

SCADAPack

470 Hardware Manual

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1 Legal Information

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

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

Trademarks

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2 Technical Support

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

Technical support: Americas, Europe, Middle East, Asia

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

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

Technical support: Australia/New Zealand (Pacific)

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

3 Safety Information

Important information

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



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



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

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

Please note

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

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

Before you begin

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

WARNING

EQUIPMENT OPERATION HAZARD

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

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

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

Test all software in both simulated and real environments.

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

Operation and adjustments

The following precautions prevail:

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

Acceptable use

WARNING

UNACCEPTABLE USE

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

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

CAUTION

EQUIPMENT OPERATION HAZARD

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

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

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

4 About the Book

Audience

WARNING

UNINTENDED EQUIPMENT OPERATION

The application of this product requires expertise in the design and programming of control systems. Only persons with such expertise are allowed to program, install, alter, and apply this product.

Follow all local and national safety codes and standards.

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

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

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Document scope

This manual describes:

- The physical design of the SCADAPack, including detailed hardware specifications.
- The physical design of integrated inputs and outputs (I/O) and the basic requirements for adding I/O modules.
- Installation, wiring and addressing for the SCADAPack.
- Diagnostics capabilities on the SCADAPack.
- Maintenance recommendations for the SCADAPack.

Validity note

This document is valid for:

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

Related documents

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

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

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

5 About the SCADAPack 470

The SCADAPack is a smart telemetry and control device that can help to remotely monitor and control physical objects. For example, in a water management environment, the SCADAPack can be used to monitor and control the valves on flow-monitoring devices at pumping stations. The SCADAPack's 1 ms Sequence of Event (SOE) monitoring capability is well suited to telemetry applications that require high-speed timestamping and data capture.



The SCADAPack difference

A SCADAPack combines the power of a programmable automation controller with the versatility of a Remote Terminal Unit (RTU). The SCADAPack is a platform that increases performance, adheres to open standards, and can operate in harsh, remote environments.

Schneider Electric's SCADAPack 470 provides:

- Support for open standard telemetry protocols such as DNP3 with Secure Authentication
- Support for open standard industrial protocols such as Modbus RTU and Modbus/TCP
- An open standard IEC 61131-3 programming environment comparable with Schneider Electric's Modicon PLC environment
- Controlling Station or Client operation capabilities for DNP3 or Modbus devices

- Support for up to 20 active Supervisory Control and Data Acquisition (SCADA) client connections using Modbus/TCP
- Support for up to 5 active SCADA client connections using Modbus RTU
- Support for up to 3 active SCADA Controlling Station connections using DNP3
- Support for up to 90 peer-to-peer devices
- SCADAPack RemoteConnect configuration software that provides a user interface so you can configure and manage communications and operations for SCADAPack x70 devices and I/O modules
- A maximum of 698 physical digital/analog inputs and outputs, calculated as follows:
 - 10** (inputs and outputs on the 470 device)
 - + **7** (maximum number of 5405 digital input modules) x **32** (number of inputs per 5405 digital input module)
 - + **8** (maximum number of 5606 I/O modules) x **58** (number of inputs and outputs per 5606 I/O module)
 - = **698** physical inputs and outputs
- 1 ms resolution timestamped digital inputs
- 1 to 4 AI are 12-bit analog-to-digital conversion (ADC)
- 2 Ethernet and 5 serial ports
- 1 USB device port for local configuration and 1 USB host port for external storage on USB host devices up to 32 GB
- A tool-free DIN rail mounting system
- 15 g acceleration
- Support for IP2x terminal blocks
- Support for operation from -40...70 °C (-40...158 °F)
- A compact form factor

Device roles

The SCADAPack x70 device can be configured to play one or more of the following roles in your Supervisory Control and Data Acquisition (SCADA) environment:

- DNP3 Outstation
- DNP3 Router
- DNP3 Peer to Peer Client
- DNP3 Data Concentrator Controlling Station
- Modbus RTU Server
- Modbus RTU Client
- Modbus IP Servers
- Modbus IP Clients

- Realflo Flow Computer that measures natural gas or petroleum liquid flow

The role your SCADAPack x70 device plays in your SCADA environment determines how you need to set up communications to and from the SCADAPack and how you need to configure the SCADAPack.

Communications

The SCADAPack 470 includes 5 serial ports and 2 Ethernet ports that are available for communications with the SCADA system, with other SCADAPacks and with devices such as Programmable Logic Controllers (PLCs), instruments, and smart devices, and with the local SCADAPack RemoteConnect configuration software. It also includes a USB 2.0 device port for local configuration and a USB 2.0 host port that supports plug-in media.

The SCADAPack communicates using the Distributed Network Protocol Version 3 (DNP3) and Modbus protocols.

Inputs and outputs

SCADAPack x70 devices provide integrated I/O. I/O can also be extended by adding I/O modules.

I/O can be extended by adding up to 15 I/O modules. For details about the number of I/O modules supported, see [Specifications](#)^[122].

Configuration

You can configure the SCADAPack in the following ways:

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

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

Security

The SCADAPack supports optional DNP3 Secure Authentication features to help improve operational integrity by checking that DNP3 critical operations are received from authenticated sources.

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

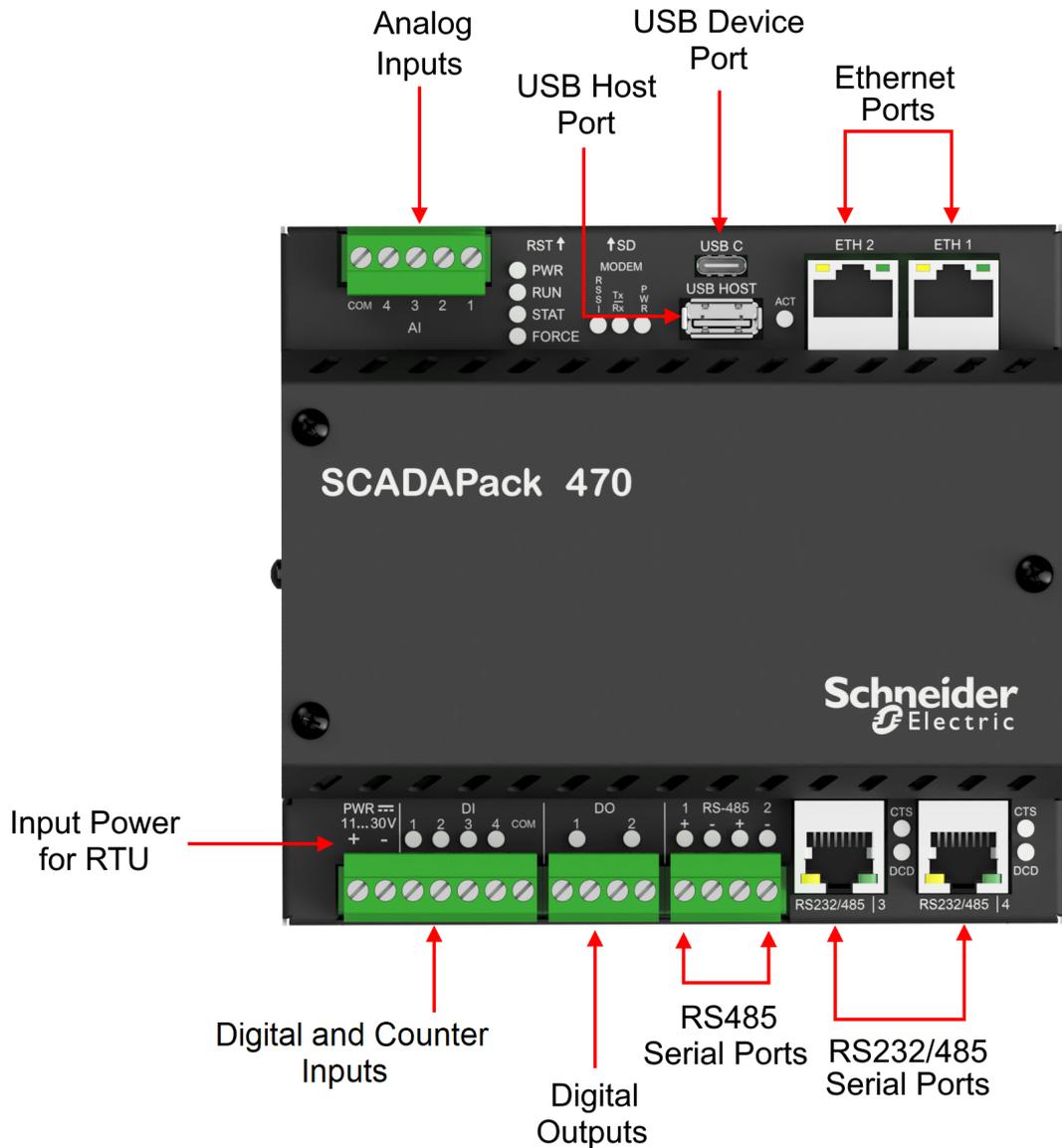
<https://www.nist.gov/publications/guide-industrial-control-systems-ics-security>

WaterISAC Water Security Network

<https://www.waterisac.org>

7 Hardware Overview

The figure below shows the locations of the inputs, outputs and ports on the SCADAPack.



For ease of wiring and maintenance, external connections are terminated on removable connectors. If you need to remove the SCADAPack 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 SCADAPack before removing the SCADAPack cover.

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

NOTICE**STATIC ELECTRICITY DAMAGE**

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

Failure to follow these instructions can result in equipment damage.

For complete hardware specifications, see [Specifications](#)^[122].

For information on adding additional I/O modules, see [Adding Inputs and Outputs](#)^[58].

Inputs and outputs	
Digital inputs ^[37]	4 each with an associated counter input
Counter inputs ^[38]	2 are configurable for turbine meter inputs
Digital outputs ^[42]	2 relay outputs
Analog inputs ^[43]	4 0...5 Vdc, 1...5 Vdc, 0...20 mA, 4...20 mA configurable
Communications	
Serial ports ^[23]	<ul style="list-style-type: none"> • 2 RS485 • 2 RS232 or RS485

	<ul style="list-style-type: none"> • 1 Modem RS232 port
Ethernet ports ^[30]	<ul style="list-style-type: none"> • 2 10/100 Mbps UTP 10/100BASE-T
USB ports ^[32]	<ul style="list-style-type: none"> • 1 USB 2.0-compliant A-type receptacle • 1 USB 2.0-compliant C-type receptacle

7.1 Processing and Storage

Processing

The CPU executes a preemptive multitasking operating system, allowing simultaneous, real-time provisioning of:

- Communications protocols such as DNP3, TCP/IP and Modbus
- Timestamped event processing
- Configuration management
- Sequence and control applications created in the SCADAPack x70 Logic Editor

Storage

The SCADAPack provides internal flash storage and support for external USB storage media. The internal flash storage is described below. For more information about support for plug-in storage media, see [USB Ports](#) ^[32].

Operating system flash

The operating system flash stores the SCADAPack firmware. The firmware implements the communications protocols — DNP3, TCP/IP, Modbus and others — the services that support the SCADAPack object database and the SCADAPack x70 logic that runs the user-created sequence and control applications.

The SCADAPack firmware can be upgraded locally or remotely.

User file system flash

The user file system flash stores the SCADAPack configuration, user logic, data files and other custom user files. See the [Specifications](#) ^[124] for details on storage space.

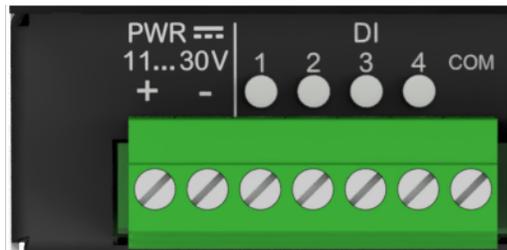
Bootloader flash

The bootloader firmware resides in a separate flash memory chip. The bootloader firmware is the first code executed by the CPU when power is applied to the SCADAPack. It configures the SCADAPack hardware then verifies, loads and executes the operating system firmware. It also provides firmware upgrade facilities.

The bootloader firmware can be upgraded locally or remotely.

7.2 Power Supply

The SCADAPack is powered by a 11...30 Vdc power supply that is connected to the power input connectors on the SCADAPack. The figure below shows the location of the power input connectors.



Power input
Connectors

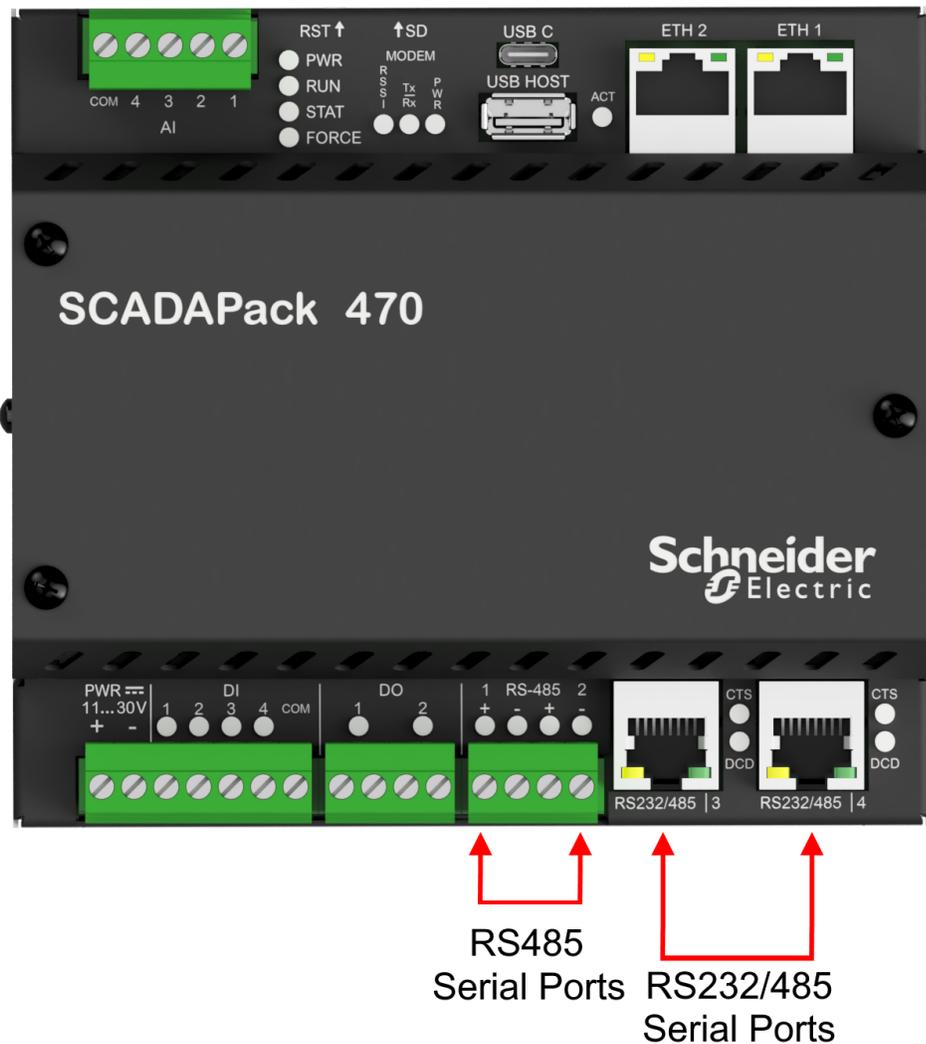
For details about power supply requirements, see [Power Supply Requirements](#)^[56].

7.3 Back-Up Battery

A 3.6 V lithium battery installed on the SCADAPack controller provides back-up power to the SCADAPack's real-time clock and RAM memory. It also maintains the SCADAPack configuration during a power-supply interruption.

7.4 Serial Ports

The figure below shows the location of the RS232 serial ports and the RS485 screw-termination connectors on the device.



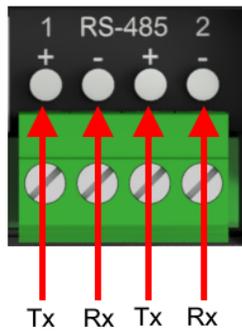
For more information see:

- [Serial1 and Serial2 Ports](#) ^[24]
- [Serial3 and Serial4 Ports](#) ^[26]
- [Serial5 \(Modem\) Port](#) ^[29]

7.4.1 Serial1 and Serial2 Ports

Serial1 and Serial2 are general-purpose serial data communications ports that can be used for RS485 communications with the SCADA system, with other SCADAPacks and with devices such as Programmable Logic Controllers (PLCs), instruments, smart devices and with the computer running the SCADAPack RemoteConnect configuration software.

The figure below shows a close-up view of the serial ports and their LEDs.



Configuration

Serial1 and Serial2 support RS485.

Using the SCADAPack RemoteConnect configuration software, you can configure Serial1 and Serial2 to define the port function, port mode, baud rate, and serial format, as summarized in the table below.

Port Function	Port Mode	Baud Rate (bps)	Serial Format
None	RS485 2w	300	8-bit No Parity (default)
DNP3		600	8-bit Even Parity
COM User (Function Block)		1200	8-bit Odd Parity
		2400	7-bit Even Parity
Terminal Server		4800	7-bit Odd Parity
Modbus (default)		9600	8-bit No Parity 2 Stop Bits
PPP/TCP/IP		(default)	
		19200	
		38400	
		57600	
		115200	

For more information about configuring serial ports, see the Configuring Serial Communication topic in the SCADAPack x70 Configuration manual.

LEDs

The following table describes the Serial1 and Serial2 LEDs on the front panel of the device and on the physical ports.

LED	Color	Description
TxD	Yellow	Lit when Serial1 or Serial2 RS485 port is transmitting
RxD	Green	Lit when Serial1 or Serial2 RS485 port is receiving

For more information see [LEDs](#).^[102]

Cabling

The Serial1 and Serial2 screw-termination connectors support wired connections:

- You can create a two-wire RS485 connection to the screw-termination connectors labeled Serial1+ and Serial1-.
- You can create a two-wire RS485 connection to the screw-termination connectors labeled Serial2+ and Serial2-.

A maximum of 32 SCADAPacks and other devices can be connected to any one RS485 network.

For more information see:

- [RS485 Wiring](#)^[75]

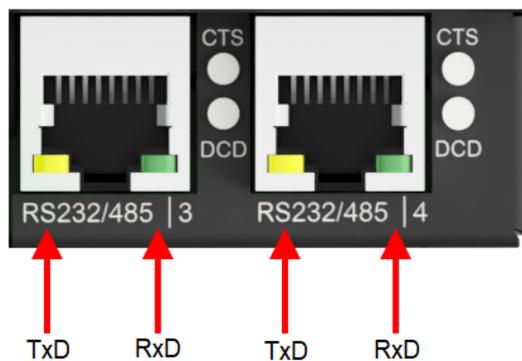
Specifications

For serial port specifications see [Communications](#).^[126]

7.4.2 Serial3 and Serial4 Ports

Serial3 and Serial4 are general-purpose serial data communications ports that can be used for RS232 or RS485 communications with the SCADA system, with other SCADAPacks and with devices such as Programmable Logic Controllers (PLCs), instruments, smart devices and with the computer running the SCADAPack RemoteConnect configuration software.

The figure below shows a close-up view of the serial ports and their LEDs.



Configuration

Serial3 and Serial4 are software configurable for RS232 communications or two-wire RS485 communications. The RJ45 connectors support RS232 and RS485 communications. If you want to use RS485 communications, use the appropriate cable with the modular connector. See [RS485 Wiring](#) [75].

Using the SCADAPack RemoteConnect configuration software, you can configure each of the serial ports to define its port function, port mode, baud rate and serial format. The table below summarizes the available options. The port mode and baud rate options presented in the user interface depend on the selected function.

Port Function	Port Mode	Baud Rate (bps)	Serial Format
None	RS232 (RTS Off)	300	8-bit No Parity (default)
DNP3	RS232 (RTS On) (default)	600	8-bit Even Parity
Command Line (default for Serial4)	RS232 (RTS) Keyed	1200	8-bit Odd Parity
		2400	7-bit Even Parity
COM User (Function Block)	RS485 2w	4800	7-bit Odd Parity
	Dialup Modem	9600	8-bit No Parity 2 Stop Bits
Terminal Server	PPP Modem	(default)	
Modbus (default for Serial3)		19200	
		38400	
PPP/TCPIP		57600	
		115200	

For more information about configuring serial ports, see the Configuring Serial Communication topic in the SCADAPack x70 Configuration manual.

LEDs

The following table describes the Serial3 and Serial4 LEDs.

LED	Color	Description
CTS for Serial3 port	Green	Lit when the CTS input is active on the Serial3 port
DCD for Serial3 port	Green	Lit when the DCD input is active on the Serial3 port
CTS for Serial4 port	Green	Lit when the CTS input is active on the Serial4 port
DCD for Serial4 port	Green	Lit when the DCD input is active on the Serial4 port
Left side of the physical port	Yellow	Blinks when data is being transmitted over the RS232 or RS485 serial connection.
Right side of the physical port	Green	Blinks when data is being received over the RS232 or RS485 serial connection.

For more information see [LEDs](#)^[102].

HMI power control

Pin 1 of the RJ45 connector for Serial3 and Serial4 provides switched 5 Vdc power for a human-machine interface (HMI) or other devices. Use SCADAPack RemoteConnect to configure the state of the power pins.

You can also associate a Digital object with system data reference **SYS_INFO_SerialPortPowerOn** and configure it from a logic application or through protocol control commands. This system data reference also indicates the current state of the power pins. The system data reference is set to true when the power to pin 1 on the ports is on, and is false when the power to pin 1 on the ports is off.

Cabling

When configured as RS232, the Serial3 and Serial4 serial ports support RS232 serial cables with an eight-pin RJ45 Data Terminal Equipment (DTE) connector. For more information see:

- [RS232 Pin Assignments](#)^[70]
- [RS232 Cable Descriptions](#)^[71]
- [RS232 Wiring Examples](#)^[72]

When configured as RS485, the Serial3 and Serial4 ports support RS485 serial cables.

A maximum of 32 SCADAPacks and other devices can be connected to any one RS485 network.

For more information see:

- [RS485 Wiring](#)^[75]

Specifications

For serial port specifications see [Communications](#)^[126].

7.4.3 Serial5 (Modem) Port

Serial5 is located under the SCADAPack 470 cover. Six RS232 lines are implemented on a removable 8 position terminal block.

A switch is available to the right of the battery switch that is accessible only by removing the cover.

- For normal operation of the Serial5 DCD line, leave the switch in the up (off) position
- The down (on) position is reserved for future use

Any pin-compatible cell modem or adaptor cable for an external modem can be connected to Serial5.

