USER MANUAL

SPECTRUM CONTROLS

An Allient Company

User's Manual Pub. 0300322-03 Rev. A0

Micro800™ Expansion I/O 8/16 Channel Thermocouple and Millivolt Analog Input Modules

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.

Under no circumstances will Spectrum Controls, Inc. be responsible or liable for any damages or losses, including indirect or consequential damages or losses, arising out of either the use of any information within this owner's guide or the use of any product or service referenced herein.

No patent liability is assumed by Spectrum Controls, Inc. with respect to the use of any of the information, products, circuits, programming, or services referenced herein.

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.'s 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, Inc. 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
- 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™ 8/16-Channel Thermocouple and Millivolt Analog Input Modules.

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.

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™ 8/16-Channel Thermocouple and Millivolt Analog Input Modules.

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
	Micro870 24V DC Expansion Power Supply Installation Instructions	2085-IN008

For	Refer to this Document	Allen-Bradley Pub. No.
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: https://spectrumcontrols.com	

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 (US/global, English only
- United Kingdom +44 0 1908 635 230 (EU phone, UK local)
- Australia, China, India, and other East Asia locations: 1-800-722-778 or +61 39757 1502
- Mexico 001-888-365-8677
- Brazil 55-11-5189-9500 (general support)
- Europe +49-211-41553-630 (Germany/general support)

or send an email to support@spectrumcontrols.com

Documentation

If you would like a manual, you can download a free electronic version from the Internet 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. These messages 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.

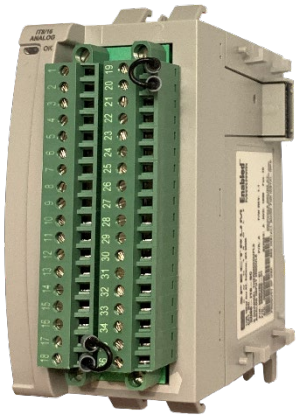
Chapter 1
Module Overview

This chapter covers the following topics:

- General description
- Input Specifications
- Data formats
- Hardware features
- System overview

The Micro800™ 8/16-Channel Thermocouple and Millivolt Analog Input Module (2085-IT8/IT16-SC Expansion I/O Module) is an 8/16 point thermocouple input module for use in Rockwell's 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.

Section 1.1 General Description



NOTE	The module firmware released as revision 1.1 is compatible with the Micro850 Series A & B PLCs and Micro870 Series A PLC with its PLC firmware revision 11.011 and under. The number of 2085-IT16-SC modules or 2085-IT8-SC modules that can be loaded with a Micro850/870 PLC is based on the PLC model and memory. The number may vary between controller firmware revision and different CCW software revisions

The 2085-IT8/IT16-SC Expansion I/O modules support direct voltage (±50 mV and ±100 mV) and direct Thermocouple (Type: J, N, T, K, E, S, R, C, B)

measurements. The module supports:

- Eight analog input channels for the 2085-IT8-SC.
- Sixteen analog input channels for the 2085-IT16-SC
- The modules measure either voltage or provide data measurements of temperature using thermocouple and CJ sensor voltage inputs for each channel.
- Direct voltage measurements. The low-drift precision resistor is not used, and the channel accepts the voltage source directly.
- Direct thermocouple. For both modules, two cold junction sensors are available to be placed at the top and bottom of each terminal block. The module measures thermocouple and CJ Sensors voltages and converts the results to a temperature reading.
- Two physical Cold Junction Compensation sensors (one at top, one at the bottom of each terminal block), and two CJC profiles (averaged and distributed) are supplied.
- Four data formats.
- Four filter frequency selections.
- Real-time Terminal Block temperature updating when the channel is enabled.
- Range scaling of input data.
- Alarm notification on each channel's status:
  - Over or under range detection (from user-defined values).
  - Open circuit detection for current measurement on the 4-20 mA range, voltage, and thermocouple measurements.
  - ADC Communication fault detection.
  - Channel bias adjustments for each channel.
  - An option to disable open-wire detection for volt, millivolt, and thermocouple measurements.

All inputs have fault tolerance and ESD protection to avoid damage to circuitry on the board. The modules use 50 VAC working Reinforced Insulation between the inputs and the backplane, and low-level (10 VDC) channel-to-channel isolation.

The 2085-IT8-SC module uses a 20-bit Sigma-Delta analog-to-digital converter to achieve a 16-bit resolution. The 2085-IT16-SC module uses two 20-bit Sigma-Delta analog-to-digital converters to achieve a 20-bit resolution. However, some of the formats display the result in 16-bit resolution. The modules measure thermocouple and CJ Sensors voltages and convert the results to a temperature reading.

Each input channel is individually configurable via Rockwell-provided Connected Component Workbench (CCW) software for the 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 power startup, all inputs are disabled and off until a valid configuration has been received.

The default configuration for the modules is for all channels enabled with the Type J TC setting with the 17 Hz filter in Engineering ×1 units.

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

Section 1.2
Input Specifications

The 2085-IT8-SC/2085-IT16-SC modules have the following input specifications.

Table 1-1. Input/Performance/Environmental Requirements

Input Specifications	Value
Operating Temperature	-20 ºC to 65 ºC (-4 ºF to 149 ºF)
Storage/Non-Operating Temperature	-40 ºC to 85 ºC (-40 ºF to 185 ºF)
Operating Humidity	5% to 95%, non-condensing
Storage/Non-Operating Humidity	5% to 85%, non-condensing
Vibration/Operating	10 Hz to 500 Hz, 2 G, 0.030 max peak-to-peak
Operating Shock	25 G, peak acceleration, 11±1 ms pulse, half sine
Storage/Non-Operating Shock	25 G peak acceleration, 11±1 ms pulse, half sine; 35 g for panel mount.
Pollution Level	Meets Pollution Degree 2 requirements.
ESD	6kV Indirect (Coupling Plate) 6kV Contact Discharge (to points of initial contact) 8kV Air Discharge (to points of initial contact)
Radiated Immunity	10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 900 and at 1890 MHz 10 V/M with 1 kHz sine-wave 80% AM from 80…2000 MHz 3 V/M with 1 kHz sine-wave 80% AM from 2000…6000 MHz
Input modes	Thermocouples and millivolt ranges.
Inputs per module (8 channels)	8 thermocouple/ millivolt inputs, and 2 CJC input channels
Inputs per module (16 channels)	16 thermocouples/ millivolt inputs, and 2 CJC input channels
Thermocouple types	J, K, T, E, R, S, B, N and C
Voltage input ranges	±50 mV and ±100 mV
Input filters	4 Hz, 17 Hz, 60 Hz, 470 Hz

Input Specifications	Value		
Thermocouple accuracy Specifications only apply to 4 Hz and 17 Hz filters	Error at 25 °C, Typical, Max		Error over -20 °C to 65 °C Typical, Max
Type J (-210°C to 1200°C)	±0.4 °C, ±0.6 °C		±0.5 °C, ±1.6 °C
Type N -100°C to 1300°C)	±0.4 °C, ±0.7°C		±0.5 °C, ±1.3 °C
Type N (-210°C to -100°C)	±0.8 °C, ±1.5°C		±1.0 °C, ±2.2 °C
Type T -170°C to 400°C)	±0.6 °C, ±1.0 °C		±0.7 °C, ±1.5 °C
Type T (-270°C to -170°C)	±3.0 °C, ±8.0 °C		±.5 °C, ±14.0 °C
Type K (-170°C to 1370°C)	±1.1 °C, ±1.5 °C		±1.2 °C, ± 2.1 °C
Type K (-270°C to -170°C)	±6.0 °C, ±15.0°C		±7.0 °C, ±20.0 °C
Type E (-190°C to 1000°C)	±0.4 °C, ±0.6 °C		±0.5 °C, ±1.2 °C
Type E (-270°C to -190°C)	±3.0 °C, ± 6.0°C		±3.5 °C, ±10.0 °C
Type S (0°C to 1768.1°C)	±1.0 °C, ± 2.0 °C		±1.2 °C, ±2.6 °C
Type R (0°C to 1768.1°C)	±1.0 °C, ±2.0 °C		±1.2 °C, ±2.6 °C
Type B (300°C to 1820°C)	±1.8 °C, ±4.0 °C		±2.1 °C, ± 4.5 °C
Type C (0°C to 2315°C)	±0.8 °C, ±1.8 °C		±1.0 °C, ±4.0 °C
CJC Sensor Range	-20 ºC to 90 ºC		
CJC Profile accuracy	±2.1 ºC maximum (Correlation between reading and target terminal)		
CJC Sensor accuracy	±0.2 ºC maximum (for 0 ºC to 70 ºC input values) ±0.4 ºC maximum (for full -20 ºC to 90 ºC CJC input values)		
CJC Measurement accuracy	±0.2 ºC maximum (for 0 ºC to 70 ºC input values) ±0.5 ºC maximum (for -20 ºC to 90 ºC input values)		
CJC Total accuracy (Sum of three items above)	±2.5 ºC maximum (for 0 ºC to 70 ºC input values) ±3.0 ºC maximum (for full -20 ºC to 90 ºC CJC input values)		
Voltage accuracy Specifications only apply to 4 Hz and 17 Hz filters	Error at 25 ºC, Max		Error over -20 ºC to 65 ºC, Max
±50 mV	±20 uV		±50 uV
±100 mV	±20 uV		±100 uV
Repeatability (at 25 ºC)	4 Hz filter	17 Hz filter	60 and 470 Hz filters[1]
Thermocouples			

[1] These filters do not reject 50/60 Hz. Repeatability for these filters is strongly dependent on how much 50/60Hz noise is in the system.

Input Specifications	Value		
Type J (-210 °C to 1200 °C)	±0.2 °C	±0.4 °C	±3 °C
Type N -100 °C to 1300 °C)	±0.2 °C	±0.2 °C	±4 °C
Type N (-210 °C to -100 °C)	±0.2 °C	±0.3 °C	±7.5 °C
Type T (-170 °C to 400 °C)	±0.2 °C	±0.2 °C	±3.3 °C
Type T (-270 °C to -170 °C)	±0.5 °C	±0.6 °C	±20 °C
Type K (-170 °C to 1370 °C)	±0.2 °C	±0.4 °C	±3.8 °C
Type K (-270 °C to -170 °C)	±2 °C	±3.5 °C	±20 °C
Type E (-190 °C to 1000 °C)	±0.2 °C	±0.4 °C	±2.4 °C
Type E (-270 °C to -190 °C)	±1 °C	±1.5 °C	±20 °C
Types S & R	±0.4 °C	±0.6 °C	±12 °C
Type B	±0.3 °C	±0.4 °C	± 0 °C
Type C	±0.2 °C	±0.3 °C	±6.7 °C
Millivolt Inputs			
±50 mV	±15 µV	±20 µV	±40 µV
±100 mV	±15 µV	20 µV	±40 µV
Filters			
CMRR	84 dB minimum at 50 and 60 Hz for 4 Hz and 17 Hz filters		
NMRR	4 Hz filter	72 dB minimum at 50 and 60 Hz	
	17 Hz filter	62 dB minimum at 50 and 60 Hz	
Crosstalk	-70 dB maximum		
Input Bias Currents and Impedance			
Input bias current	Approx. 100 uA during open wire check)		
Input impedance	Greater than 15 MΩ (except during open wire checks)		
Input protection	Voltage Mode ±28 VDC continuous. NOTE: maximum voltage between any two pins must be limited to 28 VDC as well. For proper operation, do not connect any external voltages to the CJC pins.		
Isolation			
Input to backplane isolation	50 VAC working Reinforced isolation tested at 2 kVDC for 1 minute		
Input to Chasis GND isolation	50 V working Reinforced isolation tested at 2 kVDC for 1 minute		
Channel to channel low level Isolation	10 VDC measured between the IN- leads. Maximum voltage between any two pins must be limited to 28 VDC. CJC input pins not designed to be attached to external voltages.		

Input Specifications	Value
Power Requirements	
Bus +5 V (4.75 V to 5.4 V)	100 mA maximum
Bus +24 V (19.9 V to 26.4 V)	20 mA maximum
Power Dissipation within module	1 W max
Inrush current	Less than 150 mA at 5 V; less than 400 mA at 24 V
Fusing	UL approved and properly sized SMD fuse or properly sized fuse resistors on both the 24 VDC and 5 VDC power supply lines.
Fault detection	Over/under range for all types Open Circuit detection Note: Thermocouple open circuit (open wire) will be periodically checked using the PGA burnout current. This saves on component cost and increases the Voltage Input impedance.
Wire Installation	
Wire size	#16 to #28 AWG
Wire Strip Length	0.375 in.
Recommended Tightening Torque:	0.25 N-m (2.2 in-lbs.)
Module Dimensions	110 mm × 87 mm × 51 mm (plastic only). (4.33 in × 3.43 in × 2.00 in) 110 mm × 89 mm × 51 mm (with RTBs installed). (4.33 in × 3.5 in × 2.00 in) (CJC adds additional height beyond this)

Table 1-2. Environmental Specification Table

Environmental Tests	Test Limits
Temperature (Operating) (Performance Criteria A)	-20 ºC to 65 ºC (-4 ºF to 149 ºF)
Temperature (Non-operating) (Performance Criteria B)	-40 ºC to 85 ºC (-40 ºF to 185 ºF)
Humidity (Operating) (Performance Criteria A)	5 to 95% non-condensing
Vibration (Operating) (Performance Criteria A)	2 G at 10 to 500 Hz, 0.030 in. max. peak-to-peak

Environmental Tests	Test Limits
Shock (Operating) **(Performance Criteria A)**	25 G, 11 ms half-sine (3 mutually perpendicular axes)
Shock (Non-operating) **(Performance Criteria B)**	25 G (35 G Panel mount), 11 ms half-sine (3 mutually perpendicular axes)
Radiated Emissions	(Enclosure) Class A, 30 MHz – 1 GHz
Conducted Emissions	Group 1, Class A (AC Mains), 150 kHz – 30 MHz
ESD immunity **(Performance Criteria B)**	6 kV Indirect (Coupling Plate) 6 kV Contact Discharge (to points of initial contact) 8 kV Air Discharge (to points of initial contact)
Radiated RF immunity **(Performance Criteria A)**	10 V/M with 200 Hz square-wave 50% Pulse 100% AM at 900 & at 1890 MHz 10 V/M with 1 kHz sine-wave 80% AM from 80…2000 MHz 3 V/M with 1 kHz sine-wave 80% AM from 2000…6000 MHz (10 V/M goal)
EFT/B immunity **(Performance Criteria 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
Surge transient immunity **(Performance Criteria B)**	Signal Ports: ±2 kV line-earth {CM} at 2 Ω on shielded ports Power Ports ±2 kV CM at 12 Ω ±1 kV DM at 2 Ω
Conducted RF immunity **(Performance Criteria A)**	10 VRMS with 1 kHz sine wave 80% AM from 150 kHz…80 MHz on signal and power ports
Magnetic Field **(Performance Criteria A)**	30 Arms/m
AC Mains Voltage Dips, Interruptions and Variations	Follow the 61000-4-11.

