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User's Manual Pub. 0300308-02 Rev. A1

# Micro800™ Expansion I/O 8-Channel Analog Output Module

Catalog Number: 2085sc-OF8

## 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

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# Table of Contents

IMPORTANT NOTES .....	II
<b>CHAPTER 1 MODULE OVERVIEW .....</b>	<b>1-1</b>
SECTION 1.1 GENERAL DESCRIPTION .....	1-1
SECTION 1.2 OUTPUT SPECIFICATIONS .....	1-3
SECTION 1.3 DATA FORMATS .....	1-7
SECTION 1.4 HARDWARE FEATURES .....	1-7
1.4.1 LED Blink Codes .....	1-8
1.4.2 1.1 LED Operation .....	1-8
1.4.3 2.1 LED Operation .....	1-8
SECTION 1.5 SYSTEM OVERVIEW AND MODULE OPERATION .....	1-9
<b>CHAPTER 2 INSTALLATION AND WIRING.....</b>	<b>2-1</b>
SECTION 2.1 COMPLIANCE TO EUROPEAN UNION DIRECTIVES .....	2-1
2.1.1 EMC Directive .....	2-1
SECTION 2.2 POWER REQUIREMENTS .....	2-1
SECTION 2.3 GENERAL CONSIDERATIONS .....	2-2
2.3.1 Hazardous Location Considerations.....	2-2
2.3.2 Prevent Electrostatic Discharge .....	2-3
2.3.3 Remove Power.....	2-3
2.3.4 Selecting a Location .....	2-3
SECTION 2.4 MOUNTING .....	2-4
2.4.1 Minimum Spacing .....	2-4
2.4.2 Parts List.....	2-4
2.4.3 Module Description .....	2-5
2.4.4 Insert Module Next to the Controller .....	2-6
Wiring Diagram.....	2-8
<b>CHAPTER 3 CONFIGURING THE 2085SC-OF8 USING CCW .....</b>	<b>3-1</b>
SECTION 3.1 INTRODUCTION .....	3-1
SECTION 3.2 2085SC-OF8 AOP .....	3-2
SECTION 3.3 CCW CONFIGURATION TAB .....	3-4
SECTION 3.4 SETTING CONFIGURATION PARAMETERS USING MCC .....	3-7
3.4.1 Software Versioning .....	3-12
3.4.2 Software Updates.....	3-12
3.4.3 Startup and Factory Default Conditions.....	3-12
SECTION 3.5 PLC INTERFACES .....	3-13
3.5.1 Module Identity .....	3-13
3.5.2 Connection Types and Assembly Sizes .....	3-13
3.5.3 Input Table .....	3-14
3.5.4 Module Status (AI_00).....	3-15
3.5.5 Channel Output Status (AI_04:01) .....	3-16
3.5.6 Data Ch<x> (AI_12:05) .....	3-17
3.5.7 Module Firmware Revision (AI_13).....	3-17
3.5.8 Output Table .....	3-18
3.5.9 Output Ch<x> (AO_07:00).....	3-18
3.5.10 Unlatch Alarm Bits .....	3-18
3.5.11 Configuration Table.....	3-19
3.5.12 Configuration Bit Definition .....	3-20
3.5.13 Channel Configuration Bit Mapping.....	3-22

3.5.14 Voltage/Current Output.....	3-22
3.5.15 User Scaling/Data Format and Range .....	3-23
3.5.16 Fault Mode/Program Mode Operation.....	3-23
3.5.17 Module Specific Hardware Errors.....	3-24
3.5.18 Module Specific Configuration Errors .....	3-24
SECTION 3.6 TECHNICAL ASSISTANCE.....	3-25
SECTION 3.7 DECLARATION OF CONFORMITY .....	3-25
<b>APPENDIX A MANUALLY IMPORTING AN AOP .....</b>	<b>A-1</b>
<b>INDEX .....</b>	<b>I-1</b>

## 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
- Related documentation
- 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 the Micro800™ 8-Channel Analog Output Module.

### NOTE



Before you access any equipment or begin to install any IO modules, review all safety material and warnings in the Micro830, Micro850, and Micro870 Programmable Controllers User Manual. Be sure to review the warnings provided in this document before you start installing a module in a system.

Keep in mind that Version 2.1 of the module firmware is required for operation with 870 controllers.

## 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™ 8-Channel Analog Output Module.

## Related Documentation

The table below provides a listing of publications that contain important information about Allen-Bradley Micro800 Expansion I/O Module systems.

For	Refer to this Document	Allen-Bradley Pub. No.
Product outline	Micro850 Programmable Logic Controller Product Profile	2080-PP003
Selection information	Micro800 Programmable Controllers Family Selection Guide	2080-SG001
General instructions for using	Micro800 Programmable Controllers General Instructions	2080-RM001
Installing an external power supply	Micro800 External AC Power Supply Installation Instructions	2080-IN001

For	Refer to this Document	Allen-Bradley Pub. No.
	Micro870 24V DC Expansion Power Supply Installation Instructions	2085-IN008
Installing 24-point PLC	Micro850 24-Point Programmable Controllers Installation Instructions	2080-IN007
Installing 48-point PLC	Micro850 48-Point Programmable Controllers Installation Instructions	2080-IN008
Installing 24-point PLC	Micro870 24-Point Programmable Controllers Installation Instructions	2080-IN012
User manual information	Micro830, Micro850, and Micro870 Programmable Controllers User Manual	2080-UM002
Environment and Enclosure Information	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.	1770-4.1  NEMA 250-2014 IEC 60529
Declarations of conformity, certificates, and other certification details.	Product Certification website: <a href="https://spectrumcontrols.com">https://spectrumcontrols.com</a>	

## 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](mailto:support@spectrumcontrols.com)




## Documentation

If you would like a manual, you can download a free electronic version from the Internet at [www.spectrumcontrols.com](http://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.

<b>WARNING</b> 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. These messages help you to identify a hazard, avoid a hazard, and recognize the consequences.
<b>ATTENTION</b> 	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.
<b>NOTE</b> 	Identifies information that is critical for successful application and understanding of the product.





# Chapter 1

## Module Overview

This chapter covers the following topics:

- General description
- Output specifications
- Data formats
- Hardware features
- System overview and module operation

The Micro800™ 8-Channel Analog Output Module is an 8-point analog output module designed to expand the local I/O capability of Rockwell Automation Micro850 and Micro870 Systems over its Expansion I/O buses. The minimum system requirement in which an Expansion I/O Module can be installed is a Micro850 or Micro870 Controller and a controller power supply.

The number of 2085sc-OF8 modules that can be installed with a Micro850/870 PLC is based on the current controller firmware revision and CCW software revision.

### Section 1.1 General Description



The 2085sc-OF8 Expansion I/O module provides current and/or voltage outputs. The module supports:

- Eight output channels. The module outputs either voltage or current signals for each channel.
- Current output. When the module receives a new command value from the output image, the module converts the digital value to an analog current signal using a Digital to Analog Converter (DAC).

- Voltage output. When the module receives a new command value from the output image, the module's circuitry converts the digital value to an analog voltage signal using a Digital to Analog Converter (DAC).
- Output fault detection.
- Range scaling of output data.
- Over or under voltage detection (from user-defined values).
- Four data formats.

All outputs have fault tolerance and ESD protection to avoid damage to circuitry on the board. The modules use 50 VAC working Reinforced Insulation between the output channels and the backplane. Individual channels are not isolated from each other.

The 2085sc-OF8 module uses a 16-bit digital-to-analog converter to achieve a 16-bit resolution with  $\pm 10$  V full scale ranges. The module also uses 8 separate output drivers to provide for either current or voltage output signals on each channel. Each output channel is individually configured via Rockwell-provided Connected Component Workbench (CCW) software for Micro850 and Micro870 family controllers or with the Module Configuration Converter (MCC) utility from Spectrum Controls, Inc.

The module is factory calibrated and tested before shipping. After installation, the modules begin operation in a default, usable condition. During startup, all outputs are disabled and off until a valid configuration has been received. Default configuration is 4 to 20 mA.

The module normally requires no further user intervention. However, if the module experiences a hard fault condition, you may need to cycle power.

## Section 1.2

### Output Specifications

The 2085sc-OF8 module has the following output specifications:

**Table 1-1. Output/Performance/Environmental Requirements**

Output Description	Value
<b>Operating Temperature</b>	-20 °C to 65 °C (-4 °F to 149 °F)
<b>Storage/Non-Operating Temperature</b>	-40 °C to 85 °C (-40 °F to 203 °F)
<b>Operating Humidity</b>	5% to 95%, non-condensing
<b>Storage/Non-Operating Humidity</b>	5% to 85%, non-condensing
<b>Vibration/Operating</b>	10 Hz to 500 Hz, 2 g, 0.030 max peak-to-peak
<b>Operating Shock</b>	25 g, peak acceleration, 11±1 ms pulse, half sine
<b>Storage/Non-Operating Shock</b>	25 g peak acceleration, (35 g for panel mount), 11±1 ms pulse, half sine
<b>Pollution Level</b>	Meets Pollution Degree 2 requirements.
<b>ESD</b>	Meets CE requirements for operating ESD category B at 6 kV indirect (coupling plate).
<b>Radiated Immunity</b>	10 V/M with 1 kHz sine-wave 80% AM from 80...6000 MHz 10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 900 MHz 10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 1890 MHz
<b>Outputs per module</b>	8 current or voltage outputs.
<b>Output ranges<sup>1</sup></b>	Current: 0-20 mA (0-20.4 mA hardware support range) 4-20 mA (3.92-20.4 mA hardware support range) Voltage: 0-5 V (Over range is 0 V to 5.25 V) 0-10 V (Over range is 0 V to 10.5 V) ±10 V (Over range is -10.5 V to +10.5 V)
<b>Current output impedance</b>	Greater than 1 Mohm
<b>Voltage output impedance</b>	Less than 1 ohm
<b>Output Overvoltage Protection</b>	±24 VDC

<sup>1</sup> The load on each channel must be within the range of 50-500 Ohm in current mode and greater than 1 kOhm in voltage mode.

