5601/5601A Input / Output (I/O) Module

Installation, Operation and Maintenance Setup Manual

2/24/2017

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

Trademarks

Address

Schneider Electric
Telemetry & Remote SCADA Solutions
415 Legget Drive, Suite 101, Kanata, Ontario K2K 3R1 Canada
Direct Worldwide: +1 (613) 591-1943
Fax: +1 (613) 591-1022
Toll Free within North America: 1 (888) 267-2232
www.schneider-electric.com

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

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

Toll free within North America	1-888-226-6876
Direct Worldwide	+1-613-591-1943
Email	supportTRSS@schneider-electric.com

Technical Support: Australia

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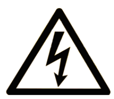
Email	au.help@schneider-electric.com

Safety Information

Important Information

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



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

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

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

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

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

NOTICE
NOTICE is used to address practices not related to physical injury.

Please Note

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

A qualified person is one who has skills and knowledge related to the construction 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.

⚠ WARNING

EQUIPMENT OPERATION HAZARD

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

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

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

Test all software in both simulated and real environments.

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

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.

Acceptable Use

SCADAPack controllers and expansion modules are intended for use in monitoring and controlling non-critical equipment only. They are not intended for safety-critical applications.

⚠WARNING

UNACCEPTABLE USE

Do not use SCADAPack controllers and expansion modules as an integral part of a safety system. These devices are not safety products.

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

⚠CAUTION

EQUIPMENT OPERATION HAZARD

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

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

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

About The Book

At a Glance

Document Scope

This manual describes the operation and maintenance of the 5601/5601A I/O module.

Validity Notes

This document is valid for all versions of the 5601/5601A I/O module.

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 or serious injury.

User Comments

We welcome your comments about this document. You can reach us by e-mail at supportTRSS@schneider-electric.com.

Overview

The 5601/A I/O module is an integrated component of a SCADAPack controller and not available as a standalone unit. The following controllers support the 5601/A I/O module:

- SCADAPack P1 - A 520x controller board with an integrated 5601 or 5601A I/O Module.
- SCADAPack P4 - A 5232 controller board with an integrated 5601 or 5601A I/O module.

The 5601 and 5601A I/O modules provides 8 analog inputs, 16 digital inputs, 12 digital outputs, two (optional) analog outputs, and one RS-232 serial communication port. The 5601 and 5601A I/O modules are identical in every respect but for the subtle differences listed below:

5601 I/O Module	5601A I/O Module
LEDs are wired using Plated Through Hole Technology (PTH).	LEDs are wired using Surface Mount Technology (SMT).
Analog Inputs use 12 bit successive approximation analog to digital (A/D) converter.	Analog Inputs use 16 bit successive approximation analog to digital (A/D) converter.
Analog inputs channels are factory configured either for current or voltage mode operation.	Individual analog input channels are user configurable for current or voltage mode using onboard jumpers.

Collectively the 5601 and 5601A I/O modules are referred to as the 5601/A throughout this manual.

Analog inputs on both versions can also be configured for a 0 or 20% offset in the measuring range. Analog input channels are transient protected, optically isolated from the main logic supply and share a common return (COM) that is connected to the chassis.

The 5601/A I/O modules can be equipped with a 5303 (PID 297191) analog output module that provides two 0-20mA outputs. The analog outputs are transient and over voltage protected. The output channels share a common return (GND) and with the analog input channels.

The 5601/A I/O module provides 16 digital input channels. The digital inputs can be configured in four standard voltage ranges for both AC and DC type applications as requested at the time of purchase. The digital inputs are optically isolated from the logic power. A current limiting resistor, on each input, determines the voltage range. Light Emitting Diodes (LEDs) on the digital inputs show the status of each of the input.

Twelve dry contact digital (mechanical relay) outputs are provided onboard this I/O module. Ten outputs are Form A (normally open NO) and two outputs are Form C (both normally open NO and normally closed NC) contacts. The Form C outputs and two of the Form A outputs are individually isolated allowing multiple power sources to be used within the same module. Loads can be connected to either output terminal and to either the high or the low side of the power source.

This manual covers the powering, wiring and configuration of a 5601/A I/O module only. It is meant to be used with the hardware manual of the respective controller board to which the I/O module is attached.

Field Wiring Connectors

For ATEX and IECx applications only:

⚠WARNING

UNEXPECTED EQUIPMENT OPERATION

- Install this equipment in an enclosure certified for use, providing a degree of protection of IP54 or better.
- The free internal volume of the enclosure must be dimensioned in order to keep the temperature rating.
- For products using solid state relays (5415, 5606 and 5607 modules and SCADAPacks using 5606 and 5607 modules), a T4 rating is acceptable for maximum loads of 2 A. When 3 A loads are connected to the solid state relays, the maximum ambient rating is lowered to 50 °C (122 ºF) in order to maintain the T4 rating.

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

The 5601/A I/O modules use screw terminal style connectors for termination of field wiring. These connectors accommodate solid or stranded wires from 12 to 22 AWG.

Remove power before servicing unit.

The 5601/A I/O module has seven connectors for field wiring. Refer to ***Figure 1: 5601/A I/O Module Layout*** for connector locations. In this section of the manual, connectors are referenced with respect to the I/O board.

- The AC/DC power inputs, DC power output and analog outputs are wired to a nine-pole connector labeled P3. Refer to section ***Power Supply Input Connections*** for details on wiring the power supply.
- The analog inputs are wired to a nine-pole connector labeled P4 on the I/O board. Refer to section ***Analog Inputs*** for more information on wiring analog inputs.
- The digital inputs are wired to two nine-pole connectors labeled P5 and P6. Refer to the section ***Digital Inputs*** for details on wiring digital inputs.
- The digital outputs are wired to two ten pole connectors labeled P7 and P8. Refer to the section ***Digital Outputs*** for details on wiring digital outputs.

- The 5601/A I/O module has one RS-232 serial communication port that is wired to a DE-9P plug connector labeled P11. Refer to section ***Serial Communication*** for details.

