

SCADAPack 32P Controller

Installation, Operation and Maintenance Setup Manual

5/19/2011



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

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

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

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Safety Information

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



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



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

DANGER

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

WARNING

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

CAUTION

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

CAUTION

CAUTION used without the safety alert symbol, indicates a potentially



hazardous situation which, if not avoided, **can result** in equipment damage..

PLEASE NOTE

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

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

BEFORE YOU BEGIN

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

CAUTION

EQUIPMENT OPERATION HAZARD

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

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

Remove tools, meters, and debris from equipment.

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

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

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

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

Before energizing equipment:

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

OPERATION AND ADJUSTMENTS

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

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

About The Book

At a Glance

Document Scope

This manual describes the operation and maintenance of the SCADAPack 32P controller.

Validity Notes

This document is valid for all versions of the SCADAPack 32P controller.

Product Related Information

WARNING

UNINTENDED EQUIPMENT OPERATION

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

Follow all local and national safety codes and standards.

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

User Comments

We welcome your comments about this document. You can reach us by e-mail at technicalsupport@controlmicrosystems.com.

Overview

The SCADAPack 32P consists of a 5232 Controller board, see **Error! Reference source not found.** Application programs for the controller can be written in either Telepace Ladder Logic, or optionally IEC 61131-1, and C/C++ language.

The 5232 Controller provides an integrated power supply, three digital/counter inputs, an interrupt input and a status output. The 10-BaseT Ethernet port and three serial communication ports enable connection to a large variety of communication networks. Two of the serial communication ports are RS-232 and the third is configurable for RS-232 or RS-485.

The RS-232 serial communication ports on the controller board support half-duplex and full-duplex communication. They support RTS/CTS hardware handshaking for connection to modems and radio modems. The RS-232 and RS-485 ports operate at baud rates from 300 baud to 38400 baud.

Using 5000 I/O modules can expand the I/O capacity of SCADAPack 32P Controllers. A maximum of twenty 5000 I/O modules may be connected.

The 5232 Controller memory has 8 Mbytes SDRAM, 4 Mbytes flash ROM, and 1 Mbyte CMOS SRAM. The CMOS SRAM is non-volatile (battery backed.). A real time clock calendar provides for time of day operations.

Low power applications also benefit from the SCADAPack 32P ability to enable and disable status LED's on modules connected to the 5000 I/O bus including the controller board.

Installation

The installation of SCADAPack 32P controllers requires mounting the SCADAPack 32P controller on the 7.5mm by 35mm DIN rail and connecting the SCADAPack controller to the system I/O Bus. Refer to the **System Configuration Guide** for complete information on system layout, I/O Bus cable routing and SCADAPack 32P controller installation.

For ATEX and IECx applications only:

This equipment is to be installed in an enclosure certified for use, providing a degree of protection of IP54 or better. The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating. A T4 rating is acceptable.

For products using Solid State Relays (5415, 5606 and 5607 modules and SCADAPack using 5606 and 5607 modules) A T4 rating is acceptable for maximum loads of 2A. When 3A loads are connected to the Solid State Relays, the maximum ambient rating is lowered to 50°C in order to maintain the T4 rating.

Field Wiring Connections

SCADAPack 32P controllers use screw termination style connectors for termination of field wiring. These connectors can accommodate solid or stranded wires from 22 to 12 AWG.

The termination connectors fit over pins on the 5232 controller board. The connectors are removable allowing replacement of the SCADAPack 32P Controller without disturbing the field wiring. Leave enough slack in the field wiring for the connector to be removed.

Remove power before servicing unit.

To remove the termination connector:

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

To install the termination connector:

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

5232 Controller Board Field Wiring Connectors

The 5232 Controller board has six termination connectors for the connection of field wiring. Refer to the diagram **Figure 1: 5232 Controller Module** for field wiring connector locations.

Primary power input connections; output power connection and ground connections are wired to a six-pole connector labeled P3. Refer to section **Controller Board Power Supply** for more information on these connections.

The three digital/counter inputs (DIN/Counters), interrupt input/counter (INT/Cntr) and status output (STATUS) are wired to an eight-pole connector labeled P4. Refer to section **Digital /Counter Inputs, Interrupt Input** and **Status Output** for more information on these connections.

Each of the three serial communication ports is wired to black 8 pin modular RJ-45 connectors. COM1 connector is labeled P6, COM2 connector is labeled P7, and COM4 connector is labeled P8. Refer to section **Serial Communication** for more information on serial communication connections.

The Ethernet LAN Port is wired to a gray 8 pin modular RJ-45 connector labeled P5. Refer to section **Ethernet Communication** for more information on Ethernet connections.

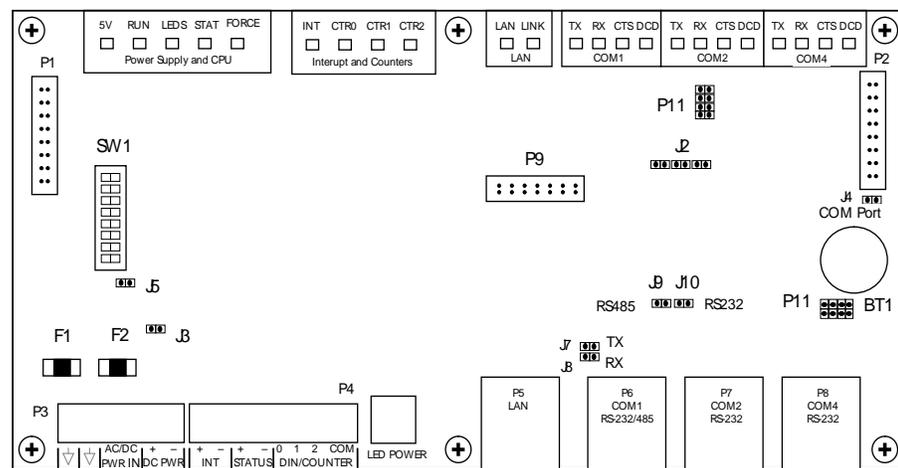


Figure 1: 5232 Controller Module

Power Supply

The SCADAPack 32P controller is primarily a DC input powered device but can be powered with 16Vac under some conditions. The power supply requirements for the 5232 Controller board are each explained in the following sections.

Voltages referred to as V_{rms} (or V_{ac}) indicate AC power. Voltages referred to as V (or V_{dc}) indicate DC power.

Controller Board Power Supply

The 5232 Controller board can be powered from a 12Vdc to 24Vdc power source applied to the DC PWR input or a 16Vac power source applied to the AC PWR IN input. With input power applied the 5232 Controller board power supply provides an internal 5V output to power 5000 modules through the inter module cable (IMC).

The 5V supply has a 1.3A output capacity of which 500mA is required by the 5232 Controller board. The remaining capacity, 800mA, is used to power 5000 modules connected through the IMC cable.

When the 5232 Controller board is powered with 16Vac power applied to the AC PWR IN input a limited amount of 24Vdc power is provided on the DC PWR terminals. The amount of 24Vdc power available is dependent on the amount of 5V output power used in the system. With a 5Vdc output power of 500mA there is 300mA is available and this value is derated linearly to 100mA with a 5Vdc output power of 1.3A.

Power Supply Input Connections

Input power is connected to the SCADAPack 32P controller in one of the following ways:

- A 16Vac source connects to the AC PWR IN terminals on the 5232 Controller board. See section

• Caution

Power can be applied to either the AC/DC power input **OR** the DC power input. Damage to the power supply may result if power is applied to both inputs.

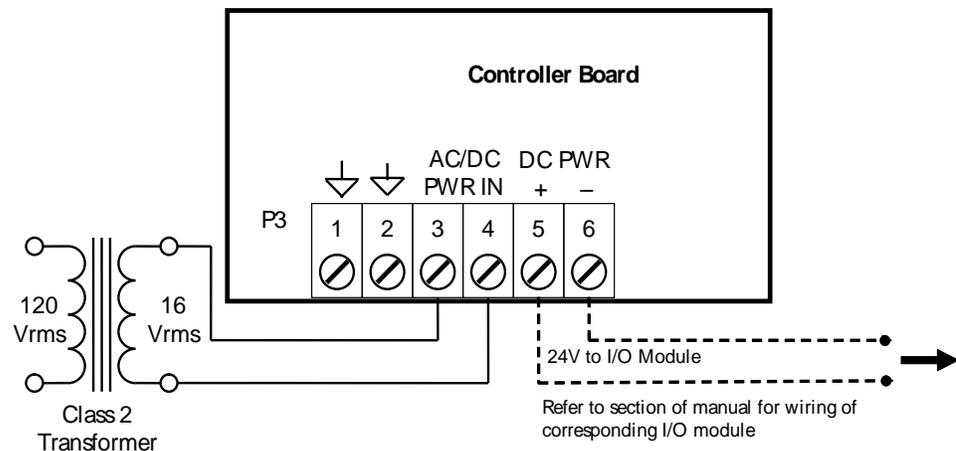
- Recommended AC Power Supply Configuration for an example of using a 16Vac transformer to power the SCADAPack 32P controller.
- An 11 to 24Vdc source connects to the DC PWR terminals on the 5232 Controller board. See section **Recommended DC Power Supply Configuration** for an example of using a DC power source.
- An 11 to 24Vdc high current capacity source, such as batteries, connects to the AC PWR IN **or** DC PWR IN terminals on the 5232 Controller Board. See section **Recommended 24VDC Battery Supply Configuration** for a wiring example.
- A 5103 UPS Power Supply supplies 5Vdc to the controller board through the IMC cable and supplies 24Vdc through the 24Vdc output. See section **Recommended 5103 Power Supply Configuration** for an example of using the 5103 UPS Power Supply.