Output Description	Value	
<b>Output Short Circuit Protection in current mode</b>	Current outputs are electronically current limited to 20.4 mA or less with no damage	
<b>Output short circuit protection in voltage mode</b>	Output current will be limited at 15 mA	
<b>Resolution in current mode</b>	750 nA/bit	
<b>Resolution in voltage mode</b>	735 uV/bit	
<b>Field Power Input Voltage Range</b>	20.4 V to 26.4 V	
<b>Peak Inrush Current</b>	Less than 150 mA at 5 V (backplane) Less than 400 mA at 24 V (backplane) Less than 900 mA at 24 V (field power)	
<b>Current accuracy (calibrated)</b>	<b>Error at 25 °C, Max</b>	<b>Error over -20 °C to 65 °C, Max</b>
0-20 mA	±50.0 µA	±75.0 µA
4-20 mA	±50.0 µA	±75.0 µA
<b>Voltage accuracy (calibrated)</b>	<b>Error at 25 °C, Max</b>	<b>Error over -20 °C to 65 °C, Max</b>
0-5 V	±5.0 mV	±15.0 mV
0-10 V	±20.0 mV	±50.0 mV
±10 V	±20.0 mV	±50.0 mV
<b>Output Current Repeatability</b>	<b>At 25 °C</b>	
0-20 mA	Better than ±5.0 µA	
4-20 mA	Better than ±5.0 µA	
<b>Output Voltage Repeatability</b>	<b>At 25 °C</b>	
0-5 V	Better than ±0.5 mV	
0-10 V	Better than ±2.0 mV	
±10 V	Better than ±2.0 mV	
<b>Module Scan Time (for all analog channels)</b>	Less than 10 ms	
<b>Drive Capability</b>	50 to 500 Ohm with short-circuit survival in current mode	
	Better than or equal to 1 Kohm in voltage mode	
<b>Load Reactance</b>	100 µH max in current mode	
	Less than 1 µF in voltage mode	
<b>Output Settling Time: Current Output</b>	Less than 2.5 ms to 63% of full scale with resistive loads	
<b>Output Settling Time: Voltage Output</b>	Less than 2.5 ms to 63% of full scale with resistive loads	

Output Description	Value
Output Ripple	Less than 15 mV in voltage mode
	Less than 30 $\mu$ A in current mode
Isolation	
Input to backplane isolation	50 VAC working Reinforced isolation tested at 2 kVDC for 1 minute.
Input to Chassis GND isolation	50 VAC working Reinforced isolation tested at 2 kVDC for 1 minute.
Fault detection	<p>Over temperature detection is supported in both current and voltage modes (over 150 °C).</p> <p>Open Circuit current loop detection is supported on each channel in current mode. A load resistance greater than 500 Ohm also triggers this fault.</p> <p>A short on an output pin in voltage mode will be detected, and output current will be limited to less than 15 mA. A load less than 1 Kohm resistance also triggers this fault.</p>
Power Requirements	
Bus +5 VDC (4.75 V to 5.4 V)	110 mA maximum (0.55 W) at 50 Ohm resistance load on all channels.
Bus +24 VDC (19.9 V to 26.4 V)	20 mA maximum (24 V from backplane, [0.48 W]).
Field	260 mA maximum (24 V from backplane, [6.24 W]).
Power Dissipation (Current mode)	<p>Less than 4.3 W at 500 Ohm</p> <p>Less than 5 W at 250 Ohm</p> <p>Less than 5.5 W at 50 Ohm</p>
Wire size	#16 to #28 AWG
RoHS	Meets European RoHS component standards (January 2015 and earlier).
Wire Strip Length	0.25 in.
Recommended Tightening Torque:	0.25 N-m (2.2 lb-in)
REACH	Meets European REACH 7 requirements.
Dimensions	<p>110 mm <math>\times</math> 87 mm <math>\times</math> 51 mm (plastic only). (4.33 in <math>\times</math> 3.43 in <math>\times</math> 2.00 in)</p> <p>110 mm <math>\times</math> 89 mm <math>\times</math> 51 mm (with RTBs installed). (4.33 in <math>\times</math> 3.5 in <math>\times</math> 2.00 in)</p>

**Table 1-2 EMC Specification Table**

<b>Environmental Tests</b>	<b>Test Level Limits</b>
<b>Radiated Emissions</b>	(Enclosure) Class A, 30 MHz – 1 GHz
<b>Conducted Emissions</b>	Group 1, Class A (AC Mains), 150 kHz – 30 MHz
<b>ESD immunity (Performance Criteria B)</b>	6 kV Indirect (Coupling Plate) 6 kV Contact Discharge (to points of initial contact) 8 kV Air Discharge (to points of initial contact)
<b>Radiated RF immunity (Performance Criteria A)</b>	10 V/M with 1 kHz sine-wave 80% AM from 80...6000 MHz 10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 900 MHz 10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 1890 MHz
<b>EFT/B immunity (Performance Criteria B)</b>	Signal Ports: ± 2 kV at 5 kHz for 5 minutes, Criteria B  Power Ports: ± 2 kV at 5 kHz for 5 minutes, Criteria B
<b>Surge transient immunity (Performance Criteria B)</b>	Signal Ports: ± 2 kV line-earth {CM} at 2Ω on shielded ports  Power Ports ±2 kV CM at 12 Ω ±1 kV DM at 2 Ω
<b>Conducted RF immunity (Performance Criteria A)</b>	10 V RMS with 1 kHz sine wave 80% AM from 150 kHz...80 MHz on signal and power ports
<b>Magnetic Field (Performance Criteria A)</b>	30 Arms/m
<b>AC Mains Voltage Dips, Interruptions and Variations</b>	Follow the 61000-4-11.

**Table 1-3. Safety Test Specification Table**

<b>Safety Tests</b>	<b>Industry Standards</b>
<b>UL Safety</b>	UL 61010-2-201 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 2-201: Particular Requirements for Control Equipment (NRAQ, NRAQ7) CAN/CSA C22.2 No. 61010-1-12 (Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use – Part 1: General Requirements)
<b>UL Hazardous Locations</b>	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
<b>CE EMC Directive</b>	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
<b>UKCA</b>	Electromagnetic Compatibility Regulations 2016 BS EN 61131-2, BS EN 61000-6-4, BS EN 61000-6-2
<b>FCC</b>	27 CFR Part 15, Class A
<b>CMIM</b>	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

### Section 1.3 Data Formats

The data format and range parameters in the channel configuration bits determine the scaling. There are four pre-defined settings:

- Engineering units
- Scaled-for-PID
- Raw/proportional data
- Percent of full range

### Section 1.4 Hardware Features

Channels are wired as outputs. This module can detect open circuit current loop on each channel in current mode, short on an output pin in voltage mode, and over temperature conditions in both current and voltage modes. Outputs are protected from electrostatic discharge up to 6 kV for indirect and contact discharge, 8 kV for air discharge. A load resistance greater than 500 Ohm also triggers this fault.

A short on an output pin in voltage mode is also detected, and output current is then limited to less than 15 mA. A load less than 1Kohm resistance also triggers this fault.

### 1.4.1 LED Blink Codes

Revision 1.1 and Revision 2.1 of the Module firmware use different LED status operations for module status or power indication. Tables for 1.1 and 2.1 LED operation are provided below.

### 1.4.2 1.1 LED Operation

When startup is completed, and all internal tests have passed, the LED is solid GREEN. If the LED remains off, there is an error with the module: it may not have power, or the module failed to pass the self-test.

**Table 1-4 LED Blink Codes for Firmware 1.1**

Indicator	State	Description
<b>Module OK LED Status</b>	Off	No power applied to device, or the module may have failed to pass its self-test.
	Solid Green	RUN mode. Module has power and passed self-test. No action is required.
	Blinking Green	LED blink status: 1. Internal use only. 2. Internal use only. 3. Internal use only. 4. Internal use only. 5. Indicates ADC communication error. 6. Indicates Watchdog reset.

### 1.4.3 2.1 LED Operation

A 2085sc-OF8 module with Version 2.1 firmware uses a single, green **OK** LED to show power or module operational status:

- When startup is completed, and all internal tests have passed, the LED is solid GREEN. This indicates RUN mode.
- If the LED remains off, there is an error with the module: it may not have power or failed to pass the self-test.
- Any time the system is not in Run mode (and showing no faults), the LED blinks rapidly, indicating the module is Offline. All inputs and outputs are disabled in this instance.

The LED identifies different conditions using specific, numeric, blink patterns. The module blinks a specific number of times, pauses, and then repeats the same blink pattern indefinitely. Blink codes are shown in the following table.

**Table 1-5 LED Blink Codes Table for Firmware 2.1**

Blink Code	Name and Description	Resolution
rapid	Offline Rapid continuous blinking indicates the module is offline and outputs are disabled.	Set controller to RUN mode. This will also be seen during power-on while it is initializing.




Blink Code	Name and Description	Resolution
ON	Run Mode The LED is solid green.	Module is initialized with no hardware fault detected. Module is in Run mode.
OFF	Major Fault or Power-up or Power Off The module is just powering up and not initialized yet or there is a major hardware fault causing the module to be held in reset by the controller. LED control is not possible for this condition and will remain off.	Give plenty of time for power-on.  Power-cycle to try and clear the error condition. If unsuccessful, the module must be replaced.
3	Calibration invalid or corrupted This code will be seen for newly manufactured boards that have yet to be calibrated.	Factory calibration must be performed. Return the module to Spectrum Controls, Inc. for recalibration.
4	Serial Number Invalid or Corrupted This code will only be seen if the module has been calibrated but the serial number is not programmed, or the flash memory sector is corrupted.	Serial number must be programmed. Return the module to Spectrum Controls, Inc. for recalibration.
5	Analog Communications Error – Input A communications error or connection error took place between the MCU and ADC or PGA circuitry.	Power-cycle to try and clear the error condition. If unsuccessful, the module must be replaced.

## Section 1.5

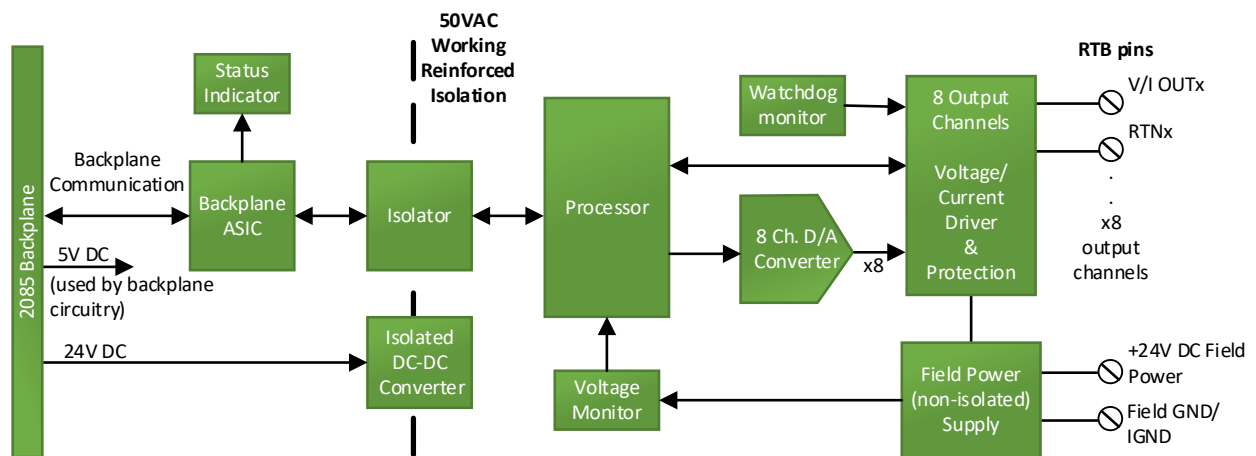
### System Overview and Module Operation

The 2085sc-OF8 module is expected to operate indefinitely. It does not require periodic maintenance or calibration. The 24 VDC field power supply must be present to allow for outputs from the module channels.

<b>WARNING</b>  	<b>Hazard of damage to module.</b> <p>When multiple channels are configured in voltage mode, and an external 24 V power source is applied to the channels via the terminal block, there is the possibility that the module will be damaged if multiple channels simultaneously experience over voltage conditions.</p> <p>This is because the heating caused by the overvoltage condition will apply to a very small area and may result in damage to that area.</p>
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The module communicates to the controller through the bus interface. The module also receives 5 and 24 VDC through the bus interface.

Block diagram:



# Chapter 2

## Installation and Wiring

This chapter will cover:

- Compliance to European union directives
- Power requirements
- General considerations
- Mounting

### Section 2.1 Compliance to European Union Directives

This product is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

#### 2.1.1 EMC Directive


This product is tested to meet Council Directive 2014/30/EU Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 61000-6-4 Electromagnetic compatibility (EMC)–Part 6-4: Generic standards–Emission standard for industrial environments.
- EN 61000-6-2 Electromagnetic compatibility (EMC)–Part 6-2: Generic standards–Immunity for industrial environments.

UKCA Electromagnetic Compatibility Regulations 2016

- BS EN 61131-2, BS EN 61000-6-4, BS EN 61000-6-2.
- This product is intended for use in an industrial environment.

