USER MANUAL

SPECTRUM CONTROLS

An Allient Company

User's Manual Pub. 0300270-02 Rev. A1

Micro800™ 2-Channel High-Current Digital Output Module

Catalog Number: 2080sc-OW2IHC

Important Notes

1. Please read all the information in this owner's guide before installing the product.
2. The information in this owner's guide applies to hardware Series A and firmware version 1.1 or later.
3. This guide assumes that the reader has a full working knowledge of the relevant processor.

Notice

The products and services described in this owner's guide are useful in a wide variety of applications. Therefore, the user and others responsible for applying the products and services described herein are responsible for determining their acceptability for each application. While efforts have been made to provide accurate information within this owner's guide, Spectrum Controls, Inc. assumes no responsibility for the accuracy, completeness, or usefulness of the information herein.

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The information in this owner's guide is subject to change without notice.

Limited Warranty

Spectrum Controls, Inc. warrants that its products are free from defects in material and workmanship under normal use and service, as described in Spectrum Controls, Inc. literature covering this product, for a period of 1 year. The obligations of Spectrum Controls, Inc. under this warranty are limited to replacing or repairing, at its option, at its factory or facility, any product which shall, in the applicable period after shipment, be returned to the Spectrum Controls, Inc. facility, transportation charges prepaid, and which after examination is determined, to the satisfaction of Spectrum Controls, Inc., to be thus defective.

This warranty shall not apply to any such equipment which shall have been repaired or altered except by Spectrum Controls or which shall have been subject to misuse, neglect, or accident. In no case shall the liability of Spectrum Controls, Inc. exceed the purchase price. The aforementioned provisions do not extend the original warranty period of any product which has either been repaired or replaced by Spectrum Controls, Inc.

Table of Contents

Preface

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- Who should use this manual
- How to use this manual
- Rockwell Automation technical support
- Documentation
- Conventions used in this manual

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Allen-Bradley I/O and/or compatible controllers, such as CompactLogix and ControlLogix.

How to Use This Manual

As much as possible, we organized this manual to explain, in a task-by-task manner, how to install, configure, program, operate, and troubleshoot a control system using the Micro800™ 2080sc-OW2IHC 2-Channel High-Current Digital Output Module.

Rockwell Automation Technical Support

For technical support, please contact your local Rockwell Automation TechConnect Office for all Spectrum products. Contact numbers are as follows:

- USA 1-440-646-6900
- United Kingdom 01-908-635-230
- Australia 1-800-809-929
- Mexico 001-888-365-8677
- Brazil 55-11-3618-8800
- Europe +49-211-41553-630

or send an email to support@spectrumcontrols.com.

Documentation

If you would like a .PDF version of a manual, you can download a free electronic version at www.spectrumcontrols.com.

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists (like this one) provide information not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- *Italic* type is used for emphasis.
- **Bold** type identifies headings and sub-headings:

WARNING 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you to identify a hazard, avoid a hazard, and recognize the consequences.

ATTENTION 	Actions ou situations risquant d'entraîner des blessures pouvant être mortelles, des dégâts matériels ou des pertes financières. Les messages « Attention » vous aident à identifier un danger, à éviter ce danger et en discerner les conséquences.

NOTE 	Identifies information that is critical for successful application and understanding of the product.

Chapter 1
Module Overview

Section 1.1 General Description

1.1.1 What is it?

The 2080sc-OW2IHC 2-Channel High-Current Digital Output Module is a relay output module designed for use with Rockwell Automation Micro800™ systems. This module provides Form A (N.O.) isolated electromechanical relay outputs rated at up to 10 A at 30 VDC or 10 A at 250 VAC for control of equipment and devices. The module interfaces with the controller via an Asynchronous Parallel Interface (API) which it shares with other plug-in peripherals in the controller. Power is provided across the same connector used to implement the APIs.

1.1.2 How does it connect mechanically?

The module plugs into any spare plug-in slot on the PLC. A 40-pin connector provides the connection between the controller and the module. Channel-to-channel isolation is provided on this relay module.

Output relay connections are connected to the module via a 12-pin terminal block on the module.