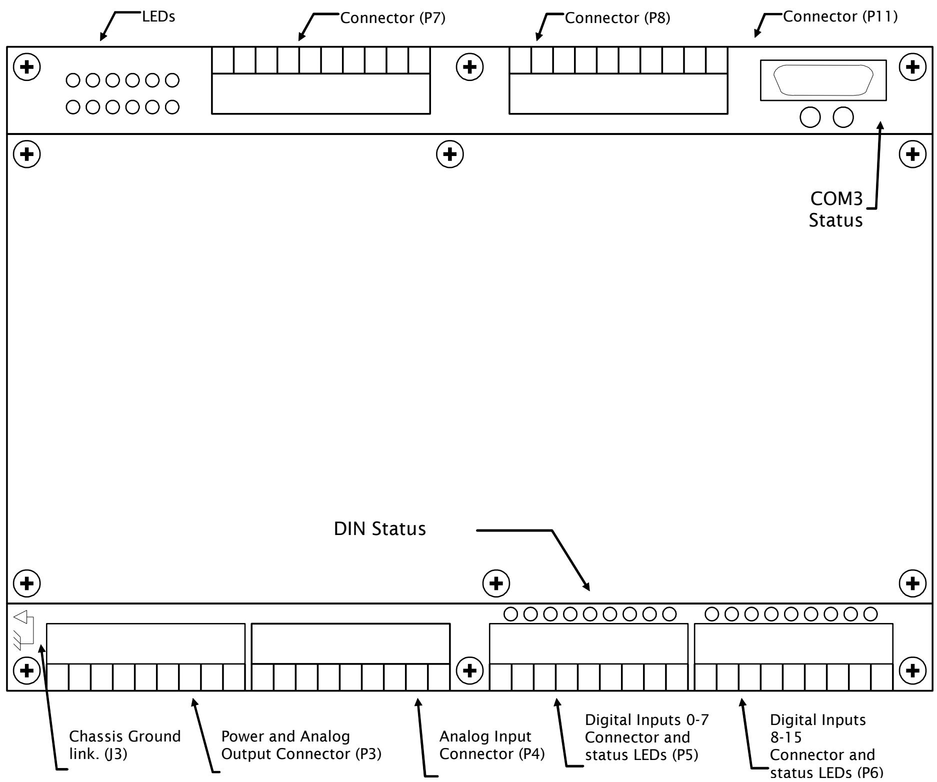


Figure 1: 5601/A I/O Module Layout

Power Supply

Overview and Requirements

The 5601/A I/O module requires 11-24Vdc or 16Vac applied to the AC/DC PWR IN terminals on connector P3 of the I/O board to power the analog input and optional analog output circuitry.

The current requirement of the analog portion (input and optional output circuitry) on the I/O board can vary from a minimum of 20mA for basic operation to a maximum of 250mA if every analog input and the optional outputs require power.

The user has four options to supply power to the I/O board as outlined in the next section but should thoroughly examine the application and supply the I/O module with a suitable power source.

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

Power Supply Input Connections

Power to DC PWR on the I/O board can be provided in several ways:

- With a 16Vac source supplying power to the controller board, 24V is available on the DC PWR terminals on connector P5 of the controller board which can be used to power the lower I/O model. See the section ***Recommended AC Power Supply Configuration*** below for details.
- An independent 16Vac power source applied directly to the AC/DC PWR input pins on connector P3 of the I/O board. This configuration requires a 1A slow blow fuse. See the section ***Alternate AC Power Supply Configuration*** below for details.
- The DC PWR pins on connector P3 of the controller board connected in parallel to the DC PWR pins of connector P5 of the controller board. In this configuration, the controller board is being powered from a 11-24V supply See the section ***Recommended DC Power Supply Configuration*** below for details
- A 5103 UPS Power Source supplies 5Vdc to the controller board through the IMC cable and 24Vdc to the 5601/A I/O module. See the section ***Recommended 5103 Power Supply Configuration*** below for an example of using the 5103 UPS Power Supply.

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 a 5203/5204 controller board and the 5601/A I/O modules. 24V are available on the controller module connector P5 which can be used to power the analog circuitry for the analog input and output circuits on the 5601/A I/O module.

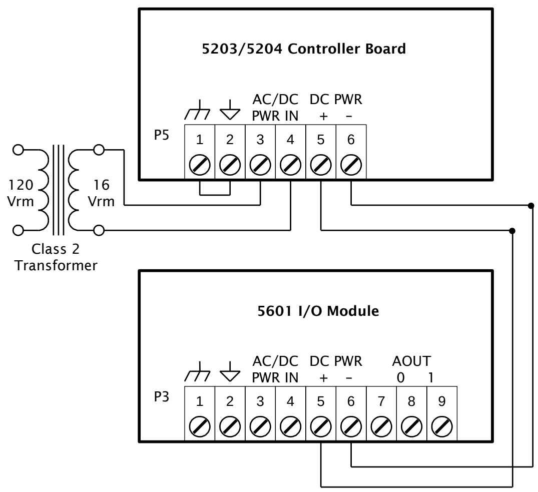


Figure 2: Recommended AC Power Supply Configuration

Alternate AC Power Supply Configuration

This configuration uses two single Class 2 transformers to power a 5203/5204 controller board and the 5601/A I/O module. This configuration is capable of providing higher DC power output levels than those shown in section ***Recommended AC Power Supply Configuration.***

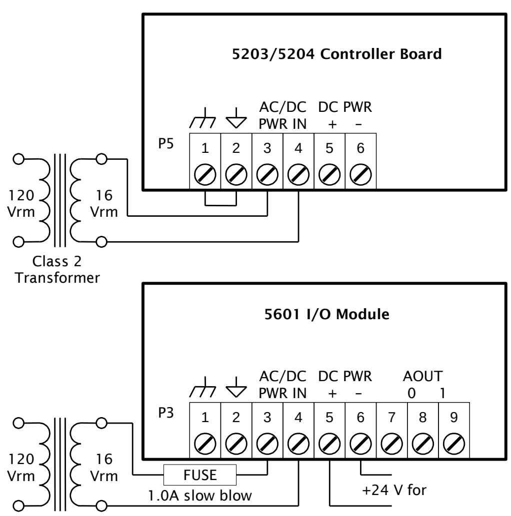


Figure 3: Alternate AC Power Supply Configuration

Recommended DC Power Supply Configuration

This configuration uses a single power supply or battery to power a 5203/5204 controller board and the 5601/A I/O module. Refer to the ***System Configuration Guide*** for more information. The power supply is used to power the analog circuitry for the 5601/A I/O module.

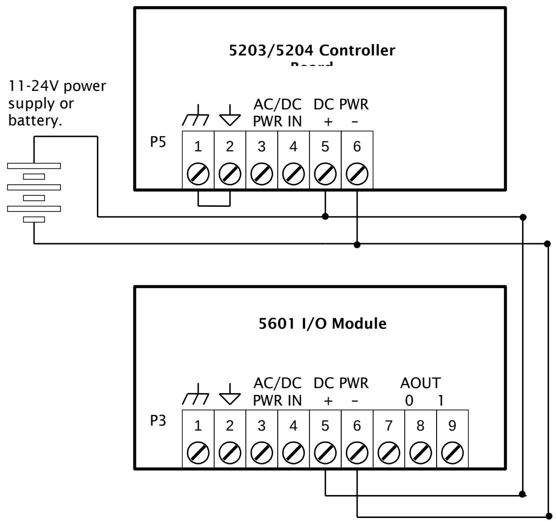


Figure 4: Recommended DC Power Supply Configuration

Recommended 5103 Power Supply Configuration

When additional power is required by the system, a 5103 power supply can be used in combination with the SCADAPack 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 Sleep Mode feature of the controller applies only to those modules powered by the controller.

The 5103 power supply may also be connected *upstream* (to the left) of any SCADAPack Controller, but only if the following conditions are observed:

- No power is applied to the power inputs of the controller board.
- A jumper is installed at position J5 for SCADAPack 5203 and 5204 controllers.
- The sleep mode feature is not used.

