User Manual

Allen-Bradley

ControlLogix Low-speed Counter Module

Catalog Number 1756-LSC8XIB8I

Allen-Bradley • Rockwell Software

Rockwell Automation

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 SGI-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.

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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.

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The ControlLogix® counter module counts incoming pulses and returns accumulated count, instantaneous and average frequencies, and instantaneous and average pulse width values. The module has two configurable On/Off windows per counter that can be used to affect outputs on a 1756-OB16IEF module in the same chassis.

The counter module requires the following:

- RSLogix™ 5000 software, version 18.02.00 or later
- The Add-on Profile (AOP) for the module available for download at http://support.rockwellautomation.com/controlflash/LogixProfiler.asp
- Ability to program and operate an Allen-Bradley® ControlLogix controller

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
1756 ControlLogix I/O Modules Specifications Technical Data, publication 1756-TD002	Provides specifications for ControlLogix I/O modules.
ControlLogix System User Manual, publication 1756-UM001	Describes how to install and use traditional and extreme environment ControlLogix controllers.
ControlLogix Digital I/O Modules User Manual, publication 1756-UM058	Describes how to install and use ControlLogix digital I/O modules.
ControlLogix Analog I/O Modules User Manual, publication 1756-UM009	Describes how to install and use ControlLogix analog I/O modules.
ControlLogix Peer I/O Control Application Technique, publication 1756-AT016	Describes typical peer control applications and provides details about how to configure I/O modules for peer control operation.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

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

Notes:

Module Features

About the Counter Module

The counter module is an eight counter, eight input point, 24V high-speed DC isolated, sink/source input module. The counter module has eight dedicated, 40 kHz counters. Each counter returns accumulated count, instantaneous frequency, average frequency, instantaneous pulse width, and average pulse width. The module provides an additional eight inputs that you can assign to counter control functions, including Up/Down Count, Count Enable, Reset Count, and Preset Count, or use as standard hardware inputs.

Based on onboard comparisons of count or frequency values, each counter has two configurable On/Off windows that are capable of controlling the On/Off behavior of outputs on a 1756-OB16IEF module. The counter module is capable of evaluating count values and activating outputs independent of the controller for fast response time.

Proximity Sensor Compatibility

Inputs comply with the IEC 61131-2 directive for Type 3 sensors. Compatible products include Allen-Bradley Bulletin 871, 872, and 875 proximity sensors.

To use the counter module with non-IEC Type 3 sensors, refer to Appendix C for alternate wiring and recommendations.

Module Features

The counter module provides the following features.

Table 1 - Counter Module Features

Feature	Description
Dedicated counters	Counters 0…7 on the module are dedicated to counting incoming pulses from a proximity sensor. Each counter returns these values: • Accumulated count • Instantaneous and average frequencies • Instantaneous and average pulse width For descriptions of each value, see Table 3 on page 12.
Configurable On/Off windows	The module provides two configurable On/Off windows per counter for output control: • Configure each window to use accumulated count, instantaneous frequency, or average frequency. • Define On/Off values via output tags. For more about On/Off windows, see page 13.
Real-time control over preset and rollover values	Preset and rollover values for each counter are configurable via output tags for real-time control: • For more about preset values, see page 21. • For more about rollover values, see page 14.
Control of counter functionality via hardware inputs or output tags	Counter control functions can be invoked by either of the following: • The state of external input devices connected to the eight standard hardware inputs on the module. • Output tags. Counter control functions include Up/Down Count, Count Enable, Preset Count, and Reset Count. For more information, see Counter Control Functions on page 15.
Peer-to-peer I/O control	The module can be used in peer control applications in which input data is consumed by a1756-OB16IEF output module and used to control outputs. For more information, see Output Control on page 23 and the Peer I/O Control Application Technique, publication 1756-AT016.

Additional I/O Module Features

Table 2 lists additional features of all ControlLogix I/O modules, including the counter module.

Table 2 - Digital I/O Module Features

Feature	Description
Configuration software	RSLogix 5000 software has a custom interface to configure your module. All module features can be enabled and disabled through the software.
Software configurable filter times	On to Off and Off to On filter times can be adjusted through RSLogix 5000 software for ControlLogix input modules. These filters improve noise immunity within a signal. A larger filter value affects the length of delay times for signals from input modules. You can configure filter values for the eight hardware inputs and eight counters separately or use no filtering.
Module fault reporting	I/O modules provide both hardware and software indications when a module fault occurs. Status indicators signal fault conditions. RSLogix 5000 software describes the fault message so you know what action to take to resume normal operation.
Status indicators	Status indicators on the front of the module report the operational status of the module. Status indicators for counters 0…7 and counter control hardware inputs 0…7 signal the presence of voltage at each terminal.

Table 2 - Digital I/O Module Features (continued)

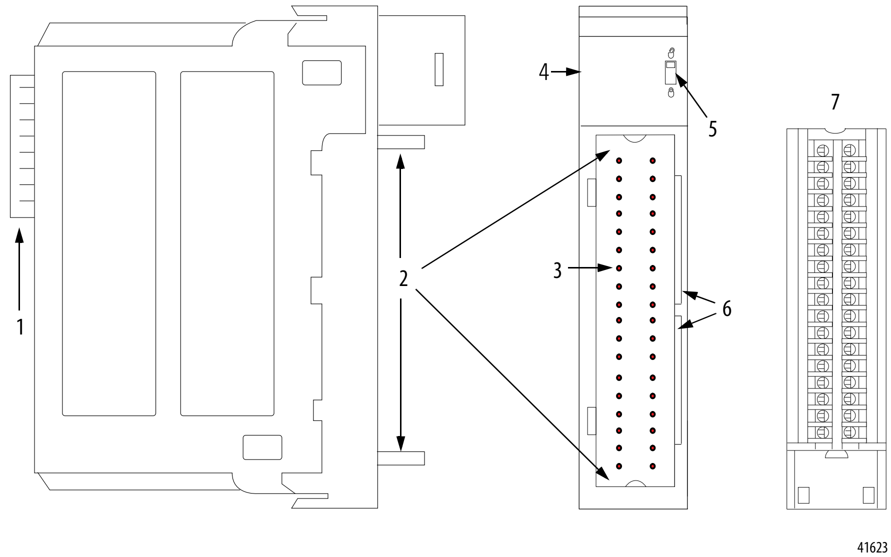
Feature	Description
Producer/consumer model	Logix5000 controllers let you produce (broadcast) and consume (receive) system-shared tags. The module can produce data without having to be polled first by a controller. The module produces the data, and any owner-controller device or 1756-OB16IEF peer output module can consume it. The module produces count, frequency, and pulse width values at the RPI. In addition to the RPI, the module also produces data whenever a Change of State (COS) occurs. A COS causes an immediate production of data and is triggered by a change in value for these input tags: • Pt[*x*].Data—Hardware input transitions On or Off. • Counter[*x*].InWindow0—Count or frequency value enters or exits window 0 parameters. • Counter[*x*].InWindow1—Count or frequency value enters or exits window 1 parameters.
Electronic Keying	Electronic keying prevents communication to a module that does not match the type and revision expected. For more information, see Appendix A.
RIUP	RIUP is an abbreviation for removal and insertion under power. The module can be inserted and removed from the chassis while power is applied. This flexibility allows you to maintain the module, either removing or inserting, without disrupting the rest of the controlled process.

WARNING: When you insert or remove a module while backplane power is applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage as a result of the following:

- Sending an erroneous signal to your system's field devices causing unintended machine motion or loss of process control.
- Causing an explosion in a hazardous environment.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connectors. Worn contacts may create electrical resistance that can affect module operation.

Parts Illustration



Item	Description
1	Backplane connector—The backplane interface for the ControlLogix system connects the module to the backplane.
2	Top and bottom guides—Guides provide assistance in seating the removable terminal block (RTB) onto the module.
3	Connector pins—Input/output, power, and grounding connections are made to the module through these pins with the use of an RTB.
4	Status indicators—Indicators display the status of communication, module health, and presence of input/output devices. Use these indicators to help in troubleshooting.
5	Locking tab—The locking tab anchors the RTB on the module and maintains wiring connections.
6	Slots for keying—The slots let you mechanically key the RTB to prevent inadvertently making the wrong wire connections to your module.
7	Removable terminal block—The RTB lets you connect and house the wiring. The counter module supports two types of RTBs: • Cage clamp, catalog number 1756-TBCH • Spring clamp, catalog number 1756-TBS6H

For wiring instructions, see Chapter 3.

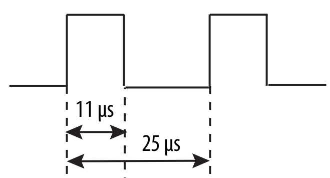
Module Operation

Counters 0…7

Counters 0...7 on the module are dedicated to up and down counting of incoming pulses. The module counts rising pulse edges at a maximum of 40 kHz. However, the following limitations apply as shown in Figure 1:

- The duration of a pulse cannot be less than 11 µs, which is the minimum hardware delay time for a transition to be detected by an input.
- For repetitive counting, the total cycle time cannot be less than 25 µs.

Figure 1 - Pulse Cycle Limits



For complete specifications, refer to the 1756 ControlLogix I/O Modules Specifications Technical Data, publication 1756-TD002.

Each of the eight counters automatically returns the values described in Table 3.