1.1.3 How does it connect via software?

The exchange of data between the module and controller is used to communicate the commanded output state (ON or OFF) of each relay output of the module.

Other types of exchanges also occur across the API. These exchanges include reset commands by the controller, interrupts from the module to the controller, module status queries by the controller, configuration changes and other associated communications.

The plug-in module contains memory with specific locations holding configuration, status, and channel values accessible to the Controller as register locations.

1.1.4 How does it indicate normal function?

Each of the two output channels has a yellow LED indicator. When the module is commanded to turn an output module ON, the LED for the channel lights. When the module is commanded to turn a channel OFF, or no command is given to turn on the channel during startup, the LED remains OFF.

The module operates in normal run mode when installed in a Micro800 controller chassis and is powered on and is designed to operate 24 hours a day, 7 days a week for a period of years.

Section 1.2 Environment and Enclosure

WARNING 	This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC publication 60664-1), at altitudes up to 2000 meters (6562 feet) without derating. This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance. This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5 VA, V2, V1, V0 (or equivalent) if non-metallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications. In addition to this publication, see: • Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional installation requirements. • NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

ATTENTION 	Cet équipement est prévu pour fonctionner en environnement industriel avec une pollution de niveau 2, dans des applications de surtension de catégorie II (telles que définies dans la publication 60664-1 de la CEI) et à une altitude maximum de 2000 m sans déclassement. Cet équipement est considéré comme étant un équipement industriel du Groupe 1, classe A selon CEI/CISPR 11. En l'absence de précautions appropriées, des problèmes de compatibilité électromagnétique peuvent survenir dans des environnements résidentiels et dans d'autres environnement en raison de perturbations conduites et rayonnées. Cet équipement est fourni en tant qu'équipement de type « ouvert ». Il doit être installé à l'intérieur d'une armoire fournissant une protection adaptée aux conditions d'utilisation ambiantes et suffisante pour éviter toute blessure pouvant résulter d'un contact direct avec des composants sous tension. L'armoire doit posséder des propriétés ignifuges capables d'empêcher ou de limiter la propagation des flammes, correspondant à un indice de propagation de 5VA, V2, V1, V0 (ou équivalent) dans le cas d'une armoire non métallique. L'accès à l'intérieur de l'armoire ne doit être possible qu'à l'aide d'un outil. Cette armoire doit permettre des connexions d'alimentation par un système de câblage de Classe I, Division 2, conformément au code électrique national (NEC). Certaines sections de la présente publication peuvent comporter des recommandations supplémentaires portant sur les indices de protection spécifiques à respecter pour maintenir la conformité à certaines normes de sécurité. En plus de cette publication, consultez: • La publication Rockwell Automation 1770-4.1, « Industrial Automation Wiring and Grounding Guidelines », pour d'autres critères d'installation. • La publication 250 de la norme NEMA ou la publication 60529 de la CEI, selon le cas, pour obtenir une description des indices de protection que fournissent les différents types d'armoires.

Section 1.3 Prevent Electrostatic Discharge

WARNING 	Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module: • Touch a grounded object to discharge static potential. • Wear an approved wrist-strap grounding device. • Do not touch connectors or pins on component boards. • Do not touch circuit components inside the module. • If available, use a static-safe workstation. • When not in use, keep the module in its static-shield box.

ATTENTION 	Cet équipement est sensible aux décharges électrostatiques, lesquelles peuvent entraîner des dommages internes et nuire à son bon onctionnement. Conformez-vous aux directives suivantes lorsque vous manipulez cet équipement: • Touchez un objet mis à la terre pour vous décharger de toute électricité statique éventuelle. • Portez au poignet un bracelet antistatique agréé. • Ne touchez pas les connecteurs ni les broches figurant sur les cartes des composants. • Ne touchez pas les circuits internes de l'équipement. • Utilisez si possible un poste de travail antistatique. • Lorsque vous n'utilisez pas l'équipement, stockez-le dans un emballage antistatique.

Section 1.4 Parts List

Your package contains one Micro800 2-Channel High-Current Digital Output Module, installation screws, and one Quick Start Guide.

You can choose to wire the plug-in before inserting it into the controller or wire it once the module is secured in place.

