

**SCADAPack 333E Hardware  
Manual**



**Documentation**

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## I SCADAPack 333E Hardware Manual



# Documentation

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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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Direct Worldwide +1-613-591-1943

Email [TechnicalSupport@controlmicrosystems.com](mailto:TechnicalSupport@controlmicrosystems.com)

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## 2 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 injury.

**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.

### 3 Introduction



**Figure 4.1: The SCADAPack 333E**

The SCADAPack 333E is an intelligent microprocessor based telemetry and control unit. The SCADAPack 333E may operate Stand-alone providing data acquisition, process control and telemetry functions, or in conjunction with other SCADAPack E RTUs, I/O modules, and peripherals such as PLC's. The SCADAPack 333E features extensive communications capabilities including Ethernet and USB interfaces and a powerful embedded micro-controller to provide the user with a sophisticated telemetry Remote Terminal Unit (RTU) in an Open Systems environment.

Many operational facilities can be configured, depending on the required telemetry and control application. This manual describes the hardware aspects of the SCADAPack 333E.

The SCADAPack 333E on-board switch mode power supply allows a wide range of voltage operation from a single external voltage supply (11 – 30 Vdc).

The use of FLASH memory chips allows new firmware to be downloaded both locally and remotely via the interfaces of the SCADAPack 333E, without removing the SCADAPack 333E from its enclosure, or



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removing the lid.

SCADAPack 333E configurations are maintained in the on-board battery backed RAM and may be modified locally or remotely.

The SCADAPack 333E is integrated with a lower I/O module known as the 5611. See the *SCADAPack E 5611 Hardware Manual* for more information.

---

## 4 Installation

The installation of SCADAPack E Smart RTUs requires mounting the controller on the 7.5mm by 35mm DIN rail and optionally connecting the SCADAPack E Smart RTU to a system I/O Bus.

### **5611 Input/Output Module**

The SCADAPack 333E is a SCADAPack E Smart RTU with an integrated 5611 lower I/O module. The Model 5611 Input Output Module adds four (4) analog inputs, 16 digital inputs, 10 relay digital outputs and two (2) optional analog output channels to the 5000 Series input/output system.

Refer to the *SCADAPack E 5611 Input / Output (I/O)* hardware manual for details on wiring, configuring and operation.

---

## 4.1 Field Wiring

SCADAPack E Smart RTUs use screw termination style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 12 to 22 AWG. The connectors are removable allowing replacement of the SCADAPack Controller without disturbing the field wiring. Leave enough slack in the field wiring for the connector to be removed.

### CAUTION

#### UNEXPECTED EQUIPMENT OPERATION

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

**Failure to follow these instructions can result in equipment damage.**

### WARNING

#### HAZARD OF ELECTRIC SHOCK

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

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

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.
- Push the connector onto the pins. Apply even pressure to both ends on the connector.

There are seven connectors for field wiring. Refer to [Figure 5.1: <sup>\[12\]</sup>SCADAPack 333E Board Layout <sup>\[12\]</sup>](#) for connector locations.

- The three RS-232 communication ports, COM 1, COM 2 and COM 3, connect to 8 pin modular jacks. Refer to Section [RS-232 Serial Communications Ports<sup>\[29\]</sup>](#) for pinout details and wiring diagrams for these modular jacks.
- One Ethernet port connects to an 8 pin modular jack. Refer to Section [Ethernet Communication<sup>\[48\]</sup>](#) for pinout details.
- The counter input wiring terminates in removable terminal connectors. Connector pinouts and wiring examples are described in sections of this manual.
- The USB ports use conventional USB-A and USB-B interface connectors. Refer to Section [USB Ports<sup>\[55\]</sup>](#) for details.

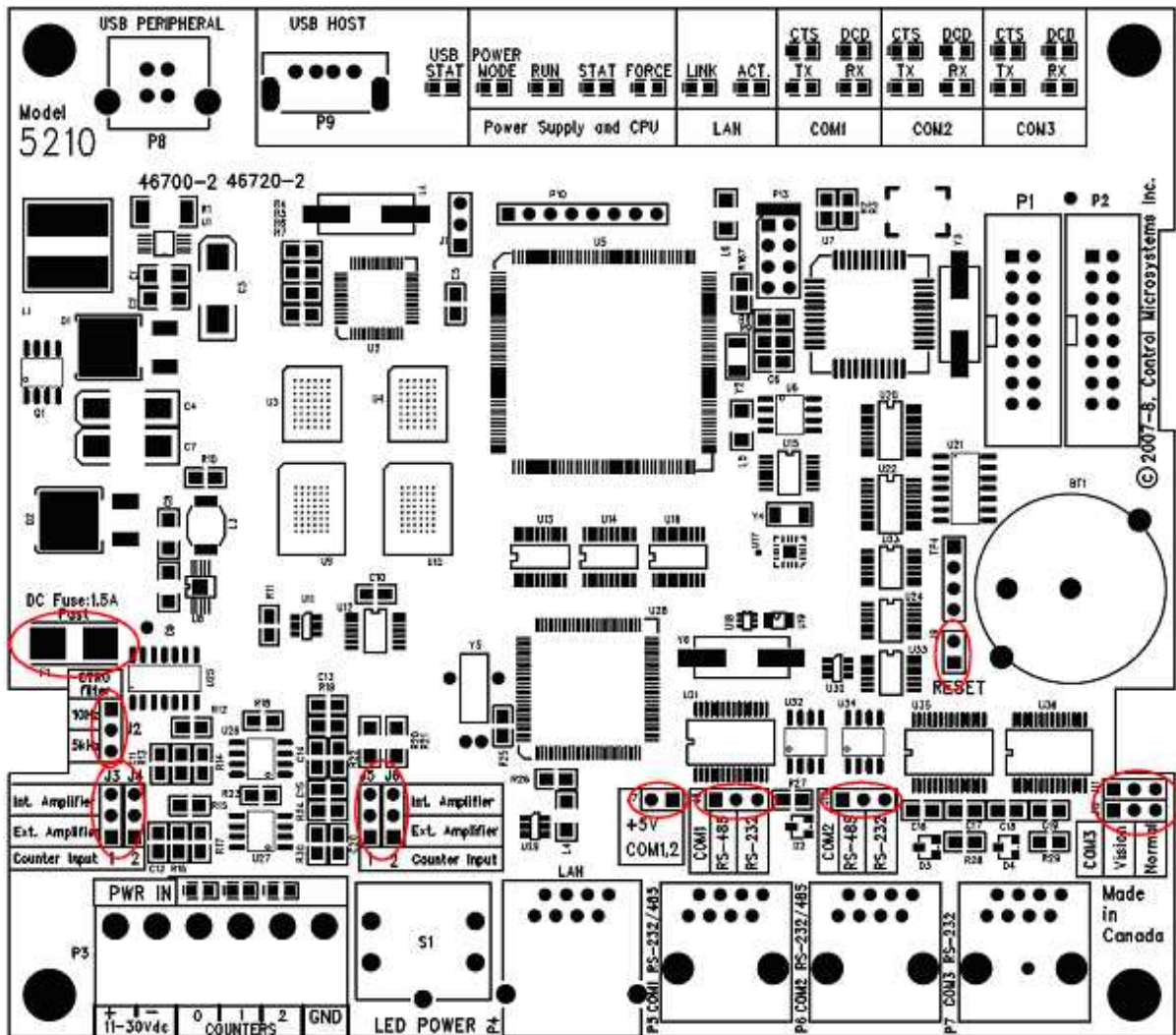


Figure 5.1: SCADAPack 333E Board Layout

## 5 Power Supply Overview & Requirements

The SCADAPack 333E is powered from an 11V DC to 30V DC input power source.

- Input power is applied to the positive (+) and negative (-) terminals on connector P3.

Refer to Section [Specifications](#)<sup>72</sup> of this manual for the minimum and maximum operating voltages and input power requirements.

- When the input voltage is below the minimum recommended voltage the SCADAPack 333E will turn off.
- Exceeding the maximum input voltage or applying a reverse voltage will blow the input power fuse.

Unlike some other members of the SCADAPack family, the SCADAPack 333E operates only on a DC power sources. Connections to power sources such as 16Vac transformers will blow the fuse and may cause damage to the SCADAPack 333E.

The DC power-input voltage is used to generate 5V at 1.2A (6W) some of which is used for the controller onboard circuitry. The output capacity of the 6W is sufficient to power the SCADAPack 333E controller board, a SCADAPack Vision operator interface with a limited number of 5000 Series I/O modules, such as the 5611 I/O Module integrated in to the SCADAPack 333E.

The power available for any 5000 Series expansion I/O modules is limited to 5.5W (5V at 1200mA) and depends on the controller features enabled.

### System Grounding

In many applications, it is desirable to ground the system by connecting the system power supply common, to the chassis or panel ground. The negative (-ve) side of the DC power input terminal as well as I/O point terminals labeled GND are connected to chassis ground.

## 5.1 Sample Power Calculations

**Example 1:** Assume we have a 5210 controller board with an integrated 5611 I/O module (SCADAPack 333E).

In this example it is assumed that the controller is powered from a 24V supply. the 4 Analog Inputs and both analog outputs are in use on the 5611. The controller will not be running in a reduced power mode.

The current requirement of the controller board and I/O module is summarized in the table below.

**Table 6.1: Sample Power Calculations (Example 1)**

	5V Current	24V Current
5210 Controller Board (base current in normal mode)	85mA	
LAN Port	135mA	
USB	35mA	
LEDs	100mA	
5611 I/O Module	235mA	10.3mA + 10 x 20mA = 211mA
<b>Total</b>	<b>590mA</b>	
Available for I/O expansion and COM/Visions	610mA remaining from 1.2A capacity	

In this case, 610mA at 5V power is available for any I/O expansion, and for COM/Vision power.

In this example, the total input power required from a 24V power supply is calculated as follows:

$$5V \text{ Power: } 5V \times .59A = 2.95W$$

Total Input Power Required =  $2.95W/0.85 = 3.47W$  (assuming 85% power supply efficiency).

Therefore your 24V power supply needs to be capable of providing  $3.47W/12 = 0.145A$  plus 0.211A for the 10 x 20mA current loops and the analog section of the 5611 for a total of 0.356A.

## 5.2 Power Management Features

The SCADAPack 333E provides a number of special features to reduce power consumption. Refer to [Figure 6.1: Power Management](#)<sup>[15]</sup> for an overview of the power management features.