Caution

Power can be applied to either the AC/DC power input **OR** the DC power input. Damage to the power supply may result if power is applied to both inputs.

Recommended AC Power Supply Configuration

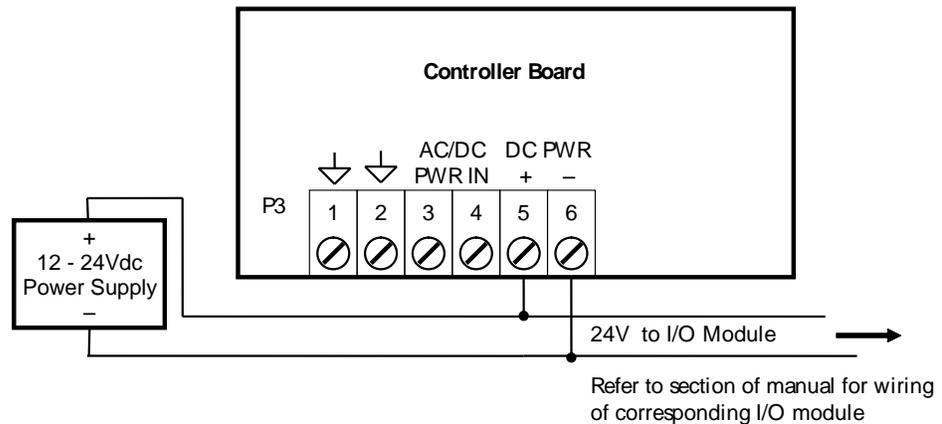
This configuration uses a single Class 2 transformer to power the SCADAPack 32P. 24V are available on the controller module connector P3. They are used to power the analog circuitry for the analog input circuits on additional 5000 Analog I/O modules.



Recommended DC Power Supply Configuration

This configuration uses a single power supply to power the SCADAPack 32P. A 12-24VDC source is applied to the DC PWR inputs (+) and (-).

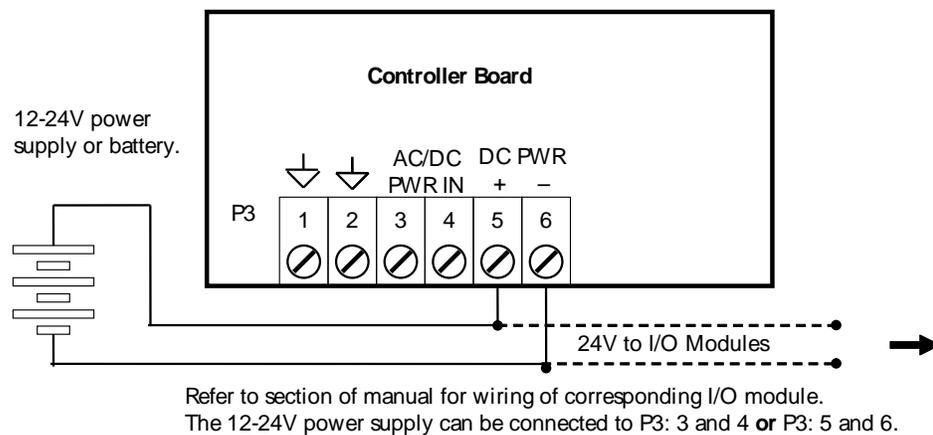
The DC power supply input inrush current can be reduced if required. Some DC power supplies will go into current limit when starting up into a high inrush current load. Battery operated systems have high current capabilities that may cause nuisance fuse blowing. If either of these situations are present in an installation, it possible to reduce the DC power supply inrush current by removing link J3. J3 is located on the controller next to the power input connector and fuses. This link may be removed in DC applications only.



Recommended 24VDC Battery Supply Configuration

This configuration uses a high capacity source, such as a battery, to power the SCADAPack 32P. An 11 – 24VDC battery source is applied with the positive to the AC PWR IN terminal 3 and the negative to DC PWR (-).

The DC power supply input inrush current can be reduced if required. Battery operated systems have high current capabilities that may cause nuisance fuse blowing. It possible to reduce the DC power supply inrush current by removing link J3. J3 is located on the controller next to the power input connector and fuses. This link may be removed in DC applications only.



Recommended 5103 Power Supply Configuration

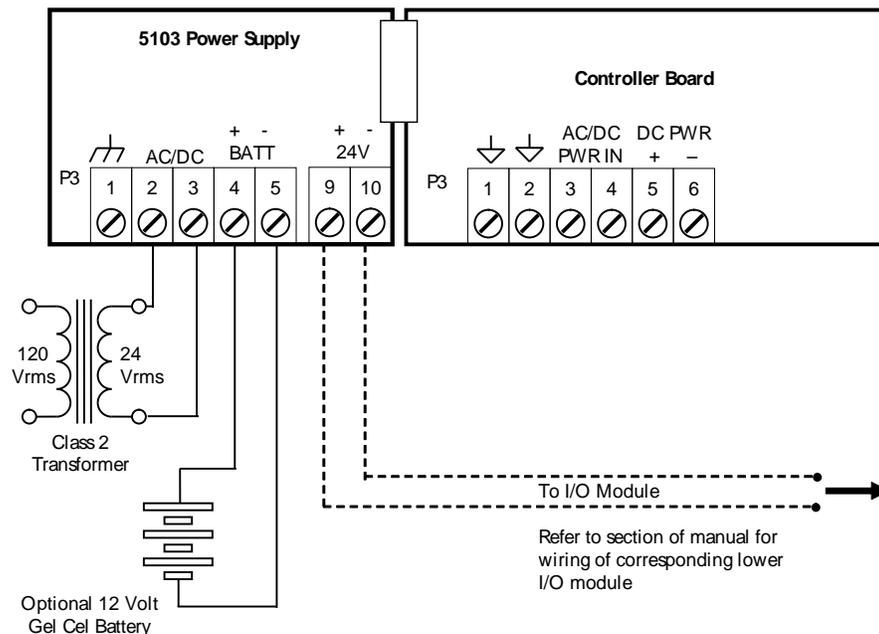
When additional power is required by the system, 5103 power supplies can be used in combination with the SCADAPack 32P controllers. Refer to the **System Configuration Guide** for more information.

The 5103 power supplies can be connected anywhere *downstream* (to the right) of the controller. They will supply power to the modules downstream of them.

The 5103 power supply may also be connected *upstream* (to the left) of any SCADAPack 32P Controller, but only if no power is applied to the power inputs of the SCADAPack 32P.

This configuration uses a 5103 Power Supply module to power a SCADAPack 32P. The 5103 power supply provides a 5V output to power the SCADAPack 32P and 5000 modules through the IMC cables.

No connection is made to the AC/DC PWR IN or DC PWR terminals on the SCADAPack 32P.



System Grounding

In applications, it is desirable to ground the system by connecting the system power supply common, to the chassis or panel ground.

On the SCADAPack 32P, the – side of both the 5V and the 24V supplies are connected to the enclosure. Pins 1 and 2 on P3 are connected internally to the enclosure.

Understanding Power Requirements

In determining the power requirements for an application it is necessary to understand how the controller, and connected I/O modules, use the input power. The terms used for calculating the power requirements for an application are discussed below.

Input Power

Input power is the power applied to the 11-30Vdc input on the controller.

Input Power Requirement

The input power requirement is the amount of power (i.e. voltage and current) needed by the controller and connected I/O modules for the application.

5V Requirements

The internal hardware in the controller uses 5Vdc to operate. The hardware that uses 5Vdc include the controller board, USB ports, LAN port, serial ports, LEDs, I/O modules connected to P2 and processor power mode. The 5Vdc is converted from the input power applied to the controller.

12/24V Requirements

The only circuitry that requires 12 or 24Vdc are the analog input loops. This requirement is added to the input power requirement to determine the overall input power requirement for the application.

Power Supply Efficiency

Some of the input power is not converted into 5Vdc but is lost due to heat dissipation and other factors. The input power minus these factors is referred to as power supply efficiency. The controller has an **85%** efficiency rating.

Power Units

The power units used for input requirements is Watts, or milliWatts (0.001 Watts). Watts are described as voltage x current ($P=IV$). Watts units are

very useful in that power, current or voltage can be determined if two of the values are known. For example:

An input of **24Vdc** at **500mA** equals **12W** (Watts)

An input of **12Vdc** at **500mA** equals **6W** (Watts)

An input of **12Vdc** at **1000mA** equals **12W** (Watts)

As a large portion of the input power (12 or 24Vdc) is needed for conversion to 5Vdc an understanding of the relationship between the input power and 5Vdc power is needed.

The controller can supply a **maximum of 1200mA @5Vdc**. A calculation is done to determine what 5Vdc current is needed and convert this to the needed input power. Some examples follow.

Assume a 12 or 24Vdc input voltage and the 5Vdc requirement is the maximum 1200mA. To determine the input power for this example:

5Vdc requirement = 1300mA x 5Vdc = **6.5W**

Power supply efficiency = **85%**

Thus the input power times the power supply efficiency equals the requirement of 6W.

Input Power = 6W / 0.85 = 7.6W (maximum)

For a 24Vdc input power supply:	For a 12Vdc input power supply:
$P=IV$	$P=IV$
$7.6W=I \times 24Vdc$	$7.6W=I \times 12Vdc$
$I = 7.6W / 24Vdc = \mathbf{320mA}$	$I = 7.6W / 12Vdc = \mathbf{640mA}$

Assume a 12 or 24Vdc input voltage and the 5Vdc requirement includes the controller board only. To determine the input power for this example:

From the specifications section of this user manual it is seen that the controller board requires 500mA @5Vdc.

5Vdc requirement = 500mA x 5Vdc = **2.5W**

Power supply efficiency = **85%**

Thus the input power times the power supply efficiency equals the requirement of 600mW.

