

SCADAPack E

530E and 535E Quick Start Guide

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1 Legal Information

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

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2 Technical Support

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

Technical Support: Americas, Europe, Middle East, Asia

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

Toll free within North America 1-888-226-6876

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Technical Support: Australia

Inside Australia 13 73 28 (13 SEAU)

Inside New Zealand 0800 652 999

Email techsupport.pz@se.com

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, service, 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 potentially 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 help prevent unauthorized changes in operating characteristics.

Acceptable Use

SCADAPack E remote Programmable Automation Controllers (rPACs), Remote Terminal Units (RTUs) and input/output (I/O) modules are intended for use in monitoring and controlling non-critical equipment only. They are not intended for safety-critical applications.

WARNING

UNACCEPTABLE USE

Do not use SCADAPack E rPACs, RTUs, or I/O modules as an integral part of a safety system. These devices are not safety products.

Failure to follow this instruction 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 this Manual

Audience

This manual is for written for people who need a brief overview of how to get their SCADAPack 530E or SCADAPack 535E started and communicating with the configuration software. These individuals are typically:

- Systems Engineers
- Commissioning Engineers
- Maintenance Technicians

Scope

This manual describes:

- The main functions the SCADAPack 530E and SCADAPack 535E provide and the roles they can play in a SCADA environment.
- How to install the SCADAPack E Configurator software and start your remote Programmable Automation Controller (rPAC) so you can begin exploring its functionality.
- How to set up serial or Ethernet communications with the computer running the SCADAPack E Configurator software.
- How to transfer configuration information from the SCADAPack E Configurator software to the rPAC database.
- The key information you need to have before you move on to more detailed configuration.

Related Documents

Use this manual in conjunction with the other manuals included in your SCADAPack E documentation set. The manuals you need to reference will depend on the role your rPAC plays in your SCADA environment. The table below is not an exhaustive list of the manuals available to you, but summarizes the key manuals you will need to reference in order to configure and maintain your rPAC. For a more detailed description of where to find information in your documentation set, see [Where to go From Here](#)

67.

For Information About	See
Installing and understanding rPAC hardware	• SCADAPack 530E Hardware Manual • SCADAPack 535E Hardware Manual
Configuring your rPAC to communicate with other rPACs and Remote Terminal Units (rPACs) and with input and output (I/O) devices	• SCADAPack E Configurator User Manual • DNP3 Technical Manuals • Protocol Technical Manuals • Communication Interfaces Manual
Configuring the rPAC points database	• SCADAPack E Configurator User Manual • Configuration Technical Manual
Configuring security on your rPAC	• Security Quick Start Guide • Security Administrator User Manual • Security Technical Reference Manual

Operating and troubleshooting your rPAC	• SCADAPack E Operational Reference Manual • SCADAPack 530E Hardware Manual • SCADAPack 535E Hardware Manual
Installing SCADAPack Workbench, using it to build custom applications and downloading the applications to the rPAC	• SCADAPack Workbench Quick Start Guide • SCADAPack E Target 5 Technical Manuals
Installing ISaGRAF 3 Workbench, using it to build custom applications and downloading the applications to the rPAC	• ISaGRAF 3 Workbench Quick Start Guide • SCADAPack E Target 3 Technical Manuals
Adding I/O expansion modules	• I/O Expansion Technical Reference Manual • SCADAPack E I/O Modules Hardware Manuals • SCADAPack System Configuration Guide

5 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.

Contact us

For more information, refer to the Schneider Electric Cybersecurity Support Portal at <http://www.schneider-electric.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>

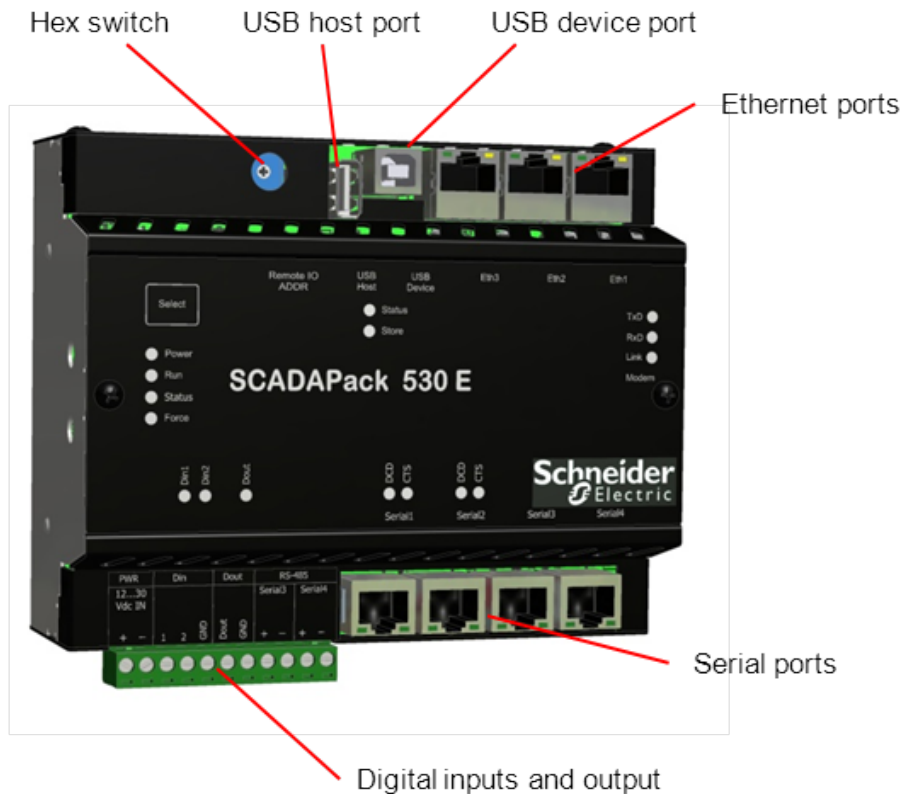
WaterISAC Water Security Network

<https://www.waterisac.org>

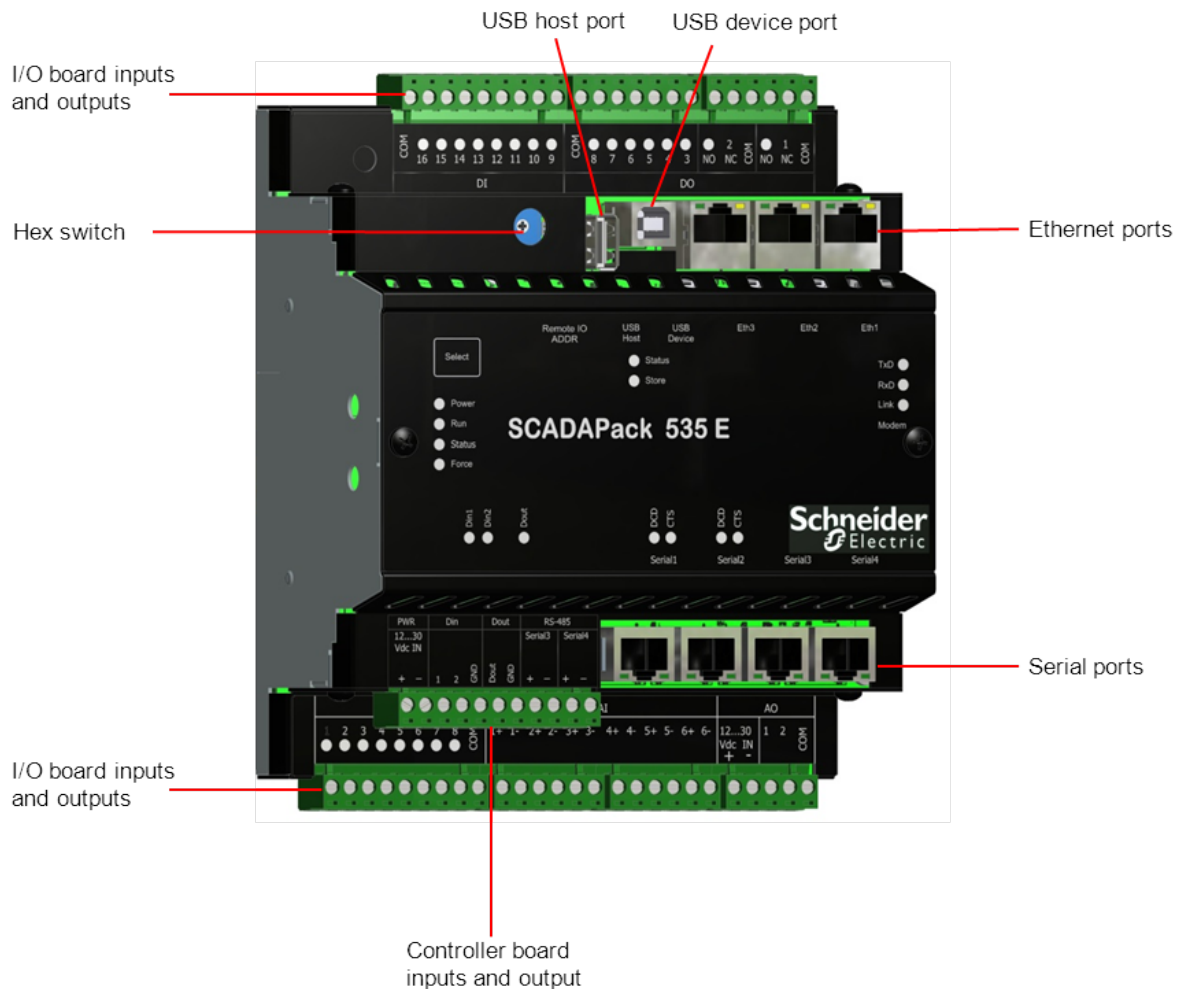
6 About the SCADAPack 530E and SCADAPack 535E

The SCADAPack 530E and SCADAPack 535E remote Programmable Automation Controllers (rPACs) are smart, microprocessor-based telemetry and control devices that can help to remotely monitor and control physical objects. For example, in a water management environment, the SCADAPack 530E and SCADAPack 535E can be used to monitor and control the valves on flow-monitoring devices at pumping stations. The rPACs' 1 ms Sequence of Event (SOE) monitoring capability is well suited to telemetry applications that require high-speed time-stamping and data capture.

The following illustrations identify the main hardware components on each rPAC.



SCADAPack 530E



SCADAPack 535E

The rPAC Difference

The ARC Advisory Group has defined the rPAC as a new way to look at remote site automation. An rPAC combines the power of a PAC with the versatility of a Remote Terminal Unit (RTU). The SCADAPack 530E and SCADAPack 535E rPACs are platforms that increase performance, adhere to open standards, and can operate in harsh, remote environments.

The SCADAPack 530E and SCADAPack 535E provide:

- Support for open standard telemetry protocols such as DNP3 level 4 with Security Suite (Secure Authentication and/or Data Encryption) and IEC 60870-5-101/-104
- Support for open standard industrial protocols such as Modbus RTU, Modbus TCP and DF1
- An open standard IEC 61131-3 programming environment
- Data concentrator capabilities for any DNP3, Modbus or DF1 devices
- Support for up to 29 active Supervisory Control and Data Acquisition (SCADA) masters, up to 100 remote/local slave devices, and up to 100 remote DNP3 devices in peer-to-peer mode

- A remote management suite to change configurations, modify programs and update firmware remotely using open standard DNP3
- Up to 515 internal digital/analog inputs and outputs
- 1 ms resolution time-stamped digital inputs, 30 ms sampled analog inputs with 16-bit analog-to-digital conversion (ADC)
- 3 Ethernet and 4 serial ports, 1 embedded 3G modem, 1 USB device port for local configuration
- 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

Roles

The SCADAPack 530E and SCADAPack 535E rPACs can be configured to play one or more of the following roles in your Supervisory Control and Data Acquisition (SCADA) environment:

- Endpoint
- DNP3 router between any combination of Ethernet and serial ports
- DNP3 peer-to-peer communications device
- Data concentrator for:
 - Remote DNP3 and DNP3 IP slaves
 - Local DNP3, DNP3 IP, Modbus RTU, Modbus TCP and DF1 serial slaves
 - Local IEC 60870-5-103 protection relays
- Protocol converter for:
 - Modbus RTU and Modbus TCP to DNP3 and DNP3 IP, and vice-versa
 - Modbus RTU and Modbus TCP to IEC 60870-5-101/-104
 - DF1 to DNP3 and DNP3 IP, IEC 60870-5-101/-104 or Modbus RTU and Modbus TCP
 - IEC 60870-5-103 to DNP3/DNP3 IP, IEC 60870-5-101/-104 or Modbus RTU and Modbus TCP

The role your SCADAPack 530E or SCADAPack 535E plays in your SCADA environment determines how you should set up communications to and from it and how you should configure it.

Communications

The SCADAPack 530E and SCADAPack 535E include four serial ports and three Ethernet ports that are available for communications with the SCADA master system, with other rPACs and RTUs, with devices such as Programmable Logic Controllers (PLCs), and with the SCADAPack E Configurator software. The rPACs also include a USB 2.0 device port for local configuration and a USB 2.0 host port that supports plug-in media.

A socket modem port that supports GPRS, 3G or LTE communications with remote devices will be available at a later date.

The SCADAPack 530E and SCADAPack 535E communicate using the Distributed Network Protocol (DNP) 3, IEC 60870-5 and Modbus protocols.

Inputs and Outputs

The following table summarizes the SCADAPack 530E and SCADAPack 535E inputs and outputs.

SCADAPack 530E and SCADAPack 535E Input and Output Summary

I/O Type	SCADAPack 530E	SCADAPack 535E
Digital inputs	2	18
Digital outputs	1	9
Analog inputs	0	6
Analog outputs ¹	0	2

¹The SCADAPack 535E provides two analog outputs if this option was requested when the rPAC was ordered.

Input and output capacity on the SCADAPack 530E and SCADAPack 535E can be extended by adding I/O expansion modules. For details about the number of I/O modules supported, see the SCADAPack 530E or SCADAPack 535E hardware manual.

Configuration

You can configure the SCADAPack 530E and SCADAPack 535E using three different methods:

- Locally or remotely using SCADAPack E Configurator, a software application that runs on a desktop or laptop computer connected to the rPAC 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 ClearSCADA software.
- Locally using applications created in the SCADAPack Workbench or ISaGRAF 3 Workbench user programming tools. Typically, applications created in these tools extend and enhance the functionality provided by the rPAC. However, you can also write applications that replace the configuration functionality provided through the SCADAPack E Configurator software or the ClearSCADA software.

Before you begin configuring the rPAC, determine whether the ClearSCADA software will be used for any configuration tasks. This documentation assumes you are using the SCADAPack E Configurator software to configure the rPAC. For information about using the ClearSCADA software, see the ClearSCADA documentation.

Security

The rPAC can communicate using the DNP3 protocol, which is level 4-compliant. The DNP3 protocol supports the optional DNP3 Secure Authentication (SAv2) features and AGA-12 DNP3 Data Encryption to help improve message confidentiality.

6.1 Configuration Overview

The steps below summarize the tasks required to get your rPAC up and running and communicating with the SCADAPack E Configurator software. These tasks are described in this Quick Start Guide.