Table 1-4. Safety Test Specification Table

Safety Tests	Industry Standards
UL Safety	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)

Safety Tests	Industry Standards
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
UKCA	Electromagnetic Compatibility Regulations 2016 BS EN 61131-2, BS EN 61000-6-4, BS EN 61000-6-2
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

Section 1.3 Data Formats

There are four data input types:

- Engineering units ×1
- Engineering units ×10
- Raw/proportional count
- Percentage Full Scale

Section 1.4 Hardware Features

Channels are wired as differential inputs. Open-circuit detection alerts users to an open circuit condition. Inputs are protected from electrostatic discharge up to 6 kV for indirect and contact discharge, 8 kV for air discharge.

1.4.1 LED Indicators

A 2085-IT8/IT16-SC module 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. 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.

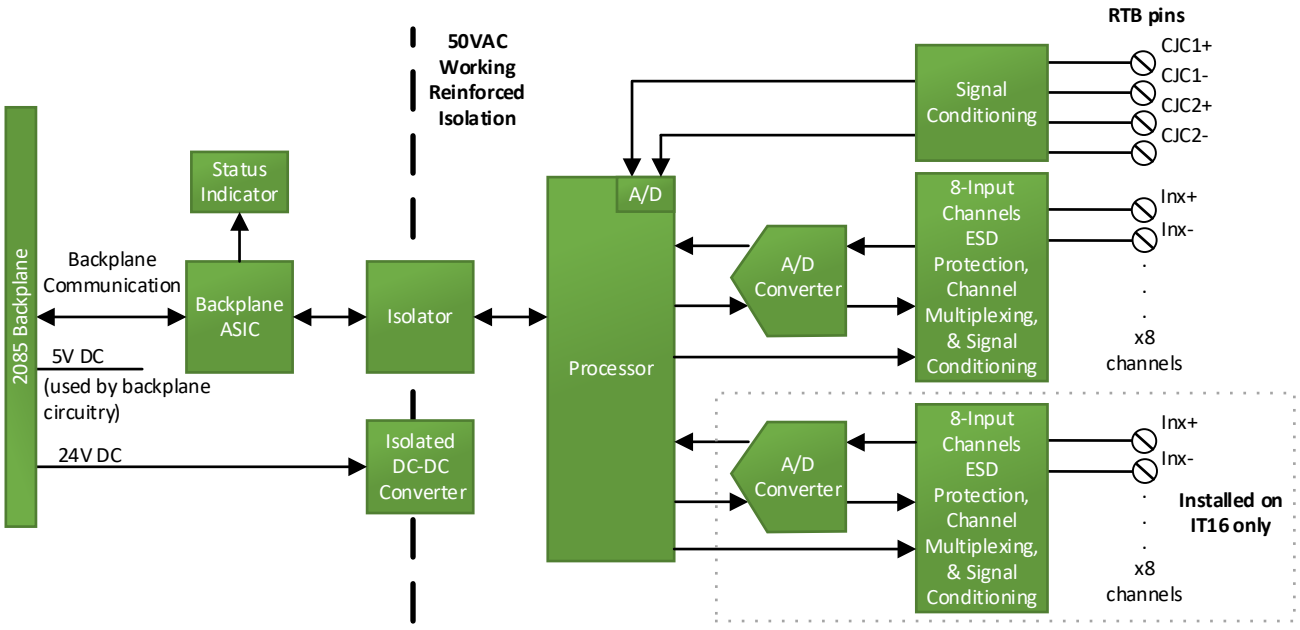
Table 1-4 LED Status Indicators

Indicator	State	Description
Module OK LED Status	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.

Section 1.5 System Overview

The 2085-IT8/IT16-SC module is expected to operate indefinitely. It does not require periodic maintenance or calibration. The module communicates to the controller through the bus interface. The module also receives 5 VDC 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
- Field wiring connections

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

WARNING 	The backplane power and the analog inputs of the device shall only be supplied by an Isolated Secondary Limited Energy Low Voltage source.

The modules receive power through the bus interface from the +5 VDC/+24 VDC system power supply, and a 24 VDC field power supply. Both must be present for the modules to operate.

Current rating at + 5 V is 100 mA maximum; for +24 V it is 20 mA maximum:

5 VDC	24 VDC
100 mA	20 mA

Section 2.3 General Considerations

The 2085-IT8/IT16-SC modules are 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[2].

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.

WARNING	EXPLOSION HAZARD
	• Substitution of components may impair suitability for Class I, Division 2; Class II, Division 2; and Class III, Division 2. Do not replace components or disconnect equipment unless power has been switched off or the area is known to be non-hazardous. • Do not connect or disconnect components unless power has been switched off or the area is known to be non-hazardous. • This product must be installed in an enclosure. • 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.

2.3.2 Prevent Electrostatic Discharge

WARNING	Electrostatic discharge can damage integrated circuits or semiconductors if you touch I/O expansion port connector pins or the terminal block on the module. 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 the port connector or connector pins. • Do not touch circuit components inside the module. • If available, use a static-safe workstation. • When it is not in use, keep the module in its static-shield bag.

[2] Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

2.3.3 Remove Power

WARNING	**Remove power before removing or inserting this module.** 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: • Sending an erroneous signal to your system's field devices, causing unintended machine motion. • Causing an explosion in a hazardous environment. • 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.

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.

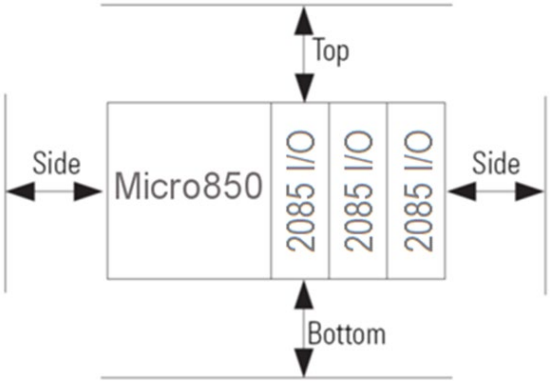
In addition, route shielded, twisted-pair analog input wiring away from any high voltage I/O wiring.

Section 2.4 Mounting

WARNING	**Keeping module free of debris and avoiding overheating:** • Do not remove protective debris strip until after the module and all other equipment near the module is mounted and the wiring is complete. • Once wiring is complete, and the module is free of debris, carefully remove protective strip. • Failure to remove strip before operating can cause overheating.

2.4.1 Minimum Spacing

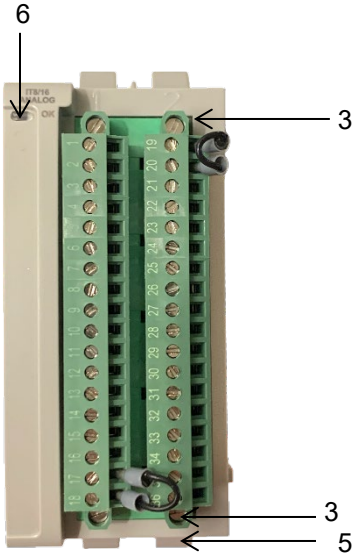
Maintain spacing from enclosure walls, wire ways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:

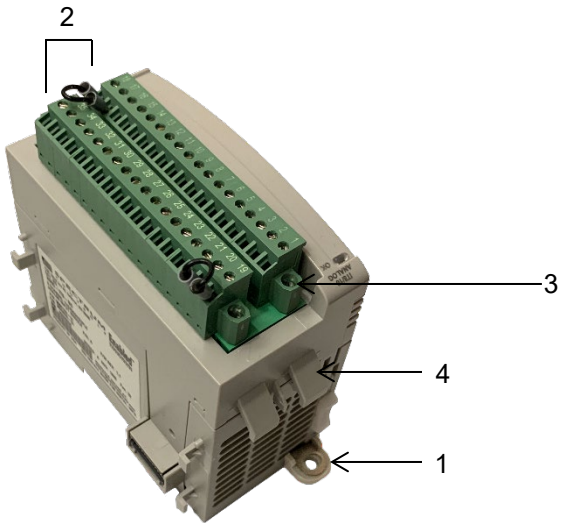


2.4.2 Parts List

Your package contains one 2085-IT8-SC or 1 2085-IT16-16-SC Channel Thermocouple and Millivolt Analog Input 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.

NOTE	
	• 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 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. • Cable connection lengths are currently 1 foot, and 1 meter.

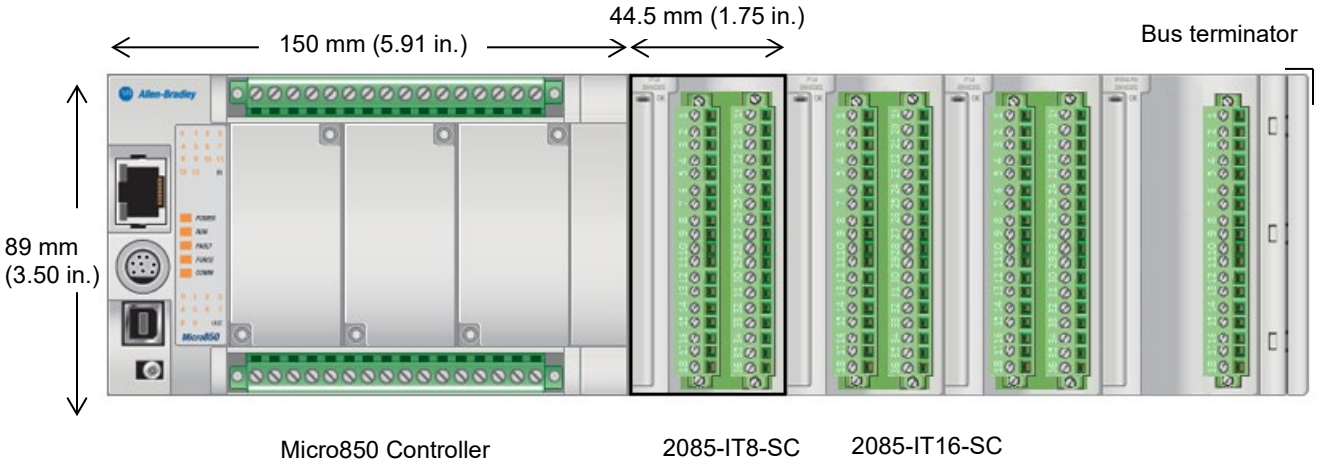
2.4.4 Insert Module Next to the Controller

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

NOTE	
	The module expansion may only be mounted horizontally.

NOTE	
	For environments with greater vibration and shock concerns, use the panel mounting method, instead of DIN rail mounting.

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.

WARNING	**Hazard of intermittent grounding.**
	**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.** 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.

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.

Panel Mounting

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

To install:

1. Place the module next to the controller against the panel where you are mounting the module.
2. Mark 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.

Section 2.5
Field Wiring Connections

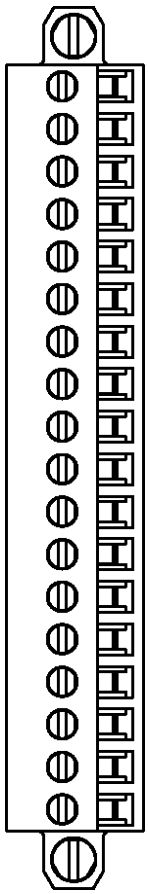
Wiring Diagram

WARNING	**Hazard of damage to the terminal connector.**
	The Spectrum Controls RTB hold down and terminal screws must be tightened by hand using the guidelines. They must not be tightened using a power tool. Use a screwdriver of 0.8 × 2 mm and tighten to no more than 0.25 N-m (2.2 in-lbs.) torque. Failure to follow these guidelines may result in damage to your connector.

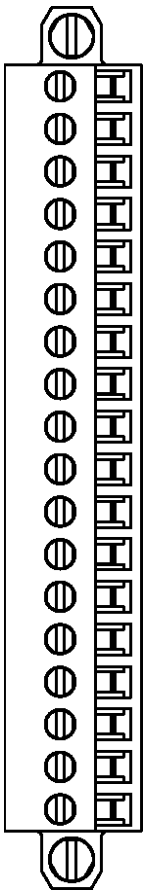
Wire the module using the following images, which explain the layout of each 2-row, 18-pin terminal block, and the associated wiring diagrams for the various input signals and the two modules.