Table 3 - Counter Values

Value	Data Type	Description
Accumulated count	DINT	The total number of pulses. The module counts pulses on their rising edge. The module stores accumulated count in the Counter[*x*].Count input tag.
Instantaneous frequency	REAL	The frequency of the last pulse detected by a counter. The module calculates frequency by timing from rising edge to rising edge of the last two pulses (cycle time): • If the cycle time is less than the frequency timeout (Counter[x].FreqTimeout) value, then instantaneous frequency = 1/cycle time. • If the cycle time is greater than the frequency timeout (Counter[x].FreqTimeout) value, then instantaneous frequency = 0. In instantaneous frequency calculations, the rising edge of the pulse that completes a cycle time is also the rising edge of the pulse that starts the next cycle time. To determine the accuracy of the instantaneous frequency value, use this formula: 0.0011 x Counter[*x*].Frequency value For example, a 1 kHz input frequency has a worst case instantaneous frequency value of ±1.1%. The module stores instantaneous frequency in the Counter[*x*].Frequency input tag.
Average frequency[1][2]	REAL	The average frequency of pulses. The module calculates average frequency over the number of pulses defined in the Counter[*x*].FreqAveragePulseCount configuration tag. You can configure this number of pulses on the Counter Configuration tab of the Module Properties dialog box. The module calculates average frequency as follows. 1. Starts timing on the first rising pulse edge and stops timing on the Counter[*x*].FreqAveragePulseCount rising pulse edge. 2. Calculates frequency based on the total time from step 1 and multiplies the Counter[*x*].FreqAveragePulseCount value by the pulse count. For example, if Counter[*x*].FreqAveragePulseCount = 10 and the calculated frequency = 1 Hz, the average frequency = 10 Hz (10 pulses/ 1 second). If Counter[*x*].FreqAveragePulseCount = 10, the module updates average frequency values as follows: • From pulses 0…9, the module does not calculate average frequency and returns a value of zero. • From pulses 10…19, the module calculates and updates the average frequency for pulses 0…9 at pulse 10. • From pulses 20…29, the module calculates and updates the average frequency for pulses 10…19 at pulse 20, and so on. The module stores the average frequency in the Counter[*x*].FreqAverage input tag.
Instantaneous pulse width	REAL	The duration in microseconds of the last rising pulse edge to falling pulse edge. The accuracy of the instantaneous pulse width is always ± -11µs regardless of the actual pulse width. The module stores instantaneous pulse width in the Counter[*x*].PulseWidth input tag.
Average pulse width[1]	REAL	The average width of pulses. The module calculates average pulse width over the number of pulses specified in the Counter[*x*].FreqAveragePulseCount configuration tag. Frequency timeouts do not affect the pulse width average. If the input is high or low for a long period of time, the average pulse width is not updated until the number of pulses in the Counter[*x*].FreqAveragePulseCount tag occurs. The module calculates average pulse width as follows. 1. Stores each instantaneous pulse width for the number of pulses in the Counter[*x*].FreqAveragePulseCount tag. 2. Calculates the total of all pulse widths stored in step 1 and divides the total by the value in the Counter[*x*].FreqAveragePulseCount tag. If Counter[*x*].FreqAveragePulseCount = 10, the module calculates average pulse width as follows: • From pulses 0…9, the module does not calculate average pulse width and returns a value of zero. • From pulses 10…19, the module calculates average pulse width for pulses 0…9 at pulse 10. • From pulses 20…29, the module calculates average pulse width for pulses 10…19 at pulse 20, and so on. The accuracy of the average pulse width is always ± - 11 µs/Counter[*x*].FreqAveragePulseCount regardless of the actual pulse width. The module stores average pulse width in the Counter[x].PulseWidthAverage input tag.

(1) The average frequency and average pulse width may not be calculated on the same pulse due to frequency timeouts.

(2) Frequency timeouts may cause the accuracy of average frequency calculations to vary.

On/Off Windows

Each counter has two configurable On/Off windows that compare the accumulated count or frequency of incoming pulses to user-defined On/Off values. When the count or frequency values are within the user-defined window parameters, the module sets the corresponding bit in the Counter[*x*].InWindow0 or Counter[*x*].InWindow1 input tag.

The module produces data to the system on the rising and falling edge of each On/Off window. A rising edge occurs when a count or frequency value enters the window, and a falling edge occurs when a count or frequency value exits a window.

You define each On/Off window by using these parameters:

- Comparison method—Defines whether the On/Off window uses accumulated count, instantaneous frequency, or average frequency. You define the comparison method for a window on the Counter Configuration tab of the Module Properties dialog box.

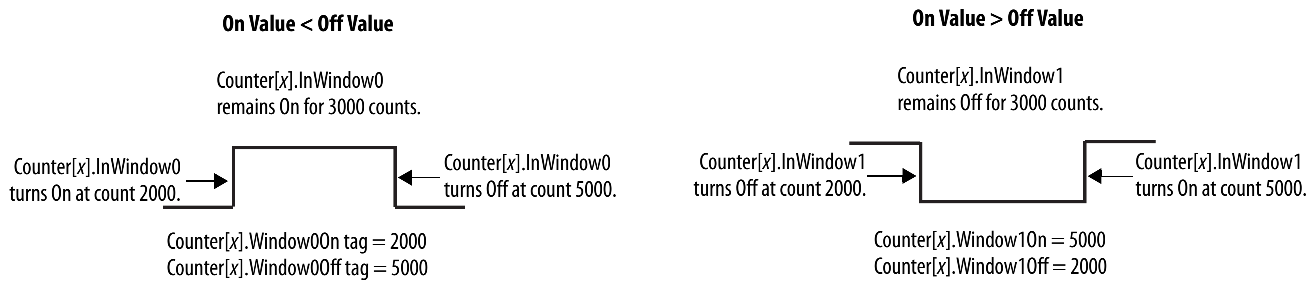
- On and Off values—Defines the count or frequency value that results in an On/Off status for the window. On and Off values represent counts or frequency depending on the window's comparison method. You define these values in a set of output tags for each window:
  - Counter[*x*].Window0On and Counter[*x*].Window0Off
  - Counter[*x*].Window1On and Counter[*x*].Window1Off

IMPORTANT Keep in mind the following when using frequency as a window comparison method:

- When configured to compare frequency values, window On/Off values are still DINT (32-bit signed integers) while the returned frequency values are REAL (32-bit IEEE float). As a result, the frequency triggers for On/Off windows can only be defined in 1 Hz increments.
- Fluctuations in high frequency values across window parameters could cause the window to transition on each pulse if the input frequency is at a window parameter and you are using instantaneous frequency as the comparison method. In this case, the module will produce a COS message on the backplane with each input. This high traffic could result in system communication issues.
- For example, if you set a window Off value at 18 kHz, and the input is at 18 kHz, the instantaneous frequency calculation could result in frequency fluctuations for each pulse between 17998.0 Hz and 18002.0 Hz. This fluctuation would cause a COS message to be sent every 55 µs. If this situation occurs for all eight counters, the module can generate a large amount of backplane traffic possibly resulting in system communication issues.

Figure 2 compares two On/Off windows by using the Accumulated Count comparison method. In the first window, the On value is less than the Off value. In the second window, the On value is greater than the Off value.

Figure 2 - Window States Based on Accumulated Count



The Counter[*x*].InWindow0 and Counter[*x*].InWindow1 input tags can be consumed by a controller or a 1756-OB16IEF peer output module and used to affect outputs. For more information about using peer modules, see the ControlLogix Peer I/O Control Application Technique, publication 1756-AT016.

Rollover Values

A rollover value determines how many counts accumulate before the count rolls over to zero. The count rolls over to zero on the rollover value. Each counter can have one rollover value.

EXAMPLE	A rollover value of 100 produces the following count sequences: • Increasing count sequence: 98, 99, 0, 1, 2… • Decreasing count sequence: 2, 1, 0, 99, 98…

For real-time control, you define a rollover value in the Counter[*x*].Rollover output tag. The following criteria applies to a rollover value:

- The default rollover value is a maximum count of 2^{31}.
- A rollover value must be a positive DINT value. If an invalid rollover value is defined, the module will use a value of 2^{31}.

Counter Control Functions

The counter module provides four counter control functions:

- Up/Down Count
- Count Enable
- Reset Count
- Preset Count

The module provides two methods to invoke counter control functions:

- Hardware inputs—You can tie counter control functions to standard hardware inputs 0…7 to let the state of external input devices directly control the functionality of a designated counter. To configure this method, you use the Input Configuration tab within the module's properties to set up ties as shown in Figure 3 on page 16.

- Output tags—The output tag method enables you to programmatically control the counter functions via the module's output tags. This method offers the most flexibility in invoking counter control functions. However, the response time is limited due to the time required for the controller to process your application routine.

Keep in mind the following when tying hardware inputs to counter control functions:

- A single input can control functionality for multiple counters. For example, you can tie input 3 to the Up/Down Count function for all eight counters.

- Only one type of counter control function can be tied to a single input. For example, you cannot tie both the Count Enable and Reset Count functions to the same input.

- If you do not require hardware inputs 0…7 to support counter control functionality, you can use the inputs as general purpose On/Off inputs without timestamping.