These power management features are:

- [COM1 and COM2 power control](#)<sup>[17]</sup>
- [COM3 serial port power control for Vision Display](#)<sup>[18]</sup>
- LED Power control

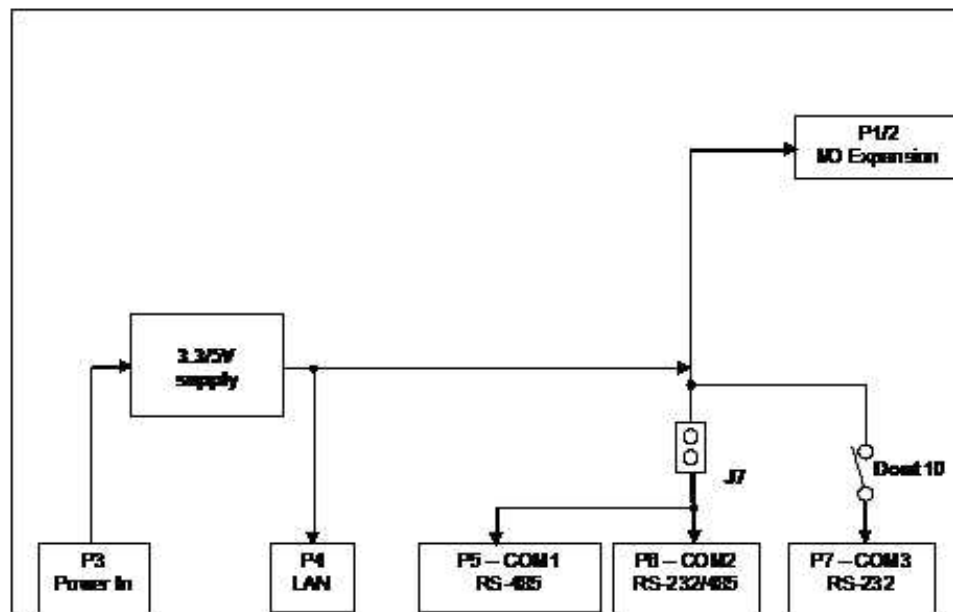


Figure 6.1: Power Management

System binary points and the power management functions they control are described in the following sections.

SCADAPack E Configurator controls for the power management modes are presented on the **General / Controller Settings** page.

SCADAPack Control/Status

LED Power State

LED Power always On

Vision Power Pin Enabled



### 5.2.1 COM1 and COM2 Serial Port Power Control

Serial ports on the SCADAPack 333E can have pin 1 on the RJ-45 connector connected to 5V. For COM1 and COM2 connectors, this pin can be connected to the 5V power supply by installing a jumper at **J7 (5V COM1,COM2)**. Refer to [COM3 Serial Port Power Control](#)<sup>181</sup> to enable 5V on COM3.

This 5V output is used to power Vision terminals and other Schneider Electric accessories. Check that cables connecting this pin have no voltages applied..

### 5.2.2 COM3 Serial Port Power Control

The COM3 serial port is for use with the SCADAPack Vision or other Human Machine Interface (HMI). Pin 1 of the RJ-45 connector provides a switched 5-volt power for the SCADAPack Vision or other HMI.

Refer to Section [COM3 RS-232 Serial Port](#)<sup>[34]</sup> for information on COM3 and Section [RS-232 Cables \(RJ-45 to SCADAPack Vision\)](#)<sup>[39]</sup> for wiring examples.

Also see [LED Power Control](#)<sup>[67]</sup>.

HMI power is controlled in the following ways.

- When the LED power is enabled, the HMI power is turned on.
- When the LED power is disabled and system **Digital Output 50750** is **ON** (SCADAPack E Configurator **Vision Power Pin Enabled ON**) HMI power is turned on.
- When the LED power is disabled and system **Digital Output 50750** is **OFF** (SCADAPack E Configurator **Vision Power Pin Enabled OFF**) HMI power is turned off.

System **Digital Input 50750** indicates the status of COM3 serial port power. **Digital Input 50750** is set when COM3 serial port power is on and is cleared when COM3 serial port power is off.

HMI power is turned on whenever the LED power is enabled. This feature is provided for service and diagnostics. Refer to Section [LED Power Control](#)<sup>[67]</sup> for further information on this feature.

The Vision Power Pin Enable control in the SCADAPack E Configurator **Control Modes** property page, located in the General folder, can also be used to control the Vision (or other HMI) power.

---

## 6 Internal Analog Points

Internal analog points measure RTU input Supply voltage and the controller's ambient temperature. These can be accessed from a user application program or via remote RTU communications.

### Supply voltage

#### System Analog point 50060

The input supply voltage measures the incoming power supply. It is useful for measuring the operating environment of the controller and returns a floating point value in the range 0 - 32.767V.

- Use the system point directly by assigning a point of this point number (50060) in the RTU database
- or, Read the system point into a user ISaGRAF application from an *Input Board* connection

### Internal temperature

#### Internal Temperature °C

##### System Analog Point 50062

This analog system point measures the ambient temperature at the controller circuit board in degrees Celsius. It is useful for measuring the operating environment of the controller and returns an integer value in the range -40 to 75.

The temperature reading represents temperatures in the range -40°C to 75°C. Temperatures outside this range cannot be measured.

- Use the system point directly by assigning an analog point of this point number (50062) in the RTU database
- Read the system point into a user ISaGRAF application as an *Integer* or *Real* variable from an *Input Board* connection

#### Internal Temperature °F

##### System Analog Point 50063

This analog system point measures the ambient temperature at the controller circuit board in degrees Fahrenheit. It is useful for measuring the operating environment of the controller and returns an integer value in the range -40 to 167.

The temperature reading represents temperatures in the range -40°C to 167°F. Temperatures outside this range cannot be measured.

- Use the system point directly by assigning an analog point at this point number (50063) in the RTU database
- Read the system point into a user ISaGRAF application as an *Integer* or *Real* variable from an input board

## 7 Internal Binary Points

Internal system binary points are provided which indicate the status such as the RTU input Supply voltage and the controller's on-board lithium battery. These can be accessed from a user application program or via remote RTU communications.

### Local Input Power Supply Low

#### Binary System Point 50206

An internal binary point indicates the condition of the input power supply. It compares the Supply Voltage System Analog Point 50060 with the Low Voltage Alarm Level set in SCADAPack E Configurator General / Control Modes page. If the input power supply is lower than the Low Voltage Alarm Level then this Binary System Point is activated.

- Use the system point directly by assigning a binary point to this point number (50206) in the RTU database
- For ISaGRAF applications, read the status point through an *Input Board* connection.

### Local On Board Battery Low

#### Binary System Point 50207

An internal binary point indicates the condition of a monitor on the lithium battery that maintains the non-volatile RAM in the controller.

If active, the point indicates that the on-board controller battery needs replacement.

- Use the system point directly by assigning a binary point to this point number (50207) in the RTU database
- For ISaGRAF applications, read the status point through an *Input Board* connection.

### COM3 Serial Port Power Control

#### Binary System Point 50750

See [COM3 Serial Port Power Control](#)<sup>18</sup>.

---

## 8 Counter Inputs

The SCADAPack 333E has three counter inputs, identified as Counter 0, 1 and 2.

Two of the counter inputs, Counter 1 and 2, are designed for millivolt level turbine meters.

The third, Counter 0, is a high level digital input for use with open collector/drain output amplifiers.

### CAUTION

#### UNEXPECTED EQUIPMENT OPERATION

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

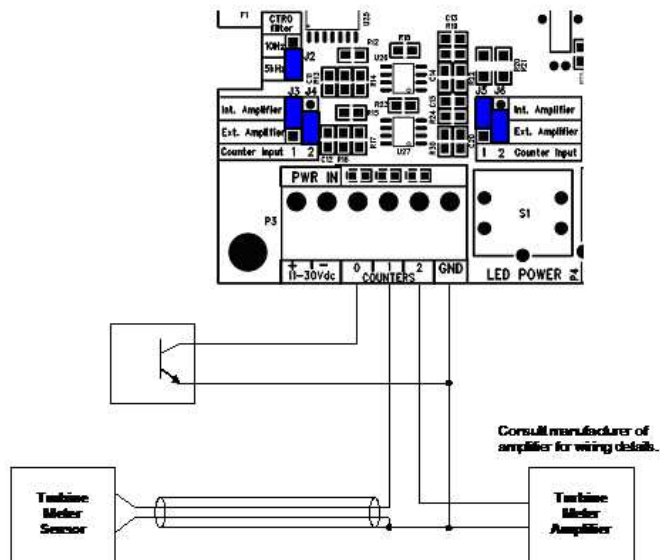
**Failure to follow these instructions can result in equipment damage.**

Refer to the appropriate software manual for information on using the SCADAPack 333E Counter Inputs in application programs.

- Assign RTU database point indexes to the *Counter In* field(s) using the 5210 I/O Module in SCADAPack E Configurator's *I/O / SCADAPack I/O* page.
  - For ISaGRAF applications use an **rtuXXctr** *Input Board* or complex equipment type for the SCADAPack 333E to read the controller board counters.
  - Use the Counter Input point directly by using a Counter Point in the RTU database for the assigned DNP Point Number
- 
- [Counter Input 0](#)<sup>[22]</sup>
  - [Turbine Meter Counter Inputs 1 and 2](#)<sup>[23]</sup>

## 8.1 Counter Input 0

Counter Input 0 is used to count contact closures. The input circuitry includes a 1000-ohm resistor from the counter input to the 5V power supply. Refer to [Figure 11.1: Counter Input Wiring](#)<sup>[22]</sup> for an example of wiring to an open collector output.



**Figure 11.1: Counter Input Wiring**

Counter 1 is shown as a millivolt input with a direct connection to a turbine meter sensor. Shielded wiring is used and that the shield is connected at one end only. Counter 2 is shown connected to an external turbine meter pre-amplifier. Refer to the following sections for details on connecting to the turbine meter counter inputs.

Counter 0 has a jumper selectable filter to set the maximum frequency of operation. [Figure 11.1: Counter Input Wiring](#)<sup>[22]</sup> shows the jumper installed in the lower or 5kHz. position. This is no filtering and allows Counter 0 to operate at the maximum frequency. When the jumper is installed in the upper or 10 Hz. position Counter 0 is filtered. The 10 Hz. position is used when the Counter 0 input has contact bounce or other higher frequencies that need to be filtered.

## 8.2 Turbine Meter Counter Inputs 1 and 2

The SCADAPack 333E allows for the direct connection of two turbine meter sensors. These sensors produce millivolt outputs and require no connection to an additional pre-amplifier when connecting to a SCADAPack 333E. The turbine meter inputs should be used in low noise environments with shielded cabling.

There are four jumper links positions: J3, J4, J5 and J6, associated with configuring the turbine meter counter inputs for either millivolt signals (direct to sensor) or high level signals from turbine meters with external amplifiers, dry contacts or open collector outputs.

Jumper positions J3 and J5 enable the SCADAPack's pre-amplifier on turbine counter input 1. Jumpers J4 and J6 enable the SCADAPack E Smart RTU pre-amplifier on turbine counter input 2.