2085-IT8-SC

RTB1#	Name
1	IN0+
2	IN0-
3	IN1+
4	IN1-
5	IN2+
6	IN2-
7	IN3+
8	IN3-
9	IN4+
10	IN4-
11	IN5+
12	IN5-
13	IN6+
14	IN6-
15	IN7+
16	IN7-
17	CJC1+
18	CJC1-

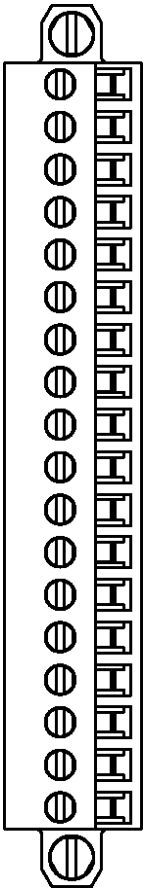


RTB2#	Name
19	CJC2+
20	CJC2-
21	NC
22	NC
23	NC
24	NC
25	NC
26	NC
27	NC
28	NC
29	NC
30	NC
31	NC
32	NC
33	NC
34	NC
35	NC
36	NC

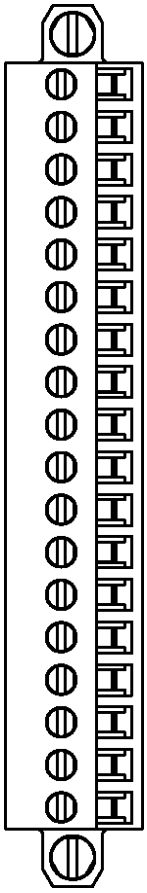


2085-IT16-SC

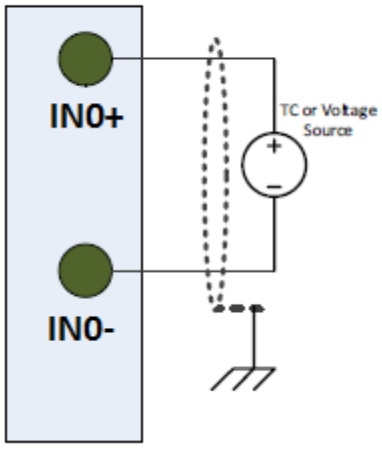
RTB1#	Name
1	IN0+
2	IN0-
3	IN1+
4	IN1-
5	IN2+
6	IN2-
7	IN3+
8	IN3-
9	IN4+
10	IN4-
11	IN5+
12	IN5-
13	IN6+
14	IN6-
15	IN7+
16	IN7-
17	CJC1+
18	CJC1-



RTB2#	Name
19	CJC2+
20	CJC2-
21	IN8+
22	IN8-
23	IN9+
24	IN9-
25	IN10+
26	IN10-
27	IN11+
28	IN11-
29	IN12+
30	IN12-
31	IN13+
32	IN13-
33	IN14+
34	IN14-
35	IN15+
36	IN15-



Voltage/TC Input



2085-IT8-SC Terminal Block Input signal descriptions are as follows:

RTB1	Name	Description	RTB2	Name	Description
1	IN0+	Ch0 Positive input	19	CJC2+	CJC 2 Positive Input (Potted thermistor on this side)
2	IN0-	Ch0 Return	20	CJC2-	CJC 2 Return
3	IN1+	Ch1 Positive input	21		NC
4	IN1-	Ch1 Return	22		NC
5	IN2+	Ch2 Positive input	23		NC
6	IN2-	Ch2 Return	24		NC
7	IN3+	Ch3 Positive input	25		NC
8	IN3-	Ch3 Return	26		NC
9	IN4+	Ch4 Positive input	27		NC
10	IN4-	Ch4 Return	28		NC
11	IN5+	Ch5 Positive input	29		NC
12	IN5-	Ch5 Return	30		NC
13	IN6+	Ch6 Positive input	31		NC
14	IN6-	Ch6 Return	32		NC
15	IN7+	Ch7 Positive input	33		NC
16	IN7-	Ch7 Return	34		NC
17	CJC1+	CJC 1 Positive Input (Potted thermistor on this side)	35		NC
18	CJC1-	CJC 1 Return	36		NC

2085-IT16-SC Terminal Block Input signal descriptions are as follows:

RTB1	Name	Description	RTB2	Name	Description
1	IN0+	Ch0 Positive input	19	CJC2+	CJC 2 Positive Input (Potted thermistor on this side)
2	IN0-	Ch0 Return	20	CJC2-	CJC 2 Return
3	IN1+	Ch1 Positive input	21	IN8+	Ch8 Positive input
4	IN1-	Ch1 Return	22	IN8-	Ch8 Return
5	IN2+	Ch2 Positive input	23	IN9+	Ch9 Positive input
6	IN2-	Ch2 Return	24	IN9-	Ch9 Return
7	IN3+	Ch3 Positive input	25	IN10+	Ch10 Positive input
8	IN3-	Ch3 Return	26	IN10-	Ch10 Return
9	IN4+	Ch4 Positive input	27	IN11+	Ch11 Positive input
10	IN4-	Ch4 Return	28	IN11-	Ch11 Return
11	IN5+	Ch5 Positive input	29	IN12+	Ch12 Positive input
12	IN5-	Ch5 Return	30	IN12-	Ch12 Return
13	IN6+	Ch6 Positive input	31	IN13+	Ch13 Positive input
14	IN6-	Ch6 Return	32	IN13-	Ch13 Return

RTB1	Name	Description	RTB2	Name	Description
15	IN7+	Ch7 Positive input	33	IN14+	Ch14 Positive input
16	IN7-	Ch7 Return	34	IN14-	Ch14 Return
17	CJC1+	CJC 1 Positive Input (Potted thermistor on this side)	35	IN15+	Ch15 Positive input
18	CJC1-	CJC 1 Return	36	IN15-	Ch15 Return

Chapter 3
Configuring the 2085-IT8-SC/IT16-SC Using CCW

This chapter covers how to use Connected Components Workbench (CCW) and optionally ModuleConfigConverter.exe software to configure the Module.

Section 3.1 Introduction

You use CCW software (v 9.00.00 and above) to configure the 2085-IT8-SC and 2085-IT16-SC Expansion I/O Modules. Spectrum Controls, Inc. provides a custom configuration software utility that you may use to provide configuration settings to the profile. You then send the configuration setup to the module.

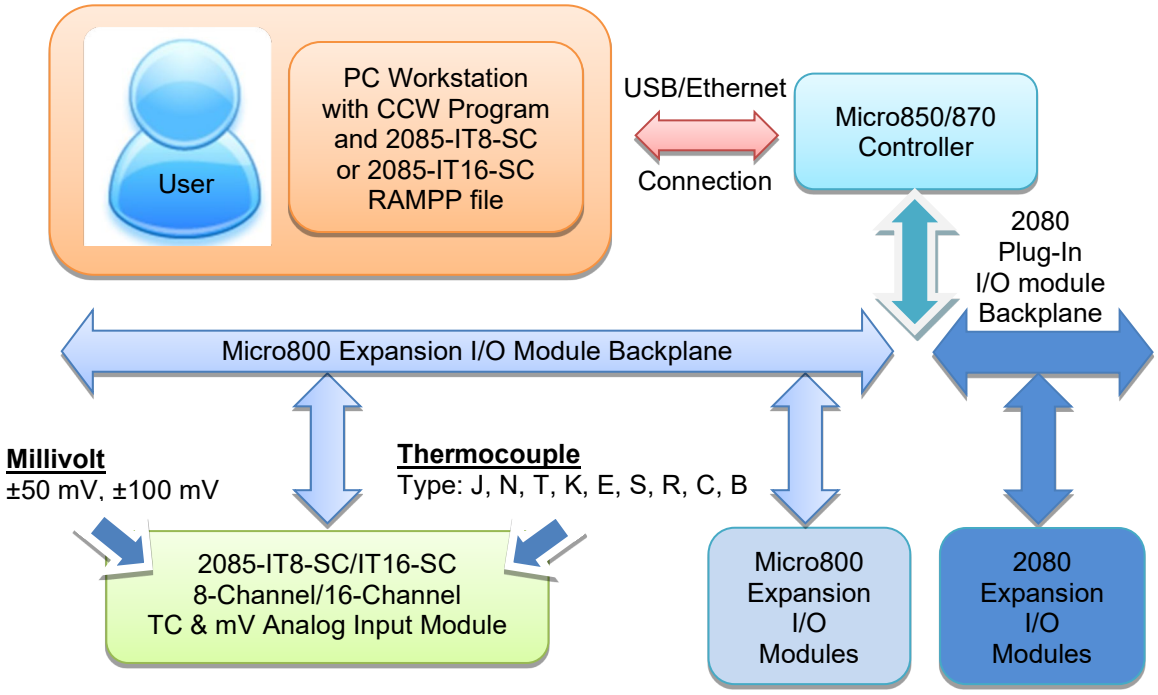
Your controller firmware must be at v. 9.011 and above as well.

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

- Micro800 Controller
- Micro800 Plug-in I/O Modules
- 2085-ECR Bus Terminator

Optional:

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

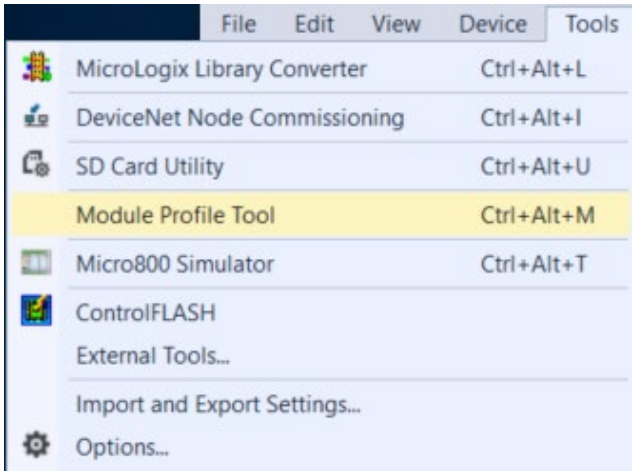


Section 3.2 2085-IT16-SC AOPs

You use each module's add-on-profile to configure your module. The profile 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.

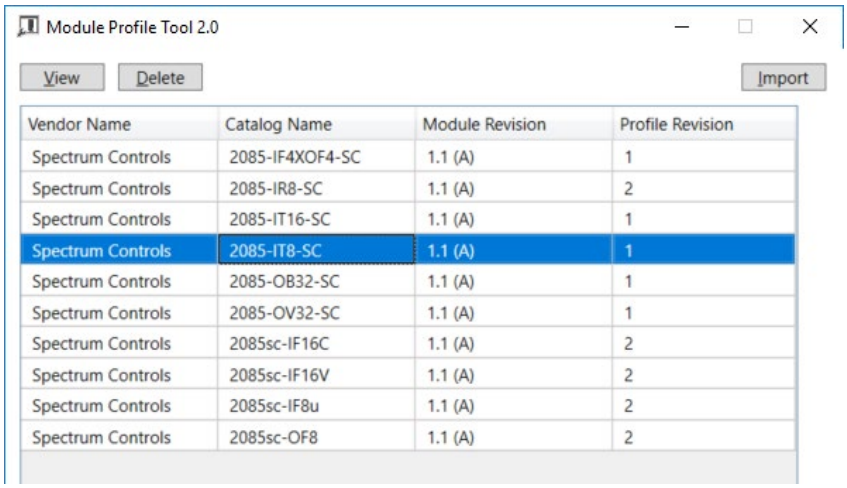
To view information about the profile:

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 the **Yes** button.

   If necessary, confirm with the Windows operating system that you wish to run the software. The Module Profile Tool dialog appears.

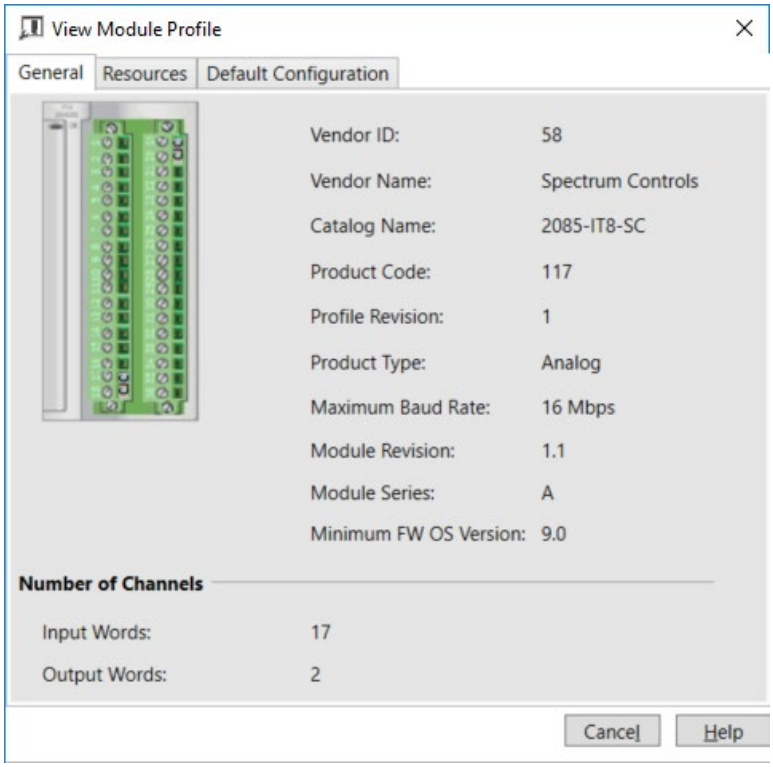


Vendor Name	Catalog Name	Module Revision	Profile Revision
Spectrum Controls	2085-IF4XOF4-SC	1.1 (A)	1
Spectrum Controls	2085-IR8-SC	1.1 (A)	2
Spectrum Controls	2085-IT16-SC	1.1 (A)	1
Spectrum Controls	2085-IT8-SC	1.1 (A)	1
Spectrum Controls	2085-OB32-SC	1.1 (A)	1
Spectrum Controls	2085-OV32-SC	1.1 (A)	1
Spectrum Controls	2085sc-IF16C	1.1 (A)	2
Spectrum Controls	2085sc-IF16V	1.1 (A)	2
Spectrum Controls	2085sc-IF8u	1.1 (A)	2
Spectrum Controls	2085sc-OF8	1.1 (A)	2