### Section 2.2 Power Requirements

<b>WARNING</b> 	The backplane power and the analog inputs of the device shall only be supplied by an Isolated Secondary Limited Energy Low Voltage source.
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The module receives power through the bus interface from the +5 VDC (4.75 V to 5.4 V)/±24 VDC (19.9 V to 26.4 V) system power supply, and a 24 VDC field power supply. Both must be present for the module to operate.

Backplane current ratings: + 5 V rail is 85 mA maximum at 5 VDC; +24 V rail it is 10 mA maximum at 24 VDC:

5 VDC	24 VDC
85 mA	10 mA

Field Power current rating is 195 mA at 24 VDC.


## Section 2.3

### General Considerations

The 2085sc-OF8 module is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2<sup>2</sup>).


#### 2.3.1 Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.


<p><b>WARNING</b></p> 	<p><b>EXPLOSION HAZARD</b></p> <ul style="list-style-type: none"> <li>• Substitution of components may impair suitability for Class I, Division 2; Class II, Division 2. Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.</li> <li>• Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous.</li> <li>• This product must be installed in an enclosure.</li> </ul> <p>All wiring must comply with N.E.C. article 501-4(b), 502-4(b), or 503-3(b), as appropriate for Class I, Class II, and Class III equipment.</p>
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<sup>2</sup> Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

### 2.3.2 Prevent Electrostatic Discharge

<p><b>WARNING</b></p> 	<p>Electrostatic discharge can damage integrated circuits or semiconductors if you touch analog module card bus connector pins or the terminal block on the output module. Follow these guidelines when you handle the module:</p> <ul style="list-style-type: none"> <li>• Touch a grounded object to discharge static potential.</li> <li>• Wear an approved wrist-strap grounding device.</li> <li>• Do not touch the bus connector or connector pins.</li> <li>• Do not touch circuit components inside the module.</li> <li>• If available, use a static-safe workstation.</li> </ul> <p>When it is not in use, keep the module in its static-shield bag.</p>
---	--

### 2.3.3 Remove Power

<p><b>WARNING</b></p> 	<p><b>This module is not designed to be hot-swapped and may be damaged if added or removed while power is applied. Remove power before removing or inserting this module.</b></p> <p>When you remove or insert a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:</p> <ul style="list-style-type: none"> <li>• Sending an erroneous signal to your system's field devices, causing unintended machine motion.</li> <li>• Causing an explosion in a hazardous environment.</li> <li>• Causing an electrical arc. Electrical arcing causes excessive wear to contacts on both the module and its mating connector and may lead to premature failure.</li> </ul>
---	---

### 2.3.4 Selecting a Location


#### Reducing Noise

Most applications require installation in an industrial enclosure to reduce the effects of electrical interference. Analog channels are highly susceptible to electrical noise. Electrical noise coupled to the analog channels will reduce the performance (accuracy) of the module. Group your modules to minimize adverse effects from radiated electrical noise and heat. Consider the following conditions when selecting a location for the analog module. Position the module:

- Away from sources of electrical noise such as hard-contact switches, relays, and AC motor drives.
- Away from modules which generate significant radiated heat. Refer to the module's heat dissipation specification.

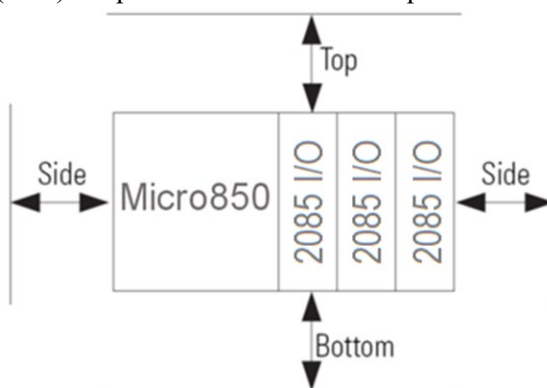
In addition, route shielded, twisted-pair analog input wiring away from any high voltage I/O wiring.

## Section 2.4 Mounting

<p><b>WARNING</b></p> 	<p>Keeping module free of debris and avoiding overheating:</p> <ul style="list-style-type: none"><li>• Do not remove protective debris strip until after the module and all other equipment near the module is mounted and the wiring is complete.</li><li>• Once wiring is complete, and the module is free of debris, carefully remove protective strip.</li><li>• Failure to remove strip before operating can cause overheating.</li></ul>
---	--

### 2.4.1 Minimum Spacing

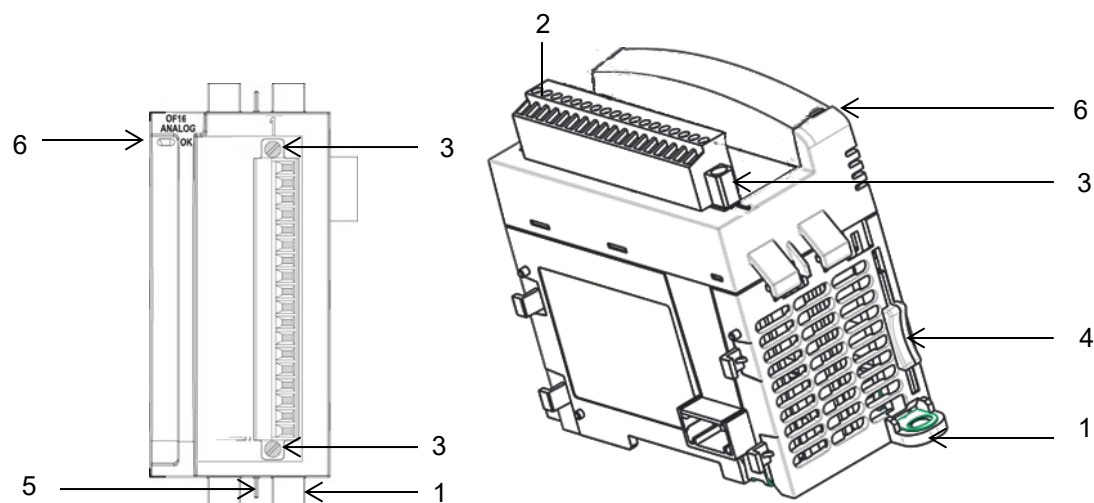
Maintain spacing from enclosure walls, wire ways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:



### 2.4.2 Parts List

Your package contains one Micro800 2085sc-OF8 (Analog Output) Plug-in Module and one Quick Start Guide.

2.4.3 Module Description



	Description		Description
1	Mounting screw hole/mounting foot	4	Module interconnect latch
2	Removable Terminal Block (RTB)	5	DIN rail mounting latch
3	RTB hold down screws	6	I/O Status LED


You can choose to wire the expansion I/O module before installing it next to the controller or wire it once the module is secured in place.


Place the module next to the controller against the panel where you are mounting it. Make sure the controller and module are spaced properly.

<div><div>NOTE</div><div></div></div>	<ul style="list-style-type: none"><li>• 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.</li><li>• 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.</li><li>• Do not wire more than 2 conductors on any single terminal.</li><li>• If you insert or remove the expansion I/O 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.</li><li>• Cable length should be less than 10 meters.</li></ul>
---------------------------------------	--

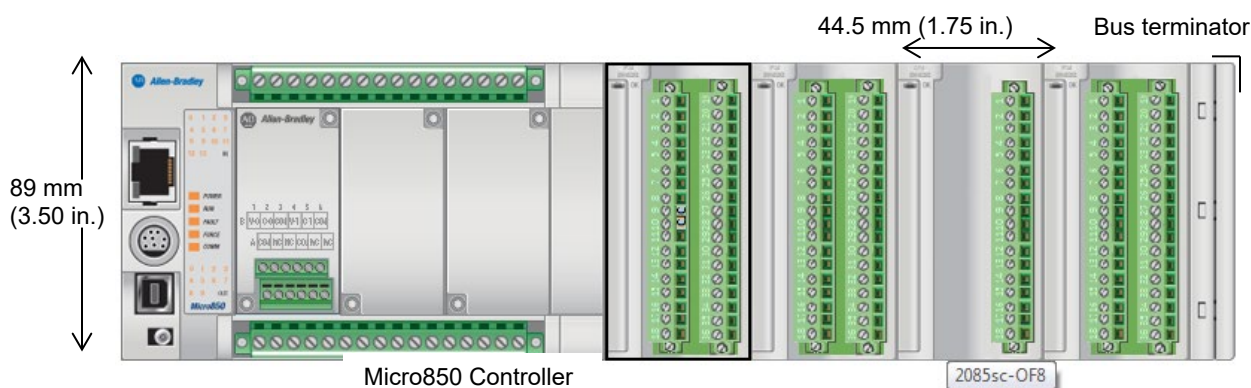
### 2.4.4 Insert Module Next to the Controller

Follow the instructions to insert and secure the expansion I/O module to the controller:


<p><b>NOTE</b></p> 	<p>The module expansion may only be mounted horizontally.</p>
--	---

<p><b>NOTE</b></p> 	<p>For environments with greater vibration and shock concerns, use the panel mounting method, instead of DIN rail mounting.</p>
--	---

### Mounting Dimensions and DIN Rail Mounting



You can install the module on DIN rails of dimension 35 mm × 7.5 mm × 1 mm (EN 50 022-35×7.5), or on a panel.

<p><b>WARNING</b></p> 	<p><b>Hazard of intermittent grounding.</b></p> <p><b>This product is grounded through the DIN rail to chassis ground. To assure proper grounding, use zinc-plated, yellow-chromate steel DIN rail. Using other DIN rail materials such as aluminum or plastic, that can corrode, oxidize, or are poor conductors, may result in improper or intermittent grounding.</b></p> <p>Use the correct DIN rail type, and secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.</p>
---	--

1. Before mounting the module on a DIN rail, use a flat-bladed screwdriver in the DIN rail latch and pry it downwards until it is in the unlatched position.
2. Hook the top of the DIN rail mounting area of the module onto the DIN rail, and then press the bottom until the module snaps onto the DIN rail.



3. Push the DIN rail latch back into the latched position. Use DIN rail end anchors for vibration or shock environments.
4. Snap the module into the module bay.

**WARNING****Hazard of damage to equipment.**

The Spectrum Controls RTB hold down and terminal screws must be tightened by hand using the guidelines in Step 5. They must not be tightened using a power tool.

Failure to follow these guidelines may result in damage to your connector.

5. Use a slot screwdriver of  $0.8 \times 2.0$  mm and carefully tighten to no more than 2.2 Lb-in torque (0.25 Nm).

**Panel Mounting**

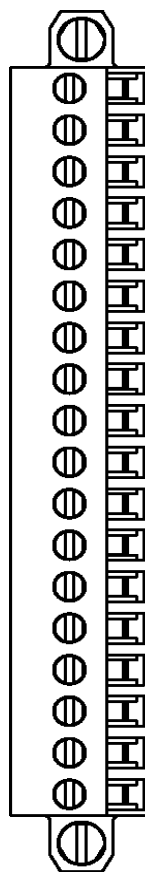
The preferred mounting method is to use two M4 (#8) screws per module. Hole spacing tolerance is  $\pm 0.4$  mm (0.016 in.). For mounting dimensions, refer to Micro830, Micro850, and Micro870 Programmable Controllers User Manual 2080-UM002:

1. Place the module next to the controller against the panel where you are mounting the module.
2. Marking drilling holes through the mounting screw holes and mounting feet, and then remove the module.
3. Drill the holes at the markings.
4. Replace the module and mount it. Leave the protective debris strip in place until you are finished wiring the module, and any other devices.