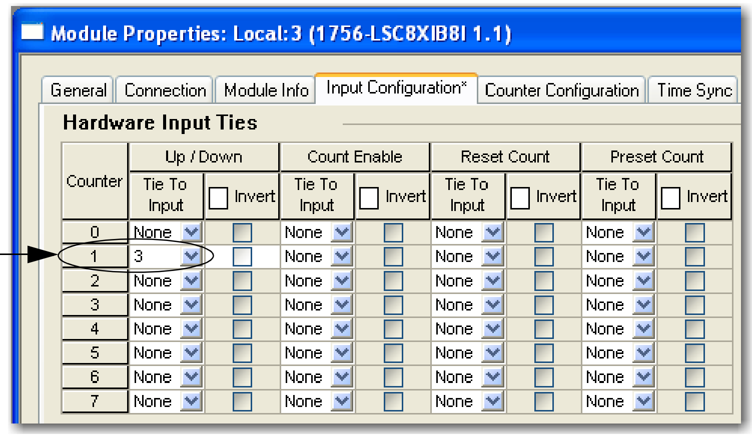
Up/Down Count Function

The Up/Down Count function causes a counter to increment or decrement accumulated count or changes the direction bit for frequency values.

To invoke the Up/Down Count function for a counter by using the hardware input method, tie the function to a hardware input on the Input Configuration tab of the Module Properties dialog box as shown in Figure 3.

Figure 3 - Up/Down Count Function Controlled by Hardware Input

Up/Down Count function for counter 1 is tied to hardware input 3.

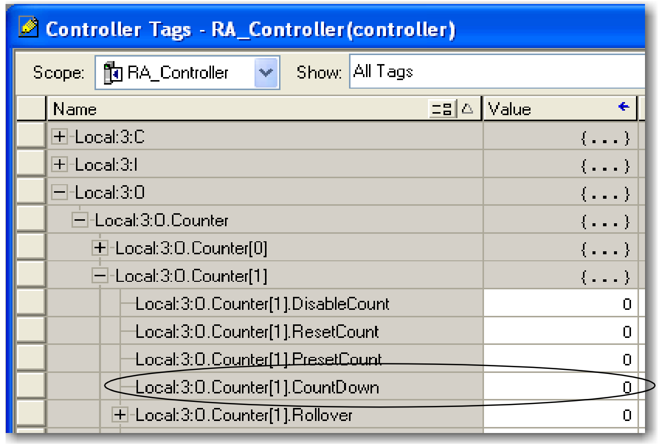


When tied to a hardware input, this function is level-sensitive resulting in a change of status when the input is either low or high:

- By default, the count direction goes up when the input is low and down when the input is high.
- When the function is inverted, the count direction goes up when an input is high and down when the input is low.

To invoke the Up/Down Count function by using the output tag method, use the Counter[*x*]CountDown output tag to define the direction of Counter[*x*] as shown in Figure 4. By default, the count direction is up.

Figure 4 - Counter[*x*]CountDown Output Tag

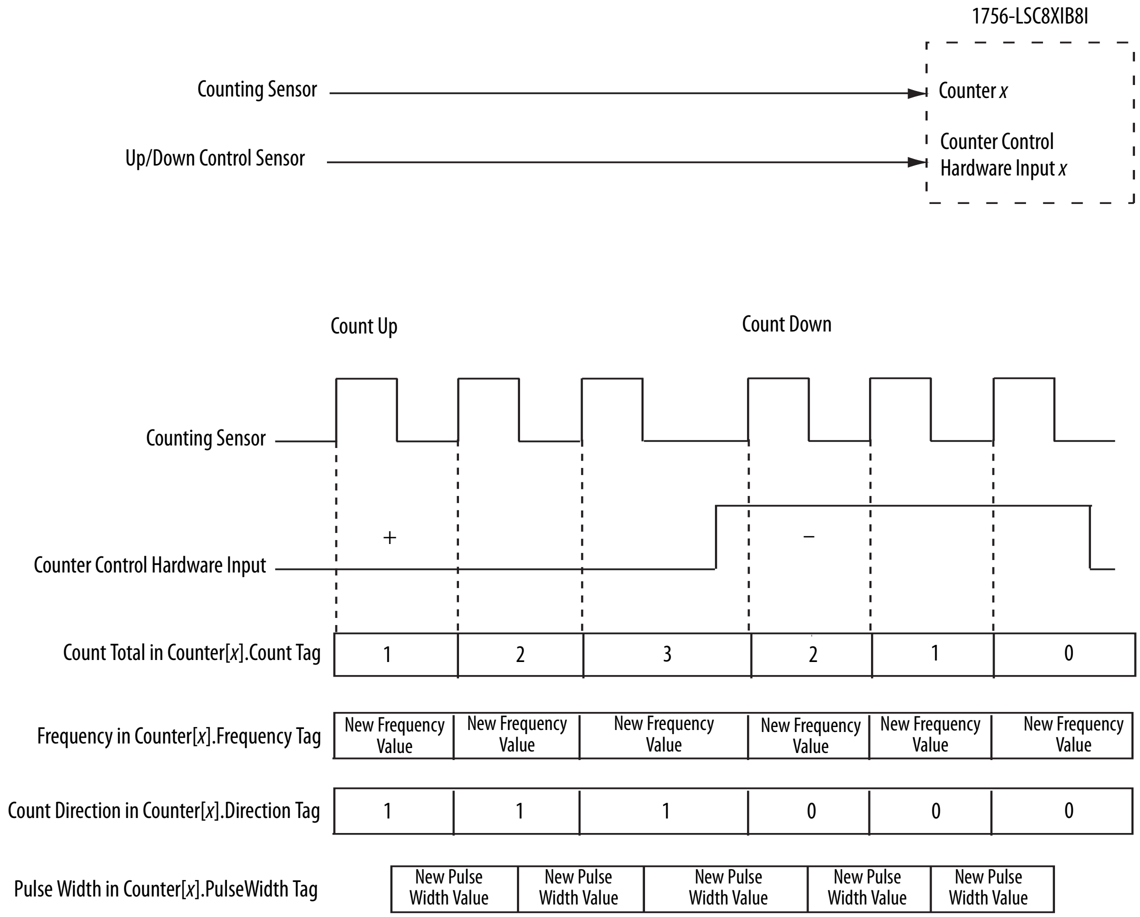


0 = Count direction is up, level-sensitive.
1 = Count direction is down, level-sensitive.

IMPORTANT	The Counter[*x*].CountDown output tag is active only if the Up/Down Count function is not tied to Counter[*x*] via a hardware input. If a hardware input is tied to Counter[*x*], the hardware input overrides the value of the Counter[*x*].CountDown output tag.

Figure 5 illustrates the input tag values returned when the Up/Down Count function is tied to an input via a hardware input.

Figure 5 - Example of Up/Down Count Function

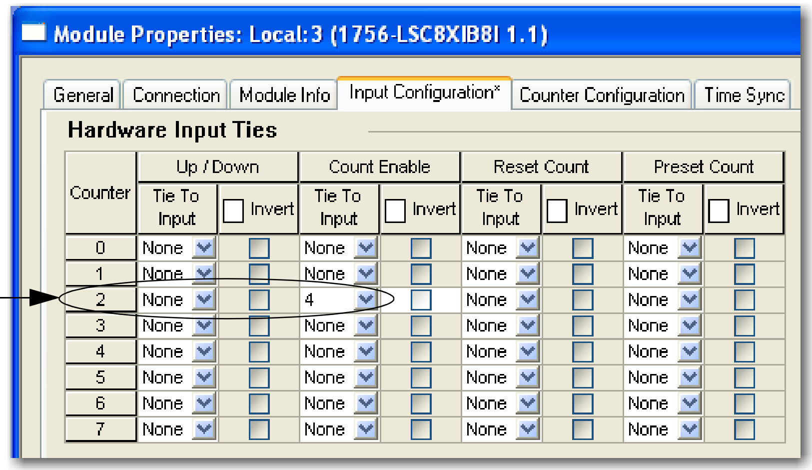


Count Enable Function

The Count Enable function serves as a gate input that controls when counting starts and stops.

To invoke the Count Enable function for a counter by using the hardware input method, tie the function to a hardware input on the Input Configuration tab of the Module Properties dialog box as shown in Figure 6 on page 19.

Figure 6 - Count Enable Function Controlled by Hardware Input

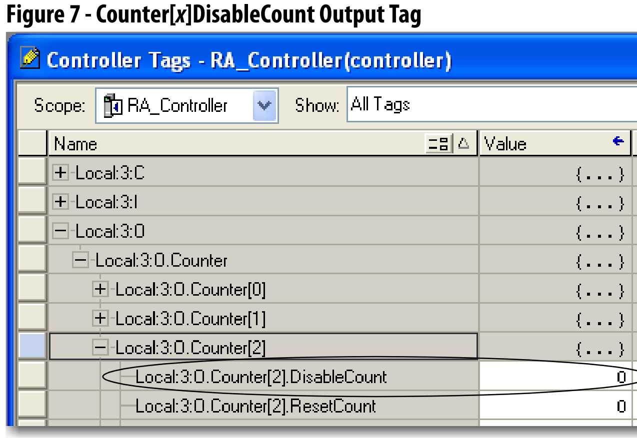


When tied to a hardware input, this function is level-sensitive resulting in a change of status when the input is either low or high:

- By default, counting starts only when the input is high and stops when the input is low.
- When the function is inverted, counting starts only when the input is low and stops when the input is high.

