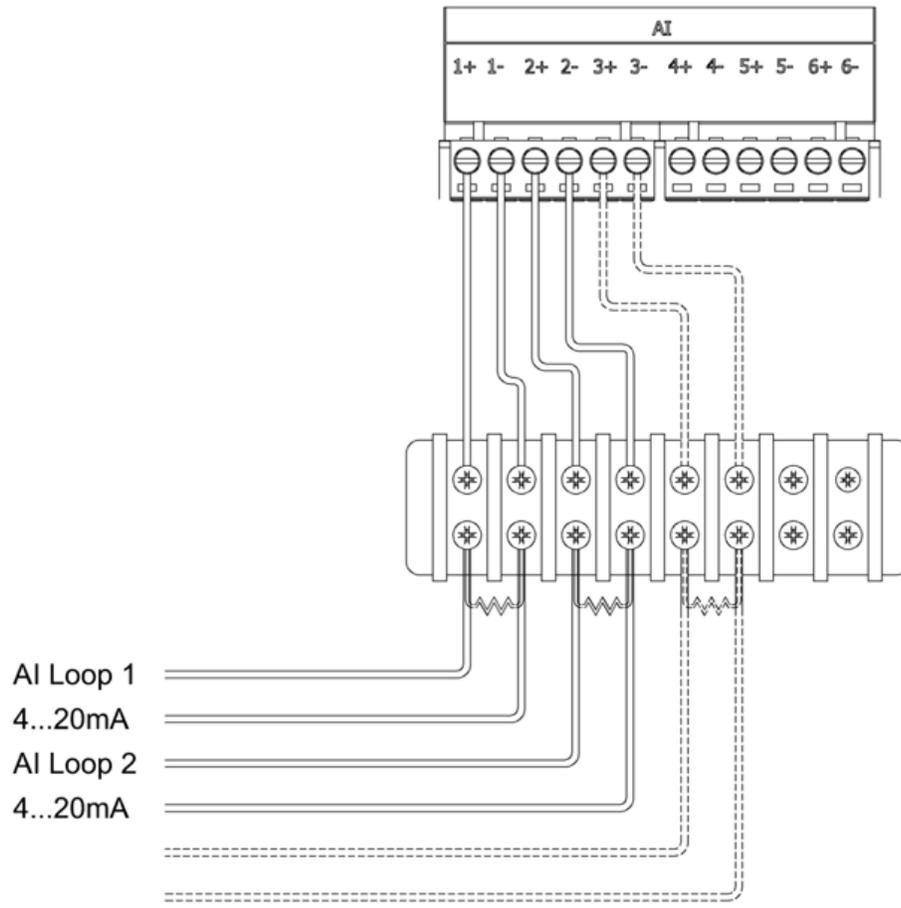
NOTICE

UNINTENDED EQUIPMENT OPERATION

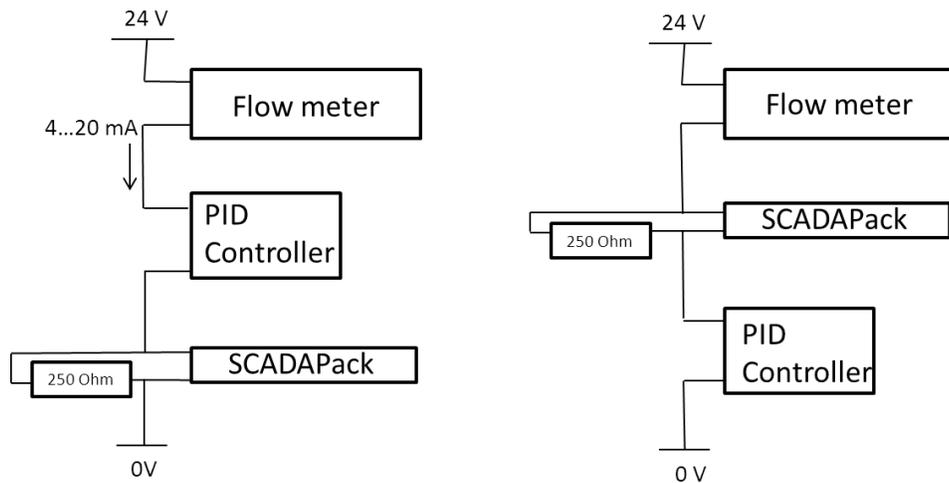
The SCADAPack or I/O module must be the only loop current measurement device in the loop when using the analog inputs in the 20 mA measurement mode. If power to the module is removed, the module reverts to voltage mode and results in an open current loop. Applications that cannot tolerate this possibility need to use external current sense resistors with the module input range set to voltage.