1. [Start the SCADAPack E Configurator software](#)^[20].
2. [Power up the rPAC](#)^[26].
3. [Set up a USB connection between the SCADAPack E Configurator computer and the rPAC](#)^[32].
4. [Confirm the rPAC is operational.](#)^[34]
5. [Explore the rPAC default configuration and SCADAPack E Configurator functionality](#)^[23].
6. [Transfer the default configuration information from the SCADAPack E Configurator computer to the rPAC](#)^[36].
7. Set up [RS232 serial](#)^[39] or [Ethernet communications](#)^[48] between the rPAC and the SCADAPack E Configurator computer.
8. [Become familiar with the rPAC points database.](#)^[54]
9. Learn how to read and write rPAC database information using [DNP3](#)^[56] or [Modbus](#)^[61].

For information about the next steps you can take after completing these tasks, see [Where to Go From Here](#)^[67].

7 Initial Startup

The information in this section explains how to get your rPAC and the SCADAPack E Configurator software up and running.

You don't need to physically install your rPAC in the field before you install the SCADAPack E Configurator software and power up the rPAC. Depending where your rPAC will be installed, it may be easier to become familiar with rPAC configuration and operation before installing it in its permanent location.

This section describes:

- [Hardware and Software Requirements](#) ^[20]
- [Starting the SCADAPack E Configurator Software](#) ^[20]
- [Exploring SCADAPack E Configurator Functionality](#) ^[23]
- [Setting the rPAC Address](#) ^[25]
- [Powering up the rPAC](#) ^[26]

7.1 Hardware and Software Requirements

Hardware Requirements

You will need the following items to power up your rPAC and learn more about its operation:

- A 12...30 Vdc power supply that meets the requirements for your configuration. See the SCADAPack 530E and SCADAPack 535E Hardware Manuals for details.
- A digital multi-meter.
- An RJ45 to DE9 crossed RS232 cable such as Schneider Electric part number TBUM297217.
- A high-speed USB cable such as Schneider Electric part number TBUM297332 or TBUM297333.
- A desktop or laptop computer that meets the requirements outlined in the Installation Instructions.

If you will be using Ethernet to communicate with SCADAPack E Configurator, you will also need:

- A switch, hub or access to a wall jack on a LAN
- A Category 5 (UTP) LAN cable with standard RJ45 modular terminal connectors (such as Schneider Electric part number TBUM297244 or TBUM297245)

A USB to RS232 adapter may be used.

Software Requirements

- SCADAPack E Utilities for device and security configuration
- SCADAPack Workbench for IEC 61131-3 logic programming

7.2 Starting the SCADAPack E Configurator Software

The following procedure provides the steps to start the SCADAPack E Configurator software for the first time. During this procedure, you will select the device type, model, and one of two ISaGRAF target types:

- Target 3 (ISaGRAF 3 Workbench)
- Target 5 (SCADAPack Workbench)

SCADAPack Workbench and ISaGRAF 3 Workbench are optional software applications that you can use to extend and enhance the configuration capabilities provided through the SCADAPack E Configurator software.

SCADAPack Workbench is the latest IEC 61131-3 programming suite available from Schneider Electric. It includes numerous enhancements compared to the legacy ISaGRAF 3 Workbench programming suite and should be selected by new users.

To Start the SCADAPack E Configurator Software for the First Time

1. Select the **Start or Windows** icon, then navigate to the **Schneider Electric** folder and select **SCADAPack E > SCADAPack E Configurator**.

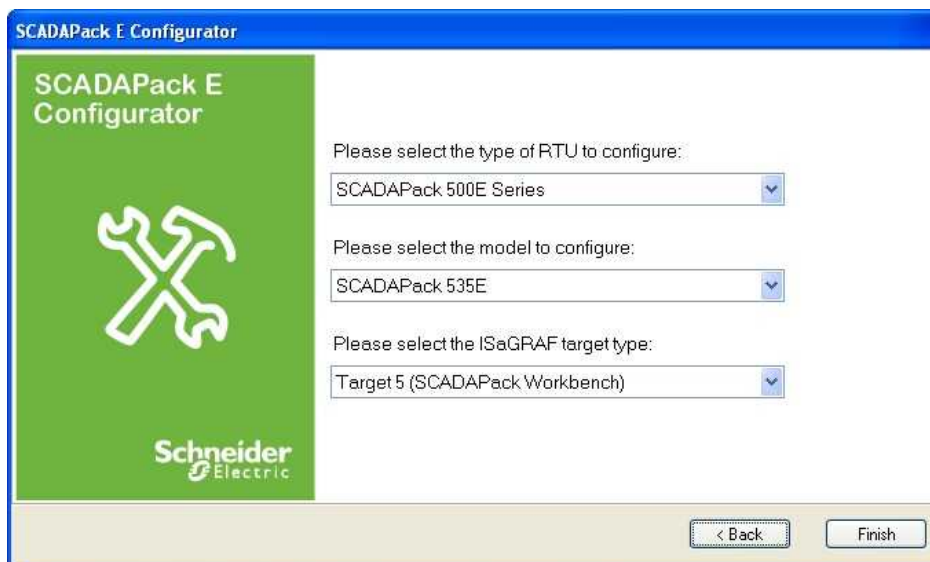
The following SCADAPack E Configurator window is displayed.



SCADAPack E Configurator Select an Activity Screen

2. Select **Create a new RTU configuration** then click **Next**.

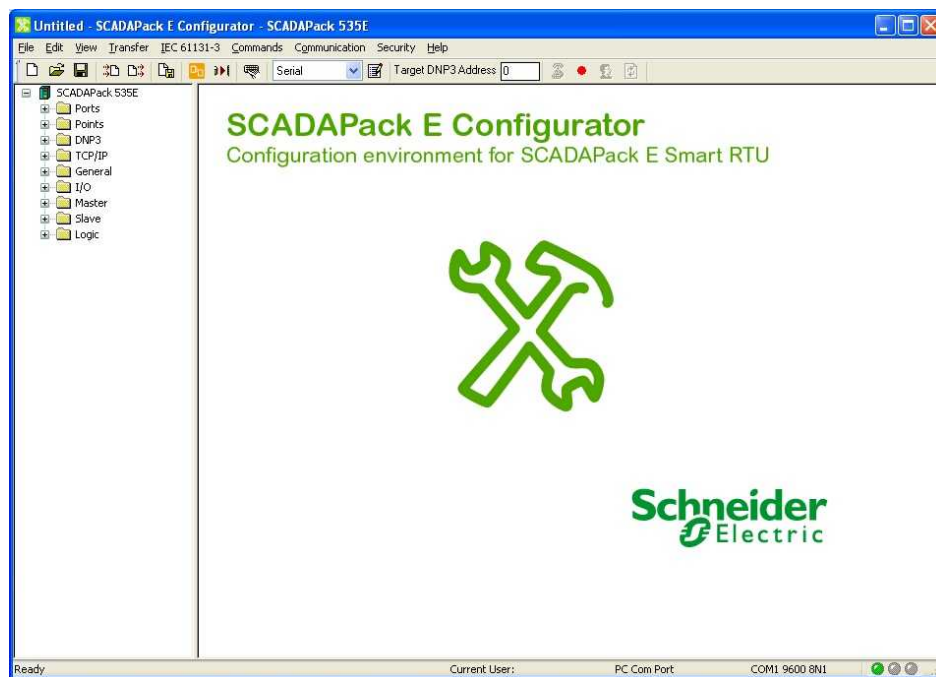
The following screen is displayed. The choices you make on this screen determine the default configuration settings for your device in the SCADAPack E Configurator software.



SCADAPack E Configurator Create a New RTU Configuration Screen

3. Use the drop-down lists to select the SCADAPack E series, device model and ISaGRAF target type then click **Finish**.

The SCADAPack E Configurator software main window is displayed, as shown below.



SCADAPack E Configurator Main Window

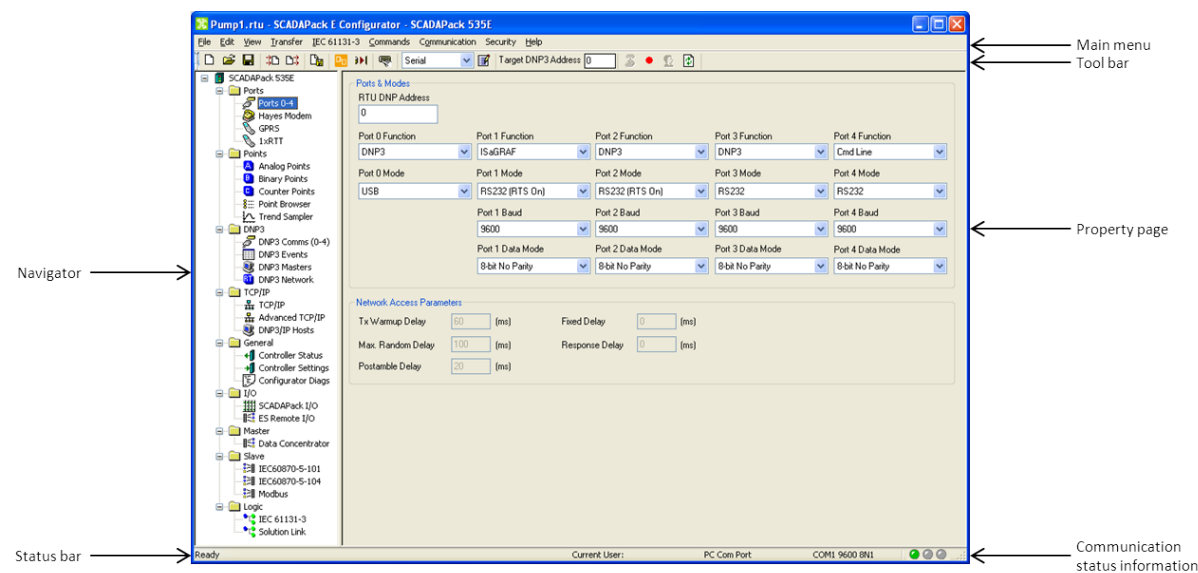
You can now browse through the SCADAPack E Configurator software menu options and properties pages to see the default settings for the rPAC points database and communications ports.

To confirm rPAC operation and communication with the SCADAPack E Configurator software, you will need to power up the rPAC and set up a USB connection from the computer running the SCADAPack E Configurator software to the rPAC. For details, see:

- [Exploring SCADAPack E Configurator Functionality](#) ²³
- [Powering up the rPAC](#) ²⁶
- [Setting Up a USB Connection to the SCADAPack E Configurator Computer](#) ³²

7.3 Exploring SCADAPack E Configurator Functionality

Before you power up the rPAC and begin configuring it, it is a good idea to become familiar with the SCADAPack E Configurator software. The figure below shows the folder and property page hierarchy in the SCADAPack E Configurator software.



SCADAPack E Configurator User Interface

The following table summarizes where you will find the main configuration capabilities in the SCADAPack E Configurator software.

Configuration Parameters in SCADAPack E Configurator

To View Configuration Parameters For	Click on This Folder	Then Select This Property Page
rPAC identification, time settings and low voltage notification levels	General	Controller Settings
Serial ports	Ports	Ports 0-4
USB device port	Ports	Ports 0-4
Ethernet ports	TCP/IP	TCP/IP
The physical inputs and outputs on the rPAC	I/O	SCADAPack I/O
The rPAC database of analog, binary (digital) and counter points	Points	- Analog Points - Binary Points - Counter Points
DNP3 communications	DNP3	DNP3 Comms (0-4)
Data concentrator setup	Master	Data Concentrator
IEC 60870-5 slave device setup	Slave	- IEC60870-5-101 - IEC60870-5-104
SCADAPack Workbench or ISaGRAF 3 Workbench application setup	Logic	IEC61131-3

7.4 Setting the rPAC Address

The SCADAPack 530E or SCADAPack 535E address only needs to be set when the rPAC is replacing a SCADAPack ES that was operating as a Main Unit for ES Remote I/O Units.

In every other configuration, the rPAC address should remain at its default setting of 0. That means:

- The physical hex switch on the rPAC should remain at 0.
- The read-only analog system point 50002 displays 0 in the SCADAPack E Configurator **Point Browser** property page.

Setting the rPAC Address for ES Remote I/O Operation

If the SCADAPack 530E or SCADAPack 535E is replacing a SCADAPack ES that was operating as a Main Unit for ES Remote I/O Units, you need to define the ES Remote I/O Group number and the Main Unit number for the rPAC:

- To define the ES Remote I/O Group number, set the Remote I/O Group parameter on the **ES Remote I/O** property page in SCADAPack E Configurator, as described below.
- To define the Main Unit number, leave the hex switch on the rPAC at its default setting of 0.

To Set the ES Remote I/O Group Number

1. In SCADAPack E Configurator, select the **I/O > ES Remote I/O** property page.
2. On the **ES Remote I/O** property page, set the value of the **Remote I/O Group** parameter in the range 0-14.

Changes to the **Remote I/O Group** parameter take effect after the rPAC is restarted.

WARNING

UNINTENDED EQUIPMENT OPERATION

Evaluate the operational state of the equipment being monitored or controlled by the rPAC before restarting it.

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

3. Restart the rPAC when prompted.

Related System Points

The analog system points described below reflect the value of the ES Remote I/O settings.

System Point	Value Reflects	Operation
50017	Remote I/O Group number	The value is displayed on the SCADAPack E Configurator Point Browser property page and is updated after the rPAC is restarted.

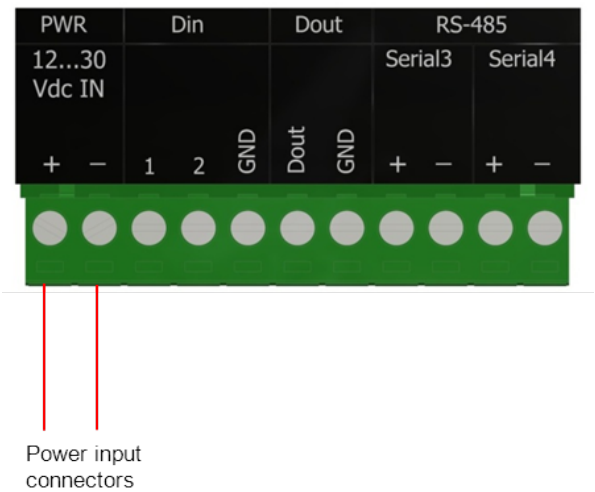
50002	Remote I/O Group number Main Unit number	The value is displayed on the SCADAPack E Configurator Point Browser property page and is updated when you read point information from the rPAC. Example: A hex value of 20 on the SCADAPack E Configurator Point Browser property means the Remote I/O Group number is 2 and the Main Unit number is 0.
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For more information about reading and writing system points on the SCADAPack E Configurator Point Browser property page, see the SCADAPack E Configurator User Manual.

7.5 **Powering Up the rPAC**

The following procedure describes how to apply power to the rPAC. There is no on/off switch on the device; it starts automatically when power is applied. By default, the rPAC starts in Run mode, the normal operating mode for day-to-day tasks. For information about starting the rPAC in other modes, see the SCADAPack 530E Hardware Manual or the SCADAPack 535E Hardware Manual.