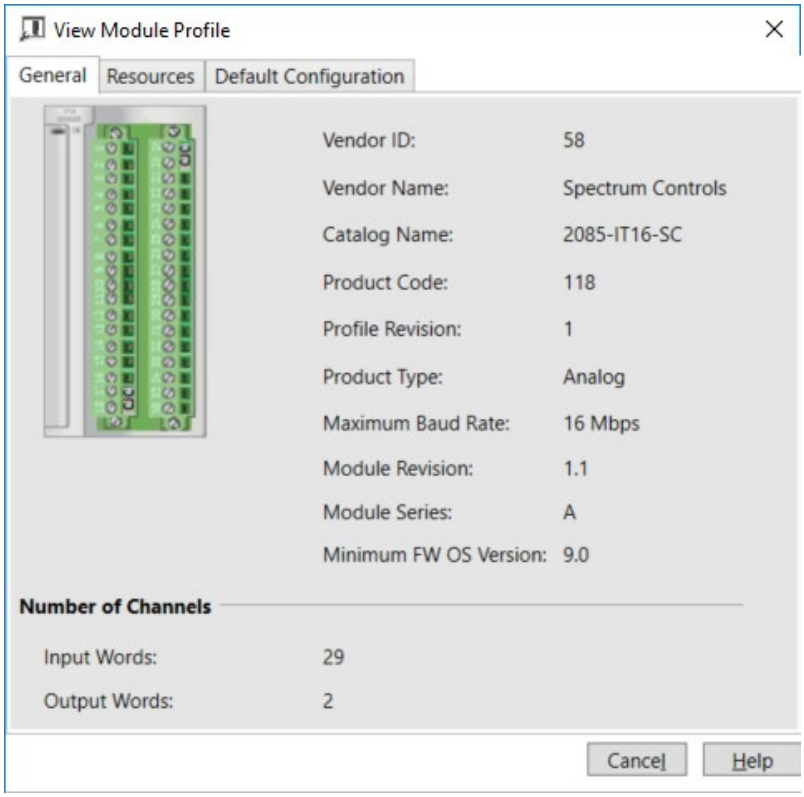
3. Select the row showing the module catalog name (2085-IT8-SC or 2085-IT16-SC), and then click the **View** button.

   The View Module Profile window appears.

2085-IT8-SC profile:



2085-IT16-SC profile:



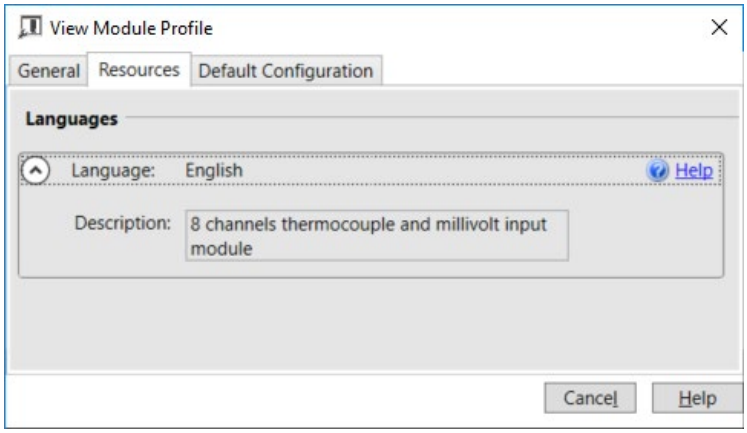
The first tab of the window provides the module identity information.

This information is described in greater detail in **Module Identity**, later in this section.

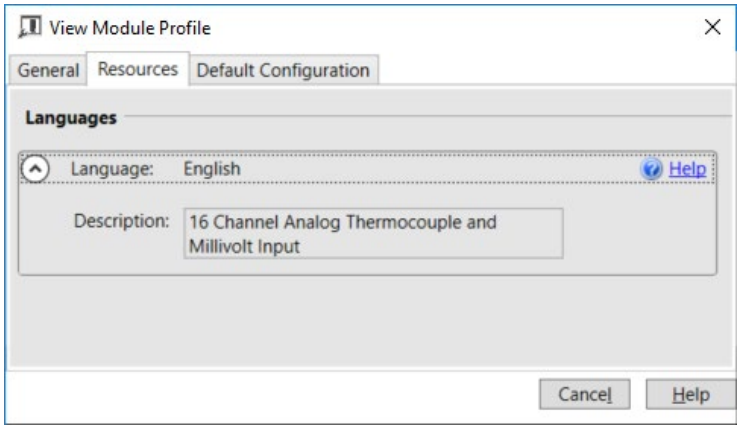
4. To view software language availability, module description, and a help file for the module, click the **Resources** tab.

   The Resources tab appears:

   2085-IT8-SC:



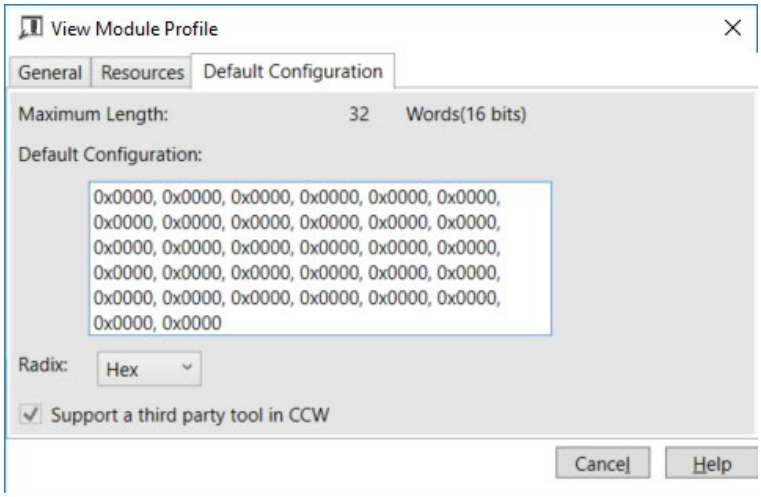
   2085-IT16-SC:



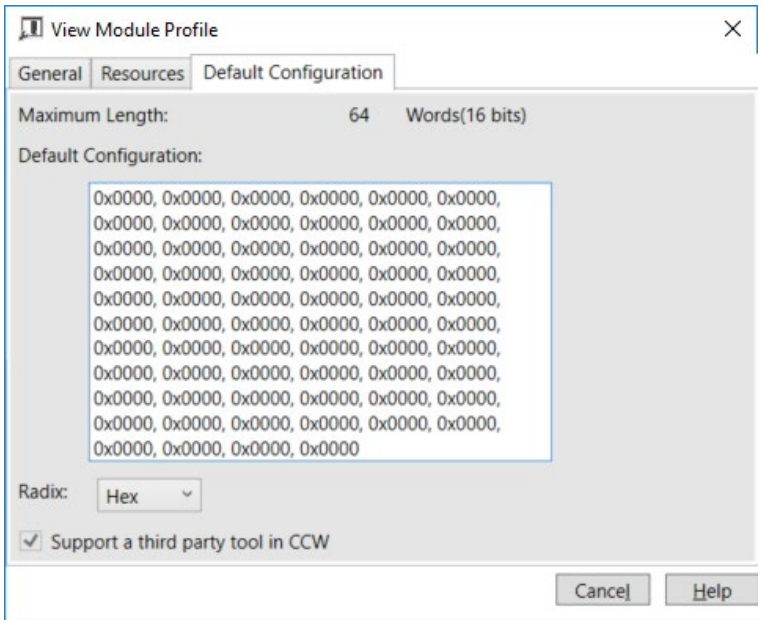
   The window lists the language chosen for the module, and the module description. You may also use this tab to access the help file provided for the module.

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

2085-IT8-SC:



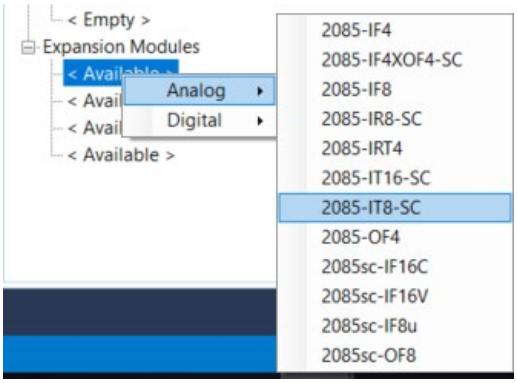
2085-IT16-SC:



6. 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.

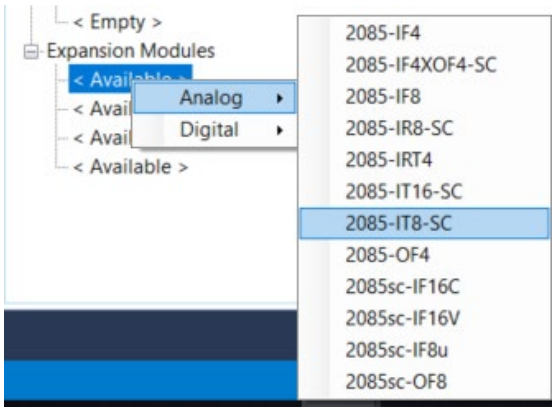
Section 3.3 CCW Configuration Tab

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 AOPs 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: 

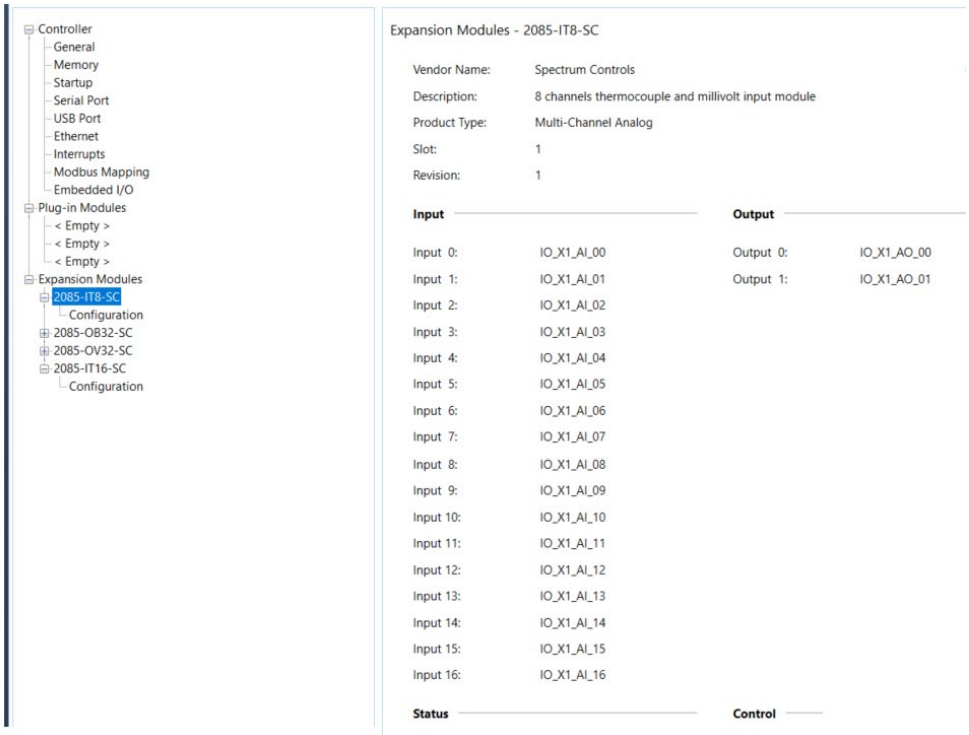
To add the module to your project, and see its configuration parameters on the CCW configuration tab:

1. From your CCW project, load the module AOP to a first **Available** slot from the Expansion Modules drop-down list (2085-IT8-SC is used as the example here):

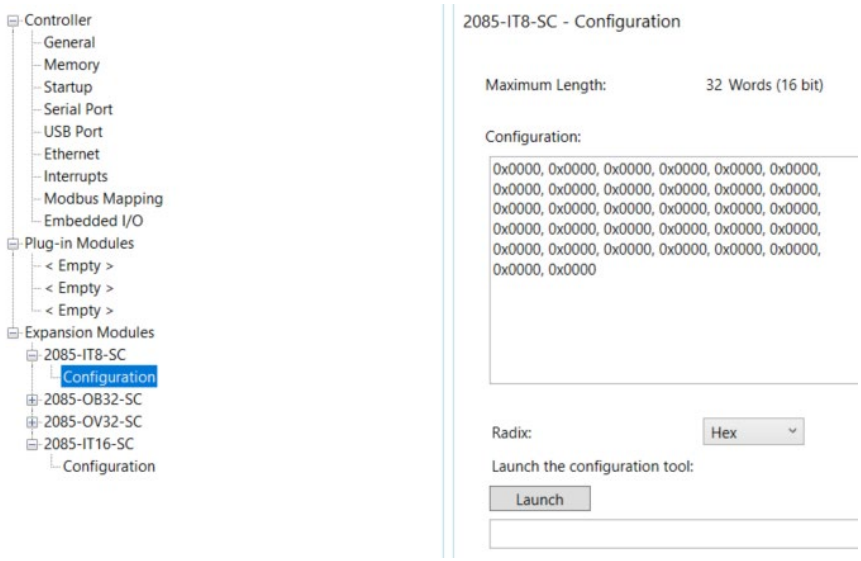


2. Once the module AOP is loaded, to view the associated variables, click the **Module Catalog Name** option.

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[3]

- **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 button to navigate to where the utility is stored. Then click the **Launch** button to start the utility.

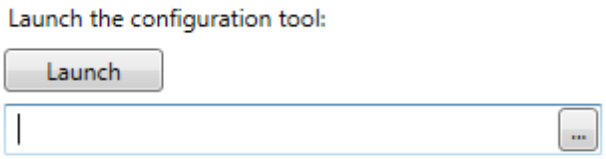
Section 3.4 Setting Configuration Parameters Using MCC

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.

