

# 5401 and 5402 Digital I/O Modules

Installation, Operation and Maintenance  
Setup Manual

5/19/2011



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

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

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

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## Safety Information

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



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



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

### **DANGER**

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

### **WARNING**

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

### **CAUTION**

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

### **CAUTION**

**CAUTION** used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage..

### PLEASE NOTE

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

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

### BEFORE YOU BEGIN

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

|  |
|--|
|  <b>CAUTION</b> |
|--|

|                                       |
|---------------------------------------|
| <b>UNINTENDED EQUIPMENT OPERATION</b> |
|---------------------------------------|

|   |
|---|
| 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 |
|---|

|  |
|--|
| <b>Failure to follow these instructions can result in death, serious injury or equipment damage.</b> |
|--|

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

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

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

Before energizing equipment:

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

### OPERATION AND ADJUSTMENTS

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

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

## About The Book

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### At a Glance

#### Document Scope

This manual describes the operation and maintenance of the 5401 and 5402 Digital I/O modules.

#### Validity Notes

This document is valid for all versions of the 5401 and 5402 Digital I/O modules.

#### Product Related Information

### **WARNING**

#### **UNINTENDED EQUIPMENT OPERATION**

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

Follow all local and national safety codes and standards.

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

#### User Comments

We welcome your comments about this document. You can reach us by e-mail at [technicalsupport@controlmicrosystems.com](mailto:technicalsupport@controlmicrosystems.com).

## Overview

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The Model 5401 Digital Input/Output module adds eight, plug-in I/O modules to a 5000 input/output system. Up to eight Model 5401 modules may be installed on the 5000 I/O bus, for a total of 64 discrete inputs and 64 discrete outputs. Input and output I/O modules can mixed in any combination.

The Model 5402 Digital Input/Output module adds sixteen, plug-in I/O modules to a 5000 input/output system. Up to sixteen Model 5402 modules may be installed on the 5000 I/O bus, for a total of 256 discrete inputs and 256 discrete outputs. Each 5402 module is either all inputs or all outputs. 5401 input and output modules can mixed in any combination.

The 5401 module is highly cost effective for applications with fewer than eight discrete I/O points. Both the 5401 and 5402 modules are useful for high power discrete output applications. These plug in I/O modules have higher current carrying capacity than either the 5000 triac or FET output modules.

The I/O modules plug into sockets, to facilitate field replacement and point configuration. Each I/O point is individually isolated, and has two poles on the field wiring terminal block. A large selection of I/O signal ranges is available.

A light emitting diode (LED) shows the status of each I/O point. The LEDs are controlled directly by the I/O module.

The SCADAPack controller addresses the 5401 module as both a digital input module and a digital output module. Therefore the 5401 module consumes one input and one output address. The 5402 module is addressed either as an input or an output module. It consumes one input or one output address (but not both).

## Installation

The installation of the 5401 and 5402 Digital Input/Output modules requires mounting the modules on the 7.5mm by 35mm DIN rail and connecting the modules to the system I/O Bus. Refer to the **System Configuration Guide**, at the beginning of this manual, for complete information on system layout, I/O Bus cable routing and module installation.

### 5401 I/O Module Installation

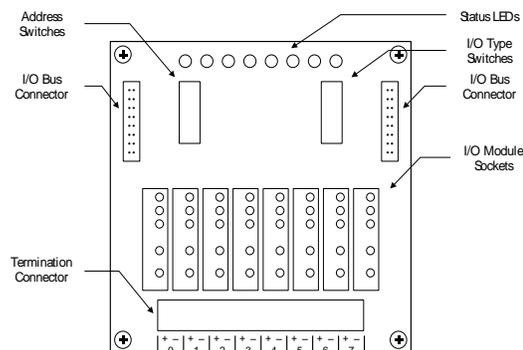
The 5401 modules support input and output solid-state I/O modules. An input or output module may be installed at any I/O point. There are 8 positions on the 5401 for I/O modules. They are labeled IO0 to IO7 (see **Figure 1: 5401 Digital I/O Module**).

A dip-switch configures each point as an input or output. They are numbered 0 to 7 on the circuit board, corresponding to sockets IO0.0 to IO0.7 and IO1.0 to IO1.7. Ignore the numbers printed on the dip-switch case.

