SCADAPack

5103 Power Supply Module

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Table of Contents

1 Legal Information 5

2 Technical Support 6

3 Safety Information 7

4 About the Book 10

5 About the 5103 Power Supply Module 13

6 Cybersecurity 15

7 Hardware Overview 17

7.1 Input Power 18

7.2 Battery Charger Operation 18

7.3 Outputs 18

7.4 Output Capability 19

7.5 Protection Summary 19

8 Installation 22

8.1 ATEX and IECEx Requirements 22

8.2 Mounting the 5103 Power Supply Module 22

8.3 Layout Guidelines 27

8.4 Connecting I/O Modules 28

8.4.1 Precautions 29

8.4.2 Cabling Guidance 30

8.4.3 Attaching Intermodule Cables 31

9 Field Wiring 34

9.1 Wiring Screw-Termination Connectors 35

9.2 Termination Connectors 37

10 Diagnostics 39

10.1 LEDs 39

10.2 Fuses 39

10.3 Troubleshooting 40

11 Maintenance 41

11.1 Calibrating the 5103 Power Supply Module 41
12 Specifications **42**
13 Standards and Certifications **44**

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.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

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? • Toll free within North America: 1-888-226-6876 • Direct Worldwide: +1-613-591-1943

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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? • 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 5103 power supply module. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5103 power supply module, including detailed hardware specifications
- Installation and wiring for the 5103 power supply module
- Diagnostics capabilities on the 5103 power supply module
- Maintenance recommendations for the 5103 power supply 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	• 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	• Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	• Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	• Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	• Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	• Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	• 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	• Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	• USB, serial and IP communications

Reference Manuals	Communication Interfaces Technical Reference	• Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	• The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	• DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	• 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	• The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	• Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	• Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	• Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 5103 Power Supply Module

The Model 5103 power supply provides operating power for SCADAPack devices and I/O and modem modules. The 5 Vdc output powers the modules. The 24 Vdc output powers analog current loops.

The Model 5103 power supply provides a battery charger. The battery charger operates when a suitable voltage is applied to the main power. The charger output trickle charges a 12 Vdc gelled electrolyte battery. If the main power is unavailable the power supply operates from the battery. This feature keeps your system up and running during power outages including loop powered instrumentation such as pressure and level transmitters.

The Model 5103 power supply uses cool running, transformer isolated, switch-mode technology for high efficiency and reliability. The 5 Vdc and 24 Vdc outputs are isolated from the input and from each other. The two outputs on the SCADAPack are isolated so that the controller module and I/O module logic are not affected by analog current loop electrical noise, static discharge or grounding.

Model 5103 power supplies can be cascaded to provide the necessary power capacity for any size of system.

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 31.

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 34.

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

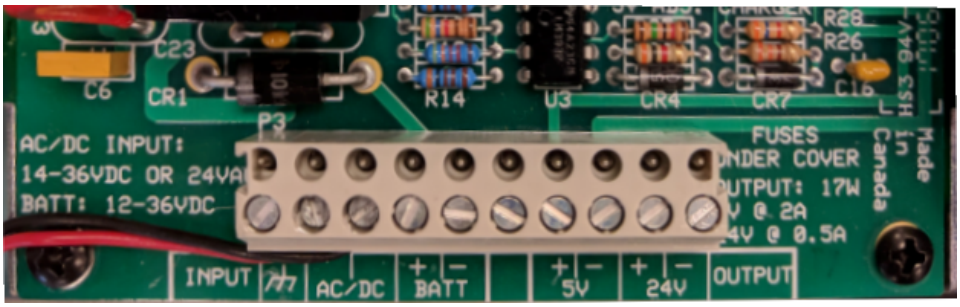
FBI Cyber Crime
https://www.fbi.gov/investigate/cyber

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 show the location of the inputs and outputs on the device.



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 42.

For more information see:

- Input Power 18

- Battery Charger Operation 18
- Outputs 18
- Output Capability 19
- Protection Summary 19

7.1 Input Power

⚠ WARNING

HAZARD OF ELECTRIC SHOCK

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.

The model 5103 power supply accepts AC or DC input power. Connect a power source to the input power in any of the following ways.

- 16...24 Vac source connected to the AC/DC input. See Specifications 42 for additional limits.
- 14...36 Vdc source connected to the AC/DC input. The polarity of the source does not matter. See Specifications 42 for additional limits.
- 12...36 Vdc source connected to the BATT input. Observe polarity on the BATT input. See Specifications 42 for additional limits.

The BATT input has a lower input voltage requirement than the AC/DC input. It is recommended when the input is marginal, as is the case with battery operation. It is also recommended for solar powered applications.

The AC transformer is a class 2 (current limiting) device. It does not require a fuse. If the input source is not class 2, then a suitable fuse is required.

7.2 Battery Charger Operation

The battery charger circuit provides a constant voltage, current limited power source at the BATT input power terminals. The charger operates when an AC or DC voltage is applied to the AC/DC terminals. See Specifications 42 for limits on this voltage. A voltage suitable for charging a 12 Vdc Gel-Cell battery is present at the BATT terminals. When power is removed from the AC/DC terminals, the 5103 will start operating from the voltage present at the BATT input.

7.3 Outputs

The model 5103 power supply has two outputs:

- 5 Vdc at 2 A
- 24 Vdc at 0.5 A

The outputs are isolated from the input power and from each other. Each output is fused and LEDs indicate the status of the output power. See Maintenance 41.

The 5 Vdc output is available on both the terminal block and the right-hand side I/O bus connector. The I/O bus connector distributes the 5 Vdc output to other modules. The 5 Vdc output on the terminal block is available to power devices that require 5 Vdc.

Exercise care when using the 5 Vdc output with an external device. The controller and I/O modules use this supply. Keep the supply free of noise.

The 24 Vdc output is available on the terminal block. Some I/O modules require a 24 Vdc supply from this output. It is also available to power devices that require a 24 Vdc supply, such as 20 mA loop powered transmitters.

7.4 Output Capability

The 5103 power supply has two outputs capable of delivering 17 W in total. The maximum outputs of 5 Vdc at 2 A and 24 Vdc at 0.5 A are used when calculating the power output. The following examples show how this output power can be distributed between the 5 Vdc and 24 Vdc outputs.

- If an application requires 0.5 A from the 24 Vdc supply then 12 W (24 Vdc x 0.5 A) is subtracted from 17 W leaving 5 W available on the 5 Vdc output. The maximum current available from the 5 Vdc output is 1 A (5 W / 5 Vdc).
- If an application requires 2 A from the 5 Vdc supply then 10 W (5 Vdc x 2 A) is subtracted from 17 W leaving 7 W available on the 24 Vdc output. The maximum current available from the 24 Vdc output is 0.29 A (7 W / 24 Vdc).

7.5 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

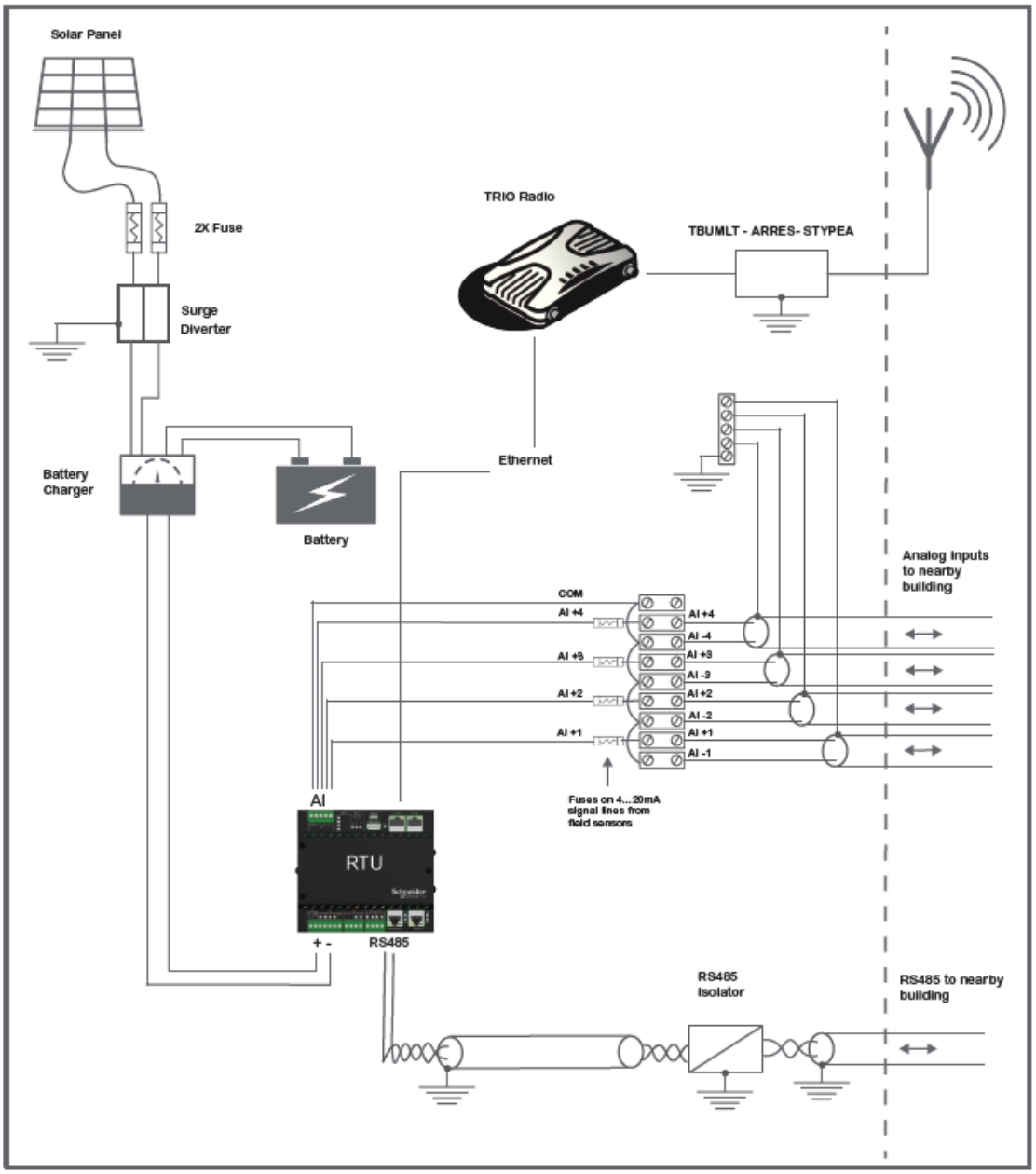
POWER SUPPLY LOSS OF FUNCTION

- 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

Installing the 5103 power supply module requires mounting the power supply on the 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and connecting the power supply to the system I/O Bus.

The following sections describe specific aspects of installing the power supply module.

For more information, see:

- ATEX and IECEx Requirements 22
- Mounting the 5103 Power Supply Module 22
- Layout Guidelines 27
- Connecting Modules 28

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

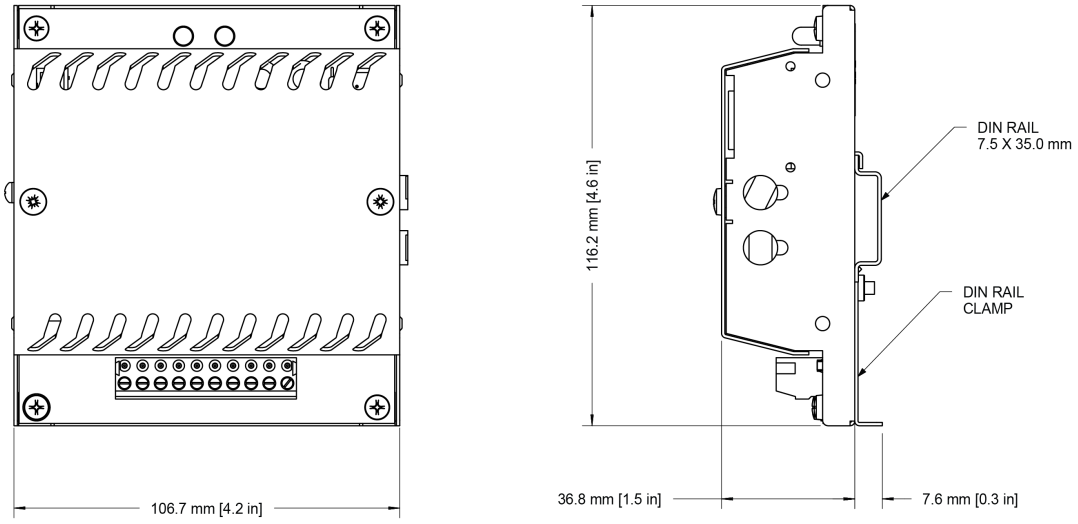
UNINTENDED EQUIPMENT OPERATION

- Install this equipment in an enclosure certified for use, providing a degree of protection of IP54 or better.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.

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

8.2 Mounting the 5103 Power Supply Module

The 5103 power supply module is mounted on the 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to the system I/O Bus.



Follow these guidelines for mounting modules:

- DIN rails install horizontally or vertically. Where possible install DIN rails horizontally. Modules are easier to install on horizontal rails. Cooling is optimal when installed horizontally.
- The model DIN17 rail holds four modules. It is 432 mm (17 in) long. If you use another length of DIN rail, trim it to a multiple of the module width.
- Mount modules tightly together on the rail, to avoid straining the intermodule cable. The spacing dimples on the sides of the modules should touch.

⚠ WARNING

ELECTRICAL HAZARD

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

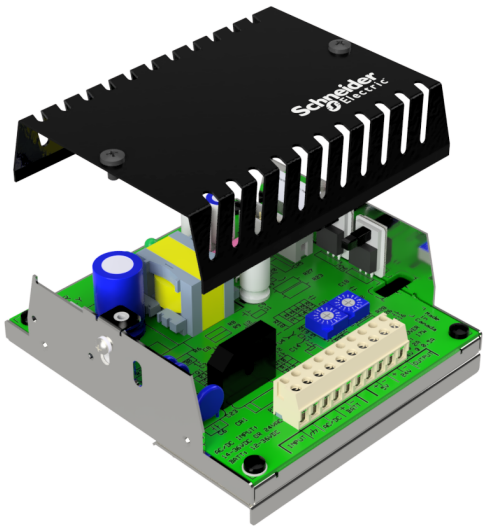
Failure to follow these instructions can result in death or serious injury.

While the size and shape of your device may differ and the color of the connectors may be different from the illustrations below, the procedure for installing the module is the same.

To mount the module on a DIN rail

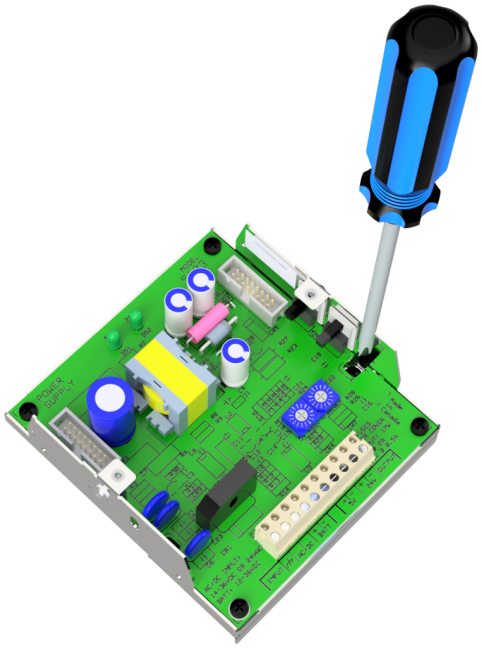
1. Unscrew the two cover screws on the module and remove the cover.

   These screws are permanently attached to the cover for ease of handling.

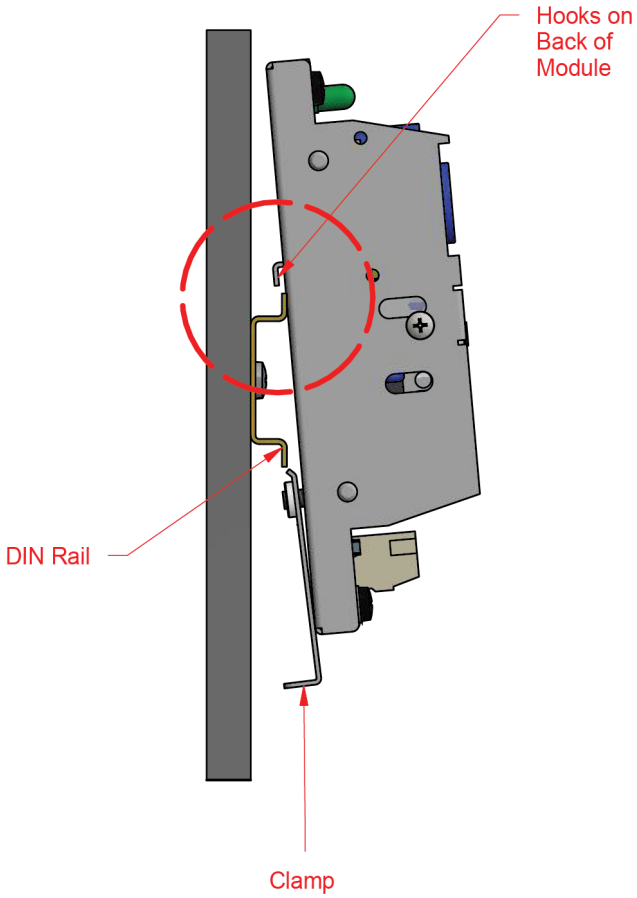


2. Loosen the 2 clamp screws on either side of the circuit board until there is a 1.5 mm (1/16 in) clearance between the back of the module and the clamp.

   The clamp screws are accessible through notches on either side of the circuit board.

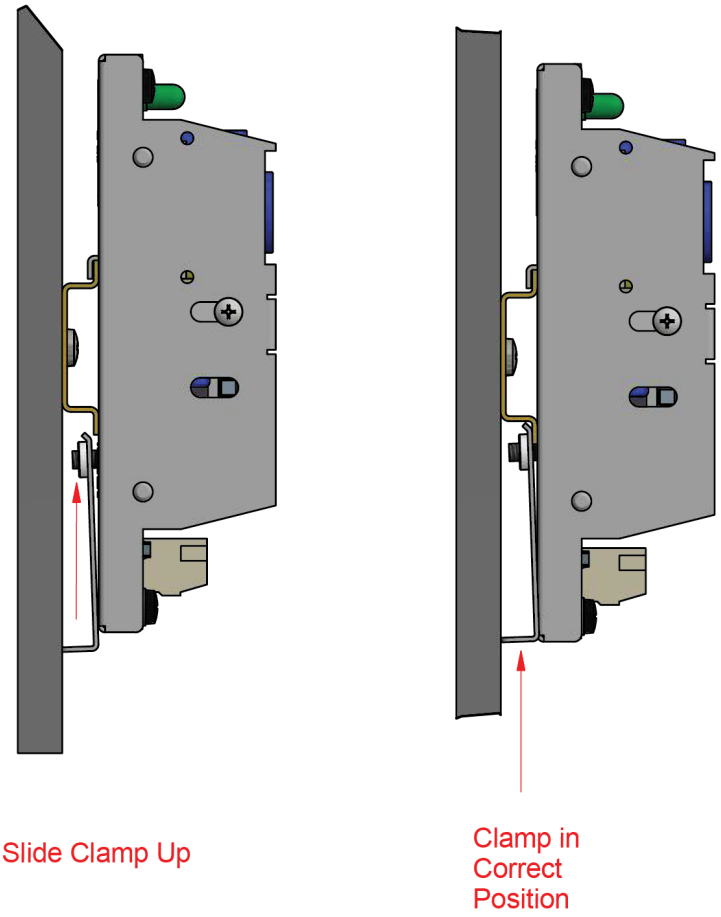


3. Slide the clamp out past the bottom of the module.
4. Position the 2 hooks on the back of the module over the top lip of the DIN rail.

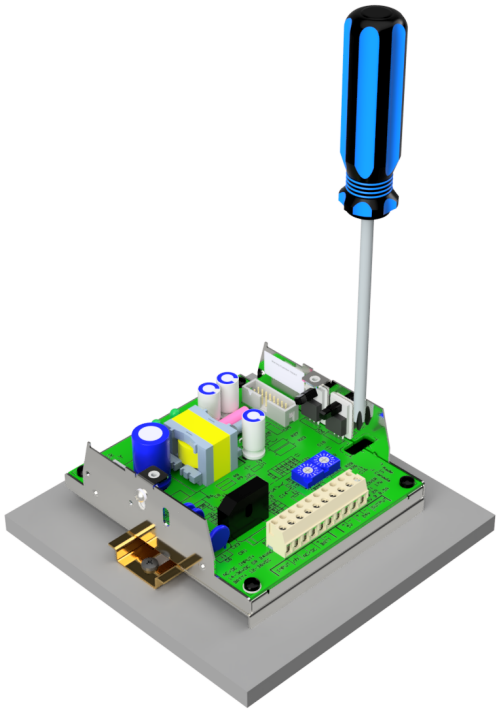


5. Slide the clamp upward until it meets the lower lip of the rail.

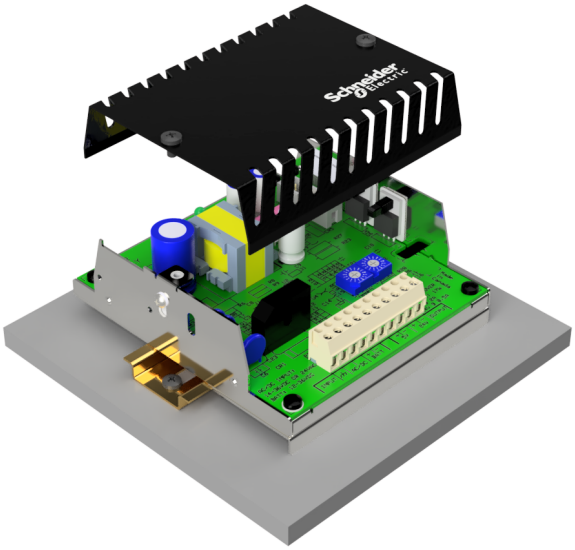
   The bottom of the clamp will be flush with the bottom of the module.