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.

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.

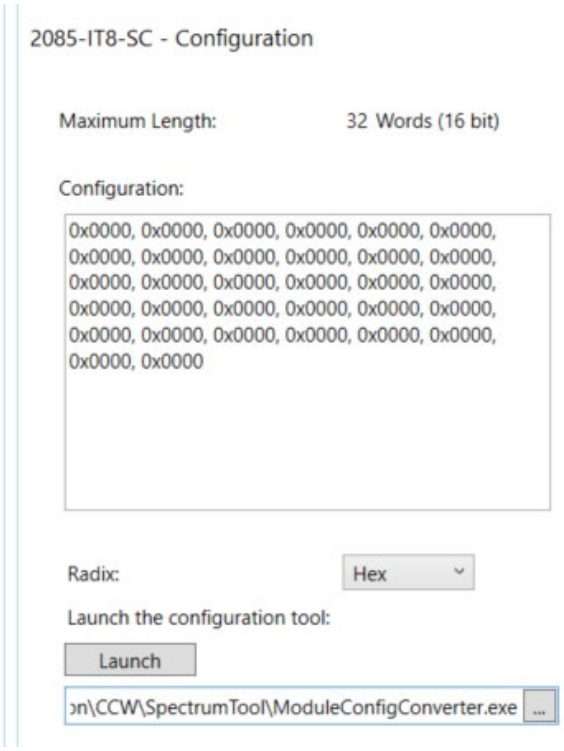


   The **Browse** button appears.

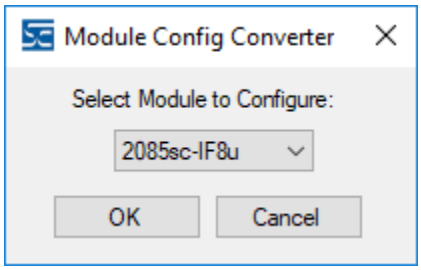
2. Click the button, navigate to the directory where you installed the CCW program, and select the ModuleConfigConverter tool located in the Spectrum Tool directory:

[3] 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.

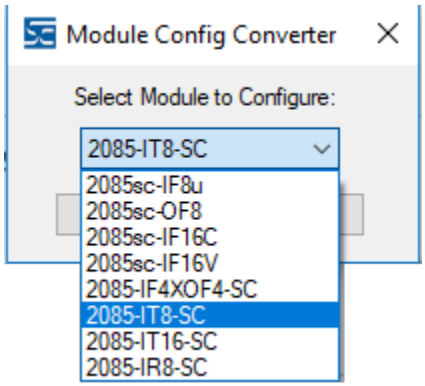
Example. C:\Program Files (x86)\Rockwell Automation\CCW\SpectrumTool



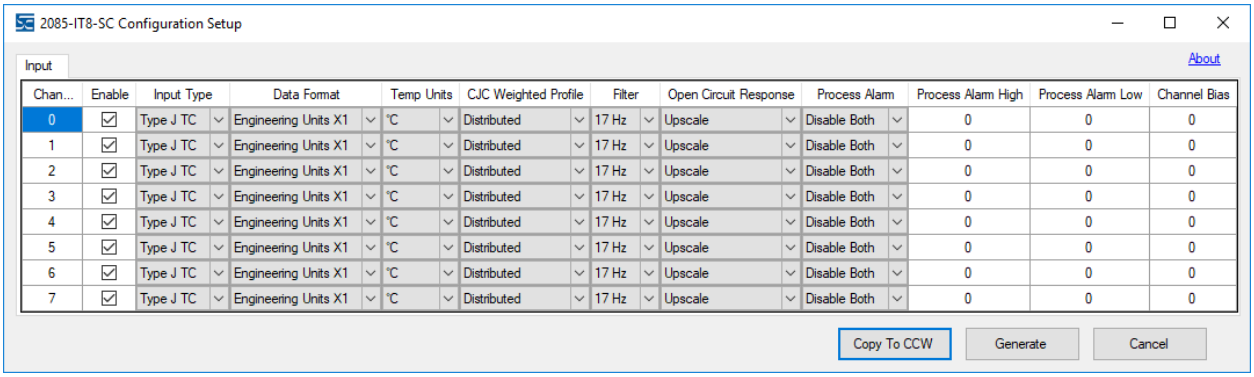
3. To run the tool, click **Launch**.
   The Module Config Converter dialog appears:



4. Select the 2085-IT8-SC module from the drop-down menu, and click **OK**:



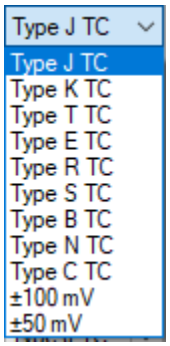
The 2085-IT8-SC Configuration Setup dialog appears:



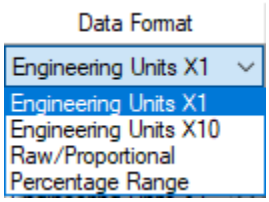
5. View and specify the following options as needed. See Channel Configuration Bit locations listed later in this section for details on the settings for every configuration bit:

   - **Chan**. Lists number of input channel from **0** to **7** (or **0 to 15** for IT16).
   - **Enable**. Specifies whether to enable use of this channel. **Enabled** by default (checkbox enabled).
   - **Input Type**. Specifies which input type to use.

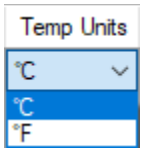
     Select type from drop-down list. **Type J TC** input is default:

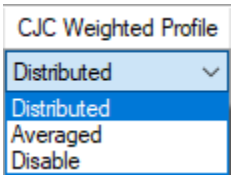
   - **Data Format**. Specifies which data format to use for reporting input values. Default is **Engineering Units X1**:

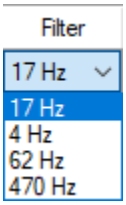
   - **Temp Units**. Specifies the temperature units the module reports in Centigrade or Fahrenheit. Default is **Centigrade**:

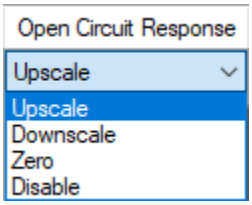
- **CJC Weighted Profile**. Defines whether the profile is distributed or averaged. Default is **Distributed**:



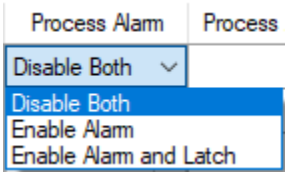
- **Filter**. Specifies which filter to use. Default is **17 Hz**.



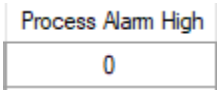
Open Circuit Response. Specifies how to respond to an open circuit condition. Default is **Upscale**[4].



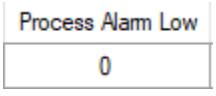
- **Process Alarm** . Specifies whether a warning on under- or over-range detection (from user-defined values) is turned on for the channel, disabled, or enabled for both alarm and latch.



- **Process Alarm High**. Specify over range value of a user-defined value for the module to monitor.



- **Process Alarm Low**. Specify under range value of a user-defined pair of high and low values for the module to monitor.



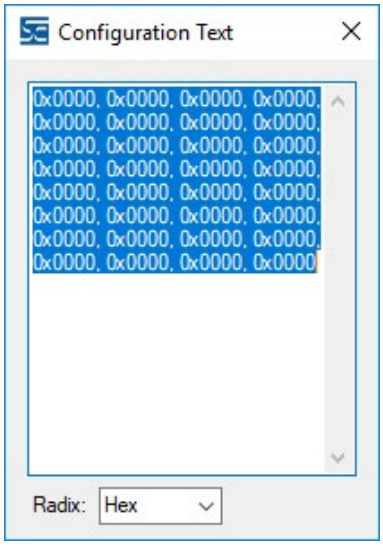
- **Channel Bias**. Specifies individual channel bias values. Default bias is **0**. Range may be **-32768** to **32767**.

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

[4] The **Disable** option is only available for voltage measurement.

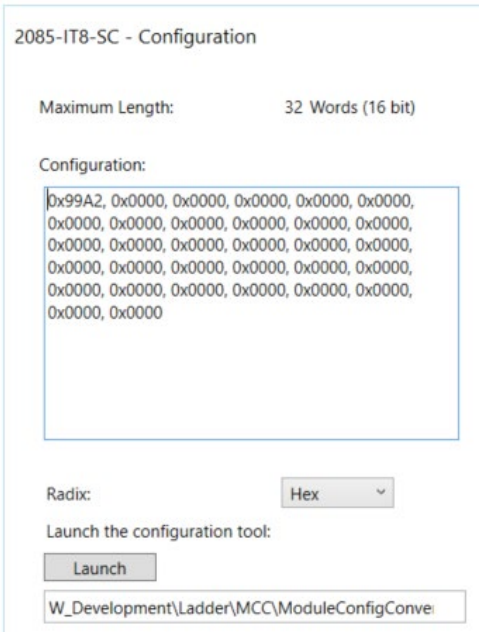
The Configuration Text dialog appears with your configuration settings for all the channels.

You can manually copy the settings and paste it to the textbox of the CCW Configuration tab[5].



7. 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[5].

   The utility copies the configuration settings and shows it inside the textbox.



[5] 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.

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

Section 3.5
Software Information

3.5.1 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.

3.5.2 Software Updates

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

3.5.3 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 Type J TC and the 17 Hz filter using the Engineering Unit ×1 setup.

Module Identity

The following values will be stored in the Vendor ID, Product_Type, Product_Code, Series_Rev, and Mod_Features arrays:

Parameter	2085-IT8-SC	2085-IT16-SC
Vendor ID	58 (Spectrum Controls) [0×03A]	58 (Spectrum Controls) [0×03A]
Product Type	10 (Analog) [0×0A]	10 (Analog) [0×0A]
Product Code	117	118
Series Rev	50208 [0×C420] (First release revision is 1.1)	50208 [0×C420] (First release revision is 1.1)
Module Catalog String	2085-IT8-SC	2085-IT16-SC

3.5.4 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	2085-IT8-SC Size (words)	2085-IT16-SC Size (words)
Configuration Assembly	32	64
Input Assembly	17	29
Output	2	2

3.5.5 Configuration Table

The configuration table size for the 2085-IT8-SC module is 32 words and 64 words for the 2085-IT16-SC module. Each Configuration Bit is formed in an unsigned 16-bit Data Type. Each value input is assigned to a signed 16-bit Data Type which has the range from -32768 to +32767.

Tag Name for 2085-IT8-SC (32 Words)	**Word Index**	**Tag Name for 2085-IT16-SC (64 Words)**
Ch0 Configuration Bits	Config. 0	Ch0 Configuration Bits
Ch0 Process Alarm High Value	Config. 1	Ch0 Process Alarm High Value
Ch0 Process Alarm Low Value	Config. 2	Ch0 Process Alarm Low Value
Ch0 Channel Bias Value	Config. 3	Ch0 Channel Bias Value
Ch1 to Ch6 Configurations	…	Ch1 to Ch6 Configurations
Ch7 Configuration Bits	Config. 28	Ch7 Configuration Bits
Ch7 Process Alarm High Value	Config. 29	Ch7 Process Alarm High Value
Ch7 Process Alarm Low Value	Config. 30	Ch7 Process Alarm Low Value
Ch7 Channel Bias Value	Config. 31	Ch7 Channel Bias Value
Unused	Config. 32	Ch8 Configuration Bits
	Config. 33	Ch8 Process Alarm High Value
	Config. 34	Ch8 Process Alarm Low Value
	Config. 35	Ch8 Channel Bias Value
	…	Ch9 to Ch14 Configurations
	Config. 60	Ch15 Configuration Bits
	Config. 61	Ch15 Process Alarm High Value
	Config. 62	Ch15 Process Alarm Low Value
	Config. 63	Ch15 Channel Bias Value

3.5.6 Channel Configuration Bits

Feature	**Option**	**Decimal Value**	**Configuration Bit**															
			15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Channel Enable	Enable	0																0
	Disable	1																1
Input Type	Type J TC	0												0	0	0	0	
	Type K TC	1												0	0	0	1	
	Type T TC	2												0	0	1	0	
	Type E TC	3												0	0	1	1	
	Type R TC	4												0	1	0	0	
	Type S TC	5												0	1	0	1	
	Type B TC	6												0	1	1	0	
	Type N TC	7												0	1	1	1	
	Type C TC	8												1	0	0	0	
	±100 mV	9												1	0	0	1	
	±50 mV	10												1	0	1	0	
	Invalid	NA												NA				
Data Format	Engineering Units X1	0										0	0					

Feature	Option	Decimal Value	Configuration Bit															
			15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Engineering Units X10	1										0	1					
	Raw/Proportional Data	2										1	0					
	Percentage Range	3										1	1					
Temperature Scale[1]	°C	0									0							
	°F	1									1							
CJ Compensation & Weighted Profile[1]	Distributed Profile Enabled	0							0	0								
	Averaged Profile Enabled	1							0	1								
	Disabled	2							1	0								
	Invalid	NA							NA									
Filter Frequency[2]	17 Hz	0					0	0										
	4 Hz	1					0	1										
	62 Hz	2					1	0										
	470 Hz	3					1	1										
Open Circuit Detection	Upscale	0			0	0												
	Downscale	1			0	1												
	Zero	2			1	0												
	Disabled	3			1	1												
Process Alarm & Latching	Both Disabled	0	0	0														
	Alarm Enabled Only	1	0	1														
	Alarm & Latching Enabled	2	1	0														
	Invalid	NA	NA															

NOTE	
	1. Effective only when the **Input Type** of the selected input channel is configured to use **Thermocouple** type. 2. The channel scan rate of the selected input channel will mix with the CJ Sensor sampling rate if the channel is configured to use **Thermocouple** type and the **CJ Compensation & Weighted Profile** option is configured to enable with the provided profile.