### Wiring Diagram

Wire the module using the following images, which explain the layout of the single-row, 18-pin terminal block, and the associated wiring diagram for the output signals, and the two, 24 VDC field power terminal input pins for the 2085sc-OF8 module:

RTB	Name
1	V/I OUT0
2	RTN0
3	V/I OUT1
4	RTN1
5	V/I OUT2
6	RTN2
7	V/I OUT3
8	RTN3
9	V/I OUT4
10	RTN4
11	V/I OUT5
12	RTN5
13	V/I OUT6
14	RTN6
15	V/I OUT7
16	RTN7
17	+24V DC
18	COM DC



Terminal Block signal descriptions are as follows:

<b>RTB</b>	<b>Name</b>	<b>Description</b>
1	V/I OUT0	Channel 0 voltage or current output
2	RTN0	Channel 0 return
3	V/I OUT1	Channel 1 voltage or current output
4	RTN1	Channel 1 return
5	V/I OUT2	Channel 2 voltage or current output
6	RTN2	Channel 2 return
7	V/I OUT3	Channel 3 voltage or current output
8	RTN3	Channel 3 return
9	V/I OUT4	Channel 4 voltage or current output
10	RTN4	Channel 4 return
11	V/I OUT5	Channel 5 voltage or current output
12	RTN5	Channel 5 return
13	V/I OUT6	Channel 6 voltage or current output
14	RTN6	Channel 6 return
15	V/I OUT7	Channel 7 voltage or current output
16	RTN7	Channel 7 return
17	+24V DC	24V DC power from field
18	COM DC	Field common ground



# Chapter 3

## Configuring the 2085sc-OF8

### Using CCW

This chapter covers the following subjects:

- How to use Connected Components Workbench (CCW) and, optionally, ModuleConfigConverter.exe software to configure the Module.
- Analog Data and Status settings.
- Data Links settings.
- Setting configuration parameters and associated values.

#### Section 3.1

##### Introduction

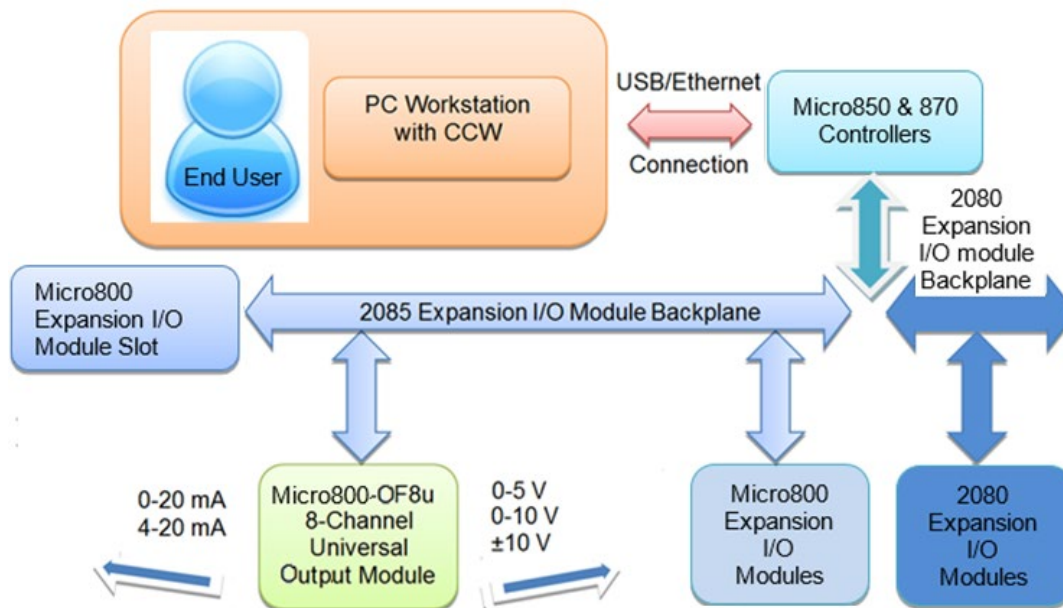
You use CCW software (v 9.00.00 and above) to configure the 2085sc-OF8 Expansion I/O Module. Your controller firmware must be at v. 9.011 and above as well. You then send the configuration setup to the module. Starting from CCW version 11.00.00 and later, the software provides a module-specific Add-On Profile (AOP) to configure the module. The process for manually importing AOP to CCW is no longer required.

The Micro850/870 Controller (Bus master) subsystem is located at the left end of the bus. This subsystem is comprised of:

- Micro850/870 Controller.
- 2085 Expansion I/O Modules.
- 2085-ECR Bus Terminator.

Optional:

- 2080-PS120-240VAC Power Supply (separate module or built-in the main controller).
- 2080 Plug-in Modules.
- 2085-EP24VDC Expansion Power Supply for Micro870 Controller with more than four 2085 Expansion I/O Modules installed.



Spectrum Controls, Inc. also provides a custom configuration software utility that you may use to provide configuration settings to the profile.

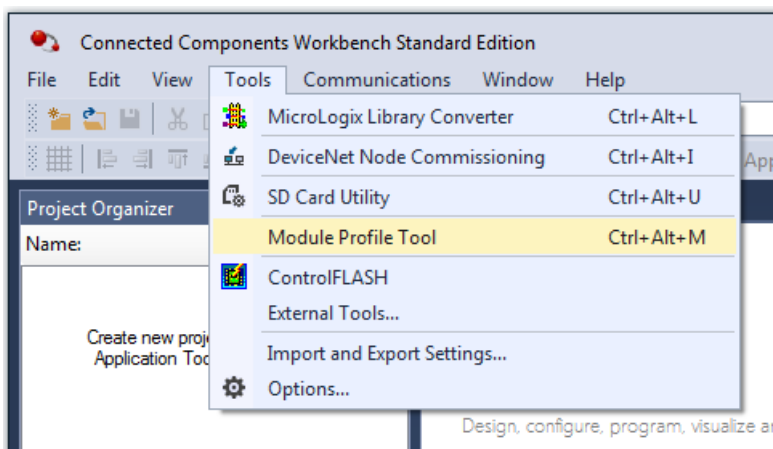
## Section 3.2

### 2085sc-OF8 AOP

You use the module's AOP to configure your module. The AOP is available in the CCW software. If not available, or a newer revision is released, see Appendix A about how to manually import a module AOP to CCW.

To view information about the AOP:

1. Use RA's Module Profile Tool 2.0. This tool may be launched from within CCW by selecting the **Module Profile Tool** option from the CCW Tools menu:

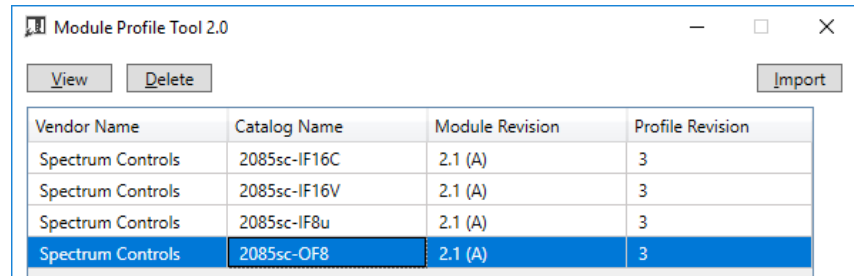


2. When prompted by Windows User Account Control, to confirm that you wish to run the program, click **Yes** button.

The Module Profile Tool window appears:

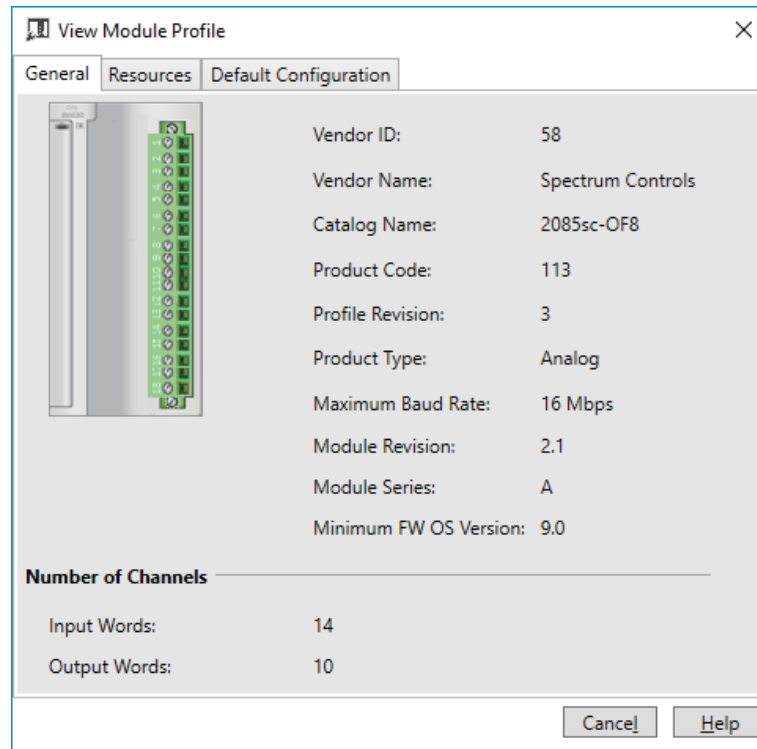
If necessary, confirm with the Windows operating system that you wish to run the software.

The Module Profile Tool dialog appears.



3. Select the row showing the module catalog name, and then click the **View** button.

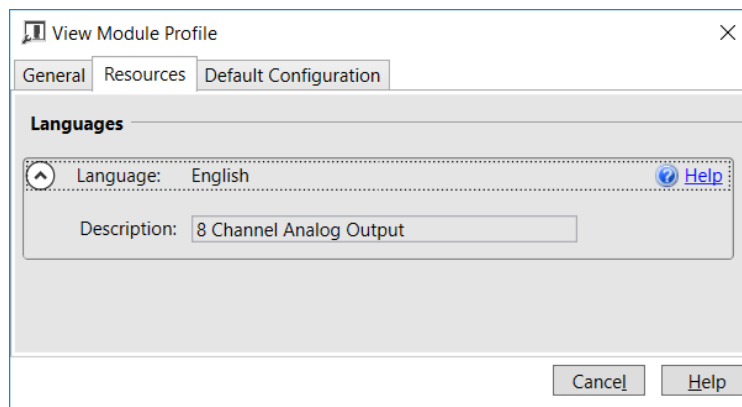
The View Module Profile window appears:



The first tab of the window provides the module identity information. This information is described in greater detail in **Module Identity**, later in this section.

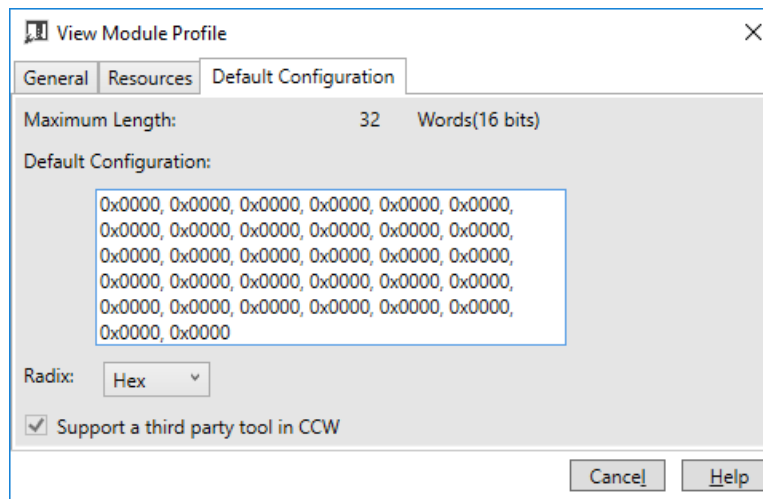
4. To view software language availability, module description, and a help file for the module, click the **Resources** tab.

The Resources tab appears:



The window lists the language chosen for the module, and the module description. You may also use this tab to access the help file provided for the module.