Line	Description
DCD	Data Carrier Detect Input
DTR	Data Terminal Ready Output
CTS	Clear to Send Input
RTS	Request to Send Output
RXD	Receive Data Input
TXD	Transit Data Output
GND	Zero voltage reference
+OUT	Switched voltage output available to power the modem

Configuration

Port Function	Port Mode	Baud Rate (bps)	Serial Format
None (default)	RS232 (RTS Off)	300	8-bit No Parity
DNP3	RS232 (RTS On)	600	8-bit Even Parity
Command Line	RS232 (RTS) Keyed	1200	8-bit Odd Parity
COM User (Function Block)	Dialup Modem	2400	8-bit No Parity 2 Stop Bits
	PPP Modem	4800	
Modbus		9600	
PPP/TCPIP		19200	
		38400	
		57600	
		115200	

For more information about configuring serial ports, see the Configuring Serial Communication topic in the SCADAPack x70 Configuration manual.

LEDs

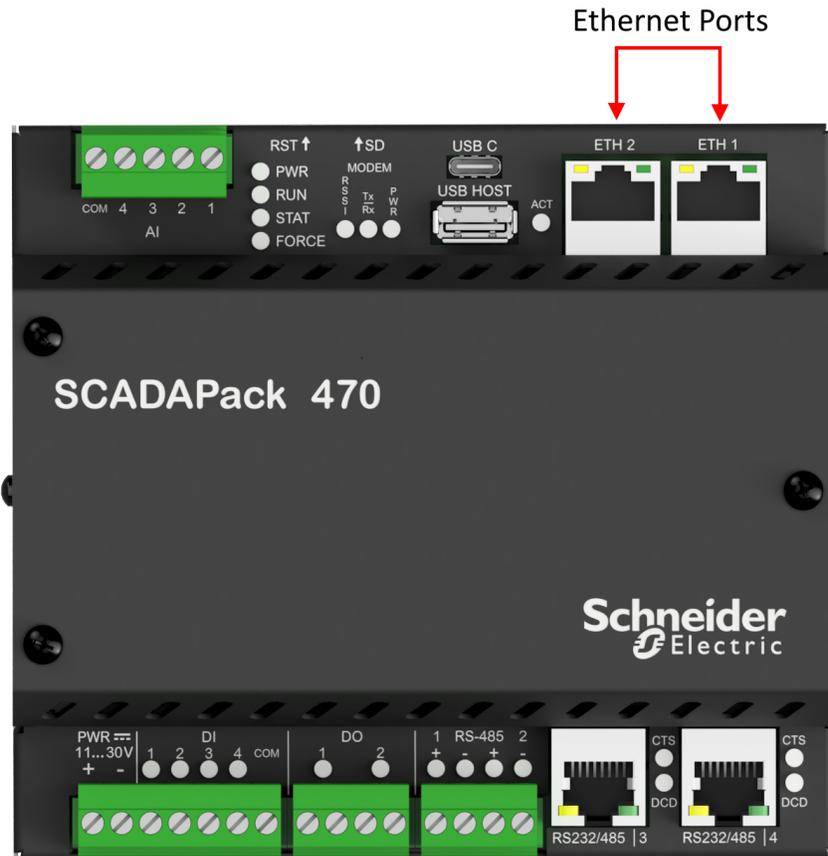
The following table describes the Serial5 LEDs.

LED	Color	Description
RSSI	Green	Reserved for future use
	Red	
Tx/Rx	Green	Lit green when receiving
	Yellow	Lit yellow when transmitting
PWR	Green	Lit green when Modem power enabled

For more information see [LEDs](#)^[102].

7.5 Ethernet Ports

The figure below shows the location of the Ethernet ports on the device.



For more information see:

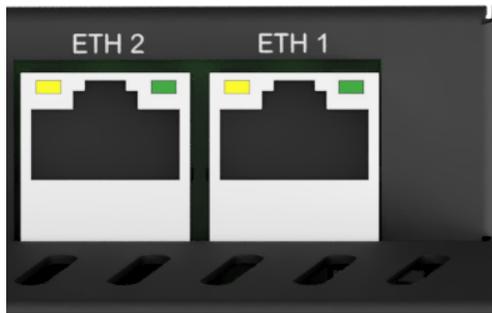
- [Eth1, 2 Ports](#)^[31]

7.5.1 Eth1, 2 Ports

The two Ethernet ports are UTP 10/100BASE-T LAN ports that can be used for IP communications. The Ethernet ports are typically used for point-to-point Ethernet connections and are usually connected to an Ethernet hub or switch, although it is also possible to connect devices together directly.

Each Ethernet port can run at 10 Mbps or 100 Mbps, at half or full duplex. The SCADAPack automatically detects an active Ethernet port and the supported speed of the connected device, giving preference to 100 Mbps full duplex connections.

The following figure shows a close-up view of the two Ethernet ports and their LEDs.



Configuration

Using the SCADAPack RemoteConnect configuration software, you can configure Ethernet settings and routing. In addition, for each of the Ethernet ports you can define its:

- IP Address
- Subnet Mask

The Default Gateway IP Address for the system can also be configured from SCADAPack RemoteConnect configuration software. For more information about configuring Ethernet ports, see the Configuring IP Communication topic in the SCADAPack x70 Configuration manual.

LEDs

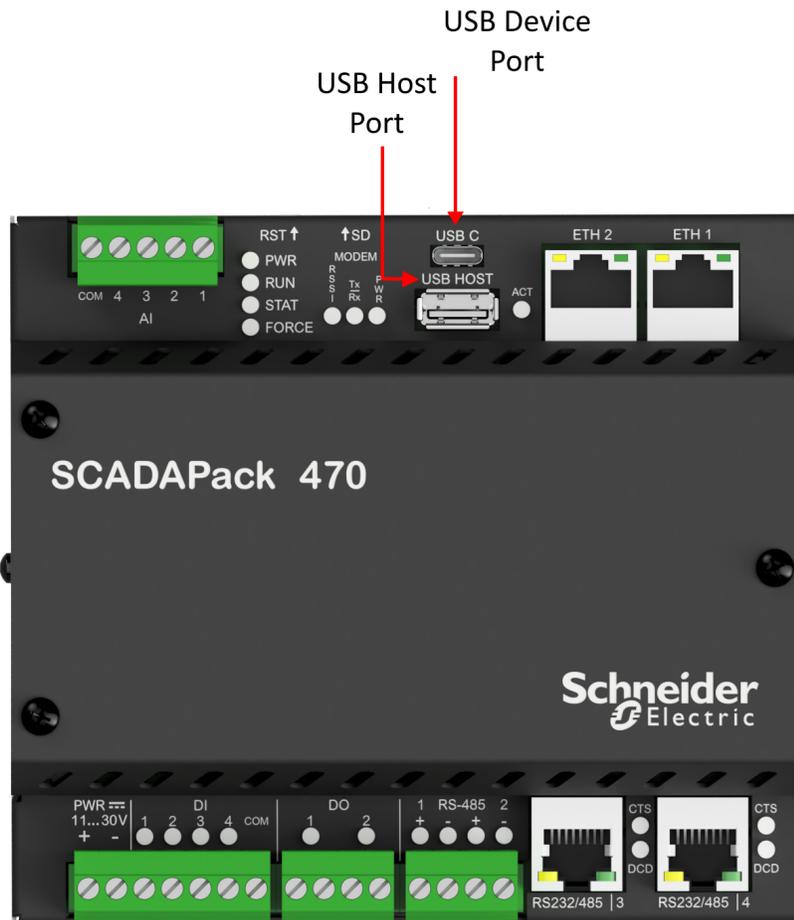
The following table describes the Ethernet LED status indications.

Location	Color	Description
Right side of the physical port	Green	Activity LED. Lit when the Ethernet port is active. Blinks when the port is transmitting or receiving data.
Left side of the physical port	Yellow	Link LED. Lit when the 10/100 Ethernet link is active.

7.6 USB Ports

The USB host and device ports are USB 2.0-compliant. The USB ports automatically detect and support the data rate of the connected device. USB drives with security locks are not supported.

The figure below shows the location of the USB ports on the device.



For more information see:

- [USB Host Port](#)^[33]
- [USB Device Port](#)^[34]

7.6.1 USB Host Port

The USB host port is a USB series A-type receptacle that allows the SCADAPack to act as a host for a plug-in USB drive. For bus-powered USB devices, the USB host port can provide up to 500 mA at 5 Vdc.

The USB host port is not user configurable. It can be mounted and accessed through the device file system at /usb0. For information about support for plug-in USB drives, see [Data Capacity](#)^[124].

⚠ WARNING

EXPLOSION RISK

Do not use USB ports in hazardous applications or hazardous locations.

Use USB ports only for non-hazardous applications in locations that are known to be in a non-hazardous state.

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

NOTICE

UNINTENDED EQUIPMENT OPERATION

Verify that the data transfer between the SCADAPack and the plug-in USB drive is complete before removing the USB drive from the USB host port.

Removing a plug-in USB drive from the USB host port while the data transfer is in progress can impact system performance and result in a system restart.

Failure to follow these instructions can result in equipment damage.

LEDs

The following table describes the USB host port LED on the device front panel.

Type	Name or Location	Color	Description
USB LED	ACT	Green	<p>Off when no USB device is connected or the connection is not complete</p> <p>Flashing when there is an established connection between a USB device and SCADAPack x70 and an operation, such as a firmware update or a file copy, is in progress.</p> <p>Lit when operations are complete and the USB can be removed.</p> <p>The LED can also be controlled using system data reference SYS_SET_USBstoreLED.</p>

7.6.2 USB Device Port

The USB device port is a USB series C-type receptacle that provides communications for local connection to the computer running the SCADAPack RemoteConnect configuration software.

⚠ WARNING**EXPLOSION RISK**

Do not use USB ports in hazardous applications or hazardous locations.

Use USB ports only for non-hazardous applications in locations that are known to be in a non-hazardous state.

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

Configuration

You can configure the USB device port for communications in the configuration software. The default configuration enables the port.

7.7 Inputs and Outputs

The SCADAPack 470 provides:

- 4 digital inputs, each with an associated counter input
- 2 digital outputs
- 4 analog inputs

The figure below shows the location of the inputs and outputs on the SCADAPack 470.



The following table describes the SCADAPack 470 input and output characteristics.

Location	Name	SCAD APac k Label	Polari ty Sensitive	Description	Isolation
Controller board	Digital inputs ³⁷ 1-2 Counter inputs ³⁸ 1-2	DI1 DI2	Yes	<ul style="list-style-type: none"> Digital input 	<ul style="list-style-type: none"> Not isolated from SCADAPack RTU circuitry Configurable for turbine meter pickups

	Turbine meter inputs ^[40] 1-2				
	Digital inputs ^[37] 3-4 Counter inputs ^[38] 3-4	DI3 DI4	Yes	• Digital input	• Not isolated from SCADAPack RTU circuitry
	Digital outputs ^[42] 1-2	DO1 DO2	No	• Relay contact, Form A	• Isolated from SCADAPack RTU circuitry
	Analog inputs ^[43] 1-4	AI1 AI2 AI3 AI4	Yes	• Analog input	• Configurable for 0...5 Vdc, 1...5 Vdc, 0...20 mA, 4...20 mA • Not isolated from SCADAPack RTU circuitry

The digital inputs, digital outputs, and analog inputs use 5 mm (0.197 in) pitch connectors. For information about wiring these connectors, see [Wiring Screw-Termination Connectors](#) ^[68].

The inputs and outputs on the SCADAPack can be:

- Monitored and controlled from a SCADA Controlling Station
- Monitored and controlled from a remote SCADAPack
- Locally controlled using an application created in SCADAPack x70 Logic Editor
- Any combination of the above

Data that is received and sent through the inputs and output can be:

- Transferred to an attached Programmable Logic Controller (PLC) for processing by that PLC
- Timestamped and stored locally for manual or automatic retrieval

These capabilities are provided by the SCADAPack firmware. For more information, see the Technical Reference manuals.

I/O can be extended by adding I/O modules. For details about the number of I/O modules supported, see [Adding Inputs and Outputs](#) ^[58].

7.7.1 Digital Inputs

There are 4 digital inputs provided.

The digital inputs:

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

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

A wetting voltage for the volt-free contacts is required.

The LED for each digital input is lit when the input is electrically active. A digital object state representing a digital input may be inverted from the electrical input state. See [Configuration](#)^[101].

Digital inputs are available for nominal 12...24 Vdc operation. Light Emitting Diodes (LEDs) on the digital inputs show the status of each input.

Configuration

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

- DNP3 parameters
- Modbus parameters
- Event attributes
- Alert notifications
- Physical I/O debouncing and state inversion¹

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

¹State inversion configuration on a physical digital input channel also affects the operation of counter and pulse rate (frequency) operation on the same physical channel. See [Counter Inputs](#)^[38] and [Configuration](#)^[101].

Wiring

Digital inputs support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[68].

Specifications

For digital input specifications, see [Specifications](#)^[128].

7.7.2 Counter Inputs

In the SCADAPack 470, DI1, DI2, DI3, and DI4 inputs have an associated counter and pulse rate (frequency).

Counters on DI1 and DI2 can be used with:

- Digital pulses
- Millivolt level Turbine meters (See [Turbine Meter Inputs](#)^[40])

Counters on DI3 and DI4 can be used with:

- Digital pulses

When connecting a digital pulse, the input counts contact closures², typically from the controller supply voltage. See [Counter Inputs](#)^[129] specification.

- For DI1 and DI2, use the SCADAPack RemoteConnect configuration software to configure the controller channel to “10kHz Counter”

SCADAPack 470 counter inputs DI1, DI2, DI3, and DI4 can count on input rising edge, or input falling edge.

Pulse counts for the input channels are represented as 32-bit counter objects.

Pulse rates (frequency) for the input channels are represented as 32-bit floating point analog objects, measured in Hz.

² Counting OFF transitions instead of ON transitions for digital pulse inputs can be achieved by configuring a digital object on the physical I/O channel. See [Configuration](#)^[101].

Configuration

Use the SCADAPack RemoteConnect configuration software to define the physical I/O characteristics of the SCADAPack 470 DI1 and DI2 input channels for the counter type:

- 10 kHz Counter (for digital pulses)
- 10 kHz Turbine Counter (See [Turbine Meter Inputs](#)^[40])

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each counter object representing the pulse counts, including:

- Modbus parameters
- DNP3 parameters
- Event attributes including counter deviation
- Alert notifications

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each pulse rate (frequency) analog object, including:

- Modbus parameters
- DNP3 parameters
- Scaling (for integer representation of the frequency)
- Event attributes
- Alert notifications

The analog objects representing the pulse rate (frequency) provide the following range of values:

- As a 32-bit floating point analog (REAL): 0.00333 Hz (5 Minutes) to 10000.0 Hz

The default scaling on the analog objects value for pulse rate (frequency) provides the following integer value range:

- As a 32-bit integer value (DINT): 0 to 1000000 representing 0.00333 Hz (5 Minutes) to 10000.0 Hz

The integer range can be rescaled by adjusting the analog object's Raw and Engineering scaling

parameters. To report the value in a 16-bit Modbus register, for example, configure the analog object's Engineering Maximum to 10000 (same as the Raw Maximum) and a Modbus UINT data type. In this case the integer range will be presented as:

- a 16-bit integer value (UINT): 0 to 10000 Hz

Use the SCADAPack RemoteConnect configuration software to define the characteristics of the input transition for each counter and pulse rate (frequency) input by configuring the digital object on the corresponding Physical I/O digital channel:

- State debouncing parameter
- Invert State parameter

When set to Invert State = Yes, the corresponding digital pulse or turbine meter counts on the OFF (falling edge) transition of the input instead of the default ON (rising edge) transition. Similarly the pulse rate (frequency) analog is calculated from OFF transitions of the input (falling edge) instead of the from the default ON transitions (rising edge).

For more information about configuring the SCADAPack 470 inputs for pulse counting and pulse rate (frequency), see Configuring Counter I/O Channels in the SCADAPack x70 Configuration manual.

Wiring

Counter inputs support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[68].

Specifications

For pulse counter input and pulse rate (frequency) specifications, see [Specifications](#)^[129].

7.7.3 Turbine Meter Inputs

In the SCADAPack 470, DI1 and DI2 inputs have an associated turbine meter input counter and pulse rate (frequency).

Counters on DI1 and DI2 can be used with:

- Digital pulses (see [Counter Inputs](#)^[38])
- Millivolt level Turbine meters

When connecting a turbine meter to DI1 or DI2, its sensor typically produces millivolt outputs. The SCADAPack input includes an integrated pre-amplifier on both DI1 and DI2 input channels. An external additional pre-amplifier is not required. The input counts transitions on the millivolt signal.³

- Use the turbine meter inputs in low noise environments with shielded cabling
- Use the SCADAPack RemoteConnect configuration software to configure the controller channel to "10kHz Turbine Counter"

SCADAPack 470 counter inputs DI1 and DI2 can count turbine pulses on input rising edge, or input falling edge.

Pulse counts for input channels are represented as 32-bit counter objects.

Pulse rates (frequency) for the input channels are represented as 32-bit floating point analog objects, measured in Hz.

³ Counting falling edge (OFF) transitions instead of rising edge (ON) transitions for turbine meter inputs can be achieved by configuring a digital object on the physical I/O channel. See [Configuration](#) ^[101].

Configuration

Use the SCADAPack RemoteConnect configuration software to define the Physical I/O characteristics of the SCADAPack 470 DI1 and DI2 input channels for the counter type:

- 10 kHz Counter (see [Counter Inputs](#) ^[38])
- 10 kHz Turbine Counter (for turbine meters)

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each counter object representing the pulse counts, including:

- Modbus parameters
- DNP3 parameters
- Event attributes including counter deviation
- Alert notifications

Use the SCADAPack RemoteConnect configuration software to define the characteristics of each pulse rate (frequency) analog object, including:

- Modbus parameters
- DNP3 parameters
- Scaling (for integer representation of the frequency)
- Event attributes
- Alert notifications

The analog objects representing the pulse rate (frequency) provide the following range of values:

- As a 32-bit floating point analog (REAL): 0.02 Hz to 10000.0 Hz

The default scaling on the analog objects value for pulse rate (frequency) provides the following integer value range:

- As a 32-bit integer value (DINT): 2 to 1000000 representing 0.02 to 10000.0 Hz

The integer range can be rescaled by adjusting the analog object's Raw and Engineering scaling parameters. To report the value in a 16-bit Modbus register, for example, configure the Analog object's Engineering Maximum to 10000 (same as the Raw Maximum) and a Modbus UINT data type. In this case the integer range will be presented as:

- A 16-bit integer value (UINT): 0 to 10000 Hz

For more information about configuring the SCADAPack 470 inputs for pulse counter and pulse rate (frequency), see [Configuring Counter I/O Channels](#) topic in the SCADAPack x70 Configuration manual.

Wiring

Counter inputs support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[68].

Specifications

For counter input specifications, see [Specifications](#)^[129].

7.7.4 Digital Outputs

There are 2 digital outputs provided.

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

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

The LED for each digital output is lit when the NO contact is closed, or activated, and the circuit is continuous.

WARNING

DATA LOSS, APPLICATION LOSS

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

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

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

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

Configuration

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

- DNP3 parameters

- Modbus parameters
- Event attributes
- Alert notifications

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

Wiring

Digital outputs support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

For more information, see [Wiring Screw-Termination Connectors](#)^[68].

Specifications

For digital output specifications, see [Specifications](#)^[130].

7.7.5 Analog Inputs

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

Each analog input is individually configured for the input type — current or voltage — and range. Refer to [Supporting Current or Voltage Mode](#)^[87] for information on how to choose input modes.

The analog inputs are factory-calibrated for 0...20 mA and 4...20 mA current operation and for 0...5 Vdc and 1...5 Vdc operation. The input range is selected using the SCADAPack RemoteConnect configuration software.

Configuration

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

- DNP3 parameters
- Modbus parameters
- Alert notifications
- [Range and Scaling](#)^[44]
- Value deviation

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

Wiring

Analog inputs support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

For more information, see, [Wiring Screw-Termination Connectors](#)^[68].

Specifications

For analog input specifications, see [Specifications](#)^[130].

7.7.5.1 Range and Scaling

The SCADAPack 470 analog inputs use single-ended, common ground, unipolar analog-to-digital converters (ADC) that measure input currents from 0...20 mA or input voltages from 0...5 Vdc including under range and over range capability. For more information, see [Analog Inputs](#)^[130] under Specifications.

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

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

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

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

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

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

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

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

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

- Over Range Limit = disabled

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

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

Current signals

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

Input	0...20 mA Range			4...20 mA Range		
Current (mA)	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value
0.00	0%	Raw Minimum	Engineering Minimum	-25% of range	Less than Raw Minimum	Less than Engineering Minimum
4.00	20% of range			0%	Raw Minimum	Engineering Minimum
8.00	40% of range			25% of range		
12.00	60% of range			50% of range		
16.00	80% of range			75% of range		
20.00	100% of range	Raw Maximum	Engineering Maximum	100% of range	Raw Maximum	Engineering Maximum
22.00	110% of range	More than Raw Maximum	More than Engineering Maximum	112.5% of range	More than Raw Maximum	More than Engineering Maximum

Values above 22 mA cannot be accurately measured by the analog inputs.

Voltage signals

The following table shows the relationship between analog input channel voltage range, analog

signal and the analog object's reported integer and engineering values.

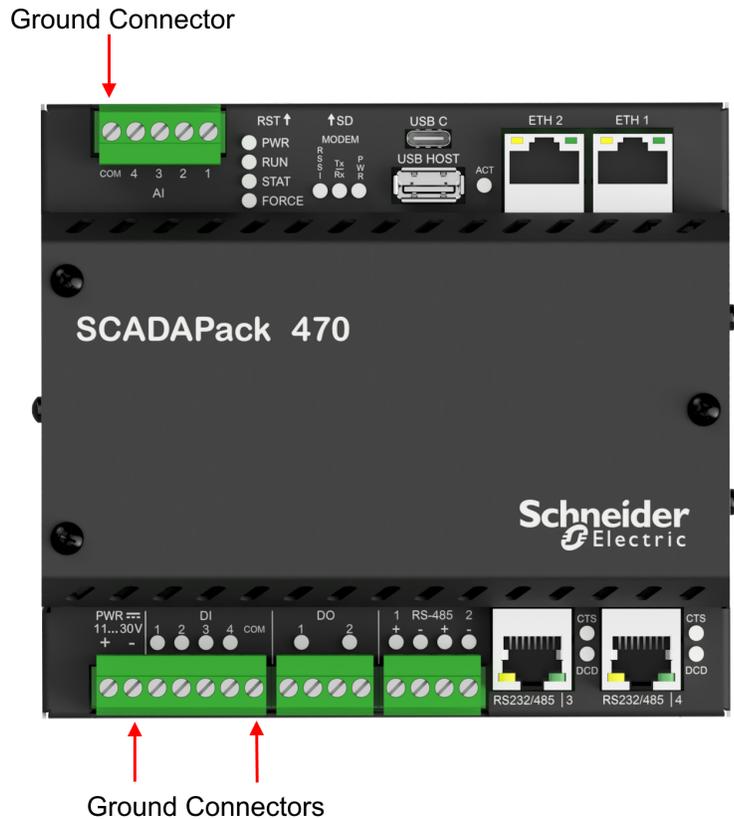
Input	0...5 Vdc Range			1...5 Vdc Range		
Voltage (Vdc)	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value	Analog Signal (% of Range)	Object Integer Value	Object Engineering Value
0.00	0%	Raw Minimum	Engineering Minimum	-25% of range	Less than Raw Minimum	Less than Engineering Minimum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

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

7.8 Ground Connectors

The SCADAPack has several connections labeled COM that are not isolated and are connected to Ground as shown in the diagram below.