The rPAC is powered by a 12...30 Vdc power supply that is wired to the two power input connectors. Before you apply power, review the wiring information below.



Wiring Connectors

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

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

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

WARNING

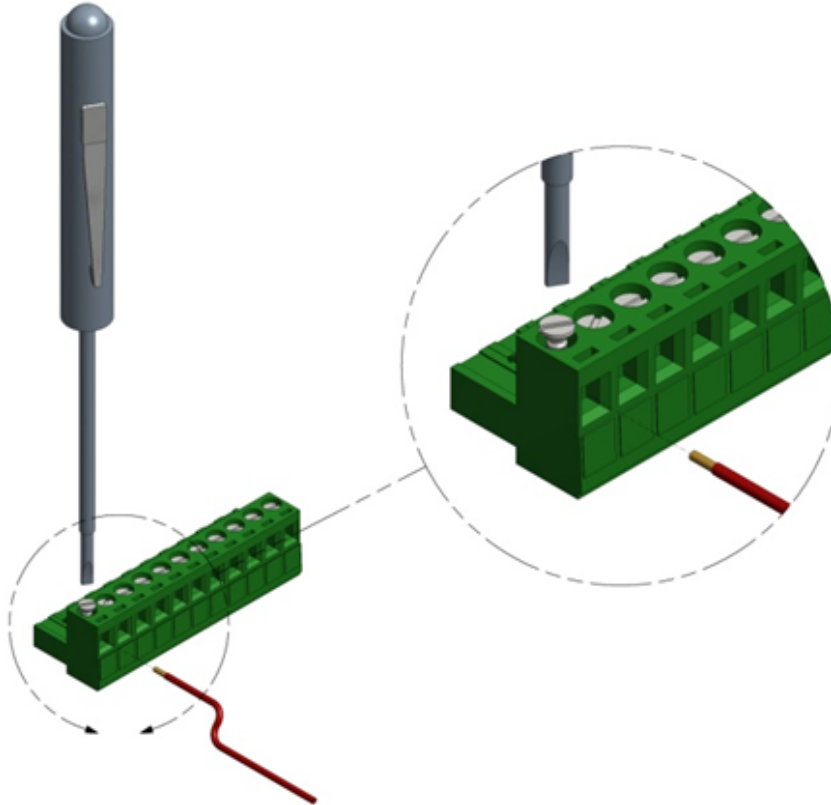
ELECTRICAL HAZARD

Remove power from the rPAC before servicing.

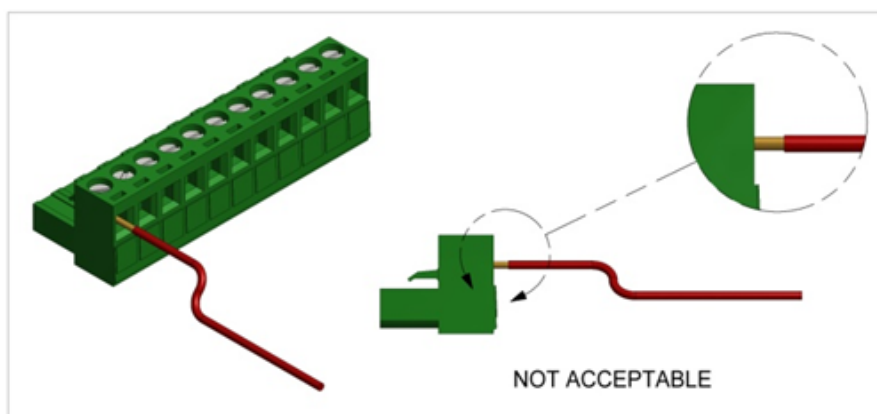
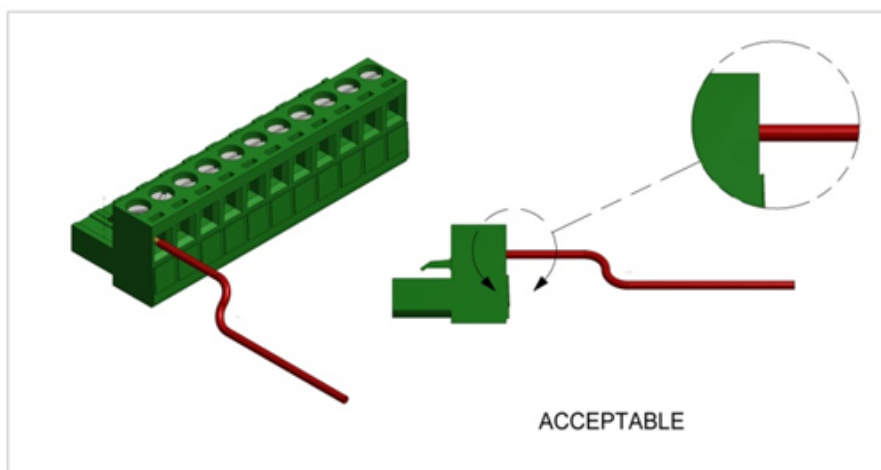
Failure to follow these instructions can result in death or serious injury.

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.

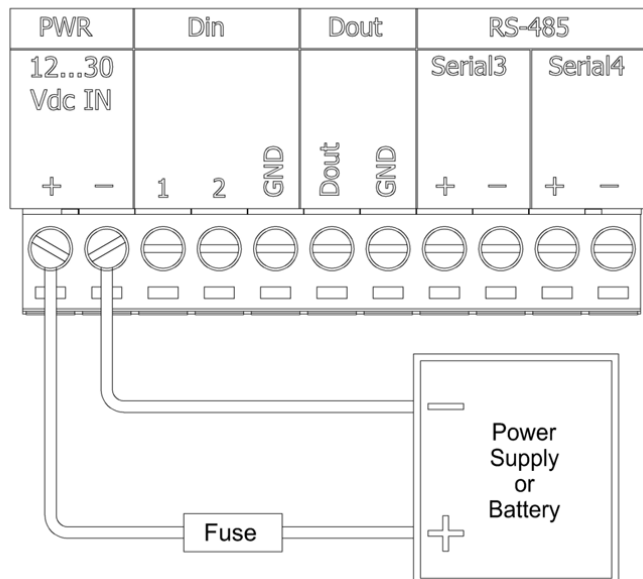


3. Apply 0.5 Nm (4.5 lb-in) torque to tighten the screw so the wire is held firmly in place.

To Power Up the rPAC for the First Time

1. Connect the output leads from your DC power supply to the positive and negative power terminals on the rPAC, as illustrated below.

<i>NOTICE</i>									
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 Power LED on the front cover lights when power is successfully applied.

2. Watch the Run LED on the front cover. After about 15 seconds, it will begin blinking approximately once every 1.5 seconds. This indicates that the rPAC is operating in Run mode.

8 Confirming rPAC Operations

Once the SCADAPack E Configurator software is installed and started on a PC and the rPAC is powered up, use a USB connection between the rPAC and the PC to confirm the rPAC is operational.

You can then transfer the default rPAC configuration information that was created when you initially started the SCADAPack E Configurator software to the rPAC. For more information, see:

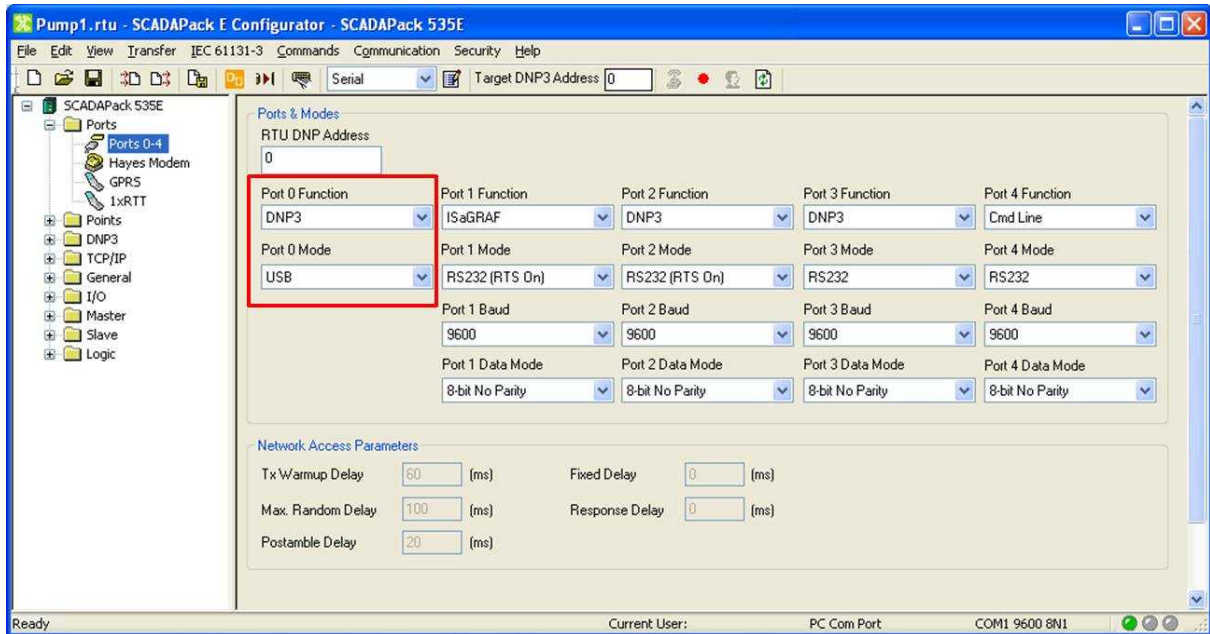
- [Setting up a USB Connection to the SCADAPack E Configurator Computer](#) ³²
- [Confirming the rPAC is Operational](#) ³⁴
- [Transferring the Default Configuration to the rPAC](#) ³⁶

8.1 Setting Up a USB Connection to the SCADAPack E Configurator Computer

By default, the port labeled **USB Device** on the rPAC is set for Distributed Network Protocol (DNP) 3 communications over a USB connection.

Use this port to set up your initial connection to the rPAC so you can confirm the rPAC is operational and transfer the default configuration from the SCADAPack E Configurator software to the rPAC.

The **USB Device** port is referred to as Port 0 in the SCADAPack E Configurator software and is configured on the Ports 0-4 property page, as shown in the figure below.



SCADAPack E Configurator Ports 0-4 Property Page

To Set Up a USB Connection to the SCADAPack E Configurator Computer

1. Connect a USB cable to the port labeled **USB Device** on the rPAC.
2. Connect the other end of the USB cable to the computer running the SCADAPack E Configurator software.
3. If the SCADAPack E Configurator software is not already running, select the **Start or Windows** icon, then navigate to the **Schneider Electric** folder and select **SCADAPack E > SCADAPack E Configurator**. For details, see [Starting the SCADAPack E Configurator Software](#)^[20].

You can now:

- [Confirm the rPAC is Operational](#)^[34]
- [Transfer the Default Configuration from the SCADAPack E Configurator Software to the rPAC](#)^[36]

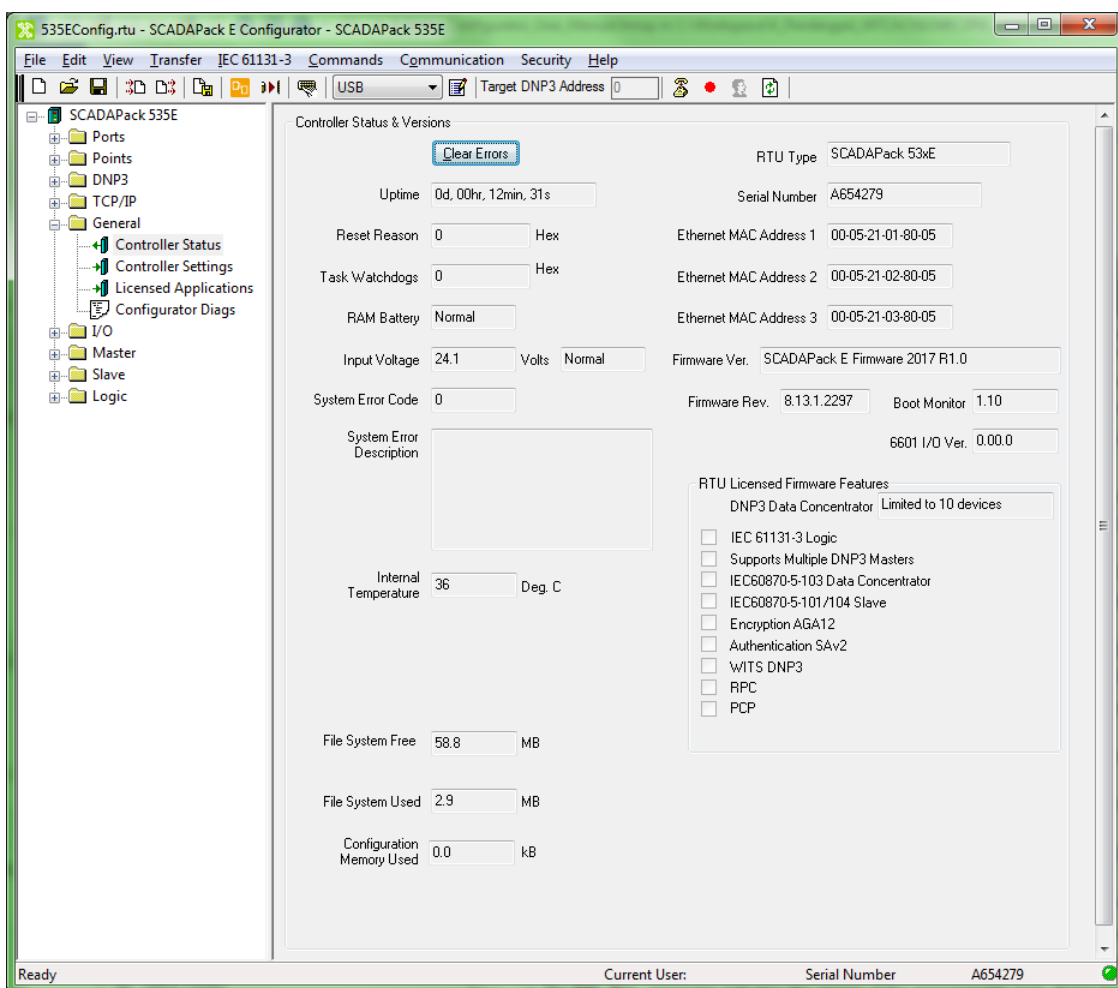
8.2 Confirming the rPAC is Operational

Once you have set up a USB connection to the powered-up rPAC and launched the SCADAPack E Configurator software, check the **Controller Status** property page in the SCADAPack E Configurator software to confirm the rPAC is operational.

To Confirm the rPAC is Operational

1. In the SCADAPack E Configurator software, expand the **General** folder then click on **Controller Status**.

The **Controller Status** property page is displayed, as shown below.



Controller Status Property Page

2. Check the parameters described in the table below. Each one provides an indication that the rPAC is operational and communicating with the SCADAPack E Configurator software.