- [Directly Connecting to Low Voltage Turbine Meters](#)<sup>24</sup>
- [Connecting to Higher Voltage Turbine Meters](#)<sup>27</sup>
- [Connecting to Open Collector / Dry Contact Turbine Meters](#)<sup>25</sup>

### 8.2.1 Directly Connecting to Low Voltage Turbine Meters

When connecting a low voltage (millivolt) turbine meter directly to counter input 1, enable the SCADAPack 333E internal pre-amplifier on this input as follows:

1. Install jumper J11 on the 'Int Amplifier' position.
2. Install jumper J9 on the 'See J11' position, as shown below.

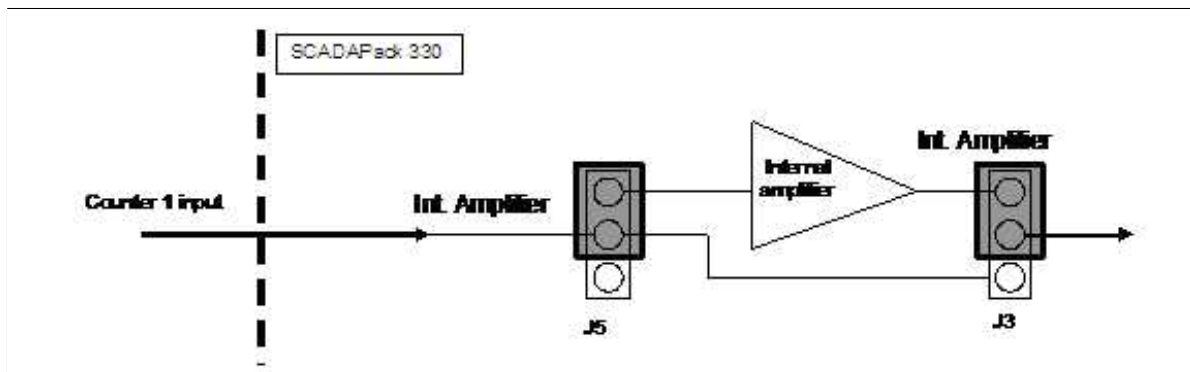


Figure 11.2: Setting Jumpers on Counter Input 1 for Low Voltage Turbine Meters

Similarly, when connecting a low voltage (millivolt) turbine meter directly to the counter input 2,

3. Install jumper J6 on the 'Int Amplifier' position.
4. Install jumper J4 on the 'See J12' position, as shown below.

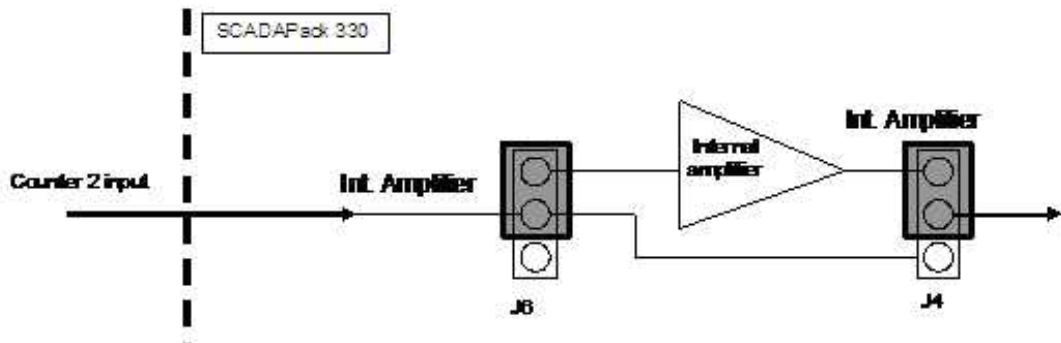


Figure 11.3: Setting Jumpers on Counter Input 2 for Low Voltage Turbine Meters



### 8.2.2 Connecting to Open Collector Outputs with Internal Pullup

Counter Inputs 1 and 2 can also be used with open collector outputs. In this configuration, the SCADAPack internal amplifiers need to be bypassed. There are 1000 ohm pull-up resistors connected to the input power supply.

This described above can only be used if the SCADAPack 333E is **powered from 12V**.

For Counter 1:

1. Install jumper J5 in the '**Ext Amplifier**' Position.
2. Install jumper J3 in the '**Ext Amplifier**' Position.

For Counter 2

3. Install jumper J6 in the '**Ext Amplifier**' Position.
4. Install jumper J4 in the '**Ext Amplifier**' Position.

Your application may have a specific current requirement as specified by the manufacturer. As shown in the figure above, the SCADAPack 333E includes a 1000-ohm resistor from the counter input to the DC input power source, when the jumpers J3 and J5 are installed in the 'Ext Amplifier' position, as described above. The above configuration is the recommended wiring for a Halliburton Low Power Pre-Amp, when the SCADAPack 333E is **powered from 12V**.

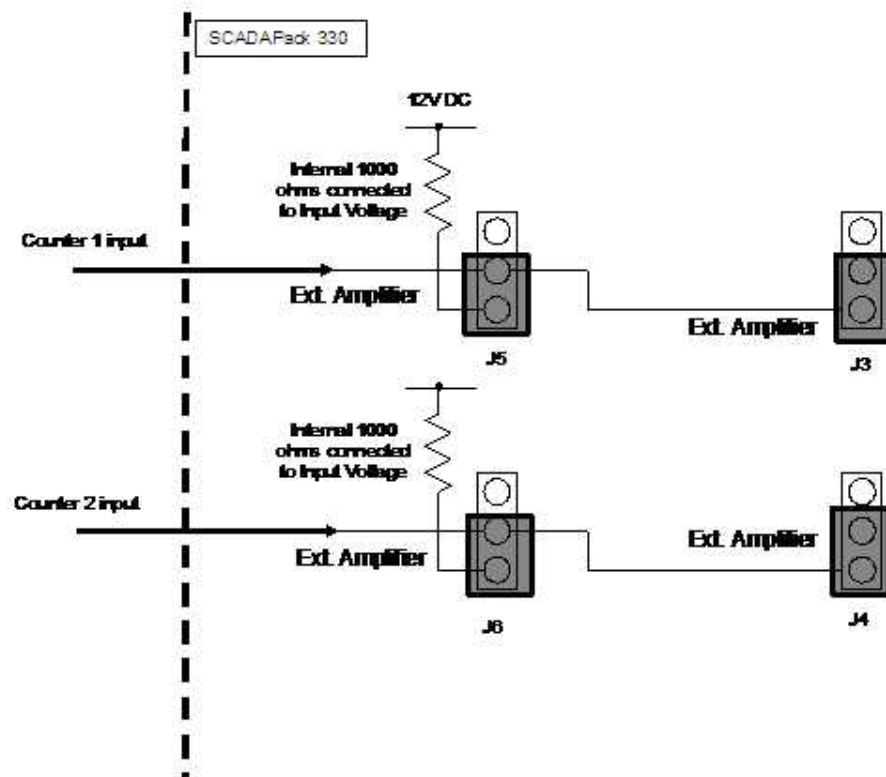


Figure 11.5: Setting Counter Inputs 1 and 2 for Open Collector outputs with Internal Pullup

The above configuration applies only when the controller is being powered using 12V.

### 8.2.3 Connecting to Open Collector Outputs with External Pullup

In applications that requires a pull-up resistor different than 1000 ohms, jumper J5 and J6 should not be installed in either position, while J3 and J4 should remain installed as shown in [Figure 11.4](#)<sup>[27]</sup>. The appropriate external pull-up resistor should then be connected between the counter input and the positive terminal of your power supply, as shown in [Figure 11.4](#)<sup>[27]</sup>.

For Counter 1:

- Install jumper J3 in the **Ext. Amplifier** position'.

Remove jumper J5 from the 'Ext Position'. This jumper is not used and can be stored, if required, on the single header pin as shown in [Figure 11.4](#)<sup>[27]</sup>.

For Counter 2

- Install jumper J4 in the **Ext. Amplifier** position.

Remove jumper J6 from the **Ext. Amplifier** position. This jumper is not used and can be stored, if required, on the single header pin as shown in [Figure 11.4](#)<sup>[27]</sup>.

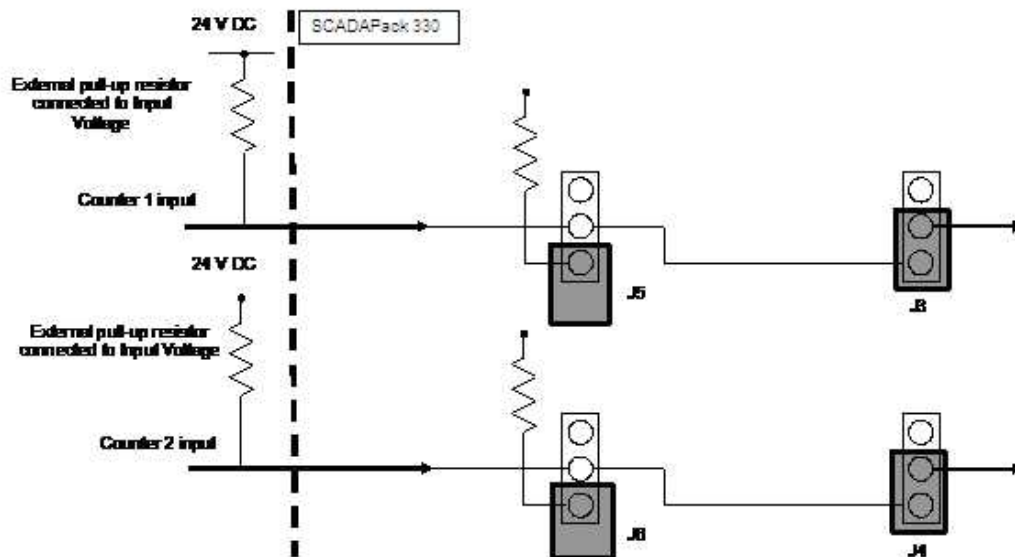


Figure 11.4: Setting Counter Input 1 and 2 for Open Collector outputs with External Pullup

## 9 Serial Communication

The SCADAPack 333E controller is equipped with three serial communication ports. COM1 and COM2 support RS-232 and RS-485 communication. COM3 is a dedicated RS-232 port.

The serial ports are labeled COM1, COM2 and COM3. Refer to [Figure 5.1: SCADAPack 333E Board Layout](#) for the location of the serial ports.

These ports correspond to PORT1, PORT2, PORT3 when using SCADAPack E Configurator and in SCADAPack E diagnostics.

COM1 can be configured for RS-232 or 2-wire RS-485.

COM2 can be configured for RS-232 or 2-wire RS-485.

COM3 is a dedicated RS-232 port.

Details of the operation and properties of each serial port is described in the following sections:

- [RS-232 Serial Communication Ports](#)
  - [RS-485 Serial Communication Ports](#)
-

## 9.1 RS-232 Serial Communications Ports

COM1, COM2 and COM3 support RS-232 communication. RS-232 wiring needs to use shielded cable. The shield should be connected to chassis ground at one point. Improperly shielded cable may result in the installation not complying with FCC or DOC radio interference regulations.

The three COM ports, when configured for RS-232 operation, have six signal lines implemented, plus signal ground and a configurable +5V output. Refer to [Table 12.2: RJ-45 RS232 Signals](#)<sup>[29]</sup> for the pinout of the connectors.

### Notes:

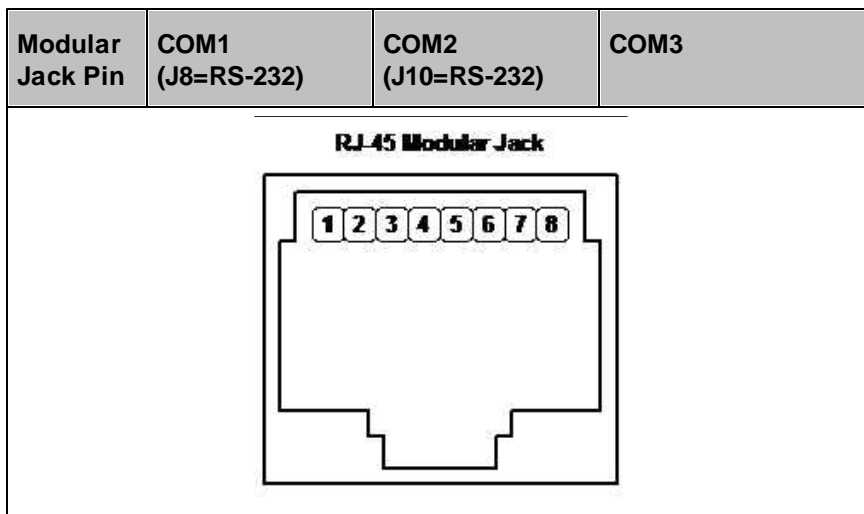
- The transmitters used on the three COM ports generate RS-232 compatible  $\pm 5V$  levels. Cables should be limited to a maximum of 10 ft (3m).