3.5.7 Channel Configuration Values

Each 2085-IT8-SC and IT16-SC module provides 3 words for user to enter each channel's Process Alarm High value, Process Alarm Low value, and Channel Bias value. Each value is specified as a full-scale integer which starts from -32768 to +32767. See the related Functional Requirements of the Process Alarm and Latching feature and of the Channel Bias.

Channel configuration values are listed in the following table:

Feature	Type	Length
Process Alarm High	INT	1 word
Process Alarm Low	INT	1 word
Channel Bias	INT	1 word

3.5.8 Input Assembly

The input table size for 2085-IT8-SC module is 17 words and 29 words for 2085-IT16-SC module. Each channel data is assigned to a signed 16-bit data byte and is capable to display value from -32768 to +32767. The actual display value is clamped by each Input Type limits or by the signed 16-bit data byte, whichever comes first. Other status indication bits, fault bits and software revision info are in an unsigned 16-bit Data Type.

2085-IT8-SC

Status & Reading Indication	**Word Index**	**High Byte**								**Low Byte**							
		Bits															
		15	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Ch0 Data	AI_00	Signed INT															
Ch1 Data	AI_01	Signed INT															
Ch2 Data	AI_02	Signed INT															
Ch3 Data	AI_03	Signed INT															
Ch4 Data	AI_04	Signed INT															
Ch5 Data	AI_05	Signed INT															
Ch6 Data	AI_06	Signed INT															
Ch7 Data	AI_07	Signed INT															
Ch 1 & 0 Status	AI_08	DNR	OC	OR	UR	PAH	PAL	ADC	FT1	DNR	OC	OR	UR	PAH	PAL	ADC	FT0
Ch 3 & 2 Status	AI_09	DNR	OC	OR	UR	PAH	PAL	ADC	FT3	DNR	OC	OR	UR	PAH	PAL	ADC	FT2
Ch 5 & 4 Status	AI_10	DNR	OC	OR	UR	PAH	PAL	ADC	FT5	DNR	OC	OR	UR	PAH	PAL	ADC	FT4
Ch 7 & 6 Status	AI_11	DNR	OC	OR	UR	PAH	PAL	ADC	FT7	DNR	OC	OR	UR	PAH	PAL	ADC	FT6
Module & CJ Sensor Status	AI_12	MF	SN	CAL	CJ Sensor 1					Unused			CJ Sensor 0				
					DNR1	OC1	OR1	UR1	CJS1				DNR0	OC0	OR0	UR0	CJS0
CJ Sensor 0 Data	AI_13	Signed INT															
CJ Sensor 1 Data	AI_14	Signed INT															
SW Rev.	AI_15	Signed INT															
Not Used	AI_16																

2085-IT16-SC

Status & Reading Indication	Word Index	High Byte								Low Byte							
		Bits															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ch0 Data	AI_0	Signed INT															
Ch1 Data	AI_1	Signed INT															
Ch2 Data	AI_2	Signed INT															
Ch3 Data	AI_3	Signed INT															
Ch4 Data	AI_4	Signed INT															
Ch5 Data	AI_5	Signed INT															
Ch6 Data	AI_6	Signed INT															
Ch7 Data	AI_7	Signed INT															
Ch8 Data	AI_8	Signed INT															
Ch9 Data	AI_9	Signed INT															
Ch10 Data	AI_10	Signed INT															
Ch11 Data	AI_11	Signed INT															
Ch12 Data	AI_12	Signed INT															
Ch13 Data	AI_13	Signed INT															
Ch14 Data	AI_14	Signed INT															
Ch15 Data	AI_15	Signed INT															
Ch 1 & 0 Status	AI_16	DNR	OC	OR	UR	PAH	PAL	ADC	FT1	DNR	OC	OR	UR	PAH	PAL	ADC	FT0
Ch 3 & 2 Status	AI_17	DNR	OC	OR	UR	PAH	PAL	ADC	FT3	DNR	OC	OR	UR	PAH	PAL	ADC	FT2
Ch 5 & 4 Status	AI_18	DNR	OC	OR	UR	PAH	PAL	ADC	FT5	DNR	OC	OR	UR	PAH	PAL	ADC	FT4
Ch 7 & 6 Status	AI_19	DNR	OC	OR	UR	PAH	PAL	ADC	FT7	DNR	OC	OR	UR	PAH	PAL	ADC	FT6
Ch 9 & 8 Status	AI_20	DNR	OC	OR	UR	PAH	PAL	ADC	FT9	DNR	OC	OR	UR	PAH	PAL	ADC	FT8
Ch 11 & 10 Status	AI_21	DNR	OC	OR	UR	PAH	PAL	ADC	FT11	DNR	OC	OR	UR	PAH	PAL	ADC	FT10
Ch 13 & 12 Status	AI_22	DNR	OC	OR	UR	PAH	PAL	ADC	FT13	DNR	OC	OR	UR	PAH	PAL	ADC	FT12
Ch 15 & 14 Status	AI_23	DNR	OC	OR	UR	PAH	PAL	ADC	FT15	DNR	OC	OR	UR	PAH	PAL	ADC	FT14
Module & CJ Sensor Status	AI_24	MF	SN	CAL	CJ Sensor 1					Unused			CJ Sensor 0				
					DNR1	OC1	OR1	UR1	CJS 1				DNR0	OC0	OR0	UR0	CJS 0
CJ Sensor 0 Data	AI_25	Signed INT															
CJ Sensor 1 Data	AI_26	Signed INT															
SW Rev.	AI_27	Signed INT															
Not Used	AI_28																

Channel Data for 2085-IT8-SC/2085-IT16-SC

Length	Name	Description
1 word	**Ch<n> Data**	**Channel Input Data <Channel>** The Data Type for the Channel Input Data is a signed 16-bit integer. The integer ranges from -32768 to +32767. See additional indication conditions in the Under/Over Range Alarm feature and in Open Circuit Detection.

3.5.9 Input Table Bit Definition

Channel Status		
	Name	**Description**
8,0	FT<n>	**Channel Fault <Channel>** Channel Fault bit. If a bit is set (1) then there is an error associated with that input channel.
9,1	ADC<n>	**ADC Communication Failure or PGA Connection Failure** When set to 1, indicates there is a channel ADC communication failure or PGA connection error. This is a hardware fault.
10,2	PAL<n>	**Process Alarm Low** When set to 1, indicates the channel input value is less than, or equal to, the user-defined Process Alarm Low Value in the configuration table.
11,3	PAH<n>	**Process Alarm High** When set to 1, indicates the channel input value is greater than, or equal to, the user-defined Process Alarm High Value in the configuration table.
12,4	UR<n>	**Under Range** When set to 1, indicates the channel input reading is less than, or equal to, the minimum point of the selected Input Type range or the Data Type low limit, -32768.
13,5	OR<n>	**Over Range** When set to 1, indicates the channel input reading is greater than, or equal to, the maximum point of the selected Input Type range or the Data Type high limit, +32767.
14,6	OC<n>	**Open Circuit** When set to 1, indicates the channel connection on the terminal block is open.
15,7	DNR<n>	**Data Not Ready** When set to 1, the module is initializing sampled data

3.5.10 Module Status and CJ Sensor Status Bit Definition

AI_00: Module Status and CJ Sensor Status		
Bit	**Name**	**Description**
8,0	CJS<x>	**CJ Sensor Fault** This bit is set when the CJ Sensor has Open Circuit, Data Not Ready or Under/Over range fault.
9,1	UR<x>	**Under Range** When set to 1, indicates the measured value is less than, or equal to, the defined Under Range value of the CJ Sensor range.
10,2	OR<x>	**Over Range** When set to 1, indicates the measured value is greater than, or equal to, the defined Over Range value of the CJ Sensor range.
11,3	OC<x>	**Open Circuit** When set to 1, indicates the CJ Sensor connection on the terminal block is

AI_00: Module Status and CJ Sensor Status		
Bit	**Name**	**Description**
		open.
12,4	DNR<x>	**Data Not Ready** When set to 1, the module is initializing sampled data.
5,6,7	Unused	Bits masked as Unused are set to 0.
13	CAL	**Invalid Cal Data** The stored calibration data or checksum is corrupt or invalid. The module must be factory calibrated before it will operate normally.
14	SN	**Invalid Serial Number Data** The stored serial number checksum is corrupt or invalid. The module must be factory calibrated before it will operate normally.
15	MF	**Module Fault** Set as global fault if any channel fault or CJ Sensor fault.

3.5.11 CJ Sensor Data for 2085-IT8-SC/2085-IT16-SC

Length	Name	Description
1 word	**CJS<x> Data**	**CJ Sensor Data <x>** The Data Type for the CJ Sensor Data is a signed 16-bit integer. The valid display range in integer format is from -2000 to +9000. See additional indication conditions in the CJ Sensor feature.

AI_15: Software Revision Info for 2085-IT8-SC/
AI_27: Software Revision Info for 2085-IT16-SC

Length	Name	Description
1 word	**SW Revision**	**Software Revision Info** Display software revision number in integer value. Example: 1101 means software version 1.1.01

3.5.12 Output Table

The output table size for 2085-IT8-SC module is 1 word and 2 words for 2085-IT16-SC module. The 16 bits in each word are the control bits on clearing the Low and High Process Alarm Latches for 8 channels a group. To operate the control bits, see the Process Alarm and Latching feature.

Tag Name for 2085-IT8-SC (1 Word)	Word Index	Tag Name for 2085-IT16-SC (2 Words)
Ch 7:0 Clear High/Low Process Alarm Latch	AO_00	Ch 7:0 Clear High/Low Process Alarm Latch
Unused	AO_01	Ch 15:8 Clear High/Low Process Alarm Latch

3.5.13 Output Bit Allocation

Process Alarm Latch	Word Index	High Byte								Low Byte							
		Bits															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Ch 7:0	AO_00	CH7	CL7	CH6	CL6	CH5	CL5	CH4	CL4	CH3	CL3	CH2	CL2	CH1	CL1	CH0	CL0
Continued for 2085-IT16-SC Module																	
Ch 15:8	AO_01	CH15	CL15	CH14	CL14	CH13	CL13	CH12	CL12	CH11	CL11	CH10	CL10	CH9	CL9	CH8	CL8

3.5.14 Output Bit Description

AO_00: Clear High/Low Process Alarm Latches for 2085-IT8-SC **AO_01:00: Clear High/Low Process Alarm Latches for 2085-IT16-SC**		
Bit	Name	Description
Even	CL<n>	Clear Low Process Alarm Latch 0: Normal Operation 1: Clear low process alarm latch
Odd	CH<n>	Clear High Process Alarm Latch 0: Normal Operation 1: Clear high process alarm latch

Section 3.6 Product Features

The following sections provide information on user-configurable parameters.

3.6.1 Data Format Description

The data format is used to define the display scale of the measured input data. Each channel can display different format based on the user selection. This module provides four options for channel input display:

Index	Data Format
0	Engineering Unit ×1
1	Engineering Unit ×10
2	Raw/Proportional
3	Percentage Full Scale

The maximum range to display a measured input data in the input table is from -32768 to +32767 as a signed 16-bit integer. The actual range will be scaled to fit the selected Input Type. For example, the valid range for Type B Thermocouple is from 300 °C to 182 0°C. In Engineering Unit ×1 format, the valid display range is from 3000 to 18200 which provides the resolution down to 1 decimal place. In Engineering Unit ×10 format, the valid display range is from 300 to 1820 as integers. The Raw/Proportional format provides 65 K resolution based on the valid range in EU×1 format of the selected Input Type. The same scaling requirement applies to the Percentage format which has 10 k or 10.5 k resolution.

3.6.2 Input Type

Index	Selection
0	Type J TC
1	Type K TC
2	Type T TC
3	Type E TC
4	Type R TC
5	Type S TC
6	Type B TC
7	Type N TC
8	Type C TC
9	±100 mV
10	±50 mV
11-15	Invalid

The following table provides the defined minimum and maximum points of each Input Type range and its limits. Thermocouple Input Type limits are set to the same as the minimum and maximum points of its range. The limits for millivolt type are set to 2.5% above and below the range.