6. Tighten the clamp screws.



7. Replace the cover.



If you route an intermodule cable (IMC) behind the module, check that there is adequate clearance between the module and the hardware used to mount the DIN rails so that the cable doesn't get pinched in the clamp.

8.3 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

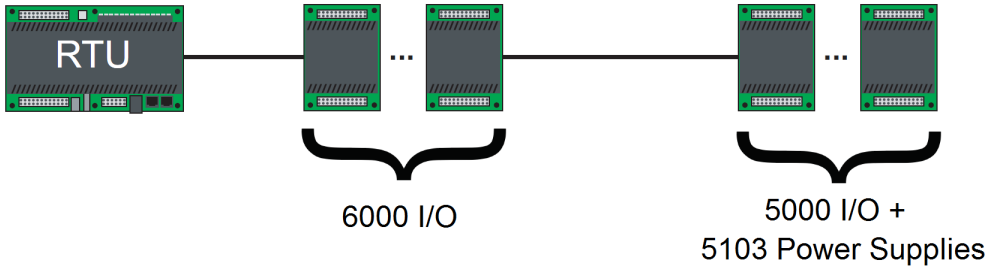
keep in mind when adding modules to your SCADAPack x70 control system.

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



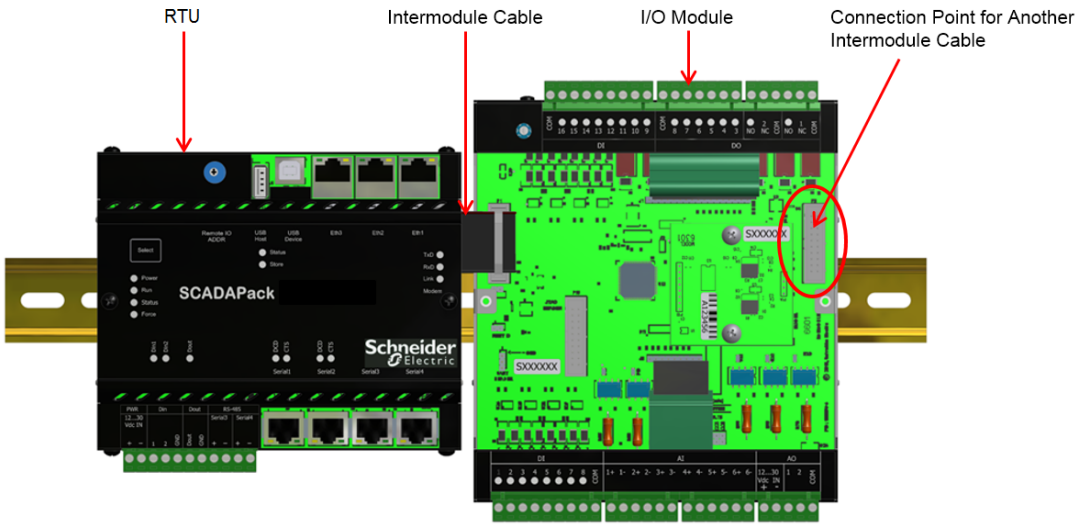
8.4 Connecting I/O Modules

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 30 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 31, read the Precautions 29 and the Cabling Guidance 30.

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 42 for details.
- Confirm that the intermodule cables you are are less than the maximum total cable length. See Maximum Intermodule Cable Length 31.
- 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.

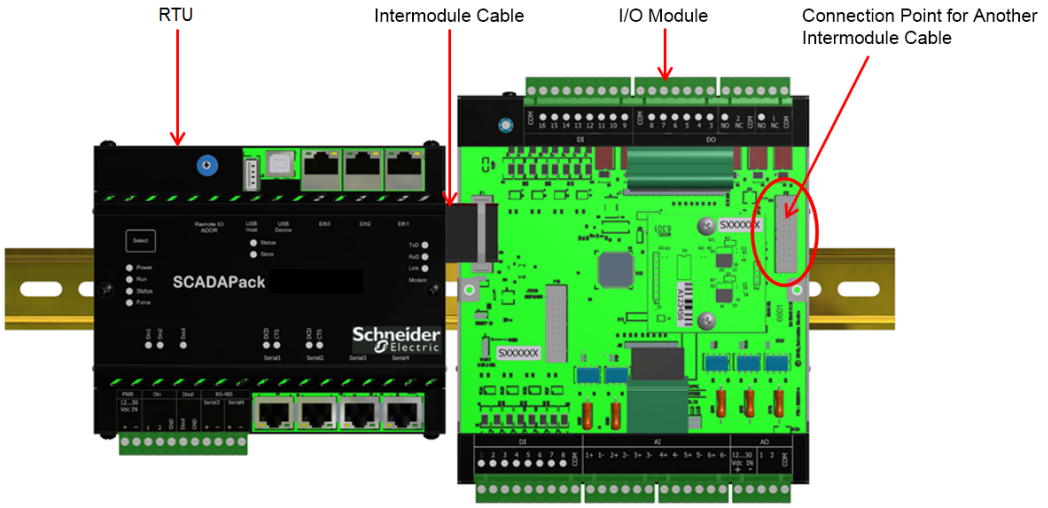
To attach intermodule cables

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 Field Wiring

Field wiring attaches to the field wiring terminal blocks on each module.

⚠ 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 input or output. See the Specifications topic for the maximum voltage.

Failure to follow these instructions can result in equipment damage.

Field wiring guidelines

Follow these guidelines when planning for field wiring:

- When modules are installed in a Class I Division 2 area, power, input and output (I/O) wiring needs to be in accordance with Class I, Division 2 wiring methods (article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction.
- Arrange the modules so field wiring is accessible.
- Field wiring termination connectors are removable. Leave enough slack in the wiring for the connector to be removed.
- Arrange the modules and wiring so the status LEDs are visible.
- Keep modules switching loads away from communication controllers and analog input modules.
- Route low-level signals separate from high-level and AC power signals.
- No bonding is usually required by Electrical Safety Standards between modules carrying primary power and AC ground, since these modules are certified as components to be installed within an enclosure thereby limiting access by unauthorized personnel. Consult individual module manuals for special bonding instructions should they be required.
- Consult individual module manuals for the connection of external fuses should they be required, in particular by primary voltage carrying modules. Install where required.

The 5103 power supply module accommodates AC or DC inputs. Observe signal polarity when using DC inputs. Connect the positive signal to the input. Connect the negative signal to the common return.

For more information see:

- Wiring Screw-Termination Connectors 35
- Termination Connectors 37

9.1 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...0.33 mm^2 (12...22 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

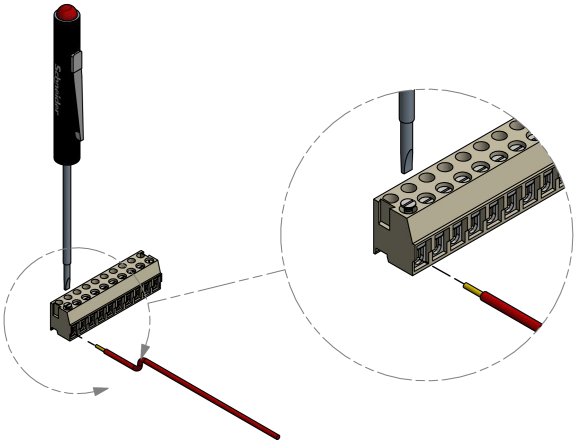
ELECTRICAL HAZARD

Remove power from all modules and devices before servicing.

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

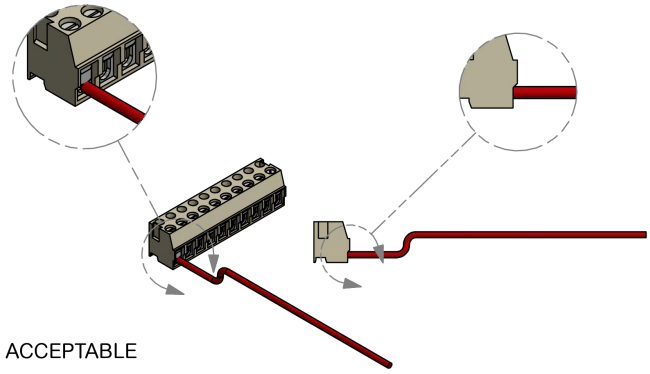
To wire a connector

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

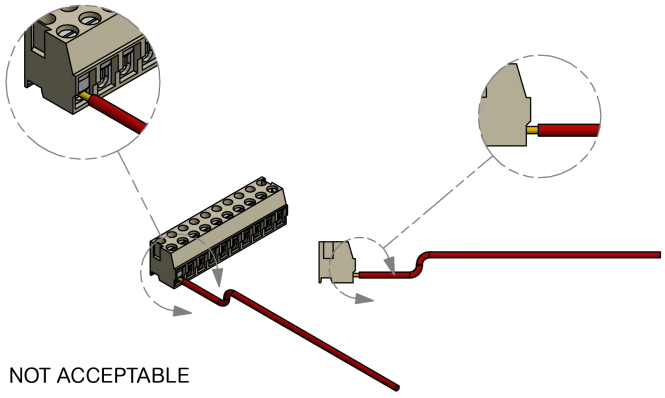


2. Insert the stripped wire into the connector so that the bared wire is located under the screw.

   Verify that the bared wire is placed fully within the connector, as illustrated below.



ACCEPTABLE



NOT ACCEPTABLE

3. Apply 0.68 N•m (6 lb-in) torque to tighten the screw so the wire is held firmly in place.

9.2 Termination Connectors

Field wiring for the model 5103 power supply terminates on a 10 pole connector. The table below lists the termination connector.

Terminal	Function
1	Chassis ground
2 and 3	Input power (see Input Power 18)
4 and 5	Battery charger (see Battery Charger Operation 18)
6	No connection
7 and 8	5 Vdc output (see Outputs 18)
9 and 10	24 Vdc output (see Outputs 18)

Voltage referred to as Vrms (or Vac on some products) indicates AC power. Voltage referred to as Vdc indicates DC power.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK

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.

Controller, modem and I/O modules use screw termination style connectors for termination of field wiring. They accommodate solid or stranded wires from 3.3...0.33 mm^2 (12...22 AWG).

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

Remove power before servicing unit.

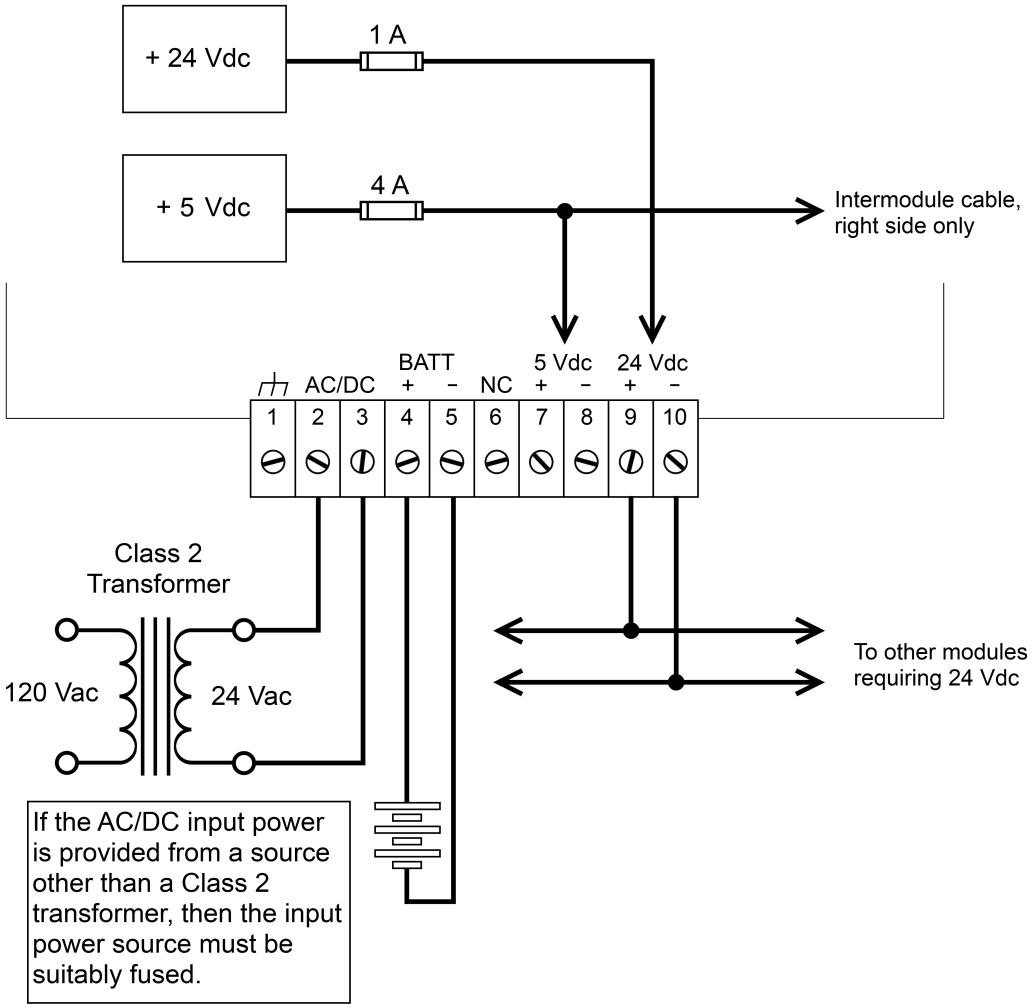
To remove the connector

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

To install the connector

1. Line up the pins on the module with the holes in the connector aligning the pins properly.
2. Push the connector onto the pins while applying even pressure to both ends on the connector.

The following figure shows a typical input power wiring and battery connection.



10 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 39
- Fuses 39
- Troubleshooting 40

10.1 LEDs

There are two green LEDs on the top of the module. They indicate the state of the 5 Vdc and 24 Vdc power supplies. The LEDs are off when the fuse is blown and when the power supply is not working.

The power supplies LEDs are powered directly by the supply. They are not affected by the LED power signal on the I/O bus.

10.2 Fuses

Picofuse type fuses are used on the 5 Vdc and 24 Vdc power supplies. The fuses are mounted on the circuit board under the cover. An ohmmeter is required to determine if picofuses are blown.

⚠ WARNING

RISK OF EXPLOSION

Before replacing the fuse, verify that the area is non-hazardous and disconnect power.

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

Before replacing the fuse assess the impact that disconnecting power may have on other devices.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Evaluate the operational state of the equipment connected to this module.

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

Replace a blown fuse with a fuse of the same rating. Under no circumstances should a fuse be bypassed or replaced with a fuse of a higher rating.

⚠ WARNING

UNEXPECTED EQUIPMENT OPERATION

Replace the fuse with a fuse of the same rating.

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

Investigate the cause of the blown fuse before replacement. Common causes of blown fuse are wiring and excessive input voltages.

A 4 A picofuse (F1) is used to fuse the 5 Vdc power supply. Replace this fuse only with Littelfuse part LF251004. Replacement fuses are available. Order part TBUM297260.

A 1 A picofuse (F2) is used to fuse the 24 Vdc power supply. Replace this fuse only with Littelfuse part LF251001. Replacement fuses are available. Order part TBUM297256.

Picofuses are formed and trimmed to size before they are installed. Form the fuse leads on 0.5 inch (12.5 mm) centers. Trim the leads 6 mm (0.25 inches) from the bend.

10.3 Troubleshooting

Condition	Action
Both the 5 Vdc and 24 Vdc LEDs are off	Check the input power and input power wiring Check the 5 Vdc fuse Check the 24 Vdc fuse If operating from the BATT input, check that the input voltage exceeds the turn on voltage
The 5 Vdc LED only is off	Check the 5 Vdc fuse Check inter-module cables connecting the power supply with other modules Check devices powered from the 5 Vdc output
The 24 Vdc LED only is off	Check the 24 Vdc fuse Check devices powered from the 24 Vdc output

11 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Technical Support 6 for more information and instructions for returning the module for repair.

For more information on calibrating, see Calibrating the 5103 Power Supply Module 41.

11.1 Calibrating the 5103 Power Supply Module

The 5103 module is calibrated and burned in at the factory. It does not require periodic calibration. Calibration may be necessary if the module has been repaired as the result of damage.

Two outputs require calibration: the 5 Vdc output and the battery charger output.

To calibrate the 5 Vdc output

1. Locate the 5 Vdc ADJ. potentiometer (R19).
2. Adjust the output to 5.15 Vdc.

To calibrate the battery charger output

1. Locate the CHARGER potentiometer (R24).
2. Place a 10 W load on the battery charger output.
3. Adjust the output to 13.5 Vdc.

12 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* 6.

Item	Specification
AC/DC Input	16…24 Vac for 5/24 Vdc outputs operational 24 Vac required for battery charging 14.5+/-0.5 Vdc for 5/24 Vdc outputs operational 20 Vdc required for battery charging
DC/Battery Input	Turn on at 11.5 +/– 0.3 Vdc Turn off at 10.5 +/– 0.5 Vdc Maximum input is 36 Vdc
Input Power	35 VA maximum at 24 Vac 1.9 A at 13.5 Vdc
Outputs	5 Vdc at 2.0 A 24 Vdc at 0.5 A 17 W total available from the two outputs 11…14 Vdc battery charger at 200 mA (factory adjusted to 13.5 Vdc for gelled electrolyte lead/acid battery)
Mode	Isolated switch-mode, 30 kHz switch frequency
Line regulation	< 1% over operating range
Load Regulation	5 Vdc output: 5.15 Vdc +/– 1% over operating range 24 Vdc output: +/– 17%
Output Ripple	5 Vdc output: < 10 mVdc at 20 °C (68 °F) 24 Vdc output: < 50 mVdc at 20 °C (68 °F)
Visual Indicators	5 Vdc and 24 Vdc green LEDs show power status
Terminations	10 pole, removable terminal block 3.3…0.33 mm^2 (12…22 AWG) 15 A contacts

Dimensions	108 mm (4.25 in) wide 118 mm (4.625 in) high 44 mm (1.75 in) deep
Mounting	7.5 x 35 mm (0.3 x 1.4 in) DIN rail
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Environment	5…95% relative humidity, non-condensing -40…60 °C (-40…140 °F)

13 Standards and Certifications

Safety	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations. Temperature Code T4 at 60 °C (140 °F) ambient. UL Listed to the following standards: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations • CSA Std. C22.2 No. 142-M1987 - Process Control Equipment
Digital Emissions	FCC Part 15, Subpart B, Class A Verification EN61000-6-4: Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment RCM compliance
Immunity	EN61000-6-2: Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments
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

SCADAPack

5304 Analog Output Module

Version: 3.9.1

Date: July 2021

Document Number: 250506

Table of Contents

1 Legal Information 5

2 Technical Support 6

3 Safety Information 7

4 About the Book 10

5 About the 5304 Analog Output Module 13

6 Cybersecurity 14

7 Hardware Overview 16

7.1 Analog Outputs 17

7.1.1 Current and Voltage Outputs 19

7.1.2 Range and Scaling 22

7.2 Protection Summary 22

8 Installation 25

8.1 ATEX and IECEx Requirements 25

8.2 Mounting the 5304 Analog Output Module 26

8.3 Power Supply Requirements 31

8.4 Layout Guidelines 32

8.5 Connecting I/O Modules 32

8.5.1 Precautions 33

8.5.2 Cabling Guidance 34

8.5.3 Attaching Intermodule Cables 36

9 Addressing 39

9.1 Addressing Rules 39

9.2 Setting the I/O Module Address 40

10 Field Wiring 42

10.1 Wiring Screw-Termination Connectors 43

10.2 Analog Output Wiring 45

11 Configuration 46

12 Diagnostics 47

12.1 LEDs 47
12.2 Analog Outputs 47
13 Maintenance 48
13.1 Calibration 48
13.1.1 Current Outputs Calibration 49
13.1.2 5 Vdc Outputs Calibration 49
13.1.3 10 Vdc Outputs Calibration 50
14 Specifications 51
14.1 General 51
14.2 Power Supply 51
14.3 Analog Outputs 52
15 Standards and Certifications 54

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? • 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? • 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 5304 analog output module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5304 analog output module, including detailed hardware specifications
- Installation and wiring for the 5304 analog output module
- Diagnostics capabilities on the 5304 analog output module
- Maintenance recommendations for the 5304 analog 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	• 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	• Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	• Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	• Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	• Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	• Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	• 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	• Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	• USB, serial and IP communications

Reference Manuals	Communication Interfaces Technical Reference	• Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	• The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	• DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	• 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	• The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	• Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	• Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	• Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 5304 Analog Output Module

The 5304 analog output module increases the SCADAPack I/O capacity by providing:

- 4 analog outputs

You can connect up to 15 5304 analog output modules to the I/O bus, for a total of 60 analog outputs.

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 36.

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 42.

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

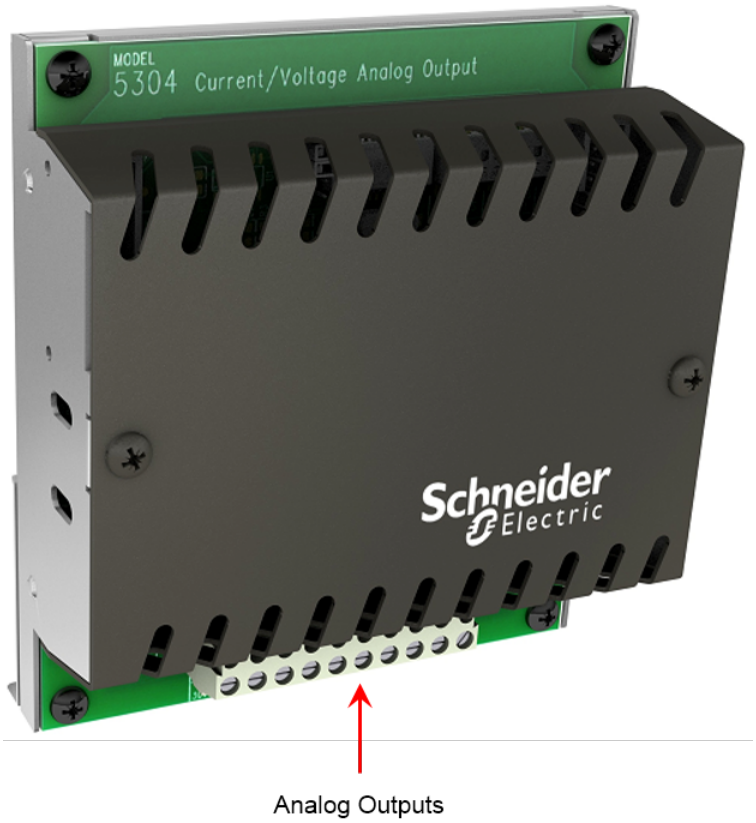
FBI Cyber Crime
https://www.fbi.gov/investigate/cyber

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 location of the analog outputs on the device.