Also see

- [COM1 and COM2 RS-232 Serial Port](#)<sup>[32]</sup>
- [COM3 RS-232 Serial Port](#)<sup>[34]</sup>
- [RS-232 Wiring Examples](#)<sup>[36]</sup>
- [RS-232 Cables](#)<sup>[39]</sup>

**Table 12.1: RJ-45 RS232 Connections**

Modular Jack Pin	COM1 (J8=RS-232)	COM2 (J10=RS-232)	COM3
1	+5V	+5V	+5V Vision Power.
2	DCD	DCD	DCD/Test1
3	DTR	DTR	DTR/Test2
4	GND	GND	GND
5	RxD	RxD	RxD
6	TxD	TxD	TxD
7	CTS	CTS	CTS
8	RTS	RTS	RTS



**Figure 12.1: RJ-45 Connector Pinout**

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

**Table 12.2: RJ-45 RS232 Signals**

Pin	Function	Description
1	5V (Output)	This pin can be connected to the 5V power supply by installing a jumper at J14 on the SCADAPack 333E. This 5V output is used to power Vision terminals and other Schneider Electric accessories. Check that cables connecting this pin have no voltage applied.
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 needs to 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 needs to 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

---

Pin	Function	Description
		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. The LED is ON for a MARK level.

---

### 9.1.1 COM1 and COM2 RS-232 Serial Port

Serial ports COM1 and COM2 can be configured as either a six-line RS-232 port or as a two-wire RS-485 port.

Refer to [Figure 12.2: COM1 and COM2 RS-232 Configuration](#)<sup>32</sup> for locations of the jumpers required to configure COM1 and COM2 for RS-232 operation. COM1 (J8) and COM2 (J10) are both shown configured as RS-232. COM3 is RS-232.

For RS-485 operation refer to section [COM1 and COM2 RS-485 Serial Port](#)<sup>42</sup>.

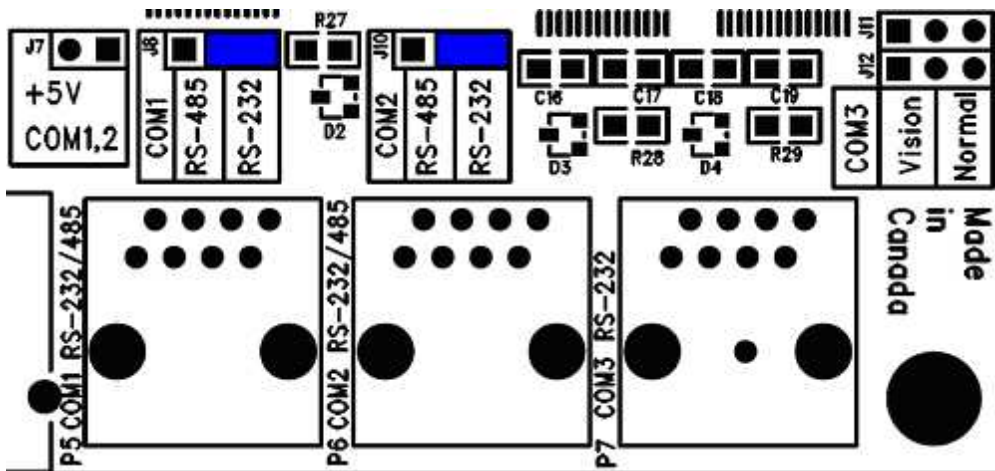


Figure 12.2: COM1 and COM2 RS232 Configuration

The following table shows the serial and protocol communication parameters supported by COM1 and COM2. These parameters are set from SCADAPack E Configurator or from an application program running in the SCADAPack 333E controller. Default values are set when a Factory Defaults Initialization is performed on the SCADAPack 333E controller.

Table 12.3: COM1 and COM2 RS232 Protocol Communication Parameters

Parameter	Supported Values
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Default: 9600
Duplex	Full or Half Default: Full (RS232)
Parity	Odd, None or Even Default: None
Data Bits	7 or 8 Bits Default: 8 Bits
Stop Bits	1 Bit
Serial Port Control	RS232 / RTS On, RS232 / RTS Off, RS232 Keyed



---

Parameter	Supported Values
	mode, RS485 2-wire (Half Duplex)
<b>Protocol</b>	ISaGRAF, DNP3, Command Line, PLC Device, ISaGRAF user, PPP/TCP/IP, TCP service, Modbus RTU slave, DNP VT service, IEC60870-5-103 Master, IEC60870-5-101 Slave or NTP GPS receiver, None
<b>Configuration &amp; Diagnostics</b>	When referenced in SCADAPack E Configuration and Diagnostic facilities, COM1 is known as PORT1 and COM2 is known as PORT2

---

### 9.1.2 COM3 RS-232 Serial Port

The SCADAPack 330 COM3 is designed to be able to operate with the SCADAPack Vision operator interface and has several features not found on COM1 and COM2. Two of the signals (DTR and DCD) are shared with the test signals used to detect the ON switch closure on the Vision interface. In order to use the signals as DTR, DCD jumpers J11, J12 need to have their jumper links installed in position “**Normal**”. To use the COM3 port with a Vision interface, jumpers J11, J12 need to have their jumper links installed in position “**Vision**”.

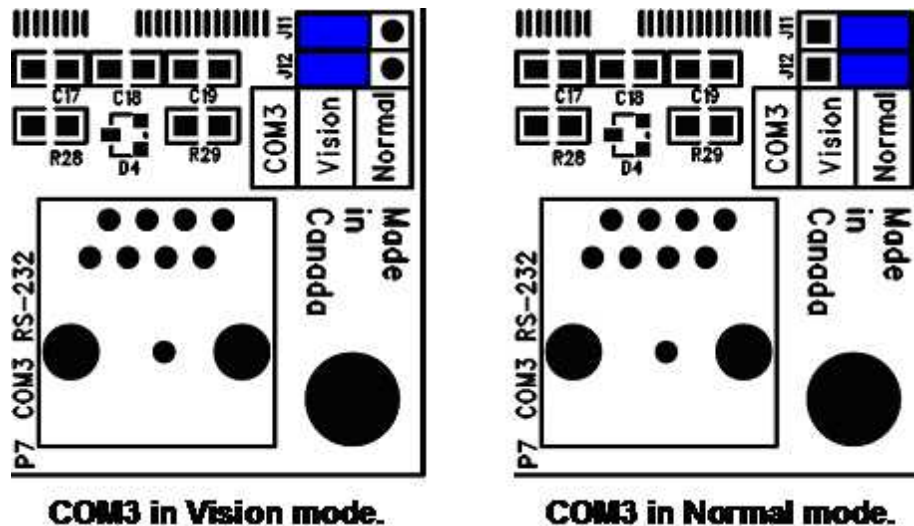


Figure 12.3: COM3 Vision and Normal Configuration

For proper operation, jumper links of J11 and J12 need to be installed both in the same position, either “**Vision**” or “**Normal**”

#### Notes:

- +5V is available on Pin 1 when turned on by the user under program control or, provided jumpers J11 and J12 have their jumper links in the “**Vision**” position, when the SCADAPack 330 detects the contact closure of the ON switch of the SCADAPack Vision or the LEDs are turned on.

This 5V output is used to power Vision terminals and other Schneider Electric accessories. Check that cables connecting this pin have no voltage applied.

- The SCADAPack Vision ON switch is wired to Pins 2 and 3. When a SCADAPack Vision is not used that jumpers J11 and J12 have their jumper links in the “**Normal**” position, to avoid generating a CPU interrupt due to a change in the state of the DCD signal.

The following table shows the serial and protocol communication parameters supported by COM3. These parameters are set from SCADAPack E Configurator or from an application program running in the SCADAPack 333E controller. Default values are set when a Factory Defaults Initialization is performed on the SCADAPack 333E controller.

COM3 Supports only RS-232.

**Table 12.3: COM3 Serial and Protocol Communication Parameters**

<b>Parameter</b>	<b>Supported Values</b>
<b>Baud Rate</b>	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Default: 9600
<b>Duplex</b>	Full or Half (protocol dependent)
<b>Parity</b>	Odd, None or Even Default: None
<b>Data Bits</b>	7 or 8 Bits Default: 8 Bits
<b>Stop Bits</b>	1 Bit
<b>Serial Port Mode</b>	RS232: DTR/DCD or VISION Display Mode (Jumper Selectable)
<b>Serial Port Control</b>	RS232 / RTS On, RS232 / RTS Off, RS232 Keyed mode
<b>Protocol</b>	ISaGRAF, DNP3, Command Line, PLC Device, ISaGRAF user, PPP/TCP/IP, TCP service, Modbus RTU slave, DNP VT service, IEC60870-5-103 Master, IEC60870-5-101 Slave or NTP GPS receiver, None
<b>Configuration &amp; Diagnostics</b>	When referenced in SCADAPack E Configuration and Diagnostic facilities, this port is known as PORT3

### 9.1.3 RS-232 Wiring Examples

## WARNING

### HAZARD OF ELECTRIC SHOCK

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

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

### DTE to DTE without Handshaking

There are several methods for wiring the RS232 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 RS232 COM port to DTE device.

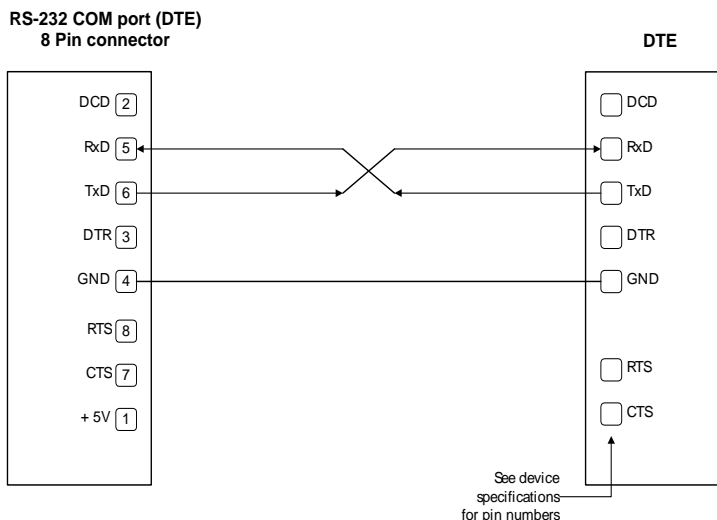


Figure 12.4: RS-232 DTE to RS-232 DTE without Handshaking

### 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 RS232 COM port with a DTE device requiring handshaking lines.

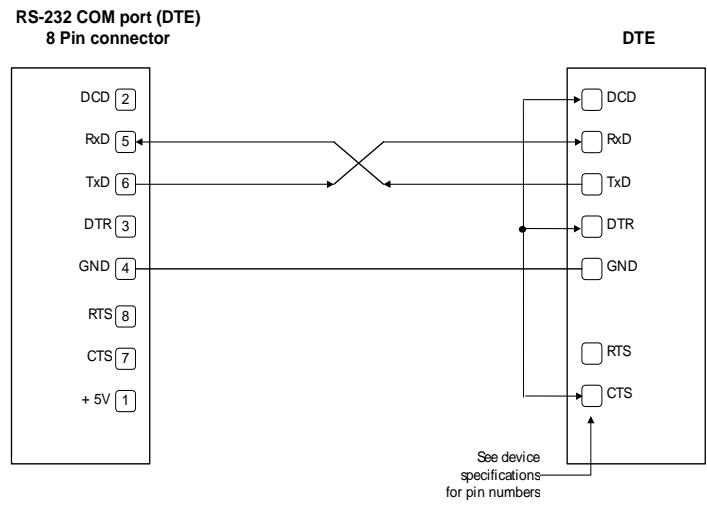
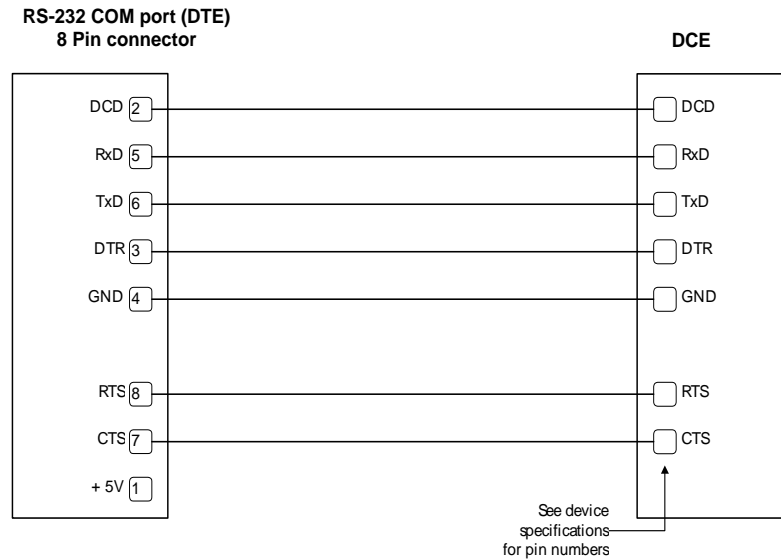


