

Micro800 Discrete and Analog Expansion I/O

Catalog Numbers Bulletin 2085



Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication [SGL-1.1](#) available from your local Rockwell Automation sales office or online at <http://www.rockwellautomation.com/literature/>) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



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



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

IMPORTANT

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

Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation
- supporting information for Micro800™

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Micro800 controllers.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Purpose of this Manual

This manual is a reference guide for Micro800 expansion I/O modules. It describes the procedures you use to install, wire, and troubleshoot your expansion I/O. This manual:

- gives you an overview of expansion I/O features and configuration parameter
- gives you an overview of the Micro800 controller system

Refer to the Online Help provided with Connected Components Workbench™ software for more information about programming.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Micro850 Programmable Controllers Installation Instructions 2080-IN007	Information on mounting and wiring the Micro850 24-point Controllers
Micro850 Programmable Controllers Installation Instructions 2080-IN008	Information on mounting and wiring the Micro850 48-point Controllers
Micro800 16-point and 32-point 12/24V Sink/Source Input Modules Installation Instructions 2085-IN001	Information on mounting and wiring the expansion I/O modules (2085-IQ16, 2085-IQ32T)
Micro800 Bus Terminator Module Installation Instruction 2085-IN002	Information on mounting and wiring the expansion I/O bus terminator (2085-ECR)
Micro800 16-Point Sink and 16-Point Source 12/24V DC Output Modules Installation Instructions 2085-IN003	Information on mounting and wiring the expansion I/O modules (2085-OV16, 2085-OB16)
Micro800 8-Point and 16-Point AC/DC Relay Output Modules Installation Instructions 2085-IN004	Information on mounting and wiring the expansion I/O modules (2085-OW8, 2085-OW16)

Resource	Description
Micro800 8-Point Input and 8-Point Output AC Modules Installation Instructions 2085-IN005	Information on mounting and wiring the expansion I/O modules (2085-IA8, 2085-IM8, 2085-OA8)
Micro800 4-channel and 8-channel Analog Voltage/current Input and Output Modules Installation Instructions 2085-IN006	Information on mounting and wiring the expansion I/O modules (2085-IF4, 2085-IF8, 2085-OF4)
Micro800 4-channel Thermocouple/RTD Input Module 2085-IN007	Information on mounting and wiring the expansion I/O module (2085-IRT4)
Micro800 RS232/485 Isolated Serial Port Plug-in Module Wiring Diagrams 2080-WD002	Information on mounting and wiring the Micro800 RS232/485 Isolated Serial Port Plug-in Module.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://ab.com	Provides declarations of conformity, certificates, and other certification details.
Application Considerations for Solid-State Controls SGI-1.1	A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices.
National Electrical Code - Published by the National Fire Protection Association of Boston, MA.	An article on wire sizes and types for grounding electrical equipment.
Allen-Bradley Industrial Automation Glossary AG-7.1	A glossary of industrial automation terms and abbreviations.

You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

You can download the latest version of Connected Components Workbench for your Micro800 at the URL below.

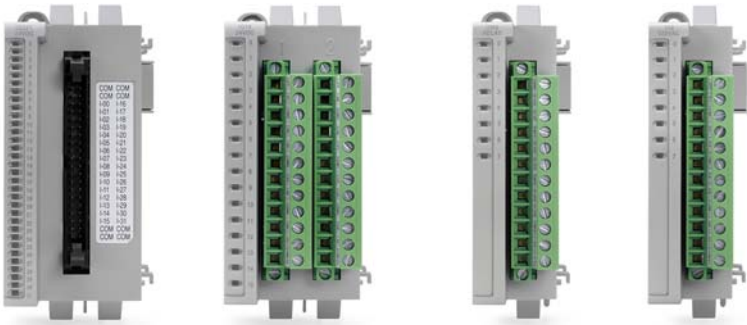
<http://ab.rockwellautomation.com/Programmable-Controllers/Connected-Components-Workbench-Software>.

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Hardware Features



Micro850 controllers support a range of discrete and analog expansion I/O modules. You can attach up to four expansion I/O modules, in any combination, to a Micro850 controller, as long as the total number of embedded, plug-in, and expansion discrete I/O points is less than or equal to 132.

Micro800 Expansion I/O Modules

The following expansion I/O modules are compatible with Micro850 controllers:

Micro800 Expansion I/O Modules

Catalog	Type	Description
2085-IA8	Discrete	8-point, 120V AC input
2085-IM8	Discrete	8-point, 240V AC input
2085-OA8	Discrete	8-point, 120/240V AC Triac Output
2085-IQ16	Discrete	16-point, 12/24V Sink/Source Input
2085-IQ32T	Discrete	32-point, 12/24V Sink/Source Input
2085-OV16	Discrete	16-point, 12/24V DC Sink Transistor Output
2085-OB16	Discrete	16-point, 12/24V DC Source Transistor Output
2085-OW8	Discrete	8-point, AC/DC Relay Output
2085-OW16	Discrete	16-point, AC/DC Relay Output
2085-IF4	Analog	4-channel, 14-bit isolated ⁽¹⁾ voltage/current input
2085-IF8	Analog	8-channel, 14-bit isolated ⁽¹⁾ voltage/current input

Micro800 Expansion I/O Modules

Catalog	Type	Description
2085-OF4	Analog	4-channel, 12-bit isolated ⁽¹⁾ voltage/current output
2085-IRT4	Analog	4-channel, 16-bit isolated ⁽¹⁾ RTD and Thermocouple input module
2085-ECR	Terminator	2085 bus terminator

(1) Refers to isolation from field side wiring to controller, **not** channel-to-channel isolation.

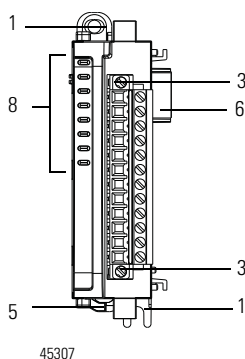
The bus terminator, 2085-ECR, serves as an end cap and terminates the end of the serial communication bus. It is **required** whenever an expansion I/O module is connected to the controller and should be connected to the last expansion I/O module in the system.

Hardware Features

Micro850 expansion I/O modules come as a single-width (87 x 28 x 90 mm, HxWxD) or double-width (87 x 46 x 90 mm, HxWxD) form factor. See specifications for [Expansion I/O on page 240](#) for information on module dimensions.

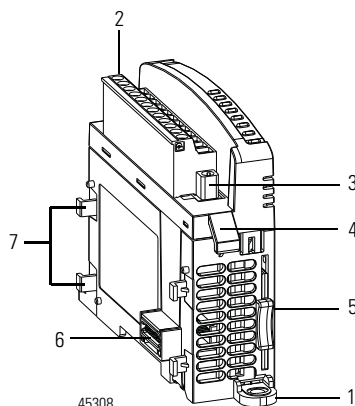
Single-width Expansion I/O

2085-OW8 shown



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Front view

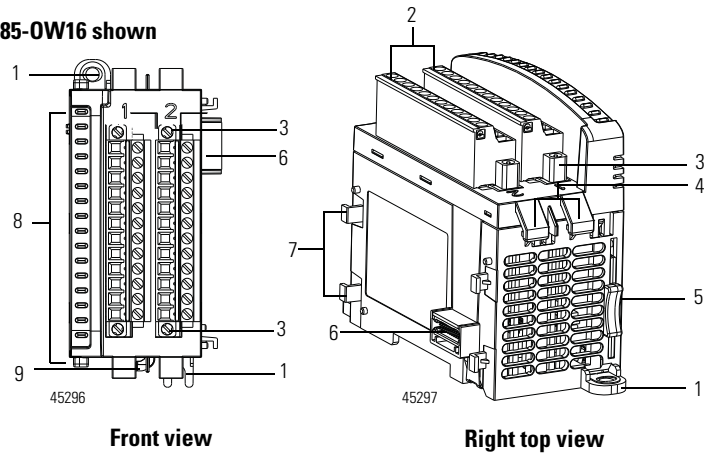


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Right top view

Double-width Expansion I/O

2085-0W16 shown

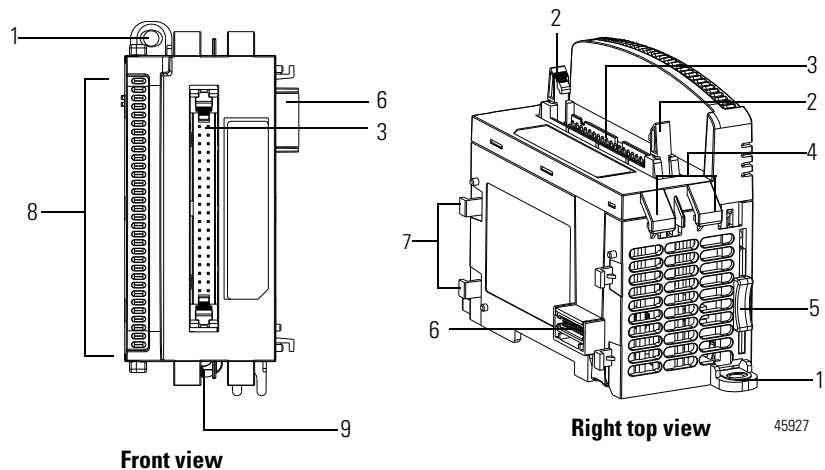


Module Description

	Description		Description
1	Mounting screw hole / mounting foot	6	Bus connector (male/female)
2	Removable Terminal Block (RTB) ⁽¹⁾	7	Latch hooks
3	RTB hold down screws	8	I/O status LED
4	Cable grip	9	DIN rail mounting latch
5	Module interconnect latch		

(1) The removable terminal block has slots for mechanical keying, to prevent inadvertently making the wrong wire connections to your module. Expansion I/O modules are shipped with keys.

2085-IQ32T Hardware Features



2085-IQ32T Hardware Components

	Description		Description
1	Mounting screw hole / mounting foot	6	bus connector (male and female)
2	Connector	7	latch hooks
3	Connector retaining arm	8	I/O status LEDs
4	Cable grip	9	DIN rail mounting latch
5	Module interconnecting latch		

Summary

This chapter included a brief introduction to the different analog and discrete Micro800 expansion I/O modules and their hardware features.

Discrete and Analog Expansion I/O Features

Overview

This section includes a brief description of the different features and configuration parameters for the analog and discrete Micro800 expansion I/O modules. It covers the following topics.

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Discrete Expansion I/O Features

Micro800 discrete expansion I/O modules are input/output modules that provide On/Off detection and actuation.

Module Information

The Connected Components Workbench programming software makes it easy to configure the modules as most module features can be enabled or disabled through the device configuration portion of the software. You can also use the software to check any expansion I/O module in the system to retrieve:

- hardware revision information
- vendor ID
- module information

Channel Status Indicator Information

The discrete expansion I/O modules have yellow status indicators for each input/output point which indicates the On/Off state of the point.

Discrete Input

Discrete input modules interface to sensing devices and detect whether they are On or Off. These modules convert AC or DC On/Off signals from user devices to appropriate logic level for use within the processor.

The 2085-IA8, 2085-IM8, 2085-IQ16 and 2085-IQ32T modules update the controller with new data whenever an input point transitions from On to Off and Off to On.

On to Off and Off to On filter times can be adjusted through the Connected Components Workbench software. These filters improve noise immunity within a signal. A larger filter value affects the length of delay times for signals from these modules.

You can select from a series of operational ranges for each channel. The range designates the minimum and maximum signals that are detectable by the module.

Discrete Output

Output modules may be used to drive a variety of output devices. Typical output devices compatible with the outputs include:

- motor starters
- solenoids
- indicators

Follow these guidelines when designing a system.

- Make sure that the outputs can supply the necessary surge and continuous current for proper operation. (See [Specifications on page 45](#) for more information.)
- Make sure that the surge and continuous current are not exceeded. Damage to the module could result. When sizing output loads, check the documentation supplied with the output device for the surge and continuous current needed to operate the device. The Micro800 standard digital outputs are capable of directly driving the Micro800 standard digital inputs.

TIP User-configurable options are not available in Connected Components Workbench for discrete output modules.

IMPORTANT On controller minor and major fault, all output channels are de-energized.

Analog Expansion I/O Features

This section pertains to the following Micro800 analog expansion I/O modules:

Micro800 Expansion I/O Modules

Catalog	Type	Description
2085-IF4	Analog	4-channel, 14-bit isolated ⁽¹⁾ voltage/current input
2085-IF8	Analog	8-channel, 14-bit isolated ⁽¹⁾ voltage/current input

Micro800 Expansion I/O Modules

Catalog	Type	Description
2085-OF4	Analog	4-channel, 12-bit isolated ⁽¹⁾ voltage/current output
2085-IRT4	Analog	4-channel, 16-bit isolated ⁽¹⁾ RTD and Thermocouple input module
2085-ECR	Terminator	2085 bus terminator

(1) Refers to isolation from field side wiring to controller, **not** channel-to-channel isolation.

Analog expansion I/O modules are interface modules that convert analog signals to digital values for inputs and convert digital values to analog signals for outputs. Controllers can then use these signals for control purposes.

Analog Input and Output*Input/Output Types and Ranges*

The 2085-IF4 and 2085-IF8 modules support four and eight input channels, respectively, while the 2085-OF4 supports four output channels. Each of the channels can be configured as current or voltage input/output, with current mode as default configuration.

Input/Output Type/Range for 2085-IF4, 2085-IF8, and 2085-OF4

Module	Input/Output Type/Range
2085-IF4	0...20 mA
2085-IF8	4...20 mA (default)
	-10...10 V
2085-OF4	0...10 V

To use an input or output as a current or voltage device, you must:

- wire the input/output connector for the correct input/output type (see [Input/Output Wiring on page 15](#))
- configure the input/output as current or voltage through Connected Components Workbench (see [Configure Your Expansion I/O Module on page 29](#))

Data formats

This parameter configures each channel to present analog data in any of the following formats:

- Raw/Proportional Data –The value presented to the controller is proportional to the selected input and scaled into the maximum data range allowed by the bit resolution of the A/D converter. For example, the data value range for a ± 10 V DC user input is -32,768...32,767, which covers the full-scale range of -10.5...10.5V. See [Valid Range of the Data Formats for 2085-IF4, 2085-IF8, and 2085-OF4 on page 8](#).

- **Engineering Units** – The module scales the analog input data to the actual current or voltage values for the selected input range. The resolution of the engineering units is 0.001V or 0.001 mA per count.
- **Percent Range** – The input data is presented as a percentage of the normal operating range. For example, 0V...10V DC equals 0...100%. The amount over and under the normal operating range (the full-scale range) is also supported.

Valid Range of the Data Formats for 2085-IF4, 2085-IF8, and 2085-OF4

The valid range of each Data Format corresponds to the **full range** of each Type/Range (or normal range). For example, the full range of 0...20 mA is 0...21 mA.

Valid Range of the 2085-IF4 and 2085-IF8 Data Formats

Data Format	Type/Range			
	0...20 mA ⁽⁴⁾	4...20 mA ⁽⁴⁾	-10...10V ⁽⁴⁾	0...10 V ⁽⁴⁾
Raw/Proportional Data ⁽¹⁾	-32768...32767			
Engineering Units ⁽²⁾	0...21000	3200...21000	-10500...10500	-500...10500
Percent Range ⁽³⁾	0...10500	-500...10625	Not supported	-500...10500

(1) See [Convert Analog Value to Data Format Value on page 9](#).