Failure to follow these instructions can result in equipment damage.

Add 250 ohm external resistors to the current loop at the terminal strip to help prevent interruption of the current loop if the SCADAPack or I/O module is being serviced. The physical wiring of the 250 ohm external resistors at the terminal strip is illustrated below.



As illustrated below, the SCADAPack or I/O module providing the analog inputs does not need to be the last device in the current loop.



10.5 Analog Output Wiring

This section describes the wiring for the analog outputs.



For more information see:

- [Analog Output Wiring Example](#)^[69]
- [Supporting Current and Voltage Outputs](#)^[71]

10.5.1 Analog Output Wiring Example

The figure below shows loads connected to the two analog outputs.

⚠ WARNING

ELECTRICAL HAZARD

Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

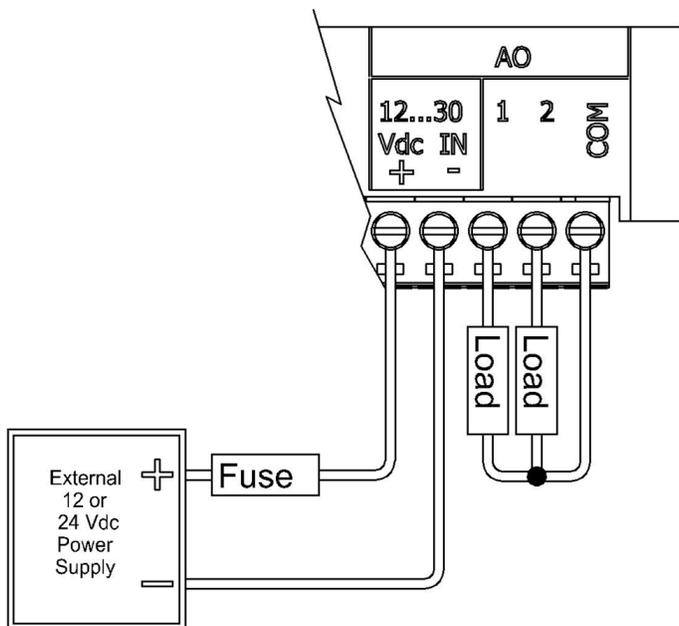
Failure to follow these instructions can result in death or serious injury.

NOTICE

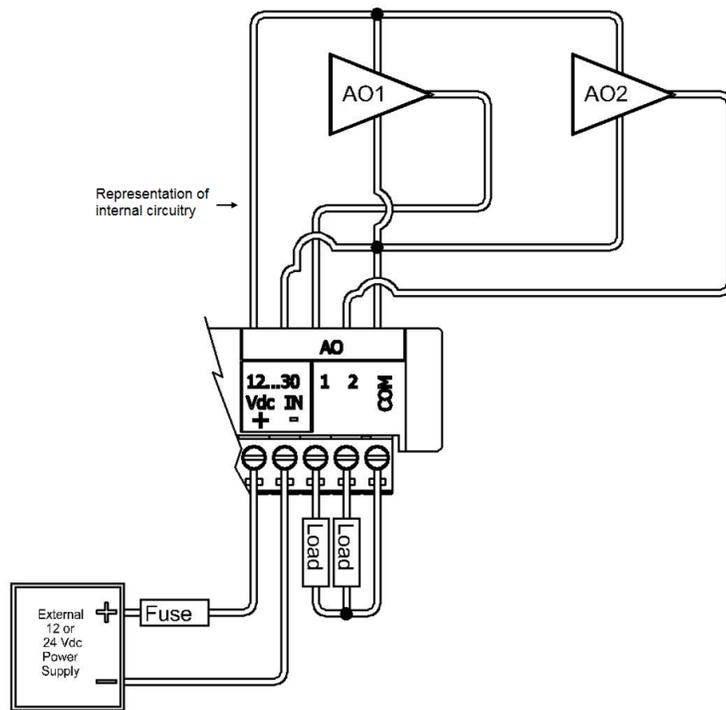
UNINTENDED EQUIPMENT OPERATION

Install a 0.063A fast-acting fuse on the input voltage side of the analog output power supply connection.