Figure 12.5: RS-232 DTE to RS-232 DTE with Handshaking

## DTE to DCE with Handshaking

DCE devices require different wiring. The handshaking lines need to be connected. Many DCE devices are half-duplex. Select half-duplex operation with these devices. The diagram below shows common connection of a SCADAPack 333E with a DCE device requiring handshaking lines.



**Figure 12.6: RS-232 DTE to RS-232 DCE With Handshaking**

#### 9.1.4 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 333E controller to DE-9P connector on a DTE such as a PC. A 10 ft. long cable is available from Schneider Electric as part number TBUM297217.

**Table 12.5: RJ-45 to DE-9S DTE Cable Description**

RJ-45 8 Pins	SCADAPack 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.			Wires not connected at this end.

##### RJ-45 to SCADAPack Vision

This cable is used to connect from COM3 (RJ-45 based RS-232) port on the SCADAPack 333E controller to DE-9P connector on a SCADAPack Vision. A 5-ft. long cable is available from Schneider Electric as part number TBUM297237.

**Table 12.6: RJ-45 to SCADAPack Vision Cable Description**

RJ-45 8 Pins	SCADAPack 333E Function	SCADAPack Vision Function	DE9S
			Shield connects to shell
6	TxD	RxD	2
5	RxD	TxD	3
4	GND	GND	5
3	DTR / Test 2	ON switch	1
2	DCD / Test 1	ON switch	4
1	+5V Out	+5V In	9
7 and 8 are not connected at this end.			Wires not 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 controller to DE-9S connector on a DCE such as a modem. A 15-inch long cable is available from Schneider Electric as part number TBUM297218.

**Table 12.7: RJ-45 to DE-9S DCE Cable Description**

RJ45	SCADAPack 333E 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



## 9.2 RS-485 Serial Communication Ports

- [COM1 and COM2 RS-485 Serial Port](#)<sup>42</sup>
- [RS-485 Bias & Termination Resistors](#)<sup>45</sup>
- [RS-485 Wiring Examples](#)<sup>47</sup>

### 9.2.1 COM1 and COM2 RS-485 Serial Port

COM1 and COM2 support RS-485 communications. RS-485 wiring needs to use shielded cable. The shield should be connected to chassis ground at one point. Improperly shielded cable may result in the installation not complying with FCC or DOC radio interference regulations.

Serial port COM1 and COM2 can be configured as either a six-line RS-232 port or as a two-wire RS-485 port. This section covers RS-485 operation. For RS-232 operation refer to Section [COM2 RS-232 Serial Port](#) <sup>32</sup>.

Refer to *Figure 12.7: COM1 and COM2 RS-485 Configuration* for the locations of the jumpers J8 and J10 required to configure COM1 and COM2. COM1 and COM2 are both shown configured to RS-485. COM3 is RS-232.

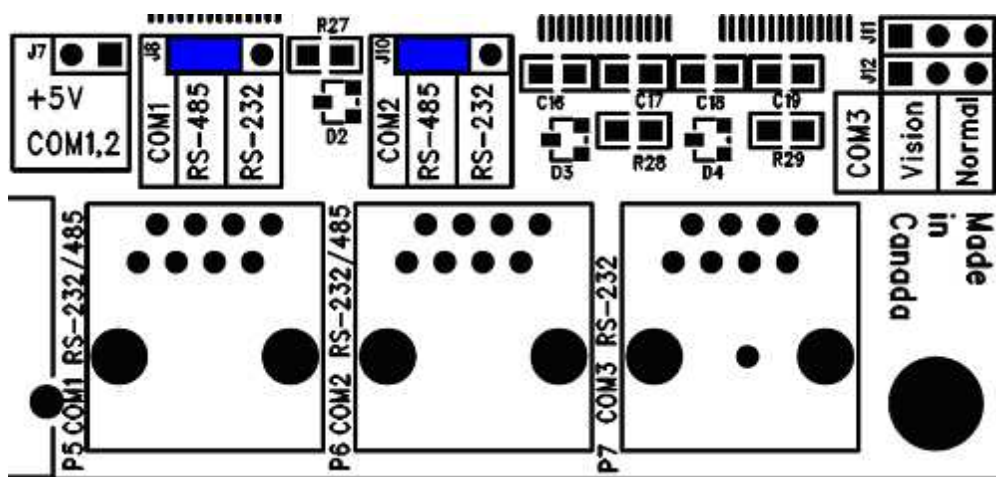




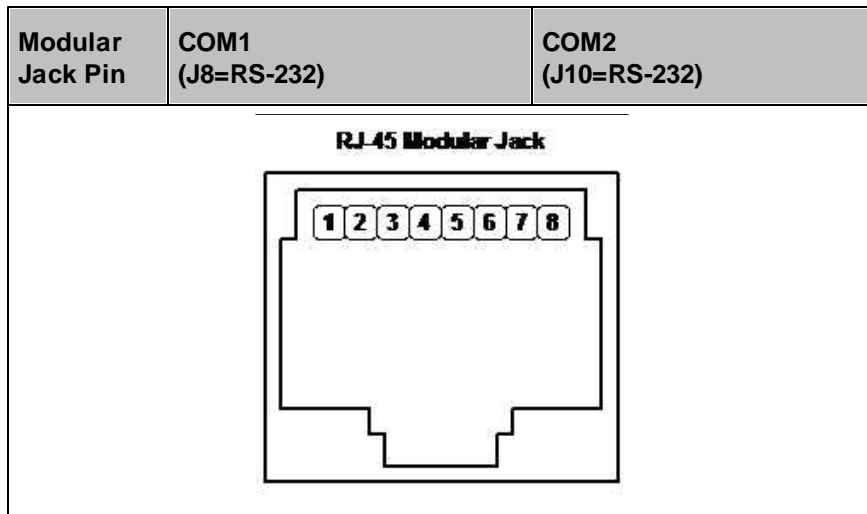


Figure 12.7: COM1 and COM2 RS-485

Table 12.8: RS-485 Connections

Modular Jack Pin	COM1 (J8=RS-232)	COM2 (J10=RS-232)
1	+5V when J7 installed	+5V when J7 installed
2	No Connection	No Connection
3	No Connection	No Connection
4	GND	GND
5	B 	B 
6	A 	A 
7	No Connection	No Connection
8	No Connection	No Connection





COM1 and COM2 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 specification for RS-485 recommends that the cable length should not exceed a maximum of 4000 feet or 1200 meters.

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. The grounds of the RS-485 devices on the network need to be within several volts of each other. Controller ground is connected to the chassis.

The following table provides a description of the function of each pin of the RJ-45 connector.

**Table 12.10: RJ-45 Connector Pin Description**

Pin	Function	Description
1	5V (Output)	This pin can be connected to the 5V power supply by installing a jumper at J14 on the SCADAPack 333E.
2	NC	Not used in RS-485 mode. Should be left open.
3	NC	Not used in RS-485 mode. Should be left open.
4	GND	This pin is connected to the system ground.
5	B  (Input/Output)	For RS-485 operation J13 needs to have the jumper link in position "RS-485" This pin is the B signal of the RS-485 bus.
6	A  (Input/Output)	For RS-485 operation J13 needs to have the jumper link in position "RS-485" his pin is the A signal of the RS-485 bus.
7	NC	Not used in RS-485 mode. Should be left open.
8	NC	Not used in RS-485 mode. Should be left open.

Connections to COM2 are made through a RJ-45 modular connector. COM2 supports two signals plus Ground and 5V power. The following diagram shows the pin connections for the RS-485 (RJ-45) port connector for COM2 operating in RS-485 mode.

The following table shows the serial and protocol communication parameters supported by COM1 and COM2. These parameters are set from SCADAPack E Configurator or from an application program running in the RTU.

Default values are set when a Factory Defaults Initialization (Cold Boot) is performed on the SCADAPack 333E controller.

**Table 12.9: COM1 and COM2 RS485 Communication Parameters**

Parameter	Supported Values
<b>Baud Rate</b>	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Default: 9600
<b>Duplex</b>	Half Default: Half
<b>Parity</b>	Odd, None or Even Default: None
<b>Data Bits</b>	7 or 8 Bits Default: 8 Bits
<b>Stop Bits</b>	1 Bit Default: 1 Bit
<b>Receive Flow Control</b>	None
<b>Transmit Flow Control</b>	None
<b>Protocol</b>	ISaGRAF, DNP3, Command Line, PLC Device, ISaGRAF user, PPP/TCPIP, TCP service, Modbus slave, DNP VT service, IEC 60870-5-103 Master, IEC 60870-5-101 Slave or NTP GPS Receiver  Default: DNP3
<b>Configuration &amp; Diagnostics</b>	When referenced in SCADAPack E Configuration and Diagnostic facilities, this port is known as PORT2

## 9.2.2 RS-485 Bias & Termination Resistors

### RS-485 Bias Resistors

The RS-485 receiver inputs on the controller are biased so that 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 5100 ohms from Ground to the B inputs and 5100 ohms from +5V to the A inputs.

### RS-485 Termination Resistors

Termination resistors are required in long networks operating at the highest baud rates. Networks as long 4000 ft. operating at 9600 baud will function without termination resistors. Terminations should only be considered if the baud rate is higher.

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.

If required, RS-485 networks are terminated with 120-ohm resistors on each end. The required 120-ohm resistor needs to be supplied and installed by the user. When using termination resistors it may be necessary to increase the line biasing by adding lower value bias resistors in order to generate at least 0.2V across RS-485 line. The suggested value of the bias resistors is 470 ohms. One bias resistor is installed from the B signal to COM. The second bias resistor is installed from the A signal to +5V. +5V is available on P8 pin 1 when J7 is installed.