To select an input point, press down on the INPUT (left) side of the switch. To select an output point, press down on the OUTPUT (right) side of the switch.

To install an I/O module:

- Remove the module cover.
- Insert the I/O module into the sockets on the board. Press the module firmly into the sockets.
- Set the I/O type switch corresponding to the I/O module. Set the switch to INPUT if the I/O point is an input. Set the switch to OUTPUT if the I/O point is an output.
- Replace the cover. It holds the I/O modules in place.



**Figure 1: 5401 Digital I/O Module**

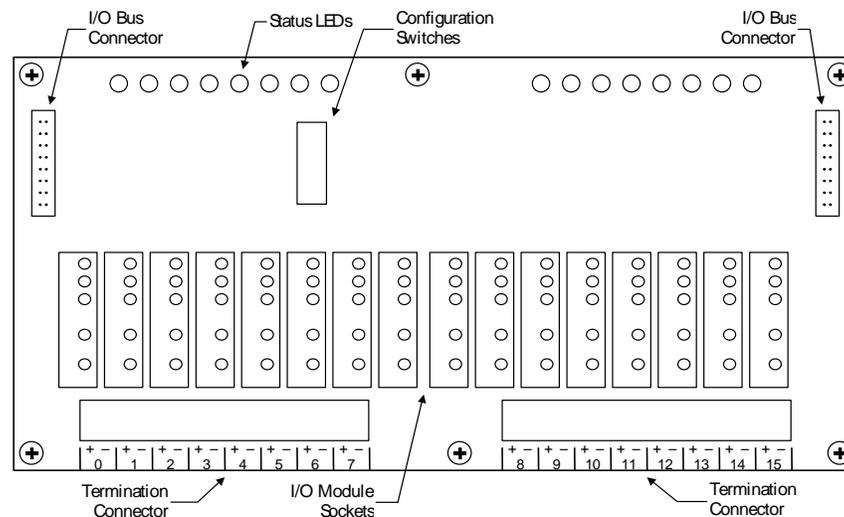
## 5402 I/O Module Installation

The 5402 modules support input and output solid state I/O modules. There are 16 positions on the 5402 for I/O modules. They are labeled IO0 to IO15 (see **Figure 2: 5402 Digital I/O Module**).

16 input modules or 16 output modules may be installed. Input and output modules cannot be mixed on the same 5402 module.

The OUTPUTS dip-switch configures the 5402 for input or output modules.

- To use the 5402 with output modules, close the OUTPUTS switch.
- To use the 5402 with input modules, open the OUTPUTS switch.
- To install an I/O module:
- Remove the module cover.
- Insert the I/O module into the sockets on the board. Press the module firmly into the sockets.
- Replace the cover. It holds the I/O modules in place.



**Figure 2: 5402 Digital I/O Module**

## Field Wiring

Field wiring connects to the termination connectors at the bottom of the module (see **Figure 1: 5401 Digital I/O Module** and **Figure 2: 5402 Digital I/O Module**). Each I/O point has two poles. On the 5401 module the pairs are numbered 0 to 7 corresponding to I/O module sockets IO0 to IO7. On the 5402 module the pairs are numbered 0 to 15 corresponding to I/O module sockets IO0 to IO15. The + and – symbols indicate the polarity of the poles.

I/O points are isolated from each other. Isolation between I/O points allows multiple power sources to be used within in the same module.