Failure to follow these instructions can result in equipment damage.



The analog output circuitry is configured internally to receive power from an external power supply on pins 1 and 2 of the removable terminal block. Pin 5 (Com 1-2) and pin 2 (power input -) are connected internally. As illustrated in the following figure, the two analog outputs are not isolated from each other, but are isolated from the SCADAPack RTU circuitry.



10.5.2 Supporting Current and Voltage Outputs

The analog outputs can be configured for 4...20 mA current or 0...20 mA current.

If a voltage output is required (1...5 Vdc, for example), run the 4...20 mA or 0...20 mA signal to the device that requires a voltage input and place a 250 ohm resistor across the input terminals of that device.

The table below lists resistance values and output range settings for common voltage ranges. The resistance value listed is the parallel resistance of the device and the load resistor.

Resistance	Output Range	Voltage Range
250 ohm	0...20 mA	0...5 Vdc
	4...20 mA	1...5 Vdc
500 ohm	0...20 mA	0...10 Vdc

11 Configuration

The inputs and outputs can be configured locally or remotely using the SCADAPack RemoteConnect configuration software on a Microsoft Windows-based computer.

SCADAPack RemoteConnect configuration software

The configuration software provides a graphical user interface that allows you to:

- Configure parameters for the SCADAPack and any attached I/O modules and then load those parameters into the SCADAPack
- Interact online with the SCADAPack to view status information, diagnostics information and current parameter values for the SCADAPack and any attached I/O modules
- Use the built-in SCADAPack x70 Logic Editor to develop IEC 61131-3 applications that extend and enhance the functionality provided by the SCADAPack and any attached I/O modules

The configuration software is comprised of a frame application that is FDT 2.1, FDT 2.0, and FDT 1.2 compliant and Device Type Managers (DTMs).

For information about	See the following manual
Working with projects and DTMs	SCADAPack RemoteConnect Configuration Software
Configuring communications with the SCADAPack	PC Communication Settings -SCADAPack CommDTM
Configuring device parameters and interacting online with the device	SCADAPack x70 Configuration
Using the SCADAPack x70 Logic Editor	SCADAPack Logic Programming Overview

12 Diagnostics

Input and output modules provide LEDs that indicate the status of inputs and outputs. There are also a number of actions you can take to determine the cause of unexpected activities.

For more information see

- [LEDs](#) ^[73]
- [Digital Inputs](#) ^[73]
- [Digital Outputs](#) ^[73]
- [Analog Inputs](#) ^[74]
- [Analog Outputs](#) ^[74]

12.1 LEDs

The I/O module provides an LED for each digital input and output. When the LED is on, the input or output is energized, meaning it has an active connection. Digital input LEDs blink when pulses are applied if the digital input is configured to be a counter.

12.2 Digital Inputs

Condition	Action
Input LED does not come on when input signal is applied.	Check that the input signal at the termination block is at least 50% of the digital input range. If this is a DC input, check the polarity of the signal.
Input is on when no signal is applied. The LED is off.	Check that the digital inputs are not forced on.
Input is off when a signal is applied. The LED is on.	Check that the digital inputs are not forced off.

12.3 Digital Outputs

Condition	Action
Output LED does not come on when output is turned on.	Check the Power LED on the SCADAPack.
Output LED comes on but the output does not close.	Check if the relay is stuck. If so, return the module for repair.
Output LED comes on and output is closed, but the field device is not	Check the field wiring. Check the external device.

activated.	
Output LED and relay are on when expected to be off.	Check that the output is not forced on.
Output LED and relay are off when expected to be on.	Check that the output is not forced off.