Input Power = 2.5W / 0.85 = 2.95W

For a 24Vdc input power supply:	For a 12Vdc input power supply:
$P=IV$	$P=IV$

$2.95W = I \times 24Vdc$	$700mW = I \times 12Vdc$
$I = 2.9W / 24Vdc = \mathbf{120mA}$	$I = 2.9W / 12Vdc = \mathbf{240mA}$

The Specification section at the end of this user manual is used to determine how much power is required for each item used by the controller for the application.

Internal Analog Inputs

The SCADAPack 32P Controller has two internal analog inputs. These internal analog inputs are accessed from the user application program.

The ambient temperature input measures the temperature at the controller circuit board. It is useful for measuring the operating environment of the controller and returns an integer value in the range – 40 to 75 deg C or –40 to 167 deg F. The temperature reading represents temperatures in the range -40°C to 75°C or -40°F to 167°F. Temperatures outside this range cannot be measured.

- For Telepace applications use the ***AIN Controller Temperature*** register assignment to read the ambient temperature in degrees C and degrees F.
- For IEC 61131-1 applications use the ***aintemp*** I/O connection to read the ambient temperature in degrees C and degrees F.

The lithium battery input measures the voltage of the battery that maintains the non-volatile RAM in the controller. The reading returned from this input is in the range from 0 – 5000 representing the battery voltage in mV. It is useful in determining if the battery needs replacement. The 3.6V lithium battery will return a typical value of 3600 or 3700. A reading less than 3000 (3.0V) indicates that the lithium battery requires replacement.

- For Telepace applications use the ***AIN Controller RAM Battery V*** register assignment to read the lithium battery voltage.
- For IEC 61131-1 applications use the ***ainbatt*** I/O connection to read the lithium battery voltage.

Digital /Counter Inputs

The SCADAPack 32P has three Digital / Counter inputs. These inputs are labeled **DIN\Counter** 0, 1 and 2 on the P4 terminal connector. These inputs operate as AC or DC digital inputs or as counter inputs.

- For DC inputs the maximum input voltage is 30V and the minimum voltage to turn the input ON is 10V.
- For AC inputs the maximum input voltage is 24Vrms and the minimum voltage to turn the input ON is 10Vrms.
- For counter inputs the maximum frequency is 5KHz with the filters off.

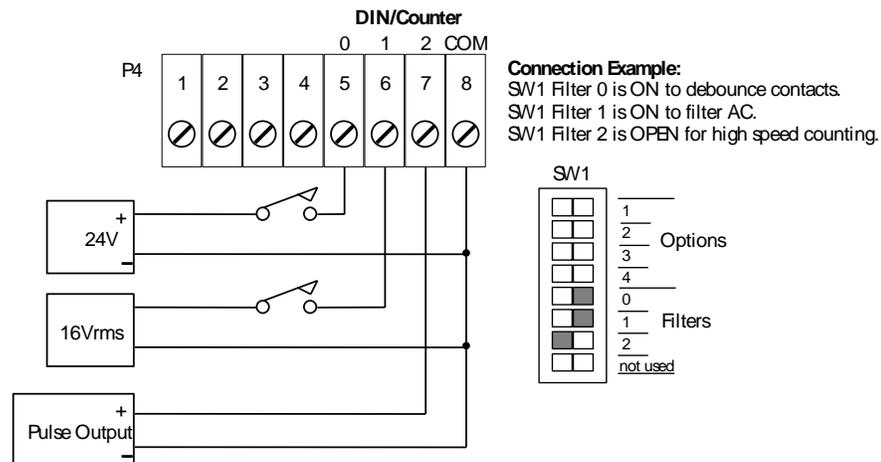
The **DIN/Counter** inputs can be used as both digital inputs and counter inputs in an application program.

- For Telepace applications use the **CNTR Controller Counter Inputs** register assignment to read the DIN/Counter inputs as counters and the **DIN Controller Digital Inputs** register assignment to read the DIN/Counter inputs as digital inputs
- For IEC 61131-1 applications use the **cntrCtrl** I/O connection to read the DIN/Counter inputs as counters and the **dinCtrl** I/O connection to read the DIN/Counter inputs as digital inputs.

Each of the three digital / counter (DIN/Counters) inputs on the SCADAPack 32P controller has a switch selectable filter, which limits the maximum input frequency. Filtering limits the maximum digital input or counter frequency to approximately 30Hz. Refer to section **Digital Input Filters** for filter selection information.

- Use a filter for 50 or 60Hz digital inputs and for low speed counting applications that experience contact bounce.
- Filtering for high speed counting applications is not required.

An example of wiring each type of input is shown in the diagram below.



Interrupt Input

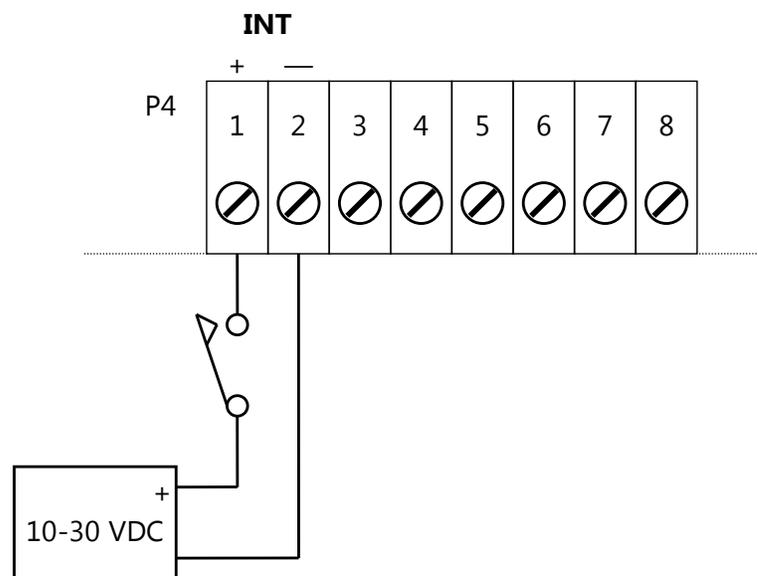
The SCADAPack 32P has one Interrupt digital input. This input is labeled **DINT** on the P4 terminal connector. This input operates as a DC digital input or as a counter input.

- For DC input the maximum input voltage is 30V and the minimum voltage to turn the input ON is 10.0V. See the **Digital Inputs** section in the Specifications.
- For counter input the maximum frequency is 500Hz.

The **INT** input can be used as both a digital input and as a counter in an application program.

- For Telepace applications use the **CNTR Controller Interrupt Input** register assignment to read the INT/Cntr input as a counter and the **DIN Controller Interrupt Input** register assignment to read the INT/Cntr input as a digital input.
- For IEC 61131-1 applications use the **cntrint** I/O connection to read the INT/Cntr input as a counter input and the **dinint** I/O connection to read the INT/Cntr input as a digital input.

The diagram below shows how to wire this input.



Status Output

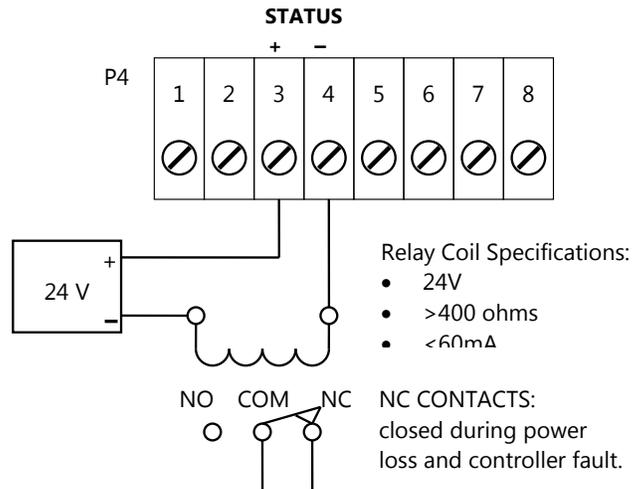
The SCADAPack 32P status output indicates a controller condition to an external device. The output is ON (capable of conducting current) during normal operation. The output is OFF (high impedance) during the following conditions:

- Power removal.
- SCADAPack 32P RESET.
- Application program defined conditions.

The status output is an optically isolated transistor.

- Observe correct polarity of the output wiring.
- Limit the output current to 60mA during the ON condition.
- Limit the output voltage to 30V during the OFF condition.

A typical application of this output is shown in the following diagram. The output energizes a relay. The normally closed contacts of this relay are used to activate an annunciator. The relay in this application has a 24V coil with greater than 400Ω resistance.



Serial Communication

The SCADAPack 32P controller is equipped with three serial communication ports. The three serial communication ports support RS-232 serial communication and one port supports both RS-232 and RS-485 serial communication.

Serial ports on the SCADAPack 32P controller are designated COM1, COM2 and COM4. Refer to **Figure 1: 5232 Controller Module** section for the location of the serial ports.

RS-232 Serial Communications Ports

RS-232 wiring uses shielded cable. The shield should be connected to chassis ground at one point. The DE-9 connector shell is a good ground point. Improperly shielded cables may result in the installation not complying with FCC or DOC radio interference regulations.

COM1 RS-232 Serial Port

Serial port COM1 may be configured as an RS-232 or RS-485 serial communication port.

- A is installed on J10 to operate COM1 in RS-232 mode.
- A jumper is installed on J9 to operate COM1 in RS-485 mode.

Refer to **Figure 1: 5232 Controller Module** for the location of COM1 and jumpers J9 and J10.

Jumpers **J7** (RS-485 TX termination resistor) or **J9** (RS-485 RX Termination resistor) are not required when using COM1 as an RS-232 serial port.