Other terminals labeled COM are the shared Isolated Common Returns for the isolated IO.



7.9 Isolation and Protection Summary

The SCADAPack 470 is designed to provide isolation from external connections as described in the table below.

Connections	Isolation	Protection
Digital inputs	None. Common return connected to chassis.	Over voltage (TVS)
Digital outputs	Relay	Isolation
Analog inputs	None. Common return connected to chassis	Withstands continuous application of 30 Vdc without damage.
Serial Ports 1 - 4 TxD, RxD, RS485	None. Common return connected to chassis	Withstands direct connection to 120 Vac
Serial Port 5 (Modem) TxD, RxD, and Serial Ports 1 - 4 RTS, CTS, DCD, DTR	None. Common return connected to chassis	Over voltage (TVS)

Ethernet ports	Transformer	Isolation
USB ports	None. Common return connected to chassis	ESD

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.

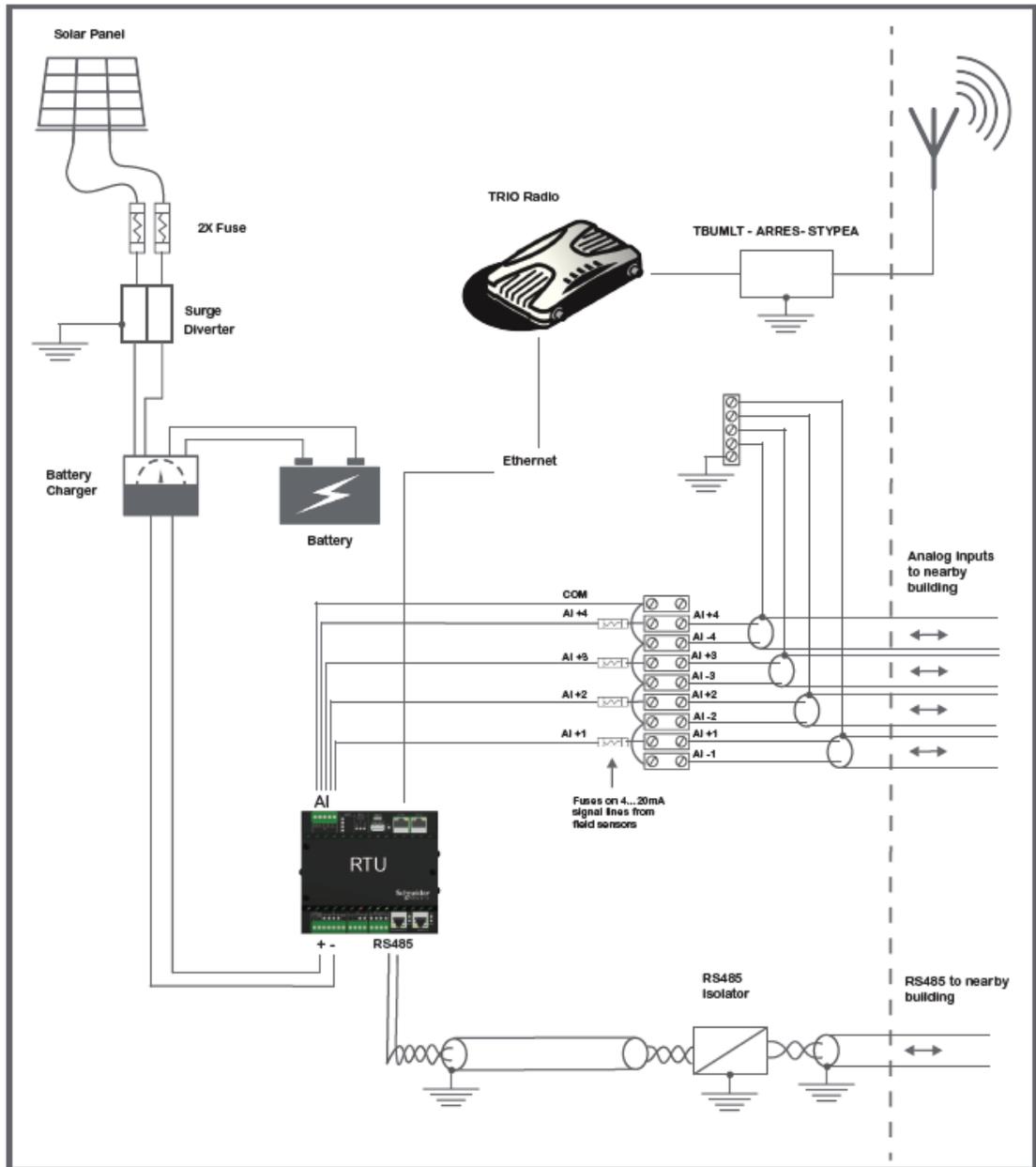
NOTICE**POWER SUPPLY LOSS OF FUNCTION**

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

The lithium-powered RAM back-up battery has a shelf life of approximately two years when the SCADAPack is not connected to a power source. Battery life can be increased to more than eight years when the SCADAPack is permanently connected to a power source.

NOTICE

UNINTENDED EQUIPMENT OPERATION

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

Before installing the SCADAPack, check the Standards and Certifications topic to verify the EMC rating.

Failure to follow these instructions can result in equipment damage.

For more information see:

- [ATEX Requirements](#) ⁵¹
- [Removing the Battery Switch Sticker](#) ⁵²
- [Mounting the SCADAPack 470](#) ⁵³
- [Power Supply Requirements](#) ⁵⁶
- [Adding Inputs and Outputs](#) ⁵⁸

8.1 ATEX Requirements

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

Specific conditions of use

Before installing the equipment, carefully review the instructions in the warning message below.

⚠ WARNING**EXPLOSION HAZARD**

Only install this equipment when the following conditions are met:

Specific Conditions of Use

- The equipment shall only be used in an area of not more than pollution degree 2, as defined in IEC/EN 60664-1.
- The equipment shall be installed in an enclosure that is only tool accessible and that provides a degree of protection not less than IP 54 in accordance with IEC/EN 60079-0.
- Transient protection shall be provided that is set at a level not exceeding 140 % of the peak rated voltage value at the supply terminals to the equipment.

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

Connection terminal blocks

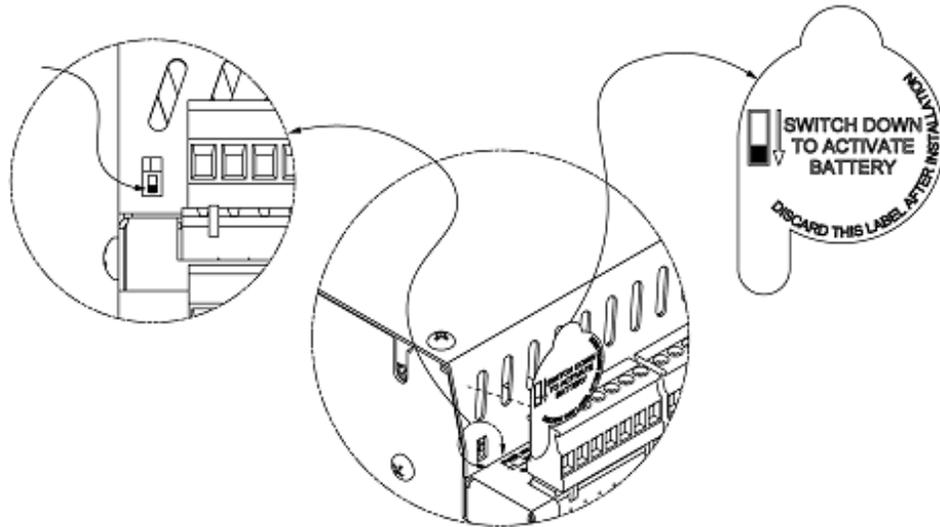
- Screw connection terminal blocks:
 - For 5 mm (0.197 in) pitch connectors support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG)
 - For 3.5 mm (0.138 in) pitch connectors support solid or stranded wires from 1.5...0.2 mm² (14...28 AWG)
- Torque for screw connection terminal block connectors: 0.5 N•m (4.5 Lb-in). For Serial 5 port, apply 0.2 N•m (1.7 lb-in) torque.
- Minimum supply cable temperature rating: 105 °C (221 °F)

8.2 Removing the Battery Switch Sticker

When you receive your SCADAPack 470, there is a sticker over the battery switch. The SCADAPack 470 is shipped with the battery switch in the up (off) position to help extend the shelf life of the battery.

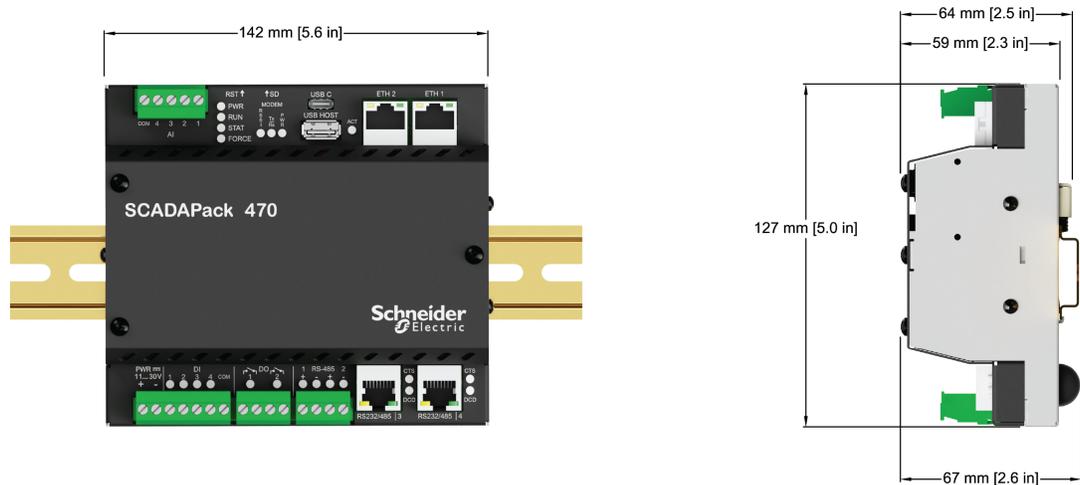
To begin using the SCADAPack 470

1. Carefully remove and discard the sticker.
2. Using a non-conductive tool, toggle the battery switch to the down (on) position.



8.3 Mounting the SCADAPack 470

The SCADAPack mounts on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail. The figures below show the SCADAPack dimensions when mounted.



⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Carefully review and follow all instructions in the Important Notices for Hazardous Locations topic for information when installing the SCADAPack in a hazardous location.

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

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack 470 before removing power.

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

⚠ WARNING**ELECTRICAL HAZARD**

Remove power from the SCADAPack before mounting it on a DIN rail.

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

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

NOTICE

UNINTENDED EQUIPMENT OPERATION

The mounting position can affect the maximum operating temperature for the SCADAPack and the current rating for the digital outputs on the I/O board.

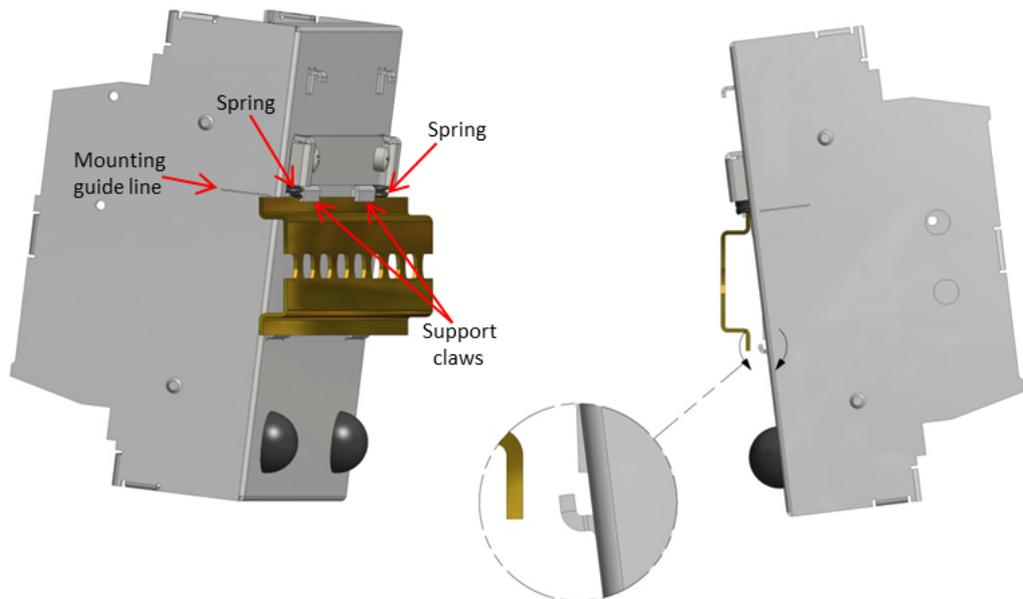
Before mounting the SCADAPack, check the Specifications topic to confirm the maximum operating temperature and digital output current rating for your mounting position.

Failure to follow these instructions can result in equipment damage.

To mount the SCADAPack

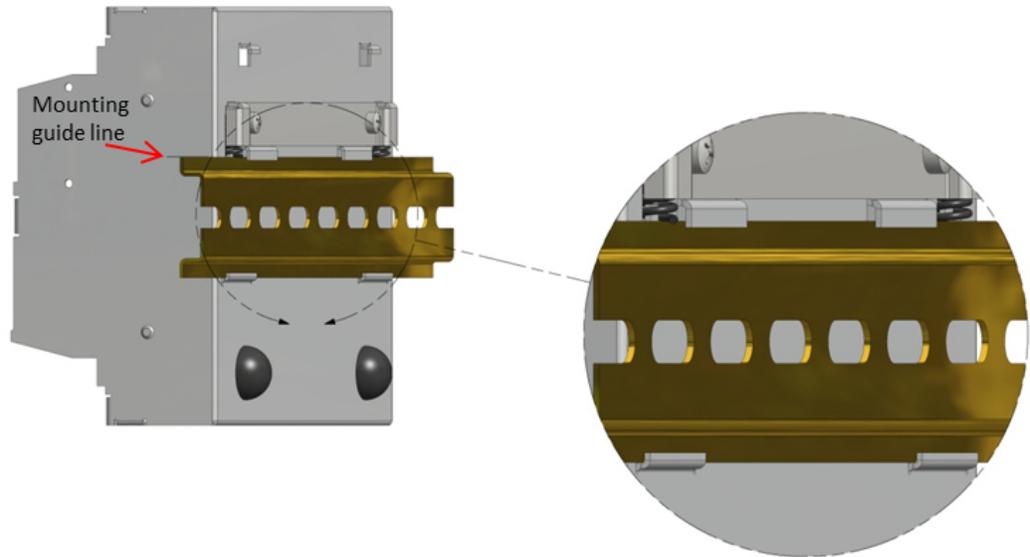
The illustrations below show how to mount the SCADAPack on a horizontally oriented DIN rail. The steps to mount the SCADAPack on a vertically oriented DIN rail are the same.

1. With the lower part of the SCADAPack tilted away from the DIN rail, position the mounting guide line on the side of the SCADAPack so that it is just above the top edge of the DIN rail. Verify that the springs on the back of the SCADAPack rest on the DIN rail and that the edge of the DIN rail is under the support claws that are adjacent to the springs, as shown below.

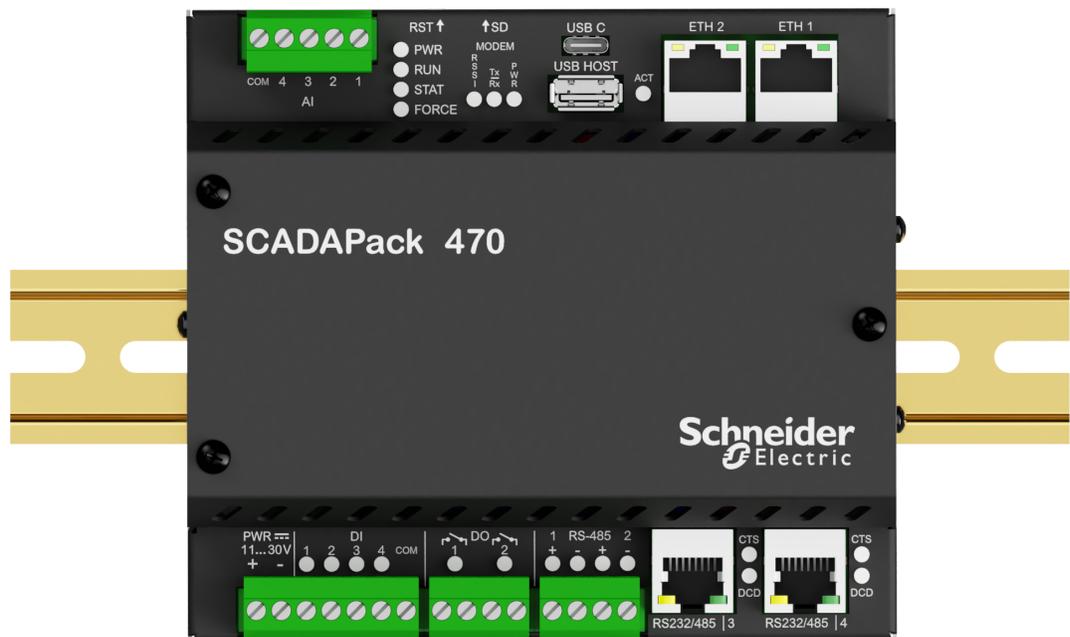


2. Push firmly on the SCADAPack while tilting it toward the DIN rail until the DIN rail is positioned under both the upper and lower claws on the back of the SCADAPack.
3. Verify that the mounting guide line is aligned with the edge of the DIN rail, then release the pressure on the springs so that the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

- The figure below shows an SCADAPack with the DIN rail correctly positioned in the upper and lower claws on the back of the SCADAPack.



- The figure below shows the front view of an SCADAPack that is mounted horizontally.



8.4 Power Supply Requirements

This topic describes the power requirements for a SCADAPack with no I/O modules.

The SCADAPack is designed for 12...30 Vdc operating voltages and is powered through a terminal connector shared with the digital/counter inputs. A SELV or PELV power supply is required.

The base power of the SCADAPack 470 is 2.8 W. Refer to the [Power Supply](#)^[123] specifications for the power consumption of the following.

Power requirements are determined by:

- The number of relays energized
- The number of LEDs activated
- The number of analog outputs
- The number and type of IO expansion modules
- Any loading such as the Serial 5 modem, Serial 3 and 4 HMLs, and the USB host

WARNING

UNINTENDED EQUIPMENT OPERATION

The input power supply must be a filtered DC supply.

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

WARNING

UNINTENDED EQUIPMENT OPERATION

Safety Extra Low Voltage (SELV) or Protective Extra Low Voltage (PELV) power supplies are required on the power input and I/O points. Power supplies with 100...240 Vac inputs that comply with safety standard IEC/EN 60950 generally have SELV outputs. Check with the manufacturer or the agency certification listing to confirm that they have SELV outputs.

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

The following Schneider Electric power supply can be used:

- Schneider Electric Phaseo regulated power supply providing 100...240 Vac in and 24 Vdc, 2.5 A out (see the SCADAPack Part Ordering List manual.)

For more information see:

- [Power Supply Wiring](#)^[57]

8.4.1 Power Supply Wiring

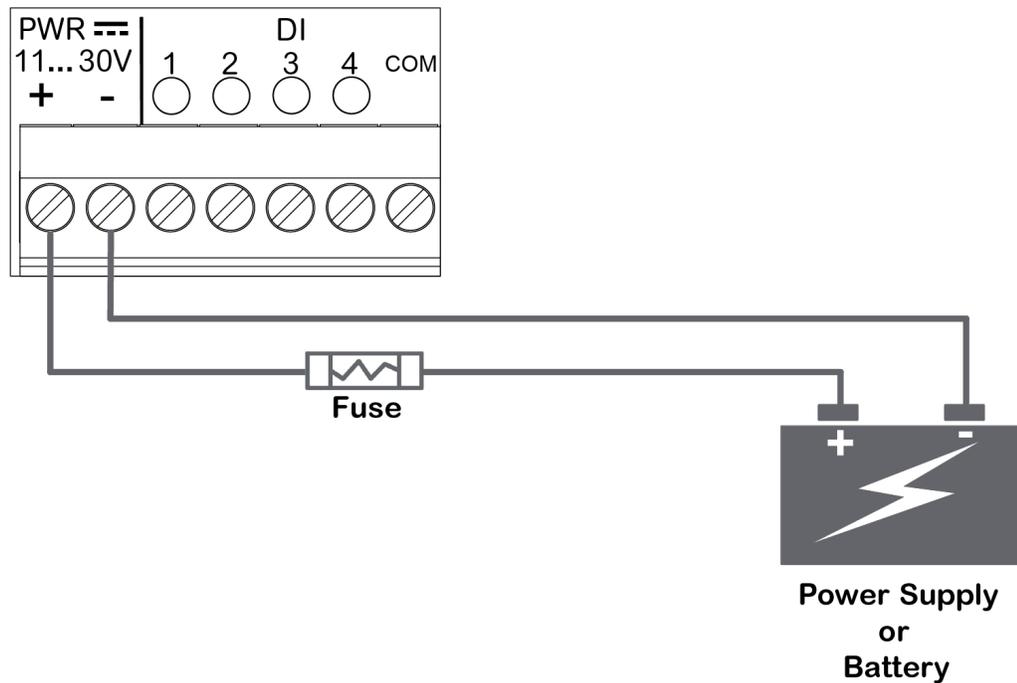
NOTICE

UNINTENDED EQUIPMENT OPERATION

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

Failure to follow these instructions can result in equipment damage.

The following figure illustrates power supply wiring. For details on wiring the power supply connectors, see [Wiring Screw-Termination Connectors](#) [68].



8.5 Adding Inputs and Outputs

I/O modules allow you to increase the number of inputs and outputs the SCADAPack monitors and controls. Each SCADAPack x70 device supports a different combination of modules.