(2) The resolution is 0.001V or 0.001 mA per count. For example, 9999 here means 9.999V or 9.999 mA (or 9999 x 0.001).

(3) The resolution is 0.01% per count. For example, 9999 here means 99.99% (or 9999 x 0.01%). See [Convert Analog Value to Data Format Value on page 9](#).

(4) The full range value of:

- 0...20 mA is 0...21 mA
- 4 to 20 mA is 3.2...21 mA
- 10...10V is -10.5...10.5V
- 0...10V is -0.5...10.5V

Valid Range of the 2085-OF4 Data Formats

Data Format	Type/Range			
	0...20 mA ⁽⁴⁾	4...20 mA ⁽⁴⁾	-10...10V ⁽⁴⁾	0...10V ⁽⁴⁾
Raw/Proportional Data ⁽¹⁾	-32768...32767			
Engineering Units ⁽²⁾	0...21000	3200...21000	-10500...10500	0...10500
Percent Range ⁽³⁾	0...10500	-500...10625	Not supported	0...10500

(1) See [Convert Analog Value to Data Format Value on page 9](#).

(2) The resolution is 0.001V or 0.001 mA per count. For example, 9999 here means 9.999V or 9.999 mA (or 9999 x 0.001).

(3) The resolution is 0.01% per count. For example, 9999 here means 99.99% (or 9999 x 0.01%). See [Convert Analog Value to Data Format Value on page 9](#).

(4) The full range value of:

- 0...20 mA is 0...21 mA
- 4...20 mA is 3.2...21 mA
- 10...10V is -10.5...10.5V
- 0...10V is 0...10.5V

Convert Analog Value to Data Format Value

The formula for converting an analog value x to a data format value y (or conversely, deriving data format value y to analog value x) is as follows:

$$Y = ((X - \text{Minimum Value of X Range}) * (\text{Range of Y}) / (\text{Range of X})) + (\text{Minimum Value of Y Range})$$

Example 1:

Find the analog value Y of Type/Range 4...20 mA when the Raw/Proportional Data X is -20000.

Given:

$$X = -20000$$

$$\text{Minimum value of X Range} = -32768$$

$$\text{Range of X} = 32767 - (-32768) = 65535$$

$$\text{Range of Y} = 21 - 3.2 = 17.8$$

$$\text{Minimum value of Y Range} = 3.2$$

Using the conversion formula:

$$Y = (-20000 - (-32768)) * 17.8 / 65535 + (3.2) = \mathbf{6.668 \text{ mA}}$$

Example 2:

Find the Raw/Proportional value (Y) of 10 mA (X) for type/range 4...20 mA.

Given:

$$X = 10 \text{ mA}$$

$$\text{Minimum Value of X Range} = 3.2 \text{ mA (Minimum value of 4...20 mA)}$$

$$\text{Range of X} = 21 - 3.2 = 17.8 \text{ mA (Range of 4...20 mA)}$$

$$\text{Range of Y} = 32767 - (-32768) = 65535 \text{ (Range of Raw/Proportional Data)}$$

$$\text{Minimum Value of Y Range} = -32768. \text{ (Min value of Raw/Proportional Data)}$$

Using the conversion formula:

$$Y = \mathbf{-7732.15} \text{ (decimals are not displayed)}$$

Input Filter

For the input modules, 2085-IF4 and 2085-IF8, the input filter parameter lets you specify the frequency filter type for each channel. Frequency filter type affects noise rejection, as explained below. Select a frequency filter type considering acceptable noise and response time.

Through the Connected Components Workbench software, you can configure input filter as:

- 50/60Hz Rejection (default)
- No Filter
- 2-Point Moving Average

- 4-Point Moving Average
- 8-Point Moving Average

Noise Rejection

The input modules use a digital filter that provides noise rejection for the input signals.

The moving average filter reduces the high frequencies and random white noise while keeping an optimal step response. (See specifications for [Analog Expansion I/O on page 50](#) for minimum and maximum response times.)

Normal Mode Rejection is better than 40 dB, while Common Mode Rejection is better than 60 dB @ 50/60 Hz, with the 50/60 Hz rejection filters selected. The modules perform well in the presence of common mode noise as long as the signals applied to the user plus and minus input terminals do not exceed the common mode voltage rating (± 10 V) of the modules. Improper earth ground may be a source of common mode noise.

Process Level Alarms

Process level alarms alert you when the module has exceeded configured high and low limits for each channel (for input modules, it provides additional high-high and low-low alarms). When the channel input or output goes below a low alarm or above a high alarm, a bit is set in the status words. All Alarm Status bits can be read individually or read through the Channel Status Byte.

For the output module, 2085-OF4, it is possible to latch the alarm status bit when the latch configuration is enabled.

You can configure each channel alarm individually.

Clamping Limits and Alarm

For the output module, 2085-OF4, clamping limits the output from the analog module to remain within a range configured by the controller, even when the controller commands an output outside that range. This safety feature sets a high clamp and a low clamp. Once clamps are determined for a module, any data received from the controller that exceeds those clamps transitions the output to that limit but not beyond the clamp value. It also sets the alarm status bit when the alarm is enabled. It is also possible to latch the alarm status bit when the latch configuration is enabled.

For example, an application may set the high clamp on a module for 8V and the low clamp for -8V. If a controller sends a value corresponding to 9V to the module, the module will only apply 8V to its screw terminals.

You can configure the clamp limit (high/low clamp), the associated alarm, and its latching configuration on a per channel basis.

The following table shows the default values of the High/Low Clamps (in the order of low clamp value followed by the high clamp value) for the respective type/range when they are first enabled. You can change these values (within their full range) according to your application.

Default Range of High Clamp/Low Clamp Values

Data Format	0...20 mA	4...20 mA	-10...10V	0...10V
Raw/Proportional Data	-32768, 29647	-29822, 29086	-31207, 31207	-32768, 29647
Engineering Units	0, 20000	4000, 20000	-10000, 10000	0, 10000
Percent Range	0, 10000	0, 10000	Not supported	0, 10000

Specialty Module 2085-IRT4 Temperature Input Module

The 2085-IRT4 module lets you configure a sensor type for each of four input channels that linearizes analog signal into a temperature value.

Sensor Type

The following Thermocouple and RTD sensor types are supported by the 2085-IRT4 expansion I/O module.

Supported Thermocouple Types and mV Range

Sensor Range	Range
B	300...1800 °C (572...3272 °F)
C	0...2315 °C (32...4199 °F)
E	-270...1000 °C (-454...1832 °F)
J	-210...1200 °C (-346...2192 °F)
K	-270...1372 °C (-454...2502 °F)
TXK/XK (L)	-200...800 °C (-328...1472 °F)
N	-270...1300 °C (-454...2372 °F)
R	-50...1768 °C (-58...3214 °F)
S	-50...1768 °C (-58...3214 °F)
T	-270...400 °C (-454...752 °F)
mV	0...100 mV

Supported RTD Types and Ohms Range

Sensor Range	Range
100 Ω Pt $\alpha = 0.00385$ Euro	-200...870 °C (-328...1598 °F)
200 Ω Pt $\alpha = 0.00385$ Euro	-200...400 °C (-328...752 °F)
100 Ω Pt $\alpha = 0.003916$ U.S	-200...630 °C (-328...1166 °F)
200 Ω Pt $\alpha = 0.003916$ U.S.	-200...400 °C (-328...752 °F)

Supported RTD Types and Ohms Range

Sensor Range	Range
100 Ω Nickel 618	-60...250 °C (-76...482 °F)
200 Ω Nickel 618	-60...200 °C (-76...392 °F)
120 Ω Nickel 672	-80...260 °C (-112...500 °F)
10 Ω Copper 427	-200...260 °C (-328...500 °F)
Ohms	0...500 Ohms

Data format

You can configure the following data formats for channels 0...3 through the Connected Components Workbench software.

- **Engineering Units x 1** – If you select engineering units x 1 as the data format for a Thermocouple and RTD input, the module scales input data to the actual temperature values for the selected Thermocouple/RTD type per Thermocouple/RTD standard. It expresses temperatures in 0.1 °C/° F units. For resistance inputs, the module expresses resistance in 0.1 ohm per count. For mV inputs, the module expresses it in 0.01 mV per count.
- **Engineering Units x 10** – For a Thermocouple or RTD input, the module scales input data to the actual temperature values for the selected Thermocouple/RTD type per Thermocouple/RTD standard. With this format, the module expresses temperatures in 1 °C/° F units. For resistance inputs, the module expresses resistance in 1 ohm per count. For mV inputs, the module expresses it in 0.1 mV per count.
- **Raw/Proportional Data Format** – The value presented to the controller is proportional to the selected input and scaled into the maximum data range allowed by the bit resolution of the A/D converter. For example, the full data value range for a thermocouple type B 300...1800 °C is mapped to -32768...32767. See [Convert Analog Value to Data Format Value on page 13](#) for the conversion method.
- **Percent Range** – The input data is presented as a percentage of the normal operating range. For example, 0...100 mV equals 0...100% or 300...1800 °C equals 0...100% for thermocouple type B sensor. See [Convert Analog Value to Data Format Value on page 13](#) for the conversion method.

Valid Range of the Data Formats for 2085-IRT4

The following table shows the valid range of the Data Format versus the Data Type/Range for channels 0...3.

Valid Range of the 2085-IRT4 Data Formats

Data Format	Sensor Type – Temperature (10 Thermocouples, 8 RTDs)	Sensor Type 0...100 mV	Sensor Type 0...500 ohms
Raw/Proportional Data ⁽¹⁾	-32768...32767		
Engineering Units x 1	Temperature Value ⁽³⁾ (°C/°F)	0...10000 ⁽⁵⁾	0...5000 ⁽⁷⁾
Engineering Units x 10	Temperature Value ⁽⁴⁾ (°C/°F)	0...1000 ⁽⁶⁾	0...500 ⁽⁸⁾
Percent Range ⁽²⁾	0...10000		

(1) See [Convert Analog Value to Data Format Value on page 13](#).

(2) The resolution is 0.01% per count. For example, 9999 here means 99.99% (or 9999 x 0.01%). See [Convert Analog Value to Data Format Value on page 13](#) for the conversion method.

(3) The resolution is 0.1 °C/°F per count. For example, 999 here means 99.9 °C/°F (or 999 x 0.1 °C/°F). The range depends on the selected sensor type.

(4) The resolution is 1 °C/°F per count. For example, 999 here means 999 °C/°F (or 999 x 1 °C/°F). The range depends on the selected sensor type.

(5) The resolution is 0.01 mV per count. For example, 9999 here means 99.99 mV (or 9999 x 0.01 mV).

(6) The resolution is 0.1 mV per count. For example, 999 here means 99.9 mV (or 999 x 0.1 mV).

(7) The resolution is 0.1 ohm per count. For example, 4999 here means 499.9 ohm (or 4999 x 0.1 ohm).

(8) The resolution is 1 ohm per count. For example, 499 here means 499 ohm (or 499 x 1 ohm).

Convert Analog Value to Data Format Value

The formula for converting an analog value x to a data format value y, or converting data format value y to analog value x, is as follows:

$$Y = ((X - \text{Minimum Value of X Range}) * (\text{Range of Y}) / (\text{Range of X})) + (\text{Minimum Value of Y Range})$$

Example:

Find the temperature value Y of thermocouple type K when the Raw/Proportional Data X is -20000.

Given:

X = -20000 (Raw/Proportional Value)

Minimum value of X Range = -32768 (Minimum value of Raw/Proportional Data)

Range of X = 32767 - (-32768) = 65535 (Range of Raw/Proportional Data)

Range of Y = 1372 - (-270) = 1642 (Range of Thermocouple K in °C)

Minimum value of Y Range = -270 °C (Minimum value of Thermocouple K)

Then:

$$Y = (-20000 - (-32768)) * 1642 / 65535 + (-270 \text{ °C}) = \mathbf{49.9 \text{ °C}}$$

Temperature Units

Temperature value can be set to °C (default) or °F.

Open circuit response

This parameter defines the response to be taken by the module during an open circuit.

- Upscale – Sets input to full upper scale value of channel data word. The full-scale value is determined by the selected input type, data format, and scaling.
- Downscale – Sets input to full lower scale value of channel data word. The low scale value is determined by the selected input type, data format, and scaling.
- Hold Last State – Sets input to last input value.
- Zero – Sets input to 0 to force the channel data word to 0.

Filter frequency

The 2085-IRT4 module uses a digital filter that provides noise rejection for the input signals. The filter is set by default at 4 Hz. The digital filter provides -3 dB (50% amplitude) attenuation at a filter frequency of 4 Hz.

The -3 dB frequency is the filter cut-off frequency. The cut-off frequency is defined as the point on the frequency response curve where frequency components of the input signal are passed with 3 dB of attenuation. All input frequency components at or below the cut-off frequency are passed by the digital filter with less than 3 dB of attenuation. All frequency components above the cutoff frequency are increasingly attenuated.

The cut-off frequency for each channel is defined by its filter frequency selection and is equal to the filter frequency setting. Choose a filter frequency so that your fastest changing signal is below that of the filter's cut-off frequency. The cut-off frequency should not be confused with the update time. The cut-off frequency relates to how the digital filter attenuates frequency components of the input signal. The update time defines the rate at which an input channel is scanned and its channel data word is updated.

A lower filter frequency provides a better noise rejection, but it also increases the update time. Conversely, a higher filter frequency provides a faster update time, but it decreases the noise rejection and effective resolution.

TIP For quickstart instructions on how to add, configure, delete and replace your expansion I/O module, see [Configure Your Expansion I/O Module](#).

Summary

This chapter discussed the features of the analog and discrete Micro800 expansion I/O modules.

Wiring Connections

In solid-state control systems, grounding and wire routing helps limit the effects of noise due to electromagnetic interference (EMI).

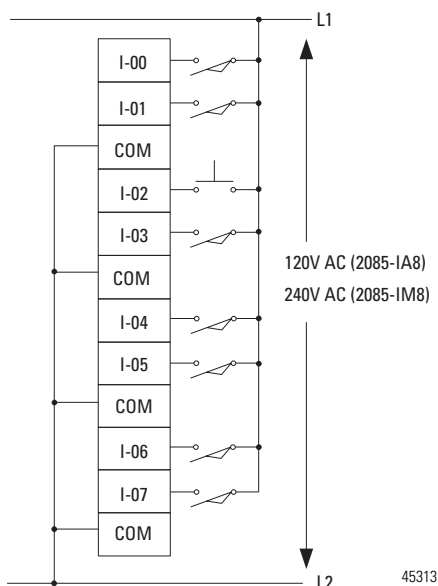


ATTENTION: Do not wire more than 2 conductors on any single terminal.