**Figure 3: Field Wiring Examples** shows typical wiring for AC and DC inputs and outputs.

### AC Modules

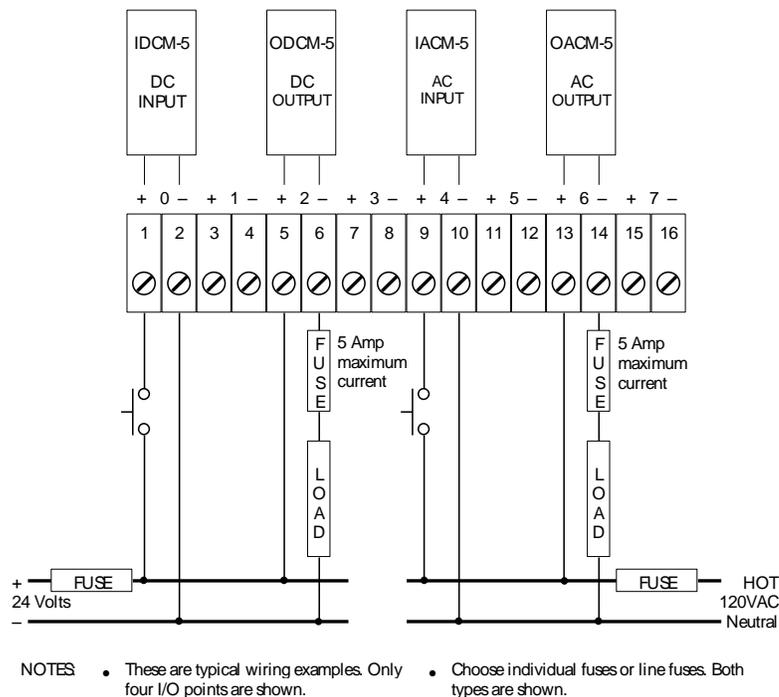
Loads can be connected to the Hot or Neutral side of the power source. They are shown connected to the neutral side in **Figure 3: Field Wiring Examples**. You may ignore the signal polarity labels on the terminal block when wiring AC input and output modules.

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.

### DC Modules

Observe the signal polarity when wiring DC input and output modules.

Digital output modules should be fused, particularly in primary voltage carrying modules. See **Figure 3: Field Wiring Examples** for fusing examples. Consult the individual I/O module specifications for the suggested ratings for external fuses.



**Figure 3: Field Wiring Examples**

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## Termination Connector

Controller, modem and I/O modules use screw termination style connectors for termination of field wiring. They accommodate solid or stranded wires from 22 to 12 AWG.

The connectors are removable. This allows module replacement without disturbing the field wiring. Leave enough slack in the wiring for the connector to be removed.

Remove power before servicing unit.

To remove the connector:

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

To install the 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.

The 5401 module uses a two piece connector. Positions 1 to 8 are on the first connector. Positions 9 to 16 are on the second connector.

The 5402 module has an additional two piece connector. Positions 17 to 24 are on the third connector. Positions 25 to 32 are on the fourth connector.

## Address Selection

The 5000 I/O bus will support a maximum of twenty I/O (input/output) modules. 5000 I/O module types may be combined in any manner to the maximum supported by the controller used. The types of input and output modules available are:

- Digital Input modules
- Digital Output modules
- Analog Input modules
- Analog Output modules
- Counter Input modules

Each type of I/O module, connected to the I/O bus, has a unique I/O module address. Different types of I/O modules may have the same module address.

The address range supported by the SCADAPack controller module may restrict the I/O module address range. Refer to the controller manual for the maximum address supported.

## 5401 Address Selection

The model 5401 Digital I/O module acts as both an input and an output module. The three address switches labeled 1, 2, and 4 set the input and output module address. To set the address:

- Open the three switches by pressing down the left side of the switch.
- Close the switches that total to the desired address.

**Figure 4: Model 5401 Digital I/O Module Address Switches** shows the switch settings for each of the 8 module addresses.

The 5401 module uses one digital input address and one digital output address per module. No other digital I/O module (input or output) may use the address set on the 5401 module.