SCADAPack 470, SCADAPack 570 and SCADAPack 574

- Supports up to 15 I/O modules with a maximum total cable length of 1.82 m (75 in)
- Maximum number of 6601 input output modules in the system is 4
- Maximum number of 6602 HART modules in the system is 1
- Maximum number of 6607 input output modules in the system is 4

SCADAPack 474

- Supports up to 15 I/O modules with a maximum total cable length of 1.82 m (75 in)
- Maximum number of 6601 input output modules in the system is 4
- Maximum number of 6602 HART modules in the system is 1
- Maximum number of 6607 input output modules in the system is 3

SCADAPack 575

- Supports up to 15 I/O modules with a maximum total cable length of 1.82 m (75 in)
- Maximum number of 6601 input output modules in the system is 3
- Maximum number of 6602 HART modules in the system is 1

- Maximum number of 6607 input output modules in the system is 4

The following table lists the I/O modules that can be connected to the SCADAPack.

I/O Module	I/O Capacity
5304 analog output module	<ul style="list-style-type: none"> • 4 analog outputs
5405 digital input module	<ul style="list-style-type: none"> • 32 digital inputs
5410 high speed counter input module	<ul style="list-style-type: none"> • 4 counter inputs
5414 digital input module	<ul style="list-style-type: none"> • 16 digital inputs
5415 relay output module	<ul style="list-style-type: none"> • 12 relay outputs
5505 RTD input module	<ul style="list-style-type: none"> • 4 RTD inputs
5506 analog input module	<ul style="list-style-type: none"> • 8 analog inputs
5606 input output module	<ul style="list-style-type: none"> • 32 digital inputs • 16 digital (relay) outputs • 8 analog inputs • 2 analog outputs (this option is selected when the 5606 input output module is ordered)
5607 input output module	<ul style="list-style-type: none"> • 16 digital inputs • 10 digital (relay) outputs • 8 analog inputs • 2 analog outputs (this option is selected when the 5607 input output module is ordered)
6601 input output module	<ul style="list-style-type: none"> • 16 digital inputs, 8 of which have an associated counter • 8 digital (relay) outputs • 6 analog inputs • 2 analog outputs (this option is selected when the 6601 input output module is ordered)
6602 HART module	<ul style="list-style-type: none"> • 8 analog inputs • 4 analog outputs <p>OR</p>

	<ul style="list-style-type: none"> • 8 analog inputs only
6607 input output module	<ul style="list-style-type: none"> • 16 digital inputs, 12 of which have an associated counter • 10 digital outputs • 8 analog inputs • 2 analog outputs

Power requirements

Each I/O module requires additional power at 5 Vdc, which is provided by the SCADAPack.

Each analog output module requires an additional 24 Vdc power supply to power the field-side circuitry. Each analog output module requires 50 mA current regardless of the system voltage.

SCADAPack RemoteConnect calculates the power consumption on the Physical I/O > Local page and recommends additional power supplies when needed.

For more information, see [I/O Module Power Supply Requirements](#)^[61] and the hardware manual for your I/O module.

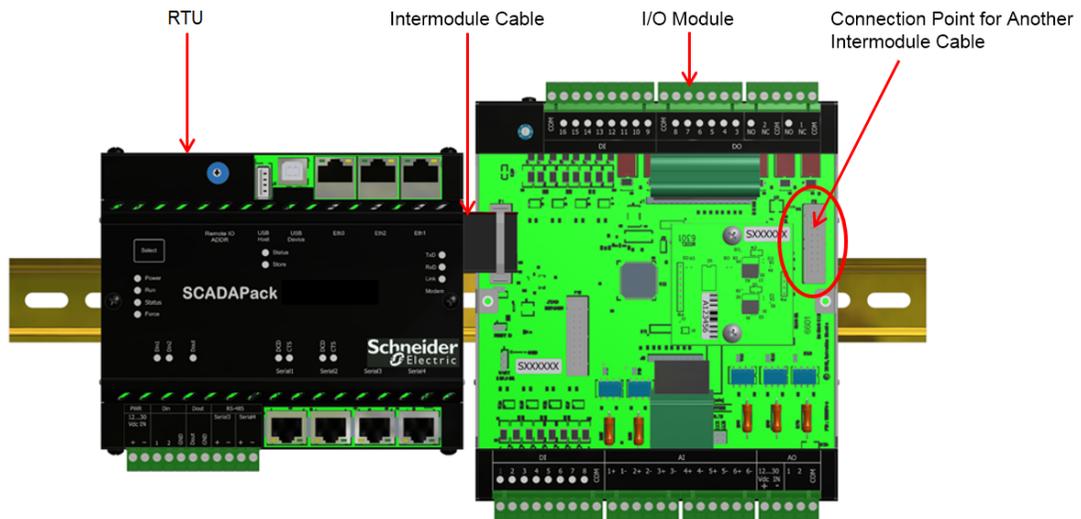
Mounting

I/O modules are mounted on a 7.5 x 35 mm (0.3 x 1.4 in) DIN rail and then connected to the SCADAPack. For more information, see the hardware manual for the I/O module.

Connecting

I/O modules are connected to the SCADAPack or to another I/O module using intermodule cables. The intermodule cable is a ribbon cable that distributes power 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 with an I/O module connected to it. While the size and shape of your devices may differ, the location of the intermodule cable is the same on each device type.



Before connecting I/O modules, read the following topics:

- [Precautions](#) ⁶³
- [Cabling Guidance](#) ⁶³
- [Attaching Intermodule Cables](#) ⁶⁵

Addressing

I/O modules can be addressed on the SCADAPack bus. Module addresses are configured using a switch on the module. For more information, see the Addressing topic in the hardware manual for your I/O module.

Configuring

Use the SCADAPack RemoteConnect configuration software to configure the inputs and outputs on the I/O module. For more information, see the:

- Adding an I/O Module topic in the SCADAPack x70 Configuration manual
- Hardware manual for your I/O module

8.5.1 I/O Module Power Supply Requirements

A total of 5.6 W of power is available for the SCADAPack 470 serial port, the USB Host port and I/O modules.

Use the table below to determine the combination that suits your needs within the power available. These requirements are valid for any input voltage within the ranges listed in the [Power Supply Specifications](#) ¹²³.

If you are using analog inputs or analog outputs, you also have to consider the current requirements for the I/O. See the specifications in the I/O module hardware manual for details.

Port or Module	Power Requirement (W)
SCADAPack serial port	1.1 W maximum
SCADAPack USB host port	2.8 W maximum
5304 analog output module	0.15
5405 digital input module	0.1
5410 high speed counter input module	0.19
5414 digital input module	0.25
5415 relay output module Dry contacts	1.6
5415 relay output module Solid state relays	0.8
5505 RTD input module	0.03
5506 analog input module	0.25
5606 input output module Dry contacts	3.4
5606 input output module Solid state relays	2.3
5607 input output module Dry contacts	2.3
5607 input output module Solid state relays	1.6
6601 input output module	1.1
6602 HART module 8 AI, 4 AO	1.3
6602 HART module 8 AI	1.0

6607 input output module	1.2
--------------------------	-----

8.5.2 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](#)^[122] for details.
- Confirm that the intermodule cables you are using are less than the maximum total cable length. See [Maximum Intermodule Cable Length](#)^[65].
- 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.

8.5.3 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 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.

8.5.4 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.

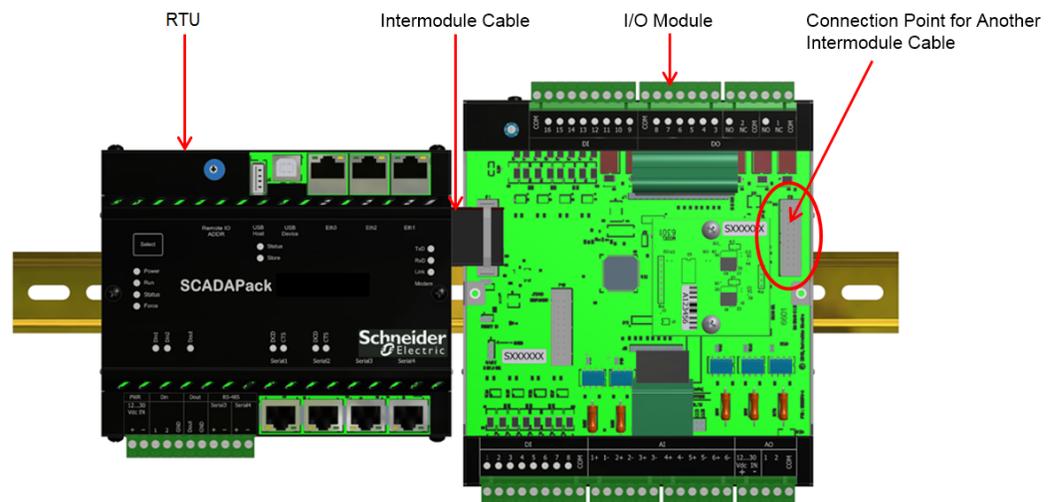
SCADAPack x70 devices and 6000 series modules provide a 20-pin I/O bus connector while

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

The serial and Ethernet ports on the SCADAPack can be connected to:

- A SCADA system such as Geo SCADA Expert
- Other SCADAPack x70 devices
- Devices such as Programmable Logic Controllers (PLCs)
- The computer running the SCADAPack RemoteConnect configuration software

For information about serial and Ethernet port wiring, see:

- [Serial Port Wiring](#)^[70]
- [Ethernet Port Wiring](#)^[76]

For more information see:

- [Wiring Screw-Termination Connectors](#)^[68]
- [Digital Input Wiring](#)^[79]
- [Digital Output Wiring](#)^[80]
- [Analog Input Wiring](#)^[84]

9.1 Wiring Screw-Termination Connectors

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

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

The 5 mm (0.197 in) pitch connectors support solid or stranded wires from 2.5...0.2 mm² (12...30 AWG).

The 3.5 mm (0.138 in) pitch connectors support solid or stranded wires from 1.5...0.2 mm² (14...28 AWG).

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

⚠ WARNING**ELECTRICAL HAZARD**

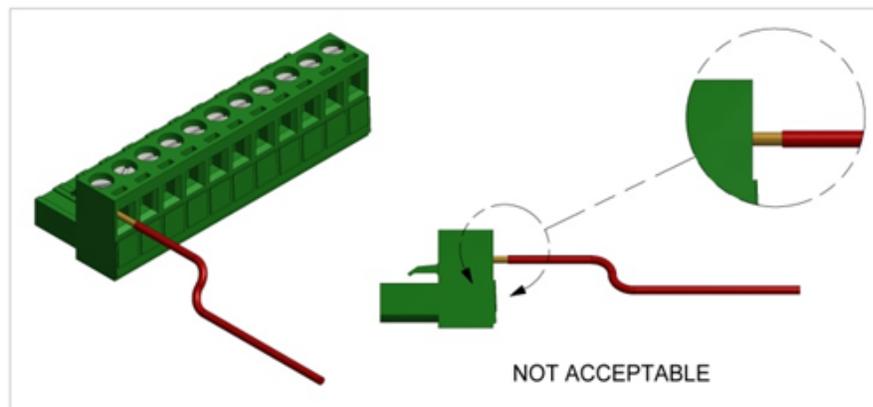
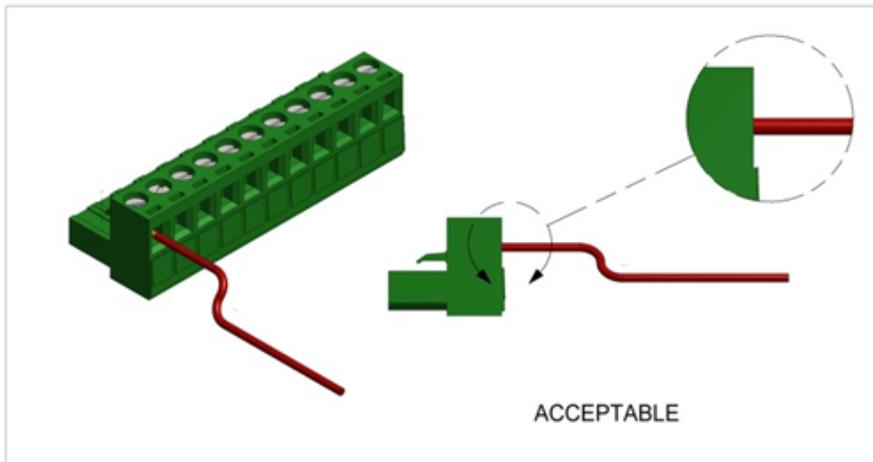
Remove power from the SCADAPack before servicing.

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

To wire a connector

1. Use a slotted screwdriver to loosen the termination screw.
2. Insert the stripped wire into the connector so that the bared wire is located under the screw.

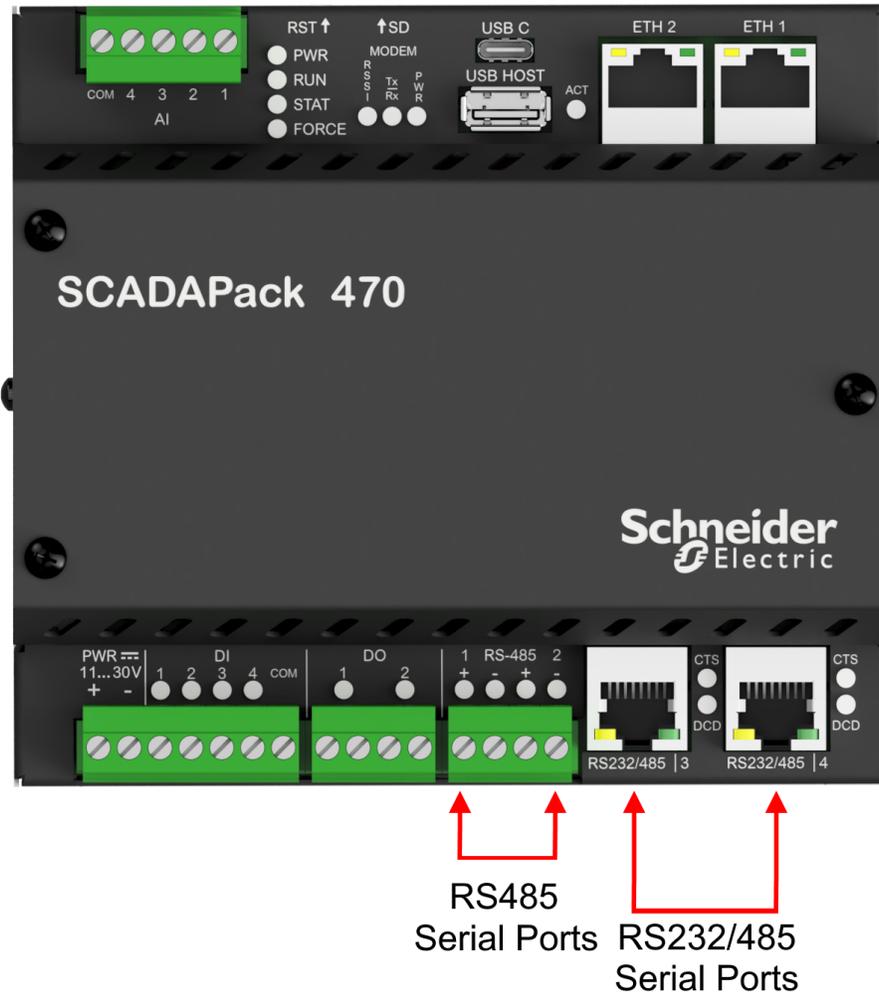
Verify that the bared wire is placed fully within the connector, as illustrated below.



3. Apply 0.5 N•m (4.5 lb-in) torque to tighten the screw so the wire is held firmly in place. For the Serial 5 port, apply 0.2 N•m (1.7 lb-in) torque to tighten the screw.

9.2 Serial Port Wiring

This section describes the wiring for RS232 serial ports and RS485 screw-termination connectors.



For more information on RS232 serial port wiring, see:

- [RS232 Pin Assignments](#)^[70]
- [RS232 Cable Descriptions](#)^[71]
- [RS232 Wiring Examples](#)^[72]

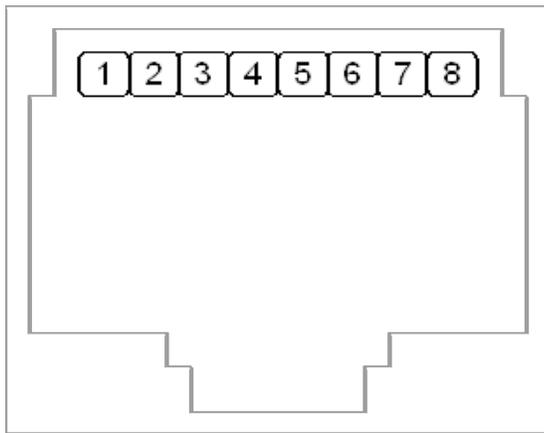
For more information on RS485 connector wiring, see:

- [Wiring Screw-Termination Connectors](#)^[68]
- [RS485 Wiring](#)^[75]

9.2.1 RS232 Pin Assignments

The serial ports on the SCADAPack support serial cables with eight-pin RJ45 modular connectors. The illustration below shows the pin numbers and assignments for the RJ45

connector.



The table below lists the RS232 pin assignments for Serial3 and Serial4.

Pin No.	Pin Function
1	+5 Vdc
2	DCD
3	DTR
4	GND
5	RxD
6	TxD
7	CTS
8	RTS

9.2.2 RS232 Cable Descriptions

The table below lists the pin functions for the following connections:

- RJ45 to DE-9S Data Terminal Equipment (DTE) for Serial3 and Serial4

RJ45 to DE-9S DTE

This cable is used to connect from either of the two RS232 serial ports on the SCADAPack to a DE-9S connector on a DTE device, such as a PC. A 3 m (10 ft) long cable is available from Schneider Electric. See the SCADAPack Part Ordering List manual.

RJ45 8 Pins	SCADAPack DTE Function	DE-9S DTE Function	DE-9S
			Shield connects to shell
6	TxD	RxD	2
5	RxD	TxD	3
4	GND	GND	5
1, 2, 3, 7 and 8 are not connected at this end.			Wires not connected at this end.

9.2.3 RS232 Wiring Examples

The illustrations in this topic show different wiring options for the RS232 serial ports. The wiring options you can use depend on the serial port signaling capabilities:

- Serial3 and Serial4: TxD, RxD, CTS, RTS, DCD, DTR

⚠ WARNING

ELECTRICAL HAZARD

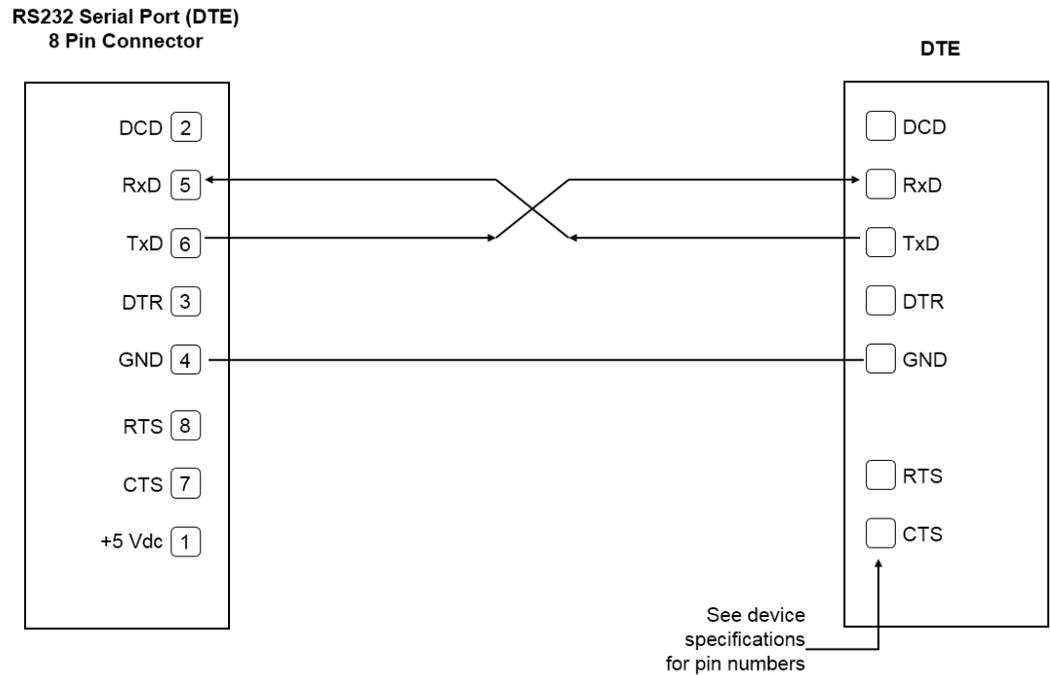
Remove power from all devices before connecting or disconnecting inputs or outputs to any terminal or installing or removing any hardware.

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

DTE to DTE without handshaking

This wiring option can be used with Serial3 and Serial4 RS232 ports.

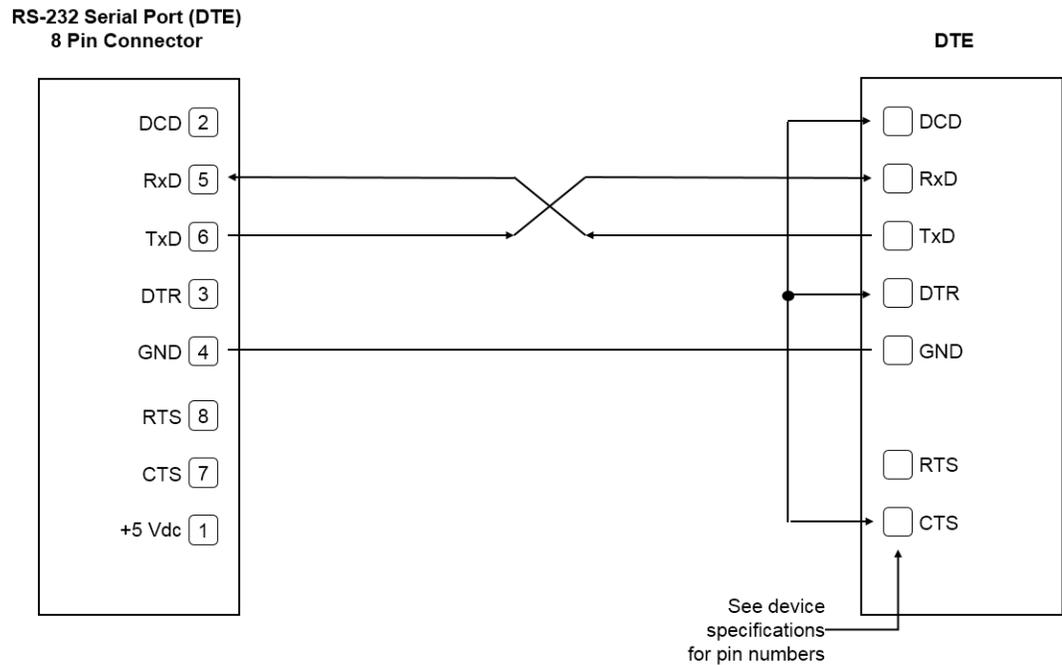
There are several methods for wiring an RS232 serial port to Data Terminal Equipment (DTE) and Data Communications Equipment (DCE) devices. The simplest connection requires only three wires: RxD, TxD and signal ground. The following diagram shows the wiring between two DTE devices when handshaking is not required.