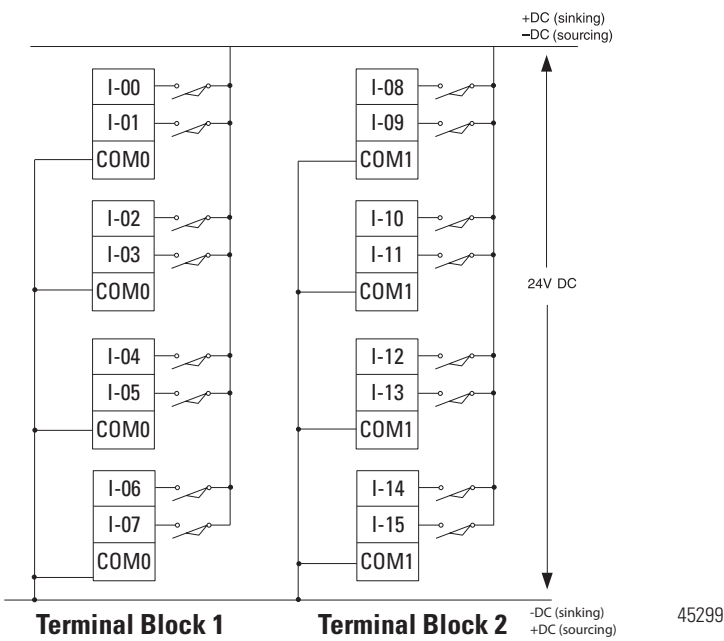
Input/Output Wiring

Basic wiring of devices to the expansion I/O modules are shown below.

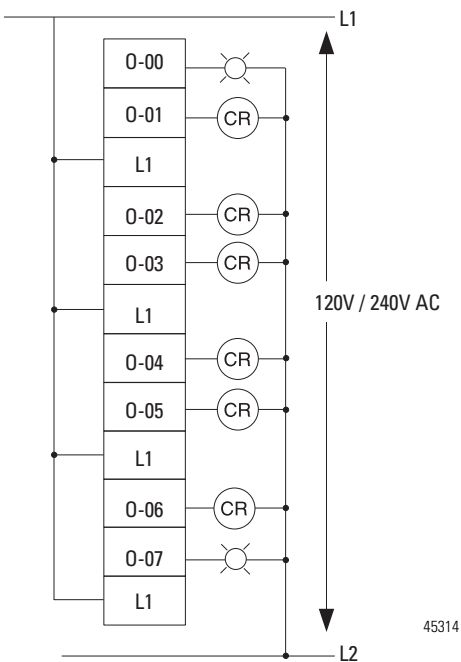
2085-IA8 or 2085-IM8



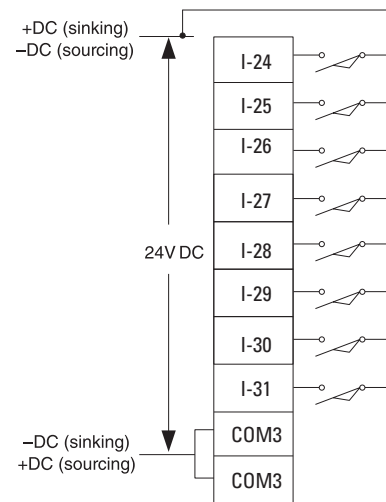
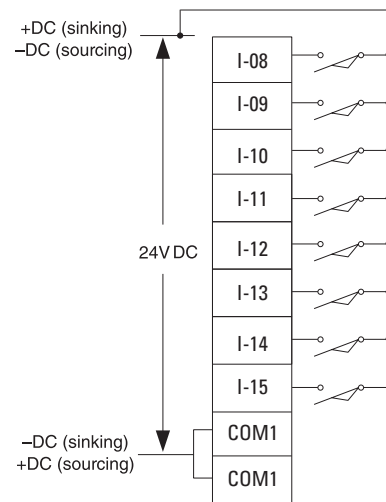
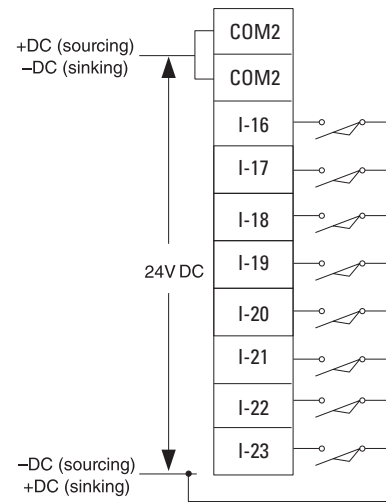
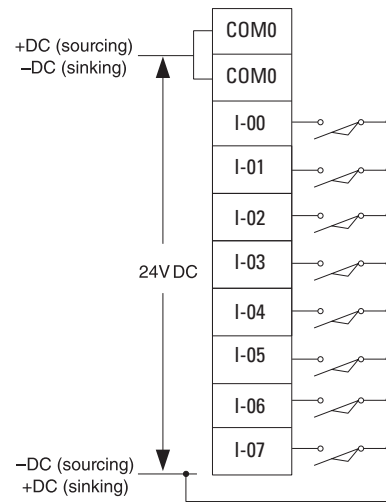
2085-IQ16



2085-OA8



2085-IQ32T

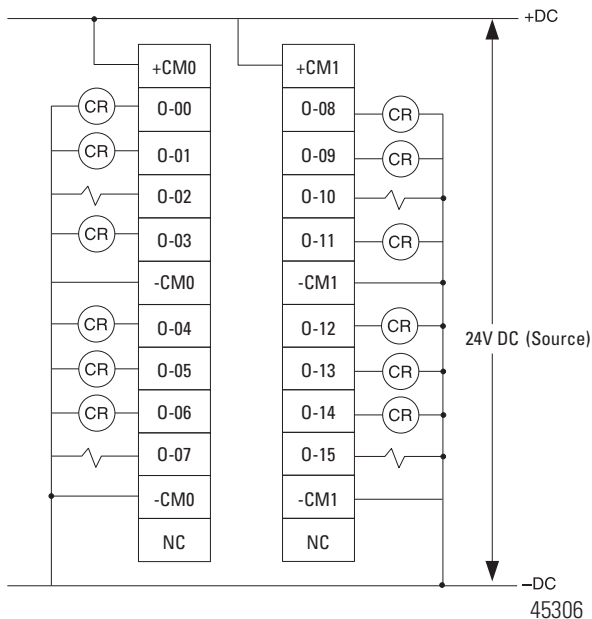


45300

See [Wiring Options for the 2085-IQ32T Module on page 21](#).

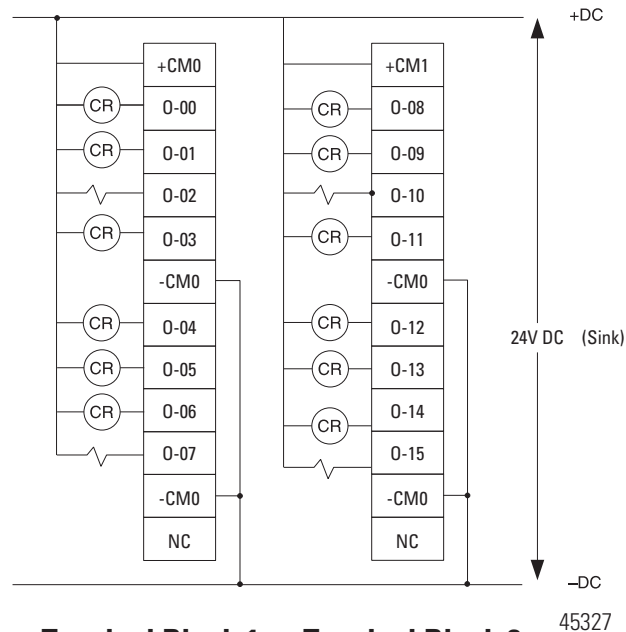
2085-OB16 and 2085-OV16

2085-OB16



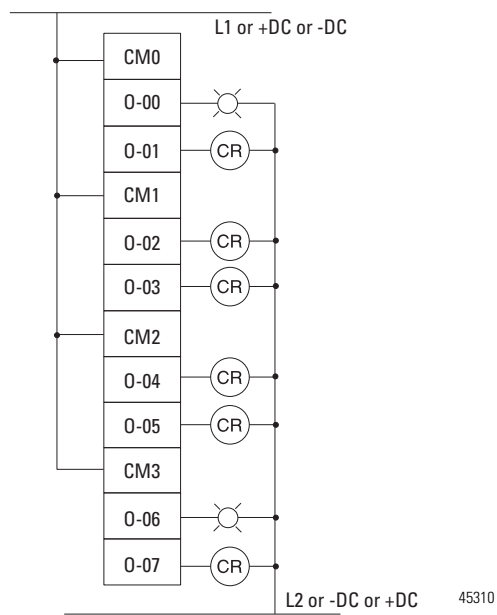
Terminal Block 1 Terminal Block 2

2085-OV16

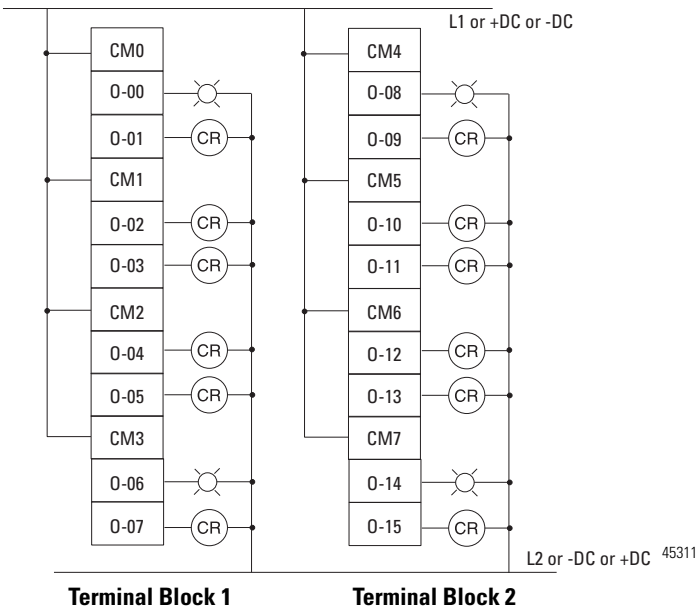


Terminal Block 1 Terminal Block 2

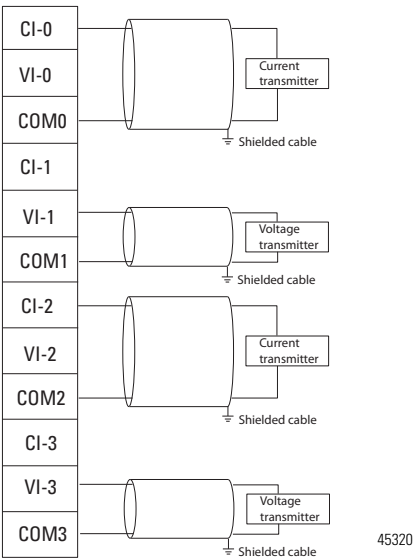
2085-OW8



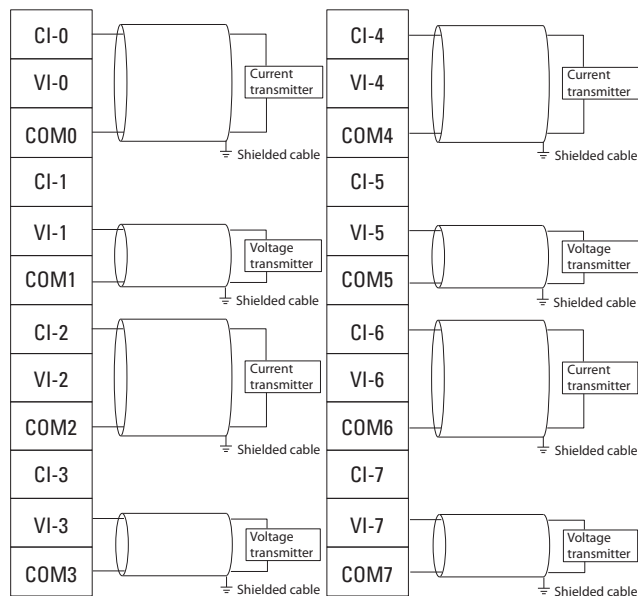
2085-0W16



2085-IF4



2085-IF8

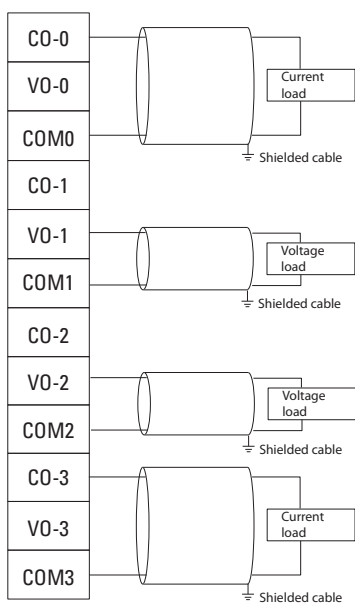


45322

Terminal Block 1

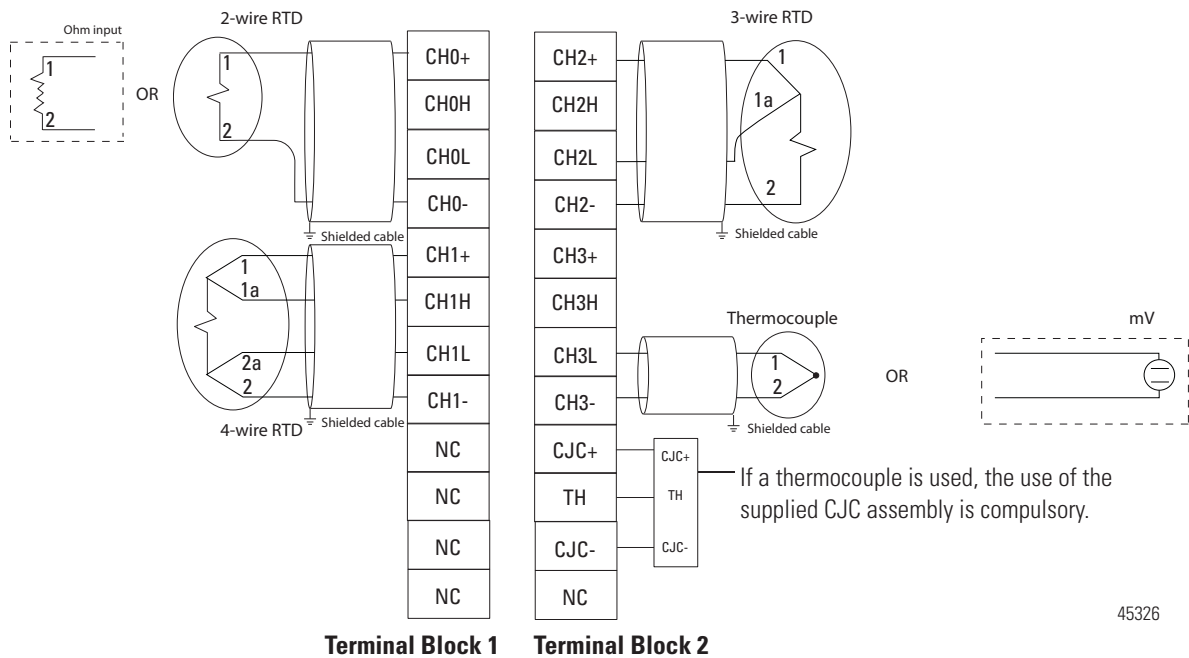
Terminal Block 2

2085-OF4



45321

2085-IRT4



45326

Wiring Options for the 2085-IQ32T Module

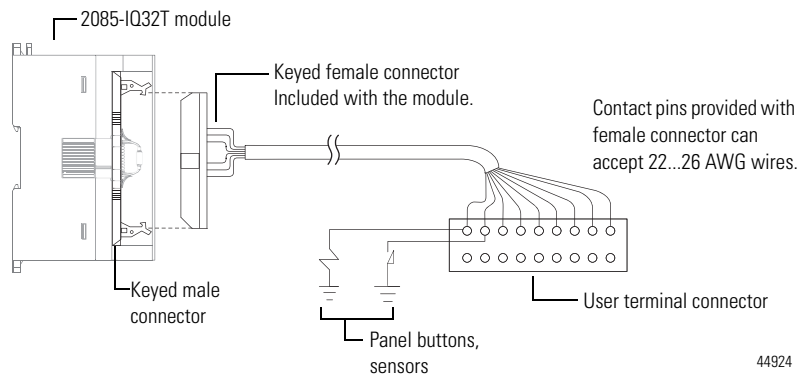
Included with your 2085-IQ32T module is a keyed 40-pin female connector and crimp type pins. These components allow you to wire I/O devices to the module using a 40-conductor cable or individual wires.