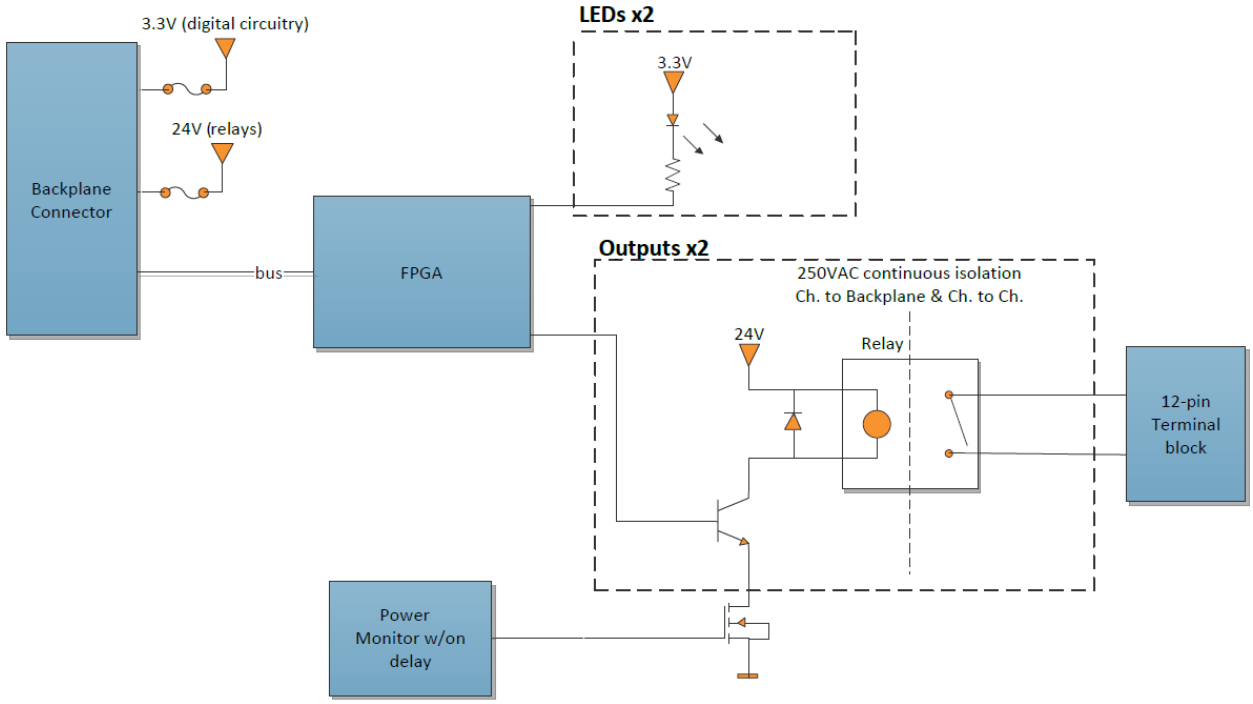
WARNING	
	• This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbance. • Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, make sure the controller is free of all metal fragments before removing the protective debris strip. • Do not wire more than 2 conductors on any single terminal. • If you insert or remove the plug-in module while power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding. • Do not insert or remove the plug-in module while power is applied; otherwise, permanent damage to equipment may occur.

ATTENTION	
	• Cet équipement est considéré comme étant un équipement industriel du Groupe 1, classe A selon CEI/CISPR 11. En l'absence de precautions appropriées, des problèmes de compatibilité électromagnétique peuvent survenir dans des environnements résidentiels et dans d'autres environnements en raison de perturbations conduites et rayonnées. • Soyez vigilant en dénudant les fils. Tout fragment de fil tombé dans l'automate risquerait de le détériorer. Une fois le câblage terminé, veillez à ce que l'automate ne présente aucun copeau de métal avant de retirer la bande de protection. • Ne câblez pas plus de 2 conducteurs sur une même borne. • L'insertion ou le retrait du module enfichable sous tension peut provoquer un arc électrique, susceptible de provoquer une explosion dans un environnement dangereux. Assurez-vous que l'alimentation est coupée ou que l'environnement est classé non dangereux avant de poursuivre. • N'insérez pas et ne retirez pas le module enfichable quand l'équipement est sous tension, au risque de provoquer des dommages irrémédiables à l'équipement.