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 51.

For more information see:

- Analog Outputs 17
- Protection Summary 22

7.1 Analog Outputs

The analog outputs can control valve actuators, motor speed controllers, temperature controllers or any device requiring an analog control signal.

⚠ 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.

The 5304 analog output module generates either current or voltage outputs.

- In current mode, it can generate either 0...20 mA outputs or 4...20 mA outputs. A configuration switch selects the output range.
- In voltage mode, the outputs can be either 0...5 Vdc or 0...10 Vdc. The configuration switch will then select the ranges 1...5 Vdc and 2...10 Vdc respectively.

The output resolution is 12 bits. Outputs are isolated from logic circuits, for protection against voltage transients and high common mode voltages.

The 5304 analog output module requires an external 12...24 Vdc power supply to power the output circuitry.

Use the SCADAPack RemoteConnect configuration software to configure each analog output.

For more information see:

- Current and Voltage Outputs 19
- Range and Scaling 22
- Wiring Screw-Termination Connectors 43

7.1.1 Current and Voltage Outputs

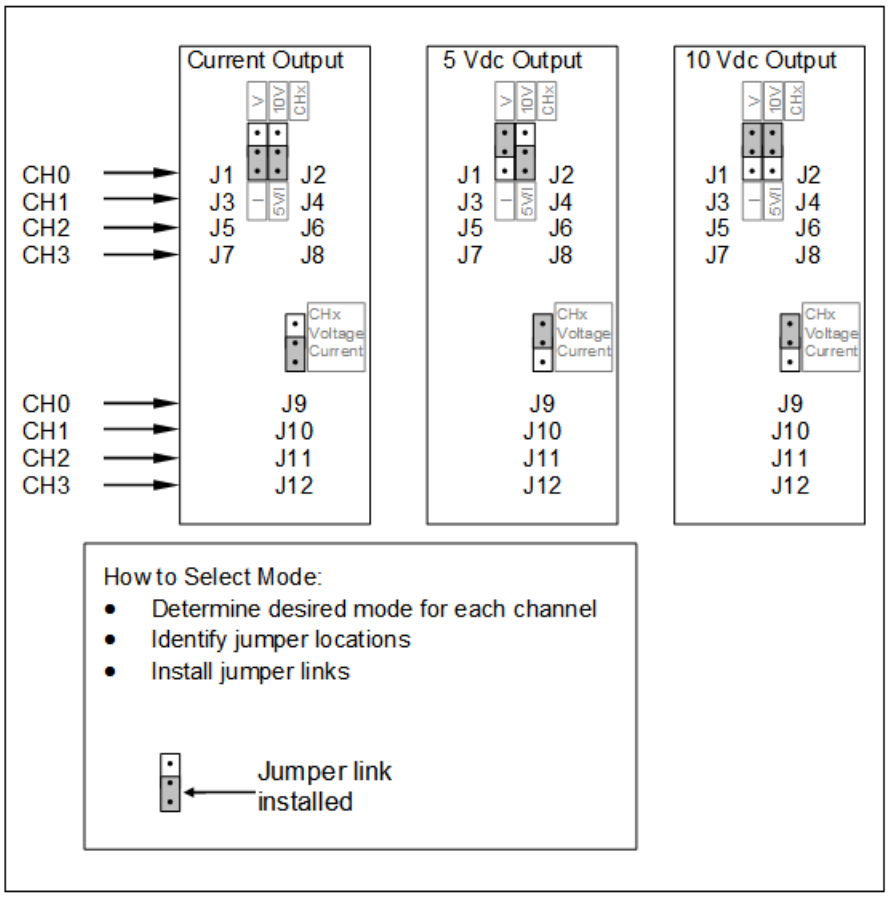
The outputs are calibrated at the factory in either current or voltage mode, depending on module version. An output requires re-calibration upon changing its operating mode. See the Calibration 48 section for details.

Each output is independently configurable as either a current or a voltage mode output. In voltage mode, two ranges are available: 0...5 Vdc and 0...10 Vdc full-scale.

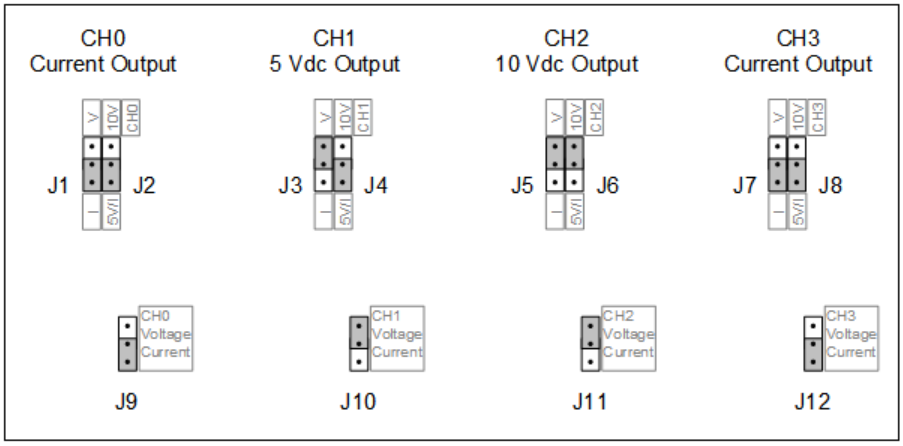
Three jumper links per channel are used to select the operating mode:

- J1, J2, J9 for Channel 0
- J3, J4, J10 for Channel 1
- J5, J6, J11 for Channel 2
- J7, J8, J12 for Channel 3

The valid configurations are shown below.



The example below shows a mixed configuration.



Output offset selection

The 5304 analog output module can be configured to output a 0...20 mA or 4...20 mA signal when operating in current mode.

When configured for voltage mode, the available ranges are 0...5 Vdc or 1...5 Vdc and 0...10 Vdc or 2...10 Vdc respectively, depending on the mode selected.

The offset is set independently for each of the four channels.

To select the 0...20 mA/ 0...5 Vdc/ 0...10 Vdc range

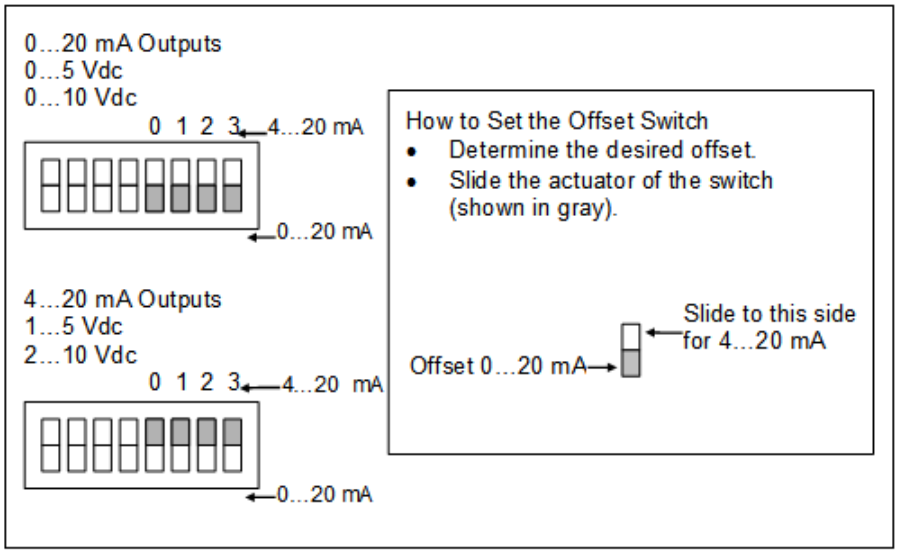
- Slide the actuator of the offset switch to the position labeled 0...20 mA.

To select the 4...20 mA/ 1...5 Vdc/ 2...10 Vdc range

- Slide the actuator of the offset switch to the position labeled 4...20 mA.

  The outputs of the module will be 0 mA or 0 Vdc during a system reset, regardless of the offset setting. When the system reset is over, the outputs will go to 0 mA/0 Vdc/0 Vdc or 4 mA/1 Vdc/2 Vdc, as configured by the mode and offset settings.

The switch setting for the output offset is shown below.



7.1.2 Range and Scaling

The 5304 analog output module has a 12-bit, unipolar, digital-to-analog converter (DAC). Using DIP switches, as described in the Current and Voltage Outputs 19 section, each channel on the analog output module can be configured for one of the following output ranges:

- 0...20 mA
- 4...20 mA
- 0...5 Vdc
- 1...5 Vdc
- 0...10 Vdc
- 2...10 Vdc

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

Analog output points for the 5304 analog output module are added to the SCADAPack configuration using the SCADAPack RemoteConnect configuration software. The **Raw Minimum to Raw Maximum** and **Engineering Minimum to Engineering Maximum** parameters are used for integer and engineering scaling, respectively.

7.2 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

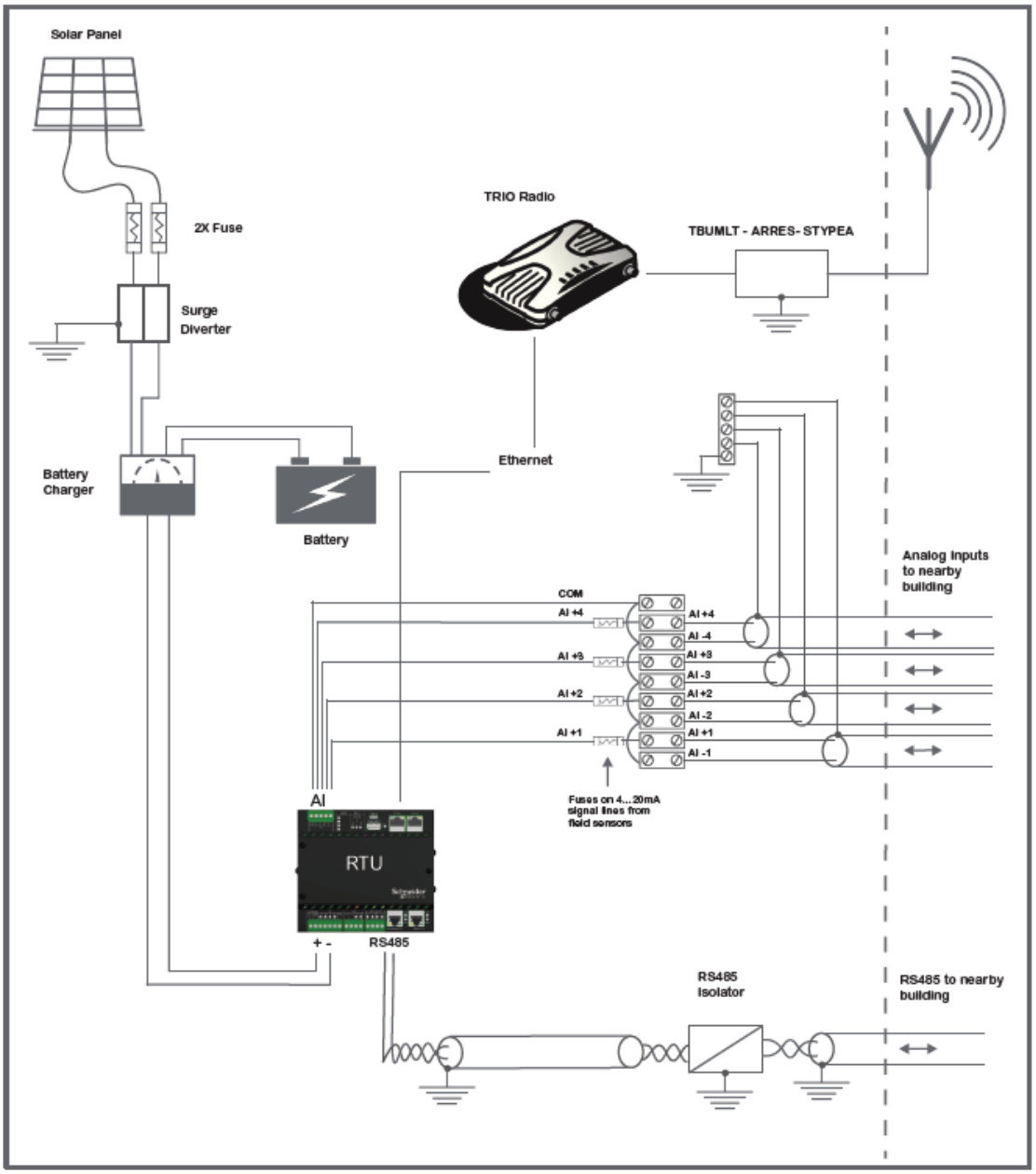
POWER SUPPLY LOSS OF FUNCTION

- 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 25
- Mounting the 5304 Analog Output Module 26
- Power Supply Requirements 31
- Layout Guidelines 32
- Connecting I/O Modules 32

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

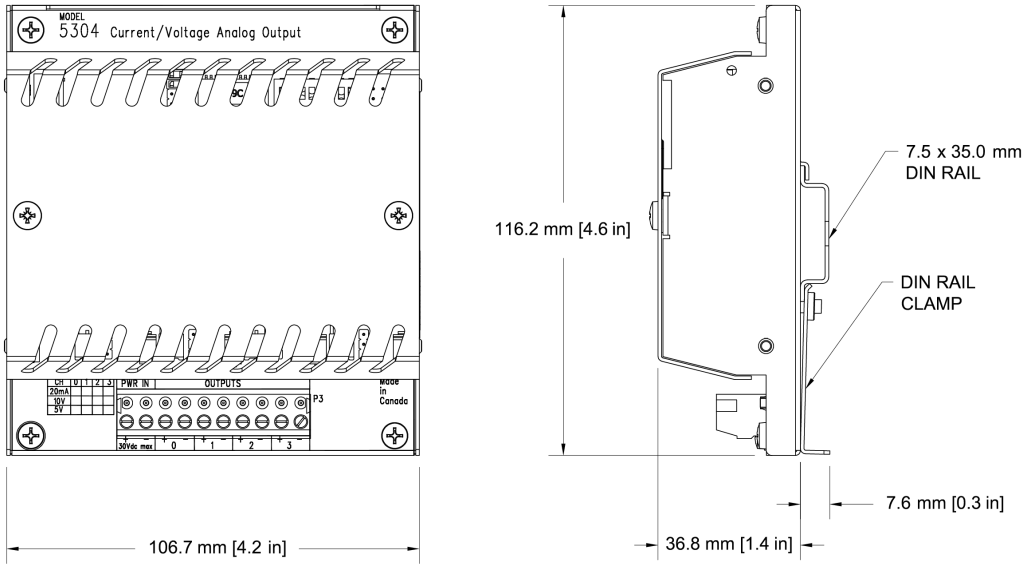
- Install this equipment in an enclosure certified for use, providing a degree of protection of IP54 or better.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.

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

8.2 Mounting the 5304 Analog Output Module

The 5304 analog output module is mounted on the 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to the system I/O Bus.

The figure below shows the module dimensions.



Follow these guidelines for mounting modules:

- DIN rails install horizontally or vertically. Where possible install DIN rails horizontally. Modules are easier to install on horizontal rails. Cooling is optimal when installed horizontally.
- The model DIN17 rail holds four modules. It is 432 mm (17 in) long. If you use another length of DIN rail, trim it to a multiple of the module width.
- Mount modules tightly together on the rail, to avoid straining the intermodule cable. The spacing dimples on the sides of the modules should touch.

⚠ WARNING

ELECTRICAL HAZARD

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

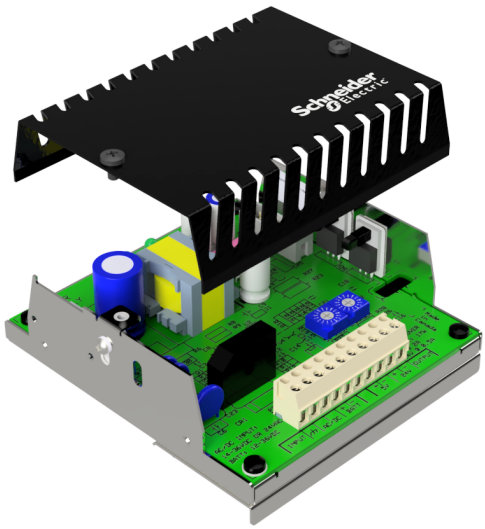
Failure to follow these instructions can result in death or serious injury.

While the size and shape of your device may differ and the color of the connectors may be different from the illustrations below, the procedure for installing the module is the same.

To mount the module on a DIN rail

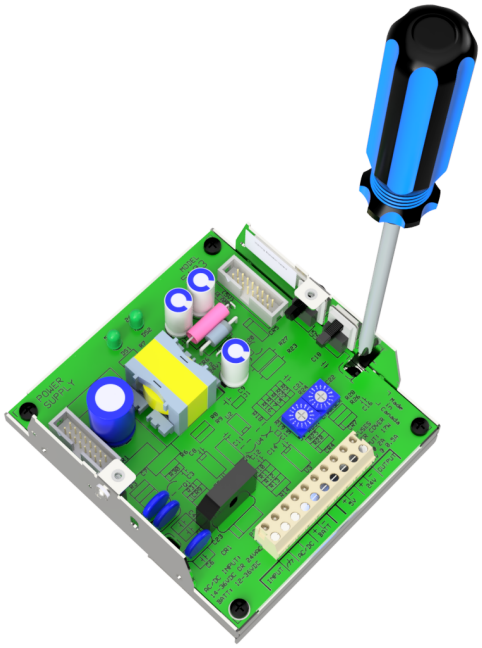
1. Unscrew the two cover screws on the module and remove the cover.

   These screws are permanently attached to the cover for ease of handling.

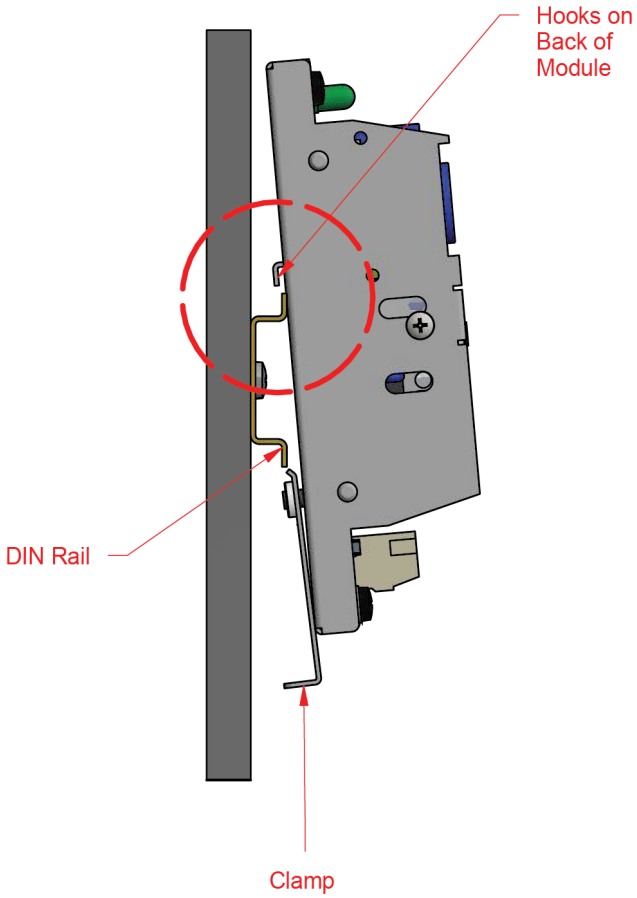


2. Loosen the 2 clamp screws on either side of the circuit board until there is a 1.5 mm (1/16 in) clearance between the back of the module and the clamp.

   The clamp screws are accessible through notches on either side of the circuit board.

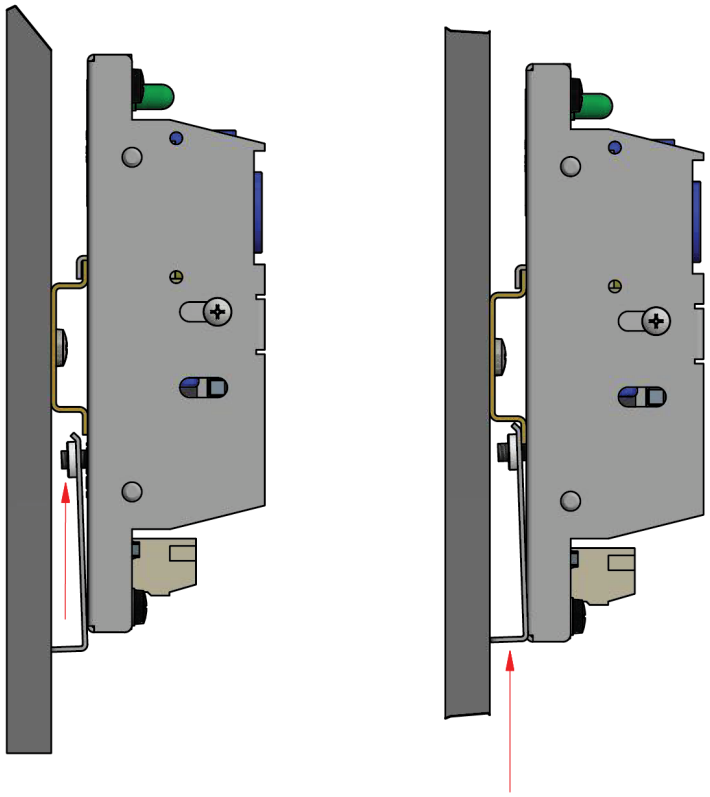


3. Slide the clamp out past the bottom of the module.
4. Position the 2 hooks on the back of the module over the top lip of the DIN rail.