To invoke the Count Enable function by using the output tag method, use the Counter[*x*].DisableCount output tag as shown in Figure 7.

Figure 7 - Counter[*x*]DisableCount Output Tag



Note that the module continues to calculate frequency and pulse width values even if you disable counting via the Count Enable function.

IMPORTANT	Either the Count Enable hardware input or the corresponding bit in the Counter[*x*]DisableCount output tag can determine whether counting is enabled or disabled. Counting is enabled under the following conditions: • Counter[*x*].CountEnTieToPt configuration tag = -1 (no tie) or 0…7 and the corresponding hardware input is non-inverted and high or inverted and low (level-sensitive) **and** • Counter[*x*]DisableCount output tag = 0 (level-sensitive) Counting is disabled under these conditions: • Counter[*x*].CountEnTieToPt configuration tag = 0…7 and the corresponding hardware input is non-inverted and low or inverted and high (level-sensitive) **or** • Counter[*x*]DisableCount output tag = 1 (level-sensitive)

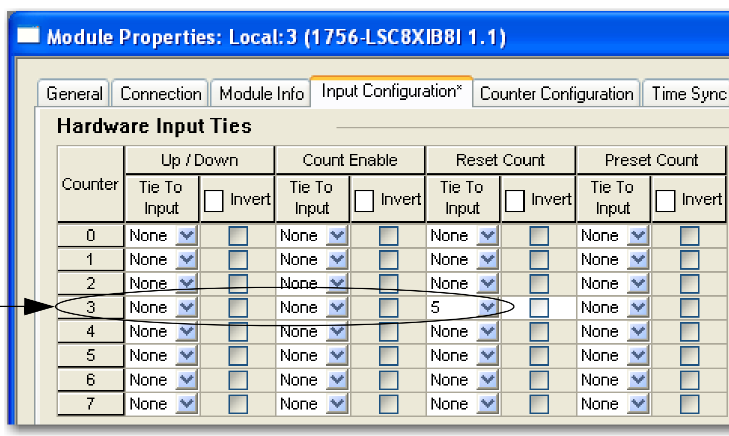
Reset Count Function

The Reset Count function resets the count to zero.

To invoke the Reset Count function for a counter by using the hardware input method, tie the function to a hardware input on the Input Configuration tab of the Module Properties dialog box as shown in Figure 8.

Figure 8 - Reset Count Function Controlled by Hardware Input

Reset Count function for counter 3 is tied to hardware input 5.

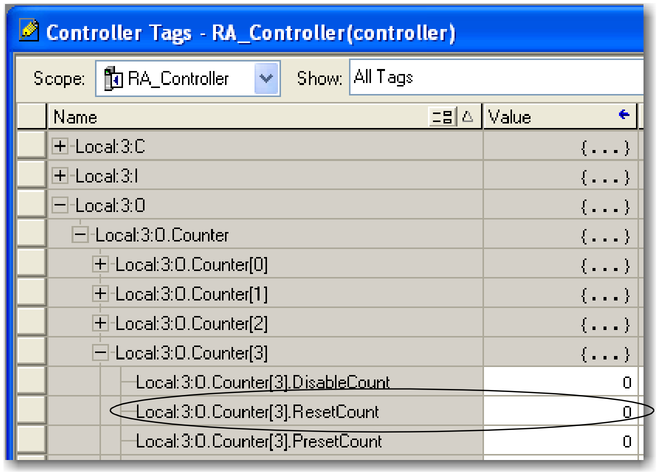


When tied to a hardware input, this function is edge-sensitive resulting in a reset when the designated input transitions low or high:

- By default, counting resets to zero on a rising pulse edge.
- When the function is inverted, counting resets to zero on a falling pulse edge.

To invoke the Reset Count function by using the output tag method, use the Counter[*x*].ResetCount output tag as shown in Figure 9.

Figure 9 - Counter[*x*]ResetCount Output Tag



0 = Tag-based reset is not active.
1 = Count transitions to zero on a rising edge.

IMPORTANT	Either the Reset Count hardware input or the corresponding bit in the Counter[*x*]ResetCount output tag can determine whether the count is reset. Counting is reset to zero under the following conditions: • Counter[x].ResetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[*x*]ResetCount output tag = 1 (rising edge-sensitive)

Preset Count Function

A preset value determines the starting value for a count. Each counter can have one preset value defined in the Counter[*x*].Preset output tag.

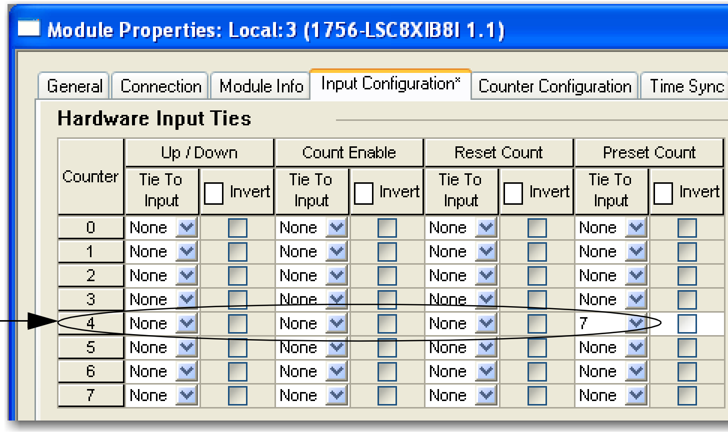
EXAMPLE	A preset value of 99 produces the following count sequences: • Increasing count sequence: 99, 100, 101, … • Decreasing count sequence: 99, 98, 97, …

The following criteria applies to a preset value:

- The default preset value is zero.
- A preset value must be a non-negative DINT value.
- A preset value must be less than the rollover value. If the preset value is greater than or equal to the rollover value, then the module uses the requested rollover value and the default preset value of zero rather than the invalid preset value.

To invoke the Preset Count function for a counter by using the hardware input method, tie the function to a hardware input on the Input Configuration tab of the Module Properties dialog box as shown in Figure 10.

Figure 10 - Preset Count Function Controlled by Hardware Input



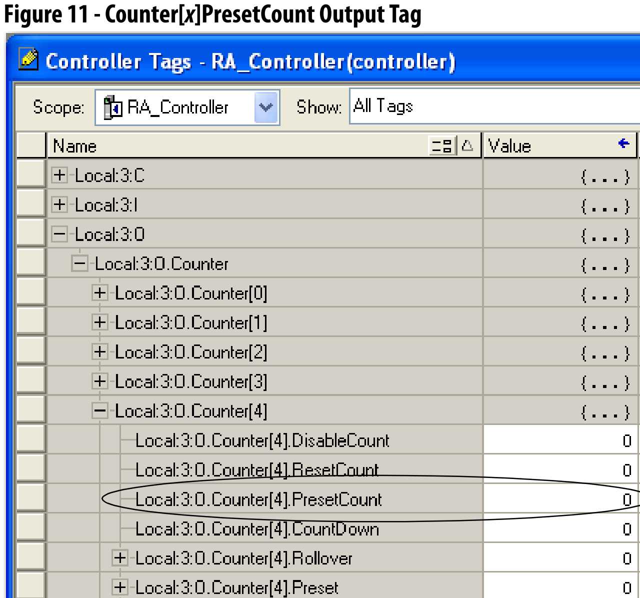
Preset Count function for counter 4 is tied to hardware input 7.

When tied to a hardware input, this function is edge-sensitive resulting in a preset when the designated input transitions low or high:

- By default, the count is set to the preset value on a rising pulse edge.
- When the function is inverted, the count is set to the preset value on a falling pulse edge.

To invoke the Preset Count function by using the output tag method, use the Counter[*x*].PresetCount output tag as shown in Figure 11.

Figure 11 - Counter[*x*]PresetCount Output Tag



0 = Tag-based preset not active.

1 = Count transitions to the preset value on a rising edge.

IMPORTANT	Either the Preset Count hardware input or the corresponding bit in the Counter[*x*]PresetCount output tag can determine whether the count is preset. The count is preset to the Counter[*x*].Preset value under the following conditions: • Counter[*x*].PresetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[*x*]PresetCount output tag = 1 (rising edge-sensitive)

Output Control

Inputs from the counter module can affect outputs on a 1756-OB16IEF module. The output module consumes data from these input tags on a peer module:

- Pt[*x*]Data—Indicates the current On/Off value of the corresponding hardware input.
- Counter[*x*]InWindow0—Indicates whether the accumulated count or frequency value of Counter[x] is within the parameters defined by the Counter[*x*].Window0On and Counter[*x*].Window0Off output tags. A change in window status triggers a Change of State (COS) message to be sent to the owner-controller or peer module.
- Counter[*x*]InWindow1—Indicates whether the accumulated count or frequency value of Counter[*x*] is within the parameters defined by the Counter[*x*].Window1On and Counter[x].Window1Off output tags. A change in window status triggers a Change of State (COS) message to be sent to the owner-controller or peer module.

You can define the output behavior on the 1756-OB16IEF module by applying Boolean logic to the On/Off windows, inputs, and any bits from the controller. To establish communication with an input module, the output module sends a Listen-only connection request to the input module. Once the connection is established, the output module can consume data directly from the input module.

For more information about peer control, refer to the Peer I/O Control Application Technique, publication 1756-AT016.