ATTENTION: To comply with UL restrictions, this equipment must be powered from a source compliant with the following:
Class 2 or Limited Voltage/Current.

When assembled, align the female connector over the module's male header using the keying slot as a guide. Firmly lock them together with the upper and lower retaining arms.

Option 1 – Wire the Connector with Available 40-pin Connector



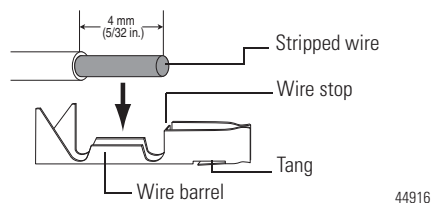
Assemble the Wire Contacts

1. Strip the wire insulation to expose 4 mm (5/32 in.) of wire. Crimp pins can accept 22...26 AWG wire.

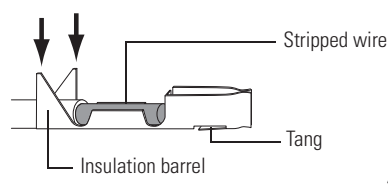


ATTENTION: Be careful when stripping wires. Wire fragments that fall into the module could cause damage. Once wiring is complete, be sure the module is free of all metal fragments before removing the protective debris strip. Failure to remove the strip before operating can cause overheating.

2. Insert the wire into the crimp pin as far as the wire stop.

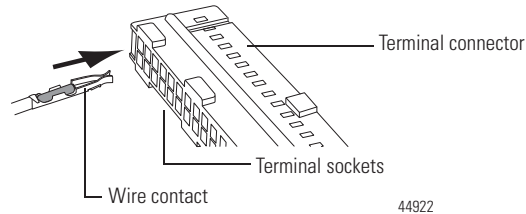


3. Crimp the wire barrel around the wire using small needle nose pliers.
4. Crimp the insulation barrel around the wire insulation using small needle nose pliers.



5. Solder wire and wire barrel together using lead-free solder and soldering pencil.

6. Insert the assembled wire contact into the terminal socket. Push the wire contact in until the tang latches. Make sure the tang is properly latched by lightly pulling on the wire.



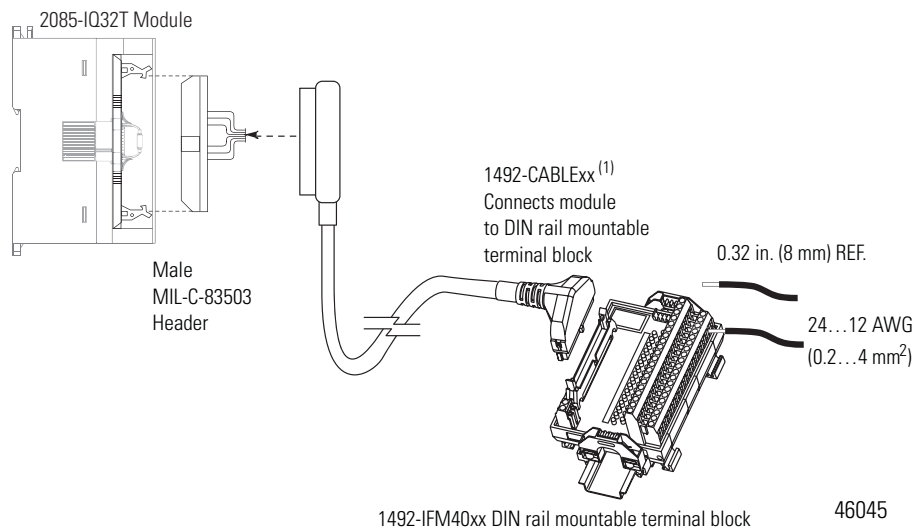
Option 2 – Use Allen-Bradley 1492 Connector Cables with Flying Leads

Preassembled 40-conductor cables with the 40-pin connector on one end and flying leads on the other end are also available from Allen-Bradley. They are available in 1 m, 2.5 m, and 5 m lengths. The catalog numbers from shortest to longest are:

- 1492-CAB010U62 (or 1492-CAB010P62)
- 1492-CAB025U62 (or 1492-CAB025P62)
- 1492-CAB050U62 (or 1492-CAB050P62)

The “U62” cables route the cable upward when plugged into the module, while “P62” cables route the cable downward when plugged into the module.

Option 3 – Use Allen-Bradley 1492 Cables with Keyed Connectors



- (1) Maximum user cable length is dependent on how much voltage drop (current x (ohms/ft.) x (feet)) the user system can tolerate. The user system should take into account the minimum turn-on voltage required by external loads connected to the module, the minimum turn-on voltage required by the module, and all of the voltage drops associated with wiring to and from the load, sensors, terminal blocks, power sources and the module itself. See the table on [page 24](#) for voltage drop values for the 1492 cables shown above.

Allen-Bradley 1492 wiring systems are available for connecting the I/O module to external I/O. These wiring systems include a pre-wired cable available in four lengths: 0.5m (1.6 feet), 1.0m (3.3 feet), 2.5m (8.2 feet), 5.0m (16.4 feet). An Interface Module for connecting external devices is also available. Cables are equipped with keyed connectors at both ends for proper connections. Interface modules are DIN rail mountable and are available with or without field side status indicating LEDs. Stick-on labels are provided with the Interface modules to identify I/O wiring termination points.

1492 Cables

Catalog No.	Voltage Drop @ 30 °C		Voltage Drop @ 60 °C	
	V DC and DC Com Wires ⁽¹⁾	Output Channel Wires ⁽²⁾	V DC and DC Com Wires	Output Channel Wires
1492-CABLE005H	127 mv	34 mv	144 mv	38 mv
1492-CABLE010H	173 mv	45 mv	196 mv	51 mv
1492-CABLE025H	334 mv	83 mv	388 mv	95 mv
1492-CABLE050H	574 mv	147 mv	686 mv	169 mv

(1) Voltage drop @ maximum rated current of 2 amps per conductor.

(2) Voltage drop at maximum rated current of 0.5 amps per output channel.

Summary

This chapter covered the input and output wiring connections for the different analog and discrete Micro800 expansion I/O modules.

Install Your Micro800 Expansion I/O

This chapter includes information on installing the Micro800 expansion I/O modules with the Micro850 controller.



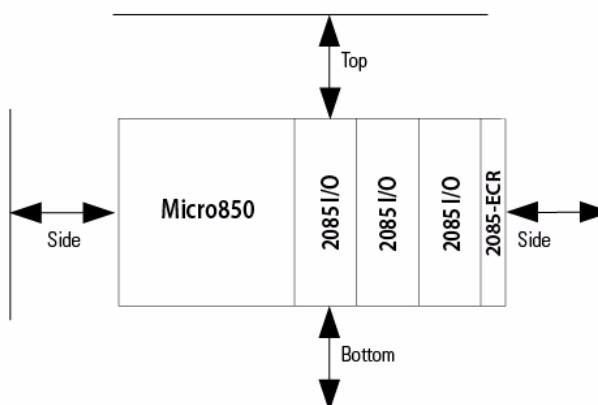
WARNING: If you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed before proceeding.

Mount the Module

For more information on proper grounding guidelines, see the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

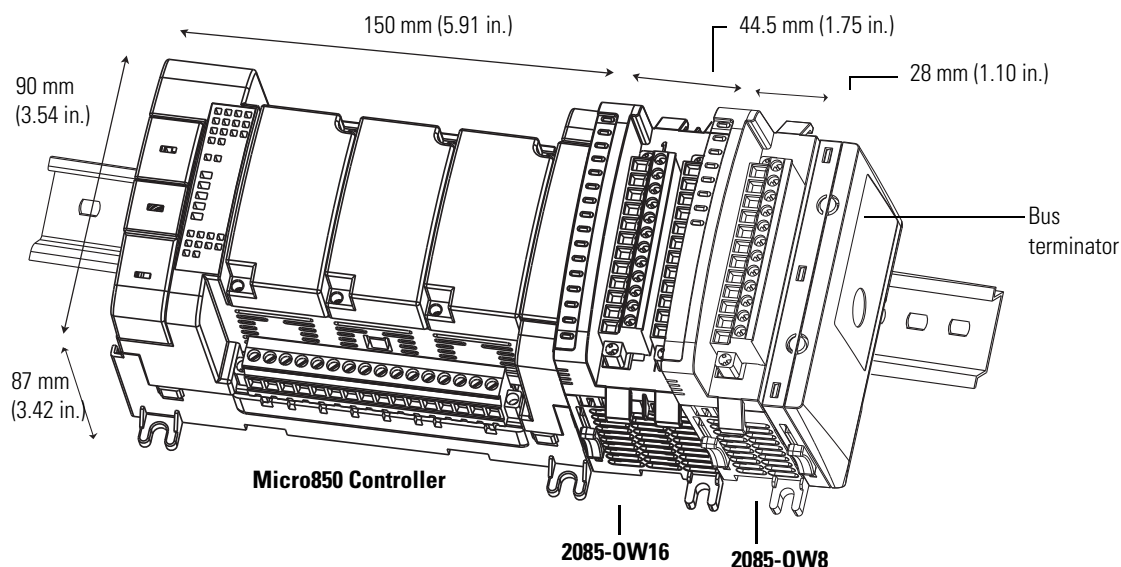
Module Spacing

Maintain spacing from objects such as enclosure walls, wireways and adjacent equipment. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:



44913

Mounting Dimensions and DIN Rail Mounting



45309

Mounting dimensions do not include mounting feet or DIN rail latches.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm x 1 mm (EN 50 022 - 35 x 7.5).

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



ATTENTION: This product is grounded through the DIN rail to chassis ground. Use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (for example, aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

Before mounting the module on a DIN rail, use a flat-blade screwdriver in the DIN rail latch and pry it downwards until it is in the unlatched position.

1. 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.
2. Push the DIN rail latch back into the latched position.
Use DIN rail end anchors (Allen-Bradley part number 1492-EAJ35 or 1492-EAHJ35) for vibration or shock environments.

To remove your module from the DIN rail, pry the DIN rail latch downwards until it is in the unlatched position.

Panel Mounting

The preferred mounting method is to use two M4 (#8) per module. Hole spacing tolerance: ± 0.4 mm (0.016 in.).

Follow these steps to install your module using mounting screws.

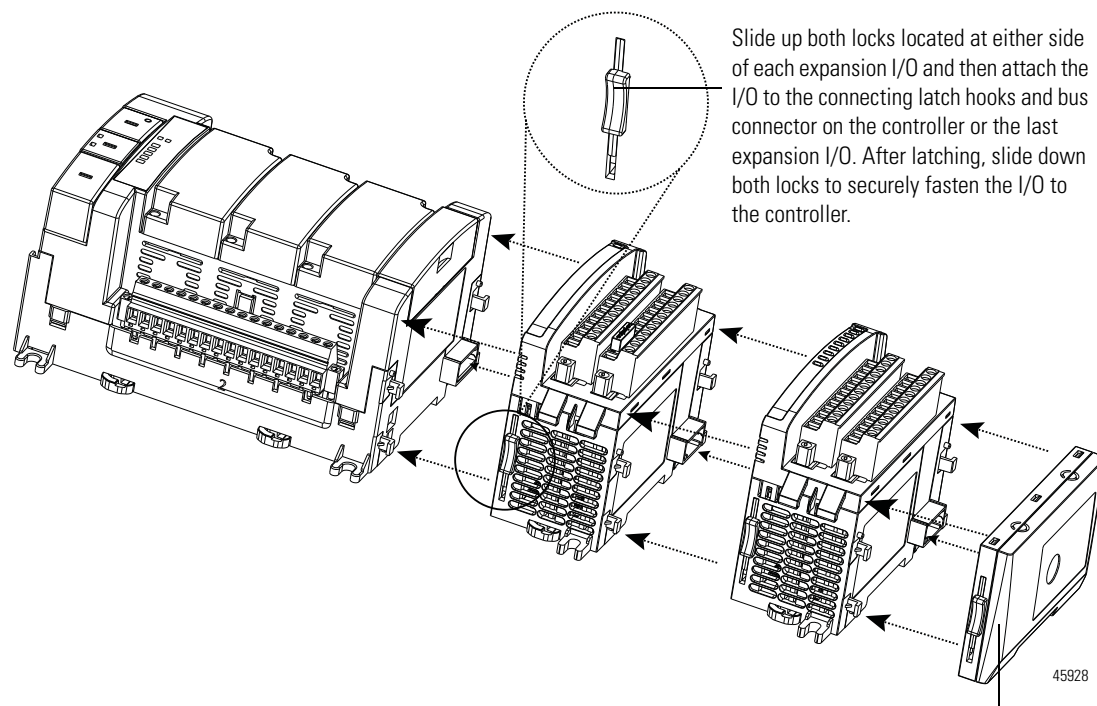
1. Place the module next to the controller against the panel where you are mounting it. Make sure the controller and module are spaced properly.
2. Mark drilling holes through the mounting screw holes and mounting feet then remove the module.
3. Drill the holes at the markings, then replace the module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

System Assembly

The Micro850 expansion I/O module is attached to the controller or another I/O module by means of interconnecting latches and hooks. The Micro850 controller and expansion I/O modules must terminate with a 2085-ECR Bus Terminator module.



ATTENTION: Failure to connect a bus terminator module to the last expansion I/O module will result in a controller fault.



2085-ECR serves as an end cap and terminates the end of the serial communication bus. The end cap is connected to the last I/O module in the system.

Summary

This chapter provided a step-by-step description of the process for assembling, mounting, and installing the Micro850 controller with the expansion I/O modules.

Configure Your Expansion I/O Module

Overview

The following sample project guides you through the step-by-step process of adding, configuring, deleting, and replacing Micro800 expansion I/O modules in Connected Components Workbench.