12.4 Analog Inputs

Condition	Action
20 mA inputs read 0.	Check transmitter power.
Reading is at or near 0 for every input signal.	Check whether the input transient suppressors are damaged.
20 mA readings are not accurate.	Check for a damaged 250 ohm current sense resistor.
Reading is constant.	Check that the analog input is not forced.
Reading seems out of calibration for small inputs but improves as input increases.	Check the input range setting.
In Current Loop Mode, there can be an open circuit in the Current Loop.	Refer to the section Helping to Prevent Interruption of the Current Loop ^[67] .
Other devices are not functional after installation of the I/O module.	In Current Loop mode, make the I/O module the last device in the loop, or use a signal isolator as discussed in the section Helping to Prevent Interruption of the Current Loop ^[67] .

12.5 Analog Outputs

Condition	Action
Outputs are 0 mA	Check whether the optional analog outputs were ordered with the I/O module. The analog outputs are installed at the factory prior to delivery. Check the 24 Vdc power supply.
The full-scale output is less than 20 mA	Check the 24 Vdc power supply. Check that the load resistance is within

Condition	Action
	specification.
Output is constant instead of changing	Check that the analog outputs are not forced.

13 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact [Technical Support](#)^[77] for more information and instructions for returning the module for repair.

For more information see

- [Calibration](#)^[76]
- [Updating Module Firmware](#)^[76]
- [Updating Bootloader Firmware](#)^[78]

13.1 Calibration

The device is electronically calibrated at the factory during the manufacturing process and after any repair procedures.

There are no user calibration procedures.

13.2 Updating Module Firmware

The module firmware on 6000 series I/O modules can be updated locally or remotely, as described below. In this topic, *Version* represents the current version.

I/O Module	Firmware Filename
6601	fw6601_ <i>Version</i> .bin

By default, the firmware file is stored in one of the following directories, where *x.xx.xx* represents the current version:

- 64-bit systems: C:\Program Files (x86)\Schneider Electric\RemoteConnect\Firmware\6601*x.xx.xx*
- 32-bit systems: C:\Program Files\Schneider Electric\RemoteConnect\Firmware\6601*x.xx.xx*

WARNING

LOSS OF CONTROL

During a firmware update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating firmware:

- Confirm that you are connected to the correct SCADAPack
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Do not remove power from the SCADAPack during the firmware update.

Do not disconnect the 6000 series I/O module from the SCADAPack during the firmware update.

If power is interrupted for any reason during the firmware update, contact Technical Support.

Failure to follow these instructions can result in death or serious injury.

NOTICE**LOSS OF CONTROL**

Do not change the name of the bootloader file. Changing the name will render the update unsuccessful.

Failure to follow these instructions can result in equipment damage.

NOTICE**INCOMPATIBLE FIRMWARE VERSIONS**

Be sure to use the corresponding firmware/bootloader for the respective I/O module.

Before installing a firmware update, check the Release Notes for the firmware update to determine the most suitable I/O module firmware version for the SCADAPack firmware version and the functionality you are using.

Failure to follow these instructions can result in equipment damage.

Note: Outputs on the I/O module turn off during the firmware update and remain off until the update is complete. Updates can take up to several minutes.

To update the firmware on a 6601 I/O module

1. Use SCADAPack RemoteConnect to transfer the **.bin** file to the SCADAPack file system:
 - a. Connect SCADAPack RemoteConnect to the SCADAPack x70 device and go **Online**.
 - b. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Write File to Device**.
 - c. In the Write File to Device dialog, click **Browse** to navigate to the location of the file on your computer.
 - d. Click **Open**.
 - e. In the Write File to Device dialog, click **OK**.

2. Start the I/O firmware upgrade:

- a. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Execute Command**.
- b. Enter the command:

```
restart iofirm fw6601_Version.bin module_address
```

Where the *module_address* is the address of your I/O module. The I/O module address is a number from 0 to 15. The 6601 module located inside a SCADAPack 575 is always address 0.

Example: `restart iofirm fw6601_Version.bin 0`

WARNING

UNINTENDED EQUIPMENT OPERATION

If the firmware update was unsuccessful, the I/O module will remain in a state where it does not monitor or control any of the devices to which it is connected.