Notes:

Install the Counter Module

ATTENTION: Environment and Enclosure

This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications (as defined in IEC 60664-1), at altitudes up to 2000 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

This equipment is supplied as open-type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA or be approved for the application if nonmetallic. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

In addition to this publication, see the following:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1, for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by enclosures.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.
WARNING: EXPLOSION HAZARD • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous.	**WARNING: RISQUE D'EXPLOSION** • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles.

European Hazardous Location Approval

The following applies when the product bears the Ex Marking.

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC and has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of Category 3 equipment intended for use in Zone 2 potentially explosive atmospheres, given in Annex II to this Directive.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 60079-15 and EN 60079-0.

ATTENTION: This equipment is not resistant to sunlight or other sources of UV radiation.

WARNING:

- This equipment must be installed in an enclosure providing at least IP54 protection when applied in Zone 2 environments.
- This equipment shall be used within its specified ratings defined by Rockwell Automation.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Zone 2 environments.
- This equipment must be used only with ATEX certified Rockwell Automation backplanes.
- Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.
- Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.

Install the Module

You can install or remove the module while chassis power is applied.

WARNING: When 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 or the area is nonhazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

The module is sensitive to electrostatic discharge when handled outside of the chassis. The module has been tested to withstand an electrostatic discharge while operating within the chassis.

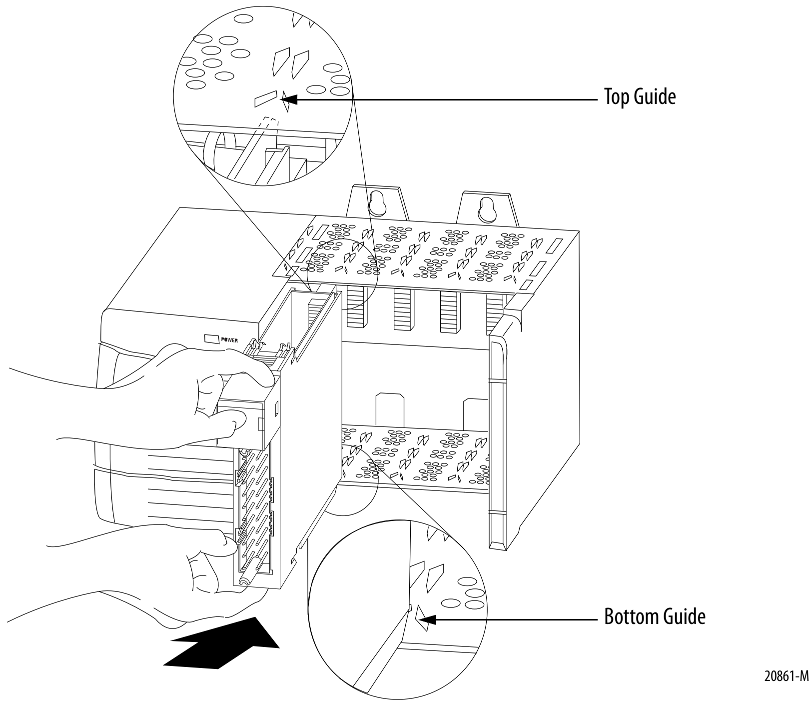
ATTENTION: Prevent Electrostatic Discharge

This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment:

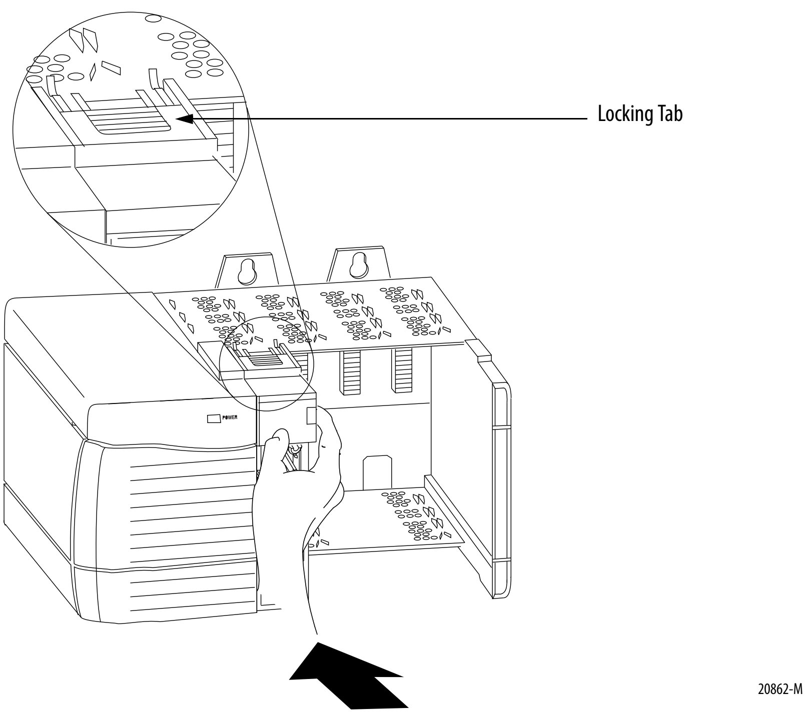
- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation, if available.
- Store the equipment in appropriate static-safe packaging when not in use.

Follow these steps to insert the module into the chassis.

1. Align the circuit board with the top and bottom chassis guides.



2. Slide the module into the chassis until the locking tabs click.



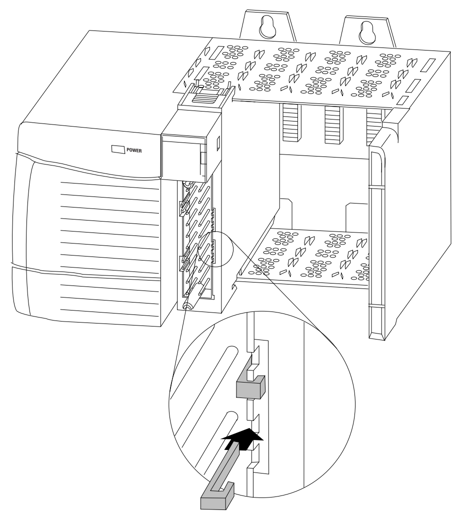
Key the Removable Terminal Block

Key the removable terminal block (RTB) to prevent inadvertently connecting the wrong wiring in the RTB to your module. Wedge- and U-shaped bands are manually inserted into the RTB and module. This process hinders a wired RTB from being accidentally inserted into a module that does not match the positioning of the respective tabs.

Key positions on the module that correspond to unkeyed positions on the RTB. For example, if you place a U-shaped keying band in slot 4 on the module, do not insert a wedge-shaped tab in slot 4 on the RTB, or your RTB will not mount on the module. We recommend that you use a unique keying pattern for each slot in the chassis.

Follow these steps to key the RTB.

1. To key the module, insert the U-shaped band with the longer side near the terminals.
2. Push the band onto the module until it snaps into place.



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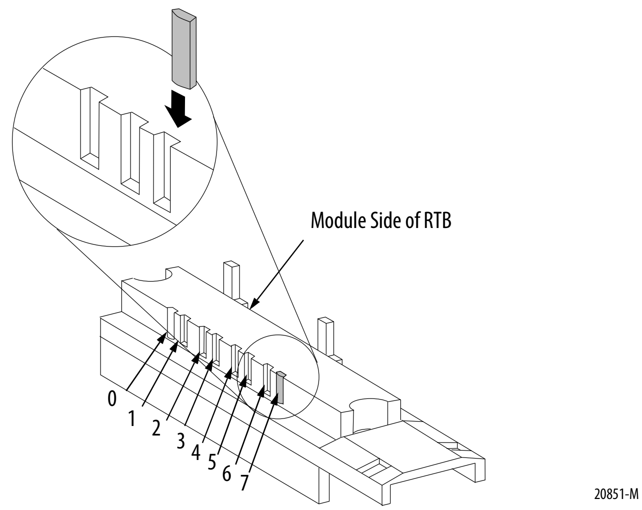
3. To key the RTB in positions that correspond to unkeyed module positions, insert the straight, wedge-shaped tab on the RTB with the rounded edge first.



4. Push the tab onto the RTB until it stops.
5. Repeat step 1...step 4 by using additional U-shaped and straight tabs until the module and RTB lock into each other properly.

Connect the Wires

Before wiring the module, adhere to these wiring guidelines.

WARNING: If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

ATTENTION: If multiple power sources are used, do not exceed the specified isolation voltage.

ATTENTION: When using the 1756-TBCH, do not wire more than two 0.33…1.3 mm^2 (22…16 AWG) conductors on any single terminal. Use only the same size wires with no intermixing of solid and stranded wire types.

When using the 1756-TBS6H, do not wire more than one conductor on any single terminal.

Use an RTB[1] or interface module (IFM) to connect wires to your module. To use an RTB, follow the directions below to connect wires to the RTB. IFMs are prewired prior to shipping. The counter module supports IFM catalog numbers 1492-IFM40F, 1492-IFM40DS24A-4, 1492-IFM40F-FS24A-4, and 1492-IFM40F-FSA-4.