TIP For more information about using the Connected Components Workbench software, you can refer to the Connected Components Workbench Online Help (it comes with your software).

In this sample project, you need to create a Connected Components Workbench project with a 2080-LC50-24QWB controller. Then, configure four expansion I/O devices (2085-IF4, 2085-IQ32T, 2085-OB16, 2085-IRT4) following the instructions below.

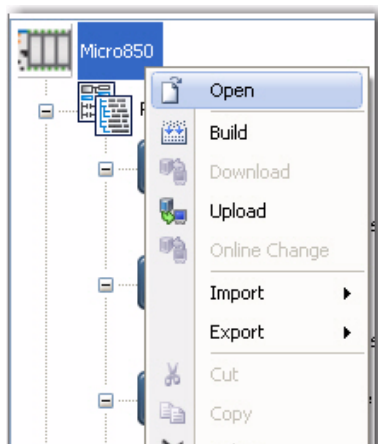
These instructions make use of the drag-and-drop mechanism available in Connected Components Workbench release 2 and higher, which allows the user to easily add, replace, and delete devices through simple drag-and-drop motion.

Add an Expansion I/O

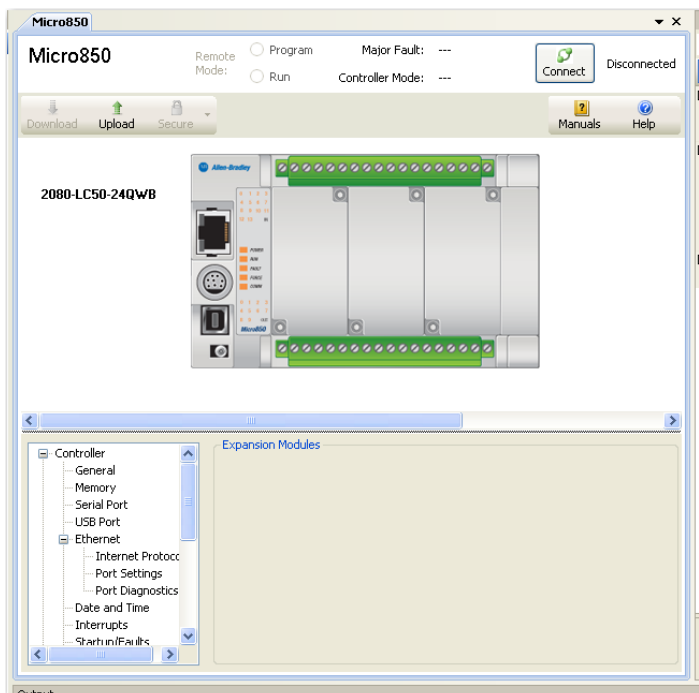
TIP Expansion I/O modules are automatically added to a project when using the "Discover" feature in Connected Components Workbench.

To add Expansion I/O modules to an existing Micro850 controller project, do the following:

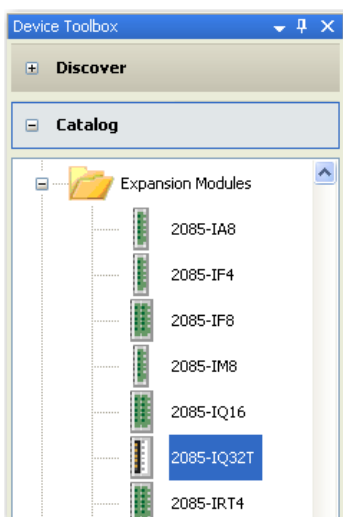
1. On the Project organizer pane, right-click Micro850 and choose Open.



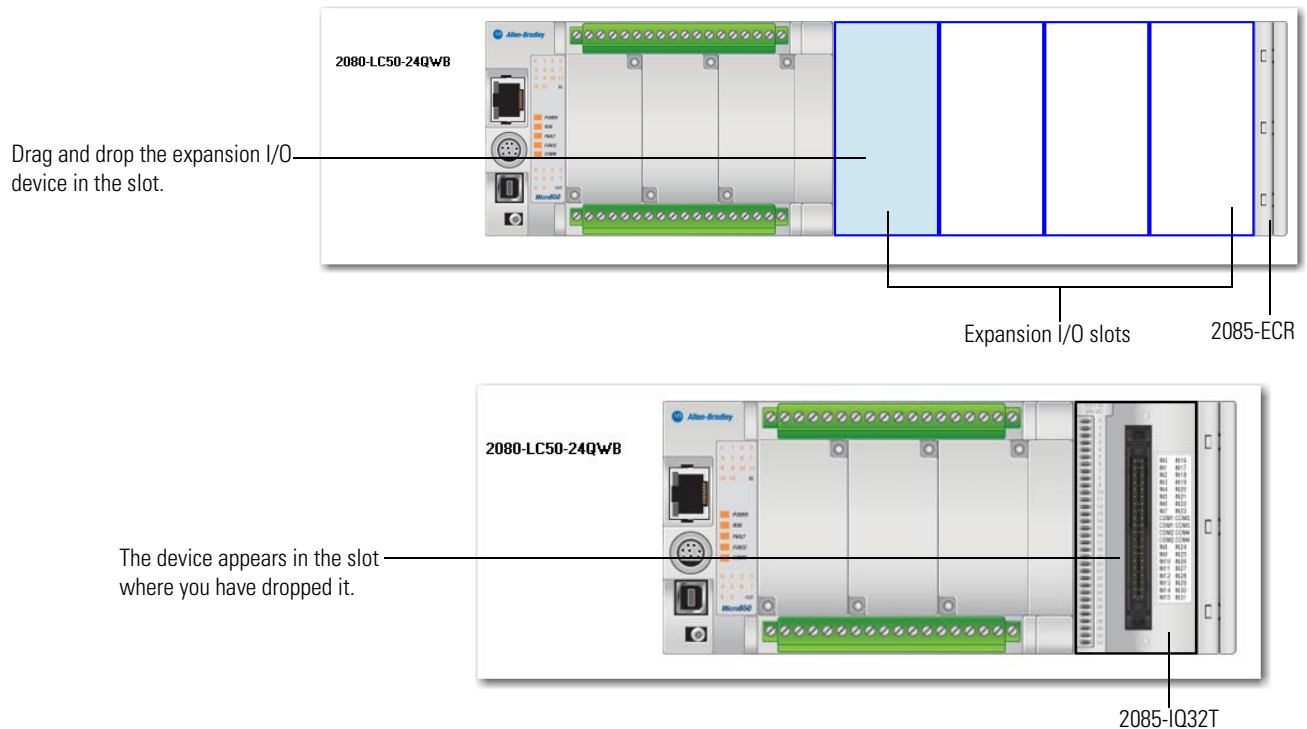
The Micro850 project page opens in the center pane with a graphical replica of the Micro850 controller on the first tier, Controller properties on the second tier, and an Output box on the last tier.



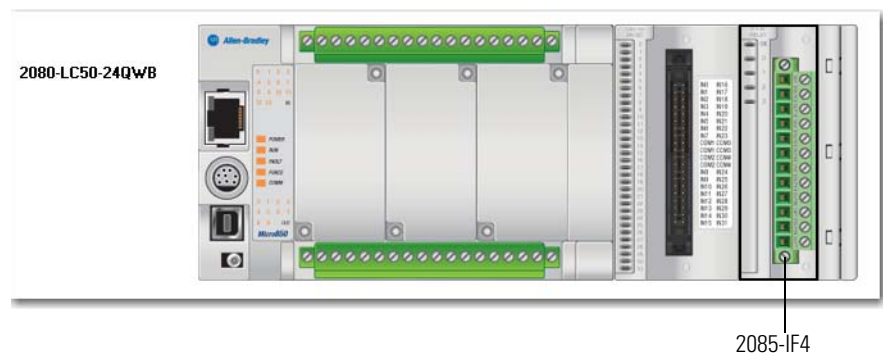
2. On the Device Toolbox pane, found at the rightmost corner of the Connected Components Workbench window, go to the Expansion Modules folder.



- Click and drag 2085-IQ32T to the right of the controller graphic at the center pane. Four blue slots appear to indicate available slots for expansion I/O modules. Drop 2085-IQ32T on the first and rightmost slot against the controller.



- From the Expansion Modules folder on the Device Toolbox pane, drag and drop 2085-IF4 on the second Expansion I/O slot, next to 2085-IQ32T.

**TIP**

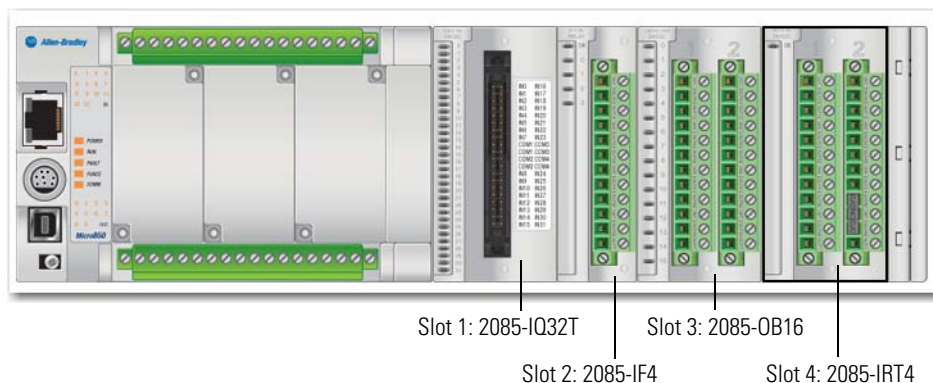
To move an expansion I/O device to another slot, simply drag and drop the device to the preferred slot. For step-by-step instructions on how to delete and replace expansion I/O devices, see [Delete and Replace an Expansion I/O Configuration on page 42](#).

- From the Expansion Modules folder on the Device Toolbox, drag and drop 2085-OB16 on the third Expansion I/O slot, next to 2085-IF4.

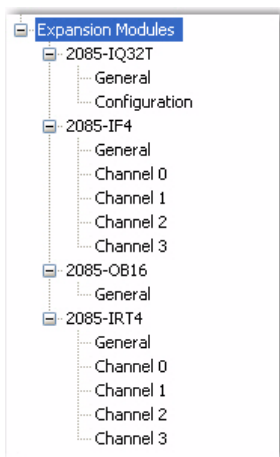
6. From the Expansion Modules folder on the Device Toolbox pane, drag and drop 2085-IRT4 on the fourth Expansion I/O slot, next to 2085-IRT4.

TIP You can edit default configuration by following the procedure provided in the next section, [Edit Expansion I/O Configuration on page 32](#).

After you have added all four expansion I/O modules, your Connected Components Workbench project should look like this:



The Expansion Modules list should appear as shown below. To see device details for each of the expansion I/O you have just added, click General. To see default configuration properties, click Configuration, if available.

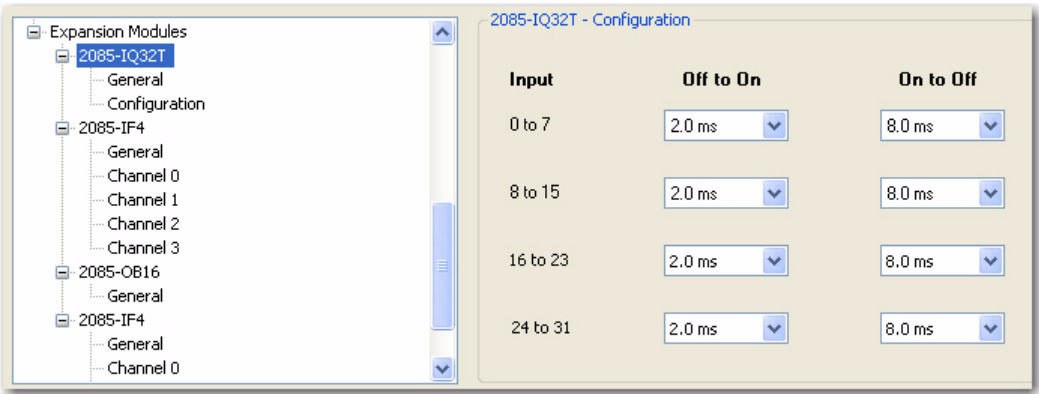


Edit Expansion I/O Configuration

You can edit default I/O configuration through the Expansion Modules Details box located right below the controller graphic.

IMPORTANT To download configuration to your device, see [Build, Save, Download a Project with Expansion I/O Configuration on page 44](#).

1. Select the Expansion I/O device you want to configure.

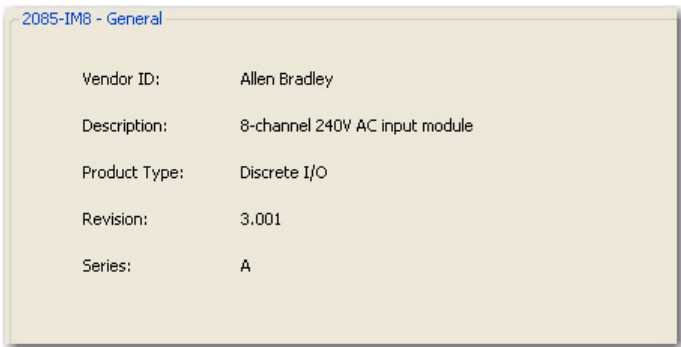
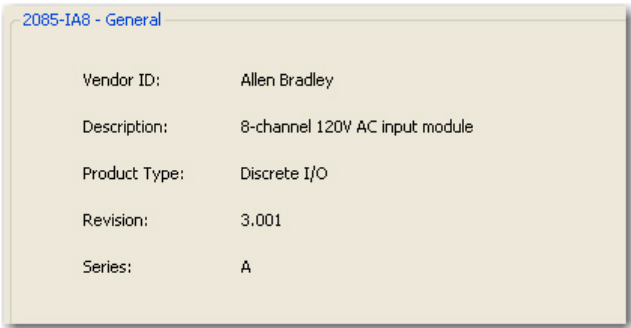


2. Click Configuration. Edit module and channel properties according to your requirements and application.

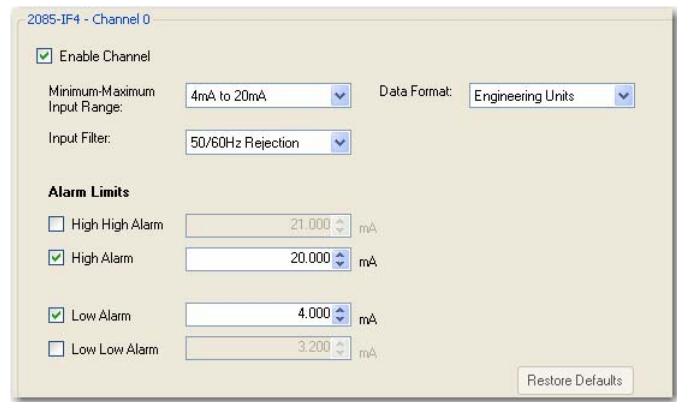
The next sections show you configuration properties for each of the expansion I/O module.

2085-IA8 and 2085-IM8

These two AC input modules only have general device details available for the user in Connected Components Workbench software. No configuration properties are available.