Key Operational Parameters

Parameter	Description
Uptime	Displays the length of time the rPAC has been continuously running. The Uptime is reset every time the rPAC is hardware reset, remotely restarted or powered up. Click the Refresh Current Page icon  to confirm that the Uptime parameter is increasing.
RAM Battery	Displays the status of the rPAC's RAM back-up lithium battery: • Normal means the back-up lithium battery is in good condition. • Low means the back-up lithium battery condition has deteriorated and should be replaced. See the SCADAPack 530E Hardware Manual or SCADAPack 535E Hardware Manual for details about replacing this battery. If the RAM battery is depleted, the rPAC configuration may be lost.
Input Voltage	Indicates the input supply voltage to the rPAC and the status of the supply voltage compared with the low voltage notification level: • Normal indicates the input voltage is above the notification threshold. • Low indicates the input supply voltage is below the notification threshold.
RTU Type	Indicates the type of device being queried by the SCADAPack E Configurator software.
Serial Number	Indicates the serial number on the rPAC being queried by the SCADAPack E Configurator software.
Firmware Ver	Indicates the release of the firmware running on the rPAC being queried by the SCADAPack E Configurator software.

8.3 Transferring the Default Configuration to the rPAC

Before you set up serial or Ethernet communications between the SCADAPack E Configurator computer and the rPAC, use a USB connection to transfer the default configuration information from the SCADAPack E Configurator computer to the rPAC.

The default configuration information includes the device type and target type (SCADAPack Workbench or ISaGRAF 3 Workbench) selected when you created the rPAC in the SCADAPack E Configurator software.

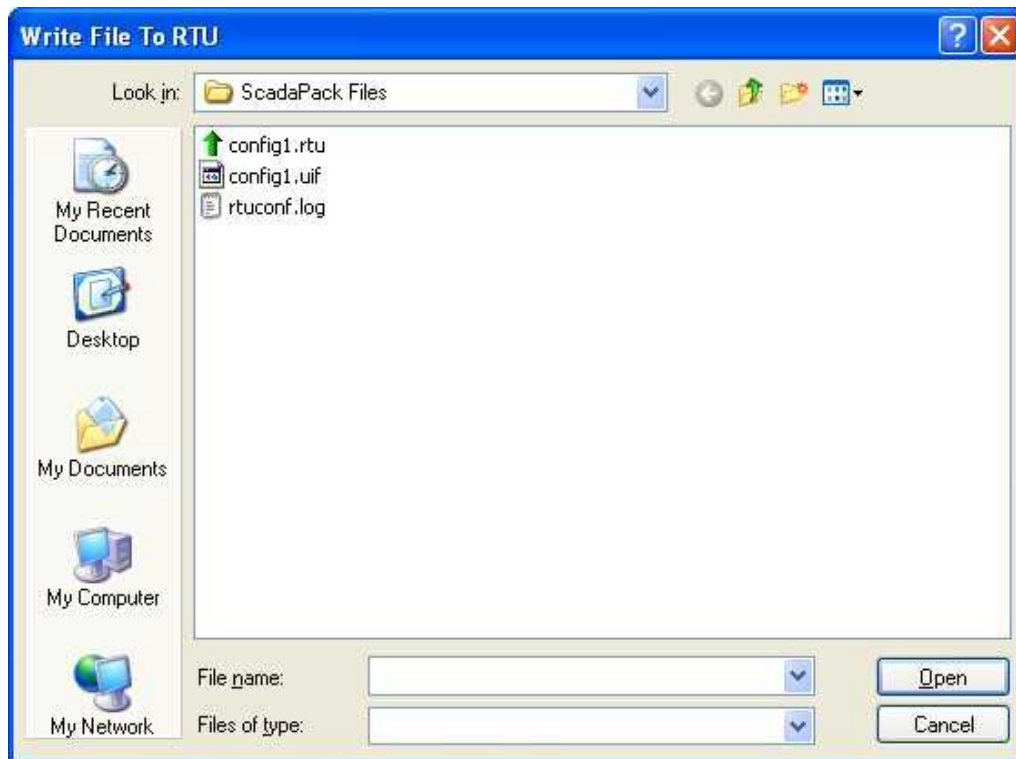
These default parameters give you a starting point for configuration after serial or Ethernet communications are established.

To Transfer the Default Configuration Information to the rPAC

1. In the SCADAPack E Configurator main window, choose the **Transfer > Write File** menu item.

The **Write File to RTU** dialog box is displayed, as shown below.

Configuration files are identified by a green arrow .



Write File to RTU Dialog Box

2. Choose the configuration file then click **Open**.

The **SCADAPack E Write File** dialog box is displayed, showing the progress of the transfer.

9 Setting Up Communications with the SCADAPack E Configurator Computer

Once you are familiar with the SCADAPack E Configurator software and have transferred the default configuration to the rPAC, you can set up communications between the rPAC and the SCADAPack E Configurator computer and begin configuring the rPAC.

The rPAC can communicate with the computer running the SCADAPack E Configurator software in two different ways:

- [Using an RS232 serial connection](#) ³⁹
- [Using an Ethernet connection](#) ⁴⁸

The status of RS232 and Ethernet connections is communicated through LEDs on the rPAC and in the SCADAPack E Configurator software. For more information, see [Understanding Communication Status](#) ³⁸.

9.1 Understanding Communication Status

The LEDs on the rPAC ports and in the SCADAPack E Configurator software tell you the status of your communications. Understanding what the LED blinking patterns mean before you set up RS232 serial or Ethernet communications will help you determine whether the communications link has been successfully established.

rPAC LEDs

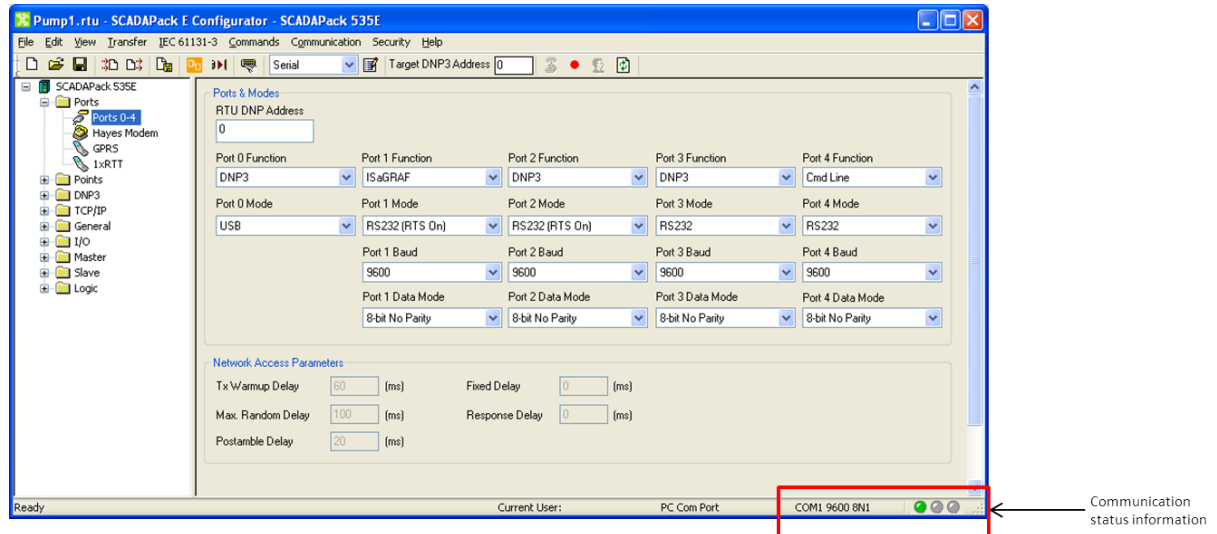
The table below summarizes the communication status information provided by the LEDs on the physical rPAC ports.

SCADAPack 530E and SCADAPack 535E LED Descriptions

	Name or Location	Color	Description
Serial1 and Serial2	CTS	Green	Lit when the CTS input is active on the port.
	DCD	Green	Lit when the DCD input is active on this serial port.
	Left side of the physical port	Yellow	Blinks when the port is transmitting data over the RS232 serial connection.
	Right side of the physical port	Green	Blinks when the port is receiving data over the RS232 serial connection.
Serial3 and Serial4	Left side of the physical port	Yellow	Blinks when data is being transmitted over the RS232 or RS485 serial connection. If the port is configured for RS485, the LEDs on the empty port indicate that data is being transmitted over the wired RS485 connection.
	Right side of the physical port	Green	Blinks when data is being received over the RS232 or RS485 serial connection. If the port is configured for RS485, the LEDs on the empty port indicate that data is being received over the wired RS485 connection.
Eth1, Eth2, Eth3	Left side of the physical port	Green	Activity LED. Lit when the Ethernet port is active. Blinks when the port is transmitting or receiving data.
	Right side of the physical port	Yellow	Link LED. Lit when 10/100 Ethernet link is active.

SCADAPack E Configurator LEDs

The communication status LEDs located in the SCADAPack E Configurator status bar show you the status of your communication requests.



Last request successful



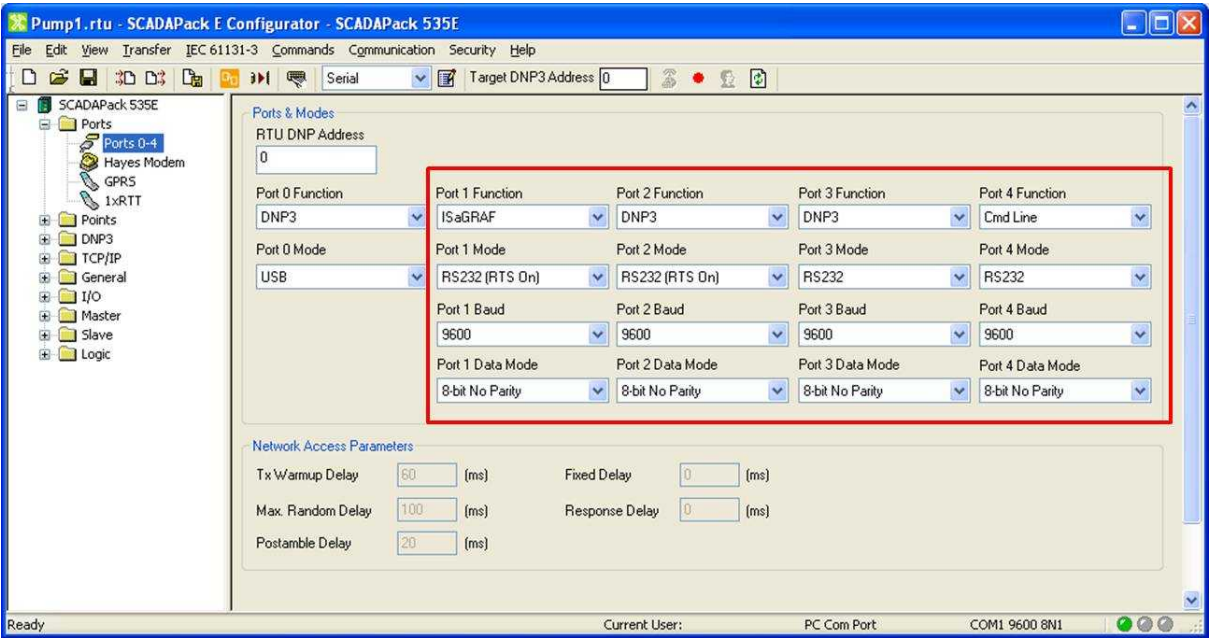
Request in progress



Last request unsuccessful

9.2 Setting Up RS232 Serial Communications

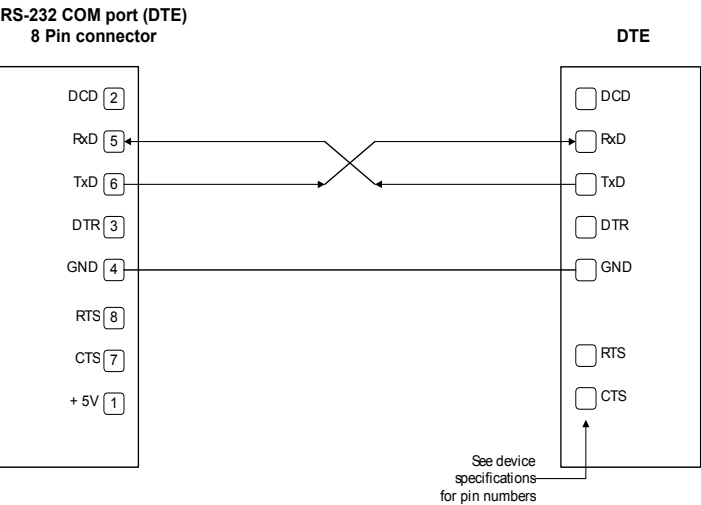
Serial ports on the rPAC are labeled Serial1, Serial2, Serial3 and Serial4. These ports correspond to Port 1, Port 2, Port 3 and Port 4 on the **Ports 0-4** property page in the SCADAPack E Configurator **Ports** folder. The figure below shows the **Ports 0-4** property page and the default serial port settings.



SCADAPack E Configurator Ports 0-4 Property Page

RS232 Cables

There are several methods for wiring the 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, and is illustrated below. For additional RS232 wiring options, see the SCADAPack 530E Hardware Manual or the SCADAPack 535E Hardware Manual.



RS232 DTE to RS232 DTE without Handshaking

More Information

[Configuring RS232 Serial Communications](#) 42

[Testing RS232 Serial Communications](#)  45

9.2.1 Configuring RS232 Serial Communications

The following procedure describes how to configure an RS232 serial communications link between Serial2 on the rPAC and the SCADAPack E Configurator computer.

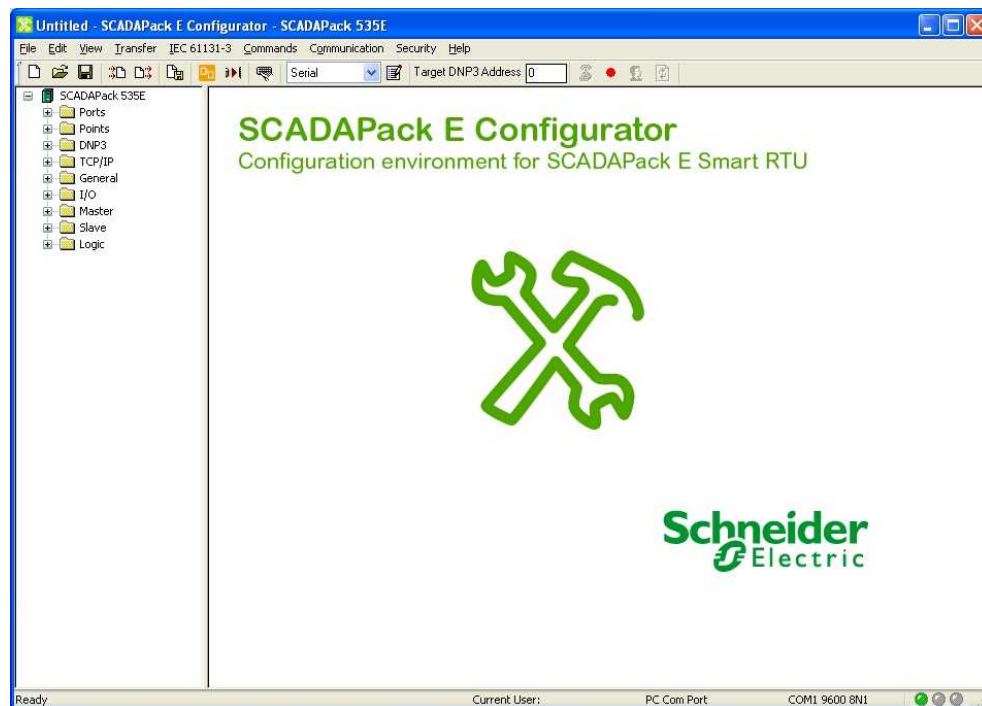
To Configure an RS232 Serial Communications Link

1. Using a three-wire crossed cable, connect Serial2 on the rPAC to an RS232 serial port on the SCADAPack E Configurator computer.