This configuration uses a 5103 Power Supply module to power a SCADAPack controller with a 5203/5204 controller board. The 24VDC output from the 5103 powers the 5601 I/O module. The 5103 power supply provides a 5V output to power the 5601 I/O module, the controller board and 5000 modules through the IMC cables.

No connection is made to the AC/DC PWR IN or DC PWR terminals on the controller board.

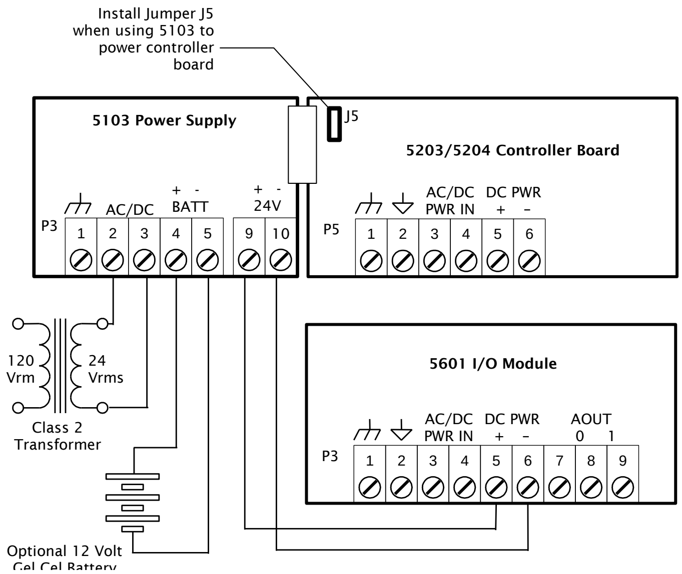


Figure 5: Recommended 5103 Power Supply Configuration

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 5601/A I/O module, "-" terminal of the 24V supply (DC PWR "-") is already connected to the enclosure by the printed circuit board traces.

J3 can be removed by the user if it is necessary that the **–** side of the 24V supply not be referenced to ground. For example, if the 5601 I/O module analog inputs were to monitor voltages that are at a potential other than ground, J3 could be removed. If removed, the **–** side of the 24V supply on the 5601 I/O module could be re-connected to the enclosure by wiring pin 1 to pin 2 on P3.

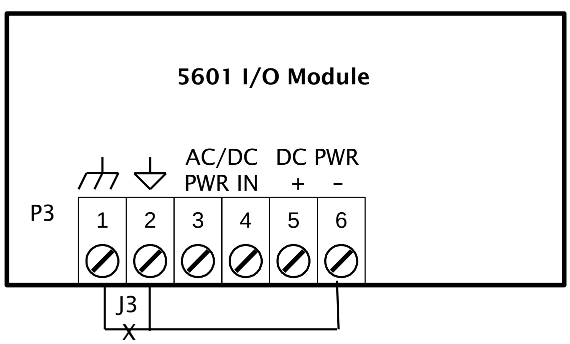


Figure 6: 5601/A I/O Board Grounding Configuration

Analog Inputs

The 5601/A I/O module enhances the I/O capacity of the SCADAPack controller by providing an additional eight single ended analog inputs on connector P4.

- The eight analog input channels of the **5601 I/O** module are factory configured for voltage or current mode.
- Individual analog channels on the **5601A I/O** module are user configurable for either current or voltage mode using onboard jumpers. Refer to section ***Current or Voltage Mode*** on how to select input modes.

In voltage mode, the analog inputs are single ended and the measurement range is 0-5V or 1-5V.

Refer to section ***Range and Resolution***.

In current mode, a 250Ω current sense resistor appears across each analog input channel. Measurement range in current mode is 0-20mA or 4-20mA selectable via the configuration switches. The 250Ω resistor produces a voltage drop (input reading) of 5V for a 20mA of current flow.

Analog input channels are transient suppressed, optically isolated from the main logic supply and share a common return (COM) that is connected to the chassis.

Analog input channels on the 5601 I/O module use a 12-bit successive approximation digital to analog (A/D) converter. The 5601A I/O module uses a 16-bit, successive approximation A/D converter in the analog input channels.

- For Telepace applications use the ***SCADAPack 5601 I/O Module*** register assignment to read the nine external and the internal analog inputs.
- For IEC 61131-1 applications use the ***sp5601*** I/O connection to read the nine external and the internal analog inputs.

Please refer to the respective Telepace and IEC 61131-1 software manuals on how to assign the above registers to read these input ports.

Current or Voltage Mode

The analog input channels on the 5601A I/O module can be configured for either voltage or current mode using jumper links. The jumper links reside on the lower I/O board itself. To access the jumper links, the main cover and controller board will have to be taken off by removing the retaining screws.

On the 5601A I/O module, analog Inputs are configured for current mode by default

To select current mode, install the jumpers on the side labeled 20mA on the I/O board as shown in the figure below for channels 0-5. In current mode a 250Ω resistor appears across the analog input channel.

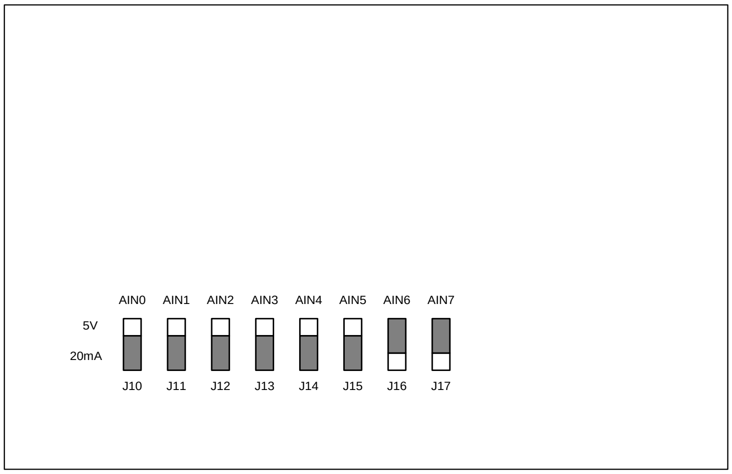


Figure 7: 5601A Analog Input Mode Setting

To select voltage mode, install the jumpers on the side labeled 5V. In the figure above, analog input channel 6 and 7 have been configured for voltage mode.

Range and Resolution

The 5601/A I/O module produces analog readings with 15 bits of resolution over the 5V/20mA measurement range. The 5601 has a 12-bit A/D converter while the 5601A has a 16-bit A/D converter.

0% Input Offset

The 0% input offset configuration measures 0-20mA or 0-5V signals. Set dip switch SW3 OPTION 1 on the 520x controller board or SW1 OPTION 1 on the 5232 controller board to OPEN (depress or slide switch to left side) to enable this setting. Please refer to the hardware manual of your respective controller board for the location of these switches.

With the 0% Input offset enabled, the input resolution is:

- 4.88uA/count in current mode.
- 1.22mV/count in voltage mode.

The table below shows the A/D output value for several input signals.