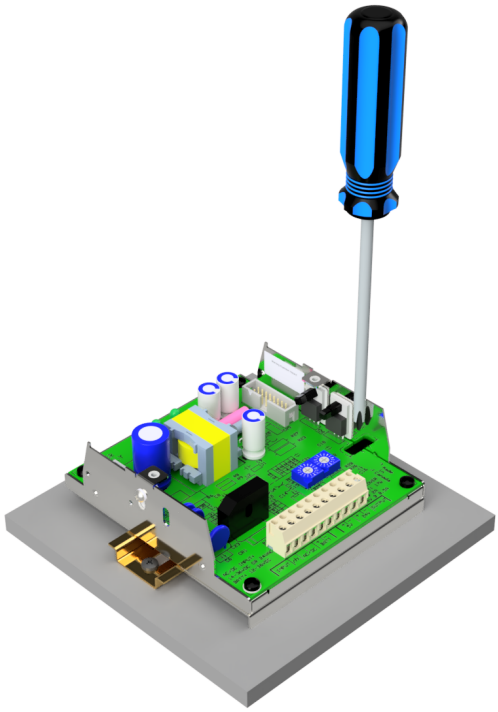


5. Slide the clamp upward until it meets the lower lip of the rail.

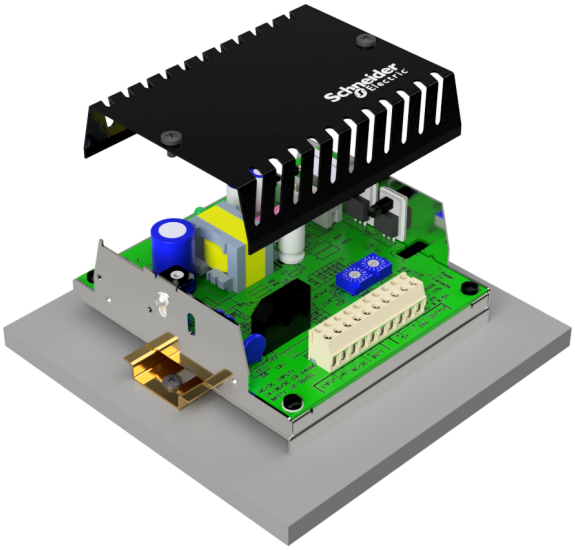
   The bottom of the clamp will be flush with the bottom of the module.



6. Tighten the clamp screws.



7. Replace the cover.



If you route an intermodule cable (IMC) behind the module, check that there is adequate clearance between the module and the hardware used to mount the DIN rails so that the cable doesn't get pinched in the clamp.

8.3 Power Supply Requirements

The analog outputs require a DC power supply. The voltage is typically in the 12...24 Vdc range although there are cases where a voltage higher than 12 Vdc is necessary. Refer to the Specifications 51 for the minimum power input voltage. When a 5 Vdc or 10 Vdc output is required and the output current approaches the maximum specified, use a power source that is greater than 12 Vdc.

Select one of the following power supply sources, depending on the application:

- SCADAPacks that have 12...24 Vdc power converters or power supplies
- External 24 Vdc power supplies that are powering other components in the system
- 12 V batteries can be used in applications subject to the minimum voltages described above and in the specifications

8.4 Layout Guidelines

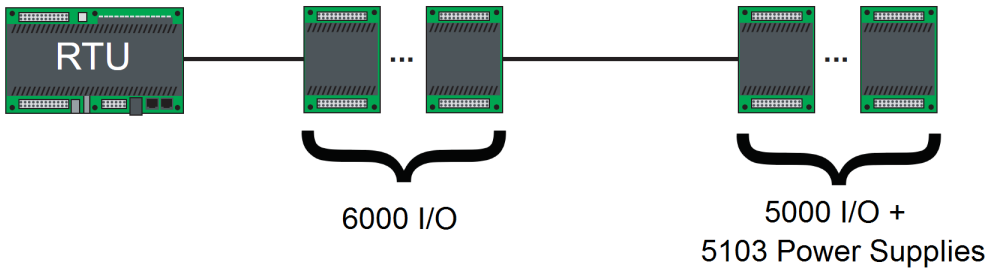
When additional I/O or power is required by the system, I/O expansion modules or 5103 power supply modules can be used in combination with the controller. There are several guidelines to keep in mind when adding modules to your SCADAPack x70 control system.

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:
  - o Connect the 5000 series modules directly to the controller until additional power is needed
  - o 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:
  - o Connect the 6000 series modules first and then follow the rules for connecting any 5000 modules
  - o The 5103 power supply module can only be placed after the 6000 series modules



8.5 Connecting I/O Modules

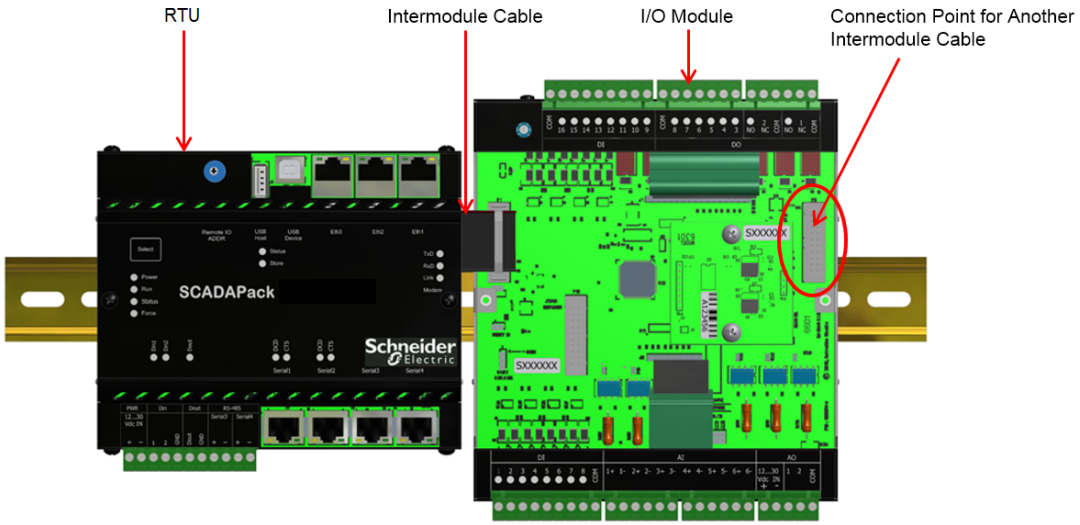
The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

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 34 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 36, read the Precautions 33 and the Cabling Guidance 34.

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 51 for details.
- Confirm that the intermodule cables you are using are less than the maximum total cable length. See Maximum Intermodule Cable Length 35.
- 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.

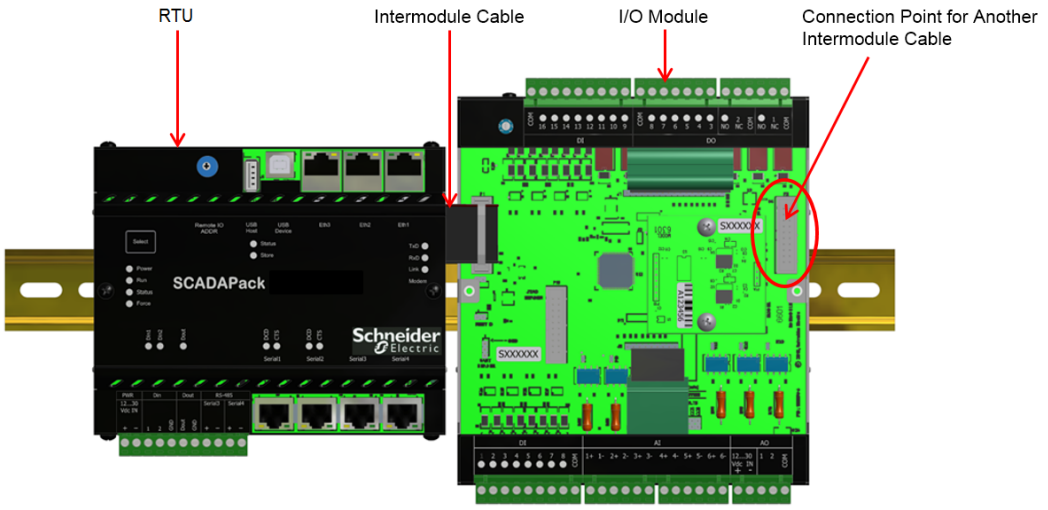
To attach intermodule cables

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 39
- Setting the I/O Module Address 40

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

5000 Series I/O module types may be combined in any manner to the maximum supported by the SCADAPack used.

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

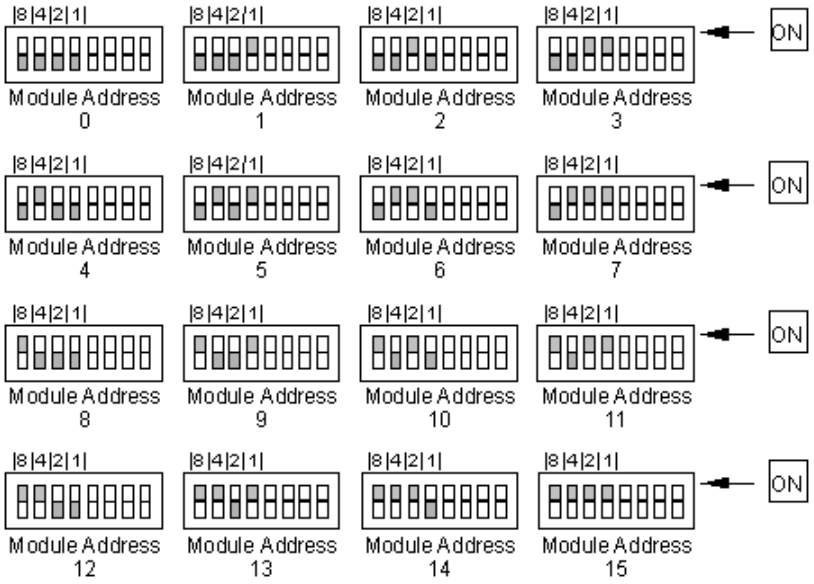
The address range supported by the SCADAPack may restrict the I/O module address range. Refer to the SCADAPack hardware manual for the maximum address range supported.

The four address switches labeled 8, 4, 2, and 1 set the address.

To set the address

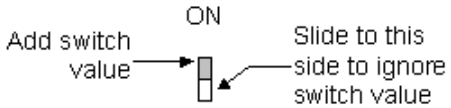
1. Open the four switches by sliding the actuators to the OFF position.
2. Close the switches that total to the desired address by sliding the actuators to ON.

   Switch settings for each of the 16 module addresses are shown below.



How to Set Address Switches

- Determine the module address.
- Slide actuators (side shown in gray).



10 Field Wiring

Field wiring attaches to the field wiring terminal blocks on each module.

⚠ 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 input or output. See the Specifications topic for the maximum voltage.

Failure to follow these instructions can result in equipment damage.

Field wiring guidelines

Follow these guidelines when planning for field wiring:

- When modules are installed in a Class I Division 2 area, power, input and output (I/O) wiring needs to be in accordance with Class I, Division 2 wiring methods (article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction.
- Arrange the modules so field wiring is accessible.
- Field wiring termination connectors are removable. Leave enough slack in the wiring for the connector to be removed.
- Arrange the modules and wiring so the status LEDs are visible.
- Keep modules switching loads away from communication controllers and analog input modules.
- Route low-level signals separate from high-level and AC power signals.
- No bonding is usually required by Electrical Safety Standards between modules carrying primary power and AC ground, since these modules are certified as components to be installed within an enclosure thereby limiting access by unauthorized personnel. Consult individual module manuals for special bonding instructions should they be required.
- Consult individual module manuals for the connection of external fuses should they be required, in particular by primary voltage carrying modules. Install where required.

For more information see:

- Wiring Screw-Termination Connectors 43

- Analog Output Wiring 45

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...0.33 mm^2 (12...22 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

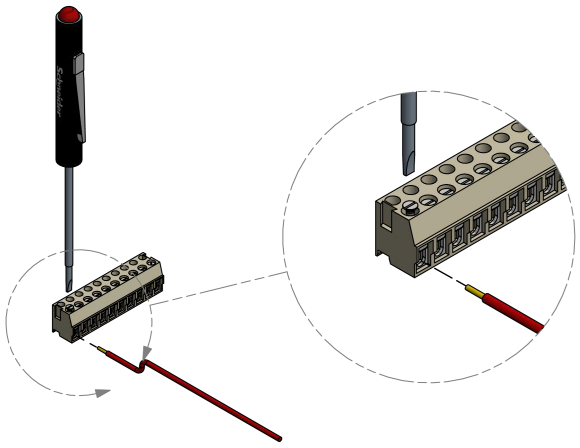
ELECTRICAL HAZARD

Remove power from all modules and devices before servicing.

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

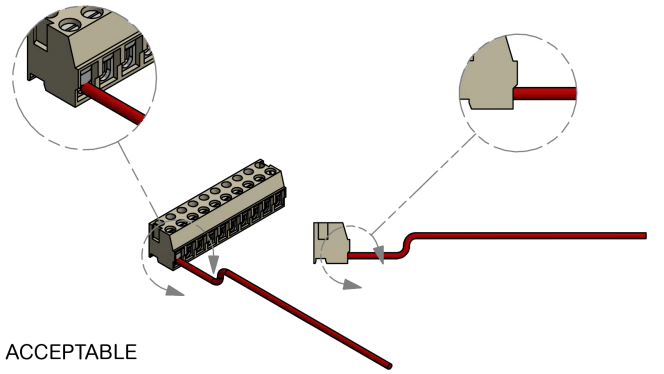
To wire a connector

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

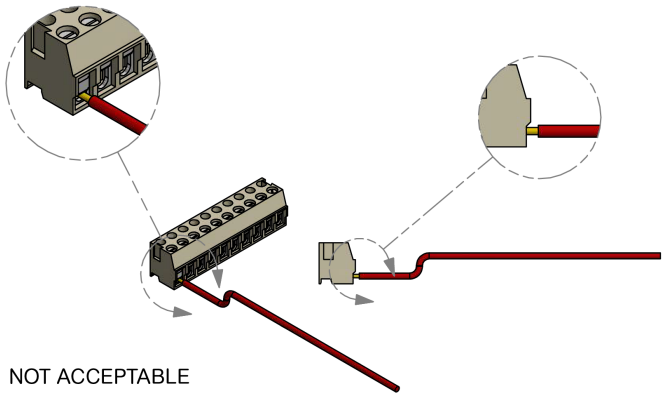


2. Insert the stripped wire into the connector so that the bared wire is located under the screw.

Verify that the bared wire is placed fully within the connector, as illustrated below.



ACCEPTABLE



NOT ACCEPTABLE

3. Apply 0.68 N•m (6 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 Analog Output Wiring

The analog outputs are isolated from the I/O bus 5 Vdc power supply but are not isolated from each other, as they share a common return.

NOTICE

UNEXPECTED EQUIPMENT OPERATION

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

Observe correct polarity.

Failure to follow these instructions can result in equipment damage.

An external 24 Vdc supply powers the isolated output circuits. This is usually the same power supply that powers current loop transmitters in the system. A power supply typically sources this power. A wide range of voltages is tolerated. Refer to section Specifications 51 of this manual for details.

Recommended field wiring for the 5304 analog output module is shown below.

- The 12...24 Vdc supply connects to terminals 1 and 2. See section Power Supply Requirements 31 for application suggestions when selecting this power supply.
- The first output connects to terminals 3 and 4.
- The second output connects to terminals 5 and 6.
- The third output connects to terminals 7 and 8.
- The fourth output connects to terminals 9 and 10.

For information on wiring screw-termination connectors, see Wiring Screw-Termination Connectors 43.

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 47
- Analog Outputs 47

12.1 LEDs

The I/O module provides an LED for each analog output. When the LED is on, the output is energized, meaning it has an active connection.

12.2 Analog Outputs

Condition	Action
Outputs are 0 mA or 0 Vdc.	Check the 12...24 Vdc power.
The full scale output is less than 20 mA in current mode.	Check the 12...24 Vdc power. Check that the load resistance is within specification.
The full scale output is less than 5 Vdc or 10 Vdc in voltage mode.	Check the 12...24 Vdc power. Check that the load resistance is within specification.
The output is 4 mA when a value of 0 is output. 0 mA was expected.	The 4...20 mA output offset is selected. Select the 0...20 mA offset.
The output is 0 mA when a value of 0 is output. 4 mA was expected.	The 0...20 mA output offset is selected. Select 4...20 mA offset.
The voltage output reading seems to be about half what is expected.	Check that the load resistance is within the specification. Check that the output is not a 5 Vdc one, instead of 10 Vdc.
The output seems to be uncalibrated at high output values. This improves somewhat as lower values are output.	Check that the load resistance is within the specification. Check that the output is a current mode one.
The output seems to be uncalibrated at small output values. This improves as larger values are output.	Check the setting of the output offset switch. An incorrect output offset may be selected.

13 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Technical Support 6 for more information and instructions for returning the module for repair.

For more information, see:

- Calibration 48

13.1 Calibration

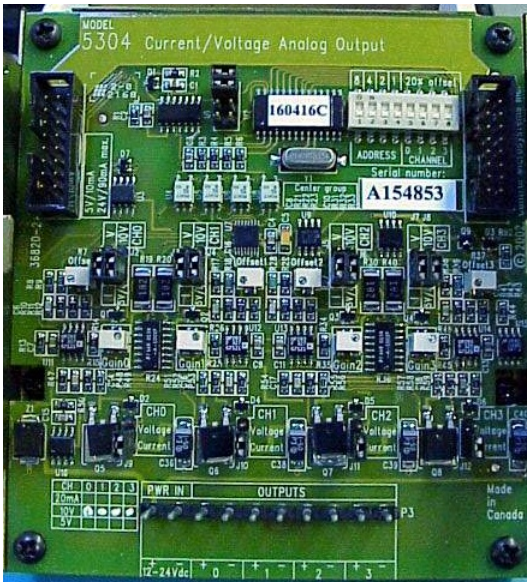
The 5304 analog output module is calibrated at the factory and should not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage or if the outputs have been reconfigured.

There are eight potentiometers for calibration of the analog outputs – two for each channel. Potentiometers Gain0, Gain1, Gain2, and Gain3 adjust the gain of channels 0 through 3 respectively, while Offset0, Offset1, Offset2, and Offset3 adjust the offset of channels 0 through 3 respectively.

Analog output calibration requires that you write values to each channel of the 5304 analog output module. Use the SCADAPack RemoteConnect configuration software to write values between the **Raw Minimum** and **Raw Maximum** parameters to the module.

The analog type and range are set individually for each channel using jumpers on the 5304 analog output module. See the Current and Voltage Outputs 19 section for jumper positions for each channel.

The gain and offset potentiometers are labeled for each analog output channel as shown in the picture below.



The following table shows the relationship between the analog output channels and the **Gain** and **Offset** potentiometers.

Channel	Gain Potentiometer	Offset Potentiometer
Channel 0	Gain0	Offset0
Channel 1	Gain1	Offset1
Channel 2	Gain2	Offset2
Channel 3	Gain3	Offset3

13.1.1 Current Outputs Calibration

For this procedure it is assumed that the output channel is a current output.

To calibrate the current outputs of the 5304 analog output module

1. Connect the 5304 analog output module to a SCADAPack.
2. Apply 24 Vdc to the analog output module terminal block P3 on terminals 1 and 2, observing polarity.
3. Set the output range for the channel to 0...20 mA.
4. Output a data value of **Raw Maximum** to the channel to be calibrated.
5. Measure the output current of the channel in series with a 250 W load resistor and adjust the corresponding **Gain** potentiometer (see Potentiometer table 48) for an output of 19.990 mA.
6. Output a data value of 2.5% of the **Raw Maximum** value.

   For a **Raw Maximum** value of 10000 this value is 250.
7. Measure the output current of the channel in series with a 250 W resistor and adjust the corresponding **Offset** potentiometer (see Potentiometer table 48) for an output of 498 uA.
8. Repeat the above procedure for each current output channel.

13.1.2 5 Vdc Outputs Calibration

For this procedure it is assumed that the output channel is a 5 Vdc voltage output.

To calibrate the 5 Vdc outputs of the 5304 analog output module

1. Connect the 5304 analog output module to a SCADAPack.
2. Apply 24 Vdc to the analog output module terminal block P3 on terminals 1 and 2, observing polarity.
3. Set the output range for the channel to 0...5 Vdc.
4. Output a data value of **Raw Maximum** to the channel to be calibrated.

5. Measure the output voltage of channel 0 and adjust the corresponding **Gain** potentiometer (see Potentiometer table 48) for an output of 4.995 Vdc
6. Output a data value of 2.5% of the **Raw Maximum** value.

   For a **Raw Maximum** value of 10000 this value is 250.
7. Measure the output voltage of channel 0 and adjust the corresponding **Offset** potentiometer (see Potentiometer table 48) for an output of 0.125 Vdc.
8. Repeat the above procedure for each 5 Vdc voltage output channel.

13.1.3 10 Vdc Outputs Calibration

For this procedure it is assumed that the output channel is a 10 Vdc voltage output.

To calibrate the 10 Vdc outputs of the 5304 analog output module

1. Connect the 5304 analog output module to a SCADAPack.
2. Apply 24 Vdc to the analog output module terminal block P3 on terminals 1 and 2, observing polarity.
3. Set the output range for the channel to 0...10 Vdc.
4. Output a data value of **Raw Maximum** to the channel to be calibrated.
5. Measure the output voltage of channel 0 and adjust the corresponding **Gain** potentiometer (see Potentiometer table 48) for an output of 9.990 Vdc.
6. Output a data value of 2.5% of the **Raw Maximum** value.

   For a **Raw Maximum** value of 10000 this value is 250
7. Measure the output voltage of channel 0 and adjust the corresponding **Offset** potentiometer (see Potentiometer table 48) for an output of 0.249 Vdc.
8. Repeat the above procedure for each 10 Vdc voltage output channel.