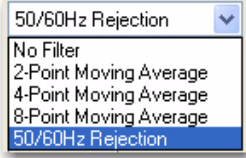


2085-IF4 and 2085-IF8



For the analog input modules, 2085-IF4 and 2085-IF8, you can configure properties such as input range, format, filter and alarm limits for each individual channel.

Configuration Parameters for 2085-IF4 and 2085-IF8

Configuration Property	What to do	Description
Enable Channel	Select or deselect the checkbox. The box is selected by default.	Enable or disable a channel through this checkbox. By default, each channel is enabled.
Minimum-Maximum Input Range	Choose from a range of values: <ul style="list-style-type: none">0...20 mA4...20 mA (default)-10...10 V0...10 V	Defines the input mode for the channel as either voltage or current, with current as default mode.
Data format	Select from the following options: <ul style="list-style-type: none">Raw/Proportional DataEngineering Units (default)Percent Range	See Data formats on page 7 for detailed information.
Input filter	Choose from the following values: 	See Input Filter on page 9 for detailed information.

Configuration Parameters for 2085-IF4 and 2085-IF8

Configuration Property	What to do	Description
High High Alarm	Check the checkbox to enable an alarm. By default, High High and Low Low Alarms are disabled and High and Low alarms are enabled.	Process level alarms alert you when the module has exceeded configured high, high high, low, and low low limits for each channel.
High Alarm		
Low Alarm		
Low Low Alarm		

2085-IQ16 and 2085-IQ32T

The screenshot shows the '2085-IQ32T - Configuration' window. It has a table with three columns: 'Input', 'Off to On', and 'On to Off'. The 'Input' column lists four ranges: '0 to 7', '8 to 15', '16 to 23', and '24 to 31'. The 'Off to On' column has four dropdown menus, all set to '2.0 ms'. The 'On to Off' column has four dropdown menus, all set to '8.0 ms'.

Input	Off to On	On to Off
0 to 7	2.0 ms	8.0 ms
8 to 15	2.0 ms	8.0 ms
16 to 23	2.0 ms	8.0 ms
24 to 31	2.0 ms	8.0 ms

For the 16- and 32-channel DC input modules, 2085-IQ16 and 2085-IQ32T respectively, you can configure OFF to ON and ON to OFF ranges.

Configuration Property	What to do
Input	—
OFF to ON	Choose from the following values: 8.0 ms 4.0 ms 2.0 ms (default) 1.0 ms 0.5 ms 0.1 ms 0.0 ms
ON to OFF	Choose from the following values: 8.0 ms (default) 4.0 ms 2.0 ms 1.0 ms 0.5 ms 0.1 ms 0.0 ms

2085-OV16, 2085-OB16, 2085-OW16, 2085-OA8, 2085-OW8

The output modules, 2085-OV16, 2085-OB16, 2085-OW16, 2085-OA8, 2085-OW8, only have device details available to the user in Connected Components Workbench. There are no user configuration pages for these modules in the Connected Components Workbench software.

2085-OB16 - General

Vendor ID:	Allen Bradley
Description:	16-channel DC source output module
Product Type:	Discrete I/O
Revision:	3.001
Series:	A

2085-OF4

2085-OF4 - Channel 0

☐ Enable Channel

Minimum-Maximum Output Range: 4mA to 20mA Data Format: Engineering Units

☐ High Clamp Value: 20.000 mA

☐ Low Clamp Value: 4.000 mA

Over Range Alarm Trigger

☐ High Clamp Value

☐ Maximum Output Value

Under Range Alarm Trigger

☐ Low Clamp Value

☐ Minimum Output Value

☐ Latch Over and Under Alarm




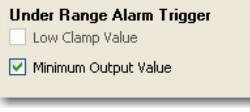
Restore Defaults

For the analog output module, 2085-OF4, you can configure output unit, minimum to maximum output range, high clamp and low clamp values, and overrange and underrange values.

Configuration Parameters for 2085-OF4

Configuration Property	What to do	Description
Enable channel	Select or deselect the checkbox. Channel is not enabled by default.	Enable or disable a channel through this checkbox. By default, each channel is disabled.
Minimum-maximum output range	Choose from a range of values: <ul style="list-style-type: none"> • 0...20 mA • 4...20 mA (default) • -10...10 V • 0...10 V 	For more information, see: <ul style="list-style-type: none"> • Input/Output Types and Ranges on page 7 • Valid Range of the Data Formats for 2085-IF4, 2085-IF8, and 2085-OF4 on page 8
Data format	Select from the following options: <ul style="list-style-type: none"> • Raw/Proportional Data • Engineering Units (default) • Percentage Data 	See Data formats on page 7 for detailed information.
High clamp value	Click the checkbox to enable and enter a high clamp value.	Sets an appropriate alarm that limits the output from the analog module to remain within a range configured by the controller, even when the controller commands an output outside that range. This safety feature sets a high clamp and a low clamp. Once clamps are determined for a module, any data received from the controller that exceeds those clamps sets an appropriate limit alarm and transitions the output to that limit but not beyond the requested value.
Low clamp value	Click the checkbox to enable and enter a low clamp value.	

Configuration Parameters for 2085-OF4

Configuration Property	What to do	Description
Overrange alarm trigger	<p>If you enabled and entered a High Clamp value, you can check High Clamp Value as overrange alarm trigger.</p>  <p>If you did not enable and entered a High Clamp value, you can check Maximum Output Value as your overrange alarm trigger.</p> 	The overrange and underrange feature detects when the output module is operating beyond limits set by the output range. The trigger could be set based on clamp values or minimum/maximum output values.
Underrange alarm trigger	<p>If you enabled and entered a Low Clamp value, you can check Low Clamp Value to set it as underrange alarm trigger.</p>  <p>If you did not enable and entered a Low Clamp value, you can check Minimum Output Value as underrange alarm trigger.</p> 	
Latch over and under alarm	Click to latch.	Check the box to latch an alarm in the set position even if the condition that causes the alarm disappears.
Restore defaults	Click button to restore defaults.	Restores default device properties.

2085-IRT4

2085-IRT4 - Channel 0

☒ Enable Channel

Sensor Type: Thermocouple K

Units: °C

RTD Wiring Type: 2-wire

RTD 2Wire Cable Resistance: 0.00 ohm

Data Format: Engineering Units x1

Filter Update Time: 120 ms

Filter Frequency (-3db): 4.0 Hz

50/60Hz Noise Rejection: Both

Open Circuit Response: Upscale

Restore Defaults

For the RTD and Thermocouple expansion I/O, 2085-IRT4, you can configure sensor type, data format, temperature units, and other properties, on each of the four individual channels.

Configuration Parameters for 2085-IRT4

Configuration Property	What to do	Description
Enable channel	Click the box to enable.	This parameter enables the particular channel for operation.
Sensor Type	Select from the following sensors: <ul style="list-style-type: none">• 100Ω Platinum 385• 200Ω Platinum 385• 100Ω Platinum 3916• 200Ω Platinum 3916• 100Ω Nickel 618• 200Ω Nickel 618• 120Ω Nickel 672• 100Ω Copper 427• 0...500 Ohm• 0...100 mV• Thermocouple B• Thermocouple C• Thermocouple E• Thermocouple J• Thermocouple K• Thermocouple TXK/XK (L)• Thermocouple N• Thermocouple R• Thermocouple S• Thermocouple T	Defines the RTD or Thermocouple sensor type for the channel.

Configuration Parameters for 2085-IRT4

Configuration Property	What to do	Description
Units	Set as °C or °F	Sets the temperature unit to be used by the channel.
RTD Wiring Type	Set as any of the following: <ul style="list-style-type: none"> • 2-wire • 3-wire • 4-wire 	The wiring type for channel x. This parameter is only available when the Sensor Type for the channel is RTD or (0 to 500 Ohm).
RTD 2Wire Cable Resistance	Replace value from 0.0 ohms...500.00 ohms to 0.0 ohms...655.35 ohms.	The specified cable resistance for the 2-wire cable. When the RTD 2Wire Cable Resistance value is smaller than the input value, it is subtracted from the input value during each read. When the value is greater than the input value, the under-range or open status bit is set (1). To configure the wire resistance, the Sensor Type must be RTD or (0...500 Ohm) and the RTD Wiring Type must be 2-wire. Otherwise, this parameter is not available.
Data Format	Choose from the following options: <ul style="list-style-type: none"> • Raw/Proportional Data • Engineering Units*1 • Engineering Units*10 • Percent range 	For more information, see: <ul style="list-style-type: none"> • Data format on page 12 • Valid Range of the Data Formats for 2085-IRT4 on page 12

Configuration Parameters for 2085-IRT4

Configuration Property	What to do	Description
Filter Update Time	Set as the following (in msec): <ul style="list-style-type: none"> • 4 • 8 • 16 • 32 • 40 • 48 • 60 • 101 • 120 • 160 • 200 • 240 • 320 • 480 	See Filter frequency on page 14 . NOTE: Filter update time 4 ms is not available for Thermocouple sensor types B, R, S, E, J, C, K, L, N, or T or 0...10 mV. Filter update time 8 ms is not available for Thermocouple sensor types B, R, S.
Filter Frequency (-3dB)	Set as the following (in Hz): <ul style="list-style-type: none"> • 114 • 60 • 30 • 14 • 12 • 9.4 • 8.0 • 4.7 • 4.0 • 3.0 • 2.4 • 2.0 • 1.5 • 1.0 	
50/60 Hz Noise Rejection	Set as: <ul style="list-style-type: none"> • Both (default) • 50 Only • 60 Only • Neither 	See Noise Rejection on page 10 .

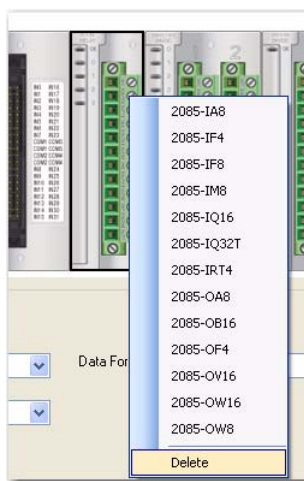
Configuration Parameters for 2085-IRT4

Configuration Property	What to do	Description
Open Circuit Response	Choose from the following options: <ul style="list-style-type: none"> Upscale Downscale Hold Last State Zero 	Defines the response to be taken during an open circuit, whether to upscale, downscale, hold last state, or zero. Upscale – Sets input to full upper scale value of channel data word. The full-scale value is determined by the selected input type, data format, and scaling. Downscale – Sets input to full lower scale value of channel data word. The low scale value is determined by the selected input type, data format, and scaling. Hold Last State – Sets input to last input value. Zero – Sets input to 0 to force the channel data word to 0.

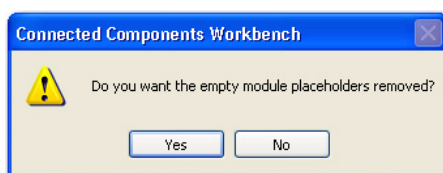
Delete and Replace an Expansion I/O Configuration

Using our example project, let us try to delete 2085-IF4 in slot 2 and 2085-OB16 in slot 3. Then, let us replace the modules with 2085-OW16 and another 2085-IQ32T module in slots 2 and 3, respectively. To do this:

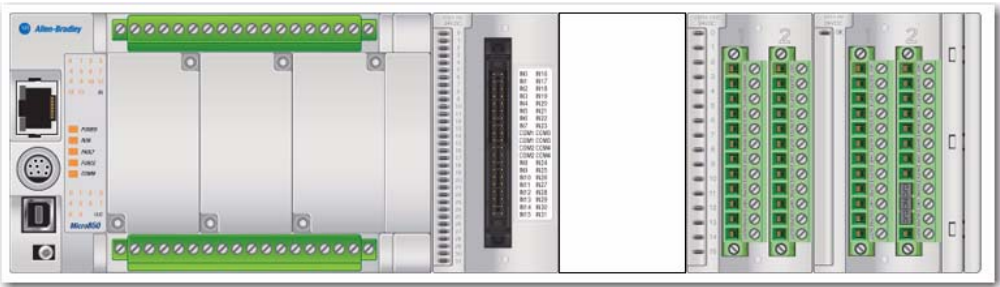
1. On the project graphic in the center pane, right-click 2085-IF4 and click Delete.



2. Another message box appears asking you if you want to empty the placeholders to the left to fill the empty slot. Click No.

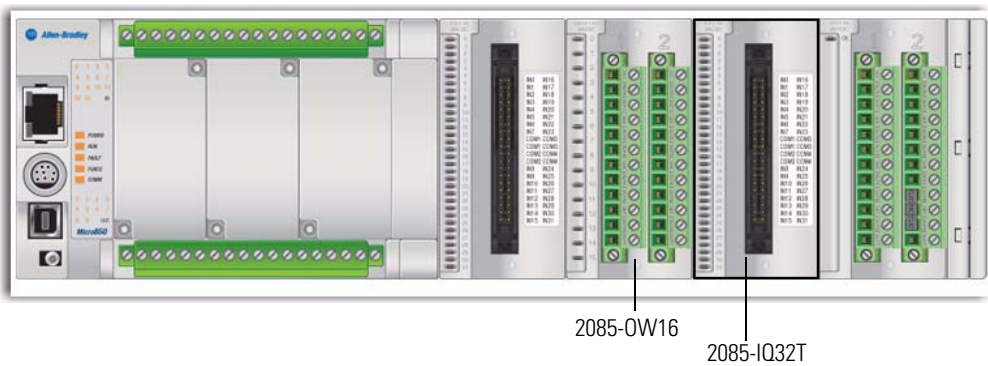
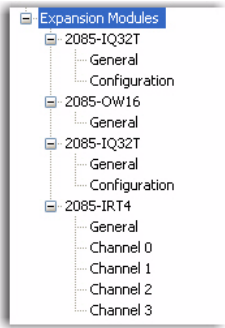


After deleting 2085-IF4 from slot 2, the project graphic should look like this:

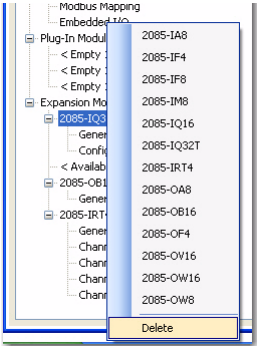


- 3. On the empty slot (slot 2), right-click and select 2085-OW16.
- 4. Next, replace 2085-OB16 in slot 3 with a 2085-IQ32T device. Right-click 2085-OB16 in slot 3, and choose 2085-IQ32T.

The project graphic and Expansion Modules list should look like these after the modules are replaced:



TIP You can also delete and replace an expansion I/O through the Expansion Modules list. To replace, right-click the expansion I/O module you would like to replace, then select the Expansion I/O module you would like to replace it with, from the list that appears. To delete the Expansion I/O, choose Delete.



Build, Save, Download a Project with Expansion I/O Configuration

To learn how to build, save, and download the project to your controller, see the Connected Components Workbench Online Help.

Summary

This chapter provided instructions on how to add, edit, configure, delete, and replace expansion I/O module configuration through the Connected Components Workbench software.

Specifications

The following tables provide specifications for digital and analog expansion I/O modules.