Current (mA)	Voltage (V)	A/D Output
0	0	0
5	1.25	8192
10	2.5	16384
15	3.75	24576
19.995	4.9988	32760
19.999	4.9998	32767

20% Input Offset

The 20% input offset configuration measures 4-20mA or 1-5V signals. Set dip switch SW3 OPTION 1 on the 520x controller board or SW1 OPTION 1 on the 5232 controller board to CLOSED (depress or slide switch to right side) to enable this setting. Please refer to the hardware manual of your respective controller board for the location of these switches.

With the 20% Input offset enabled, the input resolution is:

- 3.91uA/count in current mode.
- 0.976mV/count in voltage mode.

The table below shows the A/D output value for several input signals.

Current (mA)	Voltage (V)	A/D Output
< 4	< 1	0
4	1	0
8	2	8192
12	3	16384
16	4	24576
19.996	4.9988	32760
19.999	4.9998	32767

Wiring

The analog inputs support loop powered and self powered transmitters. Loop powered transmitters are two terminal devices that connect between a power supply and the analog input. The loop current continues from the power supply, through the transmitter and to ground through a 250Ω resistor built into the 20mA input circuit. Self-powered transmitters have three terminals called power in, signal out and common. Self-powered transmitters can have a current or voltage output. The signal out connects to the Analog Input Channel, the common connects to COM and the power in connects to a power supply

Check that the minimum output range of the voltage is 0-5V. Also ensure that the transmitter has enough power for operation. Refer to transmitter specifications provided by manufacturer

Several wiring examples for loop and self powered transmitters are illustrated in ***Figure 8: Analog Input Wiring*** below. In the example below, AIN1 (pin 2) is configured for voltage mode with a 0-5V measuring range. Other channels remain in the default current mode configuration.

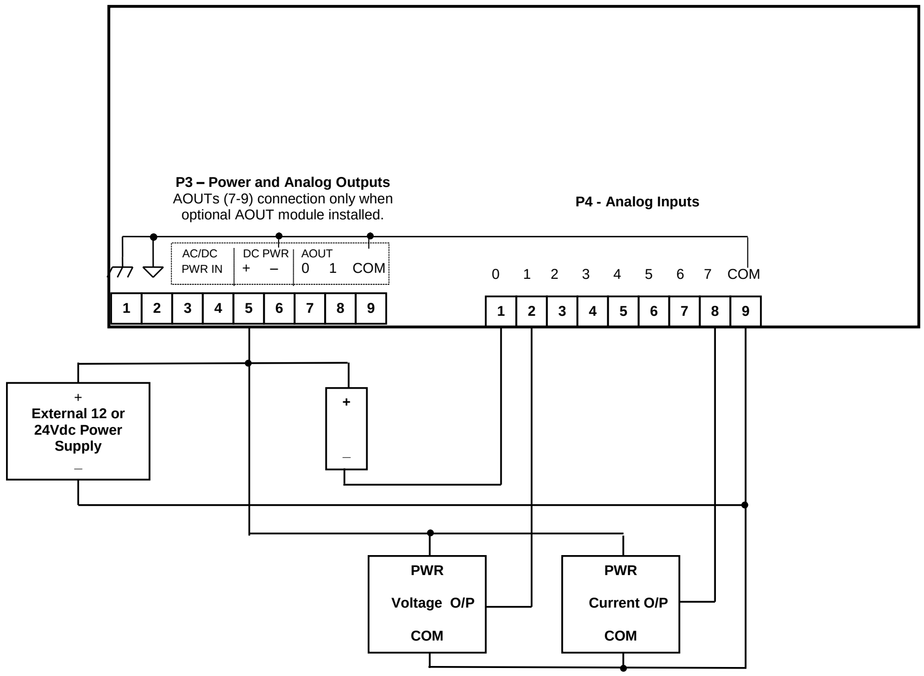


Figure 8: Analog Input Wiring

Analog input channel 0 has a loop powered current transmitter connected to the external power supply. AIN1 1 has a self-powered voltage transmitter connected to the external power supply. Analog input channels 2 to 6 are unused. Analog input channel 7 has a self-powered current transmitter connected to the external power supply.

Analog Outputs

The 5601/A I/O module may include a two analog output channel module (PID 297191) , if this option was requested at time of purchase. The analog outputs produce 0-20mA of current but can easily be wired to provide an output voltage by connecting a load resistor across the output channel. See details below.

- For Telepace applications use the ***SCADAPack Two Point Analog Output Module*** register assignment to write to the two analog outputs.
- For IEC 61131-1 applications use the **spaout** I/O connection to write to the two analog outputs.

Current Outputs

The optional analog output module on the 5601/A provides two 0-20mA or 4-20mA analog outputs. These outputs are isolated from the system 5V power supply. They are not isolated from each other. The outputs share a common return with each other and the 5601/A I/O module analog inputs.

The analog output is represented with 12 bits. Analog outputs are isolated from logic circuits, for protection against voltage transients and high common mode voltages.

An external 24V supply powers the isolated output circuits. This is usually the same power supply that powers current loop transmitters in the system. A power supply normally provides this power. A wide range of voltages are tolerated. Refer to the Specifications section for details.

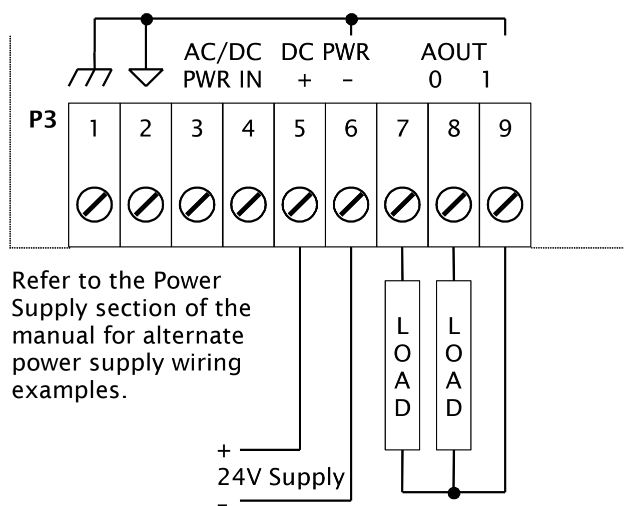


Figure 9: Analog Outputs Wiring

Voltage Outputs

To obtain voltage outputs, connect a load resistor as shown in ***Figure 9: Analog Outputs Wiring*** . Connect the voltage device across the load resistor. The table below list resistance values and output range settings for common voltage ranges. The resistance value listed is the combined parallel resistance of the device and the load resistor.

Voltage Range	Resistance	Output Range
0 to 5V	250Ω	0-20mA
0 to 10V	500Ω	0-20mA

Range and Resolution

The optional analog output module installed on the 5601/A I/O Module has a 12-bit, unipolar, digital to analog (D/A) converter. These analog outputs can be configured for a 0% (0-20mA) or 20% (4-20mA) range.

The 0% output offset configuration outputs 0-20mA or 0-5V signals. Set dip switch SW3 OPTION 2 on the 520x controller board or SW1 OPTION 2 on the 5232 controller board to OPEN (depress or slide switch to left side) to enable this setting.