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 6

For more information see:

- General 51
- Power Supply 51
- Analog Output 52

14.1 General

Item	Specifications
Terminations	10 pole, removable terminal block 3.3...0.33 mm^2 (12...22 AWG), 15 amp contacts Screw termination: 0.5 N•m (4.5 lb-in) torque
Addressing	DIP switch configurable
Dimensions	106.7 mm (4.2 in) wide 116.2 mm (4.6 in) high 36.8 mm (1.4 in) deep
Mounting	7.5 x 35 mm (0.3 x 1.4 in) DIN rail
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing -40...70 °C (-40...158 °F)

14.2 Power Supply

Item	Specifications
5 Vdc power requirements	6 mA minimum. 25 mA maximum. This current is a function of the SCADAPack, I/O size and data.
DC power requirements	15 mA quiescent plus 80 mA maximum in current mode 15 mA quiescent plus 20 mA maximum in voltage mode

DC operating voltage limits	9 Vdc or (20 mA x load resistance) + 4 Vdc (whichever is greater) in current mode (1.5 x Range / load resistance) + Range + 2.5 Vdc in voltage mode 30 Vdc maximum UL508 rated 13.75...28 Vdc. Class 2
Maximum load resistance in current mode	1000 ohms with 24 Vdc loop power 400 ohms with 12 Vdc loop power 250 ohms with 9 Vdc loop power
Minimum load resistance in voltage mode	2 kohms for 10 Vdc full scale, with minimum 20 Vdc power applied 1 kohm for 5 Vdc full scale, with minimum 15 Vdc power applied
Noise and ripple	0.04% maximum
Transient protection	600 watt transient suppressor on each output and power input 2.5 kV surge withstand capability as per ANSI/IEEE C37.90.1-1989

14.3 Analog Outputs

Item	Specifications
Output points	Four
Output modes	Current mode, jumper link selectable Voltage mode, 5 Vdc full scale, jumper link selectable Voltage mode, 10 Vdc full scale, jumper link selectable
Output signal ranges	0...20 mA or 4...20 mA, switch configurable 0...5 Vdc or 1...5 Vdc, switch configurable 0...10 Vdc or 2...10 Vdc, switch configurable
Output type	Single ended regulation on positive side with common negative return
Resolution	12 bits over the 0...20 mA or 0...5 Vdc or 0...10 Vdc ranges
Absolute accuracy	+/– 0.05% of full scale at 25 °C (77 °F)

	+/– 0.2% of full scale over temperature range
Isolation	500 Vac field to logic
Response time	2 ms typical to 90% signal change

15 Standards and Certifications

Hazardous Locations - North America	Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 CSA approved to the following standards: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • ANSI/ISA-121201-2007 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	ATEX II 3G, Ex nA IIC T4 per EN 60079-15, protection type n (Zone 2)
Hazardous Locations	IECEx, Ex nA IIC T4 per IEC 60079-15, protection type n (Zone 2)
Safety	CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL508. (Process Control Equipment, Industrial Control Equipment) in Canada and USA. UL (cULus) listed: UL508 (Industrial Control Equipment)
Digital emissions	FCC47 Part 15, Subpart B, Class A Verification EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment RCM compliance.
Immunity	EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments
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

SCADAPack

5405 Digital Input Module

Version: 3.9.1

Date: July 2021

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Table of Contents

1 Legal Information 5

2 Technical Support 6

3 Safety Information 7

4 About the Book 10

5 About the 5405 Digital Input Module 13

6 Cybersecurity 14

7 Hardware Overview 16

7.1 Digital Inputs 17

7.2 Protection Summary 17

8 Installation 21

8.1 ATEX and IECEx Requirements 21

8.2 Mounting the 5405 Digital Input Module 22

8.3 Layout Guidelines 27

8.4 Connecting I/O Modules 27

8.4.1 Precautions 28

8.4.2 Cabling Guidance 29

8.4.3 Attaching Intermodule Cables 31

9 Addressing 34

9.1 Addressing Rules 34

9.2 Setting the I/O Module Address 35

10 Field Wiring 38

10.1 Wiring Screw-Termination Connectors 40

10.2 AC Input Wiring 42

10.3 DC Input Wiring 43

11 Configuration 44

12 Diagnostics 45

12.1 LEDs 45

12.2 Digital Inputs 45

13 Maintenance 46

13.1 Calibration 46

14 Specifications 47

14.1 General 48

14.2 Power Supply 48

14.3 Digital Inputs 49

15 Standards and Certifications 50

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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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? • 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? • 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 5405 digital input module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5405 digital input module, including detailed hardware specifications
- Installation and wiring for the 5405 digital input module
- Diagnostics capabilities on the 5405 digital input module
- Maintenance recommendations for the 5405 digital input 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	• 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	• Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	• Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	• Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	• Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	• Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	• 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	• Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical	SCADAPack	• USB, serial and IP communications

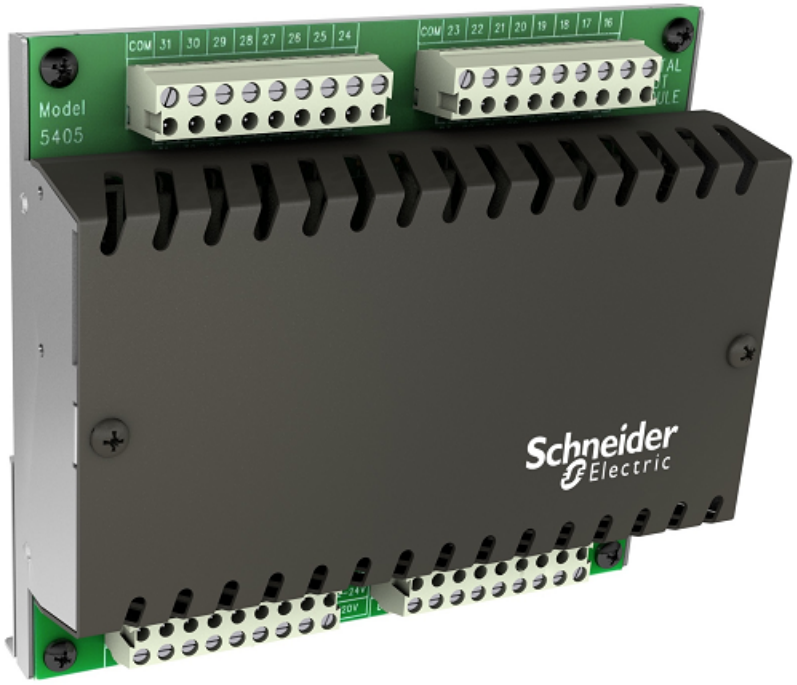
Reference Manuals	Communication Interfaces Technical Reference	• Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	• The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	• DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	• 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	• The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	• Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	• Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	• Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 5405 Digital Input Module

The 5405 digital input module increases the SCADAPack I/O capacity by providing:

- 32 digital inputs

You can connect up to 15 5405 digital input modules to the I/O bus, for a total of 480 digital inputs.



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 31.

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 38.

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

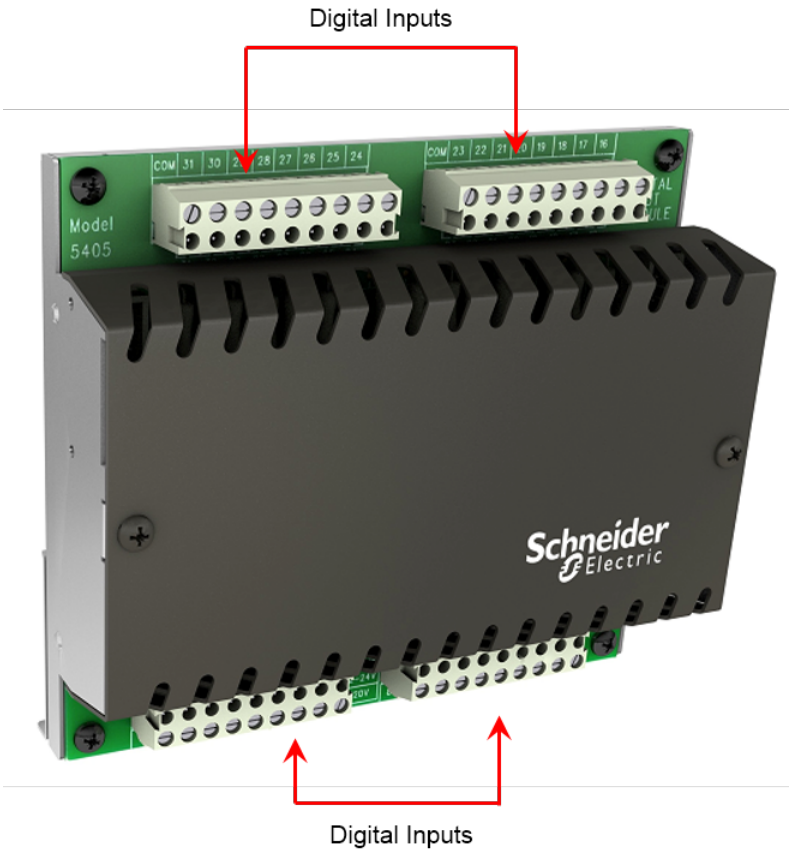
FBI Cyber Crime
https://www.fbi.gov/investigate/cyber

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 location of the digital inputs on the device.



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 47.

For more information see:

- Digital Inputs 17
- Protection Summary 17

7.1 Digital Inputs

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

The input voltage range is set at the factory. The inputs are grouped with eight inputs sharing a single common return. The groups are isolated from each other.

The 5405 digital input module includes 32 digital inputs. Use the SCADAPack RemoteConnect configuration software to configure each digital input.

The digital input module is available in two standard voltage ranges, for both AC and DC applications. A current limiting resistor on each input determines the voltage range. These resistors can be easily changed to accommodate non-standard signal ranges.

For more information, see Wiring Screw-Termination Connectors 40.

7.2 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

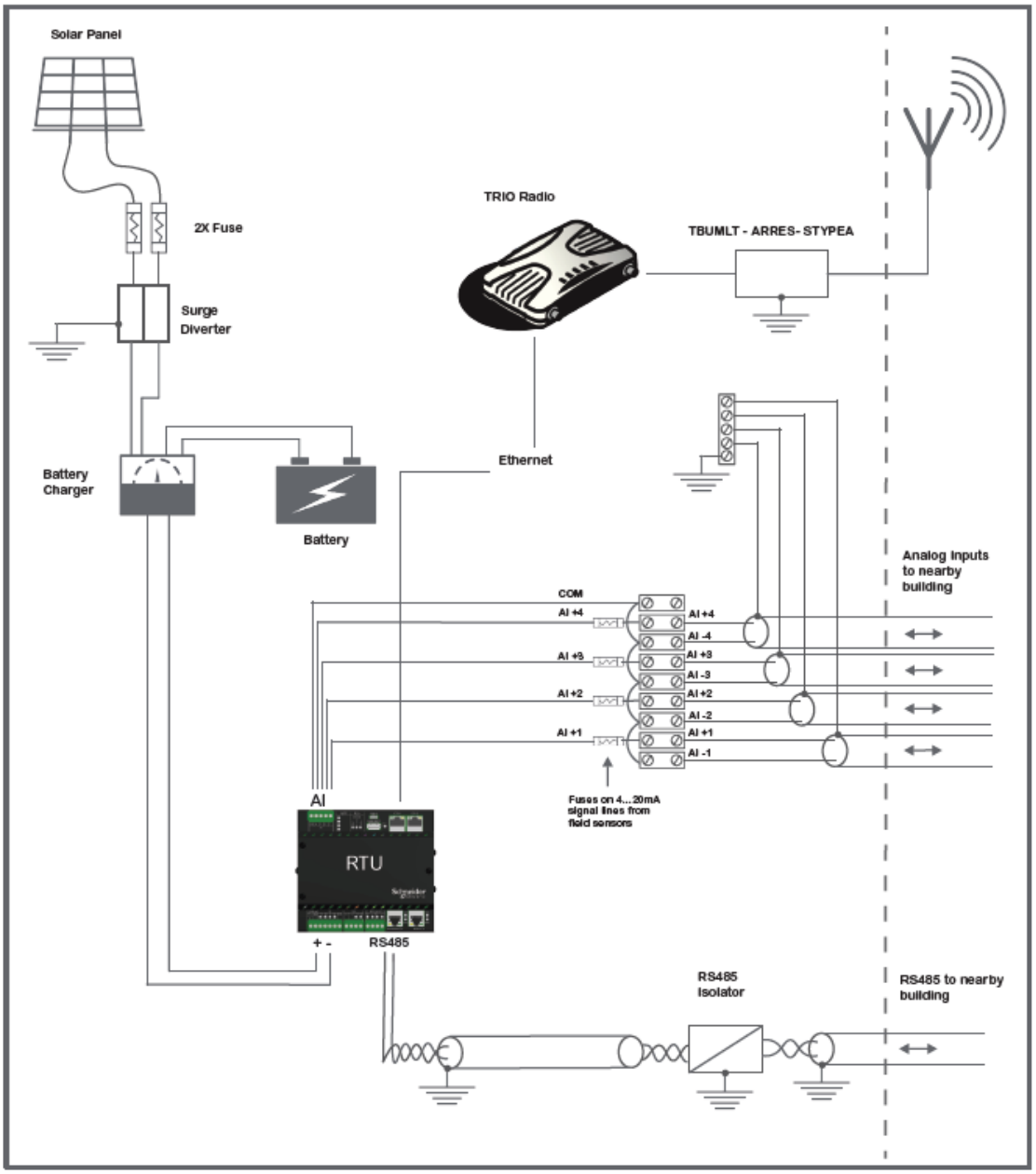
POWER SUPPLY LOSS OF FUNCTION

- 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 21
- Mounting the 5405 Digital Input Module 22
- Layout Guidelines 27
- Connecting I/O Modules 27

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

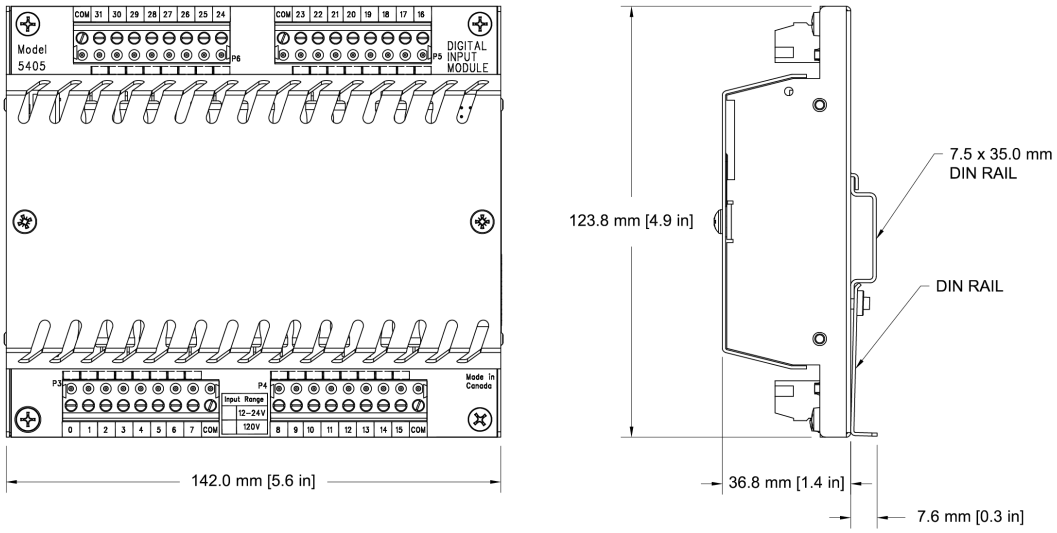
- Install this equipment in an enclosure certified for use, providing a degree of protection of IP54 or better.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.

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

8.2 Mounting the 5405 Digital Input Module

The 5405 digital input module is mounted on the 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to the system I/O Bus.

The figure below shows the module dimensions.



Follow these guidelines for mounting modules:

- DIN rails install horizontally or vertically. Where possible install DIN rails horizontally. Modules are easier to install on horizontal rails. Cooling is optimal when installed horizontally.
- The model DIN17 rail holds four modules. It is 432 mm (17 in) long. If you use another length of DIN rail, trim it to a multiple of the module width.
- Mount modules tightly together on the rail, to avoid straining the intermodule cable. The spacing dimples on the sides of the modules should touch.

⚠ WARNING

ELECTRICAL HAZARD

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

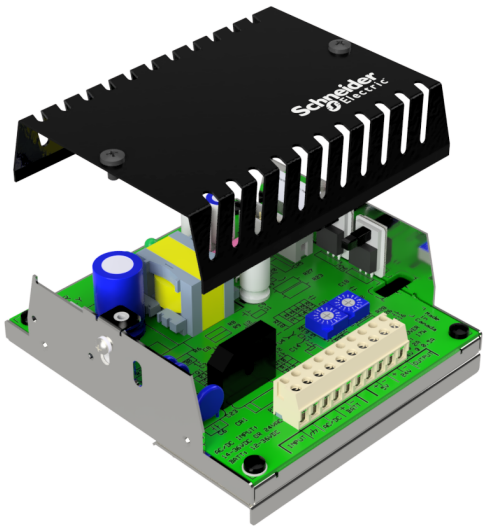
Failure to follow these instructions can result in death or serious injury.

While the size and shape of your device may differ and the color of the connectors may be different from the illustrations below, the procedure for installing the module is the same.

To mount the module on a DIN rail

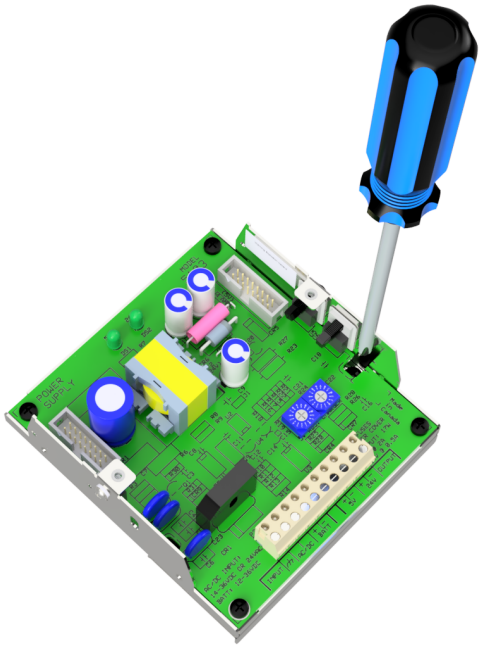
1. Unscrew the two cover screws on the module and remove the cover.

   These screws are permanently attached to the cover for ease of handling.

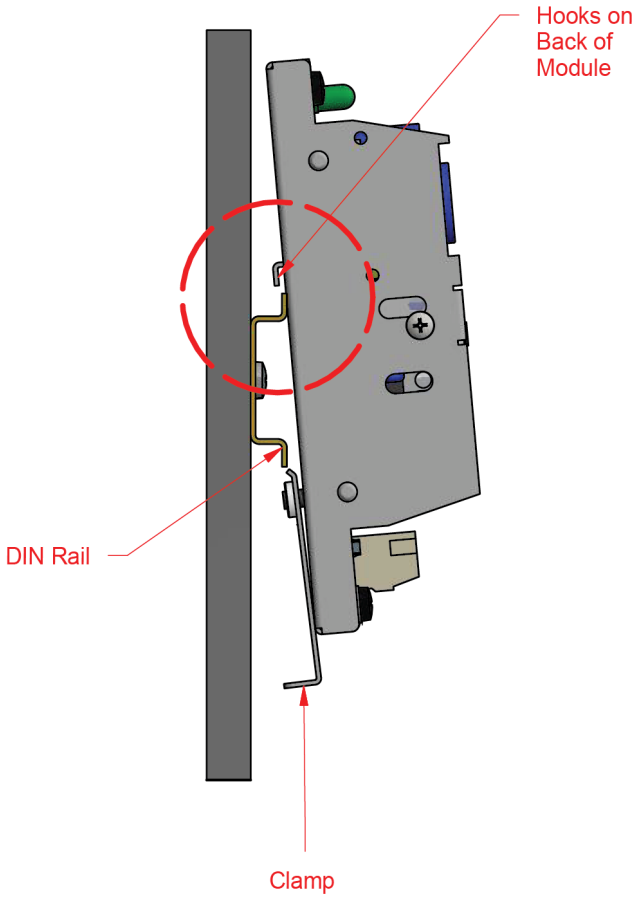


2. Loosen the 2 clamp screws on either side of the circuit board until there is a 1.5 mm (1/16 in) clearance between the back of the module and the clamp.

   The clamp screws are accessible through notches on either side of the circuit board.

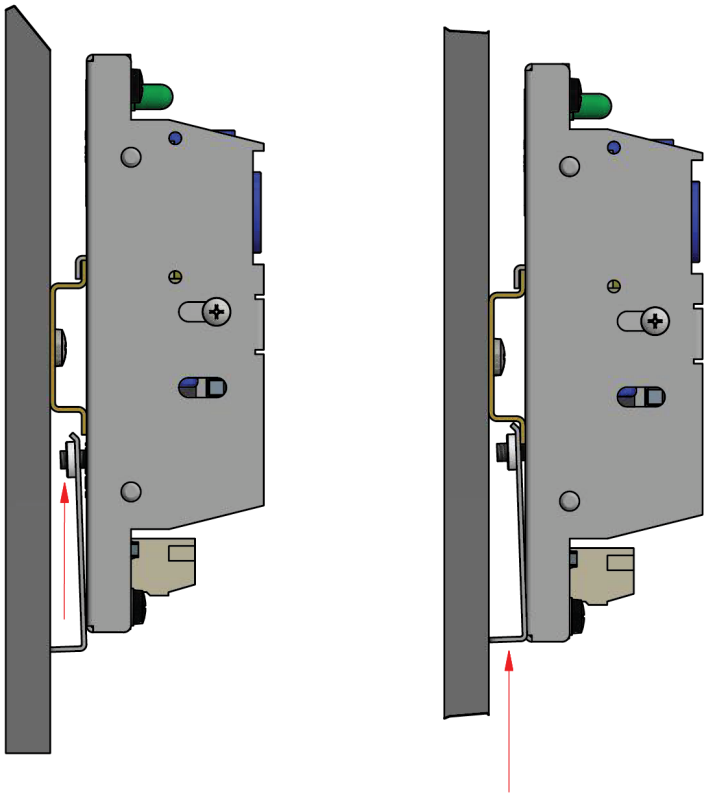


3. Slide the clamp out past the bottom of the module.
4. Position the 2 hooks on the back of the module over the top lip of the DIN rail.