RTB Types

Use one of these types of RTBs with your counter module:

- Cage clamp, catalog number 1756-TBCH
- Spring clamp, catalog number 1756-TBS6H

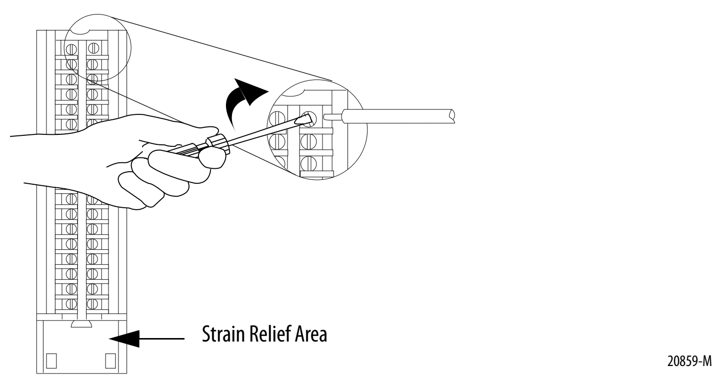
ATTENTION: The ControlLogix system has been agency certified using only the ControlLogix RTBs 1756-TBCH, 1756-TBNH, 1756-TBSH, and 1756-TBS6H). Any application that requires agency certification of the ControlLogix system using other wiring termination methods may require application specific approval by the certifying agency.

Each RTP comes with housing. Wire the RTB with a 3.2 mm (1/8 in.) maximum screwdriver before installing it onto the module.

Cage Clamp

Follow these steps to wire a cage clamp.

1. Strip 9.5 mm (3/8 in.) maximum length of wire.
2. Insert the wire into the open terminal on the side.
3. Turn the screw clockwise to close the terminal on the wire.



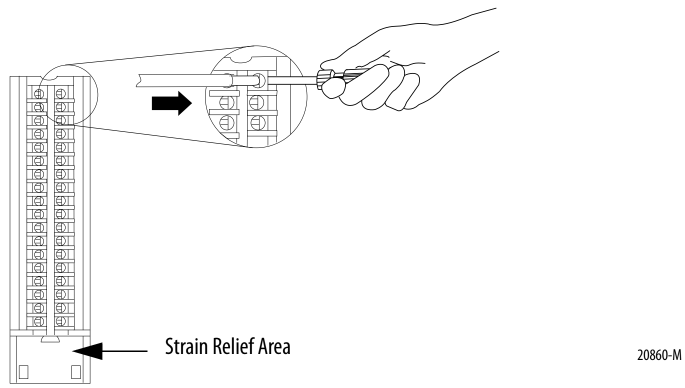
The open section at the bottom of the RTB is called the strain relief area. The wiring from the connections can be grouped with a plastic tie.

(1) The ControlLogix system has been agency certified using only the ControlLogix RTBs (1756-TBCH, 1756-TBNH, 1756-TBSH, and 1756-TBS6H). Any application that requires agency certification of the ControlLogix system using other wiring termination methods may require application specific approval by the certifying agency.

Spring Clamp

Follow these steps to wire a spring clamp.

1. Strip 11 mm (7/16 in.) maximum length of wire.
2. Insert the screwdriver into the outer hole of the RTB to depress the spring-loaded clamp.
3. Insert the wire into the open terminal and remove the screwdriver.



IMPORTANT	Make sure the wire, and not the screwdriver, is inserted into the open terminal to prevent damage to the module.

The open section at the bottom of the RTB is called the strain relief area. The wiring from the connections can be grouped with a plastic tie.

RTB Wiring Recommendations

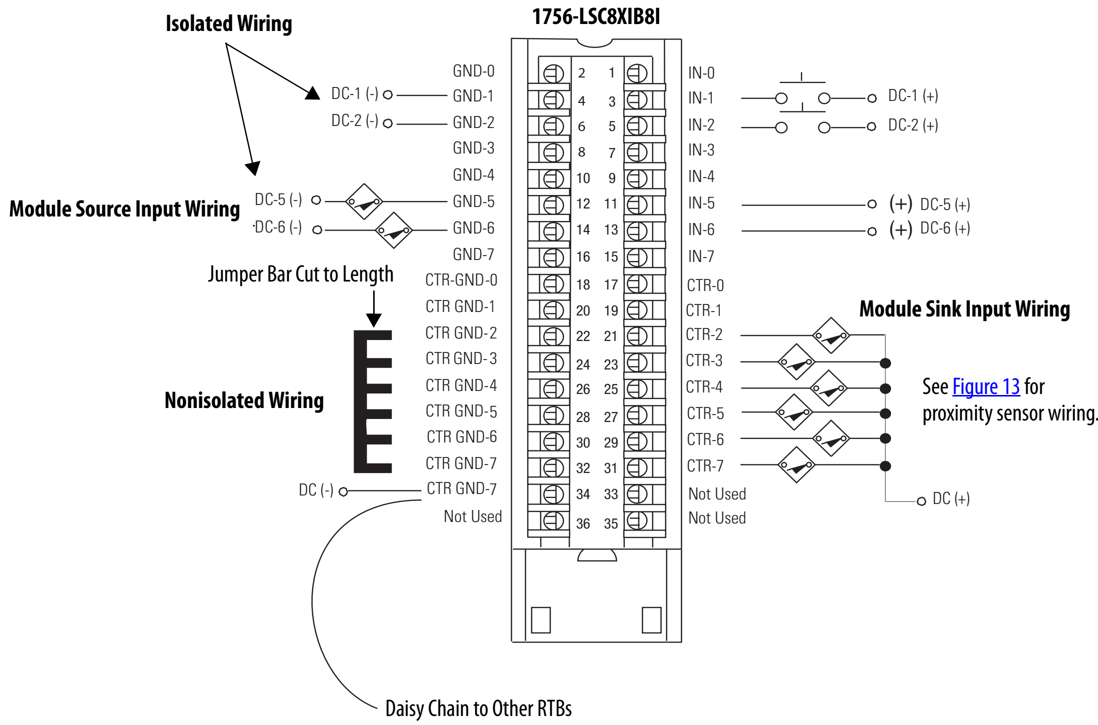
Consider these guidelines when wiring your RTB:

- Begin wiring the RTB at the bottom terminals and move up.
- Use a tie to secure the wires in the strain relief area of the RTB.
- A jumper bar is shipped with certain I/O modules to assist in installation. Additional jumper bars can be purchased in packages of 25 by ordering catalog number 1756-JMPR.
- For applications that require heavy gauge wiring, order and use an extended-depth housing, catalog number 1756-TBE.

Wire Terminations

The following diagrams provide wiring examples for the eight counter, eight input point, 24V high-speed DC isolated, sink/source input module. For alternate wiring for use with non-IEC Type 3 sensors, refer to Appendix D.

Figure 12 - Device Wiring



Simplified Schematic

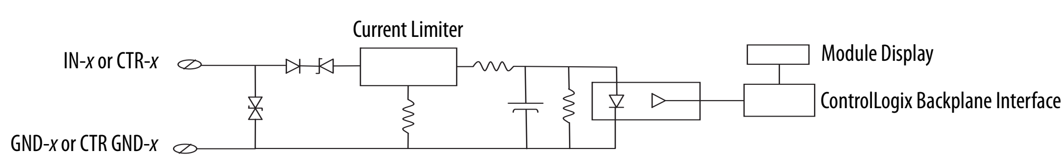
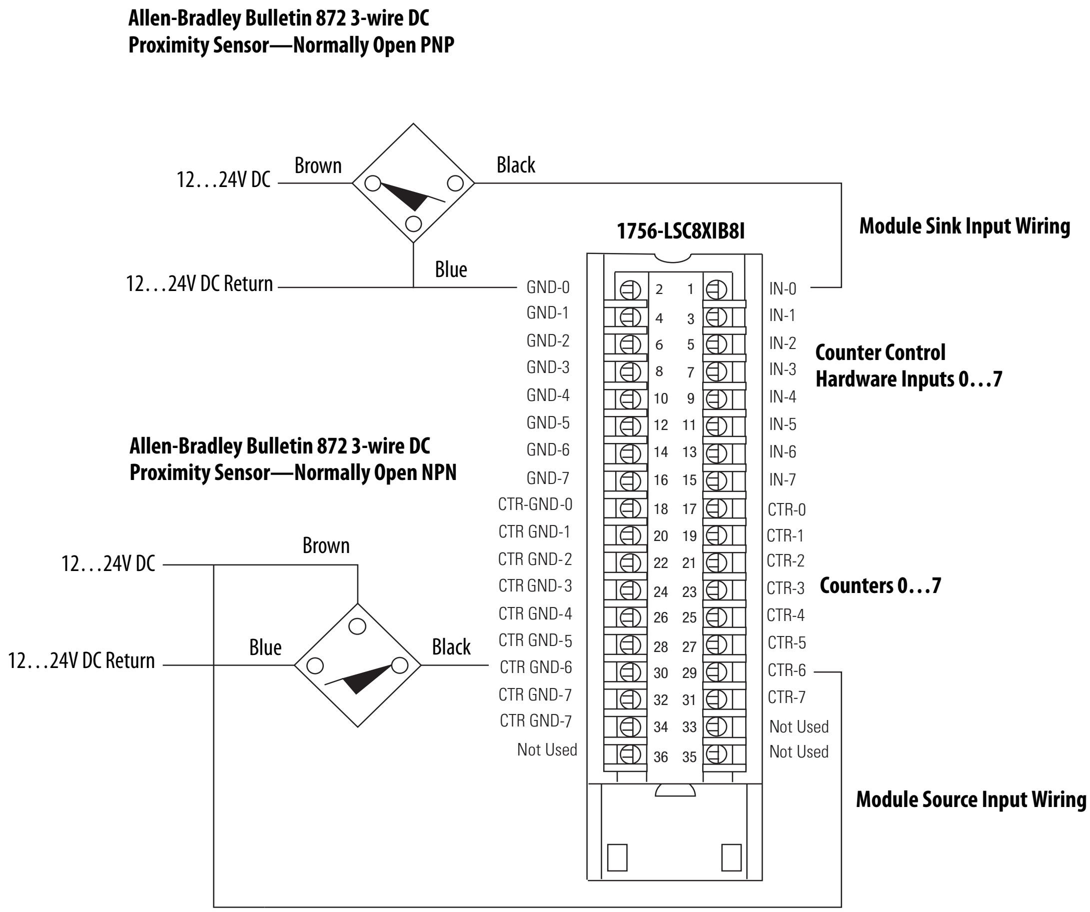
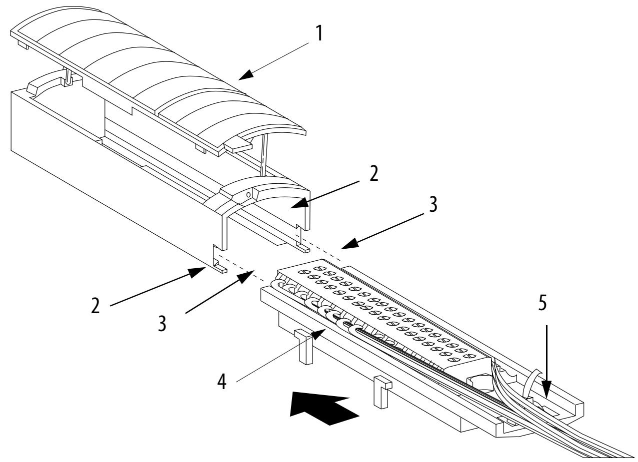