3.6.3 Range Points and Limits for Input Type

Input Type	Input Value		Condition	EU ×1		EU ×10		Raw Prop	Percentage
	°F	°C							
Thermocouple									
J	2192.0	1200.0	High Limit	21920	12000	2192	1200	32767	10000
	2192.0	1200.0	High Range	21920	12000	2192	1200	32767	10000
	-346.0	-210.0	Low Range	-3460	-2100	-346	-210	-32768	0
	-346.0	-210.0	Low Limit	-3460	-2100	-346	-210	-32768	0
K	2498.0	1370.0	High Limit	24980	13700	2498	1370	32767	10000
	2498.0	1370.0	High Range	24980	13700	2498	1370	32767	10000
	-454.0	-270.0	Low Range	-4540	-2700	-454	-270	-32768	0
	-454.0	-270.0	Low Limit	-4540	-2700	-454	-270	-32768	0
T	752.0	400.0	High Limit	7520	4000	752	400	32767	10000
	752.0	400.0	High Range	7520	4000	752	400	32767	10000
	-454.0	-270.0	Low Range	-4540	-2700	-454	-270	-32768	0
	-454.0	-270.0	Low Limit	-4540	-2700	-454	-270	-32768	0
E	1832.0	1000.0	High Limit	18320	10000	1832	1000	32767	10000
	1832.0	1000.0	High Range	18320	10000	1832	1000	32767	10000
	-454.0	-270.00	Low Range	-4540	-2700	-454	-270	-32768	0
	-454.0	-270.00	Low Limit	-4540	-2700	-454	-270	-32768	0
R	3214.0	1768.0	High Limit	32140	17680	3214	1768	32767	10000
	3214.0	1768.0	High Range	32140	17680	3214	1768	32767	10000
	32.0	0.00	Low Range	320	0	32	0	-32768	0
	32.0	0.00	Low Limit	320	0	32	0	-32768	0

Input Type	Input Value		Condition	EU ×1		EU ×10		Raw Prop	Percentage
	°F	°C							
S	3214.0	1768.0	High Limit	32140	17680	3214	1768	32767	10000
	3214.0	1768.0	High Range	32140	17680	3214	1768	32767	10000
	32.0	0.00	Low Range	320	0	32	0	-32768	0
	32.0	0.00	Low Limit	320	0	32	0	-32768	0
B	3308.0	1820.0	High Limit	32767[1]	18200	3308	1820	32767	10000
	3308.0	1820.0	High Range	32767[1]	18200	3308	1820	32767	10000
	572.0	300.0	Low Range	5720	3000	572	300	-32768	0
	572.0	300.0	Low Limit	5720	3000	572	300	-32768	0
N	2372.0	1300.0	High Limit	23720	13000	2372	1300	32767	10000
	2372.0	1300.0	High Range	23720	13000	2372	1300	32767	10000
	-346.0	-210.0	Low Range	-3460	-2100	-346	-210	-32768	0
	-346.0	-210.0	Low Limit	-3460	-2100	-346	-210	-32768	0
C	4199.0	2315.0	High Limit	32767[1]	23150	4199	2315	32767	10000
	4199.0	2315.0	High Range	32767[1]	23150	4199	2315	32767	10000
	32.0	0.00	Low Range	320	0	32	0	-32768	0
	32.0	0.00	Low Limit	320	0	32	0	-32768	0
Millivolt									
	Input Value		**Condition**	**X1**		**X10**		Prop	Percent
±50 mV	52.50 mVDC		High Limit	5250		525		32767	10250
	50.00 mVDC		High Range	5000		500		31207	10000
	-50.00 mVDC		Low Range	-5000		-500		-31208	0
	-52.50 mVDC		Low Limit	-5250		-525		-32768	-250
±100 mV	105.00 mVDC		High Limit	10500		1050		32767	10250
	100.00 mVDC		High Range	10000		1000		31207	10000
	-100.00 mVDC		Low Range	-10000		-1000		-31208	0
	-105.00 mVDC		Low Limit	-10500		-1050		-32768	-250

1. Type B and C thermocouples cannot be represented in engineering units ×1 (°F) above 3276.7 °F. Software treats it as an over range error.
2. When millivolts are selected, the temperature setting is ignored. Analog input data is the same for either °C or °F selection.

The firmware will report a configuration error if an invalid range value is entered in the configuration table. The table below provides the defined resolution for each Input Type. If the Data Format of the Input Type supports the resolution up to after the decimal point, the fractional part of the input reading will be shifted up to display in integers. Data display resolution is:

Input Type	EU×1	EU×10	Raw Prop	Percentage
TC	1 digital point	Integer	56 K	10 K
mV	2 digital points	1 digital point		10.5 K

3.6.4 Channel Bias

The module provides a signed 16-bit integer for user to enter a channel bias value in the configuration table. It can be used to adjust the channel input reading if the inserted Input Type sensor has measurement offset or when the user turns off the CJ Compensation feature for Thermocouple measurement. The available range is from -32768 to +32767.

The *scaling formula* with the channel bias applied is:

$$y = mx + b + Channel\ Bias$$

Where:

y is the final scaled reading shown in the input table

m is the gain:

$$m = \frac{(User\ High\ Limit\ -\ User\ Low\ Limit)}{(Actual\ High\ Limit - Actual\ Low\ Limit)}$$

The User High/Low Limit value is based on the selected Input Type and the selected Data Format. The Actual High/Low Limit value is the actual limits of the selected Input Type without scaling. See table above.

For example, if Type B Thermocouple and EU×1 are selected in the configuration table, the gain will be 10 = (18200-3000) / (1820-300), m = 10.

x is the ADC signal data acquired at the terminal block and converted to the corresponding data format.

For a Thermocouple input, this x is the actual temperature in °C. The circuit board first reads in the ADC data count. Data count is then converted to millivolts based on the gain setting of the ADC. Next the millivolt reading is converted to temperature in °C based on the thermocouple curve specification.

b is the offset: $User\ Low\ Limit - (m * Actual\ Low\ Limit)$.

In above example, b = 3000 – (10 * 300) = 0, so if the thermocouple measured 10.0 degrees C, then the display of the reading for EU×1 is 10.0 * 10 + 0 + Channel Bias.

$Channel\ Bias$ is an offset in integer format.

The Channel Bias value is only applied to the raw measured value. It will not be applied to shift the minimum and the maximum points and the limits of the selected Input Type range. If the final channel input reading is equal to, or goes beyond, the minimum or the maximum point of the selected Input Type range, Channel Fault and an Over/Under Range Fault bits will be set in the input table.

The other case is, if the final input reading reaches the Data Type limit (-32768 or +32767) before reaching the minimum or the maximum point of the selected Input Type range, the same Fault bits will be set in the input table.

3.6.5 Channel Temperature Unit

The module provides a feature to select the temperature display unit for each

channel input reading if the channel is configured to use thermocouple measurement with EU×1 or EU×10 Data Format used.

Index	Unit	Note
0	ºC	Default
1	ºF	

This configuration setup has no effect if the channel is selected to run millivolt measurements, or a non-Engineering Unit Data Format is used.

If the input channel is configured to use Fahrenheit units, its Channel Fault and the Over/Under Range status bits will be set in the input table if:

- The final display value is equal to, or goes beyond, the Data Type limits (-32768/+32767) before reaching its minimum or maximum point of the Input Type range or vice versa.
- Once the above condition happens, the display value will stay at the data limit.

3.6.6 CJ Sensors

Both 2085-IT8-SC and 2085-IT16-SC modules have two CJ Sensors located at the two-column terminal block. Each sensor's valid working range is from -20 ºC to +90 ºC. The temperature reading is measured by the 12-bit resolution ADC on the main processor.

The Data Type in the input table used to display the CJ Sensor reading is a signed 16-bit integer. The valid range is scaled down at -2000 to +9000, indicating its resolution up to two decimal places in Celsius units. The sensor limits are set to the same as the minimum and maximum points of the sensor range.

Range points and limits for the CJ sensors are listed in the following table:

	Range		**Condition**	**EU×1**	
	ºF	°C		ºF	°C
CJ Sensors	194 ºF	90.00 °C	High Limit	19400	9000
	194 ºF	90.00 °C	High Range	19400	9000
	-4 ºF	-20.00 °C	Low Range	-400	-2000
	-4 ºF	-20.00 °C	Low Limit	-400	-2000

The data format for displaying the CJ Sensor reading is not configurable. EU×1 format and Celsius units are used for scaling the CJ Sensor reading.

Each sensor has its own status bits to indicate fault in the input table. Below are the cases on handling CJ Sensor faults for Cold Junction Compensation to continue.

Under Range Condition:

If the sampled value is less than or equal to -20 °C, the CJ Sensor reading will be set to that value (-2000). The CJ Senor Fault bit and the CJ Sensor Under Range bit will be set in its CJ Sensor Status byte. The CJ compensation profile will use this value to run compensation.

The bit status and fault will be cleared once this condition no longer exists. The CJ compensation profile will continue to use the new reading to run compensation.

Over Range Condition:

If the sampled value is greater than or equal to +90 °C, the CJ Sensor reading will be set to that value (+9000). The CJ Senor Fault bit and the CJ Sensor Over Range bit will be set in its CJ Sensor Status byte. The CJ compensation profile will use this value to run compensation.

The bit status and fault will be cleared once this condition no longer exists. The CJ compensation profile will continue to use the new reading to run compensation.

Open Circuit Condition:

If both CJ Sensor connections on the terminal block are open, the default room temperature value, +25 °C (+2500) will be applied to the CJ Sensor reading. The CJ Senor Fault bit and the CJ Sensor Open Circuit bit will be set in its CJ Sensor Status byte. The CJ compensation profile will use this value to run compensation.

If one of the CJ Sensors is open, the other CJ Sensor reading will be used for both CJ Sensors and that open CJ Sensor Fault bit and the Open Circuit bit will be set.

Once this condition no longer exists, the CJ sensor will restart to collect 100 samples as the following Data Not Ready condition. The OC bit will be cleared and the DNR bit will be set instead. The CJ Sensor Fault bit remains set.

Data Not Ready Condition:

Whenever the module is powered up or any of the CJ Sensors is reconnected on the terminal block, the CJ Sensor needs to collect the initial 100 samples. The CJ Sensor reading will be set to 0, and the CJ Senor Fault bit and the CJ Sensor DNR bit will be set in its CJ Sensor Status byte.

After the initial samples are collected, the new CJ Sensor reading will be applied, and the CJ Sensor Fault bit and the CJ Sensor DNR bit will be cleared. The same behavior applies to an input channel configured to use thermocouple measurement with the CJC Profile feature enabled; its status bit indication and input reading will have the same pattern as the CJ Sensor's.

- The update rate on the CJ Sensor reading and its status is about 0.5 seconds.
- The CJ Sensor reading, and status will remain functioning and reporting, even if all the input channels are configured to be disabled. This allows you to use your own ladder to monitor the related CJ Sensor information and to reconfigure the module to reenable input channels if one of the CJ sensor fault conditions described above have occurred.

3.6.7 Cold Junction Compensation Weighted Profile

There are two CJC weighted profiles available for estimating each channel's junction temperature. The default option, **Enable Distributed Profile**, dynamically provides an estimate temperature varied by each channel's location and height on the terminal block. The **Averaged CJC Temp** option provides an average temperature from the CJ Sensor(s) to be applied to all the channels.

Index	CJC Weighted Profile	Note
0	Enable Distributed Profile	Default
1	Enable Averaged Profile	
2	Disable CJ Compensation	
3	Invalid	

When the channel Cold Junction Compensation is enabled for Thermocouple Type-B measurement, if the channel CJC reading is below 50 °C, due to the impact from the thermal Electromotive Force (EMF), the cold junction compensation will be skipped.

If Thermocouple Type C is used and channel CJC reading is below 0°C, where the temperature is out of the thermocouple profile range, the cold junction compensation will also be skipped.

If an invalid CJC Profile is entered in the configuration table, the module reports a configuration error.

3.6.8 Input ADC Filter Frequencies Description

The modules use an input ADC digital filter that provides high-frequency noise rejection for each input signal. The filter for each channel is programmable, allowing you to select from four different filter frequencies.

Index	Filter (Hz)	Note
0	17	Default
1	4	
2	62	
3	470	

The module will apply the ADC filter setting to each input channel in sequence for data acquisition. The module scan rate on displaying data is tied to the summation of each ADC filter settling time and each channel sampling time. The 2085-IT16-SC will have two sets of ADC measurement circuitries to process input data in parallel.

3.6.9 Open Circuit Detection Description

The open circuit detection feature will alert you to a channel open circuit condition by selecting the open circuit behavior option in the configuration table to display a high limit, low limit, or zero data value for the appropriate channel(s) in the input table. Open circuit detection may also be disabled for any or all channels.

Settings are:

Index	Open Circuit Detection	Note
0	Upscale	Default
1	Downscale	
2	Zero	
3	Disable[6]*	

Open circuit detection takes place on a periodic basis, every 4 seconds, by temporarily enabling the PGA burnout current and initiating an ADC conversion at the fastest filter frequency (470 Hz). This open circuit detection will also add about 23 ms delay per channel on top of normal scan time.

The previous measurement remains in the input table during the open circuit detection procedure (that is, the measurement value with the burnout current enabled is not reported).

Within 3 seconds of an open circuit condition, transitional data may be reported prior to the open circuit status bit being set.

Each channel has its own status bits to indicate open circuit fault in the input table. Below are the cases for handling open circuit condition based on the Open Circuit Detection selection,

- For the Upscale option, the channel input reading will be set to the high limit point based on the selected Input Type and Data Format. The Channel Fault bit and the OC bit will be set.
- For the Downscale option, the channel input reading will be set to the low limit point based on the selected Input Type and Data Format. The Channel Fault bit and the OC bit will be set.
- For the Zero option, the channel input reading will be set to 0 no matter what Input Type and Data Format is configured. The Channel Fault bit and the OC bit will be set.
- For the Disable option, an open circuit condition will not be reported. Also, the periodic open circuit detection will not take place.
- The Channel Fault bit and the OC bit will be cleared once the open circuit condition on the channel has been resolved. The time to update the bit status is controlled by the 4-second, or the module scan rate, whichever takes longer.
- If any limit value of the selected Input Type is beyond the signed 16-bit Data Type limit, the data limit value will be assigned to the input channel reading instead. This could happen when using Fahrenheit units with a Type B or C thermocouple.

[6] Disabling open circuit detection is available for all channels. When the measurement sensor is equipped with sensitive low-impedance functionality, applying open circuit circuitry may affect the measurement accuracy. When the open circuit detection is disabled, the corresponding open circuit status bit located in the channel status bits will not be updated in the input table.

- An open circuit condition may also be triggered by feeding channel input voltage or temperature well beyond the defined limit values indicated in the Range Points and Limits table.
- To get the most accurate measurement results from 2085-IT16-SC modules, please follow these tips:
  - In applications that need open circuit detection, do not tie signals together between two terminal block banks (for instance IN0- and IN14-).
  - Turn off open circuit detection for both terminal blocks in applications that need to tie signals together between terminal blocks (like an external common ground that is needed to tie together terminals in voltage measurement applications).
  - Turn off open circuit detection function on the channels that are using a sensor that has more than 80 Kohm output impedance.

3.6.10 Process Alarm and Latching

The Process Alarm feature allows you to enter a pair of user-defined high and low values for the module to monitor between the channel input reading. The maximum enterable range is based on the limits of the selected Input Type and the Data Format. This alarm feature can also be used as an Over or Under Input Type Limit alarm. Once the channel input reading is equal to or greater/less than your user-defined value, the corresponding channel Process Alarm status bit in the input table will be set.