DTE to DTE with handshaking

This wiring option can be used with Serial3 and Serial4 RS232 ports.

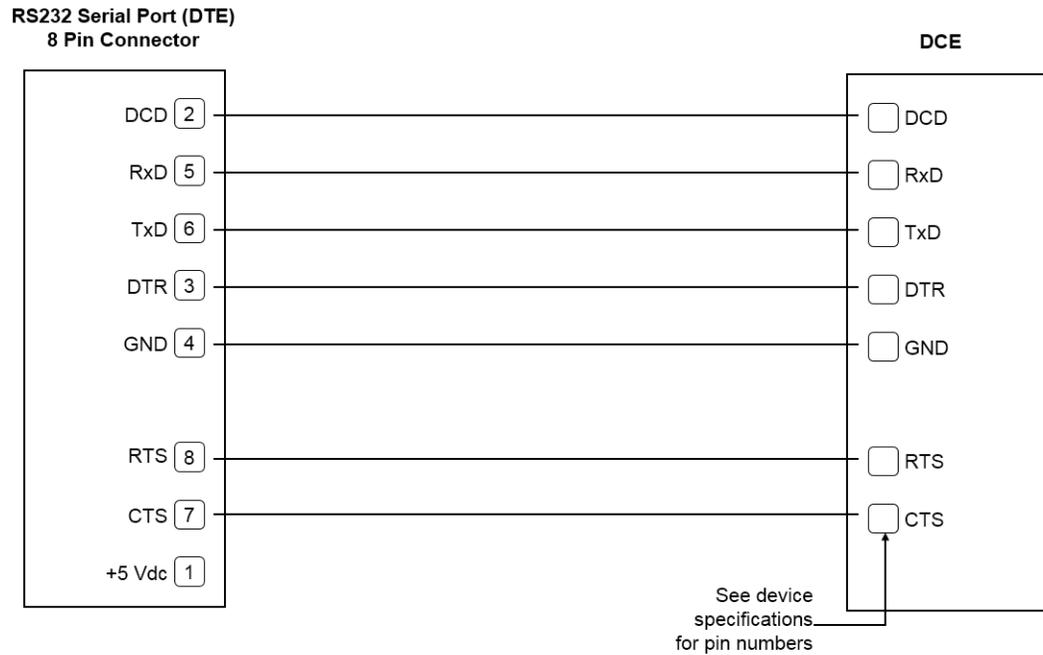
Some DTE devices may require hardware handshaking lines. The CTS and RTS lines are commonly used for handshaking. The DTR and DCD lines are less commonly used. The SCADAPack does not require these lines. Refer to the specifications for the external device for exact requirements. The following diagram shows the wiring between two DTE devices when handshaking is required.



DTE to DCE with handshaking

This wiring option can be used with Serial3 and Serial4 RS232 ports.

DCE devices require different wiring. The handshaking lines need to be connected. Many DCE devices are half-duplex. Select half-duplex operation with these devices. The diagram below shows the wiring between a DTE device and a DCE device with handshaking.



9.2.4 RS485 Wiring

⚠ 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.

Serial1 and Serial2 connect to removable screw termination connectors.

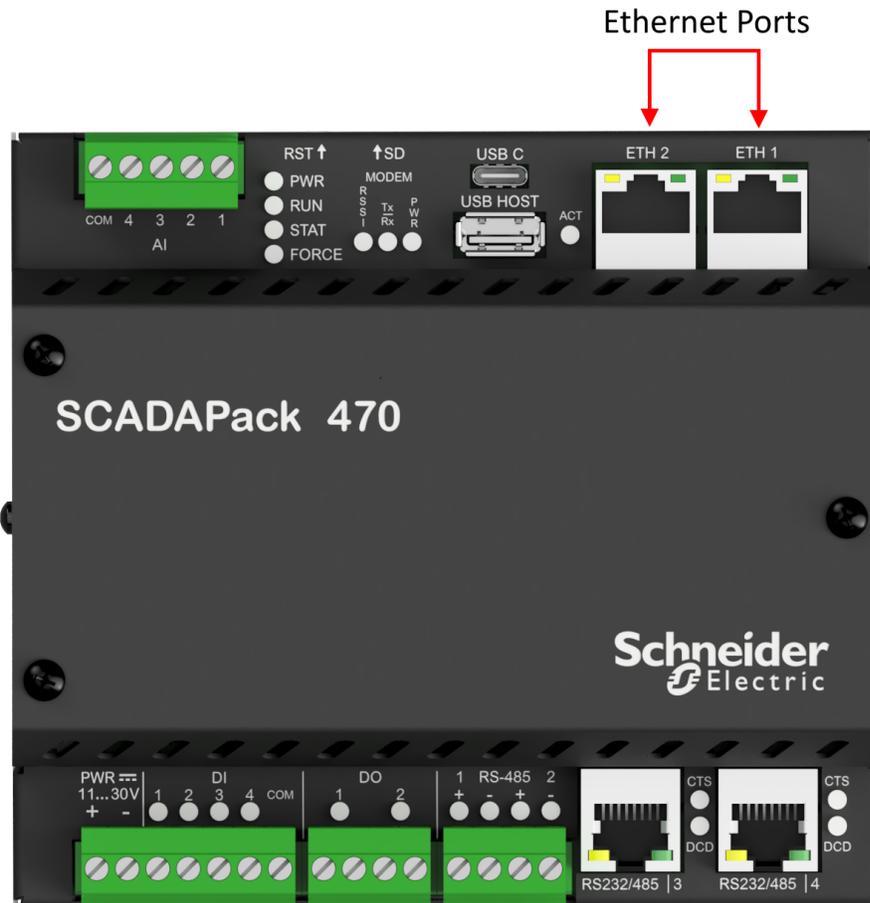
Pin number	Connection
1	Serial1+
2	Serial1-
3	Serial2+
4	Serial2-

Serial3 and Serial4 connect to 8 pin RJ45 modular connectors.

Pin number	Serial3	Serial4
1	+5 Vdc	+5 Vdc
2		
3		
4	GND	GND
5	Negative	Negative
6	Positive	Positive
7		
8		

9.3 Ethernet Port Wiring

This section describes the wiring for the Ethernet ports on the SCADAPack.

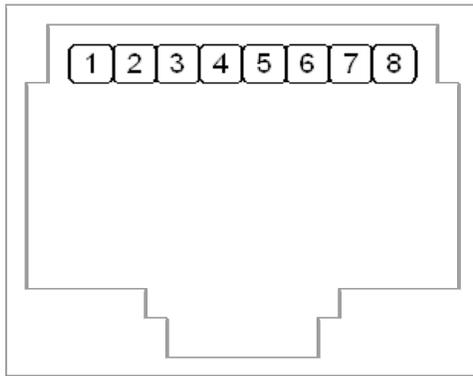


For more information see:

- [Ethernet Pin Assignments](#)⁷⁷
- [Ethernet Cable Descriptions](#)⁷⁸

9.3.1 Ethernet Pin Assignments

The Ethernet ports on the SCADAPack can be connected to an Ethernet wall jack or hub using standard RJ45 Category 5 patch cables. The illustration and table below show the pin assignments for the RJ45 modular connector.



Pin No.	Pin Function
1	+TxD
2	-TxD
3	+RxD
4	
5	
6	-RxD
7	
8	

9.3.2 Ethernet Cable Descriptions

Ethernet cables are used in 10/100 BASE-T LANs. These networks are also known as unshielded twisted pair (UTP), copper wire, Category 3, 4 and 5 Ethernet wire or twisted pair.

NOTICE

COMMUNICATION INTERRUPTION

The IEEE 802.3 10 BASE-T specification requires that 10 BASE-T and 100 BASE-T devices support UTP 100-120 unshielded twisted pair cables up to 100 m (328 ft) in length. However, this requirement does not factor in losses due to connectors, patch panels, punch-down blocks, or other cable management hardware, which introduce additional loss.

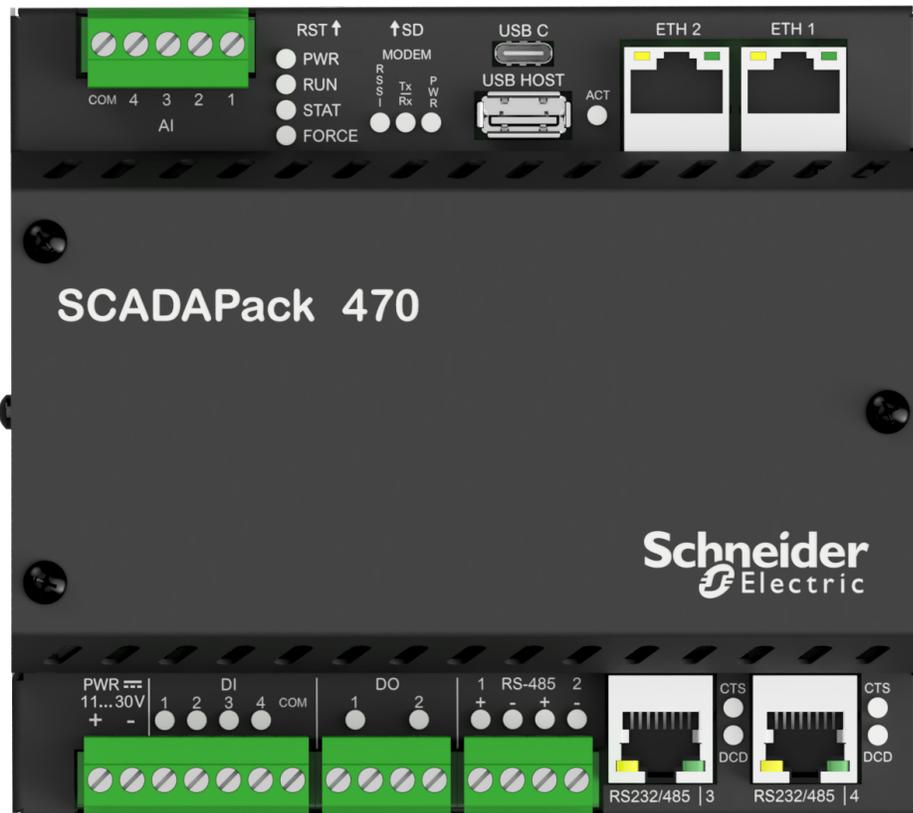
For each connector or other intrusive cable management device along the link, subtract 12 m (39 ft) from the total allowable link length.

Failure to follow these instructions can result in loss of data.

The Ethernet ports on the SCADAPack automatically configure themselves for Medium Dependent Interface (MDI) or MDI-X. This means that either a crossover or a straight-through Ethernet cable can be used. The SCADAPack will automatically detect the interface used and serve the cable appropriately.

9.4 Digital Input Wiring

This section describes the wiring for the digital inputs.



Digital
Inputs

For more information see:

- [Digital Input Wiring Example](#)

9.4.1 Digital Input Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

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

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

NOTICE

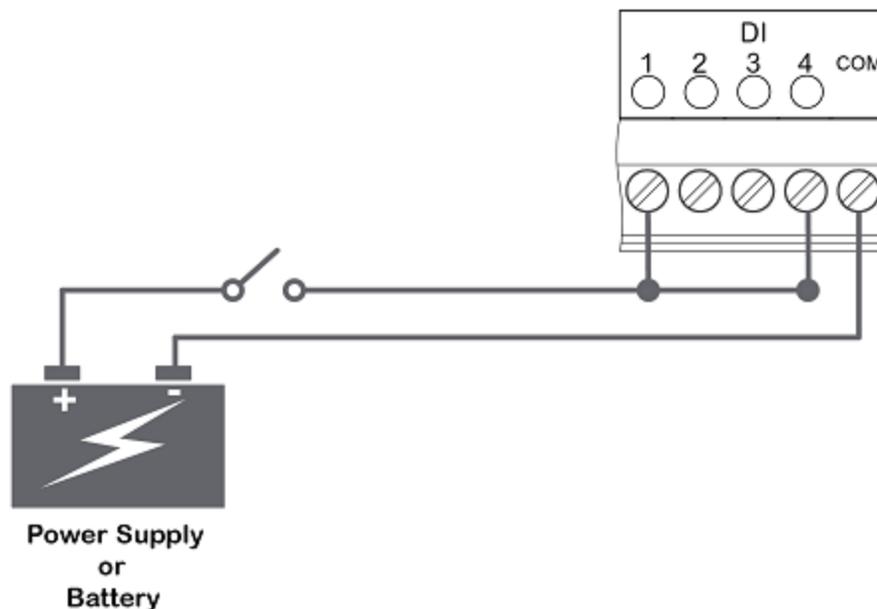
UNINTENDED EQUIPMENT OPERATION

When wiring digital inputs:

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

Failure to follow these instructions can result in equipment damage.

The figure below shows a connection from Din 1 and Din 4 and a ground connector to a power supply or battery.



9.5 Digital Output Wiring

This section describes the wiring for the digital outputs.



Digital Outputs

For more information see:

- [Digital Output Wiring Example](#)^[81]
- [Controlling Devices with the Controller Board Digital Output](#)^[83]

9.5.1 Digital Output Wiring Example

⚠ WARNING

ELECTRICAL HAZARD

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

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

NOTICE**RELAY CONTACT DAMAGE**

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

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

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

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

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

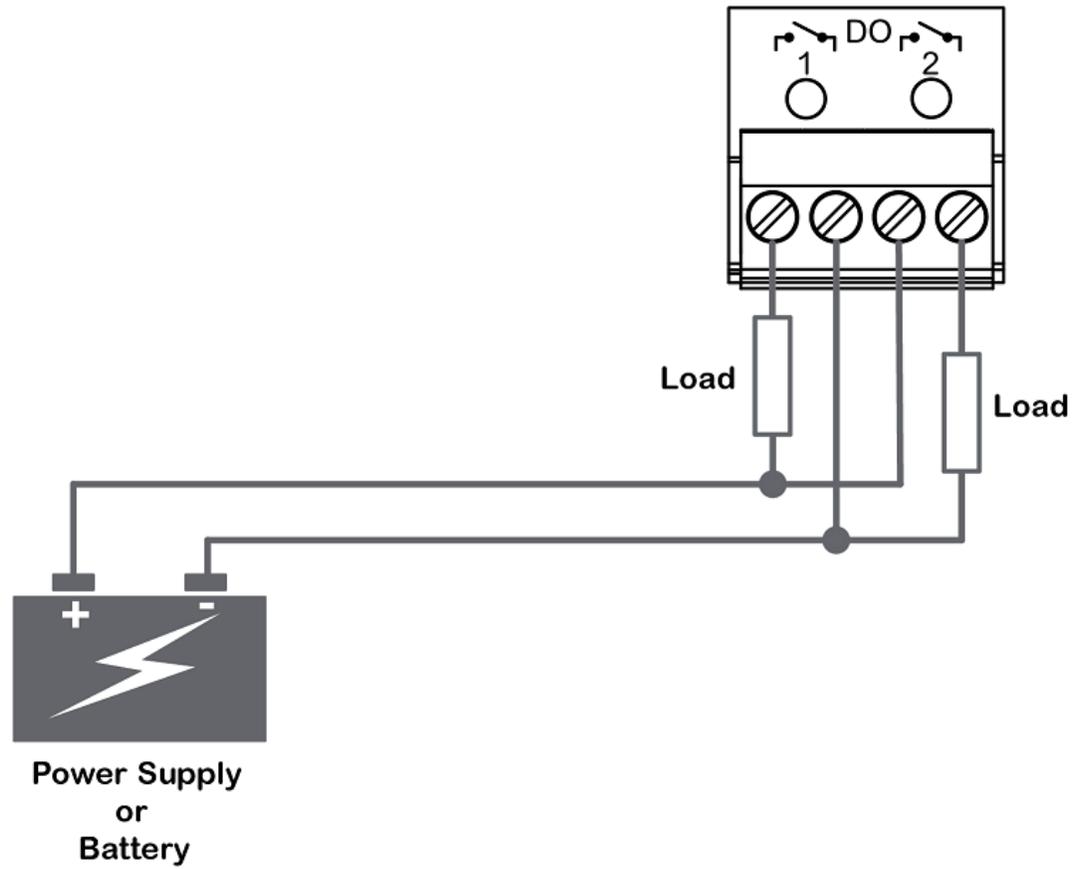
Failure to follow these instructions can result in equipment damage.

The figure below shows a wiring example for the controller board digital output which provides two relays for controlling loads such as interposing relays or lamps. See [Specifications](#)^[122] for details about the power rating for this digital output.

The load on Digital Output 1 is shown connected to the +ve power supply and switched to the -ve power supply.

The load on Digital Output 2 is shown connected to the -ve power supply and switched to the +ve power supply.

For information about controlling devices with this digital output, see [Controlling Devices with the Controller Board Digital Output](#)^[83].



9.5.2 Controlling Devices with the Controller Board Digital Output

⚠ WARNING

ELECTRICAL HAZARD

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

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

NOTICE**RELAY CONTACT DAMAGE**

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

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

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

Failure to follow these instructions can result in equipment damage.

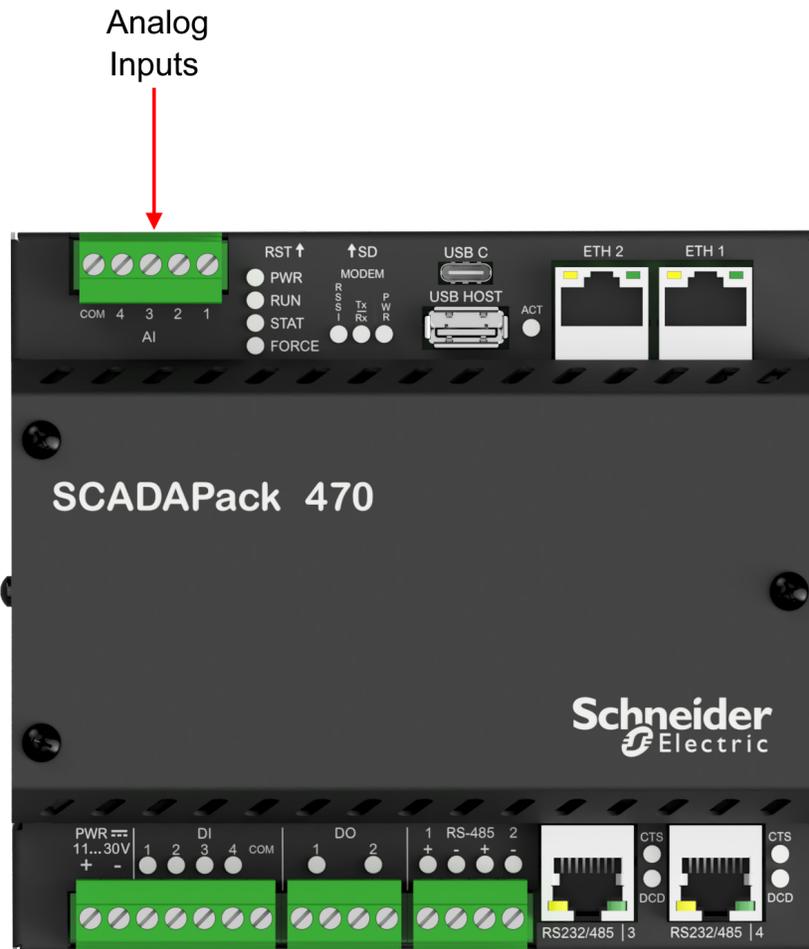
NOTICE**UNINTENDED EQUIPMENT OPERATION**

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

Failure to follow these instructions can result in equipment damage.

9.6 Analog Input Wiring

This section describes the wiring for the analog inputs.



For more information, see:

- [Analog Input Wiring Example](#)^[85]
- [Supporting Current or Voltage Mode](#)^[87]
- [Current Inputs Supporting SCADAPack Removal](#)^[87]
- [Helping to Prevent Interruption of the Current Loop](#)^[88]

9.6.1 Analog Input Wiring Example

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

⚠ WARNING

ELECTRICAL HAZARD

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

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

NOTICE**LIGHTNING SURGE THROUGH ANALOG INPUTS**

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

Failure to follow these instructions can result in equipment damage.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

Do not exceed the maximum input range specified for each analog input. For details, see the Specifications topic for details.

Failure to follow these instructions can result in equipment damage.

Self-powered and loop-powered transmitters

Self-powered transmitters have three terminals:

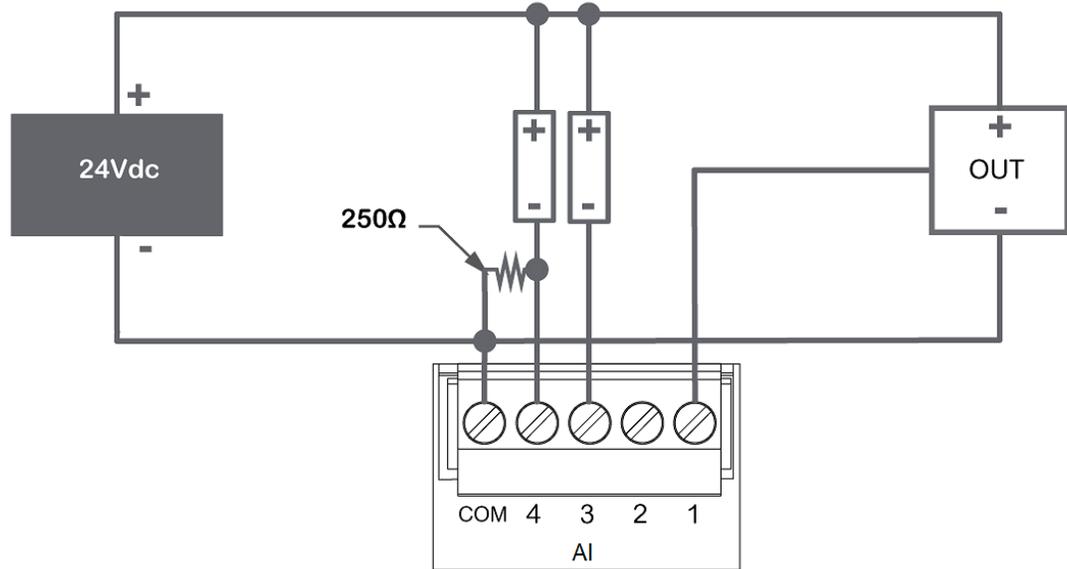
- Power In connects to a power supply
- Signal Out connects to the analog input channel
- Common connects to COM

Self-powered transmitters can have a current or voltage output.

Loop-powered transmitters are two-terminal devices that are connected between a power supply and the analog input. The loop current from the power supply passes through the transmitter and returns to the power supply through a 250 ohm resistor in the 20 mA input circuit.