For basic RS232 cabling information, see [Setting Up RS232 Serial Communications](#)^[39]. For additional RS232 wiring options, see the SCADAPack 530E Hardware Manual or the SCADAPack 535E Hardware Manual.

2. If the SCADAPack E Configurator software is not already running, select the **Start or Windows** icon, then navigate to the **Schneider Electric** folder and select **SCADAPack E > SCADAPack E Configurator**. For details, see [Starting the SCADAPack E Configurator Software](#)^[20].

The SCADAPack E Configurator main window opens as shown below.



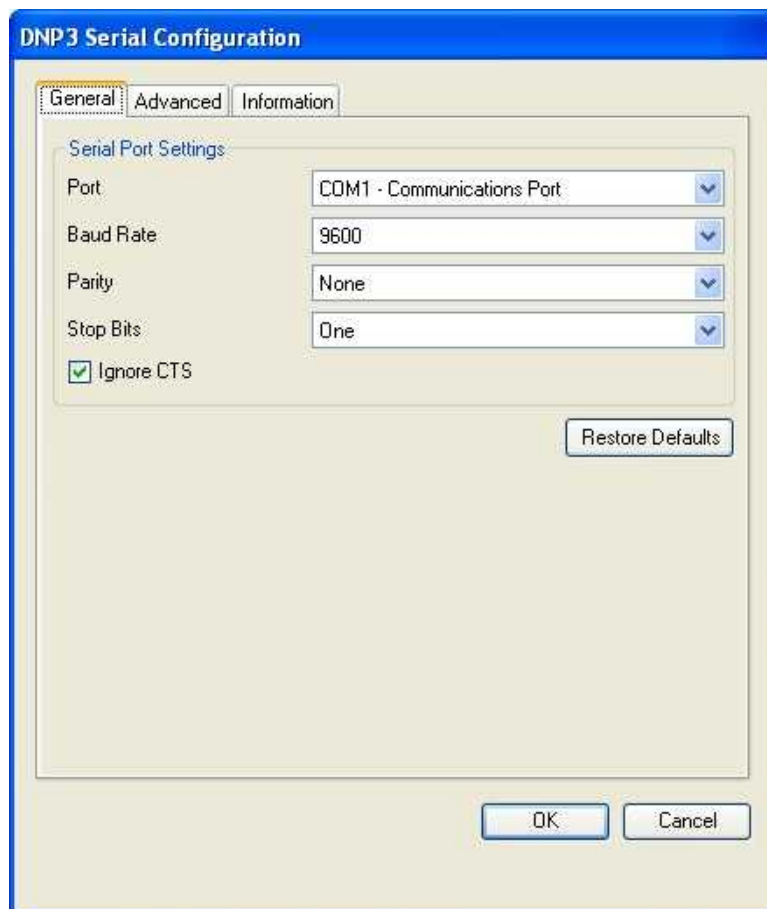
SCADAPack E Configurator Main Window

3. In the SCADAPack E Configurator menu, select **Communication > Communication Type**. The **Communication** dialog box is displayed as shown below.



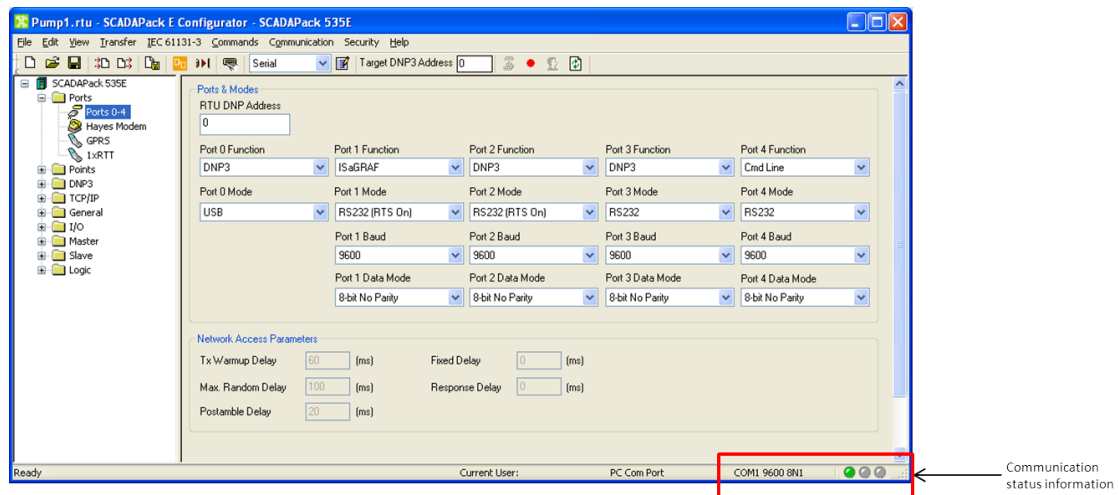
Communication Dialog Box

4. In the **Communication** dialog box, select **Serial** as the **Type** then click **OK**.
5. In the SCADAPack E Configurator menu, select **Communication > Communication Settings**. The **DNP3 Serial Configuration** dialog box is displayed, as shown below.



DNP3 Serial Configuration Dialog Box

- a. On the **General** tab, set the fields as follows:
 - Com Port = COM1 - Communications Port
 - Baud Rate = 9600
 - Parity = None
 - Stop Bits = 1
 - Ignore CTS = True
 - b. Click **OK** to save the changes and close the dialog box.
6. Expand the **Ports** folder then select the **Ports 0-4** property page to confirm the **PC Com Port** field in the SCADAPack E Configurator status bar displays the correct settings.



SCADAPack E Configurator Communication Status Information

You can now test the RS232 serial communications link as described in [Testing RS232 Serial Communications](#) [45].

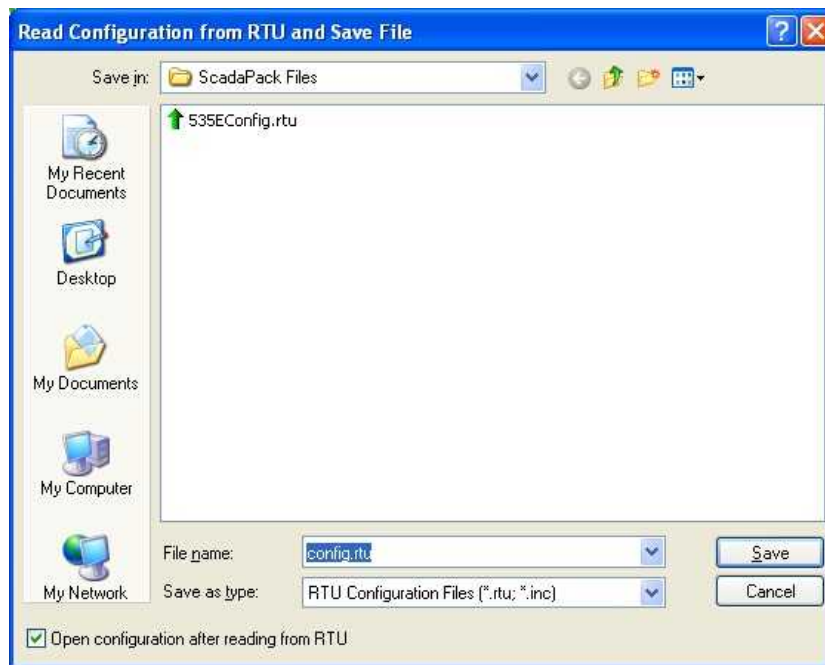
9.2.2 Testing RS232 Serial Communications

Once you have [configured the RS232 communications link](#)⁴², you can test it by downloading the default configuration from the battery-backed RAM on the rPAC to the hard drive on the SCADAPack E Configurator computer.

To Test the RS232 Serial Communications Link

1. In the SCADAPack E Configurator menu, select **File > Read RTU Configuration**.

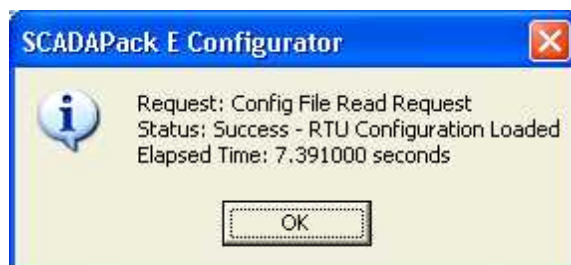
The **Read Configuration From RTU and Save File** dialog box is displayed as shown below.



Read Configuration from RTU and Save File Dialog Box

2. Select the rPAC configuration file then click **Save**.
3. If prompted, select **Yes** to replace the existing configuration file.

The **Config File Read Request** dialog box appears within a few seconds, displaying the progress of the file transfer. A successful status message is then displayed, as shown below.



Successful File Read Request Message

4. Click **OK** to acknowledge the successful transaction.

The default configuration has now been successfully transferred from rPAC memory to the PC hard drive. The successful completion of the read file request confirms that the RS232 serial communication link is operational.

If the successful file read request message is not displayed within a few seconds, or a timeout message is displayed after about three minutes, then the RS232 communication channel was not successfully established. If you have correctly executed the procedure described in [Configuring RS232 Serial Communications](#) ⁴², you may need to reset the rPAC to its factory default settings, as described below.



Timeout Message

Returning the rPAC to its Factory Default Settings

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

When a SCADAPack 530E or SCADAPack 535E rPAC starts in Factory Boot mode:

- IEC 61131-3 applications are erased.
- The rPAC points database is cleared.
- rPAC 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.

Factory Boot Serial and USB Port Parameters for SCADAPack 530E and SCADAPack 535E rPACs

Parameter	USB (Port 0)	Serial1 (Port 1)	Serial2 (Port 2)	Serial3 (Port 3)	Serial4 (Port 4)
Function	DNP3	ISaGRAF	DNP3	DNP3	Cmd Line
Mode	USB	RS232 (RTS On)	RS232 (RTS On)	RS232	RS232
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
Duplex		Full	Full	Full	Full

Factory Boot Ethernet Port Parameters for SCADAPack 530E and SCADAPack 535E rPACs

Parameter	Ethernet 1	Ethernet 2	Ethernet 3
Function	TCP/IP+RemIO	TCP/IP+RemIO	TCP/IP+RemIO
IP Address	172.16.1.200	0.0.0.0	0.0.0.0
Subnet Mask	255.255.255.0	0.0.0.0	0.0.0.0

Factory Boot IP Routing Settings for SCADAPack 530E and SCADAPack 535E rPACs

Parameter	Address
Gateway IP	0.0.0.0

To Start a SCADAPack 530E or SCADAPack 535E rPAC in Factory Boot Mode

⚠ WARNING

UNINTENDED EQUIPMENT OPERATION

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

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

NOTICE

CONFIGURATION AND APPLICATION LOSS

Starting the rPAC in Factory Boot mode returns rPAC configuration parameters to their default settings and erases applications created in SCADAPack Workbench and ISaGRAF 3 Workbench. This information must be reloaded into the rPAC for correct rPAC operation.

Before starting the rPAC in Factory Boot mode, save a copy of the rPAC 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 rPAC.
2. Hold down the Select button.
3. Apply power to the rPAC.

- Continue holding down the Select button for longer than 30 seconds until the Status LED stops blinking on and off and remains lit.

If you release the Select button while the Status LED is still blinking, the rPAC will start in Cold Boot mode.

To cancel the startup mode selection, remove power from the RTU while the Select button is depressed.

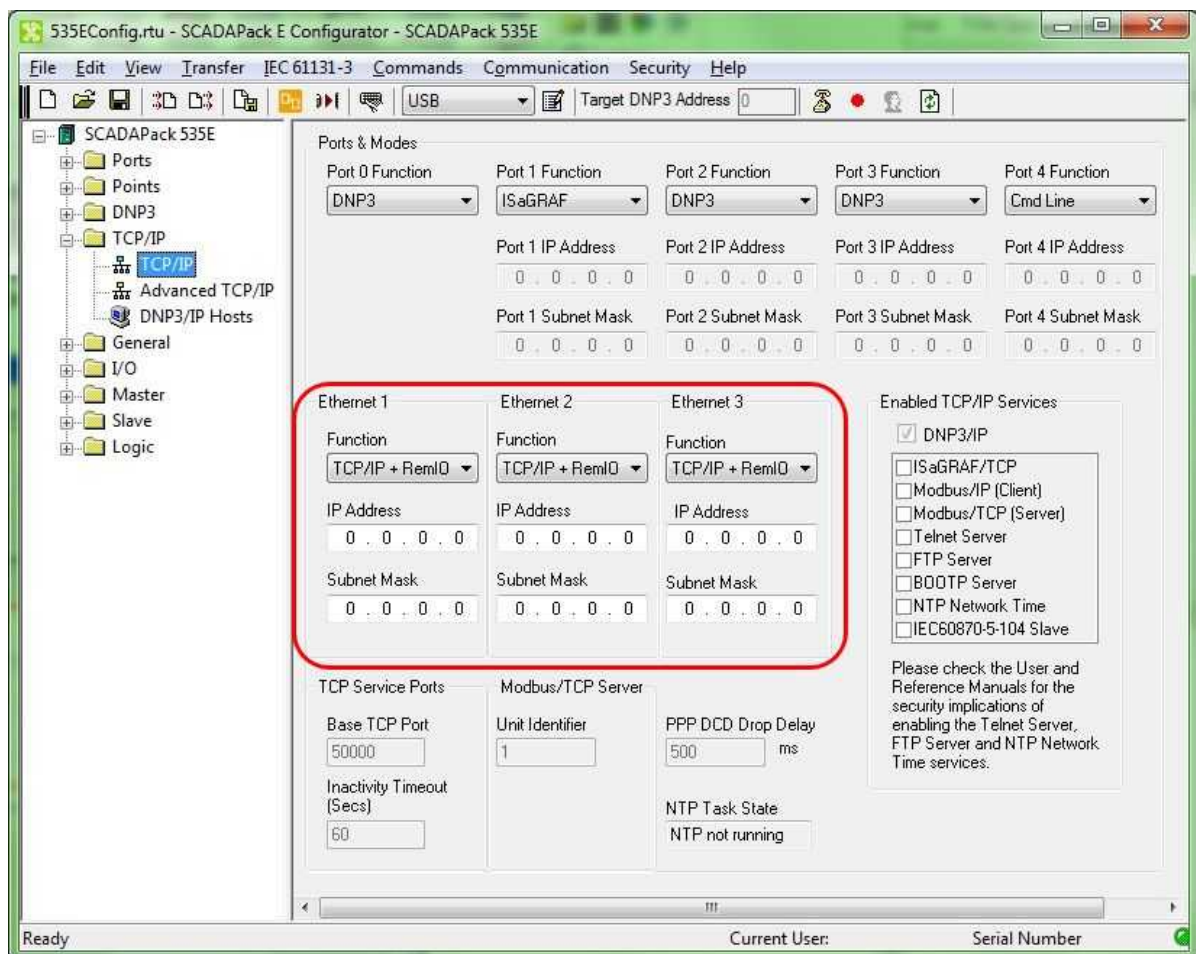
- Release the Select button.