The 20% output offset configuration outputs 4-20mA or 1-5V signals. Set dip switch SW3 OPTION 2 on the 520x controller board or SW1 OPTION 2 on the 5232 controller board to CLOSED (depress or slide switch to right side) to enable this setting. Please refer to the hardware manual of your respective controller board for the location of these switches.

There are 4096 D/A counts in the output signal range and one D/A count represents a value of 8 raw counts. Raw counts are displayed or issued from the application program.

The 0-20mA output range resolution is 4.88µA/count, such that 8 raw counts represent 4.88 µA. For a 0% offset, use the following relationship to determine the output current based on your raw counts:

Output Current [mA] = (20 * Raw Count) / 32760

For a 20% offset, use the following relationship:

Output Current [mA] = ((16 * Raw Count) / 32760) + 4

The table below shows the output current for several raw counts, when the analog output is configured for a 0% and 20% offset.

Raw Count	Current (0% offset)	Current (20% offset)
0	0 mA	4 mA
8	4.88 µA	4 mA
1500	0.92 mA	4.73 mA
3200	1.95 mA	5.56mA
6552	4 mA	7.2 mA

Raw Count	**Current (0% offset)**	**Current (20% offset)**
7000	4.27 mA	7.42 mA
10000	6.11 mA	8.88 mA
16384	10 mA	12 mA
24576	15 mA	16 mA
32760	19.995 mA	19.995 mA

Digital Inputs

The 5601/A I/O module enhances the I/O capacity of the SCADAPack controller by providing an additional 16 digital inputs configurable in four standard voltage ranges for both AC and DC type applications as requested at the time of purchase.

The digital inputs are optically isolated from the logic power. A current limiting resistor, on each input, determines the voltage range. Light Emitting Diodes (LED) on the digital inputs show the status of each of the input.

Wiring Examples

To simplify field wiring, the inputs are organized into two groups of eight inputs. Each group shares a common return. These groups of eight inputs are isolated from each other. Inputs 0 to 7 are in one group. Inputs 8 to 15 are in the other group.

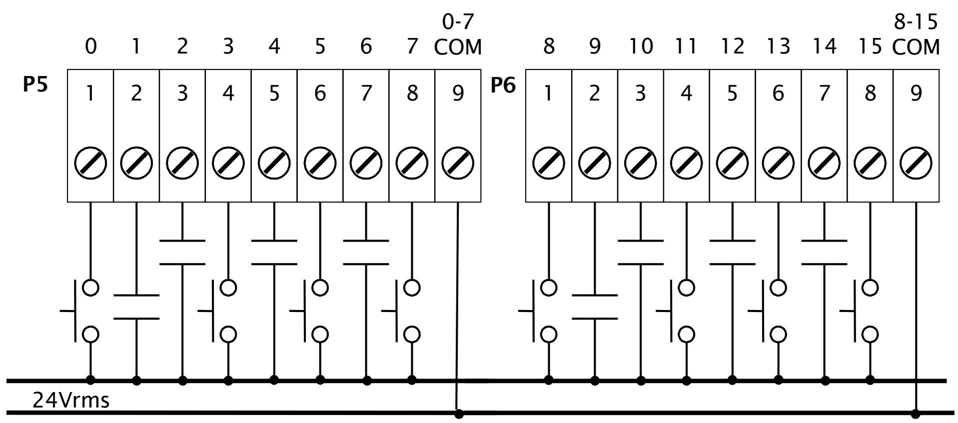


Figure 10: Digital AC Input Wiring

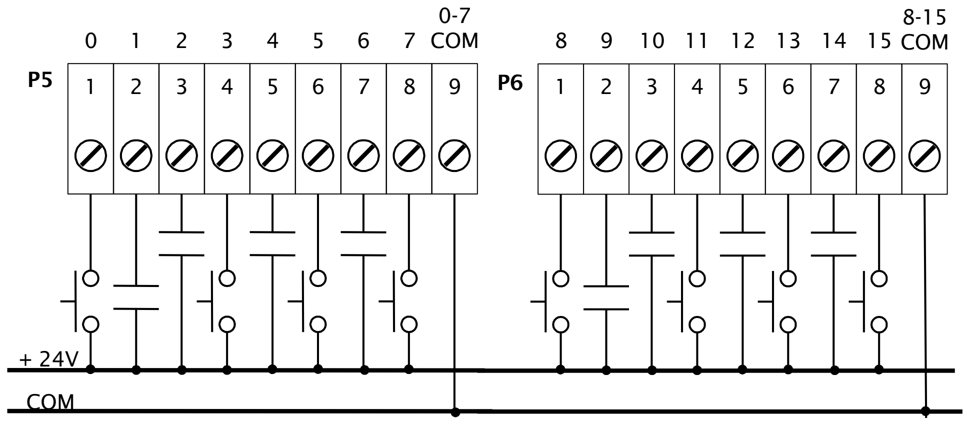


Figure 11: Digital DC Input Wiring

Figure 10: Digital AC Input Wiring above shows typical AC input field wiring.

120 VAC digital inputs don't work with some UPSs. The digital input firmware is looking for a minimum input on-time generated by a sine-wave. This time is longer than the on-time generated by some UPSs. The module should not be used with a non-sine wave UPS.

Figure 11: Digital DC Input Wiring above shows typical DC input field wiring. Observe signal polarity when using DC inputs. Connect the positive signal to the input. Connect the negative signal to the common.

Digital Outputs

The 5601/A I/O module enhances the I/O capacity of the SCADAPack P1 controller by providing 12 dry contact digital (mechanical relay) outputs. Ten outputs are Form A (normally open NO) and two outputs are Form C (both normally open NO and normally closed NC) contacts.

The Form C outputs and two of the Form A outputs are individually isolated allowing multiple power sources to be used within the same module. Loads can be connected to either output terminal and to either the high or the low side of the power source. ***Figure 12: Isolated Digital Output Wiring*** and ***Figure 13: Shared Common Digital Output Wiring*** illustrate how to wire these outputs.

The table below shows the type of digital outputs for each 5601/A I/O module digital output.

Digital Output	Pin Terminals #	Digital Output Channel	Type	Contact Description
0	P7 - 8,9,10	NO, NC, COM 0	Form C	NO and NC – isolated
1	P7 - 5,6,7	NO, NC, COM 1	Form C	NO and NC – isolated
2	P7 - 3, 4	2	Form A	NO – isolated
3	P7 - 1, 2	3	Form A	NO – isolated
4	P8 – 9	4	Form A	NO – common return P8-10
5	P8 – 8	5	Form A	NO – common return P8-10
6	P8 – 7	6	Form A	NO – common return P8-10
7	P8 – 6	7	Form A	NO – common return P8-10
8	P8 – 4	8	Form A	NO – common return P8-5
9	P8 – 3	9	Form A	NO – common return P8-5
10	P8 – 2	10	Form A	NO – common return P8-5
11	P8 – 1	11	Form A	NO – common return P8-5

When controlling inductive loads with digital outputs the energy stored in the coil is capable of generating significant electrical noise when the relay contacts are opened. This noise can be suppressed using a diode across the coil in DC circuits or using a MOV (varistor) or across the coil in AC circuits.