Figure 13 - Electronic Device Wiring



Assemble the Removable Terminal Block and Housing

Removable housing covers the wired RTB to protect wiring connections when the RTB is seated on the module. Parts of the 1756-TBCH RTB are identified in the table.



Item	Description
1	Housing cover
2	Groove
3	Side edge of RTB
4	RTB
5	Strain relief area

Follow these steps to attach the RTB to the housing.

1. Align the grooves at the bottom of each side of the housing with the side edges of the RTB.
2. Slide the RTB into the housing until it snaps into place.

IMPORTANT	If additional wire routing space is required for your application, use the extended-depth housing, catalog number 1756-TBE.

Install the Removable Terminal Block

This section shows how to install the RTB onto the module to connect the wiring.

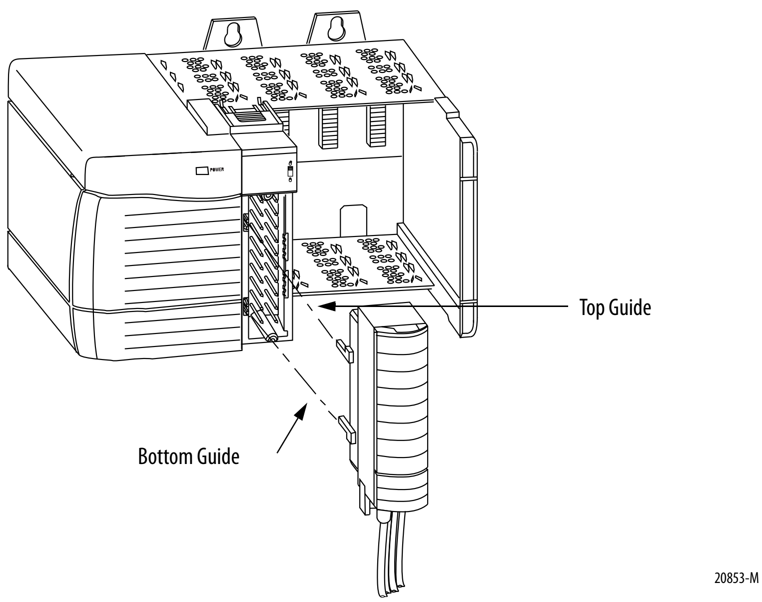
WARNING: When you connect or disconnect the removable terminal block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

Be sure that power is removed or the area is nonhazardous before proceeding.

Before installing the RTB, make sure of the following:

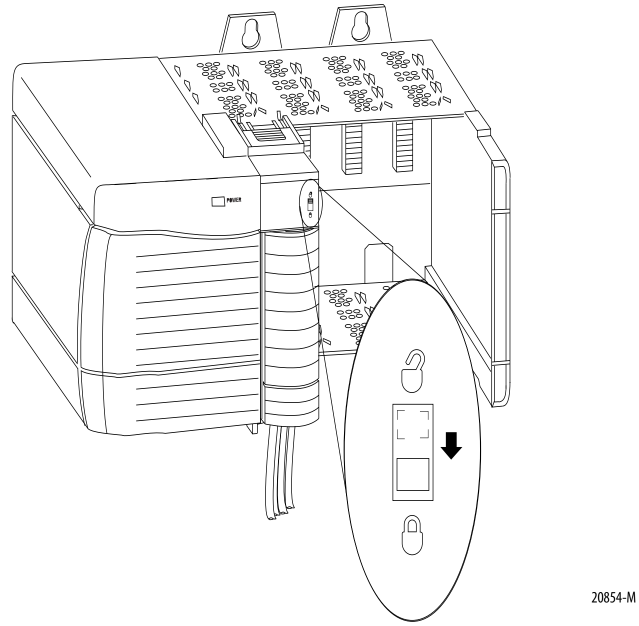
- Field-side wiring of the RTB has been completed.
- The RTB housing is snapped into place on the RTB.
- The RTB housing door is closed.
- The locking tab at the top of the module is unlocked.

1. Align the top, bottom, and left side guides of the RTB with the guides on the module.



2. Press quickly and evenly to seat the RTB on the module until the latches snap into place.

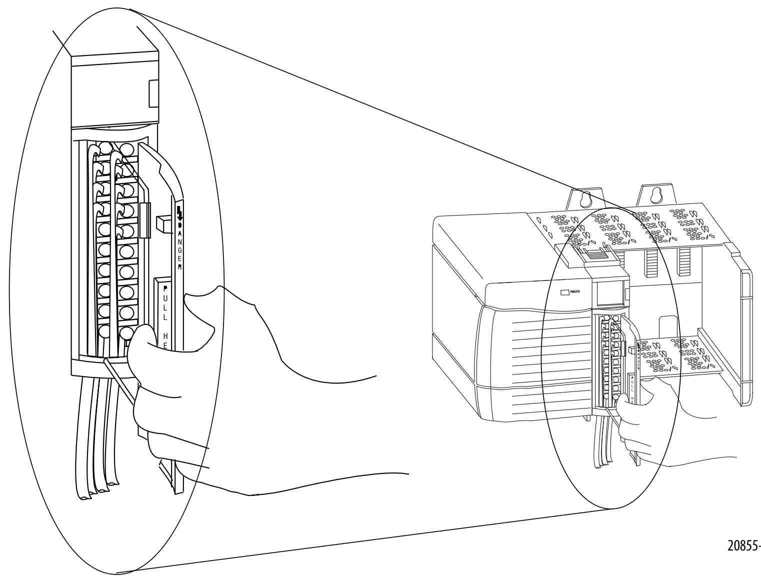
3. Slide the locking tab down to lock the RTB onto the module.



Remove the Removable Terminal Block

If you need to remove the module from the chassis, you must first remove the RTB from the module.

1. Unlock the locking tab at the top of the module.
2. Open the RTB door by using the bottom tab.
3. Hold the spot marked PULL HERE and pull the RTB off the module.



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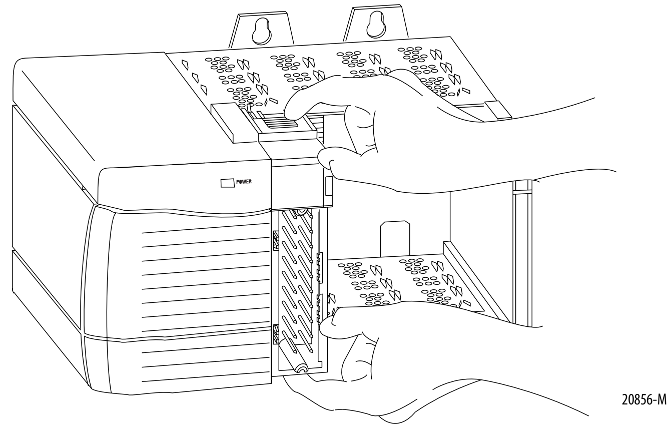
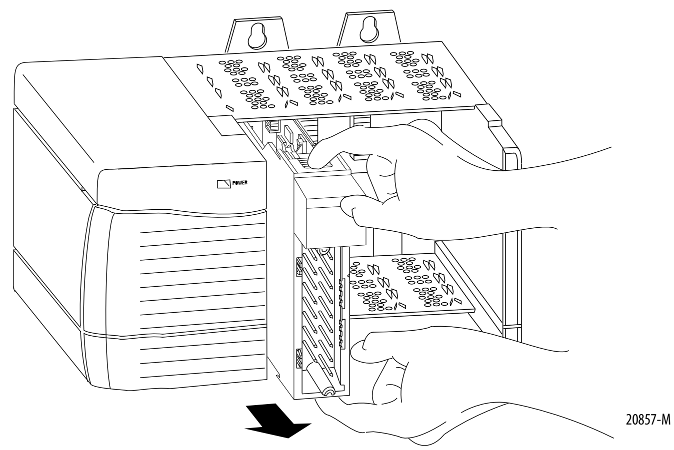
Remove the Module from the Chassis

Follow these steps to remove a module from its chassis.