For information on using COM1 as a RS-485 serial port refer to section **RS-485 Serial Communication Port**.

Connections to COM1 are made through a RJ-45 modular connector. The wiring and pin connections for this connector are described in section **RJ-45 Modular Connector for RS-232**.

The following table shows the serial and protocol communication parameters supported by COM1. These parameters are set from Telepace, IEC 61131-1 or from an application program running in the SCADAPack 32P controller. Default values are set when a Cold Boot or Service Boot is performed on the SCADAPack 32P controller.

Parameter	Supported Values
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. Default: 9600
Duplex	Full or Half Default: Full
Parity	Odd, None or Even Default: None
Data Bits	7 or 8 Bits Default: 8 Bits
Stop Bits	1 or 2 Bits Default: 1 Bit
Receive Flow Control	ModbusRTU or None Default: ModbusRTU
Transmit Flow Control	Ignore CTS or None Default: None
Station	1 to 65534 Default: 1
Protocol	None, Modbus RTU or Modbus ASCII Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

COM2 RS-232 Serial Port

Connections to COM2 are made through a RJ-45 modular connector. The wiring and pin connections for this connector are described in section ***RJ-45 Modular Connector for RS-232***.

Refer to section ***Field Wiring Connections*** for the location of COM2 on the SCADAPack 32P.

The following table shows the serial and protocol communication parameters supported by COM2. These parameters are set from Telepace, IEC 61131-1 or from an application program running in the SCADAPack 32P controller. Default values are set when a Cold Boot or Service Boot is performed on the SCADAPack 32P controller.

Parameter	Supported Values
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. Default: 9600
Duplex	Full or Half Default: Full
Parity	Odd, None or Even Default: None

Parameter	Supported Values
Data Bits	7 or 8 Bits Default: 8 Bits
Stop Bits	1 or 2 Bits Default: 1 Bit
Receive Flow Control	ModbusRTU or None Default: ModbusRTU
Transmit Flow Control	Ignore CTS or None Default: None
Station	1 to 65534 Default: 1
Protocol	None, Modbus RTU or Modbus ASCII Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

COM4 RS-232 Serial Port

Connections to COM4 are made through a RJ-45 modular connector. The wiring and pin connections for this connector are described in section ***RJ-45 Modular Connector for RS-232***.

Refer to section ***Field Wiring Connections*** for the location of COM4 on the SCADAPack 32P.

The following table shows the serial and protocol communication parameters supported by COM4. These parameters are set from Telepace, IEC 61131-1 or from an application program running in the SCADAPack 32P controller. Default values are set when a Cold Boot or Service Boot is performed on the SCADAPack 32P controller.

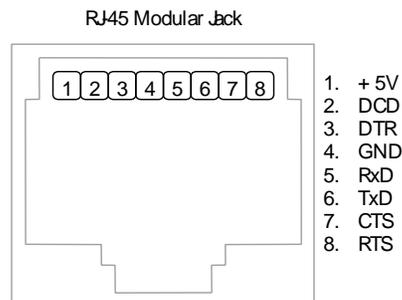
Parameter	Supported Values
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200. Default: 9600
Duplex	Full or Half Default: Full
Parity	Odd, None or Even Default: None
Data Bits	7 or 8 Bits Default: 8 Bits
Stop Bits	1 or 2 Bits Default: 1 Bit
Receive Flow Control	ModbusRTU or None Default: ModbusRTU

Parameter	Supported Values
Transmit Flow Control	Ignore CTS or None Default: None
Station	1 to 65534 Default: 1
Protocol	None, Modbus RTU or Modbus ASCII Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

RJ-45 Modular Connector for RS-232

Serial communication ports COM1, COM2 and COM4 are located on the SCADAPack 32P SCADAPack 32P. These are RS-232 serial ports using a 8-pin female RJ-45 connectors configured as Data Terminal Equipment (DTE). The recommended specification for RS-232 cable length is a maximum of 50 feet or 15.2 meters. Use shielded cable and connect the shield to chassis ground at one end.

The following diagram shows the pin connections for the RS-232 (RJ-45) port connector for COM1, COM2 and COM4.



Notes:

- +5V is only available on Pin 1 when a jumper is installed on J4. Refer to section **Field Wiring Connections** for the location of J4.
- Serial port COM1 may be configured as RS-232 or RS-485. A jumper is installed on J10 to operate COM1 in RS-232 mode. Refer to section **Field Wiring Connections** for the location of J10.

The following table provides a description of the function of each pin of the RJ-45 connector. In this table a MARK level is a voltage of +3V or greater and a SPACE level is a voltage of -3V or less.

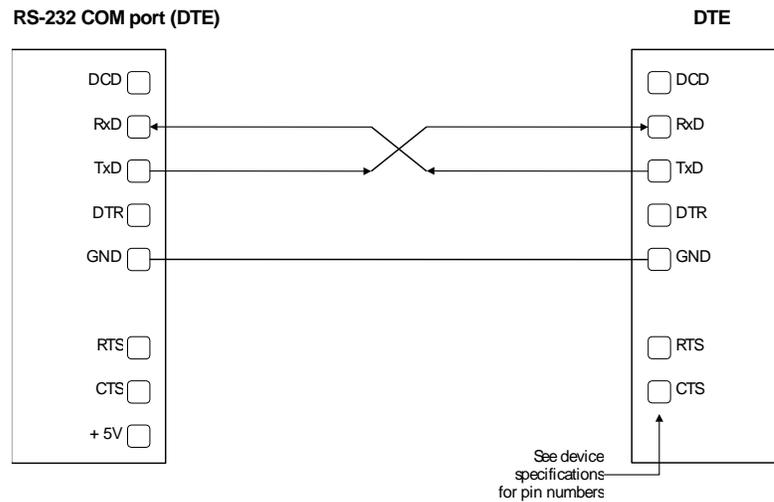
Pin	Function	Description
1	5V (Output)	This pin can be connected to the 5V power supply by installing a jumper at J4 on the SCADAPack controller

Pin	Function	Description
		board.
2	DCD (Input)	The DCD led is on for a MARK level.
3	DTR (Output)	This pin is normally at a MARK level. This pin is at a SPACE level when DTR is de-asserted.
4	GND	This pin is connected to the system ground.
5	RxD (Input)	The level is SPACE on standby and MARK for received data. The LED is lit for a MARK level.
6	TxD (Output)	The level is SPACE on standby and MARK for transmitted data. The LED is lit for a MARK level.
7	CTS (Input)	This level must be a MARK for the communication port to transmit data. When the attached device does not provide this signal, the controller keeps the line at a MARK. When the attached device does provide this signal, it must set CTS to MARK to allow the controller to transmit data.
8	RTS (Output)	This pin is a MARK if full-duplex operation is selected for the port. This pin is set to a MARK just before and during transmission of data if half-duplex operation is selected. This pin is set to a SPACE when no data is being transmitted.

RS-232 Wiring Examples

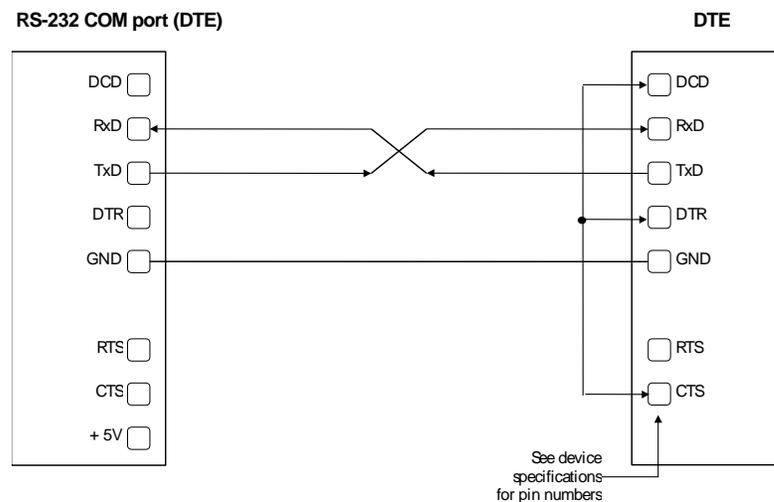
DTE to DTE without Handshaking

There are several methods for wiring the RS-232 COM port to DTE (Data Terminal Equipment) and DCE (Data Communications Equipment) devices. The simplest connection requires only 3 wires: RxD, TxD and signal ground. The following diagram shows a common RS-232 COM port to DTE device.



DTE to DTE with Handshaking

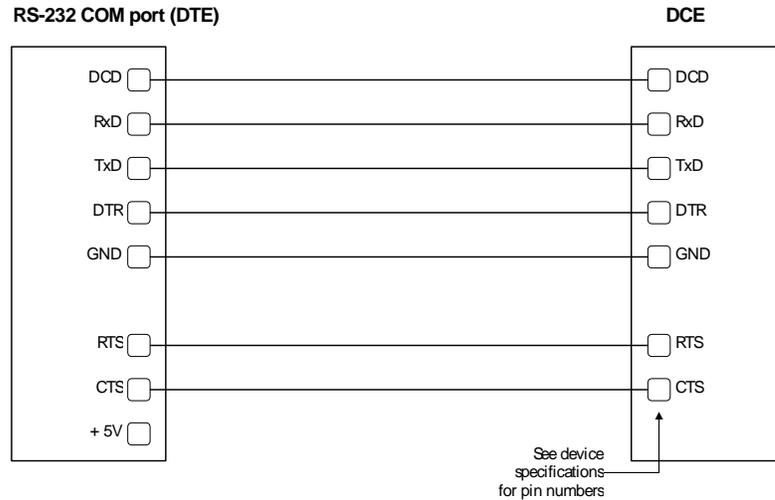
Some DTE devices may require hardware handshaking lines. Common lines are the CTS and RTS lines. Less common are the DTR and DCD lines. The controller does not require these lines. Refer to the specifications of the external device for exact requirements. The following diagram shows a common connection of an RS-232 COM port with a DTE device requiring handshaking lines.