5. To view default configuration information, click the **Default Configuration** tab:



The enabled checkbox shown on the bottom of the tab indicates that the module AOP provides the service for launching the MCC utility to help you configure your module. More information is described in Setting Configuration Parameters Using MCC, later in this section.

### Section 3.3

## CCW

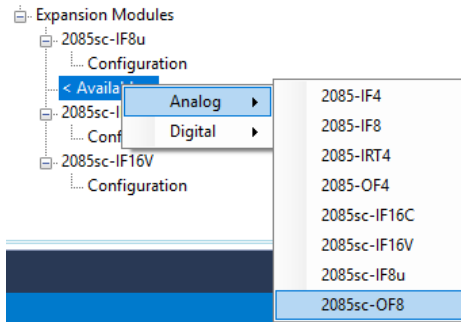
### Configuration Tab

Before you start, if needed, install the latest version of Rockwell Automation's Connected Components Workbench (CCW) Standard Edition.



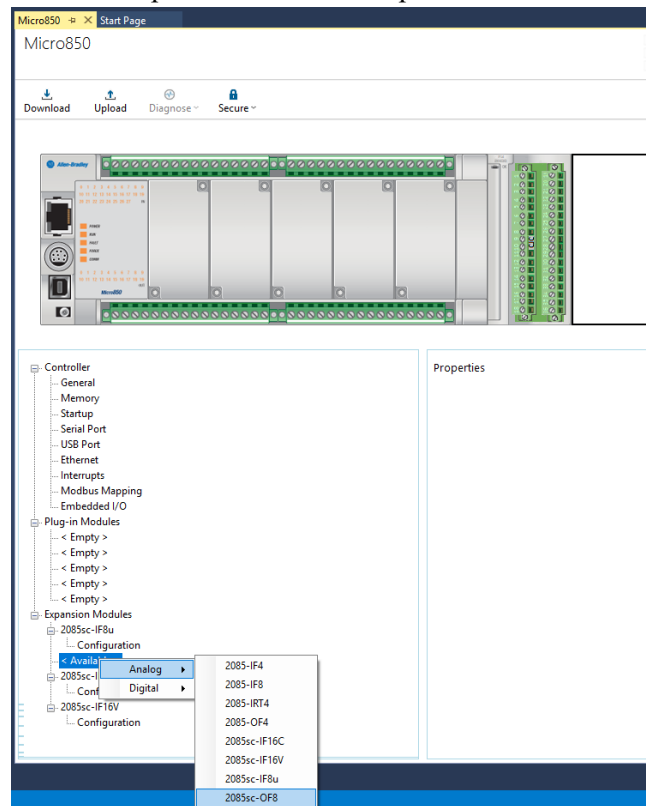
**NOTE**

Using the Module Profile Tool to import the 2085sc-OF8 AOP into CCW software is necessary only if you are using a CCW version earlier than 11.00.00. For information on manually importing an AOP file, see Appendix A. For Version 11.00.00 and later, the module is already available as a selection from the CCW Expansion Modules drop-down menu:



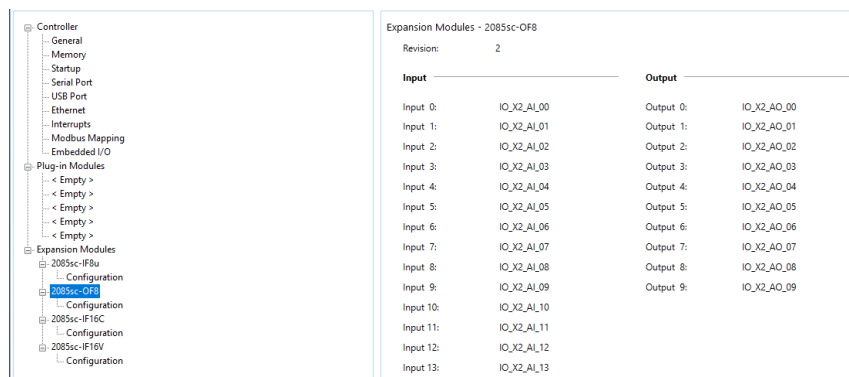
To add the module to your project, and see its configuration parameters on the CCW configuration tab:

1. From your CCW project, load the module AOP to a first **Available** slot from the Expansion Modules drop-down list.

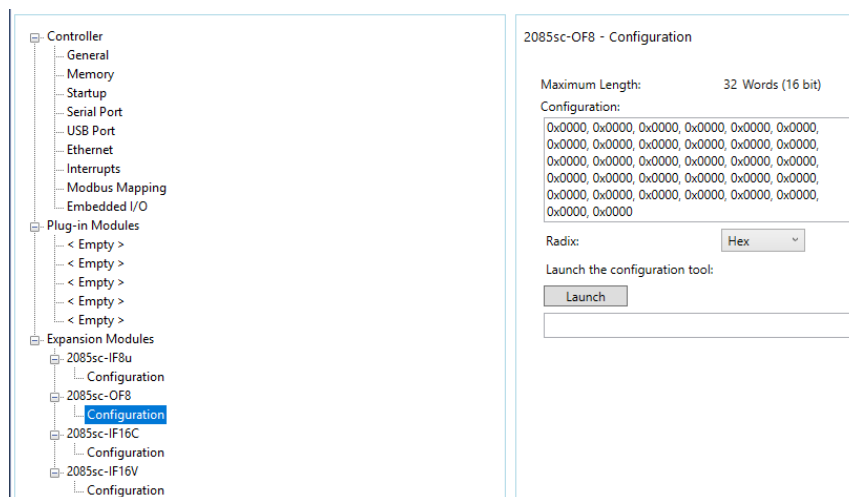


2. Once the module AOP is loaded, to view the associated variables, click the **Module Catalog Name** option.

The same variables can also be found on the CCW Global Variables Tab:



3. To view the configuration tab, click the **Configuration** option:



- **Maximum Length.** Shows maximum number of words available. Each word is 16-bit.
- **Configuration.** The textbox lists out the whole module configuration value.
- **Radix.** The drop-down menu contains the following number formats for indicating module configuration value. Options are:
  - Hex. Default option. Characters represented as hexadecimal. Example: 0×7FFF as 32767 in decimal format.
  - ASCII. Characters represented as ASCII. Example: \7F\FF
  - Binary. Characters represented as 0 and 1. Example: 0111111111111111
  - Decimal. Characters represented as decimals. Example: 32767<sup>3</sup>

<sup>3</sup> The valid range for the Decimal Radix indication is from 0 to 65535. It does not accept negative values. If you need to receive negative values, select the **Hex Radix** option instead.

- **Launch.** Use to populate the file path field. The file path lets you enter the file path for opening the MCC utility program to assist you in configuring the module. Use the **Browse** ellipse to navigate to where the utility is stored. Then click the **Launch** button to start the utility.

### Section 3.4 Setting Configuration Parameters Using MCC

You may create the configuration for each channel using the utility provided by Spectrum Controls, Inc. You download the utility from the Spectrum Controls website at [www.spectrumcontrols.com](http://www.spectrumcontrols.com).

#### NOTE



It is recommended that when you generate your configuration, that you use the **Binary Radix** selection. If you choose the **Decimal Radix**, the utility is unable to work with negative values.

You may create the configuration for each channel using the MCC utility provided by Spectrum Controls, Inc. You download the utility from the Spectrum Controls website at <https://www.spectrumcontrols.com>.

To use the MCC utility:

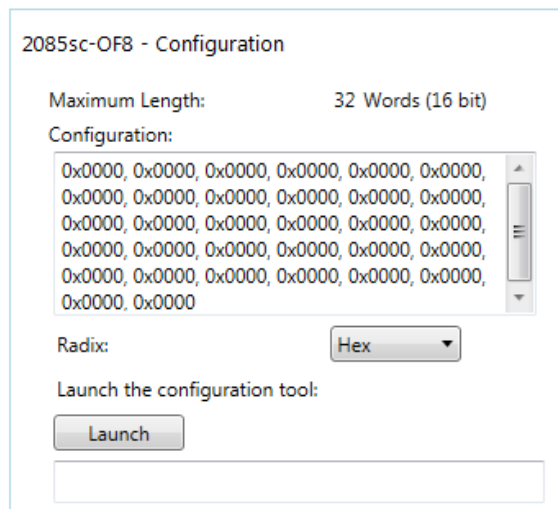
1. The first time you configure a Spectrum Controls 2085 analog module, you must provide the file path of the utility to the CCW software. Navigate to the CCW Configuration Tab and click in the file path textbox below the **Launch** button.

Launch the configuration tool:

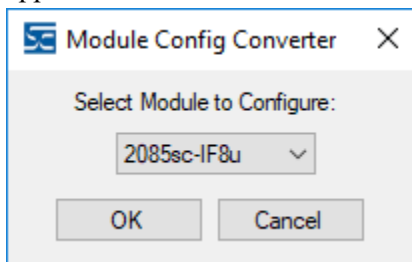
The **Browse** button appears.

2. Click the button, navigate to the directory where you installed the CCW program, and select the ModuleConfigConverter tool located in the Spectrum Tool directory:

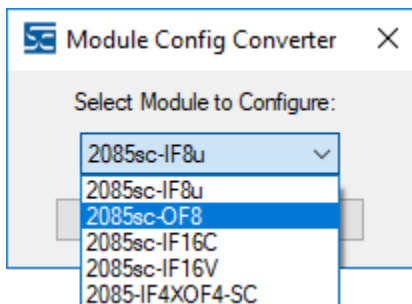
Example. **C:\Program Files (x86)\Rockwell Automation\CCW\SpectrumTool**



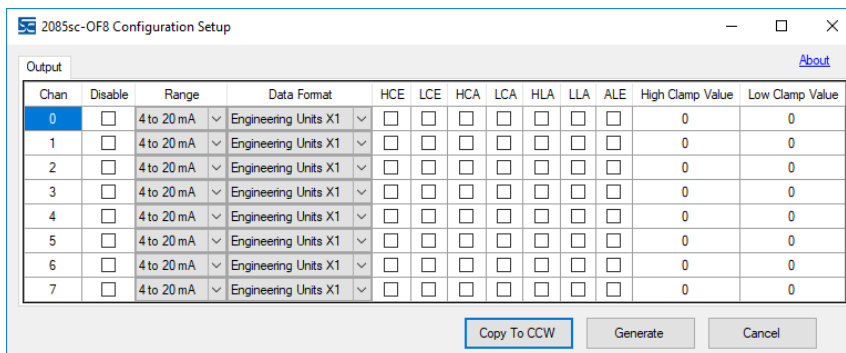
- To run the tool, click **Launch**. The Module Config Converter dialog appears:



- Select the 2085sc-OF8 module from the drop-down menu, and click **OK**:



The 2085sc-OF8 Configuration Setup dialog appears:



5. View and specify the following options as needed. See Channel Configuration Bit locations listed later in this section for details on the settings for every configuration bit:

- **Channel.** Lists number of input channel from **0** to **7**. Click to select.
- **Disable.** Specifies whether to disable use of this channel. **Enabled** by default (checkmark not selected):

Disable

☐

- **Range.** Specifies which Range (voltage or current) to use. Select type from drop-down list. **4 to 20 mA** input is default:

Range

4 to 20 mA ▾

4 to 20 mA

0 to 20 mA

-10 to 10 V

0 to 10 V

0 to 5 V

- **Data Format.** Specifies which data format to use for reporting input values. Default is **Engineering Units X1**:

Data Format

Engineering Units X1 ▾

Engineering Units X1

PID

Percentage Range

Raw/Proportional

- **HCE.** High Clamp Enable. Enables and disables the maximum output to be clamped at the user-defined High Clamp Value for the channel. When the HCE check box is selected, the High Clamp Value is enabled.