The Factory Boot will take approximately 60 seconds to complete. During this time, the rPAC may appear unresponsive while the file system is being formatted. The Status LED will remain lit until the Factory Boot has completed and the rPAC restarts.

- Reload the rPAC configuration and user-created applications from backup.

9.3 Setting up Ethernet Communications

Ethernet ports on the rPAC are labeled Eth1, Eth2 and Eth3. These ports correspond to Ethernet 1, Ethernet 2 and Ethernet 3 on the **TCP/IP** property page in the SCADAPack E Configurator **TCP/IP** folder. The figure below shows the **TCP/IP** property page and the default Ethernet port settings.



SCADAPack E Configurator TCP/IP Property Page

Ethernet Cables

The Ethernet ports on the rPAC 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 rPAC will automatically detect the interface used and serve the cable appropriately. For more information on Ethernet cabling see the SCADAPack 530E Hardware Manual or the SCADAPack 535E Hardware Manual.

Before you begin setting Ethernet communications, you will need to obtain an IP address and subnet mask from your network administrator.

More Information

[Configuring Ethernet Communications](#)  50

[Testing Ethernet Communications](#)  52

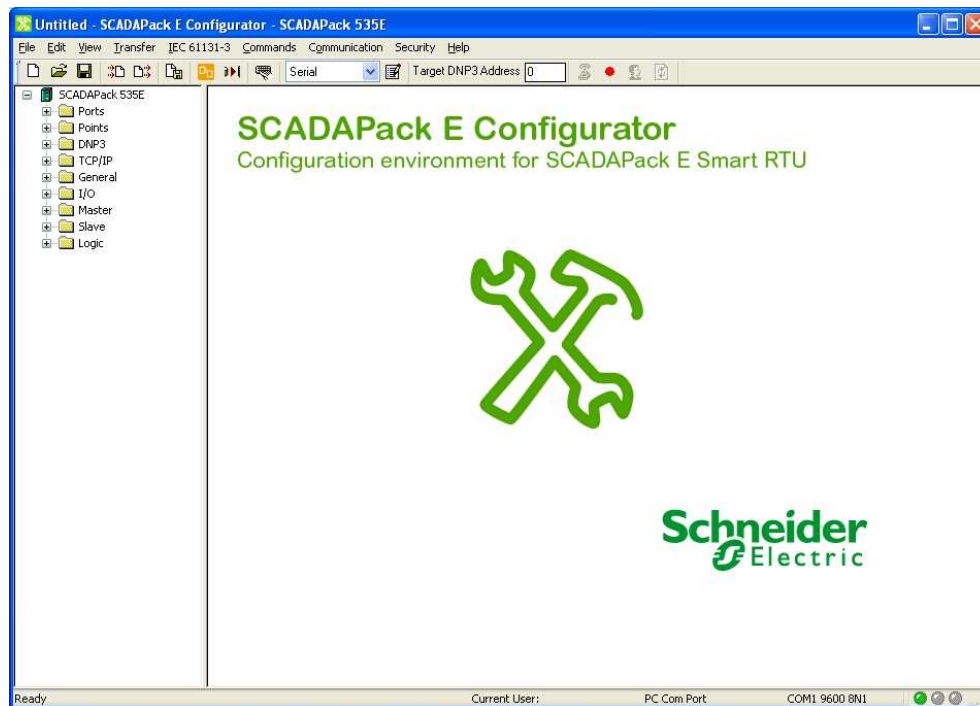
9.3.1 Configuring Ethernet Communications

The following procedure describes how to configure an Ethernet communications link between Eth1 on the rPAC and the SCADAPack E Configurator computer.

To Configure an Ethernet Communications Link

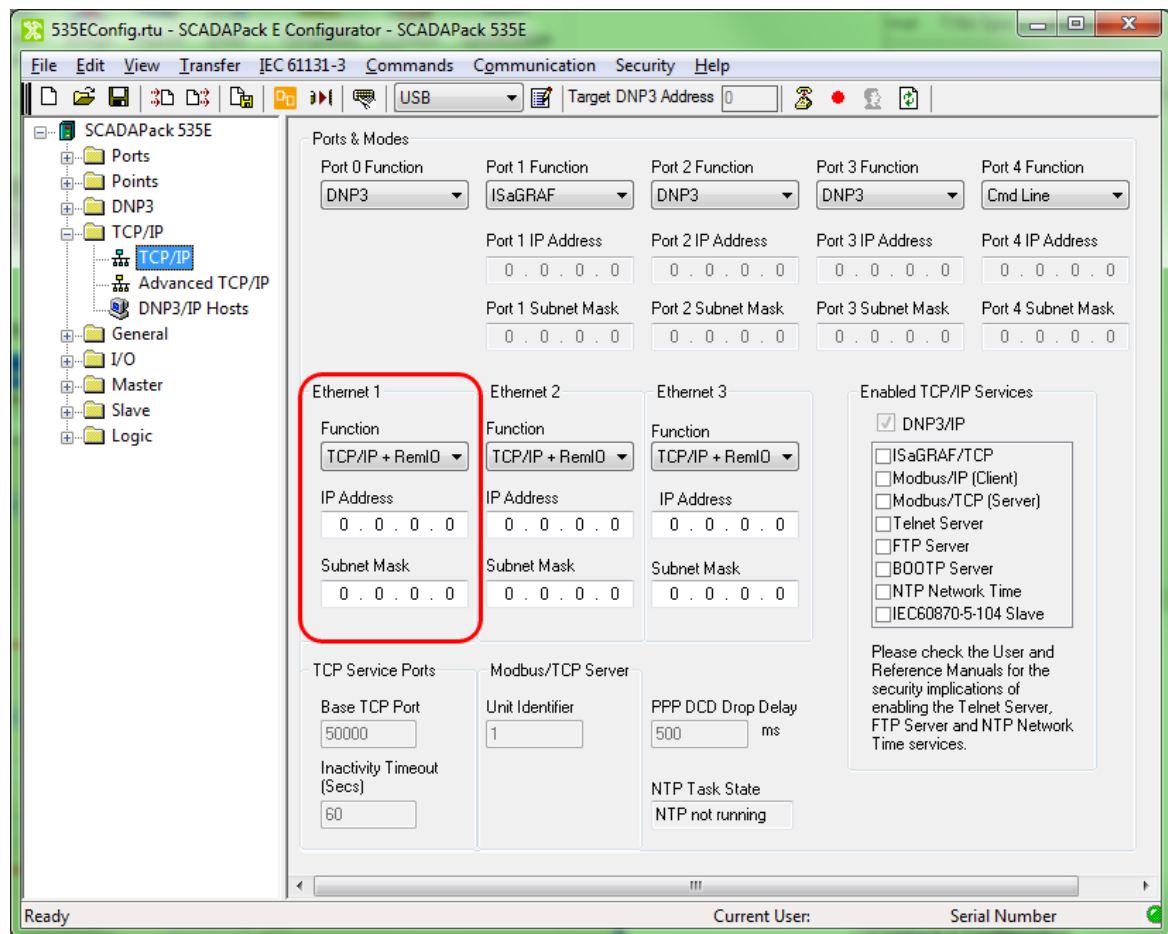
1. Using a CAT5 UTP cable, connect Eth1 on the rPAC to a switch, a hub, or a wall outlet for your LAN.
2. Confirm that the SCADAPack E Configurator computer is also connected to the LAN.
3. If the SCADAPack E Configurator software is not already running, select the **Start or Windows** icon, then navigate to the **Schneider Electric** folder and select **SCADAPack E > SCADAPack E Configurator**. For details, see [Starting the SCADAPack E Configurator Software](#) [20].

The SCADAPack E Configurator main window opens as shown below.



SCADAPack E Configurator Main Window

4. In the SCADAPack E Configurator software, expand the **TCP/IP** folder then select the **TCP/IP** property page.



SCADAPack E Configurator TCP/IP Property Page

5. Enter the **IP Address** and **Subnet Mask** obtained from your network administrator.

You can now test the Ethernet communications link as described in [Testing Ethernet Communications](#) ⁵².

9.3.2 Testing Ethernet Communications

Once you have [configured the Ethernet communications link](#)⁵⁰¹, you can test it by reading and writing the time of day from and to the rPAC.

To Test the Ethernet Communications Link

1. In the SCADAPack E Configurator menu, select **Communication > Communication Type**.

The Communication dialog box is displayed, as shown below.



Communication Dialog Box

2. In the **Communication** dialog box, select UDP as the **Type** then click **OK**.
3. In the SCADAPack E Configurator menu, select **Communication > Communication Settings**.
 - a. On the **General** tab, enter the **IP Address** or **Name** and the **UDP Port Number**.
 - b. On the **Advanced** tab, make changes to the default values as required then click **OK**.
4. The **Remote IP Address** information in the status bar at the bottom of the SCADAPack E Configurator window is updated to reflect the information you entered.
5. In the SCADAPack E Configurator menu, select **Transfer > Get RTU Time**.

The **Read RTU Time** dialog box is displayed, as shown below.



Read RTU Time Dialog Box

6. Select the time source then click **OK**.

The communication status LEDs in the SCADAPack E Configurator status bar change from green to yellow and back to green indicating a successful read.

The time from the rPAC real time clock will be displayed in a dialog to indicate a successful read request using the Ethernet communication channel.

7. In the SCADAPack E Configurator menu, select **Transfer > Write RTU Time**.
8. Confirm the time source to use.
9. Repeats steps 5-7 to read the rPAC time and confirm it is the same as the PC time.

10 Reading and Writing rPAC Database Information

Points Database Overview

The information in the rPAC database is stored as points. The following table summarizes the different point types.

Database Point Types

Point Type	Description	May represent
Physical	Internal representations of the electrical terminations on the rPAC — the inputs and outputs. In general, you configure an input when you want to read data from a device, and an output when you want to set or control a device.	Analog inputs and outputs that monitor or control a changing value, such as the depth of water in a tank.
		Binary (digital) inputs and outputs that monitor or control the state of a device that is either on or off, such as a motor that is running or not running.
		Counter inputs that monitor or control the number of occurrences of an action, such as the number of pulses from a flow meter. Counter inputs are digital inputs that have an associated counter. If a digital input is being used as a counter, that is its sole role.
Derived	Used for internal rPAC data	User points that you create. User points are analog or binary (digital) points that are accessed by applications created with SCADAPack Workbench or ISaGRAF 3 Workbench.
		- System points that provide information about rPAC operations. System points can be: - Analog points that measure a changing value, such as the ambient temperature of the controller board on the rPAC. - Binary (digital) points that monitor a state, such as the status of the rPAC's power supply or onboard RAM back-up battery.

Each point in the rPAC database has a set of attributes that define how the rPAC processes the point. Points that are the same type — digital input for example — share a common set of point attributes. Different point types have a different set of attributes. The **DNP3 Point Data Class** and **DNP3 Object Type** are examples of different point attributes.

Point properties are generally read-only database fields that describe a status or characteristic of a point to the SCADA master device, the SCADAPack E Configurator software or an application created using SCADAPack Workbench or ISaGRAF 3 Workbench. The **Current State** of a digital point or the **Current Integer Value** of an analog point are two examples of point attributes.

Reading and Writing Point Information

Reading data from the rPAC transfers information about the current state or value of the physical and derived points on the rPAC into the points database in the SCADAPack E Configurator software.

Writing data from the SCADAPack E Configurator points database to the rPAC transfers information about the current state or value of the physical and derived points from the SCADAPack E Configurator software to the rPAC.

Depending on the protocol you are using for communications between the rPAC and the SCADAPack E Configurator computer, the procedure to read and write information about points is different. For more information, see:

- [Reading and Writing rPAC Data Using DNP](#) ⁵⁶
- [Reading and Writing rPAC Data Using Modbus](#) ⁶⁶

10.1 Reading and Writing rPAC Data Using DNP

You can use DNP to read and write data for physical and derived rPAC points.

Because the SCADAPack 530E and SCADAPack 535E rPACs are native DNP3 devices, the attributes and properties of the points are stored in the DNP point address space in the database. As a result, no additional configuration tasks are required before you can read and write rPAC data using DNP.

For more information, see:

- [Reading Data From the rPAC Using DNP](#) ⁵⁷
- [Writing Data to the rPAC Using DNP](#) ⁵⁹

10.1.1 Reading Data From the rPAC Using DNP

To help you learn how to read DNP data from the rPAC, this procedure takes you through the steps required to add system points to the SCADAPack E Configurator points database then read the current state or value for those system points from the rPAC.

Before you begin this procedure:

- [Power-up the rPAC](#)^[26] and set up an [RS232 serial](#)^[39] or [Ethernet](#)^[48] connection to the SCADAPack E Configurator computer.
- [Start the SCADAPack E Configurator software](#)^[20].

To Read Data From the rPAC to the SCADAPack E Configurator Database

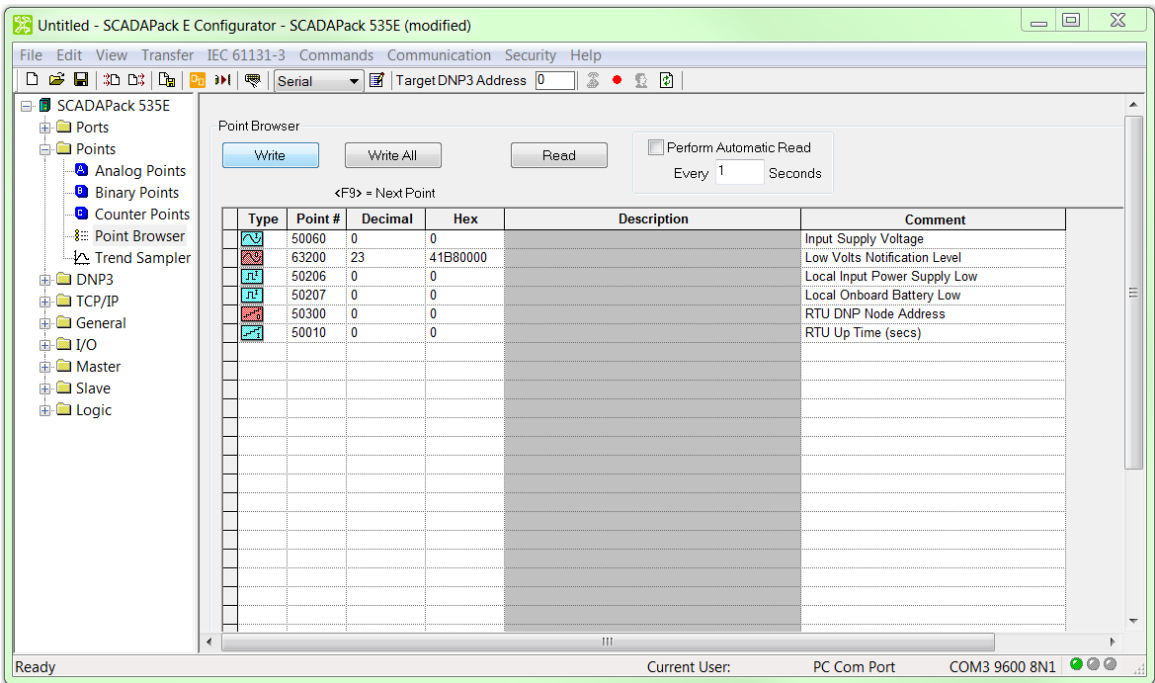
1. In the SCADAPack E Configurator software, expand the **Points** folder then select the **Point Browser** property page.
2. Add the information in the table below to the **Point Browser**.