DTE to DCE with Handshaking

DCE devices require different wiring. The handshaking lines are connected. Many DCE devices are half duplex. Select half-duplex operation with these devices. The diagram below shows common

connection of a SCADAPack with a DCE device requiring handshaking lines.



RS-232 Cables

RJ-45 to DE-9S DTE

This cable is used to connect from an RJ-45 based RS-232 port on the SCADAPack 32P controller to DE-9P connector on a DTE such as a PC. A 10 ft. long cable is available from Control Microsystems as part number TBUM297217.

RJ-45 8 Pins	SCADAPack 32P DTE Function	DE9S DTE Function	DE9S
			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.	GND	GND	No wires connected at this end.

RJ-45 to DE-9P DCE

This cable is used to connect from an RJ-45 based RS-232 port on the SCADAPack 32P controller to DE-9S connector on a DCE such as a modem. A 15 inch long cable is available from Control Microsystems as part number TBUM297218.

RJ45	SCADAPack 32P DTE Function	DE-9P DCE Function	DE-9P
			Shield connects to shell
3	DTR	DTR	4
6	TxD	TxD	3
5	RxD	RxD	2
2	DCD	DCD	1
4	GND	GND	5
7	CTS	CTS	8
8	RTS	RTS	7
1	+5V	+5V	9

RS-485 Serial Communication Port

Serial port COM1 on the SCADAPack 32 controller may be configured as an RS-485 serial communication port. A jumper is installed on J9 to operate COM1 in RS-232 mode. Refer to section **Field Wiring Connections** for the location of J9.

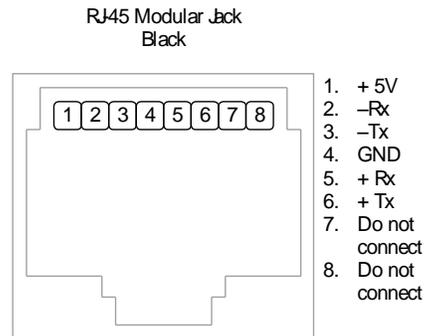
When configured as a RS-485 port COM1 transmits and receives differential voltages to other RS-485 devices on a network. The RS-485 specification allows a maximum of 32 devices connected on a single RS-485 network. The recommended specification for RS-485 is the cable length should not exceed a maximum of 4000 feet or 1200 meters. Termination resistors are required when using long cable lengths and high baud rates. Refer to section **RS-485 Termination Resistors** for information on termination resistors.

The signal grounds of the RS-485 devices in the network are not connected together but instead are referenced to their respective incoming electrical grounds. Wire the grounds of the RS-485 devices on the network such that they are within several volts of each other.

The RS-485 port operates in two or four wire mode.

RJ-45 Modular Connector for RS-485

The following diagram shows the pin connections for the RS-485 (RJ-45) port connector for COM1.



+5V is only available on Pin 1 when a jumper is installed on J4. Refer to section **Field Wiring Connections** for the location of J4.

Serial port COM1 may be configured as RS-232 or RS-485. A jumper is be installed on J9 to operate COM1 in RS-485 mode. Refer to section **Field Wiring Connections** for the location of J9.

The differential receive and transmit signals are labeled +/-Rx and +/-Tx respectively. Some RS-485 devices refer to the - side of the signal as A and the + side of the signal as B.

The following table provides a description of the function of each pin of the RJ-45 connector. In this table a MARK level is a voltage of +3V or greater and a SPACE level is a voltage of -3V or less.

Pin	Function	Description
1	5V (Output)	This pin can be connected to the 5V power supply by installing a jumper at J4 on the SCADAPack 32P.
2	-Rx (Input)	The DCD led is on for a MARK level.
3	-Tx (Output)	This pin is normally at a MARK level. This pin is at a SPACE level when DTR is de-asserted.
4	GND	This pin is connected to the system ground.
5	+Rx (Input)	The level is SPACE on standby and MARK for received data. The LED is lit for a MARK level.
6	+Tx (Output)	The level is SPACE on standby and MARK for transmitted data. The LED is lit for a MARK level.
7	N/C	This pin is not used for RS-485 operation.
8	N/C	This pin is not used for RS-485 operation.

RS-485 Bias Resistors

The RS-485 receiver inputs on the SCADAPack 32P controller are biased so that received data is driven to a valid state (space) when there are no active drivers on the network. The value of these bias resistors is 4700 ohms from Ground to the $-Rx$ input and 4700 ohms from +5V to the $+Rx$ input.

RS-485 Termination Resistors

Termination resistors are required in long networks operating at the highest baud rates. Shorter networks in high noise environments may also benefit from terminations. Networks as long 1000 ft. operating at 9600 baud will function without termination resistors. Terminations should be considered if the baud rate is higher and the network is longer.

When termination resistors are required, they are installed on the first and last station on the RS-485 wire pair. Other stations should not have termination resistors.

RS-485 networks are generally terminated with 120 ohm resistors on each end. The required 120 ohm resistor is built into the SCADAPack 32P controller. When these termination resistors are used, the biasing generally has to be increased in order to generate at least 0.2V across the $+/-Rx$ input.

To connect the termination resistors:

- Install a jumper across J8 to terminate the Rx pair.
- Install a jumper across J7 to terminate the Tx pair.

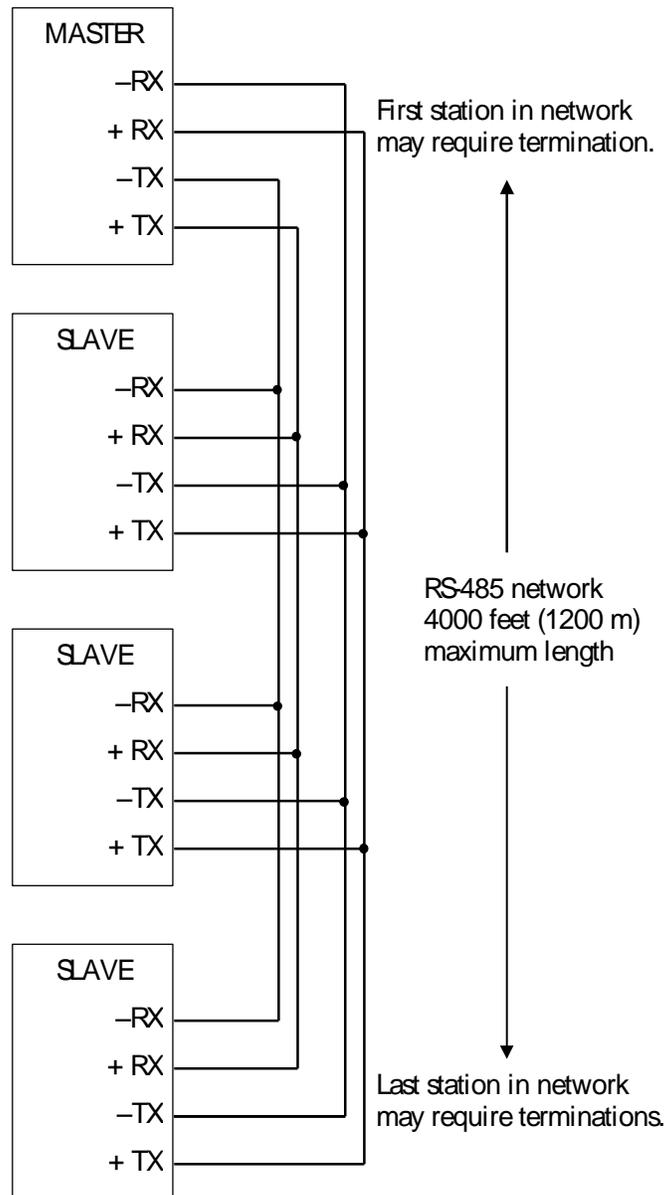
To remove the termination resistors:

- Remove the jumper across J8 to not terminate the Rx pair.
- Remove the jumper across J7 to not terminate the Tx pair.

RS-485 Wiring Examples

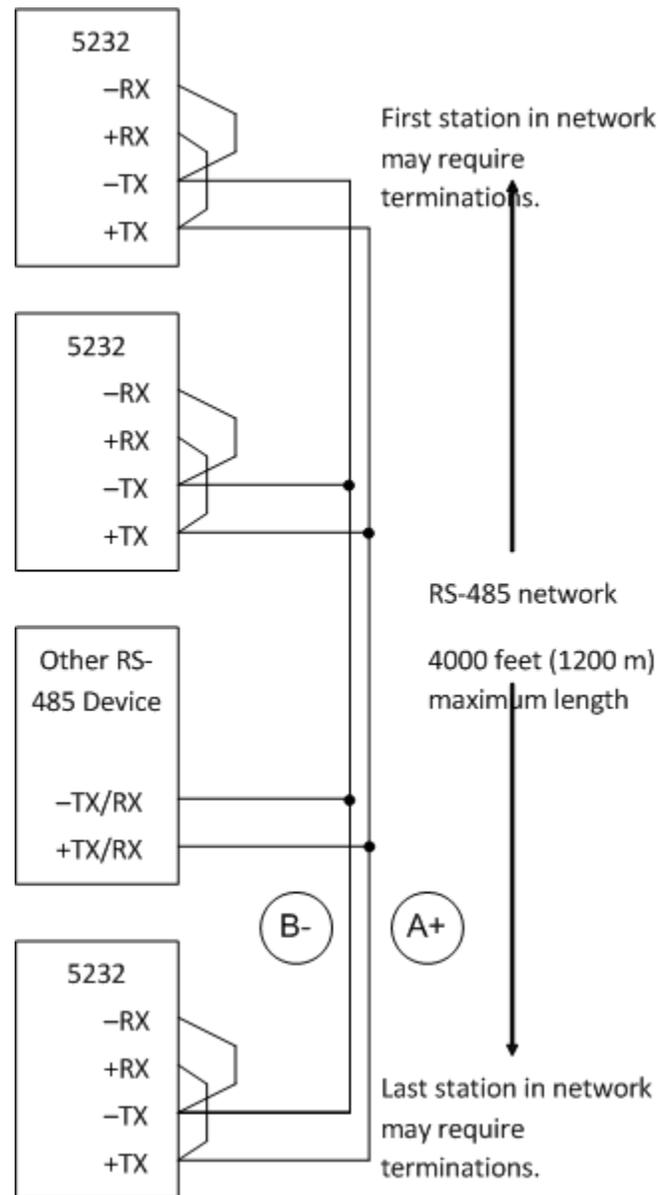
Four wire mode

Four-wire operation uses one pair of wires for transmitting data and a second pair for receiving data. The transmitting pair is connected to $+Tx$ and $-Tx$. The receiving pair is connected $+Rx$ and $-Rx$. The following diagram shows the wiring details for a four-wire connection.