Discrete Expansion I/O

2085-IQ16 and 2085-IQ32T DC Sink/Source Input Modules⁽¹⁾

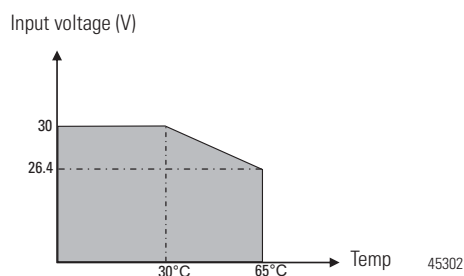
Attribute	2085-IQ16		2085-IQ32T
Number of inputs	16 sink/source		32 sink/source
Dimensions, HxWxD	44.5 x 90 x 87 mm (1.75 x 3.54 x 3.42 in.)		
Shipping weight, approx.	220 g (7.76 oz)		
Bus current draw, max	170 mA @ 5V DC		190 mA @ 5V DC
Wire size			
		Min	Max
	Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)
	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)
	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max		
Wiring category ⁽²⁾	2 – on signal ports		
Terminal screw torque, max	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽³⁾		
Input circuit type	24V AC/DC sink/source or 24V AC 50/60 Hz		
Power dissipation, total	4.5 W		7 W
Power supply	24V DC		

2085-IQ16 and 2085-IQ32T DC Sink/Source Input Modules⁽¹⁾

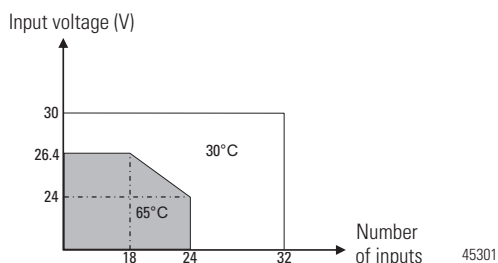
Attribute	2085-IQ16	2085-IQ32T
Status indicators	16 yellow indicators	32 yellow indicators
Isolation voltage	50V (continuous), Reinforced Insulation Type, channel to system Type tested @ 720V DC for 60 s	
Enclosure type rating	Meets IP20	
North American temp code	T4	
Operating voltage range	10...30V DC, Class 2 21.6...26.4V AC, 50/60 Hz, Class 2 See Derating Curve for 2085-IQ16 and Derating Curve for 2085-IQ32T on page 46	
Off-state voltage, max	5V DC	
Off-state current, max	1.5 mA	1.2 mA
On-state current, min	1.8 mA @ 10V DC	
On-state current, nom	6.0 mA @ 24V DC	5.2 mA @ 24V DC
On-state current, max	8.0 mA @ 30V DC	7.0 mA @ 30V DC
Input impedance, max	3.9 k Ω	4.6 k Ω
IEC input compatibility	Type 3	Type 1

- (1) Meets IEC Type 1 24V DC Input Specifications.
- (2) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).
- (3) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Derating Curve for 2085-IQ16



Derating Curve for 2085-IQ32T



2085-OV16 Sink and 2085-OB16 Source DC Output Module

Attribute	2085-OV16	2085-OB16		
Number of outputs	16 sinking	16 sourcing		
Dimensions, HxWxD	44.5 x 90 x 87 mm (1.75 x 3.54 x 3.42 in.)			
Shipping weight, approx.	220 g (7.76 oz)			
Bus current draw, max	200 mA @ 5V DC			
Wire size				
		Min	Max	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max
	Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)	
	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)	
Wiring category ⁽¹⁾	2 – on signal ports			
Terminal screw torque, max	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽²⁾			
Output circuit type	24V DC sink		24V DC source	
Power dissipation, total	5 W			
Power supply	24V DC, Class 2			
Status indicators	16 Yellow channel indicators			
Isolation voltage	50V (continuous), Reinforced Insulation Type, channel to system Type tested @ 720V AC for 60 s			
Enclosure type rating	Meets IP20			
North American temp code	T4			

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

(2) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Output Specifications – 2085-OV16 and 2085-OB16

Attribute	2085-OV16	2085-OB16
Operating voltage range	10...30V DC	
On-state voltage, min	10V DC	
On-state voltage, nom	24V DC	
On-state voltage, max	30V DC	
On-state current, max	0.5 A @ 30V DC, per output 8 A, per module	
On-state voltage drop, max	1.0V DC @ 0.5 A	
Off-state leakage current, max	1 mA @ 30V DC	

2085-IA8, 2085-IM8, 2085-OA8 AC Input/Output Modules

Attribute	2085-IA8	2085-IM8	2085-OA8	
Number of I/O	8			
Dimensions, HxWxD	28 x 90 x 87 mm (1.10 x 3.54 x 3.42 in.)			
Shipping weight, approx.	140 g (4.93 oz)			
Bus current draw, max	5V DC, 150 mA		5V DC, 180 mA	
Wire size				
		Min	Max	
	Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max
	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)	
Insulation stripping length	10 mm (0.39 in.)			
Wiring category ⁽¹⁾	2 – on signal ports			
Wire type	Copper			
Terminal screw torque, max	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽²⁾			
Input/output circuit type	120V AC input	240V AC input	120V/240V AC output	
Power supply	120V AC, 50/60 Hz	240V AC, 50/60 Hz	120V/240V AC, 50/60 Hz	
Power dissipation, total	2.36 W	2.34 W	5.19 W	
Enclosure type rating	Meets IP20			
Status indicators	8 yellow indicators			
Isolation voltage	150V (continuous), Reinforced Insulation Type, channel to system Type tested @ 1950V DC for 60 s	240V (continuous), Reinforced Insulation Type, channel to system Type tested @ 3250V DC for 60 s		
North American temp code	T4			

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

(2) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Input Specifications – 2085-IA8 and 2085-IM8

Attribute	2085-IA8	2085-IM8
Number of Inputs	8	
Voltage category	120V AC	240V AC
Operating voltage range	74...120V AC, 50/60 Hz	159...240V AC, 50/60 Hz
Off-state voltage, max	20V AC	40V AC

Input Specifications – 2005-IA8 and 2005-IM8

Attribute	2005-IA8	2005-IM8
Off-state current, max	2.5 mA	
On-state current, min	5.0 mA @ 74V AC	4.0 mA @ 159V AC
On-state current, max	12.5 mA @ 120V AC	7.0 mA @ 240V AC
Input impedance, max	22.2 k Ω	
Inrush current, max	450 mA	
Input filter time Off to On On to Off	≤ 20 ms	
IEC type compliance	Type 3	

Output Specifications – 2005-OA8

Attribute	2005-OA8
Number of inputs	8
Voltage category	120V/230V AC
Operating voltage range	120...240V AC, 50/60 Hz
Output voltage, min	85V AC
Output voltage, max	240V AC
Off-state leakage current, max	2.5 mA
On-state current, min	10 mA per output
On-state current, max	0.5 A per output
On-state current, per module, max	4 A
Off-state voltage drop, max	1.5V AC @ 0.5 A 2.5V AC @ 10 mA
Fusing	Not protected. A suitable rating fuse is recommended to protect outputs.
Output signal delay Off to On On to Off	9.3 ms for 60 Hz, 11 ms for 50 Hz 9.3 ms for 60 Hz, 11 ms for 50 Hz
Surge current, max	5 A

2005-OW8 and 2005-OW16 Relay Output Module

Attribute	2085-OW8	2085-OW16												
Number of outputs	8, relay	16, relay												
Dimensions, HxWxD	28 x 90 x 87 mm (1.10 x 3.54 x 3.42 in.)	44.5 x 90 x 87 mm (1.75 x 3.54 x 3.42 in.)												
Shipping weight, approx.	140 g (4.93 oz)	220 g (7.76 oz)												
Wire size	<table><tr><th></th><th>Min</th><th>Max</th><th></th></tr><tr><td>Solid</td><td>0.34 mm² (22 AWG)</td><td>2.5 mm² (14 AWG)</td><td rowspan="2">Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max</td></tr><tr><td>Stranded</td><td>0.20 mm²</td><td>2.5 mm² (14 AWG)</td></tr></table>				Min	Max		Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)
	Min	Max												
Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max											
Stranded	0.20 mm ²	2.5 mm ² (14 AWG)												
Insulation strip length	10 mm (0.39 in.)													

2085-OW8 and 2085-OW16 Relay Output Module

Attribute	2085-OW8	2085-OW16																														
Wiring category ⁽¹⁾	2 – on signal ports																															
Wire type	Copper																															
Terminal screw torque, max	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽²⁾																															
Bus current draw, max	5V DC, 120 mA 24V DC, 50 mA	5V DC, 160 mA 24V DC, 100 mA																														
Load current, max	2 A																															
Power dissipation, total	2.72 W	5.14 W																														
Relay contact, (0.35 power factor)	<table><tr><th rowspan="2">Max Volts</th><th colspan="2">Amperes</th><th>Amperes</th><th colspan="2">Volt Amperes</th></tr><tr><th>Make</th><th>Break</th><th>Continuous</th><th>Make</th><th>Break</th></tr><tr><td>120V AC</td><td>15 A</td><td>1.5 A</td><td>2.0 A</td><td rowspan="2">1800V A</td><td rowspan="2">180V A</td></tr><tr><td>240V AC</td><td>7.5 A</td><td>0.75 A</td><td></td></tr><tr><td>24V DC</td><td colspan="2">1.0 A</td><td rowspan="2">1.0 A</td><td colspan="2" rowspan="2">28V A</td></tr><tr><td>125V DC</td><td colspan="2">0.22 A</td></tr></table>		Max Volts	Amperes		Amperes	Volt Amperes		Make	Break	Continuous	Make	Break	120V AC	15 A	1.5 A	2.0 A	1800V A	180V A	240V AC	7.5 A	0.75 A		24V DC	1.0 A		1.0 A	28V A		125V DC	0.22 A	
Max Volts	Amperes			Amperes	Volt Amperes																											
	Make	Break	Continuous	Make	Break																											
120V AC	15 A	1.5 A	2.0 A	1800V A	180V A																											
240V AC	7.5 A	0.75 A																														
24V DC	1.0 A		1.0 A	28V A																												
125V DC	0.22 A																															
Minimum load, per point	10 mA per point																															
Off-state leakage, max	1.5 mA																															
Status indicators	8 yellow indicators	16 yellow indicators																														
Isolation voltage	240V (continuous), Reinforced Insulation Type, channel to system Type tested @ 3250V DC for 60 s																															
Pilot duty rating	C300, R150																															
Enclosure type rating	Meets IP20																															
North American temp code	T4																															

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

(2) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Analog Expansion I/O

2085-IF4, 2085-IF8, 2085-OF4 Analog Input and Output Modules

Attribute	2085-IF4	2085-OF4	2085-IF8
Number of I/O	4		8
Dimensions, HxWxD	28 x 90 x 87 mm (1.1 x 3.54 x 3.42 in.)		44.5 x 90 x 87 mm (1.75 x 3.54 x 3.42 in.)
Shipping weight, approx.	140 g (4.93 oz)		220 g (7.76 oz)
Bus current draw, max	5V DC, 100 mA 24V DC, 50 mA	5V DC, 160 mA 24V DC, 120 mA	5V DC, 110 mA 24V DC, 50 mA

2085-IF4, 2085-IF8, 2085-OF4 Analog Input and Output Modules

Attribute	2085-IF4	2085-OF4	2085-IF8
Wire size			
		Min	Max
	Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)
	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)
	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max		
Wiring category ⁽¹⁾	2 – on signal ports		
Wire type	Shielded		
Terminal screw torque	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽²⁾		
Power dissipation, total	1.7 W	3.7 W	1.75 W
Enclosure type rating	Meets IP20		
Status indicators	1 green health indicator	1 green health indicator	1 green health indicator 8 red error indicators
Isolation voltage	50V (continuous), Reinforced Insulation Type, channel to system and channel to channel. Type tested @ 720V DC for 60 s		
North American temp code	T4		

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

(2) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Input Specifications – 2085-IF4 and 2085-IF8

Attribute	2085-IF4	2085-IF8
Number of inputs	4	8
Resolution Voltage Current	14 bits (13 bits plus sign bit) 1.28 mV/cnt unipolar; 1.28 mV/cnt bipolar 1.28 µA/cnt	
Data format	Left justified, 16 bit 2s complement	
Conversion type	SAR	
Update rate	< 2 ms per enabled channel without 50 Hz/60 Hz rejection, < 8 ms for all channel, 8 ms with 50 Hz/60 Hz rejection	
Step response time up to 63% 2-point Moving Average Filter 4-point Moving Average Filter 8-point Moving Average Filter 50/60 Hz Rejection Filter	4...16 ms (for 1...8 enabled channels) 6...24 ms (for 1...8 enabled channels) 12...60 ms (for 1...8 enabled channels) 600 ms (for 1...8 enabled channels)	
Input current terminal, user configurable	4...20 mA (default) 0...20 mA	
Input voltage terminal, user configurable	±10V 0...10V	
Input impedance	Voltage terminal >1 MΩ Current terminal <100 Ω	

Input Specifications – 2085-IF4 and 2085-IF8

Attribute	2085-IF4	2085-IF8
Absolute accuracy	$\pm 0.10\%$ Full Scale @ 25 ° C	
Accuracy drift with temp	Voltage terminal – 0.00428 % Full Scale/° C Current terminal – 0.00407 % Full Scale/° C	
Calibration required	Factory calibrated. No customer calibration supported.	
Overload, max.	30V continuous or 32 mA continuous, one channel at a time.	
Channel diagnostics	Over and under range or open circuit condition by bit reporting	

Output Specifications – 2085-OF4

Attribute	2085-OF4
Number of outputs	4
Resolution Voltage Current	12 bits unipolar; 11 bits plus sign bipolar 2.56 mV/cnt unipolar; 5.13 mV/cnt bipolar 5.13 μ A/cnt
Data format	Left justified, 16 bit 2s complement
Step response time up to 63%	2 ms
Conversion rate, max	2 ms per channel
Output current terminal, user configurable	0 mA output until module is configured 4...20 mA (default) 0...20 mA
Output voltage terminal, user configurable	± 10 V 0...10V
Current load on voltage output, max	3 mA
Absolute accuracy Voltage terminal Current terminal	0.133 % Full Scale @ 25 ° C or better 0.425 % Full Scale @ 25 ° C or better
Accuracy drift with temp	Voltage terminal – 0.0045 % Full Scale/° C Current terminal – 0.0069 % Full Scale/° C
Resistive load on mA output	15...500 ohm @ 24V DC

Specialty Expansion I/O

2085-IRT4 Temperature Input Module

Attribute	2085-IRT4
Number of inputs	4
Dimensions, HxWxD	44.5 x 90 x 87 mm (1.75 x 3.54 x 3.42 in.)
Shipping weight, approx.	220 g (7.76 oz)
Bus current draw, max	5V DC, 160 mA 24V DC, 50 mA

2085-IRT4 Temperature Input Module

Attribute	2085-IRT4			
Wire size				
		Min	Max	
	Solid	0.34 mm ² (22 AWG)	2.5 mm ² (14 AWG)	Copper wire rated @ 90 °C (194 °F), or greater, 1.2 mm (3/64 in.) insulation max
	Stranded	0.20 mm ²	2.5 mm ² (14 AWG)	
Wiring category ⁽¹⁾	2 – on signal ports			
Terminal screw torque	0.5...0.6 Nm (4.4...5.3 lb-in.) ⁽²⁾			
Input type	Thermocouple type: B, C, E, J, K, TXK/XK (L), N, R, S, T RTD type: 100 Ω Pt α = 0.00385 Euro 200 Ω Pt α = 0.00385 Euro 100 Ω Pt α = 0.003916 U.S. 200 Ω Pt α = 0.003916 U.S. 100 Ω Nickel 618 200 Ω Nickel 618 120 Ω Nickel 672 10 Ω Copper 427 mV range: 0...100 mV Ohm input: 0...500 Ω			
Resolution	16 bits			
Channel update time, typical	12...500 ms per enabled channel			
Input impedance	> 10 M Ω			
Accuracy	±0.5...±3.0 °C accuracy for Thermocouple inputs ±0.2...±0.6 °C accuracy for RTD inputs			
Power dissipation, total	2 W			
Enclosure type rating	Meets IP20			
Status indicators	1 green health indicator			
Isolation voltage	50V (continuous), Reinforced Insulation Type, channel to system. Type tested @ 720V DC for 60 s			
North American temp code	T4			

(1) Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

(2) RTB hold down screws should be tightened by hand. They should not be tightened using a power tool.