Carefully review the message indicating whether the firmware update was successful or unsuccessful. Unsuccessful firmware updates are also reported through the SCADAPack x70 device's System Status Code. See RemoteConnect Online Diagnostics mode. For a list of the possible status code values, see the System Status Codes topic.

Failure to follow these instructions can result in death or serious injury.

3. After the firmware update is complete, open a command line or Telnet session and use the VER command to display device version information.

If after updating the firmware and waiting several minutes, the I/O module is not detected or is in an inactive state, try to recover by updating the firmware again. If after updating the firmware a second time the I/O module is not detected, contact [Schneider Electric technical support](#) ⁽⁷⁾ for assistance.

13.3 Updating Bootloader Firmware

The bootloader firmware on 6000 series I/O modules can be updated locally or remotely, as described below.

I/O Module	Bootloader Filename
6601	bl6601.bin

By default, the bootloader file is stored in one of the following directories, where *x.xx.xx* represents the current version:

- 64-bit systems: C:\Program Files (x86)\Schneider Electric\RemoteConnect\Firmware\6601\x.xx.xx
- 32-bit systems: C:\Program Files\Schneider Electric\RemoteConnect\Firmware\6601\x.xx.xx

⚠ WARNING**LOSS OF CONTROL**

During a bootloader update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating the bootloader on the I/O module:

- Confirm that you are connected to the correct SCADAPack
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module.

Failure to follow these instructions can result in death or serious injury.

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Do not remove power from the SCADAPack during the bootloader update.

Do not disconnect the 6000 series I/O module from the SCADAPack during the bootloader update.

If power is interrupted for any reason during the bootloader update, contact Technical Support.

Failure to follow these instructions can result in death or serious injury.

NOTICE**LOSS OF CONTROL**

Do not change the name of the bootloader file. Changing the name will render the update unsuccessful.

Failure to follow these instructions can result in equipment damage.

NOTICE**INCOMPATIBLE FIRMWARE VERSIONS**

Before installing a bootloader update, check the Release Notes for the bootloader update to determine the most suitable I/O module bootloader version for the SCADAPack firmware version and the functionality you are using.

Failure to follow these instructions can result in equipment damage.

To update the bootloader on a 6601 I/O module

1. Use SCADAPack RemoteConnect to transfer the **.bin** file to the SCADAPack file system:
 - a. Connect SCADAPack RemoteConnect to the SCADAPack x70 device and go **Online**.

- b. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Write File to Device**.
 - c. In the Write File to Device dialog, click **Browse** to navigate to the location of the file on your computer.
 - d. Click **Open**.
 - e. In the Write File to Device dialog, click **OK**.
2. Start the I/O firmware upgrade:
- a. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Execute Command**.
 - b. Enter the command:

```
restart iofirm bl6601.bin module_address
```

where *module_address* is the I/O module address. The I/O module address is a number from 0 to 15. The 6601 module located inside a SCADAPack 575 is always address 0.

Example: `restart iofirm bl6601.bin 0`

WARNING

UNINTENDED EQUIPMENT OPERATION

If the bootloader update was unsuccessful, the I/O module will remain in a state where it does not monitor or control any of the devices to which it is connected.

Carefully review the message indicating whether the firmware update was successful or unsuccessful. Unsuccessful firmware updates are also reported through the SCADAPack x70 device's System Status Code. See RemoteConnect Online Diagnostics mode. For a list of the possible status code values, see the System Status Codes topic.

Failure to follow these instructions can result in death or serious injury.

If after updating the firmware and waiting several minutes, the I/O module is not detected or is in an inactive state, try to recover by updating the firmware again. If after updating the firmware a second time the I/O module is not detected, contact [Schneider Electric technical support](#) for assistance.

14 Specifications

Disclaimer: Schneider Electric reserves the right to change product specifications without notice. If you have questions about any of the specifications, contact [Technical Support](#)^[7].