Section 1.5
Hardware Features

The module plugs into, and communicates with, a controller in the Micro800 family. The only exchange of data between the controller and the Plug-In Module is through the API. The Plug-In Module shares the parallel bus with other plug-in peripherals in the controller.

The block diagram for the Plug-In Module interface is shown below:



Section 1.6 Module Power Specifications

The controller provides two Power Supplies to the module:

- 3.3 Volts (3.0 V Min, 3.6 V Max), Current Rating: 60 mA.
- 24 Volts (20.4 V Min, 26.4 V Max), Current Rating: 60 mA.

You may not use an external power source to power the module. Refer to the specifications in the Appendix for further information.

Section 1.7 Module Chassis Earth Ground

The Micro800 controller does not have a chassis (earth) ground. If a chassis (earth) ground connection is needed for a Plug-In Module or devices connected to a Plug-In Module, it must be provided externally. A capacitive coupling between chassis (earth) ground and Plug-In module signal ground is acceptable if required. The capacitor must be rated for least 500 VAC (707 VDC). The module does not use a chassis ground since it is not available on the backplane or the terminal block.

Chapter 2
Installation and Wiring

Section 2.1
Insert Module into Controller

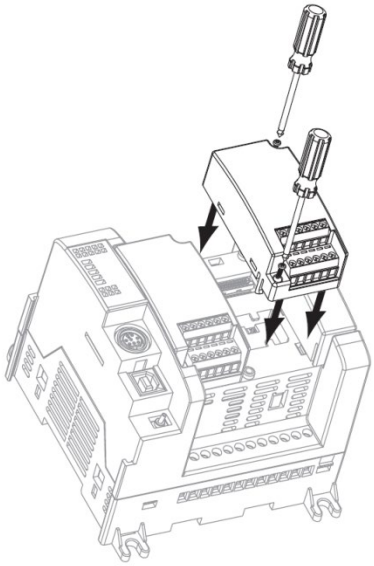
Follow the instructions to insert and secure the plug-in module to the controller.

WARNING 	Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module: • Touch a grounded object to discharge static potential. • Wear an approved wrist-strap grounding device. • Do not touch connectors or pins on component boards. • Do not touch circuit components inside the module. • If available, use a static-safe workstation. • When not in use, keep the module in its static-shield box.

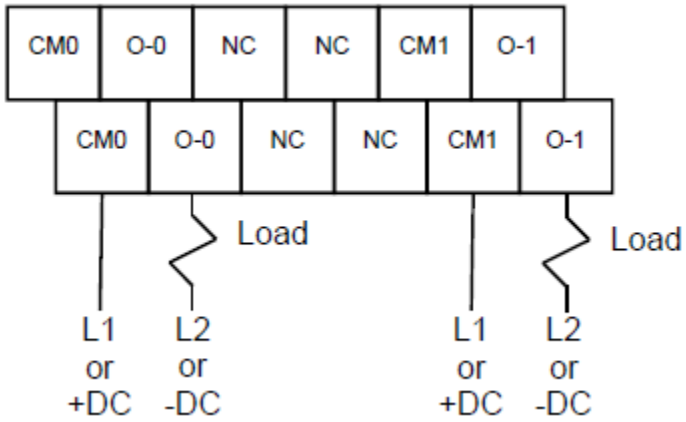
ATTENTION 	Cet équipement est sensible aux décharges électrostatiques, lesquelles peuvent entraîner des dommages internes et nuire à son bon onctionnement. Conformez-vous aux directives suivantes lorsque vous manipulez cet équipement: • Touchez un objet mis à la terre pour vous décharger de toute électricité statique éventuelle. • Portez au poignet un bracelet antistatique agréé. • Ne touchez pas les connecteurs ni les broches figurant sur les cartes des composants. • Ne touchez pas les circuits internes de l'équipement. • Utilisez si possible un poste de travail antistatique. • Lorsque vous n'utilisez pas l'équipement, stockez-le dans un emballage antistatique.