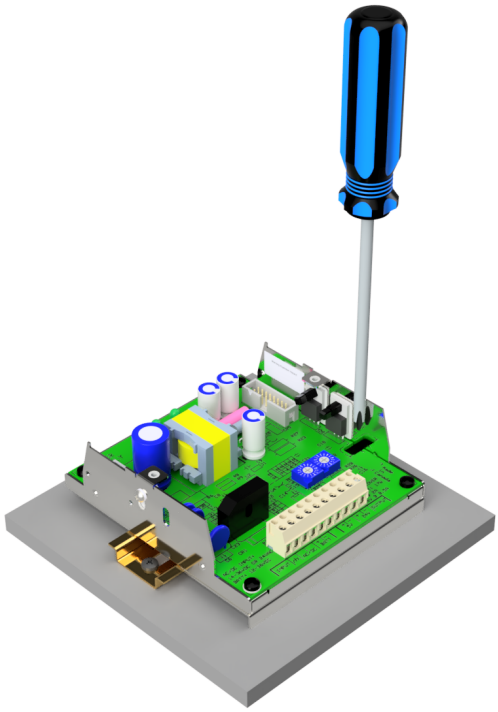


5. Slide the clamp upward until it meets the lower lip of the rail.

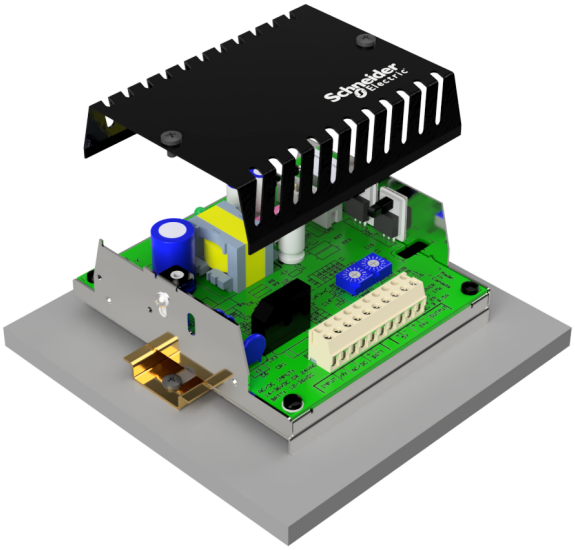
   The bottom of the clamp will be flush with the bottom of the module.



6. Tighten the clamp screws.



7. Replace the cover.



If you route an intermodule cable (IMC) behind the module, check that there is adequate clearance between the module and the hardware used to mount the DIN rails so that the cable doesn't get pinched in the clamp.

8.3 Layout Guidelines

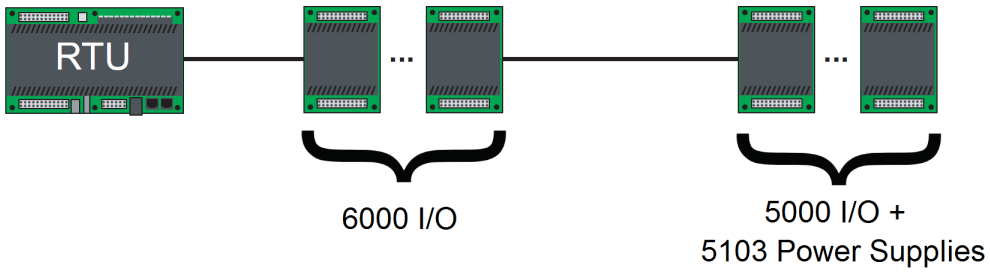
When additional I/O or power is required by the system, I/O expansion modules or 5103 power supply modules can be used in combination with the controller. There are several guidelines to keep in mind when adding modules to your SCADAPack x70 control system.

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 Connecting I/O Modules

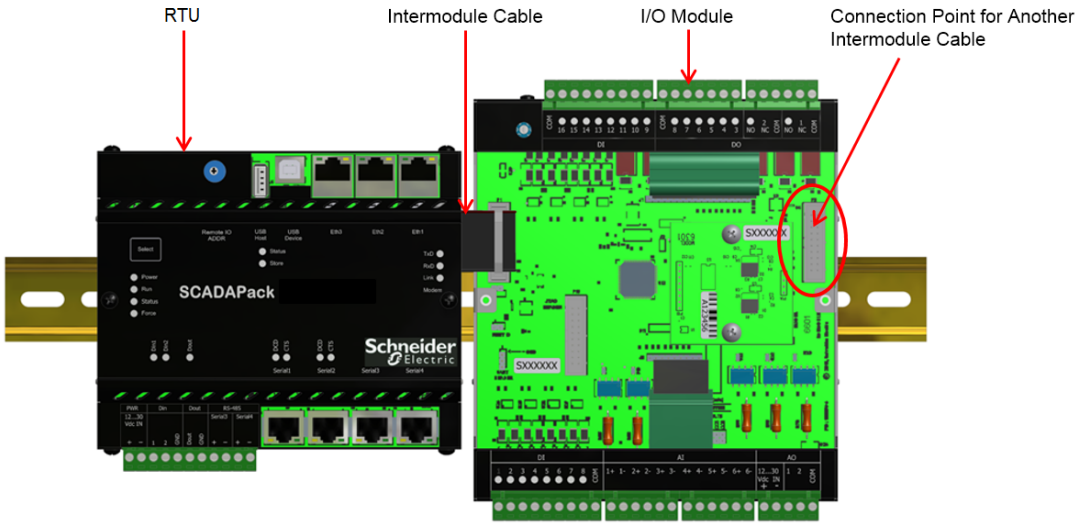
The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

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 29 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 31, read the Precautions 28 and the Cabling Guidance 29.

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 48 for details.
- Confirm that the intermodule cables you are are less than the maximum total cable length. See Maximum Intermodule Cable Length 30.
- 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.

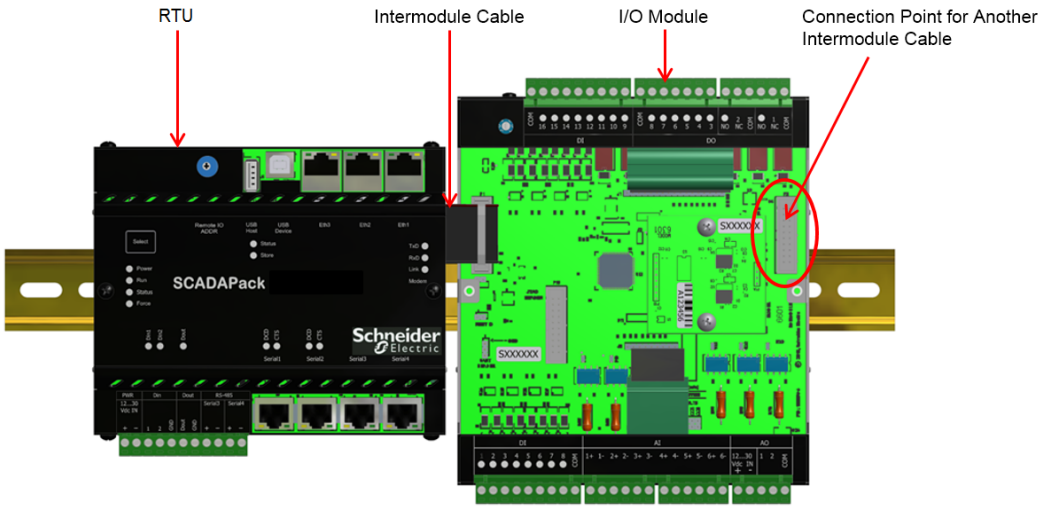
To attach intermodule cables

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 34
- Setting the I/O Module Address 35

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

5000 Series I/O module types may be combined in any manner to the maximum supported by the SCADAPack used.

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

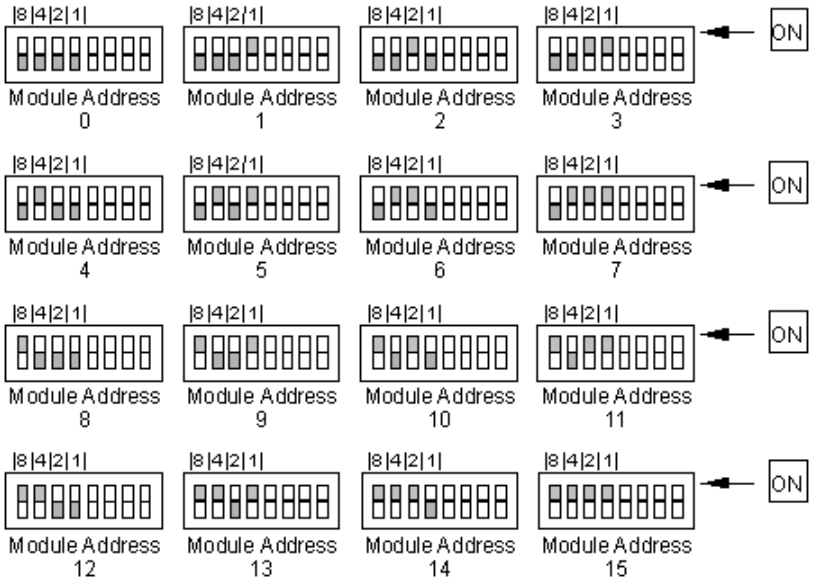
The address range supported by the SCADAPack may restrict the I/O module address range. Refer to the SCADAPack hardware manual for the maximum address range supported.

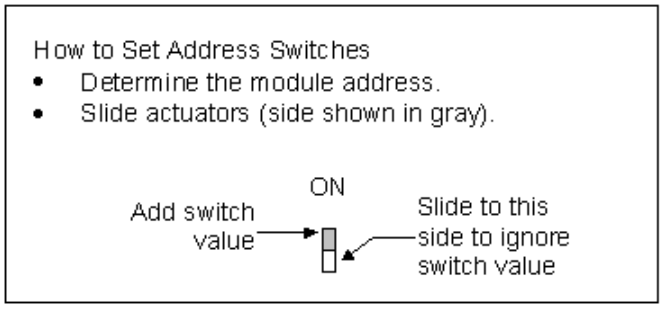
The four address switches labeled 8, 4, 2, and 1 set the address.

To set the address

1. Open the four 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 16 module addresses are shown below.





AC/DC input and frequency selection

5405 digital input module is capable of monitoring AC or DC inputs. Set the switches on the module according to the type of signal (AC or DC) and if AC, according to the frequency of operation.

AC/DC operation

Switch 6 selects AC or DC operation. Refer to the figure below

For DC operation

- Slide the actuator up to the ON position. 5405 digital input module responds faster in this position.

For AC operation

- Slide the actuator down to the OFF position. 5405 digital input module response is filtered according to the frequency selection of Switch 5.

Frequency selection

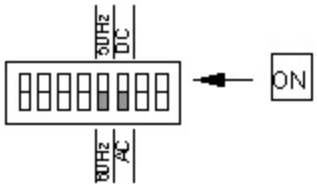
Switch 5 selects 50 or 60 Hz operation in AC mode only. Refer to the figure below.

For 50 Hz operation

- Slide the actuator up to the ON position.

For 60 Hz operation

- Slide the actuator down to the OFF position.



Switches 5 and 6
Actuators (gray)
shown for AC 60 Hz
operation

10 Field Wiring

The digital inputs are optically isolated from the logic power. To simplify field wiring, the inputs are grouped with eight inputs sharing a single common return. These groups of eight inputs are isolated from each other. Light emitting diodes on 5405 digital input module show the status of each of the inputs.

Field wiring attaches to the field wiring terminal blocks on each module.

⚠ 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 input or output. See the Specifications topic for the maximum voltage.

Failure to follow these instructions can result in equipment damage.

Field wiring guidelines

Follow these guidelines when planning for field wiring:

- When modules are installed in a Class I Division 2 area, power, input and output (I/O) wiring needs to be in accordance with Class I, Division 2 wiring methods (article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction.
- Arrange the modules so field wiring is accessible.
- Field wiring termination connectors are removable. Leave enough slack in the wiring for the connector to be removed.
- Arrange the modules and wiring so the status LEDs are visible.
- Keep modules switching loads away from communication controllers and analog input modules.
- Route low-level signals separate from high-level and AC power signals.
- No bonding is usually required by Electrical Safety Standards between modules carrying primary power and AC ground, since these modules are certified as components to be installed within an enclosure thereby limiting access by unauthorized personnel. Consult individual module manuals for special bonding instructions should they be required.
- Consult individual module manuals for the connection of external fuses should they be

required, in particular by primary voltage carrying modules. Install where required.

The 5405 digital input module accommodates AC or DC inputs. Observe signal polarity when using DC inputs. Connect the positive signal to the input. Connect the negative signal to the common return.

For more information see:

- Wiring Screw-Termination Connectors 40
- AC Input Wiring 42
- DC Input Wiring 43

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...0.33 mm^2 (12...22 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

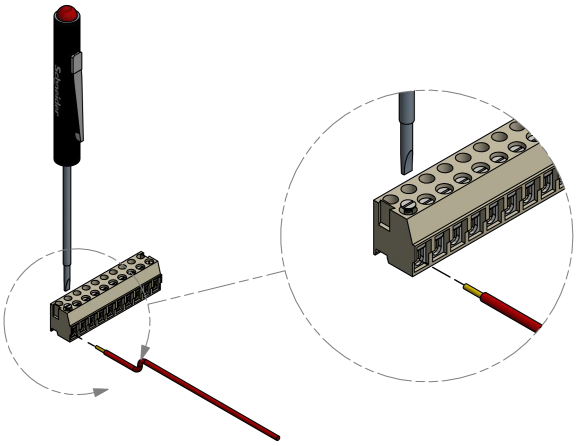
ELECTRICAL HAZARD

Remove power from all modules and devices before servicing.

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

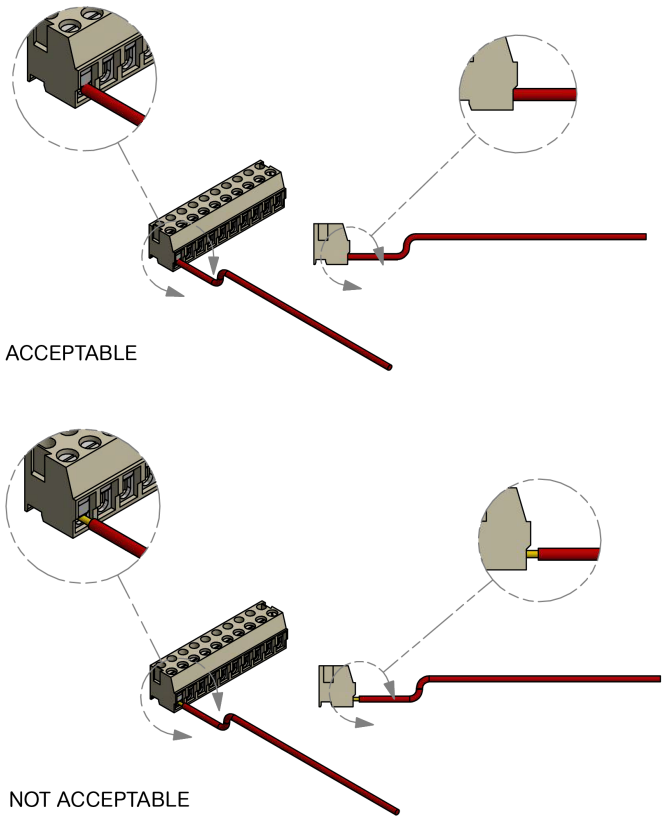
To wire a connector

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.

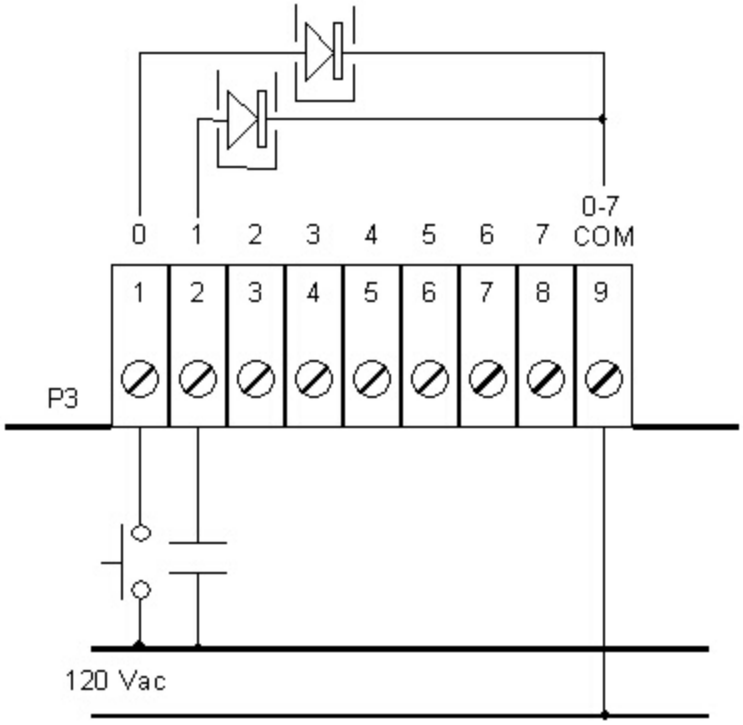


3. Apply 0.68 N•m (6 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 AC Input Wiring

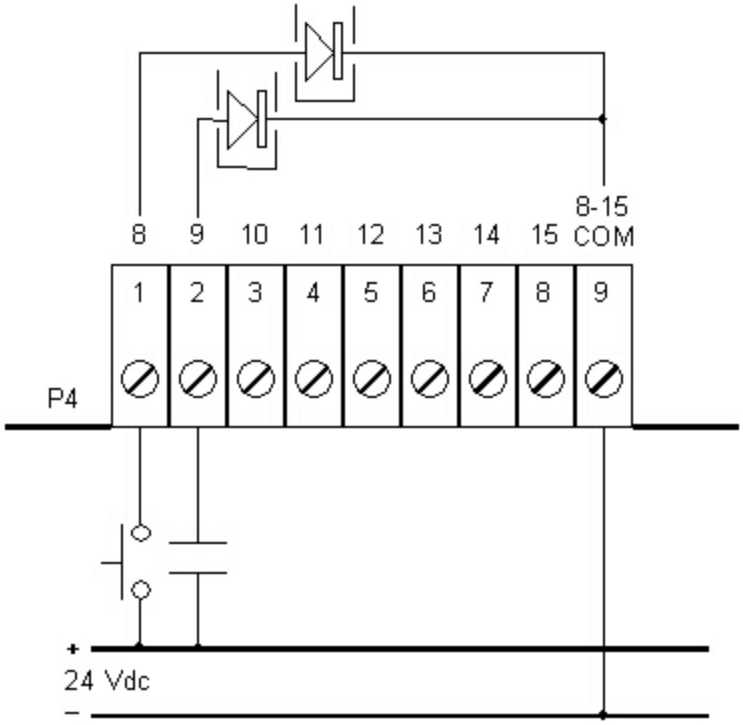
Below is an example showing 2 120 Vac contacts monitored by digital inputs 0 and 1 on P3. 5405 digital input module is available in different input voltage ranges. Check that the monitored voltages do not exceed the specified range of the input module. Similar wiring is possible on the remaining 24 inputs connected to P4 through P6. This wiring example shows a simplified representation of channels 0 and 1 in the 5405 digital input module.

120 VAC digital inputs do not work with some Uninterruptible Power Supplies (UPSs). The digital input firmware is looking for a minimum input on-time generated by a sine-wave. This time is longer than the on-time generated by some UPSs. The module should not be used with a non-sine wave UPS.



10.3 DC Input Wiring

Below is an example showing 2 24 Vdc contacts monitored by digital inputs 8 and 9 on P4. Observe signal polarity when using DC signals. 5405 digital input module is available in different input voltage ranges. Check that the signals monitored are in the specified range of the input module. Similar wiring is possible on the remaining 24 inputs connected to P3, P5 and P6. This wiring example shows a simplified representation of channels 8 and 9 in the 5405 digital input module.



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 45
- Digital Inputs 45

12.1 LEDs

The 5405 digital input module has one red status LED per I/O point. This LED is on when the input is monitoring a voltage greater than the minimum rated input voltage.

The digital input status LEDs are located between the field wiring terminal connector and the module cover.

The LEDs are powered by the field wiring and cannot be disabled. The intensity of the LEDs will vary slightly as a function of the voltage present on the digital input.

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.

13 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Technical Support 6 for more information and instructions for returning the module for repair.

For more information see:

- Calibration 46

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.

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 6.