For more information see

- [General](#)^[81]
- [Power Supply](#)^[82]
- [Communications](#)^[82]
- [Digital Inputs](#)^[83]
- [Counter Inputs](#)^[83]
- [Digital Outputs](#)^[84]
- [Analog Inputs](#)^[85]
- [Analog Outputs](#)^[86]

14.1 General

Item	Specification
Environment	-40...70 °C (-40...158 °F) operating temperature when the unit is mounted horizontally on a vertical surface -40...65 °C (-40...149 °F) operating temperature when the unit is mounted in any other position -40...85 °C (-40...185 °F) storage temperature 5...95% relative humidity, non-condensing Pollution Degree 2, Installation Category I, Indoor use
Elevation	3,000 m (9,842 ft)
Terminations	3.3...0.08 mm ² (12...28 AWG), solid or stranded
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Dimensions	151 mm (5.9 in) wide 182 mm (7.2 in) high 47 mm (1.9 in) deep
Mechanical Shock	IEC 61131-2 ½ sine, 15 ms, 15 g

Vibration	<p>IEC 61131-2</p> <p>5...8.4 Hz: Amplitude controlled, 7.0 mm (0.28 in) peak-to-peak</p> <p>8.4...150 Hz: Acceleration controlled, 1.0 g peak</p>
-----------	--

14.2 Power Supply

Item	Specification
Power requirements at 30 Vdc (from the SCADAPack)	1.1 W

14.3 Communications

Item	Specification
I/O bus	<p>SCADAPack 470, SCADAPack 570, and SCADAPack 574</p> <ul style="list-style-type: none"> • Maximum number of 6601 input output modules with optional analog outputs is 4 • Maximum number of 6602 HART modules with optional analog outputs is 1 • Maximum number of 6607 input output modules in the system is 4 <p>SCADAPack 474</p> <ul style="list-style-type: none"> • Maximum number of 6601 input output modules with optional analog outputs is 4 • Maximum number of 6602 HART modules with optional analog outputs is 1 • Maximum number of 6607 input output modules in the system is 3 <p>SCADAPack 575</p> <ul style="list-style-type: none"> • Maximum number of 6601 input output modules with optional analog outputs is 3 • Maximum number of 6602 HART modules with optional analog outputs is 1 • Maximum number of 6607 input output modules in the system is 4

14.4 Digital Inputs

Item	Specification
Quantity	16
Typical operating voltage	12 Vdc 24 Vdc
Turn-on voltage	Minimum: 9 Vdc
Turn-off voltage	Maximum: 4 Vdc
Over-voltage tolerance	36 Vdc sustained over-voltage without foreseeable damage
Input current	0.9...1.2 mA at 12 Vdc 2.1...2.4 mA at 24 Vdc
Reporting	1 ms timestamped Sequence of Event (SOE)
Status	Chatter filter detection when digital state changes faster than 25 Hz
Isolation	Isolation is in 2 groups of 8 Isolation from device logic and chassis 1000 Vac or 1500 Vdc

14.5 Counter Inputs

Item	Specification
Quantity	8
Electrical characteristics	Shared with digital input channels
Reporting	16-bit and 32-bit counters Deviation Timestamped events Polled, unsolicited reporting
Frequency	Up to 8 channels: DI 1 to 4: 0...1.5 kHz

	DI 5 to 8: 0...150 Hz
--	-----------------------

14.6 Digital Outputs

Item	Specification
Quantity	8
Type	<p>2 Form C single-pole double-throw (SPDT) relays available to the application</p> <p>Separate Normally Open/Normally Closed/Common</p> <p>6 Form A relays available to the application</p> <p>Normally Open, one Common</p>
Isolation	500 Vac minimum to device logic
Maximum switching voltage	30 Vdc or 25 Vac
Maximum switching load	<p>60 W or 50 VA per relay</p> <p>2 A per relay</p> <p>2 A per common on digital outputs 1-2</p> <p>12 A per common on digital outputs 3-8</p>
Status and reporting	<p>Individual relay pole feedback to software</p> <p>Output state poll</p>
Temperature de-rating	<p>Mounted horizontally on a vertical surface:</p> <ul style="list-style-type: none"> • 2 A maximum per relay at 60 °C (140 °F), de-rate by 0.1 A per 1 °C to 1 A maximum per relay at a maximum ambient temperature of 70 °C (158 °F) <p>Mounted in any other position:</p> <ul style="list-style-type: none"> • 2 A maximum per relay at 60 °C (140 °F), de-rate by 0.1 A per 1 °C to 1.5 A maximum per relay at a maximum ambient temperature of 65 °C (149 °F)
Controls	<p>Direct Operate</p> <p>Select Before Operate</p> <p>Trip/Close</p> <p>Latch</p>