WARNING 	To comply with the CE Low Voltage Directive (LVD), all connected I/O must be powered from a source compliant with the following: Safety Extra Low Voltage (SELV) or Protected Extra Low Voltage (PELV).

1. Position the plug-in module with the terminal block facing the front of the controller as shown:



2. Snap the module into the module bay.
3. Using a screwdriver, tighten the supplied, self-tapping screw to torque specifications.
4. Follow the wiring diagram below to wire the module:



NOTE	In the diagram above, terminals with the same label are internally shorted together. Example, CM0 (Top Row) and CM0 (Bottom Row) are internally shorted together.

Section 2.2 Configuring the Module

The 2080sc-OW2IHC configuration consists only of placing it into run mode or stopping it.

To place the module in run, write a value of A5 Hex (165 decimal) to offset 17 (the MOD_MODE_CONTROL parameter).

NOTE	Micro 800 controllers running OS firmware revision 1.12 or older, require a decimal value of 16 be written to offset 11 (the CONTR_OPS_STATUS parameter) before the module will go into run mode. See the program sample later in the manual.

Table 2-1. General Module Status

Bit Number	Description
0-1	These 2 bits define module operation mode: • 0: Idle: Module is ready to RUN, and I/O is off. • 1: RUN: Module is under RUN, and I/O is on. • 2: Error: Error happens, and I/O is off. • 3: Busy: Module is busy, cannot go to RUN, and I/O is off.

Section 2.3 Module Output Data

The two output channels on the OW2IHC are controlled by memory location 64; bits 0 and 1 control channels 0 and 1 respectively. See Table 2-3 for memory location offsets. The table below describes the state of each output channel in relation to the control bits.

Table 2-2. Module Output Data

Channel Number	Bit State	Output State
0	0	OPEN
	1	CLOSED
1	0	OPEN
	1	CLOSED

Section 2.4 Adding the OW2IHC to CCW

The 2080sc-OW2IHC is configured for CCW (Connected Components Workbench) using the PLUGIN_READ and PLUGIN_WRITE instructions for generic plug-in modules.

The configuration, output data, and status structures discussed in the sections above, are stored at different memory locations in the module. The following table lists the memory location offset for each parameter which is used when

configuring the PLUGIN_READ, WRITE, and INFO instructions.

Table 2-3. Parameter Offset

Parameter	Offset (Dec)	Comments
MOD_ID_LO	0	Module ID
MOD_ID_HI	1	
VENDOR_ID_LO	2	Vendor ID
VENDOR_ID_HI	3	
PRODUCT_TYPE_LO	4	
PRODUCT_TYPE_HI	5	
PRODUCT_CODE_LO	6	
PRODUCT_CODE_HI	7	
MOD_REV_LO	8	Minor revision, 1-255
MOD_REV_HI	9	Major revision, 1-127
CONTR_OPS_STATUS	11	Controller operation status information (see Table 2-4)
MOD_STATUS	16	Module status register (see Table 2-1)
MOD_MODE_CONTROL	17	Module Mode Control Register
OUTPUT_DATA	64	Output Data Register

Table 2-4. Controller Operation Status Register

Bit Number	Description
0-3	Controller Error info: 0×00: no Error. 0×01: Operation Error. 0×02: Fatal Error. 0×03-0x0F: reserved.
c4-5	Controller mode: 0×00: non-RUN mode. 0×01: RUN mode. 0×02-0×03 : reserved.
6-7	Controller Power info: 0×00: Power O.K. 0×01: power failure triggered. 0×02-0×03: reserved.