In the figure below:

- A self-powered transmitter is shown connected to AIN 1. This could be a 20 mA or 5 Vdc output. The AIN 1 needs to be configured according to the type of transmitter.
- A loop powered transmitter is shown connected to AIN 3. AIN3 is configured for current.
- A loop powered transmitter is shown connected to AIN 4. AIN 4 is configured for voltage. An external 250 Ohm resistor converts the 20 mA signal to 5 Vdc.



9.6.2 Supporting Current or Voltage Mode

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

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

9.6.3 Current Inputs Supporting SCADAPack Removal

You can change the input mode for individual analog inputs to support a mix of current and voltage analog inputs if needed.

The unit is factory-calibrated for 0...20 mA and 4...20 mA current inputs and for 0...5 Vdc and 1...5 Vdc operation so there is no need to adjust the calibration when you change the input mode for an analog input.

The table below summarizes the options for supporting a mix of current and voltage analog inputs.

Analog Input Configured for...	Measuring	Considerations
Voltage	Current	Requires addition of external 250 Ohm resistor. Allows the SCADAPack 470 to be removed

		while not interrupting the 20 mA current flow and transmitter operation.
Current	Current	Removing the SCADAPack 470 or powering off will interrupt the current flow.
Voltage	Voltage	None

9.6.4 Helping to Prevent Interruption of the Current Loop

⚠ WARNING

ELECTRICAL HAZARD

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

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

NOTICE

UNINTENDED EQUIPMENT OPERATION

Do not exceed the maximum voltage specified for each analog input.

Failure to follow these instructions can result in equipment damage.

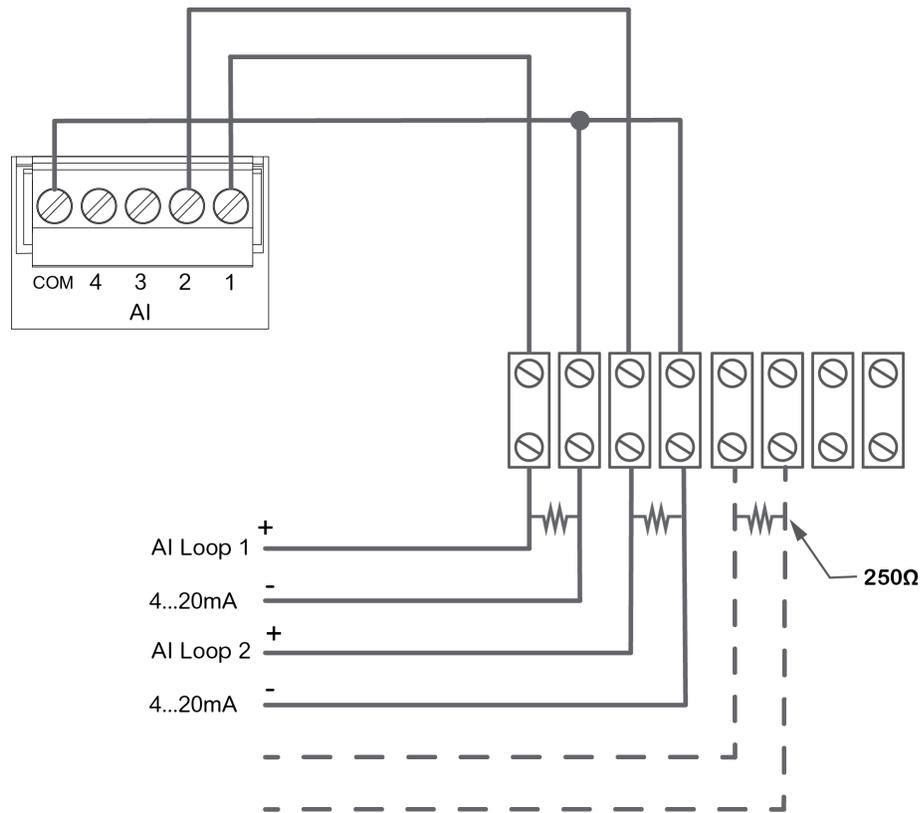
NOTICE

UNINTENDED EQUIPMENT OPERATION

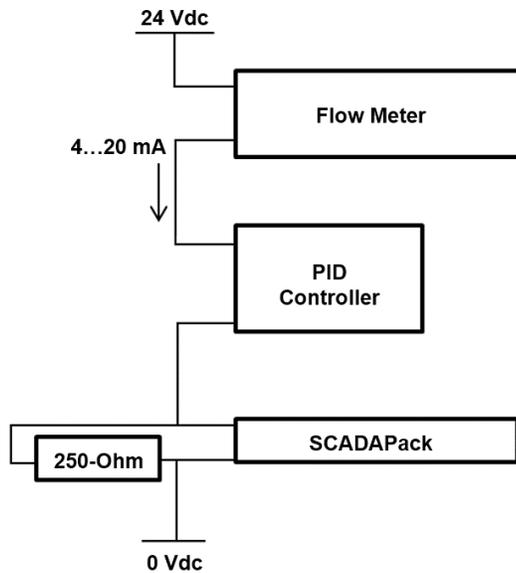
The SCADAPack or I/O module must be the only loop current measurement device in the loop when using the analog inputs in the 20 mA measurement mode. If power to the module is removed, the module reverts to voltage mode and results in an open current loop. Applications that cannot tolerate this possibility need to use external current sense resistors with the module input range set to voltage.

Failure to follow these instructions can result in equipment damage.

Add 250 ohm external resistors to the current loop at the terminal strip to help prevent interruption of the current loop if the SCADAPack or I/O module is being serviced. The physical wiring of the 250 ohm external resistors at the terminal strip is illustrated below.



As illustrated below, the SCADAPack providing the analog input needs to be the last device in the current loop.



10 Startup Modes

The SCADAPack can be started in four different operating modes:

- [Run mode](#)^[92]
- [Service Boot mode](#)^[92]
- [Cold Boot mode](#)^[94]
- [Factory Boot mode](#)^[97]

By default, the SCADAPack starts in Run mode when power is applied. Run mode is used for normal day-to-day operations.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack before restarting the SCADAPack in a new mode of operation.

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

Holding down the **RST** button on the SCADAPack front cover allows you to start the SCADAPack in other modes of operation. The startup mode is determined by the length of time the **RST** button is depressed when power is applied to the SCADAPack or the device restarts. The longer the **RST** button is depressed, the more actions are applied to the SCADAPack.

Because the startup mode is not determined until the **RST** button is released, you can cancel the startup mode selection by removing power to the SCADAPack while the **RST** button is depressed. This can be a useful tactic to avoid starting up in modes where more actions are applied if you have held the **RST** button down longer than your preferred startup mode requires.

Startup mode actions

NOTICE

CONFIGURATION AND APPLICATION LOSS

Starting the SCADAPack in Cold Boot mode or Factory Boot mode returns SCADAPack configuration parameters to their default settings and erases the SCADAPack x70 logic application. This information must be reloaded into the SCADAPack for correct SCADAPack operation.

Before starting the SCADAPack in Cold Boot mode or Factory Boot mode, save a copy of the SCADAPack configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in equipment damage.

Communication with SCADAPack RemoteConnect can be disturbed by service, cold, and factory boot modes.

To restore communication

For USB:

1. Go offline before restarting the device.
2. Wait for the device to restart.
3. Go online after the device has restarted.

It can take up to 90 seconds for the SCADAPack x70 USB port to be ready.

For Serial or Ethernet:

1. Go offline before restarting the device.
2. In SCADAPack RemoteConnect configuration software, change the PC Communication Settings to match the device.
3. Go online after the device has restarted.

Action	Run Mode	Service Boot Mode	Cold Boot Mode	Factory Boot Mode
DNP node address set to zero (0)		X	X	X
SCADAPack x70 logic application stopped		X		
Modbus Scanner stopped		X		
Serial port parameters set to Service Boot settings		X		
Ethernet port parameters set to Service Boot settings		X		
Serial port parameters set to defaults			X	X
Ethernet port parameters set to defaults			X	X
LED power set to default			X	X
Database initialized			X	X
SCADAPack x70 logic application erased			X	X
Files erased				X
Flash file system reformatted				X

Action	Run Mode	Service Boot Mode	Cold Boot Mode	Factory Boot Mode
SCADAPack x70 logic application started	X			
Settings retained in non-volatile memory	X	X		
SCADAPack x70 logic application in flash erased			X	X
Protocols set to defaults			X	X
Security locking mode initialized			X	X
Security locking mode may be changed		X		

10.1 Run Mode

Run mode is the normal operating mode for SCADAPacks. The SCADAPack automatically starts in Run mode when power is applied or when a board reset occurs. No action is required to select Run mode.

When a SCADAPack starts in Run mode, it loads:

- The defined serial and Ethernet communication parameters for every port.
- The SCADAPack database configuration and object parameter settings.
- The SCADAPack x70 logic application, then executes it.

When the SCADAPack is operating in Run mode, the Run LED on the SCADAPack front cover either:

- Is solidly lit, meaning the SCADAPack x70 logic application is running.
- Blinks approximately once every 3 seconds, meaning the SCADAPack x70 logic application is not running.

10.2 Service Boot Mode

Service Boot mode is used for configuration, programming and maintenance work, usually when the communication settings are unknown.

When a SCADAPack starts in Service Boot mode:

- DNP3 node address zero (0) is set, enabling communications with the computer running the SCADAPack RemoteConnect configuration software at a known DNP3 address. Connect the SCADAPack RemoteConnect computer to the USB Device port or to a serial communications port.
- A SCADAPack x70 logic application that is running is stopped.
- Modbus Scanner operations are stopped.

- Programs and configurations are retained in non-volatile memory.
- Serial, USB, Ethernet, and IP Routing parameters are set to the values listed in the tables below. This allows you to connect to the SCADAPack for configuration, programming, and maintenance tasks without knowing the port settings used for daily operations. Only Serial 2 retains its pre-Service Boot settings when you start the SCADAPack in Service Boot mode.
- SCADAPack x70 device security locking mode may be changed by SCADAPack RemoteConnect configuration software.
 - See the Working With Security Locking topic in the Getting Started manual before configuring or operating the SCADAPack x70 device.

Service Boot serial and USB port settings

Parameter	USB	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5
Function	Enabled	Modbus	Unchanged	Modbus	Cmd Line	Disabled
Mode	USB	RS485 2w	Unchanged	RS232 (RTS On)	RS232 (RTS On)	
Baud		9600 bps	Unchanged	9600 bps	9600 bps	
Data Mode		8-bit No Parity	Unchanged	8-bit No Parity	8-bit No Parity	
Stop Bits		1	Unchanged	1	1	

Service Boot Ethernet port settings

Parameter	Ethernet 1	Ethernet 2
IP Address	172.16.1.200	172.16.2.200
Subnet Mask	255.255.255.0	255.255.255.0

Service Boot IP routing settings

Parameter	Address
Gateway IP	0.0.0.0

To start a SCADAPack in Service Boot mode

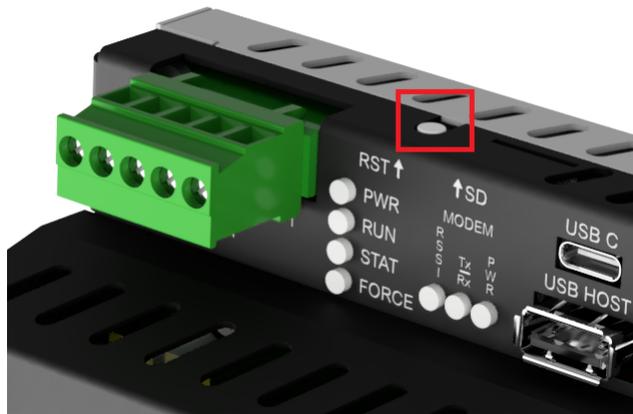
⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

1. Remove power from the SCADAPack.
2. Hold down the **RST** button, shown in the image below.



3. Apply power to the SCADAPack.
4. Continue holding the **RST** button down until the **STAT** LED turns on.

To cancel the startup mode selection at this point, remove power from the SCADAPack before you proceed to step 5. This can be a useful tactic to avoid starting up in modes where more actions are applied if you have held the **RST** button down longer than this mode requires.

5. Release the **RST** button.

If you release the **RST** button before the **STAT** LED turns on, the SCADAPack will start in Run mode.

10.3 Cold Boot Mode

Cold Boot mode is used when you need to clear a configuration from the SCADAPack. It is optional after installing new controller firmware.

Cold Boot mode does not format the flash file system. Start in [Factory Boot Mode](#)⁹⁷ to do this.

If you have a default configuration that you have saved in the system drive of the device, this

configuration is applied during a cold boot.

When a SCADAPack starts in Cold Boot mode:

- The SCADAPack x70 logic application is erased
- The SCADAPack objects database is cleared
- If there is no saved default configuration, then:
 - SCADAPack configuration settings are returned to default
 - The DNP3 Device Address is set to 0
 - Serial, USB, Ethernet, and IP Routing parameters are restored to the default settings listed in the tables below
- Security locking mode is initialized
 - Requires SCADAPack configuration software to set the security locking mode before configuring or operating the SCADAPack x70 device. See the Working With Security Locking topic in the Getting Started manual.

Cold Boot serial and USB port settings

Parameter	USB	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5
Function	Enabled	Modbus	Modbus	Modbus	Cmd Line	Disabled
Mode	USB	RS485 2w	RS485 2w	RS232 (RTS On)	RS232 (RTS On)	
Baud		9600 bps	9600 bps	9600 bps	9600 bps	
Data Mode		8-bit No Parity	8-bit No Parity	8-bit No Parity	8-bit No Parity	
Stop Bits		1	1	1	1	

Cold Boot Ethernet port settings

Parameter	Ethernet 1	Ethernet 2
IP Address	172.16.1.200	0.0.0.0
Subnet Mask	255.255.255.0	255.255.255.0

Cold Boot IP routing settings

Parameter	Address
Gateway IP	0.0.0.0

To start a SCADAPack in Cold Boot mode

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

NOTICE

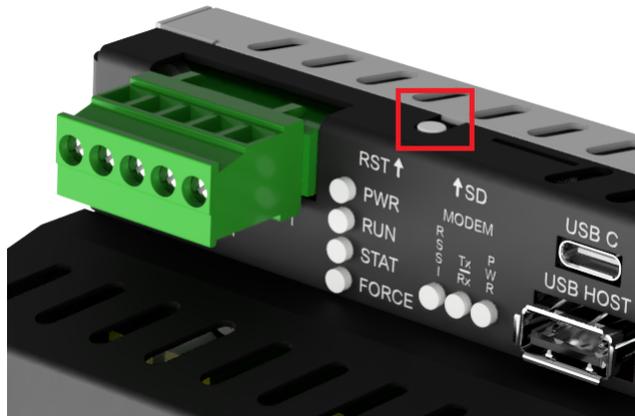
CONFIGURATION AND APPLICATION LOSS

Starting the SCADAPack in Cold Boot mode or Factory Boot mode returns SCADAPack configuration parameters to their default settings and erases the SCADAPack x70 logic application. This information must be reloaded into the SCADAPack for correct SCADAPack operation.

Before starting the SCADAPack in Cold Boot mode or Factory Boot mode, save a copy of the SCADAPack configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in equipment damage.

1. Remove power from the SCADAPack.
2. Hold down the **RST** button, shown in the image below.



3. Apply power to the SCADAPack.
4. Continue holding down the **RST** button until the only the **Status** LED begins blinking on and off.

If you release the **RST** button before the **STAT** LED begins blinking on and off, the SCADAPack starts in Service Boot mode.

To cancel the startup mode selection, remove power from the SCADAPack while the **RST** button is depressed. This can be a useful tactic to avoid starting up in Factory Boot mode if you have held the **RST** button down until the **STAT** LED stops blinking on and off.

5. Release the **RST** button.
6. Reload the SCADAPack configuration and user-created applications from backup.

10.4 Factory Boot Mode

Factory Boot mode is used to reformat the flash file system and initialize the SCADAPack to its factory default settings.

When a SCADAPack starts in Factory Boot mode:

- The SCADAPack x70 logic application is erased
- The SCADAPack objects database is cleared
- SCADAPack configurations are returned to their default settings
- The flash file system is reformatted
- Serial, USB, Ethernet, and IP Routing parameters are restored to the default settings listed in the tables below
- Security locking mode is initialized
 - Requires SCADAPack configuration software to set the security locking mode before configuring or operating the SCADAPack x70 device. See the Working With Security Locking topic in the Getting Started manual.

Factory Boot serial and USB port settings

Parameter	USB	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5
Function	Enabled	Modbus	Modbus	Modbus	Cmd Line	Disabled
Mode	USB	RS485 2w	RS485 2w	RS232 (RTS On)	RS232 (RTS On)	
Baud		9600 bps	9600 bps	9600 bps	9600 bps	
Data Mode		8-bit No Parity	8-bit No Parity	8-bit No Parity	8-bit No Parity	
Stop Bits		1	1	1	1	

Factory Boot Ethernet port settings

Parameter	Ethernet 1	Ethernet 2
IP Address	172.16.1.200	0.0.0.0
Subnet Mask	255.255.255.0	255.255.255.0

Factory Boot IP routing settings

Parameter	Address
Gateway IP	0.0.0.0

To start a SCADAPack in Factory Boot mode

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

NOTICE

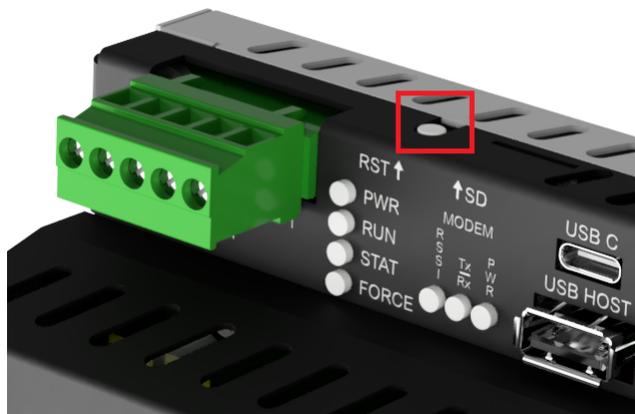
CONFIGURATION AND APPLICATION LOSS

Starting the SCADAPack in Cold Boot mode or Factory Boot mode returns SCADAPack configuration parameters to their default settings and erases the SCADAPack x70 logic application. This information must be reloaded into the SCADAPack for correct SCADAPack operation.

Before starting the SCADAPack in Cold Boot mode or Factory Boot mode, save a copy of the SCADAPack configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in equipment damage.

1. Remove power from the SCADAPack.
2. Hold down the **RST** button, shown in the image below.



3. Apply power to the SCADAPack.
4. Continue holding down the **RST** button until the **STAT** LED stops blinking on and off and remains lit.

If you release the **RST** button while the **STAT** LED is still blinking, the SCADAPack will start in Cold Boot mode.

If the **RST** button is held down for longer than 60 seconds, the SCADAPack will start in Run mode.

To cancel the startup mode selection, remove power from the SCADAPack while the **RST** button is depressed.

5. Release the **RST** button.

The **STAT** LED turns off. The Factory Boot takes approximately 60 seconds to complete. During this time, the SCADAPack may appear unresponsive while the file system is being formatted. When the Factory Boot is complete, the **Run** LED blinks slowly and the logic application is not in a RUN state.

6. Reload the SCADAPack configuration and user-created applications from backup.

11 Configuration

The SCADAPack 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 communications with the SCADAPack
- Configure SCADAPack and I/O parameters offline 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 its I/O
- Use the built-in SCADAPack x70 Logic Editor to develop IEC 61131-3 applications that extend and enhance SCADAPack functionality

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
Working with projects and DTMs	SCADAPack RemoteConnect Configuration Software
Configuring communications with the SCADAPack	PC Communication Settings -SCADAPack CommDTM
Configuring SCADAPack parameters and interacting online with the SCADAPack	SCADAPack x70 Configuration
Porting your project from SCADAPack E to SCADAPack RemoteConnect	Porting Guide for SCADAPack E to SCADAPack RemoteConnect
Porting your project from Telepace Studio to SCADAPack RemoteConnect	Porting guide for Telepace to SCADAPack RemoteConnect

12 Diagnostics

The SCADAPack provides a number of capabilities that can help you monitor SCADAPack operations and perform troubleshooting tasks. They include:

- LEDs that indicate the status of SCADAPack ports and communications
- Diagnostics for several aspects of SCADAPack communications and exceptional SCADAPack operating conditions
- System objects that measure internal SCADAPack temperature and provide power supply and battery status
- System objects that provide communications status information
- Status codes that provide information about system, communication and device status

For more information see:

- [LEDs](#) ^[102]
- [Accessing Diagnostics](#) ^[104]
- [Startup Diagnostics](#) ^[105]
- [Internal Temperature Reading](#) ^[106]
- [Power Supply and Battery Status](#) ^[107]
- [Communication Statistics](#) ^[108]
- [Status Codes](#) ^[108]

12.1 LEDs

The table below describes the LEDs on the SCADAPack.

Type	Name or Location	Color	Description
General	PWR	Green	Lit when correct voltage is applied to the power terminals. Does not indicate whether the CPU is running.
	RUN	Green	Lit when the SCADAPack is operating with the logic application in the RUN state. Blinks slowly when the SCADAPack is operating and the logic application is not in a RUN state. Blinks rapidly when the SCADAPack is starting.
	STAT	Red	Blinks to indicate a new status code has been generated. To view the status code and its description, in the SCADAPack RemoteConnect configuration software, go to the Status tab of the Online

			<p>Diags – SPx70 Controller parameters and look at Diagnostics.</p> <p>The system status code is also available through system data reference SYS_CODE_StatusCode.</p>
	FORCE	Red	<p>Lit when a SCADAPack x70 object or EBOOL logic variable is being forced to a value that does not represent its actual value.</p> <p>This typically occurs during commissioning and fault-finding activities.</p> <p>For a summary of the number of objects or EBOOL logic variables that are forced, in SCADAPack RemoteConnect configuration software, go to the Status tab of the Online Diags – SPx70 Controller parameters and look at Operation Status. For more information, see the EBOOL Variable Type topic in the Logic Programming Overview manual.</p> <p>For a list of forced objects and to change object forcing, in Online mode, see Objects > Forced Objects.</p> <p>To see a list of forced variables in the logic editor, in the SCADAPack x70 Logic Editor, in Connected mode, double-click the red F in the lower status bar.</p> <p>For more information see the Managing Object Forcing topic in the SCADAPack x70 Configuration manual.</p>
Input and Output	Digital input (DI)	Green	On when the corresponding digital input is on
	Digital output (DO)	Green	On when the corresponding digital output is on
USB LED	ACT	Green	<p>Off when no USB device is connected or the connection is not complete</p> <p>Flashing when there is an established connection between a USB device and SCADAPack x70 and an operation, such as a firmware update or a file copy, is in progress.</p> <p>Lit when operations are complete and the USB can be removed.</p> <p>The LED can also be controlled using system data reference SYS_SET_USBstoreLED.</p>

Eth1, Eth2	Right side of the physical port	Green	Activity LED Lit when the Ethernet port is active Blinks when the port is transmitting or receiving data
	Left side of the physical port	Yellow	Link LED Lit when 10/100 Ethernet link is active
Modem	RSSI	Green Red	Reserved for future use
	Tx/Rx	Green	Lit green when receiving
		Yellow	Lit yellow when transmitting
PWR	Green	Lit green when Modem power enabled	
Serial1 and Serial2	TxD	Green	Lit when Serial1 or Serial2 RS485 is transmitting
	RxD	Green	Lit when Serial1 or Serial2 RS485 is receiving
Serial3 and Serial4	CTS for Serial3 port	Green	Lit when the CTS input is active on the Serial 3 port
	DCD for Serial3 port	Green	Lit when the DCD input is active on the Serial 3 port
	CTS for Serial4 port	Green	Lit when the CTS input is active on the port Serial 4 port
	DCD for Serial4 port	Green	Lit when the DCD input is active on the Serial 4 port
	Left side of the physical port	Yellow	Blinks when data is being transmitted over the RS232 or RS485 serial connection
	Right side of the physical port	Green	Blinks when data is being received over the RS232 or RS485 serial connection

12.2 Accessing Diagnostics

The SCADAPack provides diagnostics for several aspects of SCADAPack communications and exceptional operating conditions. The following operational diagnostics are specifically supported:

- DNP3 diagnostics at each protocol layer, including network routing.
- TCP/IP diagnostics including DNP3 over IP, IP servers and TCP service ports.