	Pulse
--	-------

14.7 Analog Inputs

Item	Specification
Quantity	6
Type	Uni-polar, differential, voltage or current
Resolution (filtered)	24-bit conversion yields an effective 19 bits of resolution during filtered conversions 10 μ V on the 5 Vdc range 40 nA resolution on the 20 mA range
Resolution (fast)	24-bit conversion yields an effective 13 bits of resolution during unfiltered conversions. 0.6 mV resolution on the 5 Vdc range 2.4 μ A resolution on the 20 mA range
Accuracy	\pm 0.1% of full scale at 25 °C (77 °F) \pm 0.2% over-temperature range
Isolation	250 Vac isolation between channels and from device logic and chassis
Input resistance	250 ohms in current configurations 800 kohms in voltage configurations
Ranges	Input Type: 4...20 mA, 0...20 mA, 1...5 Vdc, or 0...5 Vdc Under-range: 4...20 mA measures to 0 mA Individual inputs can be configured for current or voltage operation using DIP switches. Calibration in voltage mode 1...5 Vdc is available as an option.
Sampling rate	Filtered: 500 ms per 6 channels Fast: 30 ms per 6 channels
Common mode rejection	80 dB
Normal mode rejection	Filtered: 86 dB (50/60 Hz) Fast: Not applicable

Reporting	Deviation 8 alert limits Under- and over range events Quality flags Integer/floating point Timestamped events Polled, unsolicited reporting on deviation and per alert limit
Timestamping	30 ms time-series samples
Cable Length	Maximum: 30 m (98.4 ft)

14.8 Analog Outputs

Item	Specification
Quantity	2 with optional analog outputs
Type	Uni-polar
Resolution	12-bit over 0...20 mA range
Accuracy	$\pm 0.15\%$ at 25 °C (77 °F) $\pm 0.35\%$ of full scale over-temperature range
Response time	Less than 10 μ s for 10% to 90% signal change
Power supply (external)	12...30 Vdc
Power supply cable length	Maximum: 30 m (98.4 ft)
Power (current) requirements	10 mA plus up to 20 mA per output
Isolation	Transformer 500 Vdc maximum to device logic and chassis
Range	0...20 mA 4...20 mA Voltage output may be accomplished with external precision resistor

Status and reporting	Power missing Open loop detected Values out of range ADC reference check
Controls	Direct Operate Select Before Operate
Load range	12 Vdc: 0...475 ohms 24 Vdc: 0...1075 ohms 30 Vdc: 250...1375 ohms

15 Standards and Certifications

Introduction

SCADAPack x70 devices are designed to comply with the relevant standards and rules for electrical equipment in an industrial automation environment.

Industrial Standards

Requirements specific to the PAC functional characteristics, immunity, robustness, and safety:

- IEC/EN 61131-2
- CSA 22.2 No. 61010-1-12 and CSA 22.2 No. 61010-2-201
- UL 61010-1 and UL 61010-2-201

CE Marking Compliance

- For the latest information regarding product compliance with European Directives for CE marking, refer to the EU Declaration of Conformity issued for your product at www.se.com
- For the latest information regarding product compliance with RoHS, WEEE directives and REACH regulation, visit the Schneider Electric **Check a Product** portal at www.reach.schneider-electric.com

Installation in Classified Ex Area

- Hazardous locations Class I, Division 2, groups A, B, C, and D and Class I, Zone 2 according to CSA C22.2 No. 213, CSA C22.2 60079-0, CSA C22.2 60079-15, ANSI/ISA 60079-0, ANSI/ISA 60079-15, ANSI/ISA 12.12.01, FM 3600 and FM 3611
- ATEX (European directive 2014/34/EU) in defined atmosphere Zone 2 according to EN 60079-0 and EN 60079-15
- IECEx in defined atmosphere Zone 2 according to IEC 60079-0 and IEC 60079-15

Specific Countries

For Australia and New Zealand: ACMA requirements for RCM marking

For United States: FCC Part 15 Subpart B Class A