Wiring Examples

The illustration below illustrate an example of a DC load being controlled by the Form C contacts at DO0 and DO1. In this same example, several AC loads are being controlled by Form A contacts at DO2 and DO3. The power source for each load is fully isolated.

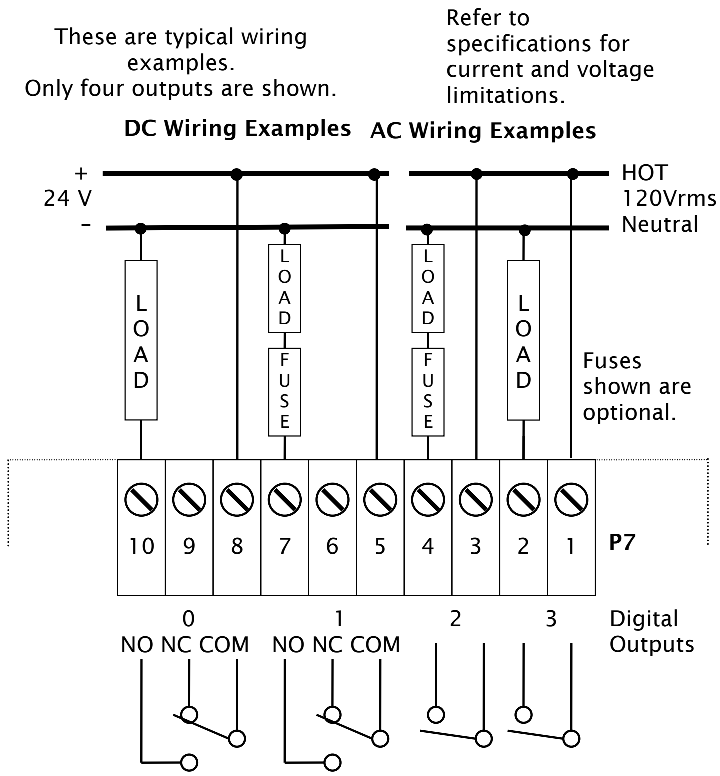


Figure 12: Isolated Digital Output Wiring

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

Figure 13: Shared Common Digital Output Wiring illustrates a DC load being controlled by the Form A contacts at DO4 and DO6. In this same example, a couple of AC loads are being controlled at DO8 and DO10. Notice the return wiring.

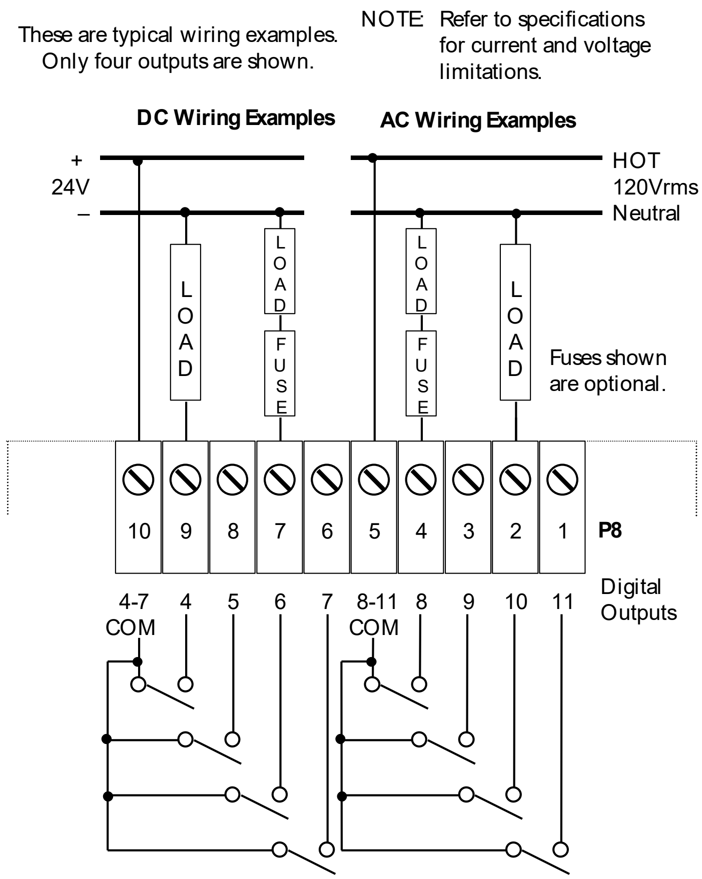


Figure 13: Shared Common Digital Output Wiring

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

Serial Communication

COM 3 RS-232 Serial Port

The 5601/A I/O module enhances the serial communication capacity of the SCADAPack P1 by providing an additional RS-232 serial port identified as COM3. The RS-232 port is a 9-pin male D-sub-miniature (DE-9P) connectors configured as Data Terminal Equipment (DTE) and only supports a half-duplex serial communication.

Port	Type	Description
COM3	RS-232	DE-9P Connector designated P11 on the 5601/A I/O Module.

Connections to COM 3 are made through a DE-9P connector. The wiring and pin connections for this connector are described below. Examples of wiring an RS-232 network are described in the hardware manual of your respective controller board or in section ***0-RS-232 Wiring Examples***.

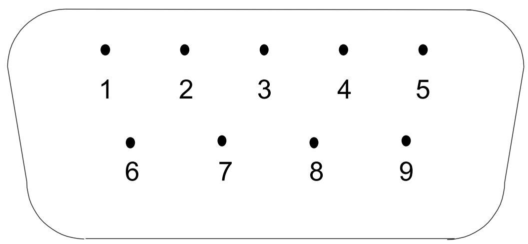
The following table shows the serial and protocol communication parameters supported by COM3. These parameters are set from Telepace, IEC 61131-1 Workbench or from an application program running in the controller. Default values are set when a Cold Boot or Service Boot is performed on the controller.

Parameter	Supported Values
Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400. Default: 9600
Duplex	Half
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

Parameter	Supported Values
Protocol	None, Modbus RTU, Modbus ASCII and optionally DF1 Or DNP. Default: Modbus RTU
Addressing Mode	Standard or Extended Default: Standard

DE-9P Connector for RS-232

RS-232 ports are 9-pin male D-sub-miniature (DE-9P) connectors configured as Data Terminal Equipment (DTE). A maximum cable length of 50ft (15.2m) is allowed. ***Figure 14: RS-232 Port Connector*** shows the pin connections on the RS-232 connectors.



1. DCD
2. RxD
3. TxD
4. DTR
5. GND
6. nc
7. RTS
8. CTS
9. + 5V

Figure 14: RS-232 Port Connector

Pin	Type	Description
Pin 1 DCD	input	The DCD led is on for a MARK level. (> +3V)
Pin 2 RxD	input	The level is SPACE (< -3V) on standby and MARK for received data. The RxD LED is lit for a MARK level.
Pin 3 TxD	output	The level is SPACE on standby and MARK for transmitted data. The LED is lit for a MARK level.
Pin 4 DTR	output	This pin is normally at a MARK level. This pin is at a SPACE level when DTR is de-asserted.
Pin 5 Ground		This pin is connected to the system ground.
Pin 6		This pin is not connected.