---

9.2.3 RS-485 Wiring Examples

**⚠ WARNING**

**HAZARD OF ELECTRIC SHOCK**

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

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

A typical RS-485 wiring example is shown below. SCADAPack 333E COM1 is shown connected to a transmitter such as a Schneider Electric SCADAPack 4203 (COM2). The power for the transmitter comes from the same power source used to supply power to the SCADAPack 333E.

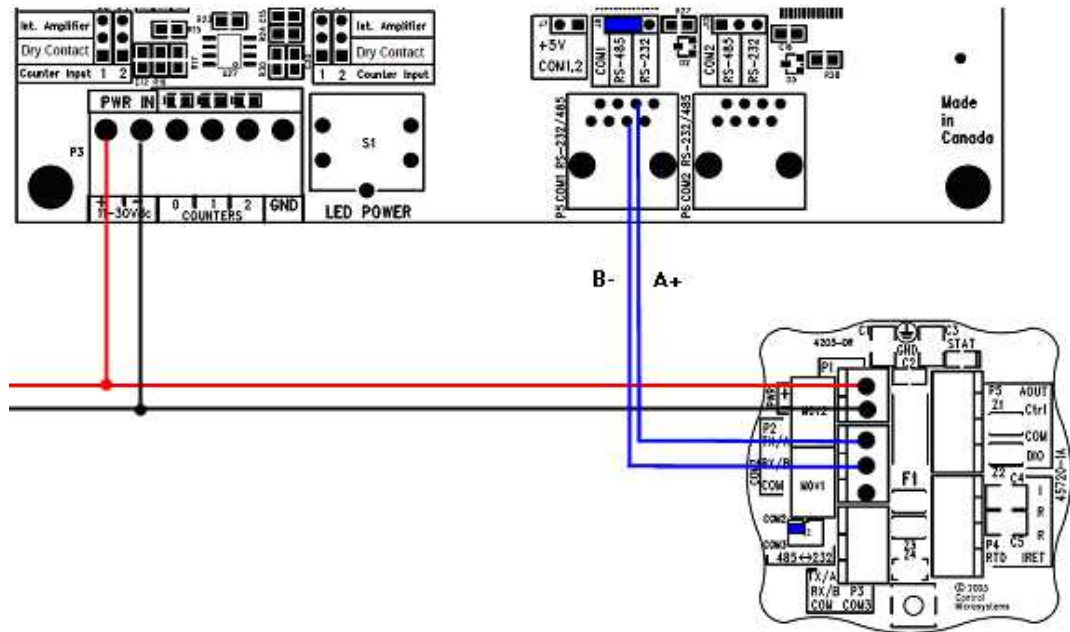


Figure 12.8: RS-485 Wiring

## 10 Ethernet Communication

The SCADAPack 333E controller has one 10/100Base-T Ethernet port. This is a single communications channel running at 10/100 Mb/s over unshielded, twisted - pair cabling, using differential signaling. It supports both half-duplex and full-duplex operation. The interface supports auto-negotiation for both the speed and half/ full-duplex mode selection.

- [LAN Port Settings](#)<sup>49</sup>
  - [RJ-45 Modular Connector for Ethernet](#)<sup>54</sup>
-



## 10.1 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 [RJ-45 Modular Connector for Ethernet](#)<sup>[54]</sup>.

Refer to Section [Field Wiring](#)<sup>[11]</sup> for the location of the LAN port on the SCADAPack controller board.

When referred to in SCADAPack E configuration and diagnostic facilities, the LAN port is referred to as communications channel number 10.

- [TCP/IP Settings](#)<sup>[50]</sup>
- [Modbus/TCP Settings](#)<sup>[51]</sup>

### 10.1.1 TCP/IP Settings

The following table shows the TCP/IP parameters supported by the LAN port. These parameters are set from SCADAPack E Configurator.

Default values are set when a Factory Default Initializations (Cold Boot) is performed on the controller.

**Table 13.1: TCP/IP Parameters**

Parameter	Supported Values
<b>IP Address</b>	In the format 255.255.255.255 Default: 0.0.0.0
<b>Subnet Mask</b>	In the format 255.255.255.255 Default: 0.0.0.0
<b>Gateway</b>	To enter a <i>Default Gateway</i> address, enter an IP Route Table entry as described below.

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 a default gateway node in the **IP Route Table** on the *Advanced TCP/IP* settings in the format:

Dest. IP Addr.	Subnet Mask	Dest. Port	Gateway IP	Metric
		Port Number of interface	Gateway IP Address	0

The gateway is statically assigned. Contact your network administrator to obtain the gateway IP address. The default gateway address needs to be a node on the subnet associated with the Dest. Port - i.e. it needs to be part of the subnet defined for the interface. In many cases this will be the Ethernet interface, and so the gateway IP address needs to be part of the Ethernet subnet.

For more information see the *SCADAPack E TCP/IP Technical Reference* manual.

### 10.1.2 Modbus/TCP Settings

#### Modbus/TCP Client (Master)

Modbus/TCP Client configurations are set by ISaGRAF I/O **mtcpXXX** i/o boards.

By default, the TCP/IP Service for the Modbus/TCP Client is DISABLED. To Enable it, use SCADAPack E Configurator **TCP/IP** page and check the **Modbus/IP (Client)** check box to enable the service.

For more information see *SCADAPack E Modbus Communication Interfaces* manual.

#### Modbus/TCP Server (Slave)

The following table shows the Modbus/TCP Server (slave) parameters supported by the SCADAPack E TCP/IP interfaces. These parameters are set from the ISaGRAF Workbench or from an application program running in the controller.

Default values are set when a Factory Defaults Initialization (Cold Boot) is performed on the RTU.

**Table 13.2: Modbus/TCP Server Parameters**

Parameter	Supported Values
<b>TCP/IP Services Modbus/TCP (Server)</b>	Enabled or Disabled Default: Disabled
<b>Maximum Server Connections</b>	Fixed: 20
<b>TCP Port</b>	Fixed: 502
<b>Modbus Addressing Type</b>	Fixed: Standard - Unit Identifier
<b>Modbus/TCP Server Unit Identifier</b>	Valid values are 1 to 247. Default: 1
<b>Store and Forward Messaging</b>	Not Supported

By default, the TCP/IP Service for the Modbus/TCP Server is DISABLED. To Enable it, use SCADAPack E Configurator **Slave / Modbus** page and check the **Modbus/TCP (Server)** tick-box.

The **Maximum Server Connections** parameter limits 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.

The **TCP Port** parameter is fixed by the Modbus/TCP protocol. 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.

The **Addressing** parameter is fixed to Standard addressing allowing choice of one of 247 station addresses for this RTU's Modbus/TCP server. The addressing is compatible with standard Modbus devices.

The **Modbus/TCP Server Unit Identifier** parameter sets the station number of the controller. The valid range is 1 to 247.

**Store and Forward Messaging** is not supported for Modbus/TCP communications on SCADAPack E RTUs.

For a complete description of Modbus/TCP Server operation, see the *SCADAPack E Modbus Communication Interfaces* manual.

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### 10.1.3 Modbus RTU in TCP Settings

#### Modbus RTU in TCP Client (Master)

Modbus RTU in TCP Client configurations are set by ISaGRAF I/O **mrtpXXX** I/O boards.

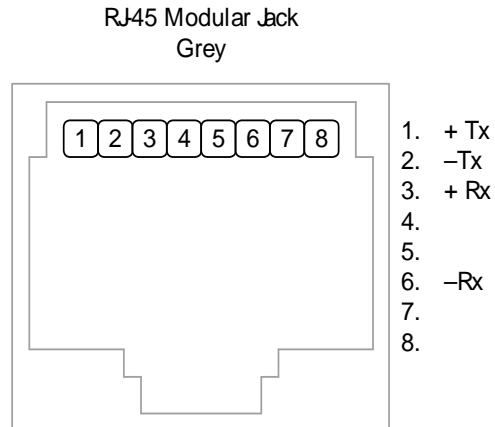
By default, the TCP/IP Service for the Modbus/IP (Client) is DISABLED. To Enable it, use SCADAPack E Configurator **TCP/IP** page and check the **Modbus/IP (Client)** tick-box.

For more information see *SCADAPack E Modbus Communication Interfaces* manual.

For a complete description of Modbus RTU in TCP Client operation, see the *SCADAPack E Modbus Communication Interfaces* manual.

## 10.2 RJ-45 Modular Connector for Ethernet

The SCADAPack 333E 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.



**Figure 13.1: RJ-45 Connector for Ethernet**

10/100Base-T has a maximum run of 100m or 350 feet, but the actual limit is based on signal loss and the noise 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 noise.

## 11 USB Ports & Connections

### USB Ports

The SCADAPack 333E controller has two USB 2.0 compliant ports, supporting both low-speed (1.5Mb/s) and full-speed (12Mb/s). One of the ports allows the controller to act as a host (Host Port), while the second port allows connection to a USB host (Peripheral Port), such as a notebook computer. The two USB ports can be used simultaneously.

- USB Peripheral Port - provides DNP3 communications for local connection to SCADAPack E Configurator.
- USB Host Port - Not currently supported by SCADAPack E operating system.

### **WARNING**

- USB ports may be permanently used in non-hazardous applications.
- USB ports may be used for corrective maintenance in locations classified as hazardous but are known to be in a non-hazardous state.

### USB Connections

The connectors used for the USB ports are compliant with the USB specification.

## 11.1 Peripheral & Host Port

### Peripheral Port

The peripheral port uses a USB series “B” receptacle.

The peripheral port is used for local connection of SCADAPack E Configurator using DNP3 protocol.

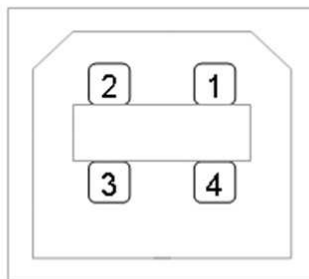
This ports correspond to PORT0 when using SCADAPack E Configurator and in SCADAPack E diagnostics.

A SCADAPack 333E will not draw any significant power from the host over the USB peripheral port. The following diagram shows the connections of the peripheral USB port.

**Table 14.1: USB Peripheral Port Communication Parameters**

Parameter	Supported Values
<b>USB</b>	USB 2.0 compliant, Peripheral port
<b>Data Rate</b>	Auto detect. Low-speed (1.5Mb/s) and Full-speed (12Mb/s)
<b>Protocol</b>	DNP3
<b>Configuration &amp; Diagnostics</b>	When referenced in SCADAPack E Configuration and Diagnostic facilities, this port is known as PORT0

USB series “B”  
receptacle



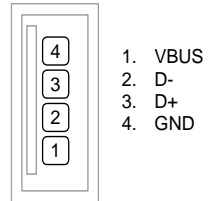
**Figure 14.2: Peripheral USB Port Connections**

### Host Port

The host port features a USB series “A” receptacle. For bus-powered USB devices, the host port can provide up to 100mA at 5V. The following diagram shows the connections for the host USB port.



USB series "A"  
receptacle



**Figure 14.1: Host USB Port Connections**

This port is not currently supported by the SCADAPack E operating system.

## 12 Operation

- [Operating Modes](#)<sup>[59]</sup>
  - [LED Indicators](#)<sup>[66]</sup>
  - [LED Power Control](#)<sup>[67]</sup>
  - [Jumpers](#)<sup>[67]</sup>
  - [Status LED](#)<sup>[68]</sup>
-

## 12.1 Operating Modes

### **WARNING**

#### **UNEXPECTED EQUIPMENT OPERATION**

Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU prior to initializing the SCADAPack E RTU.

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

A SCADAPack 300E may start up in RUN, SERVICE, COLD BOOT or FACTORY BOOT modes.