Two wire mode

Two wire operation uses one pair of wires for transmitting and receiving data. +Tx is connected to +Rx (this is the A+) and -Tx is connected to the -Rx (this is the B-). This pair of wires becomes the transmitting and receiving pair. The following diagram shows the wiring details for a two wire connection.



RS-485 Cable

This cable is used to connect from an RJ-45 based RS-485 port on the SCADAPack 32P controller to other RS-485 devices. The cable has a RJ-45 connector on one end and stripped wires at the other end. A 10-foot long cable is available from Control Microsystems as part number TBUM-297234.

RJ45	Function	Wire color
	Connect to Chassis	Shield
3	-Tx	Orange
6	+Tx	Blue
5	+Rx	Grey
2	-Rx	Brown
4	GND	Black
7	No connection	Yellow
8	No connection	Green
1	+5V	Red

Ethernet Communication

The SCADAPack 32P controller has one 10BaseT Ethernet port. 10BaseT is a single communications channel running at 10MHz over unshielded, twisted - pair cabling. 10BaseT uses differential signaling.

LAN Port Settings

Connections to the LAN port are made through a RJ-45 modular connector. The wiring and pin connections for this connector are described in section ***0-RJ-45 Modular Connector for Ethernet***.

Refer to section ***0-Field Wiring Connections*** for the location of the LAN port on the SCADAPack 32P.

TCP/IP Settings

The following table shows the TCP/IP parameters supported by the LAN port. These parameters are set from the IEC 61131-1 or from an application program running in the SCADAPack 32P controller. Default values are set when a Cold Boot is performed on the SCADAPack 32P controller.

Parameter	Supported Values
IP Address	In the format 255.255.255.255 Default: 0.0.0.0
Subnet Mask	In the format 255.255.255.255 Default: 0.0.0.0
Gateway	In the format 255.255.255.255 Default: 0.0.0.0

The **IP Address** is the address of the controller. The IP address is statically assigned. Contact your network administrator to obtain an IP address for the controller.

The **Subnet Mask** is determines the subnet on which the controller is located. The subnet mask is statically assigned. Contact your network administrator to obtain the subnet mask for the controller.

The **Gateway** determines how your controller communicates with devices outside its subnet. Enter the IP address of the gateway. The gateway is statically assigned. Contact your network administrator to obtain the gateway IP address.

Modbus/TCP Settings

The following table shows the Modbus/TCP parameters supported by the LAN port. These parameters are set from the IEC 61131-1 or from an application program running in the SCADAPack 32P controller. Default values are set when a Cold Boot or Service Boot is performed on the SCADAPack 32P controller.

Parameter	Supported Values
Master Idle Timeout	Any value in seconds. Default: 10 seconds
Server Receive Timeout	Any value in seconds. Default: 10 seconds
Maximum Server Connections	Valid values are 1 to 20. Default: 20
TCP Port	Valid values are 1 to 65535 Default: 502
Modbus Addressing Type	Valid values are Standard or Extended Default: Standard
Modbus Station Address	Valid values are 1 to 65534. Default: 1
Store and Forward Messaging	Valid values are Enabled and disabled. Default: Disabled

The **Master Idle Timeout** parameter sets when connections to a slave controller are closed. Setting this value to zero disables the timeout; the connection will be closed only when your program closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are sent in that time. This allows the slave device to free unused connections.

The **Server Receive Timeout** parameter sets when connections from a remote device are closed. Setting this value to zero disables the timeout; the connection will be closed only when the remote device closes it. Any other value sets the timeout in seconds. The connection will be closed if no messages are received in that time. This allows the controller to free unused connections.

The **Maximum Server Connections** parameter sets the number of incoming (server) connections that the controller will allow. Incoming (server) connections are used when a remote device creates a connection to this controller. Outgoing connections are used when this controller creates a connection to a remote device (e.g. using a **masterip** function block). Setting this value to the maximum allows the server to use available connections for incoming connections. Setting the value below the maximum limits the number of incoming connections from

remote devices. This reserves the remaining connections for use by the controller for outgoing connections.

The **TCP Port** parameter sets the port used by the Modbus/TCP protocol. This should be set to 502. This is the well-known port number for Modbus/TCP. Modbus/TCP devices use 502 by default, and on many devices the value cannot be changed. It is suggested that you change this value only if this port is used by another service on your network. Consult your network administrator to obtain a port if you are not using the default.

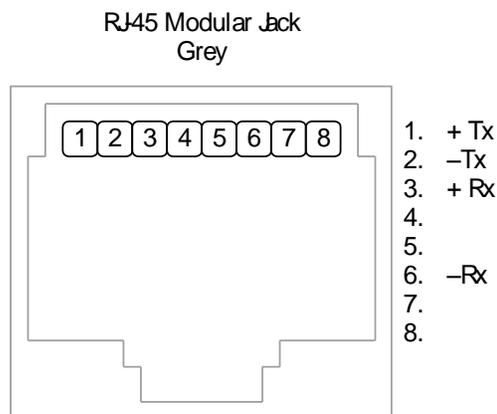
The **Addressing** parameter selects standard or extended Modbus addressing. Standard addressing allows 255 stations and is compatible with standard Modbus devices. Extended addressing allows 65534 stations, with stations 1 to 254 compatible with standard Modbus devices.

The **Station** parameter sets the station number of the controller. The valid range is 1 to 255 if standard addressing is used, and 1 to 65534 if extended addressing is used.

The **Store and Forward Messaging** parameter controls forwarding of messages on the Ethernet port. If this option is enabled, messages will be forwarded according to the settings in the store and forward routing table.

RJ-45 Modular Connector for Ethernet

The SCADAPack 32P can be connected directly to a wall jack or hub using standard RJ-45 Category 5 patch cables. The following diagram shows the pin connections for the RJ-45 modular connector.



10BaseT has a maximum run of 100m or 350 feet, but the actual limit is based on signal level and the level of unwanted electrical signals in the environment. This may limit the practical distance to less than 100m or 350 feet. The Ethernet cables should not be run in parallel with power or any cables that generate unwanted electrical signals.

Operation

Operating Modes

SCADAPack 32P Controllers may start up in RUN, SERVICE or COLD BOOT mode. Start up in the RUN mode automatically executes the application programs in the controller memory. Start up in the SERVICE mode stops the programs to allow reprogramming and controller initialization. Start up in the COLD BOOT mode initializes the controller and erases application programs.

Run Mode

The RUN mode is the normal operating mode of the SCADAPack 32P Controller. No action is required to select RUN mode. When power is applied to the SCADAPack 32P:

- The user defined serial communication parameters for COM ports are used.
- The user defined TCP/IP and Modbus/TCP parameters are used for the Ethernet port.
- If a Telepace or IEC 61131-1 application program is loaded it is executed.
- If a Telepace or IEC 61131-1 C/C++ application program is loaded and the program checksum is correct, it is executed.

The controller lock settings and password are used.

Service Mode

SERVICE mode is used during application programming and maintenance work. When the SCADAPack 32P controller starts in SERVICE mode:

- The default serial communication parameters are used. See section **RS-232 Serial Communications Ports** of this manual for a description of the default parameters.
- The user defined TCP/IP parameters are used for the Ethernet port.
- The default Modbus/TCP parameters are used for the Ethernet port. See section **Modbus/TCP Settings** of this manual for the default parameters.
- If a Telepace or IEC 61131-1 application program is loaded it is stopped.
- If an IEC 61131-1 C++ application program is loaded it is stopped.
- Application programs are retained in non-volatile memory.

- The controller lock settings and password are used.

SERVICE mode is selected by performing a SERVICE BOOT using the following procedure:

- Remove power from the SCADAPack 32P controller.
- Hold down the LED POWER button.
- Apply power to the controller.
- Continue holding the LED POWER button until the STAT LED turns on.
- Release the LED POWER button.

If the LED POWER button is released before the STAT LED turns on, the SCADAPack 32P controller will start in RUN mode.

Cold Boot Mode

COLD BOOT mode is used after installing new controller firmware. When the SCADAPack 32P controller starts in COLD BOOT mode:

The default serial communication parameters are used. See section **RS-232 Serial Communications Ports** of this manual for a description of the default parameters.

The default TCP/IP parameters are used for the Ethernet port. See section **TCP/IP Settings** of this manual for the default parameters.

- The default Modbus/TCP parameters are used for the Ethernet port. See section **Modbus/TCP Settings** of this manual for the default parameters.
- The Telepace or IEC 61131-1 application program is erased.
- The IEC 61131-1 C++ application program is erased.
- The controller is unlocked.