The following sample program, written in structured text, demonstrates how to configure the module in CCW:

```
u800Slot := 1;   (* Slot number for module. *)

(* This section of code is to handle the controller with
Firmware earlier than rev 1.13 *)
SYS_INFO_FW(True);
IF (SYS_INFO_FW.Sts.OSMajRev = 1 and
SYS_INFO_FW.Sts.OSMinRev <=12) THEN
     IF SYS_INFO_FW.Sts.MajErrCode = 0 THEN
         ControllerStatus[1] := 2#00010000;

WriteControllerStatus(True,u800Slot,11,1,ControllerStatus);
     END_IF;
END_IF;

RunMode[1] := 16#A5;    (* Initialize RunMode register *)
WriteModModeControl(true,u800Slot,17,1,RunMode);       (*
Write A5 Hex  to MOD_MODE_CONTROL for run mode*)
ReadModStatus(true,u800Slot,16,1,OW2IHC_S1_ModStatus);
      (* Read general module status *)
WriteOutputs(True,u800Slot,64,1,OW2IHC_S1_Outputs);     (*
Write Output states *)
```

Table 2-5. CCW Program Variables

Variable Name	Data Type	Dimension
U800Slot	UINT	NA
SYS_INFO_FW	SYS_INFO	NA
ControllerStatus	USINT	[1..1]
WriteControllerStatus	Plugin_Write	NA
WriteModModeControl	Plugin_Write	NA
RunMode	USINT	[1..1]
ReadModStatus	Plugin_Read	NA
OW2IHC_S1_ModStatus	USINT	[1..1]
WriteOutputs	Plugin_Write	NA
OW2IHC_S1_Outputs	USINT	[1..1]

The sample project above can be downloaded from our website at www.spectrumcontrols.com.

Section 2.5
Technical Assistance

Note that your module contains electrostatic components that are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary wrapping or cushioning material. **In the**

unlikely event that the module should need to be returned to Spectrum Controls, Inc., please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding/metallized bag or black conductive container). Spectrum Controls, Inc. reserves the right to void the warranty on any unit that is improperly packaged for shipment.

For further information or assistance, please contact your local distributor, or call the technical support number provided under the Technical Support section in the Preface.

Appendix A
Configuration Information

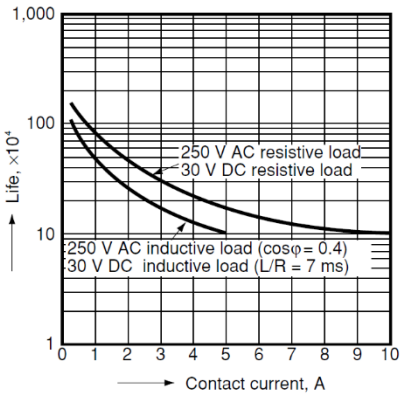
This appendix contains configuration information as follows:

Output Specifications

Description	2-Channel Relay Output Module
Relay Functionality	Form A normally open
Output Current Rating (at rated power)	**Resistive load at up to 30° C** 10 A at 5-30 VDC 10 A at 125 VAC 10 A at 125 VAC **Resistive load at up to 65° C** 6 A at 5-30 VDC 6 A at 125 VAC 6 A at 125 VAC
Output Power Rating (Resistive	**Resistive load at up to 30° C** 300 W Maximum for 30.0 VDC 1250 VA Maximum for 125 VAC 2500 VA Maximum for 250 VAC
	Inductive Loads[1]

[1] Connecting surge suppressors across your external load will extend the life of the relay contacts.