- Start up in the RUN mode automatically loads the RTU database, executes ISaGRAF programs in the controller memory, and communicates on its interfaces, as per its configuration.
- Start up in the SERVICE mode stops the ISaGRAF user applications and overrides RTU ports with DNP3 communications at node address "0" to allow controller reprogramming and initialization.
- Start up in the COLD BOOT mode initializes the controller and erases user application programs.
- Start up in FACTORY BOOT reformats the Flash file system, initializes the controller and erases user application programs.

Each boot mode is determined by the amount of time that the LED power switch is depressed when power is applied or a board reset occurs.

The boot mode is not performed until the LED power switch is released. As such power can be removed prior to releasing the LED power switch without performing the selected boot mode.

The following sections describe in detail the selection of each operating mode.

- [Run Mode](#)<sup>[60]</sup>
- [Service Mode](#)<sup>[61]</sup>
- [Cold Boot Mode](#)<sup>[62]</sup>
- [Factory Boot Mode](#)<sup>[64]</sup>
- [Boot Mode Effects](#)<sup>[65]</sup>

### 12.1.1 Run Mode

The RUN mode is the normal operating mode of the controller. No action is required to select RUN mode.

When the controller starts:

- The RTU loads the defined serial and Ethernet communication parameters, for every COM port.
  - RTU database configuration and point attributes are loaded
  - ISaGRAF application programs are loaded and executed
  - If there is no ISaGRAF application program in RAM and there is an application program in flash ROM then the flash ROM program will be loaded in RAM and executed.
-

### 12.1.2 Service Mode

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

When a SCADAPack 300E controller starts in SERVICE mode:

- DNP3 node address zero (0) is set, enabling communication via SCADAPack E Configurator at a known DNP address. Connect SCADAPack E Configurator to USB, or serial PORT 2 or PORT 3.
- The ISaGRAF user applications are stopped.
- Programs and configurations are retained in non-volatile memory.
- Serial port configurations are restored to default (see tables below)

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

1. Remove power from the controller.
2. Hold down the LED POWER button.
3. Apply power to the controller.
4. Continue holding the LED POWER button until the **STAT LED** turns on.
5. Release the LED POWER button.

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

### Default Port Settings for SCADAPack 333E

	USB	COM1	COM2	COM3
Serial interface type	USB Peripheral	RS485*	RS232*	RS232
Port speed	Auto	9600 bps	9600 bps	9600 bps
Duplex	-	Half	Full	Full
Parity	-	None	None	None
Data bits	-	8-bits	8-bits	8-bits
Stop bits	-	1-bit	1-bit	1-bit
Protocol	SCADAPack E Configurator DNP3	None (disabled)	DNP3	ISaGRAF

\* Default software configuration setting shown. Check that hardware jumpers match this setting.

### 12.1.3 Cold Boot Mode

COLD BOOT mode is used when it is required to clear a configuration from the RTU. It is optional after installing new SCADAPack Econtroller firmware.

Cold Boot mode does not format the Flash file system (see [Factory Boot Mode](#)<sup>64</sup> for doing this)

When a SCADAPack 300E controller starts in COLD BOOT mode:

- The ISaGRAF user applications are erased.
- The RTU point database is cleared
- RTU configurations are returned to default
- DNP3 Device Address is set to 0
- Ethernet configurations are restored to default (Ethernet communications disabled)
- Serial port configurations are restored to default (see tables below)

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

1. Remove power from the SCADAPack controller.
2. Hold down the LED POWER button.
3. Apply power to the SCADAPack controller.
4. Continue holding the LED POWER button for 20 seconds until the **STAT LED** begins to flash on and off repeatedly.
5. Release the LED POWER button.

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

### Default Port Settings for SCADAPack 333E

	USB	COM1	COM2	COM3
Serial interface type	USB Peripheral	RS485*	RS232*	RS232
Port speed	Auto	9600 bps	9600 bps	9600 bps
Duplex	-	Half	Full	Full
Parity	-	None	None	None
Data bits	-	8-bits	8-bits	8-bits
Stop bits	-	1-bit	1-bit	1-bit
Protocol	SCADAPack E Configurator DNP3	None (disabled)	DNP3	ISaGRAF

\* Default software configuration setting shown. Check that hardware jumpers match this setting.

#### 12.1.4 Factory Boot Mode

FACTORY BOOT mode is used to reformat the Flash File system and initialize the SCADAPack 300E controller to factory default settings.

When the controller starts in FACTORY BOOT mode:

- The ISaGRAF user applications are erased.
- The RTU point database is cleared
- RTU configurations are returned to default
- Flash File system is reformatted
- Ethernet configurations are restored to default (Ethernet communications disabled)
- Serial port configurations are restored to default (see tables in [Cold Boot Mode](#)<sup>621</sup>)

FACTORY BOOT mode is selected by performing the following procedure:

1. Remove power from the SCADAPack controller.
2. Hold down the LED POWER button.
3. Apply power to the SCADAPack controller.
4. Continue holding the LED POWER button for longer than 30 seconds until the **STAT LED** turns solid.
5. Release the LED POWER button.

The FACTORY boot will take approximately 60 seconds to complete. During this time the controller may appear unresponsive while the file system is being formatted to fix any corruption. The STAT LED will remain on until the FACTORY boot has completed and the controller restarts.

---



### 12.1.5 Boot Mode Effects

The table below summarizes the effects of the various boot modes.

**Table 15.1: Effects of Various Boot Modes**

Run Mode	Service Mode	Cold Boot	Factory Boot	Action
	X	X	X	DNP node address set to zero (0)
	X			serial ports protocol set to DNP3
		X	X	serial settings set to default
		X	X	LED power set to default
		X	X	Database initialized
		X	X	ISaGRAF applications erased
			X	Files are erased
			X	Flash File System reformatted
X				ISaGRAF applications started
	X			Settings retained in non-volatile memory
		X	X	ISaGRAF applications in flash erased
		X	X	Protocols are set to defaults

## 12.2 LED Indicators

The table below describes the LEDs on the SCADAPack 333E. LEDs can be disabled to conserve power.

**Table 15.3: SCADAPack 333E LED Descriptions**

LED	Function
Power Mode	On when operating and the LEDs are enabled. Off when the LEDs are disabled Off when powered off
RUN	Blinking every 1.5 secs when the RTU is operating normally For detailed information about indication of RTU startup phases see the <i>SCADAPack E Operational Reference</i> manual.
STAT	Blinking when there is a status code requiring attention. The status code and description can be viewed from SCADAPack E Configurator's General   Controller Status page. The status code is also available in SCADAPack E Analog System Point 50020
FORCE	On when I/O points are forced (LOCKED by ISaGRAF)
USB STAT	This is under control of SCADAPack E Binary System Point 50611. It may be controlled by an ISaGRAF application or from protocol control commands.
LINK	On when the LAN port has established a link
ACT.	On to signal activity on the LAN port
RX	On when receiving data on the corresponding serial port
TX	On when transmitting data on the corresponding serial port
CTS	On when the CTS input is asserted COM2
DCD	On when the DCD input is asserted COM2
Counter 0	On when the counter input is present and low
Counters 1,2	When the input is configured to use an external amplifier, the LED is on when the counter input is present and low. When the input is configured to use the internal amplifier, the LED is on when input pulses are present

## 12.3 LED Power Control

The SCADAPack 333E controller board can disable the LEDs on the controller board and the 5000 Series I/O modules to conserve power. This is particularly useful in solar powered or unattended installations.

The Power Mode LED on the controller board indicates the LED power state. It is on when the controller board enables LED power.

The LED POWER push-button toggles the LED power signal. Press the LED POWER push-button to toggle LED power from off to on, or from on to off.

The SCADAPack E Configurator enables the LED power mode.

If the **LED Power always On** control in the General / Controller Modes page is active, the LED POWER button has no effect and the SCADAPack 333E LEDs and 5000 Series I/O LEDs are on.

If the **LED Power always On** control SCADAPack E Configurator is inactive, the state of LEDs at RTU startup is Enabled. 60 seconds after the controller has started the LEDs will be Disabled. While the controller is running, when the LED POWER button is pushed the LED displays are Enabled for a period of 60 seconds. After this time the LED displays are again disabled.

The LED state is independent of the Vision display controls on the SCADAPack 300E RTU. The user may programmatically relate these items together through ISaGRAF logic if required (e.g. activate the DC/DC converter and Vision display when the LEDs are activated).

## 12.4 Jumpers

Headers on the SCADAPack 333E are user configurable and are described in the appropriate sections of this manual. Some headers and jumpers on the controller are reserved for manufacturing and test functions. Refer to [Figure 5.1: SCADAPack 333E Board Layout](#) for the location of jumpers.

The following table lists the jumpers and the relevant section of this manual.

**Table 15.4: SCADAPack 333E Jumpers**

Jumper	Function
J3, J5	Counter Input 1 Type See <a href="#">Figure 11.1: Counter Input Wiring</a>
J4, J6	Counter Input 2 Type See <a href="#">Figure 11.1: Counter Input Wiring</a>
J7	+5V Power to COM1 and COM2 See <a href="#">COM2 RS-232 Serial Port</a>
J8	COM1 RS-232 / RS-485 mode selection See <a href="#">COM1 and COM 2 RS-232 Serial Port</a>
J9	Reset Jumper (Performs a controller board reset similar to power cycle)
J10	COM2 RS-232 / RS-485 mode selection See <a href="#">COM1 and COM 2 RS-232 Serial Port</a>
J11, J12	COM3 Vision / Normal mode select <a href="#">COM3 RS-232 Serial Port</a> These jumpers need to be both in the same position, either <b>Vision</b> or <b>Normal</b> .

## 12.5 Status LED

The STAT LED indicates the current RTU status condition.

The STAT LED blinks when a status code requiring attention is present

The STAT LED turns off when the status code is returned to 0.

The RTU status condition causing the STAT LED can be determined from the RTU's system point **50020** or by viewing SCADAPack E Configurator General / Controller Status page - **System Error Code** field.

To clear the status code and the STAT LED indicator, press the **Clear Errors** button on SCADAPack E Configurator General / Controller Status page.

## 13 Maintenance

The SCADAPack 333E, as with other SCADAPack controllers, requires little maintenance. The Power Mode LED indicates the status of the 5V supply. If the LED is off, the on board fuse F1 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 controller is not functioning correctly, contact Schneider Electric Technical Support for information regarding returning the SCADAPack E Smart RTU for repair.

### **WARNING**

#### **HAZARD OF ELECTRIC SHOCK**


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

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


- [Fuses](#)<sup>69</sup>
  - [Lithium Battery](#)<sup>70</sup>
-

## 13.1 Fuses


A single 1.5 Amp fast-blow fuse provides protection for the power supply. The fuse is mounted under the cover. Refer to [Figure 5.1: SCADAPack 333E Board Layout](#)<sup>(12)</sup> for the location.

 <b>WARNING</b>
<b>RISK OF EXPLOSION</b> Before replacing the fuse verify that the area is non-hazardous and disconnect power. <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b>

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

 <b>WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b> Evaluate the operational state of the equipment monitored and controlled by the SCADAPack E RTU. <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b>

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.

 <b>WARNING</b>
<b>UNEXPECTED EQUIPMENT OPERATION</b> Replace the fuse with a fuse of the same rating. <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b>

The fuse is a Littelfuse Nano-SMF, part number **045301.5** or **R45101.5**. This fuse is available in a package of 10 from Schneider Electric as part number TBUM297327.