When the HCE check box is cleared, the High Clamp Value is disabled, and the maximum output is clamped at the Hight Limit value based on the Data Format and Range Type selections.

The default is **Disabled** (cleared):

HCE

☐

**LCE.** Low Clamp Enable. Enables and disables the minimum output to be clamped at the user-defined Low Clamp Value for the channel. When the LCE check box is selected, the Low Clamp Value is enabled. When the LCE check box is cleared, the Low Clamp Value is disabled, and the minimum output is clamped at the Low Limit value based on the Data Format and Range Type selections.

The default is **Disabled** (cleared):

LCE

☐

- **HCA. High Clamp Alarm Enable.**

To trigger the channel Over Range Alarm at the user-defined High Clamp Value, enable the HCE feature together to take effect. Otherwise, the alarm can be triggered at the High Range or Limit value based on the Data Format and Range Type selections.

Default is **Disabled**:

HCA
<input type="checkbox"/>

- **LCA. Low Clamp Alarm Enable.**

To trigger the channel Under Range Alarm at the user-defined Low Clamp Value, enable the LCE feature together to take effect. Otherwise, the alarm will be triggered at the Low Range or Limit value based on the Data Format and Range Type selections. Default is **Disabled**:

LCA
<input type="checkbox"/>

- **HLA. High Limit Alarm Enable.**

To trigger the channel Over Range Alarm at the High Limit value based on the Data Format and Range Type selections, enable this feature with the HCE feature disabled to take effect. Default is **Disabled**:

HLA
<input type="checkbox"/>

- **LLA. Low Limit Alarm Enable.**

To trigger the channel Under Range Alarm at the Low Limit value based on the Data Format and Range Type selections, enable this feature with the LCE feature disabled to take effect. Default is **Disabled**:

LLA
<input type="checkbox"/>

- **ALE. Alarm Latch Enable.**

Enable this feature to latch channel alarms like **Over Range**, **Under Range** and **LD** error even after the output is normal. It can only be cleared using the **Unlatch Alarm** bit on the Output Variable, `_IO_Xx_AO_08` or `_IO_Xx_AO_09`.

ALE
<input type="checkbox"/>

- **High Clamp Value.** Specifies high value at which output is clamped:

High Clamp Value
0

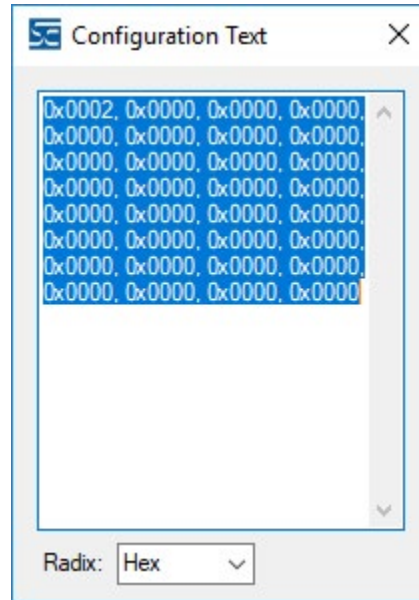
- **Low Clamp Value.** Specifies low value at which output is clamped:

Low Clamp Value
0

- When finished making selections, click **Generate**.

The Configuration Text dialog appears, with your configuration settings for all channels.

You can manually copy the settings and paste it to the textbox of the CCW Configuration tab<sup>4</sup>:



- To automatically copy the generated settings into the textbox of the CCW Configuration tab, have the textbox visible on the monitor screen, and then click **Copy to CCW** button.
- The utility copies the configuration settings and shows it inside the textbox.

<sup>4</sup> It is recommended that before manually or automatically pasting your configuration settings to the textbox of the CCW Configuration tab, be sure to select the **Hex Radix** indication on both software packages. The CCW software is unable to receive negative values under **Decimal Radix** indication.

2085sc-OF8 - Configuration

Maximum Length: 32 Words (16 bit)

Configuration:

0x0002, 0x0000, 0x0000, 0x0000, 0x0000, 0x0000,  
0x0000, 0x0000, 0x0000, 0x0000, 0x0000, 0x0000,  
0x0000, 0x0000, 0x0000, 0x0000, 0x0000, 0x0000,  
0x0000, 0x0000, 0x0000, 0x0000, 0x0000, 0x0000,  
0x0000, 0x0000, 0x0000, 0x0000, 0x0000, 0x0000,  
0x0000, 0x0000

Radix: Hex

Launch the configuration tool:

Launch

9. Download the CCW project to controller and start to run the module operation.

### 3.4.1 Software Versioning

The software version tracks major and minor revisions for end users.

The shipped software version begins at version 1.1.

Once released, the major revision is typically incremented if new features are introduced to the product. Otherwise only the minor revision is incremented.

### 3.4.2 Software Updates

In-field updating of the software by the end user is not supported.

### 3.4.3 Startup and Factory Default Conditions

After the module boots and before the initial configuration is received, the module holds the default configuration as specified in the Configuration Assembly. There is no input data communication and no signal outputting before the controller goes into run mode. The initial configuration assumes a default configuration of 4-20 mA for all channels.



## Section 3.5 PLC Interfaces

The 2085 platform treats all data on an I/O module as a member of a named Array of Words.

### 3.5.1 Module Identity

The following values are stored in the Vendor\_ID, Product\_Type, Product\_Code, Series\_Rev, and Mod\_Features arrays:

Parameter	Hex	OF8
Vendor ID	0×3A (58)	58 (Spectrum Controls)
Product Type	0×0A	10 (Analog)
Product Code	0×71	(113)
Series Rev (1.1)	0×C420	50208 (First release revision is 1.1)
Series Rev (2.1)	0×C820	51232 (Second release revision is 2.1)
Module Catalog String		2085sc-OF8

### 3.5.2 Connection Types and Assembly Sizes

The size of each assembly is listed in the table below. Each word takes 2 bytes.

These values are stored in the Mod\_Size array:

Table	Size (Words)
Configuration Assembly	32
Input Assembly	14
Output Assembly	10

### 3.5.3 Input Table

The Input Table provides status bits for the module and individual channels. One byte (8-bits) is allocated for each channel output status. The Input Table also indicates the currently applied output value for each channel:

Channel	CCW-Var Word Index	High Byte								Low Byte							
		Bits															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Module Status	AI_00	-	-	-	-	-	-	CAL	FP	S7	S6	S5	S4	S3	S2	S1	S0
Output Status Ch 1 & 0	AI_01	-	-	-	-	-	LD 1	UR 1	OR 1	-	-	-	-	-	LD 0	UR 0	OR 0
Output Status Ch 3 & 2	AI_02	-	-	-	-	-	LD 3	UR 3	OR 3	-	-	-	-	-	LD 2	UR 2	OR 2
Output Status Ch 5 & 4	AI_03	-	-	-	-	-	LD 5	UR 5	OR 5	-	-	-	-	-	LD 4	UR 4	OR 4
Output Status Ch 7 & 6	AI_04	-	-	-	-	-	LD 7	UR 7	OR 7	-	-	-	-	-	LD 6	UR 6	OR 6
Output Data Ch 0	AI_05	Signed INT															
Output Data Ch 1	AI_06	Signed INT															
Output Data Ch 2	AI_07	Signed INT															
Output Data Ch 3	AI_08	Signed INT															
Output Data Ch 4	AI_09	Signed INT															
Output Data Ch 5	AI_10	Signed INT															
Output Data Ch 6	AI_11	Signed INT															
Output Data Ch 7	AI_12	Signed INT															
FW Revision	AI_13	Major								Minor							

### 3.5.4 Module Status (AI\_00)

The 2085sc-OF8 module status bit definitions are listed below:

Bit	Name	Description
7:0	S<n>	General Status <channel> General status bit. If a bit is set (1) then there is an error associated with that channel (check Status bits for the indicated channel). Bit 0 = Channel 0, Bit 1 = Channel 1 etc.
8	FP	Field Power Fault When set, 24 VDC field power is over-voltage or under-voltage. The user-specified voltage range is 20.4 V ~ 26.4 V. The module can operate outside of this range but will disable outputs when the voltage is outside of maximum and minimum values. There is no guarantee that outputs will perform as specified when outside the user-specified range. When the Field Power drops from normal operating range to a value below 18.7 volts, outputs are disabled and this flag set. There is no guarantee at which voltage below 18.7 will set this bit. When Field Power is applied, the FP bit is cleared, and outputs enabled when the voltage is greater than 19.9 V ( $\pm 0$ V) and less than 27.8 V ( $\pm 1$ V). The FP bit is set, and outputs disabled when Field Power is greater than 28.1 V ( $\pm 1$ V).
9	CAL	Invalid Cal Data The stored calibration data is corrupt or invalid. The module must be factory calibrated before it will operate normally.
15:10	Not Used	Bits marked as Not Used are set to 0.

### 3.5.5 Channel Output Status (AI\_04:01)

Each word holds two channel output status bits. The high byte is for odd channel and the low byte is for even channel. Bit definitions for channel output status are:

Bit	Name	Description																				
8, 0	OR<n>	Over Range <channel> When set to 1, indicates the output word value set by the user is greater than or equal to the defined Over Range Alarm value. The Over Range value is determined by the HCE and HLA configuration bit settings:																				
		<table><tr><td>HCE</td><td>HLA</td><td>HCA</td><td>Over Range Value</td></tr><tr><td>0</td><td>0</td><td>X</td><td>High Range (HCA ignored)</td></tr><tr><td>0</td><td>1</td><td>X</td><td>High Limit (HCA ignored)</td></tr><tr><td>1</td><td>X</td><td>0</td><td>High Range (HLA ignored)</td></tr><tr><td>1</td><td>X</td><td>1</td><td>High Clamp (HLA ignored)</td></tr></table>	HCE	HLA	HCA	Over Range Value	0	0	X	High Range (HCA ignored)	0	1	X	High Limit (HCA ignored)	1	X	0	High Range (HLA ignored)	1	X	1	High Clamp (HLA ignored)
		HCE	HLA	HCA	Over Range Value																	
		0	0	X	High Range (HCA ignored)																	
		0	1	X	High Limit (HCA ignored)																	
		1	X	0	High Range (HLA ignored)																	
		1	X	1	High Clamp (HLA ignored)																	
NOTE: Low Range and Limit values are noted in the Data Format and Range table <sup>5</sup> .																						

Bit	Name	Description																				
9, 1	UR<n>	<p>Under Range &lt;channel&gt;</p> <p>When set to 1, indicates the output word value set by the user is less than or equal to the defined Under Range Alarm value. The Under Range value is determined by the LCE and LLA configuration bit settings:</p> <table><tr><th>LCE</th><th>LLA</th><th>LCA</th><th>Under Range Value</th></tr><tr><td>0</td><td>0</td><td>X</td><td>Low Range (LCA ignored)</td></tr><tr><td>0</td><td>1</td><td>X</td><td>Low Limit (LCA ignored)</td></tr><tr><td>1</td><td>X</td><td>0</td><td>Low Range (LLA ignored)</td></tr><tr><td>1</td><td>X</td><td>1</td><td>Low Clamp (LLA ignored)</td></tr></table> <p>NOTE: Low Range and Limit values are noted in the Data Format and Range table<sup>5</sup>.</p>	LCE	LLA	LCA	Under Range Value	0	0	X	Low Range (LCA ignored)	0	1	X	Low Limit (LCA ignored)	1	X	0	Low Range (LLA ignored)	1	X	1	Low Clamp (LLA ignored)
LCE	LLA	LCA	Under Range Value																			
0	0	X	Low Range (LCA ignored)																			
0	1	X	Low Limit (LCA ignored)																			
1	X	0	Low Range (LLA ignored)																			
1	X	1	Low Clamp (LLA ignored)																			
10, 2	LD<n>	<p>Load Error &lt;channel&gt;</p> <p>If the channel is set to voltage mode, this bit indicates a short circuit. If the channel is set to current mode, open circuit is indicated.</p> <p>NOTE: Low Range and Limit values are noted in the Data Format and Range table<sup>5</sup>.</p>																				
7:3 and 15:11	Not Used	<p>Bits marked as Not Used are set to 0.</p> <p>For even channels, bits 3:7 in the word are unused.</p> <p>For odd channels, bits 11:15 in the word are unused.</p>																				

### 3.5.6 Data Ch<x> (AI\_12:05)

This word reflects the current output value in Engineering Units. It is not necessarily the same value in the user Output Word. It depends on the operating mode (Run/Program/Fault).