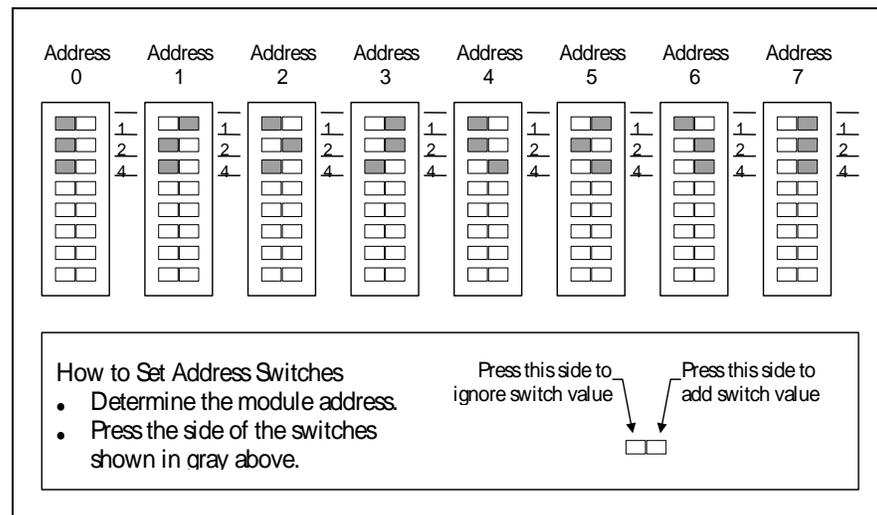
## 5402 Address Selection

The model 5402 Digital I/O module acts as either an input or an output module. If the OUTPUTS switch is closed, the 5402 module uses 1 digital output module address. If the OUTPUTS switch is open the 5402 module uses 1 digital input module address.

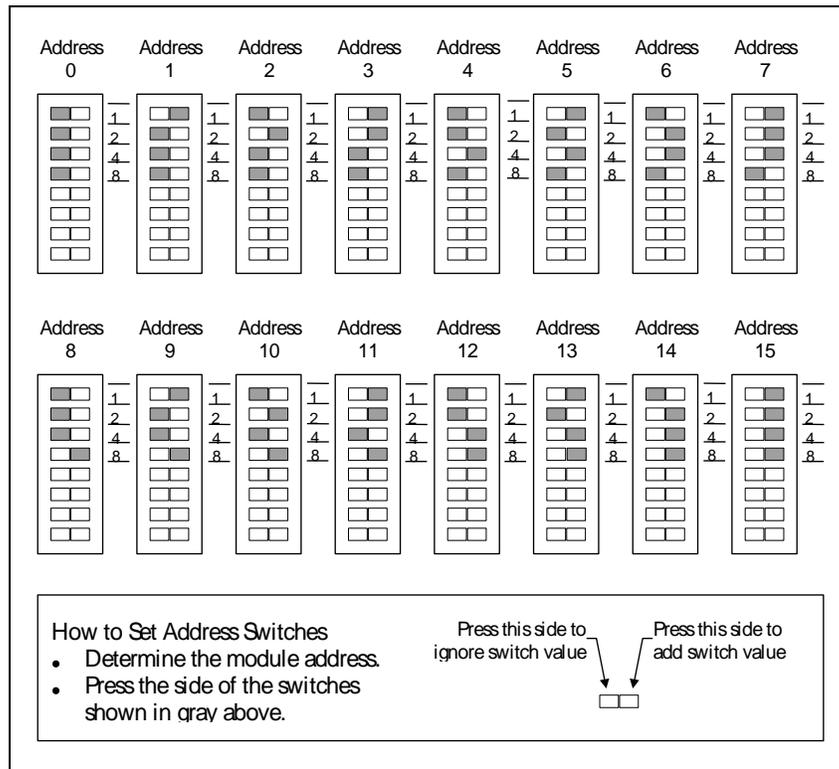
The four address switches labeled 1, 2, 4 and 8 set the input and output module address. To set the address:

- Open all four switches by pressing down the left side of the switch.
- Close the switches that total to the desired address.

**Figure 5: Model 5402 Digital I/O Module Address Switches** shows the switch settings for each of the 16 module addresses.



**Figure 4: Model 5401 Digital I/O Module Address Switches**



**Figure 5: Model 5402 Digital I/O Module Address Switches**

## Operation and Maintenance

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This 5401 and 5402 modules require no routine maintenance or calibration. If a module is not functioning correctly, contact Control Microsystems Technical Support for more information and instructions for returning the module for repair.

### LED Indicators

The models 5401 and 5402 modules have one red status LED per I/O point. This LED is on when an I/O module is installed and an output is turned on or the input is monitoring a voltage greater than the minimum rated input voltage. The LEDs are enabled when an I/O module is installed. They are not affected by the LED power signal on the I/O bus.

### Troubleshooting

| Condition  | Action  |
|--|---|
| Input LED does not come on when input signal is applied. | Check that the I/O module is the correct type.<br>Check that the I/O module is properly seated in the sockets.<br>If this is a DC input, check the polarity of the signal.<br>Check the magnitude of the input voltage. It must be greater than the I/O module turn on voltage. |
| Output LED does not come on when output is turned on.    | Check that the I/O module is properly seated in the sockets.  |
| Output LED comes on but output is not energized.         | Check that the I/O module is the correct type.<br>Check the external fuse if one is installed.<br>Check the field wiring.   |

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## Specifications

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**Disclaimer:** Control Microsystems reserves the right to change product specifications. For more information visit [www.controlmicrosystems.com](http://www.controlmicrosystems.com).