In every case investigate and correct the cause of the blown fuse before replacement. Common causes of a blown fuse are short circuits and excessive input voltages.

## 13.2 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 (typically 3.5 ~ 3.7V). The SCADAPack 300E RTUs monitor the lithium battery and provide a status indication if the battery voltage is less than 3.0V (RAM Battery Low - **Binary System Point 50207**). See [Internal Binary Points](#)<sup>[20]</sup>.

The battery should not require regular 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 Schneider Electric.

1. Save the existing configuration and ISaGRAF user applications running in the RTU, if applicable.
2. Remove power from the RTU.
3. Remove the RTU top cover and locate the battery. It is found at the far right side of the circuit board.
4. The battery is wrapped in place at the factory. This is to keep the battery from becoming disconnected during shipment. Remove the tie wrap using wire cutters.
5. 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.
6. Replace the battery. A replacement tie wrap is not necessary.
7. Cold boot the controller. (Refer to Section [Cold Boot Mode](#)<sup>[62]</sup> in of this manual for the Cold Boot procedure.)

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

8. The controller's configuration and applications may now be loaded.
-

## 14 Troubleshooting

### Counter Inputs

Condition	Action
Input LED does not come on when input signal is applied.	Check the input signal at the termination block. It should be at least 50% of the counter input range. Check the LEDs are turned on.

## 15 Specifications

*Disclaimer:* Control Microsystems Inc. reserves the right to change product specifications without notice. For more information visit <http://www.schneider-electric.com>.

- [General & Controller](#)<sup>[73]</sup>
  - [Data Capacity](#)<sup>[74]</sup>
  - [Serial Ports](#)<sup>[75]</sup>
  - [Ethernet Port & USB Ports](#)<sup>[77]</sup>
  - [Visual Indicators](#)<sup>[78]</sup>
  - [Power Supply & I/O Expansion](#)<sup>[79]</sup>
  - [Counter Inputs](#)<sup>[81]</sup>
-



## 15.1 General & Controller

### General

<b>I/O Terminations</b>	8 pole, removable terminal block 12 to 22 AWG 15A contacts Screw termination - 6 lb.-in. (0.68 Nm) torque
<b>Dimensions</b>	5.65 inch (144mm) wide 5.00 inch (127 mm) high 1.80 inch (45mm) deep
<b>Packaging</b>	Corrosion resistant zinc plated steel with black enamel paint
<b>Environment</b>	5% RH to 95% RH, non-condensing -25°C to 70°C (-13°F to 158°F) operation -40°C to 85°C (-40°F to 185°F) storage

### Controller

<b>Processors</b>	32-bit ARM7-TDMI microcontroller, 32 MHz clock integrated watchdog timer Microcontroller I/O co-processors, 20 MHz clock
<b>Memory</b>	16MBytes FLASH ROM 4MBytes CMOS RAM 4kBytes EEPROM
<b>Non-volatile RAM</b>	CMOS RAM with lithium battery retains contents for 2 years with no power
<b>Clock calendar</b>	±1 minute/month at 25°C +1/-3 minutes/month 0 to 50°C
<b>Internal temperature</b>	Measurement range -40°C to 75°C. Accuracy ±5°C. Measurement range -40°F to 167°F. Accuracy ±9°F.
<b>Lithium Battery Monitor</b>	Accuracy ±0.2V (status indicated by <a href="#">Internal Binary Point</a> <sup>[20]</sup> )
<b>Power Input Voltage Monitor</b>	Accuracy ±0.4V.

## 15.2 Data Capacity

<b>Maximum Database Points</b>	Approx. 1,000
<b>Maximum DNP3 Events</b>	20,000
<b>Maximum Data Concentrator points</b>	500
<b>Maximum Data Concentrator Devices</b>	10
<b>File System Typical Storage</b>	5 MB
<b>Trend sample files</b>	80 (when no user programming used)
Integers	20,000
Floats	10,000
<b>Trend aggregation</b>	up to 5 MB (with ISaGRAF <i>Restart History</i> programming. See <i>SCADAPack E Trend Sampler Technical</i> manual)
Integers	1,200,000
Floats	600,000

### 15.3 Serial Ports

<b>Communication Port COM1</b>	Jumper configurable RS-232 or RS-485 RS-232 compatible serial port Data Terminal Equipment (DTE) 8 pin modular jack Full or half duplex with RTS/CTS control Implemented: TxD, RxD, CTS, RTS, DCD, DTR, 5V power with jumper link (shared with COM2). RS-485 mode Two-wire half duplex Bias resistors installed
<b>Communication Port COM2</b>	Jumper configurable RS-232 or RS-485 RS-232 compatible serial port Data Terminal Equipment (DTE) 8 pin modular jack Full or half duplex with RTS/CTS control Implemented: TxD, RxD, CTS, RTS, DCD, DTR, 5V power with jumper link (shared with COM1). RS-485 mode Two-wire half duplex Bias resistors installed
<b>Communication Port COM3</b>	RS-232 compatible serial port Data Terminal Equipment (DTE) 8 pin modular jack Full or half duplex with RTS/ CTS control Implemented TxD, RxD, CTS, RTS, DCD, DTR and 5V power under program control. For use with SCADAPack Vision operator interface.
<b>Baud Rates</b>	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
<b>Parity</b>	none, even, or odd
<b>Word Length</b>	7 or 8 bits
<b>Stop Bits</b>	1 Bit
<b>Transient Protection</b>	COM1, COM2: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
<b>Isolation</b>	Common ground return connected to Chassis Ground.
<b>Cable Length</b>	RS-232 –maximum 10 ft (3 m) RS-485 –maximum 4000 ft (1200 m)
<b>Protocol</b>	DNP3 Slave, DNP3 Master, IEC60870-5-101 Slave, IEC60870-5-103 Master, Modbus RTU Master, Modbus RTU Slave, DF1

<b>Protocol Modes</b>	Slave, master, master/slave, store and forward
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## 15.4 Ethernet Port & USB Ports

### Ethernet Port

<b>Terminations</b>	RJ-45 modular connector 10BaseT / 100BaseT (twisted pair) 10/100 Mbits per second
<b>Protocols Supported</b>	DNP3 in TCP Master / Slave (default) DNP3 in UDP Master / Slave (default) ISaGRAF/TCP Modbus/TCP Client Modbus/TCP Server Modbus RTU in TCP Client IEC60870-5-104 Slave [subject to license] NTP Server Telnet Server FTP Server BOOTP Server

### USB Ports

<b>Ports</b>	USB Peripheral: One Port "B" connector. USB Host: One Port "A" connector with 5V/100mA capacity [Not presently supported on SCADAPack E]
<b>Speed</b>	USB 2.0 compliant Low speed (1.5Mb/s) Full-speed (12MB/s)
<b>Protocols Supported</b>	DNP3

## 15.5 Visual Indicators

<b>COM1</b>	received data transmitted data clear to send data carrier detect	(RX) LED (TX) LED (CTS) LED (DCD) LED
<b>COM2</b>	received data transmitted data clear to send data carrier detect	(RX) LED (TX) LED (CTS) LED (DCD) LED
<b>COM3</b>	received data transmitted data clear to send data carrier detect	(RX) LED (TX) LED (CTS) LED (DCD) LED
<b>Status</b>	Power Mode LED Run LED Status LED (blinking when operational non-zero status code present) FORCE LED (some I/O has been locked by ISaGRAF)	
<b>Counters</b>	3 LEDs	
<b>LAN</b>	Link indicator Activity indicator	(LINK) LED (ACT.) LED
<b>USB</b>	USB status indicator (under user program control)	
<b>Push-button</b>	LED power toggle	

## 15.6 Power Supply & I/O Expansion

### Power Supply

<b>DC power Input</b>	30V maximum 10.0 to 11.5V turn on 9.0V to 10.0V turn off UL508 rated 13.75 to 28Vdc. SCADAPack 333E: 8.5W typical Add 25 to 100mW when enabling the LEDs. 12W at 24V maximum. 5V supply fully loaded
<b>Output capacity</b>	5V at 1.2A capacity 5V at 255mA required to power the controller 5V at 5 to 20mA to power LEDs 5V at 1.1A (current limited) for COM1, COM2 and I/O expansion 5V at 250mA (current limited) on COM3 for Vision displays
<b>Efficiency</b>	85%, 12Vdc input, at full load

### I/O Expansion

<b>5000 Series I/O Expansion Capacity</b>	Maximum 16 I/O modules (including SCADAPack 333E 5611 I/O module). Additional power supply modules may be required.		
	The following 5000 series I/O modules are supported by SCADAPack E controllers:		
	<b>5000 Series Module</b>	<b>Type</b>	<b>I/O</b>
	5304	Analog Out	4 Analog Outputs
	5405	Digital In	32 Digital Inputs
	5411	Digital Out	32 Digital Outputs
	5414	Digital In	16 Digital Inputs
	5415	Relay Output	12 Relay Outputs
	5505	RTD	4 RTD (Temperature) Inputs
	5506	Analog In	8 Analog Inputs
	5606	Composite I/O	32DI, 16 Relay Out, 8AI, 2AO (optional with 5305)
	5607	Composite I/O	16DI, 10 Relay Out, 8AI,

			2AO (optional with 5305)
	5608	Composite I/O	12DI, 6 Relay Out
	5610	Composite I/O	16DI, 10 Relay Out
	5611	Composite I/O	16DI, 10 Relay Out, 4AI, 2AO (optional with 5305)
<b>5000 Series Input Change to Database Update</b>	SCADAPack 333E Typical: 170mS Add 20mS for each additional 5000 Series I/O Module		
<b>Database Change to 5000 Series Output Signal</b>	Typical: 18mS With up to 10 off 5000 Series I/O modules, Typical: 18-27mS		



## 15.7 Counter Inputs

<b>Counter Inputs</b>	Counter 0 Digital Input Counter Counter 1 Turbine Meter inputs Counter 2 Turbine Meter inputs
<b>Digital Input Counter 0</b>	Jumper Selectable maximum frequency 10Hz. or 5kHz. Dry contact input. Wetting current typically 5mA. Contact closure to ground is ON. Open input is OFF
<b>Counter 1 and 2</b>	Designed for use with low voltage, turbine meter outputs. Jumper link selectable for use with turbine meter amplifiers or dry contact closure
<b>Counter 1 and 2 Turbine Meter Sensitivity</b>	Minimum input 30mVp-p at 5-50Hz. Minimum input 150mVp-p at 150Hz. Minimum input 650mVp-p at 5kHz. Minimum input 750mVp-p at 10kHz. Maximum input 4Vp-p using internal amplifier
<b>Counter 1 and 2 Dry Contact</b>	Maximum input 10Vp-p without internal amplifier. Maximum frequency 10KHz
<b>Transient Protection</b>	2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
<b>Isolation</b>	Common ground return connected to Chassis Ground

## 16 Approvals and Certifications

<b>Safety</b>	UL (cULus) listed: UL508 (Industrial Control Equipment), CSA C22.2 No.142-M1987 (Process Control Equipment)
<b>Digital Emissions</b>	FCC47 Part 15, Subpart B, Class A Verification EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment C-Tick compliance. Registration number N15744
<b>Immunity</b>	EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments
<b>CE Mark Declaration</b>	This product conforms to the above Emissions and Immunity Standards and therefore conforms with the requirements of Council Directive 2004/108/EEC (as amended) relating to electromagnetic compatibility and is eligible to bear the CE mark The Low Voltage Directive is not applicable to this product