### 3.5.7 Module Firmware Revision (AI\_13)

The lower byte of the word indicates the minor revision of the module firmware. The upper byte of the word indicates the major revision.

<sup>5</sup> If ALE configuration bit is not set the error bit is cleared (0) at the time the condition is cleared. If ALE configuration bit is set, this alarm will remain set (1) until the condition clears and the user sets the appropriate unlatch bit in the Output Table.

### 3.5.8 Output Table

The Output Table consists of 10 INTs (signed 16-bit integer). The meaning of the values depends on the individual channel's scaling configuration.

Channel	WORD	Usage															
Output Ch 0	AO_00	Signed INT															
Output Ch 1	AO_01	Signed INT															
Output Ch 2	AO_02	Signed INT															
Output Ch 3	AO_03	Signed INT															
Output Ch 4	AO_04	Signed INT															
Output Ch 5	AO_05	Signed INT															
Output Ch 6	AO_06	Signed INT															
Output Ch 7	AO_07	Signed INT															
Unlatch Bits	Word Index	High Byte								Low Byte							
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Unlatch Alarm Ch 3 - Ch 0	AO_08	-	ULD 3	UUR 3	UOR 3	-	ULD 2	UUR 2	UOR 2	-	ULD 1	UUR 1	UOR 1	-	ULD 0	UUR 0	UOR 0
Unlatch Alarm Ch 7 - Ch 4	AO_09	-	ULD 7	UUR 7	UOR 7	-	ULD 6	UUR 6	UOR 6	-	ULD 5	UUR 5	UOR 5	-	ULD 4	UUR 4	UOR 4

### 3.5.9 Output Ch<x> (AO\_07:00)

This word is read by the module and scaled to the appropriate analog output level based on the Range and Format setting. It is considered a signed integer with values ranging from -32768 to +32767.

### 3.5.10 Unlatch Alarm Bits

When the Alarm Latch configuration setting is enabled for a channel, the Over Range, Under Range and LD status alarm bits remain set even when the condition is cleared. The only way to clear the alarm is to set the appropriate unlatch bit for that channel. Once it has been set, and the alarm condition has been cleared, the Unlatch bit should be cleared as well to allow subsequent latching. If the Alarm Latch channel setting is not enabled, these bits are ignored by the module.

The LD status bit is always active and may be latched and unlatched any time the Alarm Latch Enable configuration setting is set.

Bit	Name	Description
12, 8, 4, 0	UOR<n>	Unlatch Over Range <channel> Set this bit to clear the channel over range alarm.
13, 9, 5, 1	UUR<n>	Unlatch Under Range <channel> Set this bit to clear the channel under range alarm.
14, 10, 6, 2	ULD<n>	Unlatch Load Error <channel> Set this bit to clear the channel load error alarm. The LD status bit on the module input table is always active and may be latched and unlatched any time if the Alarm Latch Enable configuration setting is set.
15, 11, 7, 3	Not Used	Bits marked as Not Used have no output control functionality.

### 3.5.11 Configuration Table

Configuration parameters for each channel are grouped together in a set of 5 words. Detailed descriptions follow.

	WORD	High Byte								Low Byte							
		Bits															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CH0 Config. Bits	C:0	-	-	ALE	LLA	HLA	LCA	HCA	LCE	HCE	Data Format			Range			Chan Disable
CH0 High Clamp Value	C:1	Signed INT															
CH0 Low Clamp Value	C:2	Signed INT															
Unused	C:3	Unused															
CH1 Config.	C:4-7	(See CH0 Config struct)															
CH2 Config.	C:8-11	(See CH0 Config struct)															
CH3Config.	C:12-15	(See CH0 Config struct)															
CH4 Config.	C:16-19	(See CH0 Config struct)															
CH5 Config.	C:20-23	(See CH0 Config struct)															
CH6 Config.	C:24-27	(See CH0 Config struct)															
CH7 Config.	C:28-31	(See CH0 Config struct)															

### 3.5.12 Configuration Bit Definition

Bit		
0	Name	Description
3:1	Disable	Set to 1 to disable channel.
6:4	Range	0 = 4-20 mA 1 = 0-20 mA 2 = $\pm 10$ V 3 = 0-10 V 4 = 0-5 V
7	Format	0 = EU $\times 1$ 1 = Raw/Proportional 2 = Scaled for PID 3 = Percent of range
8	HCE	High Clamp Enable The High Clamp configuration value is used to clamp the maximum output. The High Clamp configuration value is ignored when this bit is cleared.
9	LCE	Low Clamp Enable The Low Clamp configuration value is used to clamp the minimum output. The Low Clamp configuration value is ignored when this bit is cleared.
10	HCA	High Clamp Alarm Enable This bit is only valid when HCE bit is set. It is ignored when HCE is cleared. When HCE and HCA are both set, the Over Range Alarm status bit is only set when the user Output is greater than or equal to the High Clamp value. When HCE is set and HCA is cleared, the Over Range Alarm is determined by the High Range value indicated in the Output Range Table. In this case the Over Range alarm may not be set if the High Clamp value is less than the High Range value since the final output cannot reach that value due to clamping.
11	LCA	Low Clamp Alarm Enable This bit is only valid when LCE bit is set. It is ignored when LCE is cleared. When LCE and LCA are both set, the Under Range Alarm status bit is only set when the Output is less than or equal to the Low Clamp value When LCE is set and LCA is cleared, the Under Range Alarm is determined by the Low Range value indicated in the Output Range Table. In this case the Under Range alarm may not be set if the Low Clamp value is less than the Low Range value since the final output cannot reach that value due to clamping.



<b>Bit</b>		
<b>0</b>	<b>Name</b>	<b>Description</b>
<b>12</b>	HLA	<p>High Limit Alarm Enable</p> <p>This bit is only valid when the HCE bit is cleared. It is ignored when HCE is set.</p> <p>When HCE is cleared and HLA set, the Over Range status bit is set when the Output is set to a value greater than or equal to the High Limit value indicated in the Output Range Table.</p> <p>When HCE is cleared and HLA cleared, the Over Range Alarm status bit is set when the Output is set to a value greater than or equal to the High Range value indicated in the Output Range Table.</p>
<b>13</b>	LLA	<p>Low Limit Alarm Enable</p> <p>This bit is only valid when the LCE bit is cleared. It is ignored when LCE is set.</p> <p>When LCE is cleared and LLA is set, the Under Range Alarm status bit is set when the Output is set to a value less than or equal to the Low Limit value indicated in the Output Range Table.</p> <p>When LCE is cleared and LLA is cleared, the Under Range Alarm status bit is set when the Output is set to a value less than or equal to the Low Range value indicated in the Output Range Table.</p>
<b>15:14</b>	ALE	<p>Alarm Latch Enable</p> <p>When this bit is set, the Over Range, Under Range and LD Alarm bits will remain set even when the Alarm condition is cleared. The Unlatch Alarm bits for this channel in the Output Table must be set to clear the alarms.</p>

#### High Clamp, Low Clamp Value

- The High Clamp value will be ignored if HCE is not set.
- The Low Clamp value will be ignored if LCE is not set.

If you set the High or Low Clamp beyond the Limit for the specific Range/Format setting, the output is internally adjusted to the Limit values. In this case, the Limit value determines the Over or Under Range Alarm trigger if HCA or LCA is set respectively (assuming HCE or LCE is set).

### 3.5.13 Channel Configuration Bit Mapping

Bit	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Options	ALE	LLA	HHA	LCA	HCA	LCE	HCE	Data Format			Range			Channel Disable
Enable														0
Disable														1
4-20 mA											0	0	0	
0-20 mA											0	0	1	
±10 V											0	1	0	
0-10 V											0	1	1	
0-5 V											1	0	0	
EU								0	0	0				
PID								0	0	1				
Percent								0	1	0				
Raw/Prop								0	1	1				
Enable	1	1	1	1	1	1	1							
Disable	0	0	0	0	0	0	0							

### 3.5.14 Voltage/Current Output

The module has one 8-channel DAC and 8 programmable output drivers. They are configured and set based on user-configurable parameters.

The final current or voltage output signal is determined by:

- Range
- Data Format
- Output Word
- Operational state of the module:
  - Run
  - Program
  - Fault

Regardless of the final scaled value, the output is clipped to a High and Low Limit based on the following table:

- The High and Low Range values indicate the intended use of the Range.
- The Current Ranges allow for a 2% overhead at each Range endpoint.
- The Voltage Ranges allow for a 5% overhead at each Range endpoint.
- Ranges with a 0 mA or 0 V Low Range are clipped at 0 mA or 0 V and do not go negative.

Range	Low Limit	Low Range	High Range	High Limit
0 mA ~ 20 mA	0.0 mA	0.0 mA	+20.0 mA	+20.4 mA
4 mA ~ 20 mA	+3.92 mA	+4.0 mA	+20.0 mA	+20.4 mA

Range	Low Limit	Low Range	High Range	High Limit
0 V ~ 5 V	0.0 V	0.0 V	+5.0 V	+5.25 V
0 V ~ 10 V	0.0 V	0.0 V	+10.0 V	+10.5 V
-10 V ~ +10 V	-10.5 V	-10.0 V	+10.0 V	+10.5 V

### 3.5.15 User Scaling/Data Format and Range

The meaning of the Output Word of each channel depends on the Range and Data Format settings.

The Data Format and Range parameters in the channel configuration bits determine scaling. There are four pre-defined Data Format settings.

The following table shows the pre-defined scaling values and how they match with the output Analog Signal.

$$\text{AnalogOutput} = \text{UserValue} * M + B$$

See corresponding M and B values in the table below.

Output Range	Condition	Analog Signal	Raw/Prop	EU	PID	% FS
4 to 20 mA	High Limit	20.40 mA	32767	20400	16793	10250
	High Range	20.00 mA	31176	20000	16383	10000
	Low Range	4.00 mA	-32450	4000	0	0
	Low Limit	3.92 mA	-32768	3920	-82	-50
0 to 20 mA	High Limit	20.40 mA	32767	20400	16711	10200
	High Range	20.00 mA	31482	20000	16383	10000
	Low Range	0.00 mA	-32768	0	0	0
	Low Limit	0.00 mA	-32768	0	0	0
±10 V	High Limit	10.50 VDC	32767	10500	16793	10500
	High Range	10.00 VDC	31207	10000	16383	10000
	Low Range	-10.00 VDC	-31208	-10000	0	-10000
	Low Limit	-10.50 VDC	-32768	-10500	-410	-10500
0 to 5 V	High Limit	5.25 VDC	32767	5500	17202	10500
	High Range	5.00 VDC	29646	5000	16383	10000
	Low Range	0.00 VDC	-32768	0	0	0
	Low Limit	0.00 VDC	-32768	0	0	0
0 to 10 V	High Limit	10.50 VDC	32767	10500	17202	10500
	High Range	10.00 VDC	29646	10000	16383	10000
	Low Range	0.00 VDC	-32768	0	0	0
	Low Limit	0.00 VDC	-32768	0	0	0

### 3.5.16 Fault Mode/Program Mode Operation

During operation, the module may detect a hardware fault or that the system has changed the run mode (run/program).