<table>
<tr><td>Description</td><td colspan="8">2-Channel Relay Output Module</td></tr>
<tr><td rowspan="5">UL Pilot Duty Contact Ratings (Power factor 0.35 or less for AC):</td><td rowspan="2">AC Contact Rating Code Designation</td><td rowspan="2">Thermal continuous test current (A)</td><td colspan="4">Max. current (A) [a, b]</td><td colspan="2" rowspan="2">Max. VA</td></tr>
<tr><td colspan="2">120 VAC</td><td colspan="2">240 VAC</td></tr>
<tr><td></td><td></td><td>Make</td><td>Break</td><td>Make</td><td>Break</td><td>Make</td><td>Break</td></tr>
<tr><td>B300</td><td>5</td><td>30</td><td>3</td><td>15</td><td>1.5</td><td>3600</td><td>360</td></tr>
<tr><td colspan="8">NOTES:
[a] Power factor 0.35 or less
[b] For maximum ratings at voltages between the maximum design value and 120 volts, the maximum make and break ratings are to be obtained by dividing the volt-amperes rating by the application voltage. For voltages below 120 volts, the maximum make current is to be the same as for 120 volts, and the maximum break current is to be obtained by dividing the break volt-amperes by the application voltage, but these currents are not to exceed the thermal continuous test current.</td></tr>
<tr><td colspan="8"><table>
<tr><td rowspan="2">DC Contact Rating Code Designation</td><td rowspan="2">Thermal continuous test current (A)</td><td colspan="2">Max. make/break current (A) [c, d]</td><td rowspan="2">Max. make/ break VA</td></tr>
<tr><td>125 VDC</td><td>250 VDC</td></tr>
<tr><td>R150</td><td>1.0</td><td>0.22</td><td>-</td><td>28</td></tr>
<tr><td>R300</td><td>1.0</td><td>0.22</td><td>0.11</td><td>28</td></tr>
</table></td></tr>
<tr><td colspan="8">NOTES:
[c] The maximum make and break ratings are to be obtained by dividing the volt-ampere rating by the application voltage, but the current values are not to exceed the thermal continuous test current.
[d] Inductive loads as specified in Section 8.2.7 of Industrial Control and Systems; Control Circuit and Pilot Devices, ANSI/NEMA ICS5-1993.</td></tr>
<tr><td>Additional UL ratings:</td><td colspan="8">1/3 HP, 125 VAC, 250 VAC
30 VDC Make/Break 2 A (Pilot Duty)
250 VAC, Make 20 A / Break 2 A (Pilot Duty)
2 A, 250 VAC, Tungsten Lamp
2 A, 30 VDC, Tungsten Lamp</td></tr>
<tr><td>Minimum Load</td><td colspan="8">10 mA at 5 VDC per point.
(This value can change due to the switching frequency, environmental conditions, and desired reliability level. Therefore, it is recommended to check this with the actual load.)</td></tr>
<tr><td>Initial Contact Res. of Relay</td><td colspan="8">< 5 mΩ typical, 30 mΩ max</td></tr>
</table>

Description	2-Channel Relay Output Module
Expected Life of Electrical Contacts	100 k operations at 20 times/min, at rated resistive capacity and temperature. 
Switching Frequency	Maximum 1 cycle /3 s at rated load (1.5 s on, 1.5 s off)
Bounce Time	1.2 ms average
Maximum Off State Leakage	1.5 mA Maximum
Output Delay Time (From the time the module receives data)	10 ms maximum on/off (5 ms typical) excluding bounce time
Status Indicators	2 yellow Status Indicators (I/O)
Power source	3.3 VDC, 24 VDC from backplane
Input to backplane isolation	250 VAC continuous, tested at 2300 VAC for 1 min.
Channel-to-channel isolation	250 VAC continuous, tested at 1500 VAC for 1 minute
Power consumption	<=35 mA at 3.3 V, <=20 mA at 24 V, <1.5 W
Inrush current	<120 mA at 3.3 V, <120 mA at 24 V
Fusing	Use external if desired
Terminal block Wire size	#16 - #30 AWG
Terminal block torque	0.19 Nm (1.7 lb-in)

Description	2-Channel Relay Output Module
Mounting torque	0.2 Nm (1.48 lb-in)
Manufacturing	RoHS compliant
Dimensions	58.4 mm x 29. 3mm x 25 mm
Status Indicators	Individual OFF/ON Status for each I/O point

Environmental Specifications

Environmental Tests	Industry Standards	Test Level Limits
Temperature (Operating) (Performance Criteria A)	IEC60068-2-1: (Test Ad, Operating Cold), IEC60068-2-2: (Test Bd, Operating Dry Heat), IEC60068-2-14: (Test Nb, Operating Thermal Shock)	-20 °C to 65 °C (-4 °F to 149 °F)
Temperature (Non-operating) (Performance Criteria B)	IEC60068-2-1: (Test Ab, Unpackaged Non-operating Cold), IEC60068-2-2: (Test Bb, Unpackaged Non-operating Dry Heat), IEC60068-2-14: (Test Na, Unpackaged Non-operating Thermal Shock)	-40 °C to 85 °C (-40 °F to 185 °F)
Humidity (Operating) (Performance Criteria A)	IEC60068-2-30: (Test Db, Unpackaged Damp Heat):	5 to 95% non-condensing
Vibration (Operating) (Performance Criteria A)	IEC60068-2-6: (Test Fc, Operating)	5 G at 10 to 500 Hz, 0.030 in. max. peak-to-peak
Shock (Operating) (Performance Criteria A)	IEC60068-2-27: (Test Ea, Unpackaged Shock)	10 G, 11 ms half-sine (3 mutually perpendicular axes)
Shock (Non-operating) (Performance Criteria B)	IEC60068-2-27: (Test Ea, Unpackaged Shock)	50 G, 11 ms half-sine (3 mutually perpendicular axes)
Radiated Emissions	CSIPR 11; Group 1, Class A	(Enclosure) Class A, 30 MHz–1 GHz