Only the **Type** and **Point #** need to be entered in the **Point Browser**. Clicking on the **Decimal** or **Hex** columns for the corresponding point will automatically populate these fields with the current value or state properties of the point. Because you have not yet read these values from the rPAC, the columns display 0.

System Points Summary

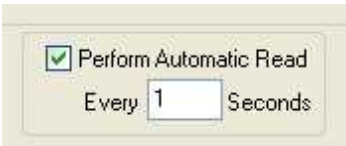
Type	Point #	Comment
Float In	50060	Input Supply Voltage
Float Out	63200	Low Volts Notification Level
Binary In	50206	Local Input Power Supply Low Notification
Binary In	50207	Local Onboard Battery Low
Analog In	50090	Low 32 bits of rPAC serial number in ASCII format
Analog In	50091	High 32 bits of rPAC serial number in ASCII format
Analog Out	50300	rPAC DNP Node Address
Analog In	50010	rPAC Up Time (secs)

The following figure shows the **Point Browser** property page with the information in the table above.



Point Browser Property Page

- 3. On the **Point Browser** property page, click **Read** to read the data from the rPAC.
The current state or value for each of the system points entered is displayed in the **Power Browser**.
- 4. On the **Point Browser** property page, select the **Perform Automatic Read** option and enter a read interval of 1 second.



Perform Automatic Read Dialog Box

The **RTU Up Time** system point (point number 50010) will increment every second.

For more information, see:

- [Initial Startup](#)^[19]
- [Setting Up Communications with the SCADAPack E Configurator Computer](#)^[37]

10.1.2 Writing Data to the rPAC Using DNP

To help you learn how to write data from the SCADAPack E Configurator software to the rPAC, this procedure takes you through the steps required to write the current state or value of system points from the SCADAPack E Configurator points database to the rPAC.

Before you begin this procedure:

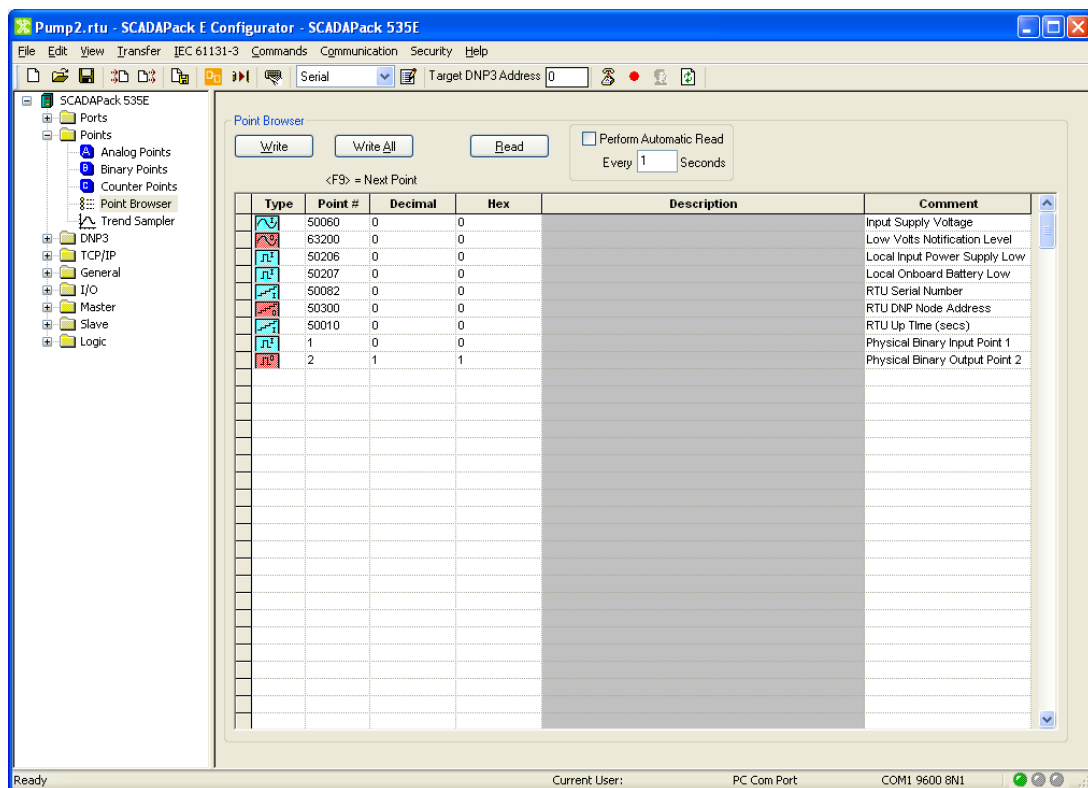
- [Power-up the rPAC](#)^[26] and set up an [RS232 serial](#)^[39] or [Ethernet](#)^[48] connection to the SCADAPack E Configurator computer.
- [Start the SCADAPack E Configurator software](#)^[20].
- Follow the steps in [Reading DNP Data From the rPAC](#)^[59] to create the appropriate system points.

To Write Data From the SCADAPack E Configurator Software to the rPAC

1. In the SCADAPack E Configurator software, expand the **Points** folder then select the **Point Browser** property page.
2. Add the information in the table below to the **Point Browser**.

Type	Point #	Decimal	Comment
Binary In	1	0	Physical Binary Input Point 1
Binary Out	2	1	Physical Binary Output Point 2

The figure below shows the **Point Browser** property page with the physical points added.



Point Browser Property Page

3. Make the following changes in the **Point Browser**:
 - a. Change the **Decimal** value of DNP Point # **63200** to **24**.
 - b. Change the **Decimal** value of DNP Point # **50207** to **250**.
4. On the **Point Browser** property page, click **Write** to write the changes to the rPAC.
5. Expand the **Ports** folder, select the **Ports 0-4** property page then check the value of Port 1 Baud field.
6. Choose **Commands > Reinitialize DNP3**. This is required for the DNP node address change to take effect.
7. Return to the **Point Browser** and change the Target DNP3 Address at the top of the SCADAPack E Configurator window to **250**.



8. On the **Point Browser** property page, click **Read** to read the rPAC data.
The current state of Digital DNP point **50206** should indicate a low voltage notification.
9. On the **Point Browser** property page, click **Write** to write the changes to the rPAC.
10. Choose **Commands > Reinitialize DNP3** for the DNP node address change to take effect.

For more information, see:

- [Initial Startup](#) ^[19]
- [Setting Up Communications with the SCADAPack E Configurator Computer](#) ^[37]
- [Reading Data From the rPAC Using DNP](#) ^[57]

10.2 Reading and Writing rPAC Data Using Modbus

SCADAPack E rPACs support customized or automatic one-to-one mapping of DNP points into corresponding Modbus addresses to allow communication with other Modbus devices. The Modbus address conforms to the Modicon PLC client style register address (protocol address + 1).

Customized Modbus Address Mapping

You can use SCADAPack E Configurator to assign a specific 5-digit or 6-digit Modbus register, or address, to any analog, counter or binary DNP point or range of points. For more information, see the SCADAPack E Configurator User Manual.

Automatic Modbus Address Mapping

When Modbus addresses are automatically assigned to DNP points:

- Digital input DNP points 1 to 16 are mapped to Modbus registers 10001-10016.
- Digital output DNP points 1 to 16 are mapped to Modbus registers 00001-00016.
- 16-bit analog input DNP points 1 to 16 are mapped to Modbus registers 30001 to 30016.
- 16-bit analog output DNP points 1 to 16 are mapped to corresponding holding registers 40001 to 40016.

32-bit analog DNP points are not automatically mapped to Modbus registers until you specify the start point in the Modbus Register/32-Bit Point Map located in the **Slave > Modbus** property page in SCADAPack E Configurator.

For details, see:

- [Mapping DNP Points to Modbus Registers](#) ^[62]
- [Reading and Writing to Modbus Registers](#) ^[66]

10.2.1 Mapping DNP Points to Modbus Registers

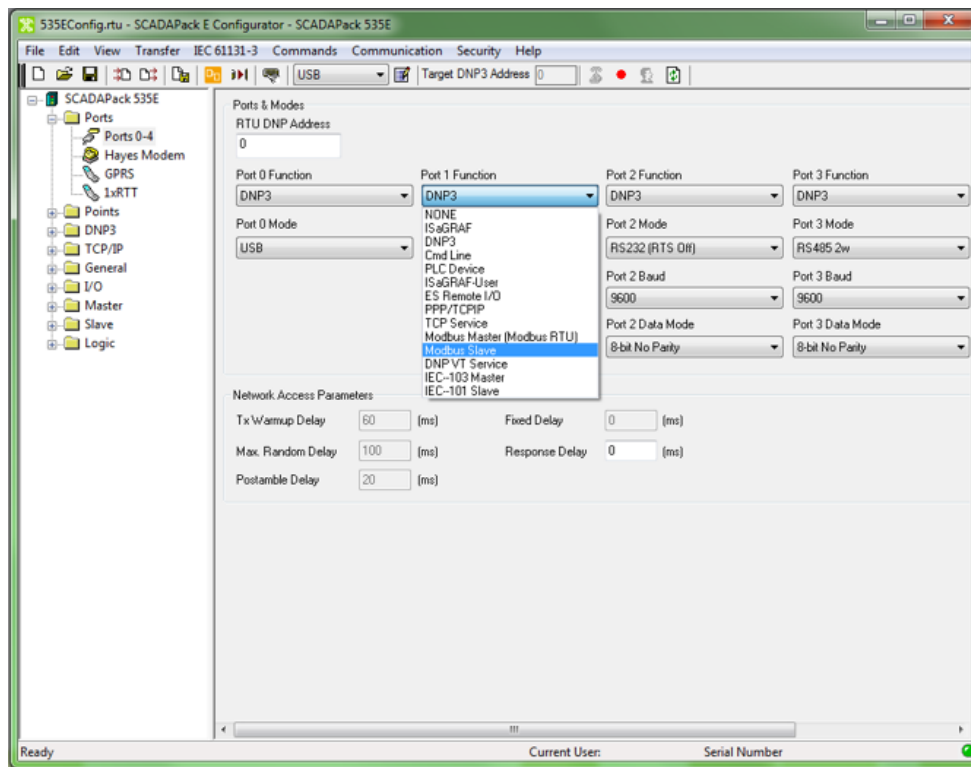
To help you learn how to read and write data using the Modbus protocol, this procedure takes you through the steps required to automatically map physical rPAC points (inputs and outputs) to the corresponding Modbus registers. If you want to assign a specific Modbus register, or address, to a DNP point or a range of points, see the SCADAPack E Configurator User Manual.

Before you begin this procedure:

- [Power-up the rPAC](#)^[26] and set up an [RS232 serial](#)^[39] or [Ethernet](#)^[48] connection to the SCADAPack E Configurator computer.
- [Start the SCADAPack E Configurator software](#)^[20].
- [Understand how DNP points are mapped to Modbus registers](#)^[61]

To Map DNP Points to Modbus Registers

1. Launch SCADAPack E Configurator.
2. In the **Ports** folder, select the **Ports 0-4** property page.
3. Select **Modbus Slave** as the function for one of the serial ports.



SCADAPack E Configurator Ports 0-4 Property Page

4. Configure the remaining serial port parameters as required.

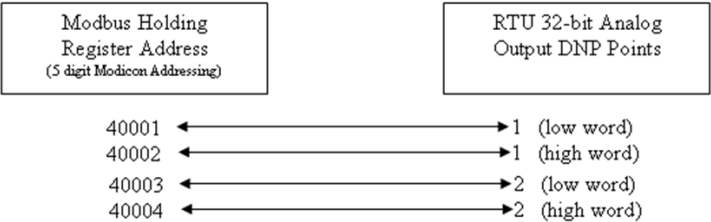
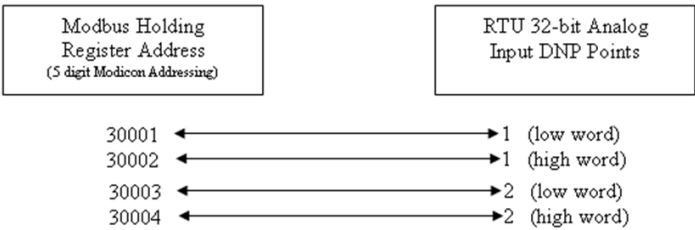
If you are mapping only binary (digital) points and 16-bit analog points, the configuration is now complete. The points are automatically mapped to Modbus registers so you can read and write

rPAC data using the Modbus protocol. For details, see [Reading and Writing to Modbus Registers](#) .

If you are mapping 32-bit analog points, proceed to the next step.

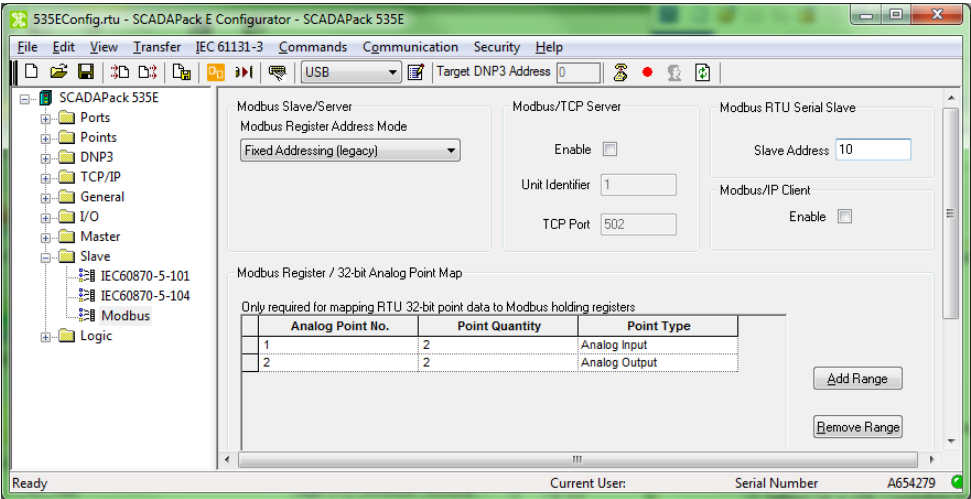
5. In the **Slave folder**, select the **Modbus** property page.

6. Enter the DNP point to Modbus register mapping in the table, as outlined below.



DNP Point to Modbus Register Mapping

In the figure below, 32-bit analog input and output points 1 and 2 have been mapped to 16-bit Modbus registers.