Pin	Type	Description
Pin 7 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. The LED is ON for a MARK level.
Pin 8 CTS	input	A MARK level is needed 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. The LED is on for a MARK level.
Pin 9	output	This pin is connected to the 5V power supply. No connection to this pin is made if the 5V is not used.

RS-232 Wiring Examples

DTE to DTE without Handshaking

There are several methods for wiring the RS-232 COM port to DTE and DCE (Data Communications Equipment) devices. The simplest connection requires only 3 wires: RxD, TxD and signal ground. ***Figure 15: RS-232 DTE to RS-232 DTE without Handshaking*** shows an RS-232 COM port to DTE device.

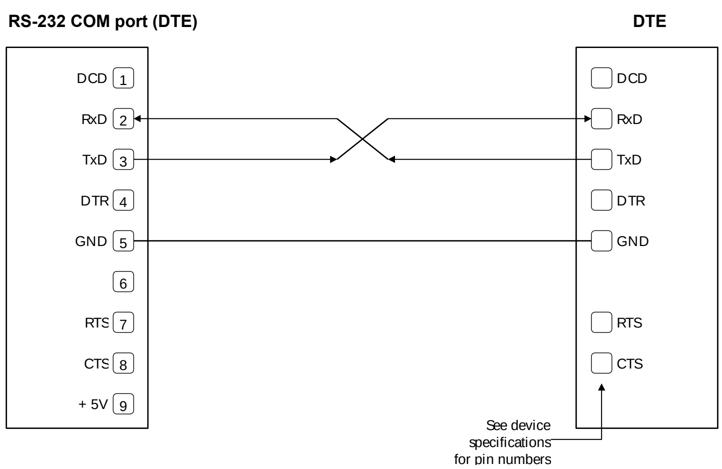


Figure 15: RS-232 DTE to RS-232 DTE without Handshaking

DTE to DTE with Handshaking

Some DTE devices may require hardware handshaking lines. The most common 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. ***Figure 16: RS-232 DTE to RS-232 DTE with Handshaking*** shows an RS-232 COM port on the SCADAPack controller connected to a DTE device requiring handshaking lines.

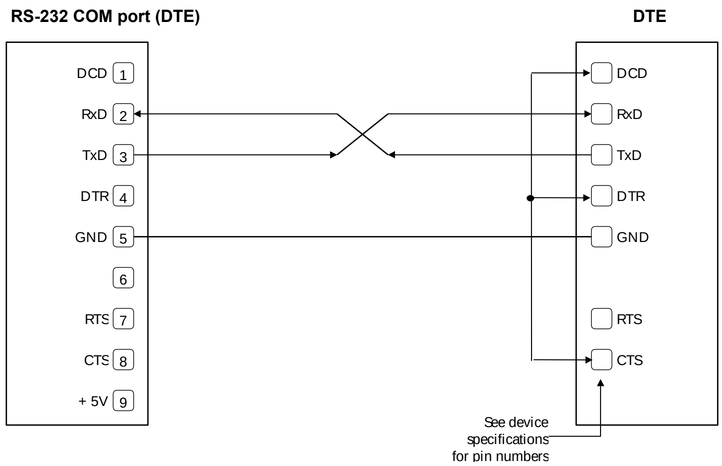


Figure 16: RS-232 DTE to RS-232 DTE with Handshaking

DTE to DCE with Handshaking

DCE devices require different wiring. The handshaking lines must be connected in most cases. Note that many DCE devices are half duplex. Select half-duplex operation with these devices. ***Figure 17: RS-232 DTE to RS-232*** illustrates a SCADAPack controller communicating via COM3 with a DCE device requiring handshaking lines.

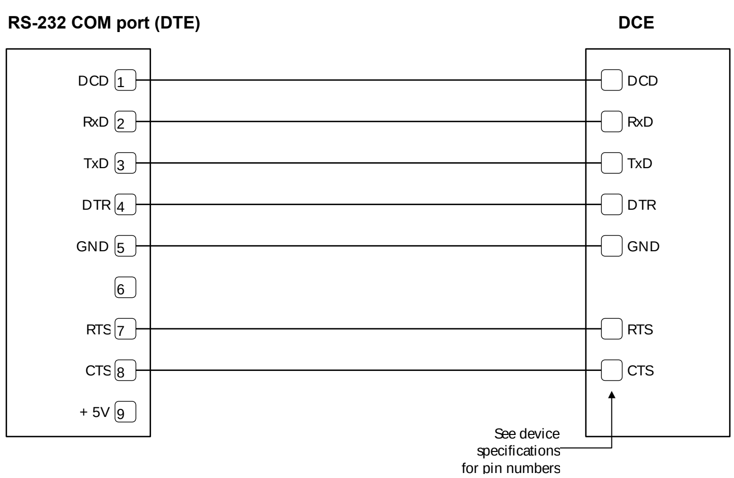


Figure 17: RS-232 DTE to RS-232

Operation

LED Indicators

The 5601/A I/O module has 30 LEDs to indicate the digital inputs, output and serial communication status.

LEDs, except the digital input LEDs, can be disabled to conserve power. Refer to the hardware manual of your respective controller board for details.

The digital input LEDs are powered from the 5V digital input source available on the controller board, and can be activated even when there is no power additional power applied to the 5601/A I/O module. Recall, additional power is only required to power the analog inputs and optional analog outputs on the I/O board.

The LEDs cannot be disabled to conserve power. The table below describes the LEDs.

LED	Color	Function
RX	Clear	On when receiving data COM3.
TX	Clear	On when transmitting data on COM3.
DINs	Red	On when the corresponding input is on.
DOUTs	Red	On when the corresponding output is on.

Maintenance

The SCADAPack controllers require little maintenance. The 5V power LED indicates the status of the 5V supply. If the LED is off, and the SCADAPack controller is powered using the integrated power supply, on board fuse F1 may require replacing. If the LED is off, and the SCADAPack 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 Controller is not functioning correctly, contact Schneider Electric Technical Support for information on returning the SCADAPack Controller for repair.

Fuse

A 0.5A, 5mm, slow-blow fuse on the main controller board is mounted under the cover. Refer to ***Figure 1*** for its 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.

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

Troubleshooting

Analog Inputs

Condition	Action
20mA inputs read 0.	Check transmitter power.
Reading is at or near 0 for input signals.	Check if the input transient suppressers are damaged.
20mA readings are not accurate.	Check for a damaged 250Ω current sense resistor.
Reading is constant.	Check that the analog input is not forced.
Reading seems out of calibration for small inputs but improves as input increases.	Check the input range switch setting.