- All Outputs are turned off if a hardware fault is detected. If the hardware fault clears, the outputs resume the previous setting.
- All outputs are turned off when Program Mode is detected. Outputs resume normal operation when Run Mode is detected.

### 3.5.17 Module Specific Hardware Errors

A Micro850 or 870 PLC can generate a series of 0×F2xy error codes specific to an Expansion I/O module. The Fault code is 0×F29z, where z indicates the slot number of the expansion I/O. If z=0, then the slot number cannot be identified.

Fault Code	Extended Fault Code	Error Description
<b>0×F29z<sup>6</sup></b>	0×301	MCU Watchdog reset
	0×302	MCU board power brownout
	0×303	Output driver over temperature
	0×304	Unused
	0×305	DAC communications error

### 3.5.18 Module Specific Configuration Errors

If you set invalid configuration values in the PLC, the CCW will generate a configuration fault. The connection status will be defaulted and disconnected.

Fault	Extended Fault Code	Error Description
<b>0×F2Bz<sup>7</sup></b>	0×410-417	<b>Invalid Range</b> The Range setting is not within the valid selectable range. See Configuration Table for possible values.
	0×420-427	<b>Invalid Data Format</b> The Data Format setting is not within the valid selectable range. See Configuration Table for possible values.

<sup>6</sup> z indicates the slot number of the expansion I/O. If z=0, then the slot number cannot be identified

<sup>7</sup> z indicates the slot number of the expansion I/O. If z=0, then the slot number cannot be identified

Fault	Extended Fault Code	Error Description
	0×430-437	<b>Invalid Clamp Value</b> If <b>LCE</b> and <b>HCE</b> configuration bits are set, the High Clamp value is less than or equal to the Low Clamp value. OR If <b>LCE</b> set and <b>HCE</b> not set, the Low Clamp Value is greater than or equal to the High Limit Value. OR If <b>HCE</b> set and <b>LCE</b> not set, the High Clamp Value is less than or equal to the Low Limit Value.

### Section 3.6 Technical Assistance

Note that your module contains electronic components which are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary plastic wrapping or cushioning material. **In the unlikely event that the module should need to be returned to Spectrum Controls, please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding / metalized bag or black conductive container).** Spectrum Controls reserves the right to void the warranty on any unit that is improperly packaged for shipment.

RMA (Return Merchandise Authorization) form required for all product returns.

For further information or assistance, please contact your local distributor, or call the Spectrum Controls Technical Support at:

For Rockwell Automation Compatible I/O Products:

- 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](mailto:support@spectrumcontrols.com)

### Section 3.7 Declaration of Conformity

Available upon request

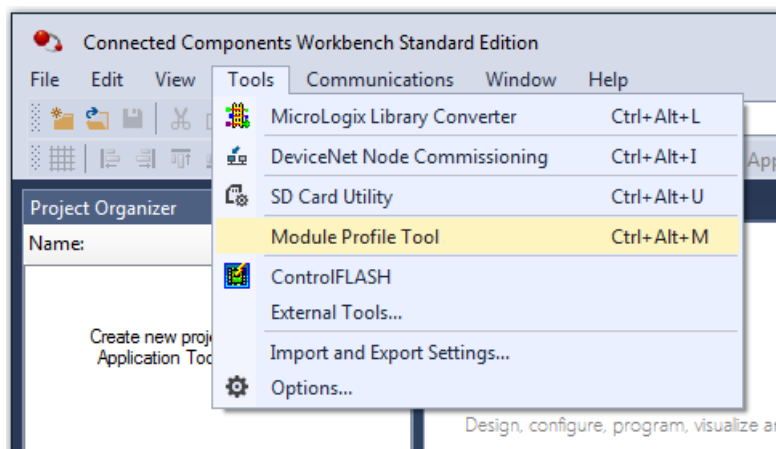


# Appendix A

## Manually Importing an AOP

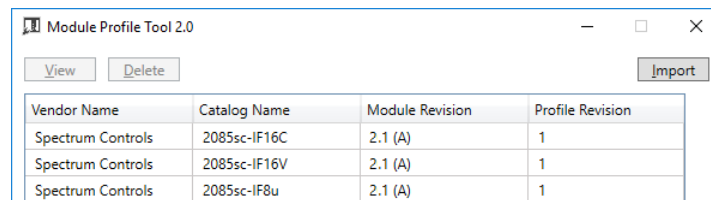
This appendix explains how to manually import an AOP rampp file into CCW software.

1. Download the latest module AOP from Spectrum Controls website, <https://www.spectrumcontrols.com>, and save the file to a local folder on your computer (normally the Downloads folder).
2. Run CCW.
3. From the Tools menu, select the **Module Profile Tool** option:

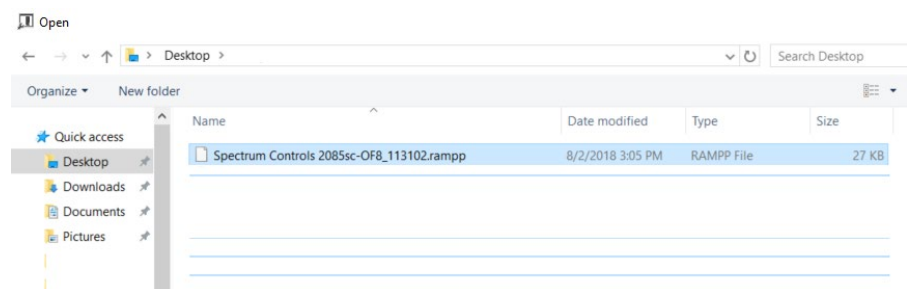


4. When prompted by Windows User Account Control, to confirm that you wish to run the program, click **Yes** button.

The Module Profile Tool 2.0 window appears:

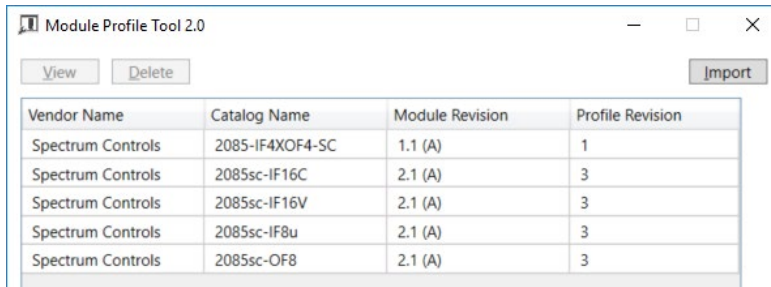


5. Click the **Import** button.
6. An Open dialog appears. Navigate to the provided .rampp file location, and click the file you downloaded:



7. Click **Open** to import the file.

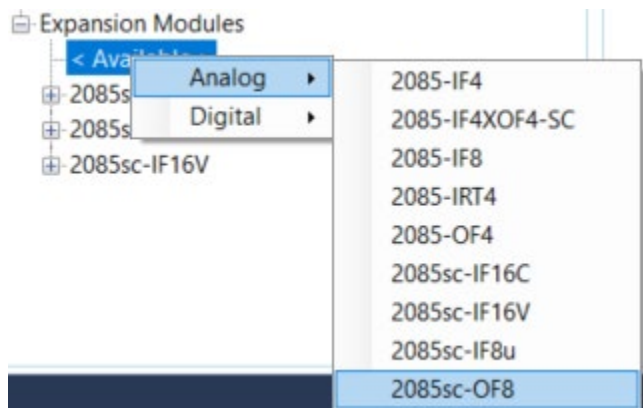
8. The program loads the .rampp file and informs you that you need to restart the CCW program.



The screenshot shows the 'Module Profile Tool 2.0' window. It has buttons for 'View', 'Delete', and 'Import'. Below the buttons is a table with four columns: 'Vendor Name', 'Catalog Name', 'Module Revision', and 'Profile Revision'. The table contains six rows of data, all from 'Spectrum Controls'.

Vendor Name	Catalog Name	Module Revision	Profile Revision
Spectrum Controls	2085-IF4XOF4-SC	1.1 (A)	1
Spectrum Controls	2085sc-IF16C	2.1 (A)	3
Spectrum Controls	2085sc-IF16V	2.1 (A)	3
Spectrum Controls	2085sc-IF8u	2.1 (A)	3
Spectrum Controls	2085sc-OF8	2.1 (A)	3

9. After the program restarts, create a new project or reload your project. Select an **Available** slot from the Expansion Modules drop-down list:



The newly imported module is now available as a selection from the Expansion Modules list.



# Index

- 2085sc-OF8 AOP
  - import 3-5
- Add On Profile (AOP) 3-2
- Alarm Latch Enable
  - description 3-21
- ALE
  - field 3-10
- AOP
  - manual importation A-1
- ASCII
  - option 3-6
- Assembly sizes 3-13
- Binary
  - option 3-6
- Block diagram 1-10
- Browse
  - button 3-7
- CCW tab 3-4
- Channel
  - field 3-9
- Configuration
  - textbox 3-6
- Configuration option 3-6
- Connection types 3-13
- Data Format
  - field 3-9
- Data Format and Range
  - list 3-23
- Decimal
  - option 3-6
- Declaration of Conformity 3-25
- Default Configuration tab 3-4
- Disable
  - field 3-9
- Electrostatic Discharge
  - prevent 2-3
- EMC Directive, 2-1
- Environmental
  - specifications 1-6
- Expansion Modules
  - drop-down list 3-5
- Factory default
  - on startup 3-12
- Generate
  - configuration 3-11
- Hardware
  - specifications 1-3
- Hardware Features 1-7
- Hazardous Location 2-2
- HCA
  - field 3-10
- Hex
  - option 3-6
- High Clamp
  - description 3-21
- High Clamp Alarm Enable
  - description 3-20
- High Clamp Enable
  - description 3-20
- High Clamp Value
  - field 3-10
- High Limit Alarm Enable
  - description 3-21
- HLA
  - field 3-10
- Installation and Wiring 2-1
- Launch
  - MCC utility 3-7
- LCA
  - field 3-10
- LCE
  - field 3-9
- LED
  - indicator information 1-8
- LLA
  - field 3-10
- Low Clamp Alarm Enable
  - description 3-20
- Low Clamp Enable
  - description 3-20
- Low Clamp Value
  - description 3-21
  - field 3-11
- Low Limit Alarm Enable
  - description 3-21
- Maximum Length
  - information 3-6
- Minimum spacing 2-4
- Module
  - configuration errors 3-24
  - description 2-5
  - mounting 2-4
  - Overview 1-1
- Module Catalog Name 3-5
- Module Identity 3-13
- Module Profile Tool 3-2
- Module status word list
  - description 3-15
- Mounting
  - DIN rail 2-6
  - module 2-4
  - panel 2-7
- Noise 2-3
- Output Ch<x>

- description 3-18
- Parts List 2-4
- PLC
  - interfaces 3-13
- Power
  - remove 2-3
- Power Requirements 2-1
- Radix
  - menu 3-6
- Range
  - field 3-9
- Remove Power 2-3
- Safety Test
  - specifications 1-7
- Software
  - updating 3-12
- Specifications
  - environmental 1-6
  - hardware 1-3
  - safety test 1-7
- System
  - description 1-1
- Technical Assistance 3-25
- Technical support
  - contact information, vi
- Unlatch Alarm Bits
  - description 3-18
- Version
  - Software 3-12
- View Module Profile window 3-3
- Wiring Diagram 2-8





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