Environmental Tests	Industry Standards	Test Level Limits
Conducted Emissions	IEC 61000-6-4:2007	Group 1, Class A (AC Mains), 150 kHz–30 MHz
ESD immunity (Performance Criteria B)	IEC 61000-4-2	4 kV Indirect (Coupling Plate) 4 kV Contact Discharge (to points of initial contact) 8 kV Air Discharge (to points of initial contact)
Radiated RF immunity (Performance Criteria A)	IEC 61000-4-3: Level 3	10 V/M with 1 kHz sine-wave 80% AM from 80…2000 MHz 10 V/M with 200 Hz sine-wave 50% Pulse 100% AM at 900 MHz 10 V/M with 200 Hz sine-wave 50% Pulse 100% AM at 1890 MHz 3 V/M with 1 kHz sine-wave 80% AM from 2000…2700 MHz
EFT/B immunity (Performance Criteria B)	IEC 61000-4-4	Signal Ports: ±3 kV at 5 kHz for 5 minutes, Criteria B (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria A (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria B (standard) Power Ports: ±2 kV at 5 kHz for 5 minutes, Criteria A (Marine) ±2 kV at 5 kHz for 5 minutes, Criteria B (standard)
Surge transient immunity (Performance Criteria B)	IEC 61000-4-5	Signal Ports: ±2 kV line-earth Power Ports ±2 kV CM ±1 kV DM
Conducted RF immunity (Performance Criteria A)	IEC 61000-4-6	10 Vrms with 1 kHz sine wave 80% AM from 150 kHz…80 MHz on signal and power ports
Magnetic Field (Performance Criteria A)	IEC 61000-4-8	30 Arms/m

Environmental Tests	Industry Standards	Test Level Limits
AC Mains Voltage Dips, Interruptions and Variations	IEC 61000-4-11	Follow the 61000-4-11.

Regulatory Requirements

Safety Tests	Industry Standards
UL Safety	UL 508, 17th Edition Safety for Industrial Control Equipment (NRAQ, NRAQ7) CAN/CSA C22.2 No. 142-M1987 (Reaffirmed 2006), Industrial Products, Process Control Equipment
UL Hazardous Locations	ANSI/ISA–12.12.01 Nonincendive Electrical Equipment for Use in Class I, Division 2 Hazardous (Classified) Locations (NRAG) CSA C22.2 No. 213-M1987 - Non-incendive Electrical Equipment for use in Class I Division 2 Hazardous Locations - March 1987 (NRAG7) Temp code T4 or better, Pollution degree 2, gas groups A, B, C, & D
CE EMC Directive	EN 61131-2 Programmable Controllers: Third Edition 2007-02, Clause 8, Zones A&B EN 61000-6-2: Generic Industrial Immunity EN 61000-6-4: Generic Industrial Emissions
CE Low Voltage Directive	EN 61010-2-201 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-201: Particular Requirements for Control Equipment
UKCA EMC Directive	Electromagnetic Compatibility Regulations 2016 BS EN 61131-2, BS EN 61000-6-4, BS EN 61000-6-2
UKCA Low Voltage Directive	BS EN 61000-6-2:2005/AC:2005
FCC	27 CFR Part 15, Class A
CMIM	Arrêté ministériel n° 6404-15 du 29 ramadan 1436 (16 juillet 2015) NM EN 61131-2, NM EN 61000-6-4, NM EN 61000-6-2, NM EN 61010-2-201

Index

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