- PLC communication diagnostics including protocol packet displays, communication status and device status for serial and network PLC services.
- SCADAPack system diagnostics.

The operational information provided during a diagnostic display session can assist in troubleshooting.

To sort these diagnostics from normal operational messages, it may be advantageous to disable DNP, TCP/IP, Modbus and system diagnostics using the DNPDIAG, TCPDIAG, MODBUSDIAG, and SYSDIAG commands from the command line.

Other SCADAPack diagnostics use the following format to assist in identifying messages from various SCADAPack tasks:

Task-name>>diagnostic text

To access diagnostics

Use a command line in a diagnostic display session to query the SCADAPack's operational status. The commands available are detailed in the Diagnostics Commands topic of the Operations Technical Reference manual.

There are two main ways to access command line diagnostics:

- Using an ASCII terminal connected to a SCADAPack serial port configured for the **Cmd Line** function. This is the method used to display startup diagnostics. For details, see [Startup Diagnostics](#) ¹⁰⁵. To access a diagnostic display session, use the DIAG command as described in the DIAG: Start Diagnostics Session topic of the Operations Technical Reference manual.
- Using Telnet over TCP/IP links. Multiple Telnet sessions may be established with the SCADAPack on the same TCP/IP interface, or multiple sessions may be simultaneously established on multiple TCP/IP interfaces.

Where a direct serial connection or Telnet is not available, diagnostics can be directed to a SCADAPack log file. This is achieved using the **FILEDIAG** command described in the FILEDIAG: Write Diagnostics to a Log File topic of the Operations Technical Reference manual. This diagnostics log file can then be retrieved for analysis using DNP3 file transfer.

12.3 Startup Diagnostics

At startup, the SCADAPack displays information about its startup sequence and configuration in ASCII text format through any port configured for the **Command Line** Port Function. By default, Serial4 (Port 4) on the SCADAPack is configured for the **Command Line** Port Function.

Once startup is complete, the SCADAPack terminates the diagnostic session and enters command mode unless you have configured it to remain in the diagnostic display session. Use the SYSDIAG OVERRIDE command described in the SYSDIAG: Display System Diagnostics topic of the Operations Technical Reference manual. to configure the SCADAPack to remain in the diagnostic display session when startup is complete.

To access command line mode from a diagnostic display session, press the **Esc** (Escape) key on your keyboard.

12.4 Internal Temperature Reading

Internal system data references are available to indicate the operating temperature of the SCADAPack x70 device. These system data references can be accessed from a user-created logic application or through remote communications.

Use the SCADAPack RemoteConnect configuration software to add objects to the SCADAPack objects database where you want to indicate a system reference value.

The **Internal Temperature** (°C and °F) is reported in the **Status** tab of the Online Diags - SPx70 Controller.

Device Internal Temperature °C

System data reference: **SYS_INFO_CPUmoduleTempC**

This system data reference indicates the measured ambient temperature at the controller in degrees Celsius. It is useful for measuring the operating environment of the controller and returns a temperature in the range -40...75 °C. Temperatures outside this range cannot be measured.

Use the system data reference in:

- An Analog object “Associations” configuration and:
 - Optionally configure as a Modbus REAL (floating-point) register pair
 - Optionally configure as a DNP3 floating-point analog point
 - Optionally configure as a T_SPx70_REAL logic variable type
- A SCADAPack RemoteConnect Online Objects browser list
 - As part of a **SYS_INFO** system data group
 - Individually as a system data reference: **SYS_INFO_CPUmoduleTempC**

Device Internal Temperature °F

System Data Reference: **SYS_INFO_CPUmoduleTempF**

This system data reference indicates the measured ambient temperature at the controller in degrees Fahrenheit. It is useful for measuring the operating environment of the controller and returns a temperature in the range -40...167 °F. Temperatures outside this range cannot be measured.

Use the system data reference in:

- An Analog object “Associations” configuration and:
 - Optionally configure as a Modbus REAL (floating-point) register pair
 - Optionally configure as a DNP3 floating-point analog point
 - Optionally configure as a T_SPx70_REAL logic variable type
- A SCADAPack RemoteConnect Online Objects browser list

- As part of a **SYS_INFO** system data group
- Individually as a system data reference: **SYS_INFO_CPUModuleTempF**

12.5 Power Supply and Battery Status

Internal system data references are available to indicate the status of the SCADAPack power supply and the onboard memory and clock back-up RAM battery. These system data references can be accessed from a user-created logic application or through remote communications.

Use the SCADAPack RemoteConnect configuration software to add objects to the SCADAPack objects database where you want to indicate a system reference value.

The **Input Voltage**, **Input Voltage Status** and **RAM Battery** status are reported in the **Status** tab of the Online Diags - SPx70 Controller.

Local Input Power Supply Low

System Data Reference: **SYS_INFO_InputSupplyLow**

This system data reference indicates the condition of the input power supply. It compares the Input Supply Voltage system data reference **SYS_INFO_InputSupplyVoltage** value against the Low Voltage Alert Level. See Basic Tab: SCADAPack Settings in the SCADAPack x70 Configuration manual configured in SCADAPack RemoteConnect (this is also available in system data reference **SYS_INFO_InputSupplyLowVthresh**). If the input power supply is lower than the low voltage threshold alert level, this system data reference is activated.

Use the system data reference in:

- A Digital object “Associations” configuration and:
 - Optionally configure as a Modbus Discrete register
 - Optionally configure as a DNP3 binary point
 - Optionally configure as a T_SPx70_BOOL logic variable type
- A SCADAPack RemoteConnect Online Objects browser list
 - As part of a **SYS_INFO** system data group
 - Individually as a system data reference: **SYS_INFO_InputSupplyLow**

Local Non-Volatile Memory Battery Alert

System Data Reference: **SYS_INFO_MemoryBatteryAlert**

This system data reference indicates the condition of a monitor on the lithium battery that maintains the non-volatile RAM and Real time clock (RTC) in the controller. If active, the alert indicates that the onboard controller battery needs replacement.

Use the system data reference in:

- A Digital object “Associations” configuration and:
 - Optionally configure as a Modbus Discrete register
 - Optionally configure as a DNP3 binary point
 - Optionally configure as a T_SPx70_BOOL logic variable type
- A SCADAPack RemoteConnect Online Objects browser list
 - As part of a **SYS_INFO** system data group
 - Individually as a system data reference: **SYS_INFO_MemoryBatteryAlert**

12.6 Communication Statistics

The SCADAPack provides three types of communication statistics through database objects that are associated with system information:

- SCADAPack (global) communication statistics
- Serial port communication statistics
- TCP/IP communication statistics

The objects for communication statistics can be read from the SCADAPack using DNP3 read requests:

- Modbus Scanner statistics objects
- DNP3 Controlling Station statistics objects

Communication statistics object values can be reset at any time by controlling the relevant object value and setting it to 0. This can be done by a SCADAPack x70 logic application for Modbus Scanner statistic and DNP3 Controlling Station statistic objects or through DNP3 object controls.

Communication statistics objects can be accessed as 16-bit or 32-bit analog input objects. For details, see the Communication Statistics topic in the Operations Technical Reference manual.

12.7 Status Information

Status information is reported in the Online Diags - SPx70 Controller, Online Diags - PC Communication and in diagnostic sessions and function blocks, as described below.

Status information reported in the Online Diags - SPx70 Controller parameters

The information that is reported in the Online Diags - SPx70 Controller is listed below.

- Identification and version information, such as the SCADAPack type and serial number, firmware versions, and Ethernet MAC addresses (**Status** tab)
- License information (**Licensing** tab)
- System status codes (**Status** tab)
- Hardware operation information, such as the internal temperature of the SCADAPack and the status of the power supply and battery (**Status** tab)
- Basic information about the logic application, such as the version and status (**Logic** tab)

- Current value for database objects (**Objects** tab)
- DNP3 with dialup modem (**Modem** tab)

For details about SCADAPack system status codes, see the System Status Codes topic in the Operations Technical Reference manual.

For details about device status and version, hardware operation, logic application information and database objects, see the Working Online with the SCADAPack x70 Device topic in the SCADAPack x70 Configuration manual.

Status information reported in the Online Diags - PC Communication parameters

The information that is reported in the PC Communication Settings -SCADAPack CommDTM online parameters is listed below.

- Request and response counts (**Runtime** tab)
- DNP3 diagnostics messages (**DNP3 Diagnostics** tab)

For details about request and response counts and DNP3 diagnostics messages, see the Viewing Online Information from the SCADAPack x70 Device topic in the PC Communication Settings -SCADAPack CommDTM manual.

Status information reported in diagnostics sessions

The information that is reported in diagnostics sessions is listed below.

- Communication and device status codes

For a list of the communication and device status codes, see the System Status Codes topic in the Operations Technical Reference manual.

13 Maintenance

The following topics describe the recommended maintenance activities for the SCADAPack.

- [Calibration](#) ¹¹⁰
- [Preventive Maintenance](#) ¹¹⁰
- [Routine Maintenance](#) ¹¹¹
- [Replacing the Battery](#) ¹¹⁴
- [Updating Firmware](#) ¹¹⁵
- [Recovering Firmware](#) ¹¹⁸
- [Updating the Bootloader](#) ¹¹⁹

13.1 Calibration

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

There are no user calibration procedures.

13.2 Preventive Maintenance

Keep circuit boards free from contaminants such as dust and moisture.

WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

WARNING

ELECTRICAL HAZARD

Remove power from the SCADAPack before removing the SCADAPack cover.

Remove power from the SCADAPack before servicing.

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

Battery handling procedures

NOTICE

UNINTENDED EQUIPMENT OPERATION

- Treat batteries with care.
- Follow the manufacturers' instructions concerning battery storage, use and disposal.
- Keep batteries clean and free from contaminants or other materials that could short the terminals.
- Connect new batteries using the correct polarity.
- Replace batteries with new units of the same chemistry, capacity and make.
- Observe the manufacturers' instructions regarding disposal of batteries. Considerable energy remains in the battery.

Failure to follow these instructions can result in equipment damage.

Electrostatic Discharge (ESD) procedures

NOTICE

STATIC ELECTRICITY DAMAGE

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

Failure to follow these instructions can result in equipment damage.

13.3 Routine Maintenance

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 SCADAPack before removing the SCADAPack cover.
 Remove power from the SCADAPack before servicing.

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

NOTICE

STATIC ELECTRICITY DAMAGE

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

Failure to follow these instructions can result in equipment damage.

Primary power supply

The primary power for the SCADAPack is a DC power supply. If this is a mains-operated power supply charger with battery backup, replace the batteries every 36 months or earlier if necessary.

Real-time clock and onboard RAM back-up battery

⚠ WARNING

FIRE AND BURN HAZARD

- Do not dispose of batteries in a fire. The batteries may explode.
- Do not recharge, disassemble, heat above 100 °C (212 °F) or incinerate
- Keep battery out of reach of children and in original packaging until ready to use
- Dispose of used batteries promptly
- Never put batteries in mouth. If swallowed, contact your physician or local poison control center.

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

Only the battery shown below can be used. You can order the recommended battery kit from Schneider Electric. See the SCADAPack Part Ordering List manual.

Manufacturer	File	Model	Ratings	Abnormal Charging
--------------	------	-------	---------	-------------------

Tadiran Batteries	MH12193	TL-2450/P	3.6 V, 0.55 Ah, 85 ° C	10 mA, 12 V
-------------------	---------	-----------	---------------------------	-------------

The SCADAPack includes a lithium-powered back-up battery on the controller. The main task of the battery is to back-up the microprocessor RAM chips and the real-time clock. However, the back-up battery also maintains the SCADAPack configuration during a power-supply interruption.

SCADAPack memory contents are lost when:

- The onboard RAM back-up battery loses its charge.
- The onboard RAM back-up battery is replaced while power to the SCADAPack is disconnected.
- Power is removed from the SCADAPack and the battery switch is in the up (off) position.

When memory contents are lost, you will need to reload SCADAPack configuration information and user-created applications for correct SCADAPack operation.

NOTICE

DATA LOSS

Before replacing the onboard RAM back-up battery, save a copy of the SCADAPack configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in equipment damage.

The onboard RAM back-up battery will retain the SCADAPack configuration for at least two years if the unit is not powered. Replace the battery with the recommended battery kit from Schneider Electric after every five years of continuous use, or earlier if necessary. See the SCADAPack Part Ordering List manual.

RAM back-up batteries are not rechargeable.

Power supply notifications

The SCADAPack provides notifications for the following:

- [Onboard lithium battery low](#)^[107]
- [Input power supply low](#)^[107]

If an **input power supply low** notification is generated, it may be due to power supply interruption, and/or low voltage on primary DC backup batteries.

Cleaning

There are no special cleaning instructions for this product.

Routine maintenance schedule

The frequency of routine maintenance depends on the specific piece of equipment and the environment in which it is installed. Routine maintenance is recommended at two time-intervals:

- Every three years
- Every five years

The following table summarizes the recommended frequency for maintenance procedures. In some cases, the period stated is the maximum interval between maintenance activities. Experience, or the high usage of a particular piece of equipment, may determine that maintenance procedures need to be performed more frequently than indicated in the table

Items requiring re-calibration may not be suitable for user servicing. Contact [Schneider Electric](#) for advice.

Routine maintenance schedule

Component	Every Three Years	Every Five Years
Connections and ground points	Check and replace if necessary	
Power supply units		Check and replace if necessary
RAM back-up battery	Check and replace if necessary	Replace the battery with the recommended battery kit from Schneider Electric when it has been installed for five years. See the SCADAPack Part Ordering List manual.

13.4 Replacing the Battery

A flat-package lithium battery located on the controller provides back-up power to the SCADAPack's real-time clock and RAM memory.

Replace this battery with the recommended battery kit from Schneider Electric as soon as possible after the SCADAPack reports that the RAM battery status is low and at the intervals recommended in the Routine Maintenance section. See the SCADAPack Part Ordering List manual.

The RAM battery status is provided in the configuration software, in the Status tab of the Online Diags - SPx70 Controller. Take care not to confuse this status with an external power supply low condition.

The procedure below requires the SCADAPack to be powered off briefly. It also requires restarting the SCADAPack in Cold Boot mode. Before proceeding, carefully review the precautions below.

Back-up data before replacing the battery

SCADAPack memory contents are lost when:

- The onboard RAM back-up battery loses its charge
- The onboard RAM back-up battery is replaced while power to the SCADAPack is disconnected.
- The SCADAPack is started in Factory Boot mode or in Cold Boot mode. Starting in Cold Boot mode is required in the procedure below.
- Power is removed from the SCADAPack and the battery switch is in the up (off) position.

When memory contents are lost, you will need to reload SCADAPack configuration information and user-created applications for correct SCADAPack operation.

NOTICE

DATA LOSS

Before replacing the onboard RAM back-up battery or starting the SCADAPack in Factory Boot mode or Cold Boot mode, save a copy of the SCADAPack configuration information, user-created applications, logs and other data to an external drive so it can be reloaded when the procedure is complete.

Failure to follow these instructions can result in equipment damage.

To replace the onboard RAM back-up battery

1. Order the recommended battery kit from Schneider Electric. See the SCADAPack Part Ordering List manual.
2. Follow the instructions in the battery replacement kit.
3. If needed, contact [Technical Support](#)^[8].

13.5 Updating Firmware

Note: Schneider Electric believes cybersecurity is critical in today's connected world. Improved cybersecurity mechanisms are now included in SCADAPack products and updated tools are required to apply the new device configurations. Before installing the new hardware, install the latest version of the configuration software. Old versions of software will not be able to configure products equipped with these enhanced cybersecurity features. See the Working With Security Locking topic in the Getting Started manual.

For assistance in obtaining these updated versions, contact [Technical Support](#)^[8].

Use the context menu that is available when the SCADAPack x70 configuration software is online to update the firmware on your SCADAPack x70 device. The following table lists important details to be aware of.

SCADAPack x70	Instructions	Firmware Filename
---------------	--------------	-------------------

Device or Module		for the Device
SCADAPack 570	Follow the procedure below	xxx57x.biz or xxx57x.biz
SCADAPack 574	Follow the procedure below. You cannot update the firmware on the 5607 input output module.	
SCADAPack 575	Follow the procedure below, then follow the procedure in the Updating Module Firmware topic of the SCADAPack 6601 Input Output Module manual to update the firmware for the I/O, if required.	Where xxx or xxxx is the firmware version number, such as 904 or 1001
SCADAPack 470	Follow the procedure below	xxx47x.fwz or xxx47x.fwz Where xxx or xxxx is the firmware version number, such as 904 or 1001
SCADAPack 474	Follow the procedure below, then follow the procedure in the Updating Module Firmware topic of the SCADAPack 6607 Input Output Module manual to update the firmware for the I/O, if required.	
An attached 6000 series I/O module	See the hardware manual for the I/O module	

WARNING

LOSS OF CONTROL

During a firmware update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating firmware:

- Confirm that you are connected to the correct SCADAPack.
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module.

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

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Do not remove power from the SCADAPack during the firmware update.

Do not disconnect the 6000 series I/O module from the SCADAPack during the firmware update.

If power is interrupted for any reason during the firmware update, contact Technical Support.

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

Preserved data

When you update the firmware on the device:

- The device configuration is preserved.
- Routes are preserved, with the exception of dynamic DNP3 routes and IP routes that were added using the `ROUTE` command.
- The logic application and the state of logic variables are preserved.

If there is insufficient space on the file system to store the items listed above during the firmware update, a message is generated and the firmware update is aborted.

NOTICE**UNINTENDED EQUIPMENT OPERATION**

The SCADAPack x70 device automatically restarts when the firmware is updated.

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device before updating the firmware.

Failure to follow these instructions can result in equipment damage.

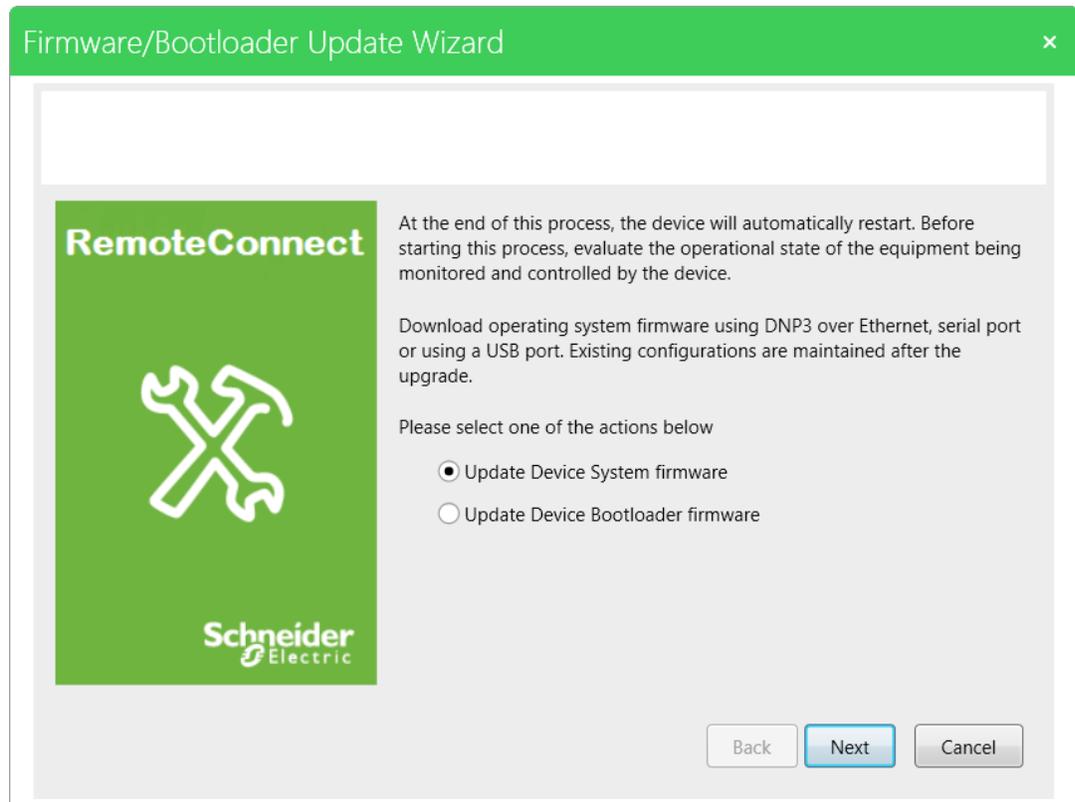
NOTICE**INCOMPATIBLE FIRMWARE VERSIONS**

Before installing any firmware updates, check the Release Notes for the firmware update to determine the most suitable firmware versions for the functionality you are using and to confirm version compatibility.

Failure to follow these instructions can result in equipment damage.

To update the firmware on the device

1. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Update Device Firmware or Bootloader**.