### 5401 Module Specifications

|                                |   |
|--------------------------------|---|
| <b>I/O points</b>              | 8   |
| <b>Voltage Range</b>           | see I/O module specifications   |
| <b>Load Current</b>            | see I/O module specifications   |
| <b>Surge Current</b>           | see I/O module specifications   |
| <b>Off-State Leakage</b>       | see I/O module specifications   |
| <b>Transient Protection</b>    | see I/O module specifications   |
| <b>Response Time</b>           | see I/O module specifications   |
| <b>Isolation</b>               | 1500 VAC  |
| <b>Addressing</b>              | DIP switch configurable<br>Addressable up to 8 modules.                       |
| <b>Input/Output Assignment</b> | DIP switch selection for each I/O point                                       |
| <b>Power Requirements</b>      | 5V @ 90mA   |
| <b>Visual Indicators</b>       | 8 red LEDs<br>permanently enabled   |
| <b>Field Terminations</b>      | Two 8 pole, removable terminal block<br>12 to 22 AWG<br>15 amp contacts       |
| <b>Dimensions</b>              | 4.25 inch (108 mm) wide<br>4.625 inch (118 mm) high<br>1.75 inch (44 mm) deep |
| <b>Mounting</b>                | 7.5 x 35 DIN rail   |
| <b>Packaging</b>               | Corrosion resistant zinc plated steel with black enamel paint                 |
| <b>Environment</b>             | 5% RH to 95% RH, non-condensing<br>-40°C to 60°C<br>-40°F to 140°F            |

## 5402 Module Specifications

|                                |  |
|--------------------------------|--|
| <b>I/O points</b>              | 16   |
| <b>Voltage Range</b>           | see I/O module specifications  |
| <b>Load Current</b>            | see I/O module specifications  |
| <b>Surge Current</b>           | see I/O module specifications  |
| <b>Off-State Leakage</b>       | see I/O module specifications  |
| <b>Transient Protection</b>    | see I/O module specifications  |
| <b>Response Time</b>           | see I/O module specifications  |
| <b>Isolation</b>               | 1500 VAC   |
| <b>Addressing</b>              | DIP switch configurable<br>Addressable up to 16 modules, depending on controller module. |
| <b>Input/Output Assignment</b> | All inputs or outputs. Selectable by DIP switch.   |
| <b>Power Requirements</b>      | 5V @ 150mA   |
| <b>Visual Indicators</b>       | 16 red LEDs<br>permanently enabled   |
| <b>Field Terminations</b>      | Four 8 pole, removable terminal block<br>12 to 22 AWG<br>15 amp contacts                 |
| <b>Dimensions</b>              | 8.37 inch (215 mm) wide<br>4.625 inch (118 mm) high<br>1.75 inch (44 mm) deep            |
| <b>Mounting</b>                | 7.5 x 35 DIN rail  |
| <b>Packaging</b>               | corrosion resistant zinc plated steel with black enamel paint                            |
| <b>Environment</b>             | 5% RH to 95% RH, non-condensing<br>-40°C to 60°C<br>-40°F to 140°F                       |

## I/O Module Specifications

The following specifications are for four common I/O modules. Specifications for other modules are available, upon request from Control Microsystems.

These specifications apply to I/O modules supplied by Control Microsystems. Specifications for I/O modules from other suppliers may be different.

| Common Specifications        |  |
|------------------------------|--|
| <b>Size</b>                  | 0.4" width X 1.7" length X 1.0" height |
| <b>Isolation</b>             | 4000 V RMS at 60 Hz.                   |
| <b>Operating temperature</b> | -40°C to +80°C<br>-40°F to +176°F      |
| <b>Insulation resistance</b> | 100 MΩ at 500 VDC                      |