Environment Specifications

Environment Specifications for Micro800 Expansion I/O Modules

Attribute	Value
Temperature, operating	IEC60068-2-1 (Test Ad, Operating Cold), IEC60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): -20...65 °C (-4...149 °F)
Temperature, nonoperating	IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock): -40...85 °C (-40...185 °F)
Temperature, surrounding air, max.	65 °C (149 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...95% noncondensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 10...500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 25 g
Shock, nonoperating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 25 g for DIN Rail Mounting 35 g for Panel Mounting
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6 kV contact discharges 8 kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 900 MHz 10V/m with 200 Hz 50% Pulse 100% AM @ 1890 MHz 10V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B Immunity	IEC 61000-4-4: ±2 kV @ 5 kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ±1 kV line-line(DM) and ±2 kV line-earth(CM) on power ports ±2 kV line-earth(CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

Certifications – All Micro800 Expansion I/O Modules

Certification (when product is marked)⁽¹⁾	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E322657. UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E334470
CE	European Union 2004/108/EC EMC Directive, compliant with: EN 61326-1; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: Article 58-2 of Radio Waves Act, Clause 3

(1) See the Product Certification link at <http://www.rockwellautomation.com/products/certification/> for Declaration of Conformity, Certificates, and other certification details.

Notes:

Expansion I/O Data Mapping

This section includes I/O data mapping for the discrete, analog, and specialty expansion I/O modules.

Discrete I/O Data Mapping

TIP Use the Connected Components Workbench software to see Global Variables.

2085-IQ16 and 2085-IQ32T I/O Data Mapping

Discrete input states can be read from Global Variables `_IO_Xx_DI_yy`, where `x` represents the expansion slot number 1...4 and `yy` represents the point number 00...15 for 2085-IQ16 and 00...31 for 2085-IQ32T.

2085-OV16 and 2085-OB16 I/O Data Mapping

Discrete output states can be read from Global Variables `_IO_Xx_ST_yy`, where “`x`” represents the expansion slot number 1...4 and `yy` represents the point number 00...15.

Discrete output states can be written to Global Variables `_IO_Xx_DO_yy`, where “`x`” represents the expansion slot number 1...4 and `yy` represents the point number 00...15.

2085-IA8 and 2085-IM8 I/O Data Mapping

Discrete input states can be read from Global Variables `_IO_Xx_DI_yy`, where `x` represents the expansion slot number 1...4 and `yy` represents the point number 00...07.

2085-OA8 I/O Data Mapping

Discrete output states can be read from Global Variables `_IO_Xx_ST_yy`, where “`x`” represents the expansion slot number 1...4 and `yy` represents the point number 00...07.

Discrete output states can be written to Global Variables `_IO_Xx_DO_yy`, where “`x`” represents the expansion slot number 1...4 and `yy` represents the point number 00...07.

2085-OW8 and 2085-OW16 I/O Data Mapping

Discrete output states can be read from Global Variables `_IO_Xx_ST_yy`, where “x” represents the expansion slot number 1...4 and yy represents the point number 00...07 for 2085-OW8 and 00...15 for 2085-OW16.

Discrete output states can be written to Global Variables `_IO_Xx_DO_yy`, where “x” represents the expansion slot number 1...4 and yy represents the point number 00...07 for 2085-OW8 and 00...15 for 2085-OW16.

Analog I/O Data Mapping

The following sections provide I/O and status mapping for the following analog expansion I/O modules:

Catalog Number	Description
2085-IF4	4-channel, 14-bit analog voltage/current input module
2085-IF8	8-channel, 14-bit analog voltage/current input module
2085-OF4	4-channel, 12-bit analog voltage/current output module
2085-IRT4	4-channel, 16-bit RTD and Thermocouple input module

TIP Use the Connected Components Workbench software to see Global Variables.

2085-IF4 I/O Data Mapping

Analog input values are read from Global Variables `_IO_Xx_AI_yy`, where “x” represents the expansion slot number 1...4 and yy represents the channel number 00...03.

Analog input status values can be read from Global Variables `IO_Xx_ST_yy`, where “x” represents the expansion slot number 1...4 and yy represents the status word number 00...02.

2085-IF4⁽¹⁾ Status Data Mapping

Word	R/W	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status 0	R	PU	GF	CRC	Reserved												
Status 1	R	Reserved		HHA1	LLA1	HA1	LA1	DE1	S1	Reserved		HHA0	LLA0	HA0	LA0	DE0	S0
Status 2	R	Reserved		HHA3	LLA3	HA3	LA3	DE3	S3	Reserved		HHA2	LLA2	HA2	LA2	DE2	S2

(1) See Field Descriptions table for definition of each bit.

2085-IF8 I/O Data Mapping

Analog input values are read from Global Variables `_IO_Xx_AI_yy`, where “x” represents the expansion slot number 1...4 and yy represents the channel number 00...07.

Analog input status values can be read from Global Variables IO_Xx_ST_yy, where “x” represents the expansion slot number 1...4 and yy represents the status word number 00...04. Individual bits within a status word can be read by appending a .zz to the Global Variable name, where “zz” is the bit number 00...15.

2085-IF8⁽¹⁾ Status Data Mapping

Word	R/W	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status 0	R	PU	GF	CRC	Reserved												
Status 1	R	Reserved		HHA1	LLA1	HA1	LA1	DE1	S1	Reserved		HHA0	LLA0	HA0	LA0	DE0	S0
Status 2	R	Reserved		HHA3	LLA3	HA3	LA3	DE3	S3	Reserved		HHA2	LLA2	HA2	LA2	DE2	S2
Status 3	R	Reserved		HHA5	LLA5	HA5	LA5	DE5	S5	Reserved		HHA4	LLA4	HA4	LA4	DE4	S4
Status 4	R	Reserved		HHA7	LLA7	HA7	LA7	DE7	S7	Reserved		HHA6	LLA6	HA6	LA6	DE6	S6

(1) See Bit Field Descriptions table for a detailed definition of each bit.

Field Descriptions for 2085-IF4 and 2085-IF8 Input Modules

Field	Description	
CRC	CRC error	This bit is set (1) when there is a CRC error on the data received. It gets cleared when the next good data is received.
DE#	Data Error	These bits are set (1) when the enabled input channels are not getting any reading for the current sampling. The respective returned Input Data value remains the same as the previous sample.
GF	General Fault	This bit is set (1) when any of these faults occur: RAM test failure, ROM test failure, EEPROM failure, and reserved bits. All channel fault bits (S#) are set too.
HA#	High Alarm Overrange	These bits are set (1) when the input channel exceeds a preset high limit defined by the configuration selected (UL# is set).
HHA#	High High Alarm Overrange	These bits are set (1) when the input channel exceeds a preset high-high limit defined by the configuration selected (UL# is set).
LA#	Low Alarm (underrange)	These bits are set (1) when the input channel goes below the configured low alarm limit.
LLA#	Low Low Alarm (underrange)	These bits are set (1) when the input channel goes below the configured low-low alarm limit.
PU	Power Up	1. This bit is set after a power on. It is cleared when good configuration data is accepted by the module. 2. It is set when an unexpected MCU reset occurs in RUN mode. All channel fault bits (S#) are set too. The module stays connected with no configuration after the reset. PU and channel fault bits (S#) are cleared when a good configuration is accepted.
S#	Channel fault	These bits are set(1) if the corresponding channels are open, have data error or under/overrange.

2085-OF4 I/O Data Mapping

Analog output data can be written to Global Variables `_IO_Xx_AO_yy`, where “x” represents the expansion slot number 1...4 and yy represents the channel number 00...03.

Control bit states can be written to Global Variable `_IO_Xx_CO_00.zz`, where “x” represents the expansion slot number 1...4 and “zz” represents the bit number 00...12.

2085-OF4 Control Data Mapping

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Control 0	Reserved				CE3	CE2	CE1	CE0	UU3	U03	UU2	U02	UU1	U01	UU0	U00

Channel Alarm/Error Unlatch

UUx and **U0x** are written during run mode to clear any latched under- and over-range alarms. The alarm is unlatched when the unlatch bit is set (1) and the alarm condition no longer exists. If the alarm condition persists, then the unlatch bit has no effect.

CEx are written during run mode to clear any DAC hardware error bits and re-enable the error-disabled channel *x*.

You need to keep the unlatch bit set until verification from the appropriate input channel status word says that the alarm status bit has cleared(0), then you need to reset(0) the unlatch bit.

Status Data

Analog output status can be read from Global Variables `IO_Xx_ST_yy`, where “x” represents the expansion slot number 1...4 and “yy” represents the status word number 00...06. Individual bits within a status word can be read by appending a .zz to the Global Variable name, where “zz” is the bit number 00...15.

2085-OF4 Status Data Mapping

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status 0	Channel 0 Data Value															
Status 1	Channel 1 Data Value															
Status 2	Channel 2 Data Value															
Status 3	Channel 3 Data Value															

2085-OF4 Status Data Mapping

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status 4	PU	GF	CRC	Reserved	Reserved				E3	E2	E1	E0	S3	S2	S1	S0
Status 5	Reserved		U3	O3	Reserved		U2	O2	Reserved		U1	O1	Reserved		U0	O0
Status 6	Reserved															

Field Descriptions for 2085-OF4 Status Word

Field	Description	
CRC	CRC error	Indicates there is a CRC error on data receive. All channel fault bits (Sx) are also set. The error is cleared when the next good data is received.
Ex	Error	Indicates there is an DAC hardware error, broken wire or high load resistance associated with the channel x, an error code may be displayed on the respective input word (0...3) and the corresponding channel is locked (disabled) until user clears the error by writing the CEx bit in output data.
GF	General Fault	Indicates a fault has occurred, including: RAM test failure, ROM test failure, EEPROM failure, and reserved bits. All channel fault bits (Sx) are also set.
Ox	Over-Range Flag	Indicates the controller is attempting to drive the analog output above its normal operating range or above the channel's High Clamp level. However the module continues to convert analog output data to a maximum full range value if clamp levels are not set for the channel.
PU	Power Up	Indicates an unexpected MCU reset has occurred in RUN mode. All channel error bits (Ex) and fault bits (Sx) are also set. The module stays connected with no configuration after the reset. PU and channel fault bits are cleared when a good configuration is downloaded.
Sx	Channel Fault	Indicates there is an error associated with the channel x.
Ux	Under-Range Flag	Indicates the controller is attempting to drive the analog output below its normal operating range or below the channel's Low Clamp level (if clamp limits are set for the channel).

Specialty I/O Data Mapping*2085-IRT4 I/O Data Mapping*

Analog input values can be read from Global Variables `_IO_Xx_AI_yy`, where "x" represents the expansion slot number 1...4 and yy represents the channel number 00...03.

Analog input status can be read from Global Variables `IO_Xx_ST_yy`, where "x" represents the expansion slot number 1...4 and yy represents the status word number 00...02. Individual bits within a status word can be read by appending a `.zz` to the Global Variable name, where "zz" is the bit number 00...15.

2085-IRT4 Status Data Mapping

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status 0	DE3	DE2	DE1	DE0	OC3	OC2	OC1	OC0	R3	R2	R1	R0	S3	S2	S1	S0
Status 1	O3	O2	O1	O0	U3	U2	U1	U0	T3	T2	T1	T0	CJC over	CJC under	CJC OC	CJC DE
Status 2	PU	GF	CRC	Reserved												

Field Descriptions for 2085-IRT4

Field	Description	
CJC OC	Cold Junction Compensation Open Circuit	Indicates that the cold junction sensor is open-circuit. CJC DE bit, when set, indicates the cold junction sensor current readings is not reliable. The previous reading shall be used instead. It indicates internal compensation status if Tx is set.
CJC DE	Cold Junction Compensation Data Error	Indicates that the cold junction sensor current readings is not reliable. The previous reading will be used instead. It indicates internal compensation status if Tx is set.
CJC over	Cold Junction Compensation overrange	Indicates cold junction sensor overrange (above 75 °C).
CJC under	Cold Junction Compensation underrange	Indicates cold junction sensor is underrange (below -25 °C).
CRC	CRC error	Indicates there is a CRC error on data receive. All channel fault bits (Sx) are also set. The error is cleared when the next good data is received.
DEx	Data Error	Indicates that the current input data is not reliable. The previous input data is sent to the controller instead. Diagnostic status bits are for internal use only.
GF	General Fault	Indicates a fault has occurred, including: RAM test failure, ROM test failure, EEPROM failure, and reserved bits. All channel fault bits (Sx) are also set.
OCx	Open-Circuit Flag	Indicates that an open-circuit condition exists on the channel x.
Ox	Over-Range Flag	Indicates the controller is attempting to drive the analog output above its normal operating range or above the channel's High Clamp level. However the module continues to convert analog output data to a maximum full range value if clamp levels are not set for the channel.
PU	Power Up	Indicates an unexpected MCU reset has occurred in RUN mode. All channel error bits (Ex) and fault bits (Sx) are also set. The module stays connected with no configuration after the reset. PU and channel fault bits are cleared when a good configuration is downloaded.
Rx	RTD compensation	Indicates that the RTD compensation of channel x is not working. This is effective for RTD and ohm type only.

Field Descriptions for 2085-IRT4

Field	Description	
Sx	Channel Fault	Indicates there is an error associated with the channel x.
Tx	Thermocouple compensation	Indicates that the thermocouple compensation of channel x is not working. This is effective for thermocouple type only.
Ux	Underrange	Indicates that the input of channel x is at the minimum end of its normal operating range. The module automatically resets the bit when the under-range condition is cleared and the data value is within the normal operating range.

Calibration of Analog Modules

The analog modules are shipped to you calibrated.

Specifications

See [Expansion I/O on page 240](#) for a list of specifications for each of the analog and digital expansion I/O modules.

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Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.

At <http://www.rockwellautomation.com/support/>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/support/>.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication [RA-DU002](#), available at <http://www.rockwellautomation.com/literature/>.

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