The lowest value for the Process Alarm Low Value that can be set is the Data Type low limit, -32768, if the low limit of the selected Input Type is lower than that value. The same requirement applies to the highest value for the Process Alarm High Value. It will be set to the Data Type high limit, +32767, if the high limit of the selected Input Type is greater than that value.

The Process Alarm Latching feature will decide if the status bit is to be cleared automatically or whether to keep it latched until a manual cleanup is triggered by the user or the ladder code. The latching feature is useful to capture whenever the channel input reading has reached, or exceeded, the user-defined value. The latch can be cleared by making a bit value transition on the control bit in the output table.

Index	Process Alarm & Latching	Note
0	Disable Both	Default
1	Enable Alarm	
2	Enable Alarm and Latch	

If Option 0 selected,

Both the Process Alarm and Latching functionality are disabled and the validation on the channel High and Low Process Alarm Values is ignored.

If Option 1 or 2 is selected,

Report a configuration error if any Process Alarm value set in the configuration

table is invalid as the following,

- The Process Alarm Low Value is equal to or greater than the Process Alarm High Value.
- The Process Alarm Low Value is less than the low limit of the selected Input Type.
- The Process Alarm High Value is greater than the high limit of the selected Input Type.

Set the Process Alarm Low status bit in the Channel Status byte and the Channel Fault bit when the channel input reading is equal to, or less than, the user-defined Process Alarm Low Value entered in the configuration table.

Set the Process Alarm High status bit in the Channel Status byte and the Channel Fault bit when the channel input reading is equal to, or greater than, the user-defined Process Alarm High Value entered in the configuration table.

If Option 1 is selected,

The module will automatically clear the Process Alarm Low status bit in the Channel Status byte and its Channel Fault bit when the channel input reading is greater than the user-defined Process Alarm Low Value entered in the configuration table.

The module will automatically clear the Process Alarm High status bit in the Channel Status byte and its Channel Fault bit when the channel input reading is less than the user-defined Process Alarm High Value entered in the configuration table.

If Option 2 is selected,

The latch functions as follows:

Once the channel Process Alarm Low or High status bit is set as latched, it will not be cleared even when the channel input reading is no longer:

- Equal to, or less than, the user-defined Process Alarm Low Value.

  OR

- Equal to, or greater than, the user-defined Process Alarm High Value.

To clear the channel Process Alarm High or Low status bits when both of the following conditions are satisfied:

- The channel input reading is no longer:
  - Equal to, or less than, the user-defined Process Alarm Low Value.

    OR

  - Equal to, or greater than, the user-defined Process Alarm High Value.
- The corresponding Clear Low or High Process Alarm Latch bit in the output table has a value transition from 0 to 1.

Section 3.7 Under/Over Range Alarms

An Under Range or Over Range alarm is set if the channel input reading reaches, or exceeds, the normal operating range. The alarm is not latched. If the reading goes back into normal operating range, the alarm is automatically cleared. This feature applies to all input types.

The Under Range and Over Range status bits are defined in the Channel Bit and value allocation of the Input Table.

- When the channel input reading is equal to or less than the minimum point of the selected Input Type range, the Channel Under Range status bit and the Channel Fault bit will be set. If the channel input reading reaches the Input Type low limit or less, the channel input reading will be clamped at that low limit value.
- When the channel input reading is equal to or greater than the maximum point of the selected Input Type range, the Channel Over Range status bit and the Channel Fault bit will be set. If the channel input reading reaches the Input Type high limit or greater, the channel input reading will be clamped at the high limit value.
- One possible condition that occurs is when the channel input reading is equal to the limits of the signed 16-bit Data Type before reaching the minimum or maximum point of the selected Input Type range. This condition can happen when the Type B or C TC is selected for measurement in Fahrenheit units. The channel Under/Over range status bits will be set, and the channel input reading will be clamped at the Data Type limits.
- The channel Under or Over range status bits will be cleared when the channel input reading is greater than the minimum point, or less than, the maximum point of the selected Input Type range.
- The channel Under or Over range status bits will also be cleared when the channel input reading is greater or less than the low or high limit of the Data Type if the minimum or maximum point of the selected Input Type range is beyond the data limits.

Section 3.8 ADC Alarm

When each input channel is acquiring its channel data in sequence on the corresponding ADC measurement circuit, to ensure the validity of the data reading, the ADC and PGA IDs and the signal reading are validated for reporting potential acquisition failure in time.

If a communication failure occurs, the channel ADC Fault bit and the Channel Fault bit will be set in the input table. This can happen when the ESD environment is out of the hardware specification tolerance or the hardware connection on the ADC and PGA component is damaged.

To clear the fault bit, cycle power the module. If still not cleared, you will need to send the module back to Spectrum Controls for further inspection.

Section 3.9 Data Not Ready Alarm

The Data Not Ready bit in the input table is useful for letting you know you should avoid monitoring the channel input data until the initial temperature sampling on the CJ Sensor is completed.

Whenever the module is powered up or any of the CJ Sensors are connected on the terminal block, the CJ Sensor needs to collect the initial 100 samples. If any input channel is configured to run thermocouple measurement with any CJC profile option enabled, the channel DNR bit and the Channel Fault bit will be set in the input table. Once the sample collection is completed and the CJ Sensor has

data ready for channel CJ compensation, these bits will be cleared, and the channel input reading will be resumed.

Estimated channel scan rates are:

ADC Filter Selection	MUX/PGA Settling Time	ADC Conversion Time	MCU Processing Overhead	Total Channel Scan Rate Measurement per Channel*
17 Hz	10	121	8	139
4 Hz	10	481	8	499
62 Hz	10	33	8	51
470 Hz	10	5	8	23

NOTE:

- All timing units are in ms.
- *: Channel configuration setup for 1 measurement only. This applies to all Input Types.
- The second measurement on open circuit detection occurs every 3 seconds which will take 23 ms per enabled channel.

Module update rate is proportional to the channels enabled and it is also affected by the open circuit detection enable bits. The following table indicates maximum module date rate with all channels enabled, and all channel open circuit detection bits enabled.

ADC Filter Selection	Scan Rate Per Channel	Number of Channels	Total Module Scan Rate
17 Hz	139 + 23	16	1296
4 Hz	499 + 23	16	4176
62 Hz	51 + 23	16	592
470 Hz	23 + 23	16	368

3.9.1 Module Specific Hardware Errors

A Micro850 or 870 PLC can generate a series of 0×F2*xy* error codes specific to an Expansion I/O module. The Fault code is 0×F29*z*, 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	Combined	Error Description
xF29z*	0×302	0×302	MCU board power brownout
	0×303	0×303	Unused
	0×304	0×304	A/D Converter Communication Error. Module detects the analog-to-digital converter is not functioning properly during data acquisition.

*: z indicates the slot number of the expansion I/O. If z=0, then the slot number cannot be identified.

Example error captured below.

Recoverable Fault

Index	Fault Code	Fault Location	Description
1	0xF291	N/A	Expansion IO Module Fault.The extended fault code is 0x0304.

3.9.2 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. Module-Specific configuration errors are listed in the following table:

Fault Code	Extended Fault Code	Error Description
0xF2Bz*	0×450	**General Channel Configuration Error** No additional information
	0×410 – 0×41F	**Invalid Input Type** The selected Input Type is out of the valid selectable range.
	0×420 – 0×42F	**Invalid CJC Profile Selection** The selected profile option is out of the valid selectable range.
	0×430 – 0×43F	**Invalid Process Alarm and Latching** The selected Process Alarm option is out of the valid selectable range.
	0×440 – 0×44F	**Invalid Process Alarm Value** Check the Process Alarm Low Value and Process Alarm High Value for legal ranges. If the module receives any of the following illegal data, this error is detected. Exception for this error is both PALV and PAHV are zero. PALV greater than or equal to PAHV OR PAHV greater than Input Type High Limit OR PALV greater than Input Type Low Limit (PALV is the Process Alarm Low Value PAHV is the Process Alarm High Value)

*: z indicates the slot number of the expansion I/O. If z=0, then the slot number cannot be identified.

Section 3.10 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 +1 (425) 746-9481.

For Rockwell Automation Compatible I/O Products:

- USA 1-440-646-6900 (US/global, English only
- United Kingdom +44 0 1908 635 230 (EU phone, UK local)
- Australia, China, India, and other East Asia locations: 1-800-722-778 or +61 39757 1502
- Mexico 001-888-365-8677
- Brazil 55-11-5189-9500 (general support)
- Europe +49-211-41553-630 (Germany/general support)

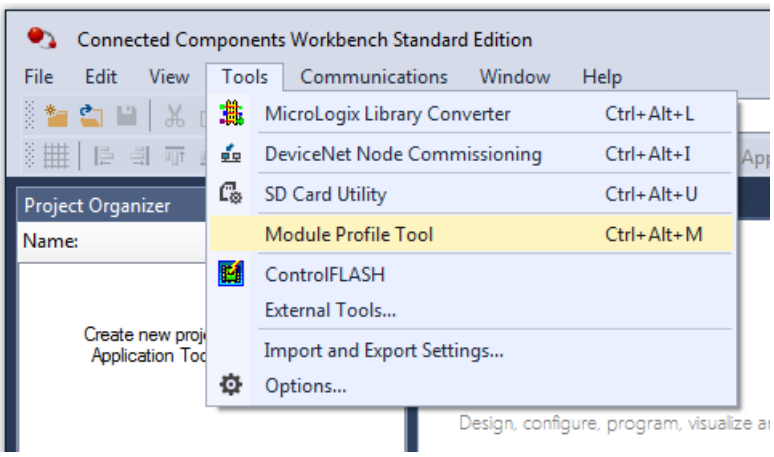
Section 3.11 Declaration of Conformity

Available upon request

Appendix A
Manually Importing an AOP

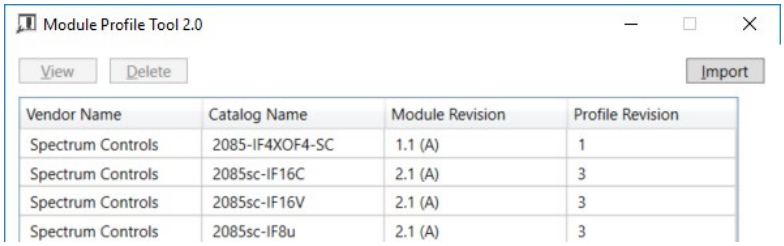
This appendix explains how to manually import an AOP rampp file into CCW software.

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:



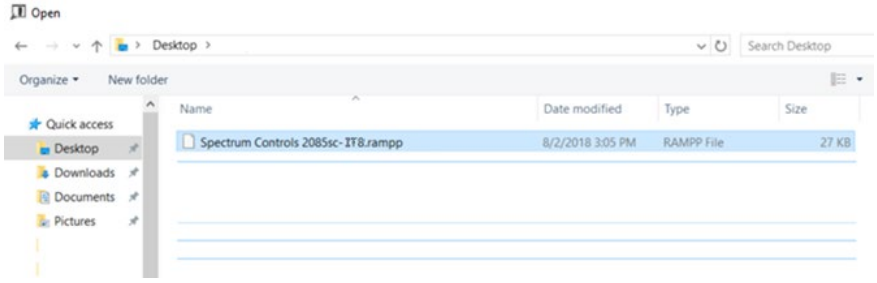
4. When prompted by Windows User Account Control, to confirm that you wish to run the program, click **Yes** button.

   The Module Profile Tool 2.0 window appears:

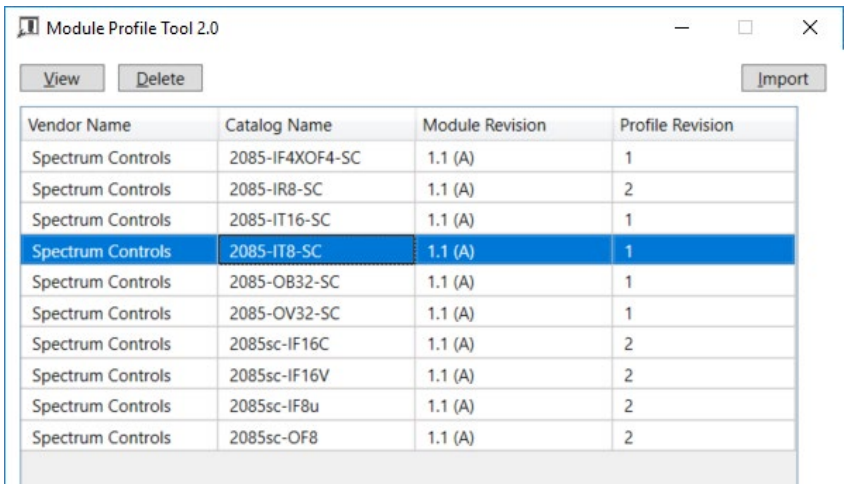


5. Click the **Import** button.
6. An Open dialog appears.

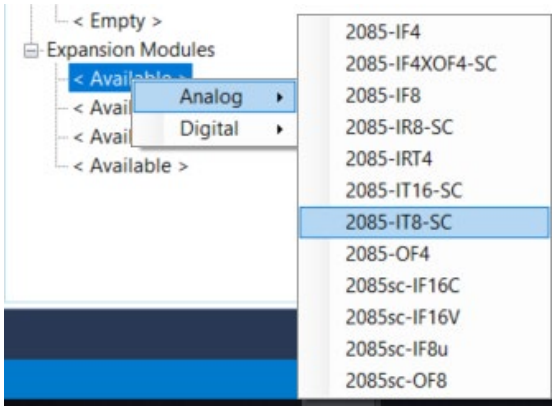
Navigate to the provided .rampp file location, and click the file you downloaded:



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.



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

Corporate Headquarters
Spectrum Controls Inc.
1705 132nd Ave NE, Bellevue, WA 98005
Fax: 425-641-9473
Tel: 425-746-9481

Web Site: www.spectrumcontrols.com
E-mail: spectrum@spectrumcontrols.com