COLD BOOT mode is selected by performing a COLD BOOT using the following procedure:

- Remove power from the controller.
- Hold down the LED POWER button.
- Apply power to the controller.
- Continue holding the LED POWER button for 25 seconds until the STAT LED begins to flash on and off continuously.
- Release the LED POWER button.

If the LED POWER button is released before the STAT LED begins to flash, the SCADAPack 32P controller will start in SERVICE mode.

SCADAPack 32P LED Indicators

There are twenty-three LEDs on the SCADAPack 32P SCADAPack 32P. These LEDs are used to indicate the operational status of the controller. LEDs, except the 5V LED, can be disabled to conserve power. Refer to section **LED Power Control** for details on LED power control.

The following table describes the SCADAPack 32P SCADAPack 32P LEDs.

LED	Function
5V	On when 5V power is present in the SCADAPack 32P controller. The controller uses 5V power to operate. 5V power is supplied by the SCADAPack 32P internal power supply or from an external model 5103 power supply.
RUN	On when an IEC 61131-1 application program is running in the SCADAPack 32P controller. This LED may be controlled by a C++ Tools application, in which case the application will control the LED status.
LEDS	On when LED power is enabled.
STAT	This LED is normally off. The LED will blink when a controller condition exists.
FORCE	On when and SCADAPack 32P I/O points are forced, or locked, in an IEC 61131-1 application.
INT/Counters 0 INT/Counters 1 INT/Counters 2	On when a signal is applied to the corresponding input.
INT	On when a signal is applied to the INT input
LAN	On when receive or transmit data on the Ethernet port.
LINK	On when Ethernet port is connected to a network.
COM1 RX COM2 RX COM4 RX.	On when receiving data on the corresponding serial port.
COM1 TX COM2 TX COM4 TX.	On when transmitting data on the corresponding serial port.
COM1 CTS COM2 CTS COM4 CTS.	On when the CTS input is asserted on the corresponding serial port.
COM1 DCD COM2 DCD COM4 DCD.	On when the DCD input is asserted on the corresponding serial port.

LED Power Control

Power to the LEDs on the SCADAPack 32P SCADAPack 32P and 5000 I/O modules connected to the SCADAPack 32P can be disabled to conserve power. This feature is particularly useful when the SCADAPack 32P is used in solar powered or unattended installations.

The LEDS LED on the SCADAPack 32P indicates the LED power state. This LED is on when power to the LEDs is enabled and off when power to the LEDs is disabled. See section **5232 Controller Board Field Wiring Connectors** for the location of the LEDS LED.

The LED POWER push-button toggles the LED power state. Press the LED POWER push-button to toggle LED power state from disable to enable, or from enable to disable.

The default setting of the LED power state is LED power enabled. The LED power returns to the default state 5 minutes after the LED POWER push-button is last pressed. The application program may change the default state and time to return to the default state using the settled function in an application program.

The LED POWER push-button does not affect some LEDs, such as digital inputs and counter inputs. These LEDs are on when a signal is applied to the corresponding input. The LEDs cannot be disabled to conserve power.

Status LED and Output

The status LED and output indicate alarm conditions. The STAT LED blinks and the STATUS output opens when an alarm occurs. The STAT LED turns off and the STATUS output closes when all alarms clear.

The STATUS output remains open continuously when an alarm condition is present. The STAT LED is on continuously during reset.

The STAT LED blinks a binary sequence indicating alarm codes. The sequences consist of long and short flashes, followed by an off delay of 1 second. The sequence then repeats. The sequence may be read as the Controller Status Code. A short flash indicates a binary zero. A long flash indicates a binary one. The least significant bit is output first. As few bits as possible are displayed, all leading zeros are ignored. The application program defines the values of the alarm codes.

The table below shows the meaning of the sequences.

Sequence	CONTROLLER STATUS CODE
Off	0 = Normal
1 Long	I/O Module Indication

1 Short, 1 Long	Register Assignment Checksum Indication
2 Long	I/O Module Error and Register Assignment Checksum Error
2 Short, 1 Long	Too many I/O operations requested
3 Long	5 = I/O Module Indication and too many I/O operations requested
3 Short, 1 Long	6 = Register Assignment Checksum Error and Too many I/O operations requested
4 Long	7 = I/O Module Indication and Register Assignment Checksum indication and too many I/O operations requested

I/O Module Indication

When the Status LED flashes the controller status code 1 (i.e. a long flash, once every second), one or more I/O module is not communicating with the controller. To correct the I/O module communication, do one of the following:

- Check that every module contained in the Register Assignment Table is connected to the controller. Check that the module address selected for each module agrees with the selection made in the Register Assignment Table.
- If a module is still suspect confirm the condition by removing the module from the Register Assignment Table. Write the changes to the controller. The Status LED should stop flashing.
- If a module is currently not connected to the controller, delete it from the Register Assignment Table. Write the changes to the controller. The Status LED should stop flashing.
- If unused modules are intentionally left in the Register Assignment Table, the I/O indication may be disabled from a selection box on the Register Assignment dialog..

Register Assignment Checksum Indication

When the status LED flashes the controller status code 2 (i.e. a short flash then a long flash followed by a 1 second of delay), this indicates the register assignment is not valid. To correct this initialize the register assignment using the Telepace or IEC 61131-1 software, or alternatively, perform a COLD BOOT as described in section **Cold Boot Mode** of this manual. The status LED should stop flashing.

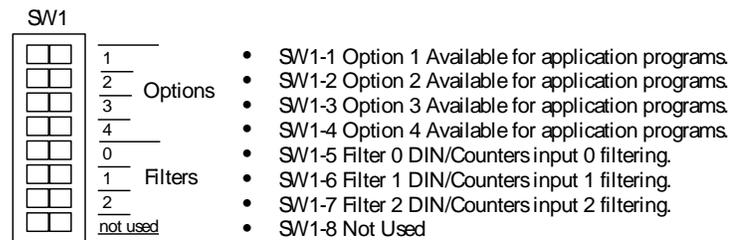
Too Many I/O Operations Requested Indication

When the status LED flashes the controller status code 4, this indicates that more I/O operations were requested than the I/O system could handle. This should only occur with custom C++ applications. It indicates the custom application is requesting I/O operations faster than the system

can process them and that the queue of pending operations is full. The custom application should reduce the rate at which it makes requests.

Configuration Switches

The SCADAPackI32 SCADAPack 32P SW1 is an eight position DIP switch. The first seven switches on SW1 are used to configure digital / counter input filtering and analog input and output ranges. SW1 is shown in the following diagram. Refer to **5232 Controller Board Field Wiring Connectors** for the location of SW1 on the SCADAPack 32P SCADAPack 32P.



C

Configuration switches can be changed with the power applied. Configuration changes take effect immediately.

To select configuration switch functions:

- Remove the module cover and locate the configuration switches. See section **Field Wiring Connections** for SW1 location.
- Slide the switch actuator to the right side of the switch to enable the switch function.
- Slide the switch actuator to the left side of the switch to disable the switch function.

Digital Input Filters

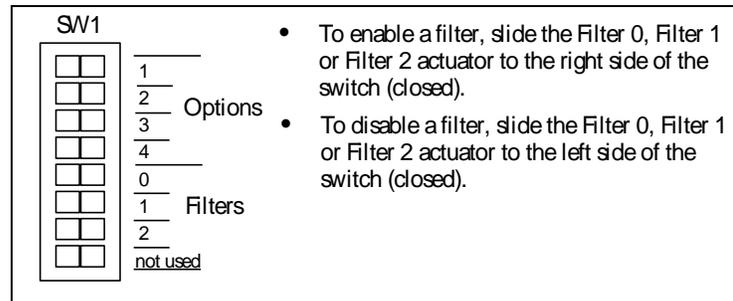
Each of the three digital / counter (DIN/Counters) inputs on the SCADAPack 32P SCADAPack 32P can be filtered. Filtering limits the maximum digital input or counter frequency to approximately 30Hz.

- Use a filter for 50 or 60Hz digital inputs and for low speed counting applications that experience contact bounce.
- Filtering is not required for high speed counting applications

SCADAPack 32P SCADAPack 32P SW1, switches Filter 0, Filter 1 and Filter 2 switches control the input filter functions.

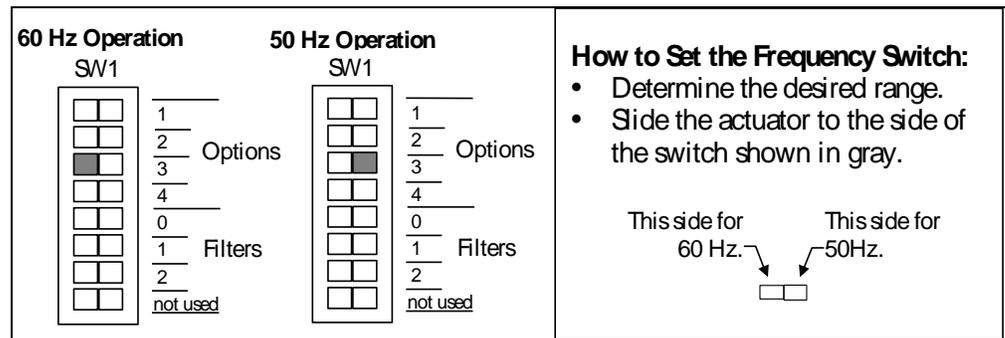
- Filter 0 for DIN/Counters input 0.
- Filter 1 for DIN/Counters input 1.

- Filter 2 for DIN/Counters input 2.



Line Frequency Selection

The SCADAPack 32P Option Switch 3 selects the line frequency option. The diagram below shows the switch settings for selecting the line frequency.