| IACM-5                       |                                     |
|------------------------------|-------------------------------------|
| <b>Type</b>                  | AC input                            |
| <b>Color</b>                 | Yellow                              |
| <b>Input voltage range</b>   | 90-140 VAC/VDC<br>nominally 120 VAC |
| <b>Must operate voltage</b>  | 90 VAC                              |
| <b>Must release voltage</b>  | 25 VAC                              |
| <b>Turn-on/turn-off time</b> | 20 ms maximum                       |

| IDCM-5                       |                      |
|------------------------------|----------------------|
| <b>Type</b>                  | DC Input             |
| <b>Color</b>                 | White                |
| <b>Input voltage range</b>   | 3-32 VDC             |
| <b>Must operate voltage</b>  | 3 VDC                |
| <b>Must release voltage</b>  | 1 VDC                |
| <b>Turn-on/turn-off time</b> | 0.20/0.40 ms maximum |

| OACM-5                      |                                  |
|-----------------------------|----------------------------------|
| <b>Type</b>                 | AC Output, zero crossing turn on |
| <b>Color</b>                | Black                            |
| <b>Output voltage range</b> | 24-140 VAC                       |

| <b>OACM-5</b>                     |  |
|-----------------------------------|--|
|                                   | typically 120 VAC  |
| <b>Load current</b>               | 0.02-3 Amps at 25°C<br>de-rate to 1.2 Amps at 70°C                                       |
| <b>Single cycle surge current</b> | 80 Amps  |
| <b>On-state voltage drop</b>      | 1.5 volts max.   |
| <b>Leakage current</b>            | 2mA maximum  |
| <b>Turn-on time</b>               | 1/2 60 Hz cycle maximum  |
| <b>Turn-off time</b>              | 1/2 cycle maximum  |
| <b>Fuse</b>                       | 5 Amp recommended on output. See <b>Figure 3: Field Wiring Examples</b> for information. |

| <b>ODCM-5</b>                   |   |
|---------------------------------|---|
| <b>Type</b>                     | DC Output   |
| <b>Color</b>                    | Red   |
| <b>Output voltage range</b>     | 3-60 VDC  |
| <b>Load current</b>             | 0.02-3 Amps at 25°C<br>de-rate to 1.4 Amps at 70°C                                      |
| <b>One second surge current</b> | 5 Amps  |
| <b>On-state voltage drop</b>    | 1.2 volts maximum   |
| <b>Leakage current</b>          | 1.5mA DC maximum  |
| <b>Turn-on time</b>             | 0.02 ms maximum   |
| <b>Turn-off time</b>            | 0.05 ms maximum   |
| <b>Fuse</b>                     | 5 Amp recommended on output See <b>Figure 3: Field Wiring Examples</b> for information. |

## Approvals and Certifications

|                          |  |
|--------------------------|--|
| <b>Safety</b>            | <p>Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.</p> <p>The 5401 is UL Listed to the following standards:</p> <ul style="list-style-type: none"> <li>• CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.</li> <li>• CSA Std. C22.2 No. 142-M1987 - Process Control Equipment.</li> <li>• UL Std. No. 1604 - Hazardous (Classified) Locations.</li> <li>• UL Std. No. 508 - Industrial Control Equipment.</li> </ul> <p>The 5402 CSA certified to the requirements of:</p> <ul style="list-style-type: none"> <li>• CSA Std. C22.2 No. 213-M1987 - Hazardous Locations.</li> <li>• CSA Std. C22.2 No. 142-M1987 - Process Control Equipment.</li> <li>• UL Std. No. 1604 - Hazardous (Classified) Locations.</li> <li>• UL Std. No. 916 – Energy Management Equipment.</li> </ul> |
| <b>Digital Emissions</b> | <p>FCC47 Part 15, Subpart B, Class A Verification</p> <p>5401: EN 50081-1</p> <p>5402: EN61000-6-4: 2007 Electromagnetic Compatibility Generic Emission Standard Part2: Industrial Environment C-Tick compliance. Registration number N15744.</p>  |
| <b>Immunity</b>          | <p>5401: EN 50082-1</p> <p>5402: EN61000-6-2: 2005 Electromagnetic Compatibility Generic Standards Immunity for Industrial Environments</p>  |
| <b>Declaration</b>       | <p>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.</p> <p>Models with digital inputs configured below 30Vdc/60Vac are eligible to bear the CE mark.</p> <p>The Low Voltage Directive is not applicable to this product in applications below 30Vdc/60Vac.</p>   |