2. Follow the instructions in the wizard to download the firmware to the device and update it.

The firmware file has a **.fwz** file extension. By default, the firmware file is stored in one of the following directories:

64-bit systems: C:\Program Files (x86)\Schneider
Electric\RemoteConnect\Firmware\SCADAPack 47x

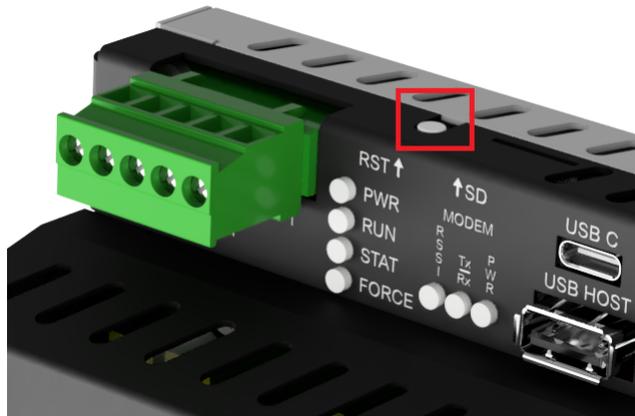
32-bit systems: C:\Program Files\Schneider Electric\RemoteConnect\Firmware\SCADAPack
47x

3. After the device has restarted, open the Online Diags – SPx70 Controller parameters and click **Refresh** on the Status tab to verify that the **Firmware Version** field was correctly updated.

13.6 Recovering Firmware

If the SCADAPack 47x does not boot because the firmware is corrupted or invalid, you can use this procedure to recover the firmware.

1. In SCADAPack RemoteConnect, create recovery media (see the Creating Recovery Media on a SCADAPack 47x topic in the SCADAPack x70 Configuration manual)
2. Insert the USB media device with the firmware.bin file on it into the SCADAPack 47x device.
3. Remove power from the SCADAPack 47x.
4. Press and hold the RST button.



5. Apply power to the SCADAPack 47x while holding the RST button.
6. Wait until the RUN, STAT, FORCE, and ACT LEDs start flashing to indicate recovery mode.
7. Release the RST button while the LEDs are still flashing.

If you release the RST button after the RUN, STAT, FORCE, and ACT LEDs stop blinking on and off and before the STAT LED turns on solid, the SCADAPack 47x will start in Run mode.

To cancel the startup mode selection, remove power from the SCADAPack while the RST button is depressed. This can be a useful tactic to avoid starting up in Factory Boot mode if you have held the RST button down until the STAT LED stops blinking on and off.
8. Wait until the RUN LED light is on and flashing slowly after approximately 2 minutes.

The SCADAPack 47x will be in the Initial state of device locking.
9. Connect a USB cable to the SCADAPack 47x and establish communication between SCADAPack RemoteConnect and the SCADAPack 47x.
10. Choose the device lock state. See the Working with Security Locking topic in the Getting Started manual.
11. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Update Device Firmware or Bootloader** and update the firmware.
12. Write the RemoteConnect configuration to the SCADAPack 47x. See the Writing the Configuration and Logic Application to the Device topic in the SCADAPack x70 Configuration manual.

13.7 Updating the Bootloader

Use the context menu that is available when the SCADAPack x70 configuration software is online to update the bootloader on your SCADAPack x70 device.

⚠ WARNING**LOSS OF CONTROL**

During a bootloader update, the 6000 series I/O module does not monitor or control any of the devices to which it is connected. Before updating the bootloader on the I/O module:

- Confirm that you are connected to the correct SCADAPack
- Evaluate the operational state of the devices that are monitored and controlled by the I/O module.

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

⚠ WARNING**UNINTENDED EQUIPMENT OPERATION**

Do not remove power from the SCADAPack during the bootloader update.

Do not disconnect the 6000 series I/O module from the SCADAPack during the bootloader update.

If power is interrupted for any reason during the bootloader update, contact Technical Support.

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

NOTICE**UNINTENDED EQUIPMENT OPERATION**

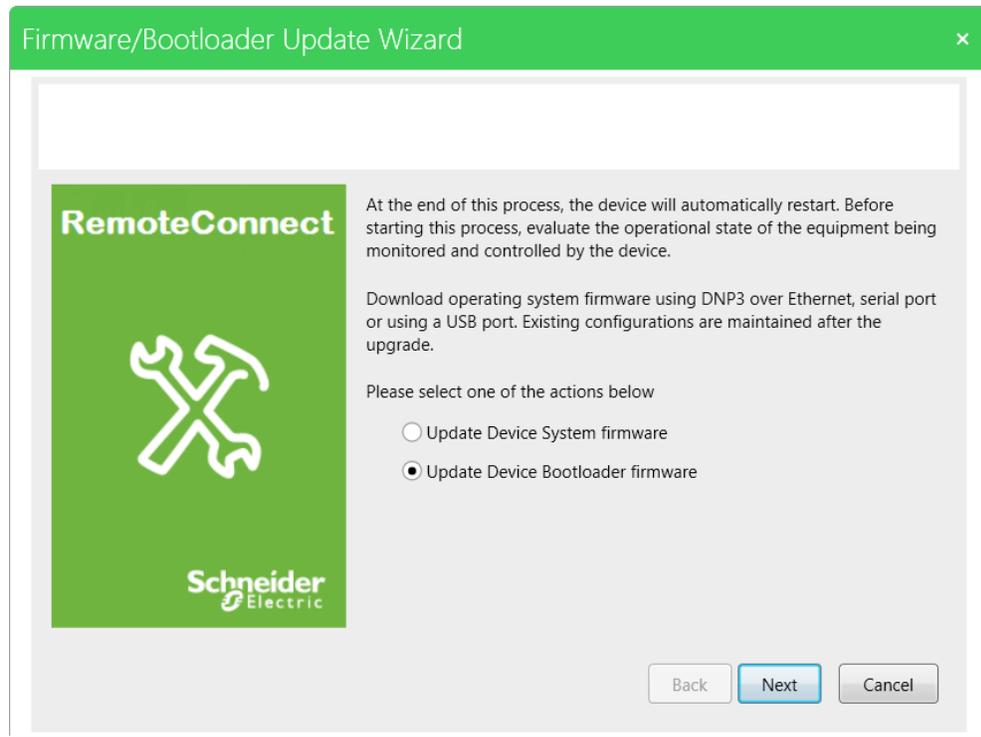
The SCADAPack x70 device automatically restarts when the bootloader is updated.

Evaluate the operational state of the equipment being monitored or controlled by the SCADAPack x70 device before updating the bootloader.

Failure to follow these instructions can result in equipment damage.

To update the bootloader on the device

1. Under **My Network**, right-click on **SCADAPack x70 Controller Settings -DeviceDTM** and select **Additional Functions > Update Device Firmware or Bootloader**.



2. Follow the instructions in the wizard to download the bootloader to the device and update it.
3. Open the Online Diags - SPx70 Controller parameters if they are not already open and click **Refresh** on the Status tab to verify that the **Bootloader Version** field was correctly updated.

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](#)^[8].

For more information see:

- [General](#)^[122]
- [Power Supply](#)^[123]
- [Controller Board](#)^[124]
- [Data Capacity](#)^[124]
- [Communications](#)^[126]
- [Digital Inputs](#)^[128]
- [Counter Inputs](#)^[129]
- [Digital Outputs](#)^[130]
- [Analog Inputs](#)^[130]

14.1 General

Item	Specification
Environment	-40...70 °C (-40...158 °F) operating temperature when the unit is mounted horizontally on a vertical surface -40...65 °C (-40...149 °F) operating temperature when the unit is mounted in any other position -40...85 °C (-40...185 °F) storage temperature 5...95% relative humidity, non-condensing Pollution Degree 2, Installation Category I, Indoor use
Elevation	3,000 m (9,842 ft)
Over-voltage category	II
Equipment class	III - SELV
Terminations	2.5...0.2 mm ² (12...30 AWG), solid or stranded
Packaging	Corrosion-resistant zinc-plated steel with black enamel paint
Dimensions	142 mm (5.6 in) wide 127 mm (5.0 in) high 67 mm (2.6 in) deep

Mechanical shock	IEC 61131-2 ½ sine, 15 ms, 15 g
Vibration	IEC 61131-2 5...8.4 Hz: Amplitude controlled, 7.0 mm (0.28 in) peak-to-peak 8.4...150 Hz: Acceleration controlled, 1.0 g peak

14.2 Power Supply

Item	Specification
Input voltage	Rated (UL): 14...29 Vdc Voltage limits: 11...30 Vdc Turn-on voltage: 10...11.5 Vdc Turn-off voltage: 9...10 Vdc
Power requirements at 30 Vdc	2.8 W Power Input is measured at the controller power input. Power Input does not include Serial, USB Host, expansion IO modules and optional modem. <ul style="list-style-type: none"> • USB (5 Vdc at 500 mA): Add 2.8 W • Serial port 3 and 4 (5 Vdc at 200 mA): Add 1.1 W
Maximum system configuration	SCADAPack 470 using 2.8 W plus any combination of serial port, USB Host port, and I/O modules up to 8.4 W
Maximum power requirements	8.4 W
Isolation	Controller power input, analog inputs, digital inputs, USB and serial communication ports are not isolated from the enclosure Ethernet ports and relay outputs are isolated See the relevant specifications for I/O point isolation information
Protection	Protected up to 40 Vdc for over-voltages and reverse polarity voltages Inrush current limited
Cable length	Maximum: 30 m (98.4 ft)

14.3 Controller Board

Item	Specification
Processor	Renesas RZ/N1D Dual ARM™ Cortex™-A7 plus ARM™ Cortex™-M3
Floating point	Integrated Hardware Floating Point Unit
CPU speed	500 MHz
Memory	4 MB SRAM 256 MB NAND Flash 256 MB DDR3 RAM
Non-volatile RAM	Non-volatile CMOS SRAM with lithium battery retains content for up to two years when not connected to an active power source
Internal analog inputs	Power input: 36 Vdc full scale. Accuracy is 0.5% of full scale. Onboard lithium battery: 4 Vdc full scale. Accuracy is 0.5% of full scale. 5 Vdc power supply: 6 Vdc full scale. Accuracy is 0.5% of full scale. 3.3 Vdc power supply: 4 Vdc full scale. Accuracy is 0.5% of full scale
Internal temperature monitor	Controller temperature: -40...75 °C (-40...167 °F)
Clock calendar	±15 seconds per month at -40...70 °C (-40...158 °F)

14.4 Data Capacity

Item	Specification
Data throughput	Maximum: 2600 changes per second from all sources combined (client and server protocols, logic, integrated applications)
Object and Event Buffer memory	Maximum memory: 2,740,000 bytes (including fragmentation allowance) To calculate available object memory: available object memory = Maximum memory – DNP3 event

	<p>storage size – integrated application memory</p> <p>Example 1: Given Maximum Event Storage = 5,000, no integrated applications enabled, then the available object memory = 2,600,000 bytes (approx)</p> <p>Example 2: Given Maximum Event Storage = 100, no integrated applications enabled, then the available object memory = 2,737,200 bytes (approx)</p> <p>Example 3: Given Maximum Event Storage = 40,000, no integrated applications enabled, then the available object memory = 1,860,000 bytes (approx)</p> <p>Example 4: Given Maximum Event Storage = 40,000, 10-run flow computer enabled, then the available object memory = 954,400 bytes (approx)</p>
Object sizes	<p>Digital object size: up to 124 bytes + text field characters*</p> <p>Analog object size: up to 248 bytes + text field characters*</p> <p>Counter object size: up to 140 bytes + text field characters*</p> <p>* The number of characters used in the object name + group name + comment fields in each object</p>
DNP3 event storage configuration	<p>Default: 5,000 events</p> <p>Maximum: 40,000 events</p> <p>Increasing the configured DNP3 event storage reduces the number of available objects in the SCADAPack object database</p>
Event storage size	28 bytes per event x DNP3 event storage configuration
Integrated application memory	Realflo: Up to 665,600 bytes (10 gas/liquid flow runs)
Memory size calculation	<p>Total object, event and integrated application memory = (number of digital objects x digital size) + (number of analog objects x analog size) + (number of counter objects x counter size) + (DNP3 event storage configuration x 28) + integrated application memory</p> <p>Memory size calculation must not exceed maximum 3,000,000 bytes</p>
Number of database objects	3,200 to 15,000, depending on Object types, DNP3 event storage, integrated application memory usage
Database objects linked with logic variables	Up to 65,536 bytes of T_SPx70_ variable types

Object-linked logic variable sizes	T_SPx70_BOOL	8 bytes
	T_SPx70_ADV_DIGITAL	12 bytes
	T_SPx70_INT	8 bytes
	T_SPx70_UINT	8 bytes
	T_SPx70_DINT	12 bytes
	T_SPx70_REAL	12 bytes
	T_SPx70_ADV_ANALOG	76 bytes
	T_SPx70_UDINT	12 bytes
	T_SPx70_ADV_COUNTER	20 bytes
Number of object-linked logic variables	860 to 6,000, depending on T_SPx70_ variable types	
Logic Program size	Maximum: 3,584 KB In the SCADAPack x70 Logic Editor, see Mode > Memory Usage	
Logic Data size	Maximum: 1024 KB (unlocated, saved data) In the SCADAPack x70 Logic Editor, see Mode > Memory Usage	
File system storage	Flash memory, approximately 70 MB available for user data	
USB host storage	Single-partition plug-in USB mass storage devices up to 32 GB File format: FAT32	

14.5 Communications

Item	Specification
Serial 1 and Serial 2	RS485 signals: TxD, RxD Signals: 2-wire half-duplex operation 4-pin removable terminal block Baud rates up to 115,200 bps
Serial 3 and Serial 4	RS232 signals: TxD, RxD, CTS, RTS, DCD, DTR RS485: 2-wire half-duplex operation

	<p>5 Vdc at 200 mA available</p> <p>8-pin modular jack connector (RJ45)</p> <p>Baud rates up to 115,200 bps</p>
Serial 5	<p>RS-232 (Modem)</p> <p>Signals: TxD, RxD, CTS, RTS, DCD, DTR</p> <p>Vin switched at 350 mA available</p> <p>8-pin removable terminal block</p>
Cable length	<p>RS232: Maximum 15 m (50 ft)</p> <p>RS485: Maximum ~ 1200 m (4000 ft)</p>
Protection	2 kV surge withstand capability as per IEC 61131-2
Ethernet 1	<p>10/100 Mbps UTP (10/100Base-T) transformer isolated</p> <p>Connected to switch</p>
Ethernet 2	<p>10/100 Mbps UTP (10/100Base-T) transformer isolated</p> <p>Selectable - Either connected to switch or directly to MAC</p>
USB host port	<p>USB 2.0-compliant A-type receptacle</p> <p>Supports USB mass storage devices up to 32 GB</p> <p>Provides up to 500 mA at 5 Vdc</p> <p>Supports communications at 1.5 Mb/s and 12 Mb/s</p>
USB device port	<p>USB 2.0-compliant C-type receptacle</p> <p>Supports communications at 1.5 Mb/s and 12 Mb/s</p>
I/O bus	<p>SCADAPack x70 devices support up to 15 I/O modules with a maximum total cable length of 1.82 m (75 in).</p> <p>See Adding Inputs and Outputs ^[58].</p>
Modbus/TCP Server, inbound connections	Maximum: 20
Modbus Server devices (configured to be polled by the SCADAPack when it is operating as a Modbus Client)	Maximum: 150 (Modbus/TCP and Modbus serial devices combined)

Objects mapped from Modbus devices	Maximum: 3,000
DNP3 connections (Controlling Station, Outstation, Peer and RemoteConnect connections)	Maximum: 100 (IP, serial, cellular, PSTN interfaces combined)
DNP3 Outstation devices (polled by the SCADAPack when it is operating as a DNP3 Controlling Station)	Maximum: approximately 90 (allowing approximately 10 spares for other Controlling Station, peer and/or RemoteConnect connections)
DNP3 Outstation objects (polled by the SCADAPack when it is operating as a DNP3 Controlling Station)	Up to the number of SCADAPack database objects available (see Data Capacity ^[124])
Concurrent TCP connections (all protocols) + open files (all file devices)	Maximum: 200
Concurrent logic editor debug (UMAS protocol) connections	Maximum: 3
Concurrent FTP connections	Maximum: 5
Concurrent Telnet connections	Maximum: 5
Terminal Server TCP connections	Maximum: 1 per serial port configured as Terminal Server

14.6 Digital Inputs

Item	Specification
Quantity	4
Typical operating voltage	12 Vdc 24 Vdc
Turn-on voltage	Minimum: 9 Vdc

Turn-off voltage	Maximum: 4 Vdc
Over-voltage tolerance	36 Vdc sustained over-voltage without foreseeable damage
Input current	0.35...0.45 mA at 12 Vdc 0.75...0.85 mA at 24 Vdc
Reporting	<ul style="list-style-type: none"> • 10 ms timestamped Sequence of Events (SOE) • Input state inversion
Status	Chatter filter detection when digital state changes faster than 5 Hz
Isolation	Ground return connected to chassis ground
Cable length	Maximum: 30 m (98.43 ft)

14.7 Counter Inputs

Item	Specification
Quantity	4 shared with digital input channels DI1, DI2, DI3, and DI4
Electrical Characteristics: <ul style="list-style-type: none"> • Digital Pulse counting 	Same as digital input channels DI1, DI2, DI3, and DI4
Electrical Characteristics: <ul style="list-style-type: none"> • DI1 and DI2 Turbine Meter Sensitivity 	Minimum input 30 mV p-p up to 50 Hz Minimum input 150 mV p-p at 150 Hz Minimum input 650 mV p-p at 5 kHz Minimum input 750 mV p-p at 10 kHz
DI1, DI2, DI3, and DI4 supported counting	Range: 0 to 10 kHz Rising edge counting Falling edge counting (using digital input state inversion)
DI1, DI2, DI3, and DI4 Pulse rate (frequency) range	Minimum 3.33 mHz (0.00333 Hz) Maximum 10 kHz (10000 Hz)
Reporting	Pulse counter: <ul style="list-style-type: none"> • 16-bit and 32-bit counters • Event deviation with optional timestamp

	<ul style="list-style-type: none"> • Polled & unsolicited reporting • Quality flags Pulse rate (frequency): <ul style="list-style-type: none"> • 32-bit floating point analog (REAL) • 32-bit integer analog (DINT) • 16-bit integer analog (UINT) by rescaling • Event deviation with optional timestamp • Polled & unsolicited reporting • 8 alert limits • Quality flags
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14.8 Digital Outputs

Item	Specification
Quantity	2
Description	Normally open relay contacts Form A
Power rating	30 Vdc, 2 A
Isolation	Ground return connected to chassis ground 250 Vac/350 Vdc maximum
Cable length	Maximum: 30 m (98.43 ft)

14.9 Analog Inputs

Item	Specification
Quantity	4
Type	Uni-polar, voltage or current
Resolution	12 bits 1.5 mV resolution on 5 V range 5.5 uA resolution on 20 mA range

Accuracy	<p>$\pm 0.1\%$ of full scale at 25 °C (77 °F)</p> <p>$\pm 0.2\%$ over-temperature range</p>
Isolation	<p>None</p> <p>Common return connected to Chassis Ground</p>
Input resistance	<p>250 ohms in current configurations</p> <p>1 Mohms in voltage configurations</p>
Ranges	<p>Input Type: 4...20 mA, 0...20 mA, 1...5 Vdc, or 0...5 Vdc</p> <p>Under-range: 4...20 mA measures to 0 mA</p> <p>Individual inputs can be configured for current or voltage operation</p>
Over range	Measures up to 22 mA / 5.5 Vdc
Under range	<p>4...20 mA measures to 0 mA</p> <p>1...5 measures to 0 Vdc</p>
Sampling rate	<p>Configurable for:</p> <p>30 ms to scan all 4 channels</p> <p>100 ms to scan all 4 channels</p>
Normal Mode Rejection	74 dB (50/60 Hz) when sampling set to 100 ms
Reporting	<p>Deviation</p> <p>8 alert limits</p> <p>Under- and over range events</p> <p>Quality flags</p> <p>Integer/floating point</p> <p>Timestamped events</p> <p>Polled, unsolicited reporting on deviation and per alert limit</p>
Timestamping	30 ms time-series samples
Cable Length	Maximum: 30 m (98.4 ft)

15 Standards and Certifications

Introduction

SCADAPacks are designed to comply with the relevant standards and rules for electrical equipment in an industrial automation environment.

Industrial Standards

Requirements specific to the SCADAPack functional characteristics, immunity, robustness, and safety:

- IEC/EN 61131-2
- CSA 22.2 No. 61010-1-12 and CSA 22.2 No. 61010-2-201
- UL 61010-1 and UL 61010-2-201

CE Marking Compliance

- For the latest information regarding product compliance with European Directives for CE marking, refer to the EU Declaration of Conformity issued for your product at www.se.com
- For the latest information regarding product compliance with RoHS, WEEE directives and REACH regulation, visit the Schneider Electric **Check a Product** portal at www.reach.schneider-electric.com

Installation in Classified Ex Area (North America)

- Hazardous locations Class I, Division 2, groups A, B, C, and D, T4 and Class I, Zone 2, T4, $-40\text{ }^{\circ}\text{C} \leq \text{Tamb} \leq 70\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F} \leq \text{Tamb} \leq 158\text{ }^{\circ}\text{F}$) according to CSA C22.2 No. 213-17, UL 12.12.01
- ATEX (EU Directive 2014/34/EU) in defined atmosphere Zone 2 according to EN IEC 60079-0, EN IEC 60079-7 and EN IEC 60079-15

MODEL SCADAPack 470 TBUP470xxxxxxxxS	 S/N: S123456 DOM: YYWW	 Refer to user manual: 250399 Revision: 3.7.3 https://shop.exchange.se.com/en-US/apps/58663
Power Input: 14...29 Vdc, 19.6 Wmax (powered by Class 2 power supply)		
  II 3 G	REYNOSA  US	 Контроллер RTU
Ex ec nC IIC T4 Gc $-40^{\circ}\text{C} \leq \text{Tamb} \leq 70^{\circ}\text{C}$	LISTED E184163 IND.CONT.EQ. FOR HAZ.LOC Class I, Div.2 GPS ABCD T4 Class I, Zone 2, IIC T4 $-40^{\circ}\text{C} \leq \text{Tamb} \leq 70^{\circ}\text{C}$	 MADE IN MEXICO
38 Neponset Avenue Foxboro, Massachusetts 02035 USA		270634 Rev. 2.0

⚠ WARNING**EXPLOSION HAZARD**

THESE DEVICES ARE OPEN-TYPE DEVICES THAT ARE TO BE INSTALLED IN AN ENCLOSURE WITH TOOL REMOVABLE COVER OR DOOR, SUITABLE FOR THE ENVIRONMENT.

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

⚠ WARNING**EXPLOSION HAZARD**

DO NOT DISCONNECT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS FREE OF IGNITABLE CONCENTRATIONS.

AVERTISSEMENT – RISQUE D'EXPLOSION. NE PAS DÉBRANCHER PENDANT QUE LE CIRCUIT EST SOUS TENSION OU À MOINS QUE L'EMPLACEMENT NE SOIT EXEMPT DE CONCENTRATIONS INFLAMMABLES.

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

Specific Countries

For Australia and New Zealand: ACMA requirements for RCM marking

Specific Countries

For United States: FCC Part 15 Subpart B Class A