For more information see:

- General 48
- Power Supply 48
- Digital Inputs 49

14.1 General

Item	Specifications
I/O terminations	Four 9 pole, removable terminal blocks 22…12 AWG 15 A contacts Screw termination: 0.5 N•m (4.5 lb-in) torque
Dimensions	142 mm (5.6 in) wide 123.8 mm (4.9 in) high 36.8 mm (1.4 in) deep
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing –40…70 °C (–40…158 °F)
Addressing	Configurable with 4 DIP switches
AC/DC operation	2 DIP switches determine AC or DC and 50 or 60 Hz operation
Visual indicators	32 red LEDs Field powered Cannot be disabled to conserve power

14.2 Power Supply

Item	Specifications
5 Vdc	5 Vdc at 10 mA with all inputs ON

14.3 Digital Inputs

Item	Specifications
I/O points	32 points
Ranges	12...24 Vdc, 16...24 Vac 120 Vac/dc
Over-voltage tolerance	150% sustained over-voltage without damage
Input current	6.0 mA typical at 24 Vdc on the 24 Vdc range 3.5 mA typical at 24 Vac on the 24 Vdc range 2.5 mA typical at 120 Vdc on the 120 Vdc range 1.5 mA typical at 120 Vac on the 120 Vdc range
DC input logic levels	OFF to ON transition threshold is typically 7.5 Vdc on the 24 Vdc range OFF to ON transition threshold is typically 55 Vdc on the 120 Vdc range
AC input levels	OFF to ON transition threshold is typically 6 Vac on the 24 Vac range OFF to ON transition threshold is typically 45 Vac on the 120 Vac range
Response time	3.5 ms typical OFF to ON with DIP Switch set to DC 4.5 ms typical ON to OFF with DIP Switch set to DC 15 ms typical OFF to ON with DIP Switch set to 60 Hz. AC 17 ms typical ON to OFF with DIP Switch set to 60 Hz. AC 16 ms typical OFF to ON with DIP Switch set to 50 Hz. AC 20 ms typical ON to OFF with DIP Switch set to 50 Hz. AC
Transient protection	2.5 kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	Isolated in four groups of 8 Inputs 0 to 15 are on the bottom edge Inputs 16 to 31 are on the top edge Isolation 500 Vac/dc from chassis and logic ground

15 Standards and Certifications

	Standards and Certifications
Hazardous Locations - North America	Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 UL Listed and CSA certified to the following standards: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	5405-24 (24 Vdc DI version) only ATEX II 3G, Ex nA IIC T4 per EN 60079-15, protection type n (Zone 2)
Hazardous Locations	IECEx, Ex nA IIC T4 per IEC 60079-15, protection type n (Zone 2)
Safety	CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL916. (Process Control Equipment, Industrial Control Equipment) in Canada and USA. UL (cULus) listed: UL508 (Industrial Control Equipment)
Digital Emissions	FCC47 Part 15, Subpart B, Class A Verification EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment C-Tick compliance. Registration number N15744.
Immunity	EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments
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

SCADAPack

5410 High Speed Counter Input Module

Version: 3.9.1

Date: July 2021

Document Number: 250508

Table of Contents

1 Legal Information 5

2 Technical Support 6

3 Safety Information 7

4 About the Book 10

5 About the 5410 High Speed Counter Input Module 13

6 Cybersecurity 14

7 Hardware Overview 16

7.1 Counter Inputs 18

7.2 Protection Summary 18

8 Installation 21

8.1 ATEX and IECEx Requirements 21

8.2 Mounting the 5410 Module 21

8.3 Layout Guidelines 27

8.4 Connecting I/O Modules 27

8.4.1 Precautions 28

8.4.2 Cabling Guidance 29

8.4.3 Attaching Intermodule Cables 31

9 Addressing 34

9.1 Addressing Rules 34

9.2 Setting the I/O Module Address 35

10 Field Wiring 37

10.1 Wiring Screw-Termination Connectors 39

10.2 Counter Input Wiring 41

10.3 De-Bounce Filter Selection 42

11 Configuration 43

12 Operating Modes Selection 44

13 Diagnostics 46

14 Maintenance 47

14.1 Use with High Frequency Inputs 47

14.2 Use with Mechanical Inputs 47

14.3 LED Indicators 47

15 Specifications 48

16 Standards and Certifications 50

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? • 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? • 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 5410 high speed counter input module hardware. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the 5410 high speed counter input module, including detailed hardware specifications
- Installation and wiring for the 5410 high speed counter input module
- Maintenance recommendations for the 5410 high speed counter input 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	• 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	• Hardware and software requirements • Installation procedures • Accessing help • Troubleshooting guidance
Hardware Manuals	The hardware manual for your SCADAPack x70 device	• Installation, wiring and addressing information • Diagnostics capabilities • Maintenance recommendations • Hardware specifications
Configuration Manuals	SCADAPack RemoteConnect Configuration Software	• Setting up and managing projects for your SCADAPack x70 device
	PC Communication Settings -SCADAPack CommDTM	• Setting up communications between SCADAPack RemoteConnect and your SCADAPack x70 device
	SCADAPack x70 Configuration	• Configuring SCADAPack x70 device operation
	Porting Guide for SCADAPack E to SCADAPack RemoteConnect	• 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	• Moving from Telepace to SCADAPack RemoteConnect • Tutorial for creating a project • Compatibility chart
Technical Reference	SCADAPack Communication Interfaces	• USB, serial and IP communications

Manuals	Technical Reference	• Mobile communications • Dialup modem communications
	SCADAPack Operations Technical Reference	• The SCADAPack x70 device file system • Command line operations • Diagnostics operations • Telnet server operations • FTP server operations
	SCADAPack SCADA Protocols Technical Reference	• DNP3 protocol support • Modbus protocol support • IEC 60870-5-104 protocol support
Logic Programming Manuals	SCADAPack Logic Programming Overview	• 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	• The custom SCADAPack x70 function blocks that are available for developing IEC 61131-3 applications
	Using EFB Toolkit with SCADAPack x70	• Using the Schneider Electric EFB Toolkit with SCADAPack x70 devices and SCADAPack RemoteConnect configuration software
Security Administrator Manuals	SCADAPack Security Administrator	• Configuring security on your SCADAPack x70 device
	SCADAPack Security Technical Reference	• Security standards • Security overview • DNP3 Secure Authentication • Diagnostics • Attack vectors and requirements

5 About the 5410 High Speed Counter Input Module

The 5410 high speed counter input module adds four high speed counter inputs to a 5000/6000 I/O system.

You can connect up to sixteen 5410 high speed counter input modules on an I/O bus to provide a total of 64 counter inputs.

Input count rates up to 10 kHz can be accommodated with no missing counts. De-bounce filters can be selected to reduce false counts when used with low speed mechanical contact inputs.

Four light emitting diodes on the 5410 high speed counter input module show the status of each of the inputs.

The 5410 high speed counter input module accumulates pulse inputs at frequencies up to 10 kHz. The minimum input pulse on and off times is at least fifty microseconds in duration to be detected.

The counters accumulate input pulses until the maximum count value of 4294967295 is reached. At the next input pulse, the counters will start counting again from zero.

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

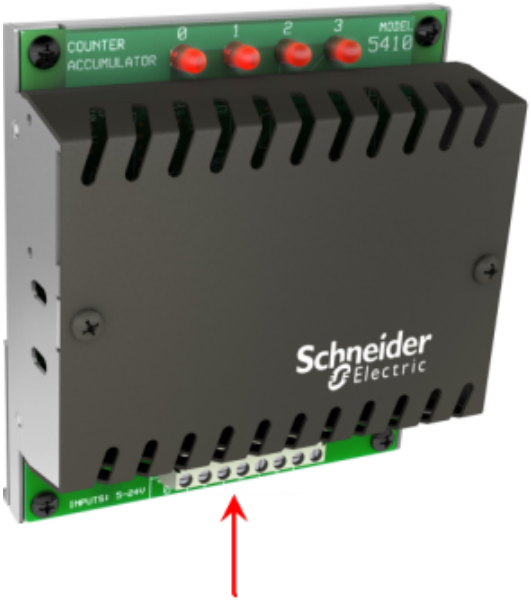
FBI Cyber Crime
https://www.fbi.gov/investigate/cyber

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 location of the counter inputs on the device.



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 48.

For more information see:

- Counter Inputs 18
- Protection Summary 18

7.1 Counter Inputs

The counters are 32 bits wide, for a maximum count value of 4294967295.

The 5410 high speed counter input module operates with DC inputs ranging from 3 to 28 volts. The counter inputs are optically isolated from the logic power and from each other.

7.2 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

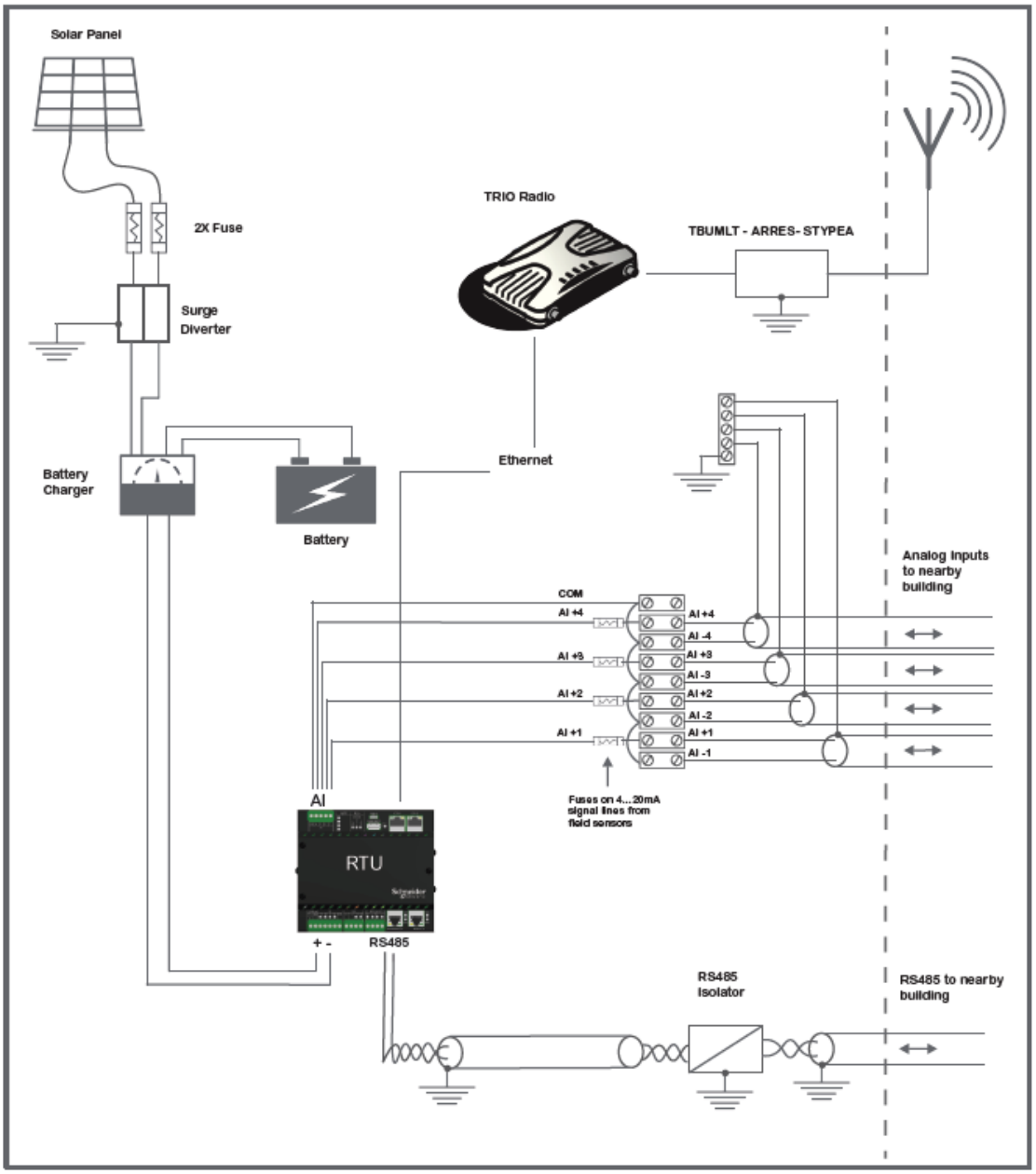
POWER SUPPLY LOSS OF FUNCTION

- 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 installation of the 5410 high speed counter input module requires mounting the module on the 7.5mm by 35mm DIN rail and connecting the module to the system I/O Bus.

See:

- ATEX and IECEx Requirements 21
- Mounting the 5410 Module 21
- Layout Guidelines 27
- Connecting I/O Modules 27

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

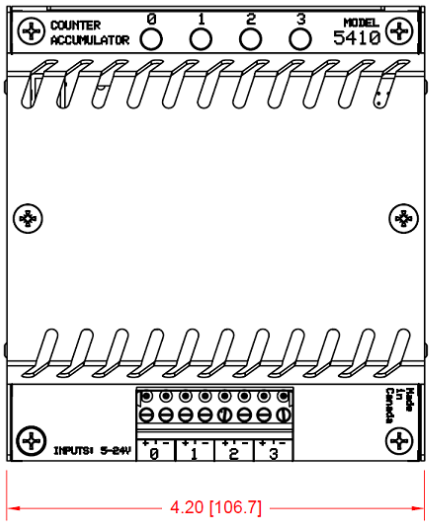
- Install this equipment in an enclosure certified for use, providing a degree of protection of IP54 or better.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.

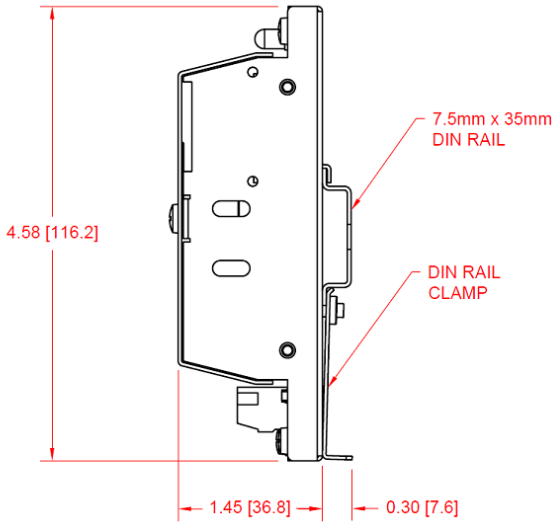
Failure to follow these instructions can result in death or serious injury.

8.2 Mounting the 5410 Module

The 5410 high speed counter input module is mounted on the 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to the system I/O Bus.

The figure below shows the module dimensions.





Follow these guidelines for mounting modules:

- DIN rails install horizontally or vertically. Where possible install DIN rails horizontally. Modules are easier to install on horizontal rails. Cooling is optimal when installed horizontally.
- The model DIN17 rail holds four modules. It is 432 mm (17 in) long. If you use another length of DIN rail, trim it to a multiple of the module width.
- Mount modules tightly together on the rail, to avoid straining the intermodule cable. The spacing dimples on the sides of the modules should touch.

⚠ WARNING

ELECTRICAL HAZARD

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

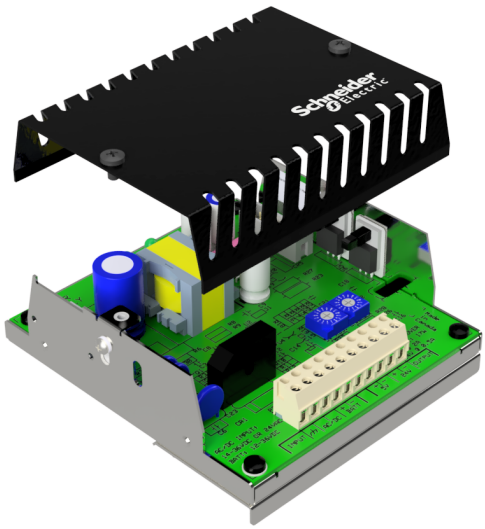
Failure to follow these instructions can result in death or serious injury.

While the size and shape of your device may differ and the color of the connectors may be different from the illustrations below, the procedure for installing the module is the same.

To mount the module on a DIN rail

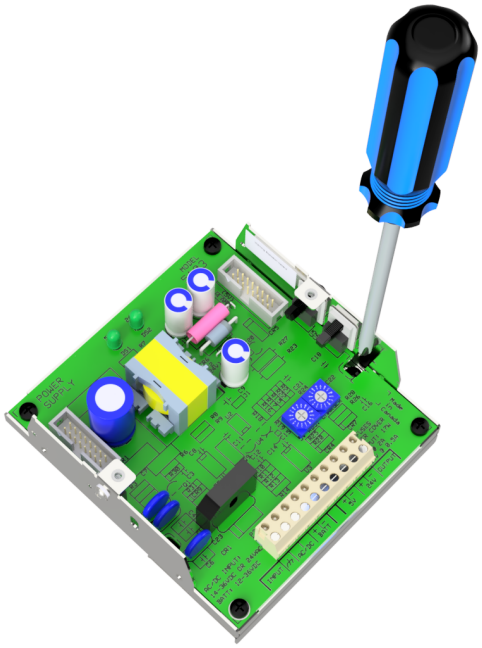
1. Unscrew the two cover screws on the module and remove the cover.

   These screws are permanently attached to the cover for ease of handling.

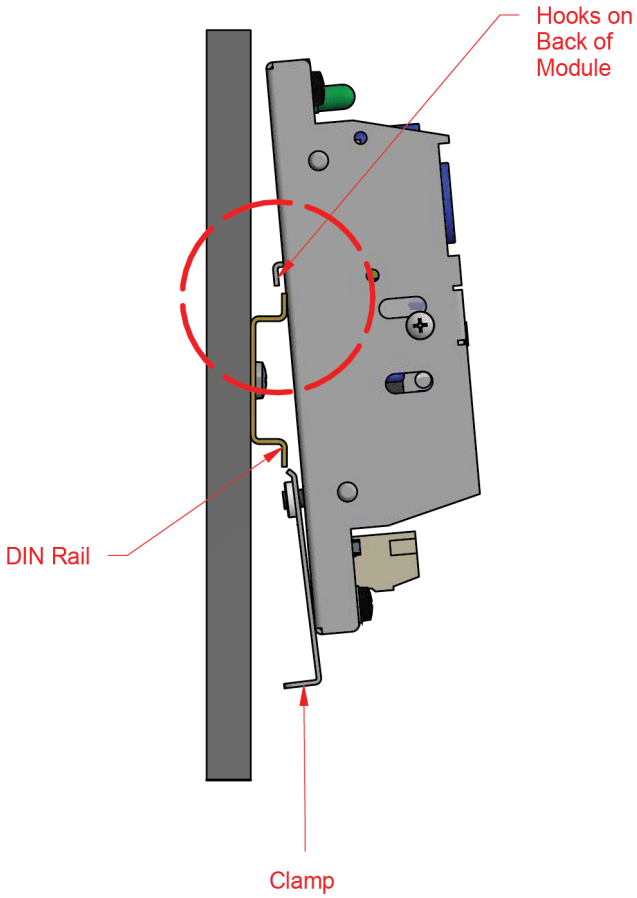


2. Loosen the 2 clamp screws on either side of the circuit board until there is a 1.5 mm (1/16 in) clearance between the back of the module and the clamp.

   The clamp screws are accessible through notches on either side of the circuit board.

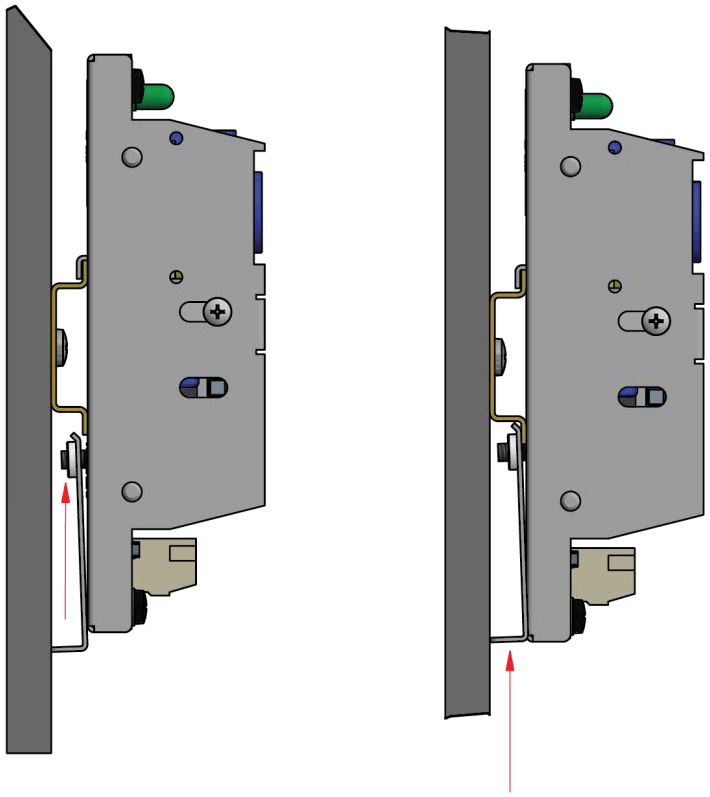


3. Slide the clamp out past the bottom of the module.
4. Position the 2 hooks on the back of the module over the top lip of the DIN rail.

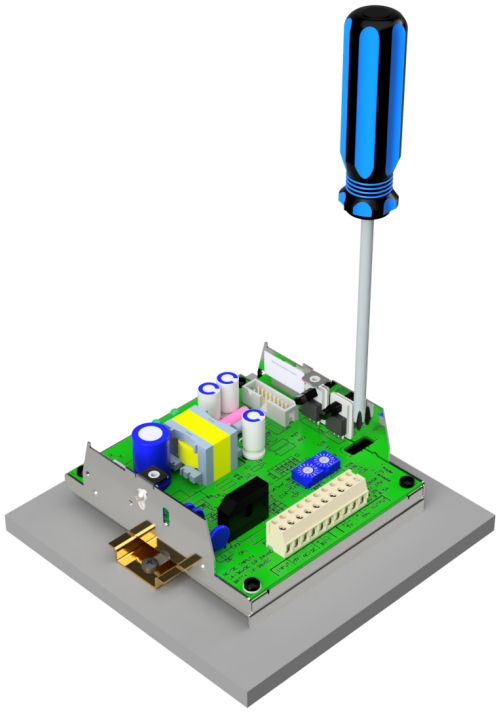


5. Slide the clamp upward until it meets the lower lip of the rail.

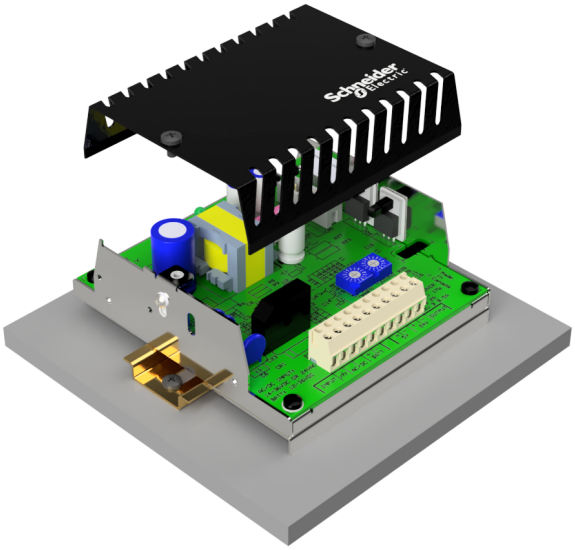
   The bottom of the clamp will be flush with the bottom of the module.



6. Tighten the clamp screws.



7. Replace the cover.



If you route an intermodule cable (IMC) behind the module, check that there is adequate clearance between the module and the hardware used to mount the DIN rails so that the cable doesn't get pinched in the clamp.