Firmware Loading

Periodically the firmware for a controller is updated to add new features or provide bug fixes. As they become available new firmware versions may be downloaded from www.controlmicrosystems.com.

Allowed connections for firmware loading for a **SCADAPack 33P** controller are **com1, com2 or com4** and the **Ethernet** port.

Maintenance

The SCADAPack 32P controllers require little maintenance. The 5V power LED indicates the status of the 5V supply. If the LED is off, and the SCADAPack 32P controller is powered using the integrated power supply, on board fuse F1 or F2 may require replacing. If the LED is off, and the SCADAPack 32P controller is powered using a 5103 power supply fuse F1 (5V) or F2 (24V) on the 5103 may require replacing. If the program is lost during power outages, the lithium battery may require replacement.

The analog input and output circuitry is calibrated at the factory and does not require periodic calibration. Calibration may be necessary if the module has been repaired as a result of damage.

If the SCADAPack 32P Controller is not functioning correctly, contact Control Microsystems Technical Support for information on returning the SCADAPack 32P Controller for repair.

 WARNING

Field wiring, including the wiring to the RS-232 ports,

Remove power or confirm the area is known to be non-hazardous before changing field wiring, including the wiring to the RS-232 ports.

Failure to follow these instructions can result in death, serious injury or equipment damage.
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Fuses

Two 1.0 Amp slow-blow fuses protects the power supply. The fuse is mounted under the cover. Fuse F1 protects the SCADAPack 32P when powered from the AC/DC Power Input. Fuse F2 protects the SCADAPack 32P controller when powered from the DC Power Input. Refer to section ***Field Wiring Connections*** for their location.

Remove power before servicing unit.

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

The fuse is a Littelfuse Nano-SMF. Littelfuse part number LF R452 001. Control Microsystems part number TBUM297256 for a kit of ten fuses.

In all cases investigate and correct the cause of the fuse failure before replacement. Common causes of blown fuses are wiring and excessive input voltages.

Refer to sections **Recommended DC Power Supply Configuration** and **Recommended 24VDC Battery Supply Configuration** for recommendations on reducing the DC inrush current if fuse blowing is being experienced in DC power supply applications.

Lithium Battery

A small lithium battery powers the CMOS memory and real-time clock when input power is removed. The voltage of a functioning battery should be greater than 3.0V. An application program can monitor this voltage. Refer to the programming manual for details.

The battery should not require replacement under normal conditions. The shelf life of the battery is 10 years. The battery is rated to maintain the real-time clock and RAM data for two years with the power off. Accidental shorting or extreme temperatures may damage the battery.

Battery Replacement Procedure

The battery is plugged into the circuit board and held in place with a tie-wrap. If necessary it can be replaced with an identical battery available from Control Microsystems.

- Save the existing program running in the SCADAPack, if applicable.
- Remove power from the SCADAPack.
- Remove the SCADAPack top cover and locate the battery. It is found at the far right side of the circuit board.
- The battery tie wrapped in place at the factory. This is to keep the battery in place during shipment. Remove the tie wrap using wire cutters.
- Remove the battery by gently lifting it straight up from the circuit board. The battery has two pins that mate with two sockets on the circuit board.
- Replace the battery. A replacement tie wrap is not necessary.
- Cold boot the controller. (Refer to section **Cold Boot Mode** section in of this manual for the Cold Boot procedure.)

If a cold boot is not done the behavior of the controller is unpredictable.

- The controller may now be programmed.

Specifications

Disclaimer: Control Microsystems reserves the right to change product specifications. For more information visit www.controlmicrosystems.com.

General

I/O Terminations	6,8,9 and 10 pole, removable terminal blocks. 12 to 22 AWG 15A contacts Screw termination - 6 lb.-in. (0.68 Nm) torque
Dimensions	8.40 inch (213mm) wide 4.625 inch (118mm) high 1.75 inch (44mm) deep
Packaging	corrosion resistant zinc plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing -40°C to 70°C -40°F to 158°F

SCADAPack 32P Controller

Processor	Hitachi SH-3 32-bit CMOS microcontroller 120 MHz. clock
Memory	4Mbytes Flash 8Mbytes SDRAM 1024kBytes CMOS RAM
Non-volatile RAM	CMOS RAM with lithium battery retains contents for 2 years with no power
Clock calendar	±1 minute/month at 25°C +1/-3 minutes/month 0 to 50°C
Internal temperature	Measurement range -40°C to 75°C. Accuracy ±5°C. Measurement range -40°F to 167°F. Accuracy ±9°F.
Lithium battery monitor	Accuracy ±0.2V.

Serial Ports

Communication	2 RS-232 serial ports (COM2, COM4)
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Ports	Data Terminal Equipment (DTE) 8 pin modular jack
Communication Ports	One serial port configurable RS-232 or RS-485 (COM1) RS-232: Data Terminal Equipment (DTE) 8 pin modular jack RS-485: 2 wire half duplex 4 wire full or half duplex optional termination resistors
Baud Rates (COM1, COM2, COM4)	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200.
Parity	none, even, or odd
Word Length	7 or 8 bits
Stop Bits	1 or 2 bits
Duplex (COM1, COM2, COM 4)	full or half with RTS/CTS control
Cable Length	RS-232 –maximum 50 ft (15.2 m) RS-485 –maximum 4000 ft (1200 m)
Protocol	TeleBUS (compatible with Modbus RTU and Modbus ASCII)
Protocol Modes	slave, master, master/slave, store and forward

Ethernet Port

Terminations	RJ-45 modular connector 10BaseT (twisted pair) 10M bits per second
Max Server Connections	20
Protocols Supported	Modbus/TCP Modbus RTU in UDP Modbus ASCII in UDP DNP in TCP DNP in UDP

Visual Indicators

COM1,COM2,	received data	(RxD) LED
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COM4	transmitted data (TxD) LED clear to send (CTS) LED data carrier detect (DCD) LED	
Ethernet LAN	Ethernet network receive or transmit data LED Ethernet port connected to a network LED	LAN LINK
	I/O module LED power status LED Status LED (shows functional status) 5V power LED (LED power not applicable) Run LED Forced I/O LED Counter Inputs 0, 1, 2 and 3 LEDs	
Push-button	LED power toggle	

Power Supply

Power Input	16Vrms \pm 20%
AC/DC PWR IN	13 to 24Vdc nominal 30Vdc maximum
DC power Input	30V maximum
DC PWR	10.7V typical turn on 9V typical turn off UL508 rated 13.75-28Vdc. Class 2.
5 Volt Power Output	5V at 1.3A capacity 5V at 500 mA required by SCADAPack 32P
DC power Output	20-24V with 1.0Vp-p maximum ripple. 300mA available at 5V/0.5A, de-rate linearly to 100mA
16Vrms applied	available at 5V/1.3A
Efficiency	80%, 12V on DC PWR input
Transient Protection	Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989

I/O Expansion Capacity

5000 I/O Expansion Capacity	Maximum 20 I/O modules with a further limitation of 16 modules of any one type.
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Digital Inputs

Input Points	4 Digital Input/Counter, opto coupler isolation
Digital Input, Counter	24Vrms/30V maximum input 10Vrms/10V minimum ON input 2V maximum OFF input Typical threshold voltage is 4 to 6V Typical input hysteresis 1.0V Typical input current 2.5mA at 10V 7mA at 24V
Counter Input Frequency (Counter 0, 1, 2)	5 kHz maximum with filter OFF 30 Hz maximum with filter ON
Counter Input Frequency (Counter 3)	500 Hz maximum
Transient Protection	Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989

Digital Outputs

Status Output	Opto coupler open collector transistor 30V, 60mA
Transient Protection	Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989

Approvals and Certifications

Hazardous Locations - North America	<p>Suitable for use in Class I, Division 2, Groups A, B, C and D Hazardous Locations. Temperature Code T4 per CSA Std C22.2 No. 213-M1987 / UL1604</p> <p>UL listed and CSA certified to the following standards:</p> <ul style="list-style-type: none"> • CSA Std. C22.2 No. 213-M1987 - Hazardous Locations. • UL Std. No. 1604 - Hazardous (Classified) Locations.
Hazardous Locations - Europe	<p>ATEX II 3G, Ex nA IIC T4</p> <p>per EN 60079-15, protection type n (Zone 2)</p> <p>Does not include Wireless versions.</p>
Hazardous Locations	<p>IECEX, Ex nA IIC T4</p> <p>per IEC 60079-15, protection type n (Zone 2)</p> <p>Does not include Wireless versions.</p>
ATEX and IECEX Applications only	<p>This equipment is to be installed in an enclosure certified for use, providing a degree of protection of IP54 or better. The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating. A T4 rating is acceptable.</p> <p>For products using Solid State Relays (5415, 5606 and 5607 modules and SCADAPack using 5606 and 5607 modules) A T4 rating is acceptable for maximum loads of 2A. When 3A loads are connected to the Solid State Relays, the maximum ambient rating is lowered to 50°C in order to maintain the T4 rating.</p>
Safety	<p>CSA (cCSAus) certified to the requirements of: CSA C22.2 No. 142-M1987 and UL508. (Process Control Equipment, Industrial Control Equipment)</p> <p>UL (cULus) listed: UL508 (Industrial Control Equipment)</p>
Digital Emissions	<p>FCC 47 Part 15, Subpart B, Class A Verification</p> <p>EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment</p> <p>C-Tick compliance. Registration number N15744.</p>
Immunity	<p>EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments</p>
Declaration	<p>This product conforms to the above Emissions and Immunity Standards and therefore conforms with the requirements of Council Directive 2004/108/EEC (as</p>

amended) relating to electromagnetic compatibility.
The Low Voltage Directive is not applicable to this
product.