SCADAPack E Configurator Modbus Property Page

7. Confirm the **Slave Address** and make changes if necessary.

In the figure above, the **Slave Address** is set to 10.

The same Modbus station number applies if multiple ports on the rPAC are configured for Modbus Slave.

8. To save your Modbus register mappings to the configuration file, select **File > Save** from the SCADAPack E Configurator menu.

⚠ WARNING
UNINTENDED EQUIPMENT OPERATION Evaluate the operational state of the equipment being monitored or controlled by the rPAC before restarting the rPAC. Failure to follow these instructions can result in death or serious injury.

9. Choose **Commands > Restart RTU** to restart the rPAC.

A master can now poll data from the SCADAPack 530E or SCADAPack 535E using the assigned Modbus registers.

For more information, see:

- [Initial Startup](#)¹⁹
- [Setting Up Communications with the SCADAPack E Configurator Computer](#)³⁷

10.2.2 Reading and Writing to Modbus Registers

Reading and writing to the SCADAPack 530E and SCADAPack 535E Modbus registers is relatively straightforward once a Modbus Slave serial interface has been defined.

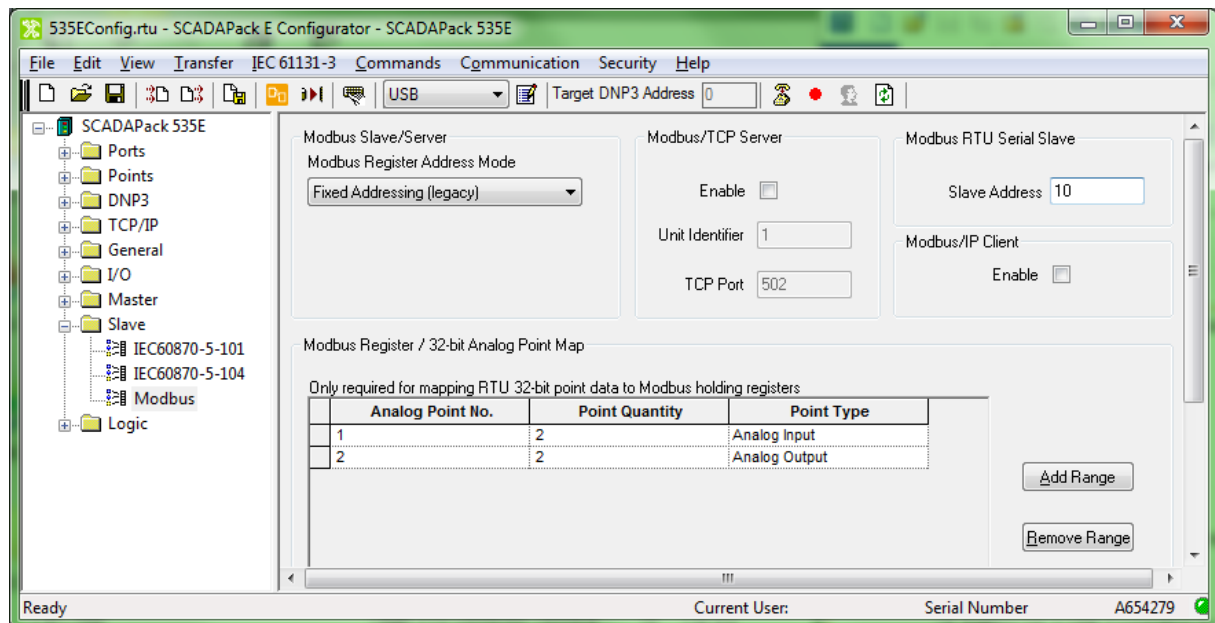
For example, using 5-digit Modicon PLC addressing:

- Digital inputs are referenced using Modbus registers 10001-19999.
- Digital outputs are referenced using Modbus registers 00001-09999.
- Analog inputs are referenced using Modbus registers 30001-39999.
- Analog outputs are referenced using Modbus holding registers 40001-65535.

Using six-digit Modicon PLC addressing:

- Digital inputs are referenced using Modbus registers 100001-165536
- Digital outputs are referenced using Modbus registers 000001-065536
- Analog inputs are referenced using Modbus registers 300001-365536
- Analog outputs are referenced using Modbus holding registers 400001-465536

When referencing 32-bit analog inputs and outputs through Modbus registers, remember that two consecutive Modbus holding registers are used to store a 32-bit analog value.



SCADAPack E Configurator Modbus Property Page

11 Where to Go From Here

Once your rPAC is up and running, you understand how to create serial and Ethernet connections to other devices, and you understand how to read and write information to the rPAC points database, you can move on to more detailed configuration tasks.

Before you begin configuring your rPAC, have a good understanding of the role the rPAC will play in your SCADA environment. The rPAC role will determine how you configure the ports, inputs and outputs, and how you set up communications with other devices.

The SCADAPack 530E and SCADAPack 535E can be configured to play one or more of the following roles in your Supervisory Control and Data Acquisition (SCADA) environment:

- Endpoint
- DNP3 router between any combination of Ethernet and serial ports
- DNP3 peer-to-peer communications device
- Data concentrator for:
 - Remote DNP3 and DNP3 IP slaves
 - Local DNP3, DNP3 IP, Modbus RTU, Modbus TCP and DF1 serial slaves
 - Local IEC 60870-5-103 protection relays
- Protocol converter for:
 - Modbus RTU and Modbus TCP to DNP3 and DNP3 IP, and vice-versa
 - Modbus RTU and Modbus TCP to IEC 60870-5-101/-104
 - DF1 to DNP3 and DNP3 IP, IEC 60870-5-101/-104 or Modbus RTU and Modbus TCP
 - IEC 60870-5-103 to DNP3/DNP3 IP, IEC 60870-5-101/-104 or Modbus RTU and Modbus TCP

You also need to understand which of the three possible configuration options — the SCADAPack E Configurator software, the ClearSCADA software, or the SCADAPack Workbench or ISaGRAF 3 Workbench software — is needed for the required tasks.

For more information, see:

- [Configuring Your rPAC](#)⁶⁸
- [Finding More Information](#)⁷²

11.1 Configuring Your rPAC

The table below summarizes the functions you can perform in each of the three configuration options:

- SCADAPack E Configurator software
- ClearSCADA software
- SCADAPack Workbench or ISaGRAF 3 Workbench software

The SCADAPack E Configurator and ClearSCADA software are used to configure and manage rPACs and RTUs.

The SCADAPack Workbench or ISaGRAF 3 Workbench software is used to program and debug IEC 61131-3 applications.

SCADAPack 530E and SCADAPack 535E Configuration Options

SCADAPack Workbench or ISaGRAF 3 Workbench	SCADAPack E Configurator and ClearSCADA ¹	SCADAPack E Configurator	ClearSCADA
Call function blocks to: • Compute the value of derived points • Perform complex logic • Access point attributes • Communicate peer-to-peer	Configure or manage: • The DNP3 and 60870-5 points database	•	•
	• Point attributes	•	•
	• I/O mapping to points	•	•
	• IEC 61131-3 application files	•	•
	• Communication port settings	•	•
Use I/O devices to: • Read and write to the points database • Read and write to Modbus or DF1 devices	• Access by up to 3 Masters	•	•
	• The DNP3 routing table	•	•
	• Data concentrator functionality	•	•
	• Firmware updates	•	•
	• License file	•	•
	• The point browser	•	
	• Diagnostic tools	•	
	• Security settings	•	

¹Before you begin configuring the rPAC, determine whether the ClearSCADA software will be used for any configuration tasks. This documentation assumes you are using the SCADAPack E Configurator software to configure the rPAC. For information about using the ClearSCADA software, see the ClearSCADA documentation.

For more information, see:

- [Tasks that Require SCADAPack E Configurator Only](#) ⁶⁹
- [Tasks that Require SCADAPack E Configurator and User Programming](#) ⁷¹
- [Tasks that can be Completed Using ClearSCADA](#) ⁷²

11.1.1 Tasks that Require SCADAPack E Configurator Only

The following are examples of tasks that you can complete using only the SCADAPack E Configurator software; no applications created in SCADAPack Workbench or ISaGRAF 3 Workbench are required.

Configuring analog and digital I/O with scaling, notification limits and data logging

- Points database of up to 20,000 physical and derived points.
- Analog points are reported both in raw sensor values and scaled to Engineering units.
- Notifications for analog points based on 13 configurable limit types:
 - Four low level and four high level limits.
 - Over-range and under-range limits.
 - Rate of rising change limit.
 - Rate of falling change limit.
 - No change limit.
 - The “Rate of change limits” and “No change limit” can be configured to actuate a digital point when the limit is exceeded.
- Notifications for digital points:
 - Notification state is selectable
 - Time deadbands for notification set and clear conditions
- Data logging through time-stamped event generation (DNP3 & IEC60670-5) may be enabled for digital point notifications, analog point notifications and for analog value changes outside a deviation set point. Up to 40,000 DNP3 events.

Configuring scalable data access for multiple clients

- The rPAC supports up to 3 independent DNP3 Masters; access by each master is configurable down to the individual point

Configuring many communications options to the master

- DNP3, Modbus and IEC 60870-5 protocol
- Protocols that run over IP, serial, GPRS or dial-up connections
- DNP3 over USB
- Unsolicited messaging for DNP3 and IEC 60870-5
- DNP3 authentication and AGA-12 encryption

- FTP and Telnet servers

Configuring DNP3 routing

- Add DNP3 routing to other DNP3 rPACs and RTUs in addition to supporting the functionality described above.

Configuring DNP3 Data Concentrator

- Make an rPAC the DNP3 data concentrator for a cluster of local rPACs and RTUs in addition to supporting the functionality described above.

11.1.2 Tasks that Require SCADAPack E Configurator and User Programming

When there is a requirement for calculations, control logic or polling of other devices, a logic application created in SCADAPack Workbench or ISaGRAF 3 Workbench is required.

The SCADAPack Workbench or ISaGRAF 3 Workbench software can be used to develop two independent applications in the IEC61131-3 programming language.

The following are examples of tasks that require an SCADAPack Workbench or ISaGRAF 3 Workbench application in addition to configuration through the SCADAPack E Configurator software.

Calculations

- Complex calculations performed in IEC61131-3 logic may also be saved to the rPAC points database

Control logic

- Simple or complex logic may be used, for example, to control SCADAPack output hardware, to make set point changes saved to derived points, to control peer-to-peer polling, or to send custom protocol commands.

DNP3 peer-to-peer communications

- Poll other DNP3 devices.

Polling other devices

- Program the rPAC to be a protocol converter by polling other devices using Modbus, DF1 or IEC 60870-5 using an IP or serial communications link.
- Program custom serial protocols.

11.1.3 Tasks that can be Completed Using ClearSCADA

The configuration tasks described in the two previous sections can be completed using ClearSCADA instead of the SCADAPack E Configurator software. However, you cannot start rPAC configuration in one application then switch to the other. For example if you configure point attributes using the SCADAPack E Configurator software, then switch to the ClearSCADA software, you will overwrite the point attributes set in the SCADAPack E Configurator software.

The executable file for applications developed in SCADAPack Workbench or ISaGRAF 3 Workbench can be loaded onto the rPAC using ClearSCADA after they are developed.

11.2 Finding More Information

The table below summarizes the main topics in the core manuals in the documentation set. Refer to your documentation set to see a complete list of the topics available to you.

For More Information About	See The
Your rPAC hardware • Installing and powering your rPAC • The CPU, RAM and storage on your rPAC • The different startup modes you can set • The serial, Ethernet and USB ports on your rPAC • The inputs and outputs (I/O) on your rPAC • The LEDs on the front panel of your rPAC • The diagnostics available on your rPAC • The maintenance recommendations for your rPAC • The hardware specifications and certifications for your rPAC	SCADAPack 530E Hardware Manual SCADAPack 535E Hardware Manual
General rPAC configuration • Configuring serial and Ethernet ports for connection to other rPACs and RTUs and to devices, such as Programmable Logic Controllers (PLCs) • Configuring the digital and analog points the rPAC will be monitoring and controlling • Configuring DNP, TCP/IP and Modbus attributes and properties • Configuring data concentrator (master) and slave attributes and properties • Determining rPAC status • The main windows and menu options in SCADAPack E Configurator • Performing common tasks such as determining and changing the DNP3 address of the rPAC • Downloading SCADAPack Workbench and ISaGRAF 3 applications • Troubleshooting the connection to the rPAC • DNP3 events and data classes	SCADAPack E Configurator User Manual

Database configuration • The technical aspects of analog, binary and counter point attributes and properties • The points database and how it is structured • Reading and writing database point records • Adding and disabling points in the database • System point maps	Configuration Technical Manual
rPAC operations • ASCII terminal connections • Status system points • Port assignments • Command line and diagnostics capabilities • ISaGRAF operation • Data logger operation • Status codes	SCADAPack E Operational Reference
I/O expansion modules • Adding and configuring I/O expansion modules in the SCADAPack E Configurator software • Installing and powering expansion I/O expansion modules • Addressing for expansion I/O expansion modules • The diagnostics and troubleshooting capabilities available for I/O expansion modules • The maintenance recommendations for I/O expansion modules • Hardware specifications for expansion I/O expansion modules	I/O Expansion Technical Reference Manual Hardware Manual for your expansion module SCADAPack System Configuration Guide
Security and how it is configured • Security overview • Configuring DNP3 authentication • ClearSCADA with DNP3 security • Frequently asked security questions	Security Quick Start Guide
The Security Administrator software • Security Administrator overview • Starting Security Administrator • Operating modes for Security Administrator	Security Administrator User Manual
Security keys and authentication • Managing keys • User-based authentication • Telnet and FTP authentication • DNP3 secure authentication • AGA12 encryption	Security Technical Reference Manual

• Security diagnostics • Attack vectors and requirements	
DNP3 communications • DNP3 protocol structure and configuration • SCADA master DNP3 interaction • DNP3 networking • DNP3 driver status codes • Common DNP3 protocol codes	DNP3 Technical Reference Manual
TCP/IP communications • TCP/IP configuration and communications • GPRS • 1xRTT radio service • FTP server support • TCP service ports • NTP network time synchronization • DNP3 TCP/IP structure • TCP/IP status codes	TCP/IP Technical Reference Manual
Modbus communications • Modbus slave, master and peripheral operations • Configuring Modbus properties and attributes • Modbus IP client functionality	Modbus Protocol Technical Reference Manual SCADAPack E Configurator User Manual SCADAPack E Product Overview TCP/IP Technical Reference Manual
Data concentrator functionality • Basic features • DNP3 data concentrator (master) functionality • SCADAPack ES Remote I/O functionality • IEC 60870-5-103 data concentrator (master) functionality • Data concentrator event buffers	Data Concentrator Technical Reference Manual
Slave functionality • Point configuration • System configuration • TCP connections • File transfers • System information commands • Command line diagnostics	IEC 60870-5-101/104 Slave Technical Reference Manual
Creating custom applications • Function block reference • I/O device reference • Technical reference • Modbus communication interfaces	SCADAPack E Target 5 Technical Manuals SCADAPack E Target 3 Technical Manuals

• DF1 PLC interface	
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