8.3 Layout Guidelines

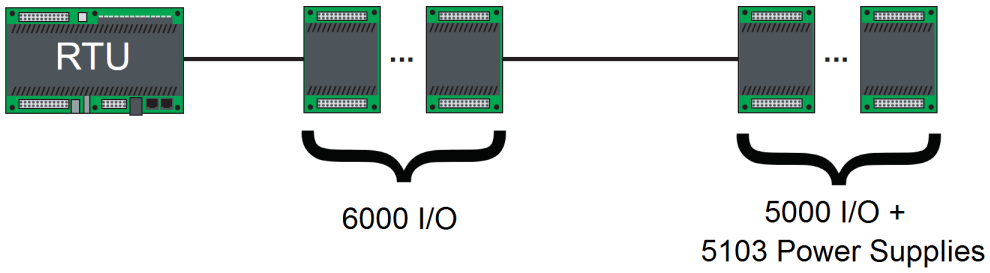
When additional I/O or power is required by the system, I/O expansion modules or 5103 power supply modules can be used in combination with the controller. There are several guidelines to keep in mind when adding modules to your SCADAPack x70 control system.

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 Connecting I/O Modules

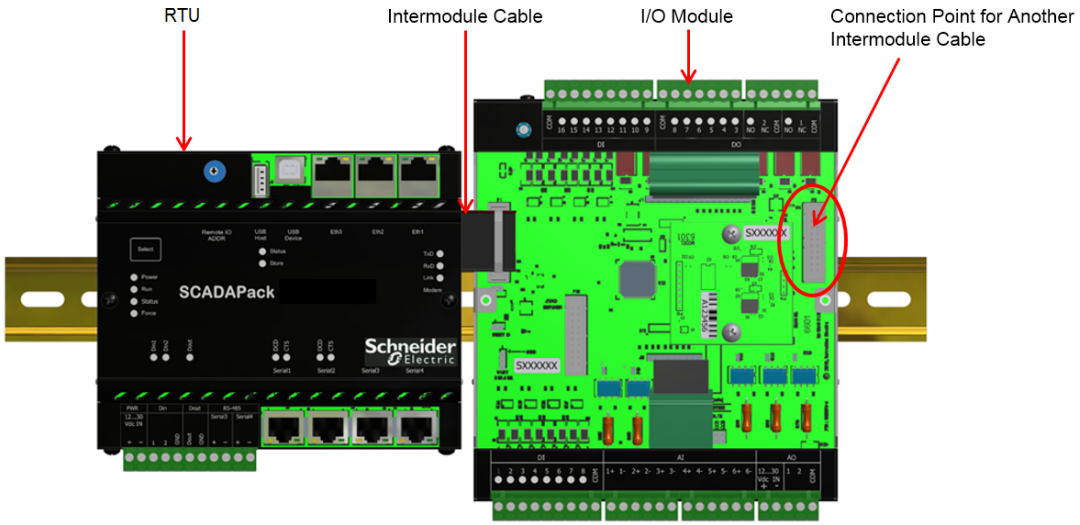
The topics in this section describe how to attach I/O modules to a SCADAPack, or to another I/O module.

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 29 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 31, read the Precautions 28 and the Cabling Guidance 29.

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 48 for details.
- Confirm that the intermodule cables you are are less than the maximum total cable length. See Maximum Intermodule Cable Length 30.
- 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.

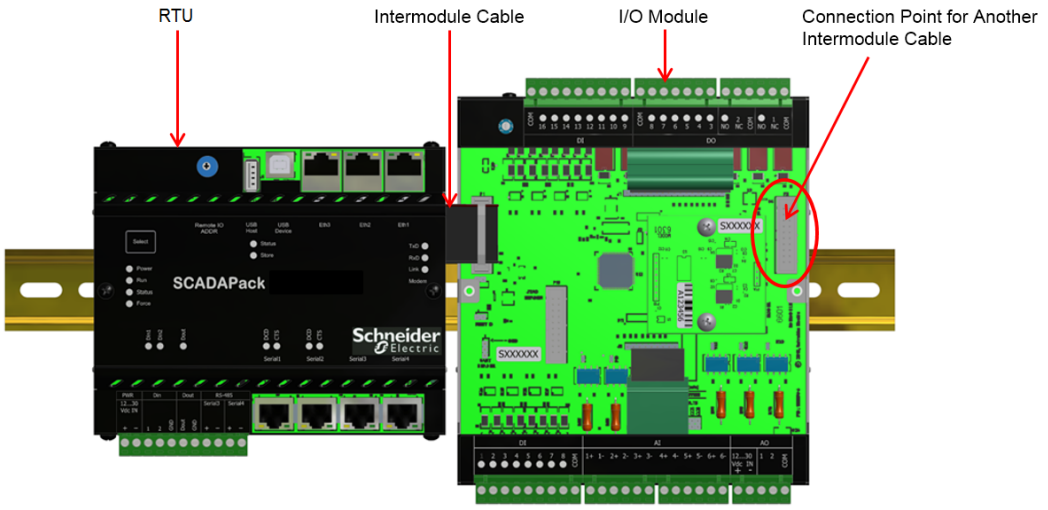
To attach intermodule cables

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 34
- Setting the I/O Module Address 35

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

The 5000 I/O bus will support a maximum of twenty I/O (input/output) modules. 5000 I/O module types may be combined in any manner to the maximum supported by the SCADAPack x70 device used. The types of input and output modules available are:

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

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

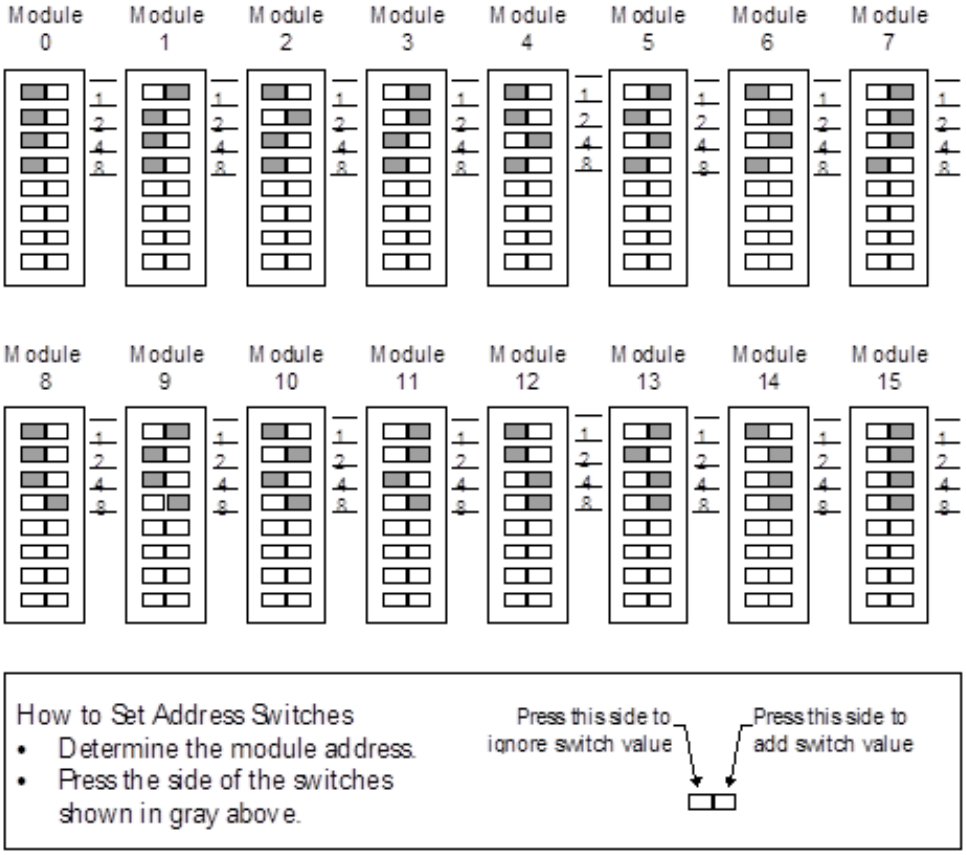
The address range supported by the SCADAPack x70 device may restrict the I/O module address range. Refer to the SCADAPack x70 device manual for the maximum address supported.

The four address switches labeled 1, 2, 4, and 8 set the module address.

To set the address

1. Open the four switches by pressing down the left side of Address SW1.
2. Close the switches that total the desired address.

The following figure shows the switch settings for each of the 16 module addresses.


Module 0
Module 1
Module 2
Module 3
Module 4
Module 5
Module 6
Module 7
Module 8
Module 9
Module 10
Module 11
Module 12
Module 13
Module 14
Module 15
1
2
4
8
How to Set Address Switches
• Determine the module address.
• Press the side of the switches shown in gray above.
Press this side to ignore switch value
Press this side to add switch value

10 Field Wiring

Field wiring attaches to the field wiring terminal blocks on each module.

⚠ 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 input or output. See the Specifications topic for the maximum voltage.

Failure to follow these instructions can result in equipment damage.

Field wiring guidelines

Follow these guidelines when planning for field wiring:

- When modules are installed in a Class I Division 2 area, power, input and output (I/O) wiring needs to be in accordance with Class I, Division 2 wiring methods (article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction.
- Arrange the modules so field wiring is accessible.
- Field wiring termination connectors are removable. Leave enough slack in the wiring for the connector to be removed.
- Arrange the modules and wiring so the status LEDs are visible.
- Keep modules switching loads away from communication controllers and analog input modules.
- Route low-level signals separate from high-level and AC power signals.
- No bonding is usually required by Electrical Safety Standards between modules carrying primary power and AC ground, since these modules are certified as components to be installed within an enclosure thereby limiting access by unauthorized personnel. Consult individual module manuals for special bonding instructions should they be required.
- Consult individual module manuals for the connection of external fuses should they be required, in particular by primary voltage carrying modules. Install where required.

Connect an external 11...30 Vdc DC power supply to the power input terminals. This is to power the isolated analog input circuits. The 5 Vdc power required for the digital circuitry is available on the I2C bus. Refer to the Specifications 48 for details.

In systems where multiple 5000 modules and other devices are connected to the DC power supply, it is possible for noise to be coupled into the DC power supply. For these reasons it is recommended that the negative side of the DC supply be connected to the panel or chassis ground. This connection can be made on the 5000 power supply.

For more information see:

- Wiring Screw-Termination Connectors 39
- Counter Input Wiring 41
- De-Bounce Filter Selection 42

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...0.33 mm^2 (12...22 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

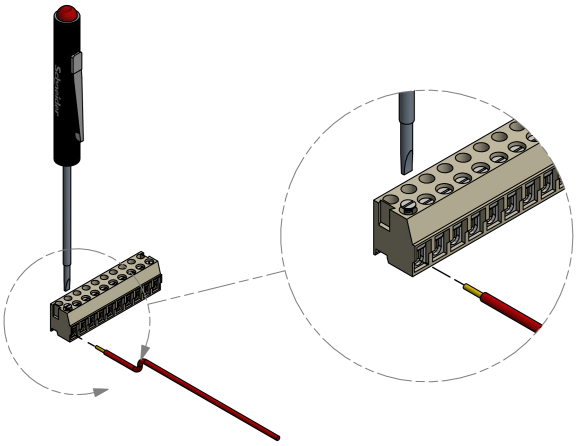
ELECTRICAL HAZARD

Remove power from all modules and devices before servicing.

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

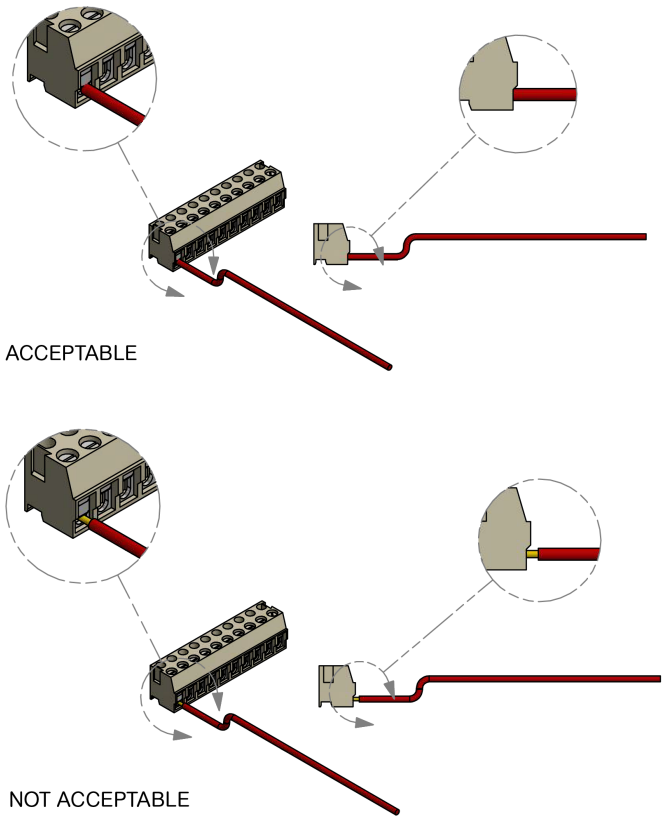
To wire a connector

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.

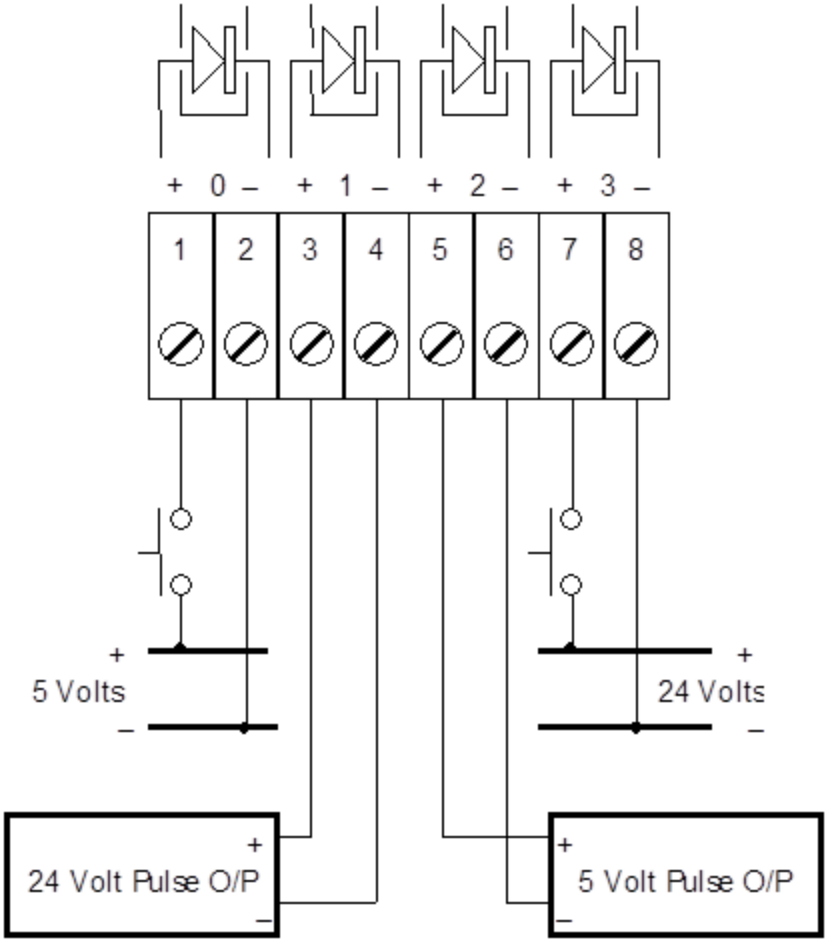


3. Apply 0.68 N•m (6 lb-in) torque to tighten the screw so the wire is held firmly in place.

10.2 Counter Input Wiring

The 5410 high speed counter input module provides four counter inputs. Individual counter inputs are wired to two poles of the eight pole terminal block.

The figure below shows typical field wiring practices.



The 5410 high speed counter input module accommodates DC inputs ranging from 3 to 28 volts. Observe signal polarity. Connect the positive signal to the (+) input. Connect the negative signal to the (-) input.

5000 modules use screw termination style connectors for termination of field wiring. They accommodate solid or stranded wires from 22 to 12 AWG.

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

Remove power before servicing unit.

To remove the connector

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

To install the connector

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

10.3 De-Bounce Filter Selection

Mechanical contact inputs often exhibit switch bounce, which can cause multiple counts to be accumulated on each opening and closing of the switch contact. To reduce false counts from switch bounce, enable de-bounce filters for each input.

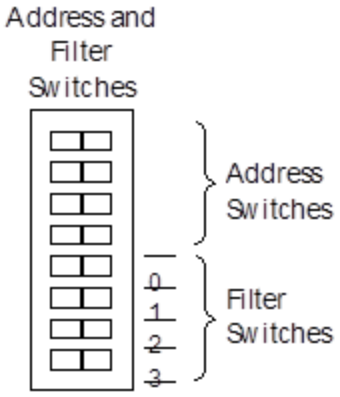
To reduce false counts, enable de-bounce filtering by pressing the right side of the switch.

To count high frequency signals, disable de-bounce filtering by pressing the left side of the switch.

To set configuration switches

- Determine the desired function.
  - To enable the function, press the right side of the switch
  - To disable the function, press the left side of the switch

The following figure shows the locations of the switches.



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 Operating Modes Selection

NOTICE

UNEXPECTED COUNTER READINGS

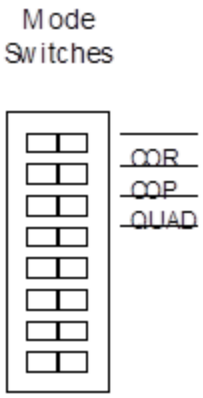
Place the COR, COP, and QUAD switches in the following positions.

- COR – Open the COR switch by pressing down the left side.
- COP – Close the COP switch by pressing down the right side.
- QUAD – Open the QUAD switch by pressing down the left side.

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

The 5410 high speed counter input module Configuration DIP Switches need to be set to the appropriate configuration to be used with a SCADAPack x70 device.

Name	State
COR	OPEN (OFF)
COP	CLOSE (ON)
QUAD	OPEN (OFF)



Clear Counters on Read

Place the COR switch as follows when used with a SCADAPack 57x or 47x RTU.

- Open the COR switch by pressing down the left side. Counters will be retained when read.

Clear Counters on Power-Up

Place the COP switch as follows when used with a SCADAPack 57x or 47x RTU.

- Close the COP switch by pressing down the right side. Counters will clear on power-up.

Quadrature Encoding

Place the QUAD switch as follows when used with a SCADAPack 57x or 47x RTU.

- Open the QUAD switch by pressing down the left side. Counters will operate as 4 pulse counters.

13 Diagnostics

Condition	Action
Input LED does not come on when input signal is applied.	Check the input signal at the termination block Check the polarity of the signal If high-frequency input signals are connected, open de-bounce switch
Counts are missed from a high-frequency signal.	Open de-bounce switch. Check that the frequency of the signal is less than 10 kHz Check that the pulse length is longer than 50 microseconds
Counts are missed from a low-frequency signal, with de-bounce switch closed.	Check that the frequency of the signal is less than 60 Hz Check that the pulse length is longer than 8.3 milliseconds
Multiple counts for each input pulse.	Close de-bounce switch

14 Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Technical Support 6 for more information and instructions for returning the module for repair.

For more information see:

- Use with High Frequency Inputs 47
- Use with Mechanical Inputs 47
- LED Indicators 47

14.1 Use with High Frequency Inputs

When used with high frequency inputs, de-bounce filters are disabled. The maximum count frequency is 10 kHz. The minimum pulse low and pulse high width is 50 microseconds.

14.2 Use with Mechanical Inputs

Mechanical contact inputs often exhibit switch bounce. The high frequency ringing caused by switch bounce can cause multiple counts to be accumulated on each opening and closing of the switch contact.

To reduce false counts from switch bounce, enable de-bounce filters for each input. To enable de-bounce filters, close the appropriate filter switch.

When de-bounce filtering is enabled, the maximum count frequency is 60 Hz. The minimum pulse low and pulse high width is 8.3 milliseconds.

14.3 LED Indicators

The 5410 high speed counter input module has one red status LED per counter input. This LED is on when the input voltage exceeds three volts DC. If the de-bounce filter is on, the input frequency needs to be 60 hertz or lower for the LED to illuminate.

For ease of viewing, the LEDs use pulse stretching to allow pulses as brief as fifty microseconds to be observed.

The SCADAPack x70 device, through the I/O bus, powers the LEDs. Refer to the SCADAPack x70 device manual for more information.

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 6

Item	Specification
Counters	4
Count Length	32 bits range is 0...4,294,967,295
Over-Voltage Protection	Transient suppresser on each input
Input Voltage Range	Typical operating inputs 5...24 volts. 3 volts minimum 28 volts maximum
Input Current	8 mA typical 13 mA maximum
Input Logic Level	off to on threshold is typically 2 volts
Maximum Input Frequency	10 kHz with filters off 60 Hz with de-bounce filters on
Minimum Pulse High Width	50 microseconds (µs) 8.3 milliseconds with de-bounce filters
Minimum Pulse Low Width	50 microseconds (µs) 8.3 milliseconds with de-bounce filters
Isolation	500 Vac input to input 500 Vac input to logic circuit
Addressing	DIP switch configurable
Configuration Switches	4 de-bounce filter on/off, one per input COR (Clear counter On Read) COP (Clear On Power-up or reset)

	QUAD (Quadrature encoder operation)
Power Requirements	5 Vdc @ 35 mA all LEDs on 5 Vdc @ 15 mA with LEDs off
Visual Indicators	4 red LEDs LED on time stretched for easy viewing controlled by device for power reduction
Field Terminations	8 pole, removable terminal block 3.3...0.33 mm^2 (12...22 AWG) 15 amp contacts
Dimensions	4.25 inch (108 mm) wide 4.625 inch (118 mm) high 1.75 inch (44 mm) deep
Mounting	7.5 x 35 mm (0.3 x 1.4 in) DIN rail
Packaging	Corrosion resistant zinc plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing –40...60 °C –40...140 °F

16 Standards and Certifications

	Standards and Certifications
Hazardous locations - North America	Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 CSA certified to the requirements of: • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Safety	CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL508. (Process Control Equipment, Industrial Control Equipment) UL (cULus) listed: UL508 (Industrial Control Equipment)
Digital emissions	FCC 47 Part 15, Subpart B, Class A Verification EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment C-Tick compliance. Registration number N15744.
Immunity	EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments
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