Analog Outputs

Condition	Action
Outputs are 0mA	Check the 24V power.
The full-scale output is less than 20mA.	Check the 24V power. Check that the load resistance is within specification.
Output is constant and should be changing.	Check that the analog outputs are not forced.
The output is 4mA when a value of 0 is output. 0mA was expected.	The 4-20mA output range is selected. Select the 0-20mA range.
The output is 0mA when a value of 0 is output. 4mA was expected.	The 0-20mA output range is selected. Select the 4-20mA range.
The output seems to be uncalibrated at small output values. This improves as larger values are output.	Check the setting of the output range switch. The wrong output range is probably selected.

Digital 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 digital input range. If this is a DC input, check the polarity of the signal.
Input is on when no signal is applied. The LED is off.	Check that the digital inputs are not forced on.
Input is off when a signal is applied. The LED is on.	Check that the digital inputs are not forced off.

Digital Outputs

Condition	Action
Output LED does not come on when output is turned on.	Check the LED POWER from the SCADAPack controller.
Output LED is off, but the output is closed. Output LED is on, but the output is open.	Relay contacts can be normally closed and/or normally open.
Output LED comes on but the output does not close.	Check if the relay is stuck. If so, return the board for repair.
Output LED comes on and output is closed, but the field device is not activated.	Check the field wiring. Check the external device.
Output LED and relay are on when they should be off.	Check that the output is not forced on.
Output LED and relay are off when they should be on.	Check that the output is not forced off.

Specifications

Disclaimer: Schneider Electric reserves the right to change product specifications. For more information, visit http://www.schneider-electric.com.

General

I/O Terminations	6,8,9 and 10 pole, removable terminal blocks. 12 to 22 AWG 15A contacts
Dimensions **SCADAPack**	8.40 inch (213mm) wide 6.13 inch (155mm) high 2.80 inch (72mm) 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

Visual Indicators

Digital Inputs 5601 /A I/O Module	16 red LEDs field powered (LED power not applicable)
Digital Outputs	12 red LEDs on SCADAPack 5601/A I/O module

Power Requirements

Power Input **AC/DC PWR IN**	16Vrms ±20% 14 to 30Vdc
DC power Input DC PWR	11 to 30V at 20mA (loop power extra at 20mA maximum per loop)
DC power Output **16Vrms applied**	20-24V with 1.0Vp-p maximum ripple. 400mA available
5V power required	500mA (all relays ON) 20mA (all relays OFF)

5601 Analog Inputs

Input Points	8 on the 5601/A I/O module
Resolution	15 bits available to the application.

Input Resistance	100kΩ for 5V inputs 250Ω for 20mA inputs
Converter type	Successive approximation. 12 bits.
Accuracy	±0.1% of full scale at 25^{o}C (77ºF) ±0.2% over temperature range
Type	single ended
Normal mode rejection	60dB at 50 / 60 Hz.
Over-scale Input Capacity (without damage)	Continuous: 60% over scale sustained input signal. 0.25A maximum current and 8.2V maximum voltage. Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	70Vrms / 100V from the logic power and chassis when jumper J3 on the 5601/A I/O module has been cut and an isolated power supply is used to power the 5601/A I/O module.
Reading Update Time	100ms
Response Time	20ms typical for 10% to 90% signal change

5601A I/O Module

Input Points	8 on the 5601A I/O module
Resolution	15 bits available to the application.
Input Resistance	65kΩ for 5V inputs 250Ω for 20mA inputs
Converter type	Successive approximation. 16 bits.
Accuracy	±0.1% of full scale at 25^{o}C (77ºF) ±0.2% over temperature range
Type	single ended
Normal mode rejection	54dB at 50 / 60 Hz at default filter setting.
Over-scale Input Capacity (without damage)	Continuous: 0.10A/14V on the 20mA inputs. 0.05A/14V on the 5V inputs. Transient: 2.5kV surge withstand capability as per ANSI/IEEE C37.90.1-1989
Isolation	70Vrms / 100V from the logic power and chassis when jumper J3 on the 5601A I/O module has been cut and an isolated power supply is used to power the 5601A I/O module.
Reading Update Time	100ms
Response Time	20ms typical for 10% to 90% signal change

Analog Outputs

Output Points	2 (when optional 5303 analog outputs installed)
Output Signal Range	0-20mA
Maximum Load Resistance	1000Ω with 24V DC loop power 400Ω with 12V DC loop power 250Ω with 9V DC loop power
Output Type	single ended regulation on positive side with common negative return
Isolation	70Vrms / 100V from the logic power and chassis when link J3 has been cut.
D/A Resolution	12 bits
Absolute Accuracy	±0.05% at 25°C (77°F) with 250Ω load ±0.2% over temperature range, 0-1000Ω load
Noise and Ripple	0.04% maximum
Transient Protection	600W transient suppresser on each output
Response Time	250ms typical for 10% to 90% signal change
Power Requirements	5V at 10mA 9 to 28V at 15mA (55mA with all outputs at 20mA)

Digital Inputs

Input Points	16	
Over-voltage Tolerance	150% sustained over-voltage without damage	
Input Current	6.5mA typical at 24V on the 24V range 3.5mA typical at 115V on the 115V range	
Input Logic-HI Level	OFF to ON transition threshold is typically 7.5V on 24V range OFF to ON transition threshold is typically 50% of full scale signal range on 48V, 115V and 220V ranges.	
AC Input Voltage **12V and 24V** **115V**	Off – To – On 8.8Vrms+/-0.5Vrms 65Vrms+/- 5Vrms	On – To – Off 6.0Vrms+/-0.5Vrms 45Vrms+/- 5Vrms
DC Input Voltage **12V and 24V** **115V**	Off – To – On 7.5Vdc+/- 0.5Vdc 57Vdc +/- 5Vdc	On – To – Off 7.5Vdc+/- 0.5Vdc 57Vdc +/- 5Vdc

AC Response Time **@50 Hz** **@60 Hz**	Off – To – On 6 – 18mS 5 – 15mS	On – To – Off 6 – 18mS 5 - 15mS
DC Response Time **@50 Hz** **@60 Hz**	Off – To – On 6 – 8mS 5 – 7mS	On – To – Off 16 – 18mS 13 - 15mS
Isolation	1500Vrms in groups of 8 inputs	

Digital Outputs

Outputs	12 on 5601/A I/O module
5601/A I/O Module	sealed mechanical relay Form C (normally open and normally closed) on Outputs 0 and 1. Form A (normally open) contacts on Outputs 2 and 3. Form A (normally open) contacts with common return on Outputs 4 through 7. Form A (normally open) contacts with common return on Outputs 8 through 11.
Contact Ratings	0.4A at 125 Vrms, 2A at 30V resistive loads 1.0A at 30V, 0.2A at 125Vrms inductive load with pf=0.4, L/R=7ms 250Vrms, 220V maximum operating voltage
Operating Frequency	36,000 operations/hour mechanically, 1,800 electrically at rated load
Service Life	1,500,000 operations at 1A/30V resistive load 150,000 operations at 0.25A/125Vrms resistive load
Operate Time	10ms maximum
Release Time	10ms maximum
Bounce Time	3ms typical
Contact Isolation	1000Vrms
Logic Isolation	1500Vrms

Approvals and Certifications

For approvals and certifications refer to the SCADAPack hardware manual of the controller board to which the I/O module is attached.