1. Push in the top and bottom locking tabs.



2. Pull the module out of the chassis.



Notes:

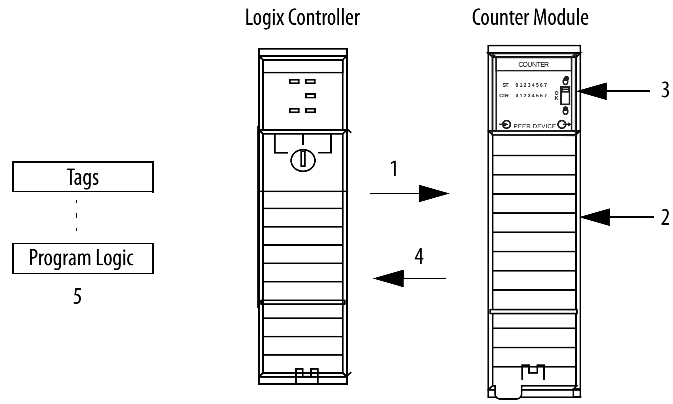
Configure the Module

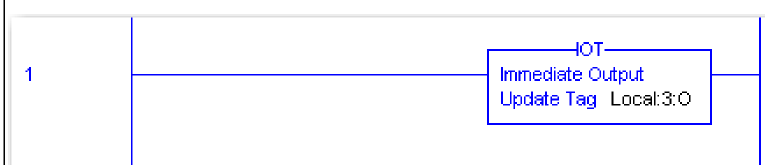
ControlLogix Overview

Before configuring your module in a local or remote chassis, you must have an understanding of how the module operates with the controller in the ControlLogix system. Every module must be owned by a Logix5000 controller. This owner-controller stores configuration data for every module that it owns. The owner-controller sends configuration data to the modules it owns when the module powers up or during a controller-initiated reconfiguration. Adding the module to the I/O configuration tree in the RSLogix 5000 software creates configuration and I/O data structures and tags for the module.

Figure 14 on page 42 shows how the module communicates with its owner-controller.

Figure 14 - Module Communication with Owner-controller



Path No.	Description
1	Controller transfers configuration data and commands to the module.
2	External devices generate input signals that are transmitted to the module.
3	Module converts signals, counts incoming pulses, calculates frequency and pulse width values, and then stores the values.
4	Counter module transfers data, including accumulated count and frequency values, to the controller. The controller stores the data in descriptive tags. If configured, a 1756-OB16IEF peer module also consumes the data via a Listen-only connection to the counter module. The peer output module evaluates the input data and applies the data to its outputs by using program logic from the controller.
5	Program logic can store and move data before new input data is broadcast over the backplane and overwrites the current input data in the controller's tags. Program logic also updates values in output tags that are sent to the counter module, such as preset and rollover values. **IMPORTANT:** In RSLogix 5000 software, versions 18.02.00 and later, output tag information is sent to the counter module only at the RPI rate defined during configuration. For optimal performance, use an Immediate Output (IOT) instruction. For example, the rung shown below contains an IOT instruction for a counter module in slot 3. Add a similar rung to your last routine within the Main Task to mimic normal output tag processing. 

A module's communication, or multicasting, behavior varies depending upon whether it operates in the local chassis or in a remote chassis.

Direct Connections

A direct connection is a real-time data transfer link between the controller and the device that occupies the slot that the configuration data references. When module configuration data is downloaded to an owner-controller, the controller attempts to establish a direct connection to each of the modules referenced by the data.

One of the following occurs:

- If the data is appropriate to the module found in the slot, a connection is made and operation begins.
- If the configuration data is not appropriate, the data is rejected and an error message appears in the software. In this case, the configuration data can be inappropriate for any of a number of reasons. For example, a module's configuration data may be appropriate except for a mismatch in electronic keying that prevents normal operation.

The controller maintains and monitors its connection with a module. Any break in the connection, such as removal of the module from the chassis while under power, causes the controller to set faults in the data area associated with the module. The RSLogix 5000 software may monitor this data area to signal the module's failures.

The time frame in which a module produces its data depends on the options chosen during configuration and where in the control system the module physically resides, such as locally or remotely.

Local Chassis Operation

A local chassis contains the module and its owner-controller. If a module resides in a local chassis, the requested packet interval (RPI) instructs the module to send its channel and status data to the local chassis backplane at specific time intervals.

IMPORTANT The RPI value is set during the initial module configuration by using RSLogix 5000 software as described in Configure Connection Properties on page 48. The RPI value can be adjusted when the controller is in Program mode.

In addition to producing data at the RPI, the module also produces data when a change in status occurs for the following input tags:

- Counter[*x*].InWindow0 or Counter[*x*].InWindow1—Indicates whether the accumulated count or frequency value of Counter[*x*] is within the defined window parameters.
- Pt[*x*].Data—Indicates the current On/Off value of the corresponding hardware input.

IMPORTANT	In a peer control operation where the counter module provides peer input data directly to a 1756-OB16IEF module, both the counter module and 1756-OB16IEF module must reside in the same physical chassis. For more information about peer control, refer to the Peer I/O Control Application Technique, publication 1756-AT016.

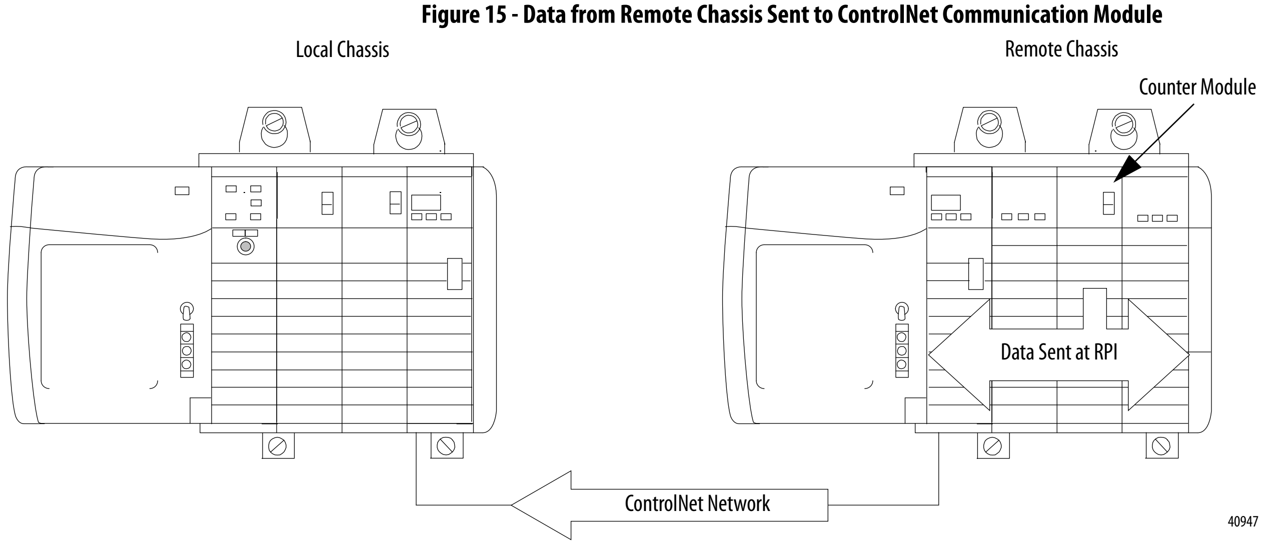
Remote Chassis Operation

A remote chassis contains the module but not the module's owner-controller. If a module resides in a remote chassis, the role of the RPI changes slightly with respect to getting data to the owner-controller. The RPI not only defines when the module produces data within its own chassis, but also determines how often the owner-controller receives it over the network.

When an RPI value is specified for a module in a remote chassis, in addition to instructing the module to produce data within its own chassis, the RPI also reserves a spot in the stream of data flowing across the network.

The timing of this reserved spot may not coincide with the exact value of the RPI, but the control system guarantees that the owner-controller receives data at least as often as the specified RPI. As shown in Figure 15, data from the remote chassis is sent to the ControlNet communication module at a rate no slower than the configured RPI.

Figure 15 - Data from Remote Chassis Sent to ControlNet Communication Module



You must run RSNetWorx software to enable modules in a remote ControlNet chassis. Running RSNetWorx software transfers configuration data to remote modules and establishes a network update time (NUT) for the ControlNet network that is compliant with the desired communication options specified for each module during configuration.

If you are not using the modules in a remote ControlNet chassis, running RSNetWorx software is not necessary. However, anytime a controller references a module in a remote chassis, RSNetWorx software must be run to configure the ControlNet network.

In an ControlNet network, scheduled data is sent at the RPI regardless of any COS activity occurring on the backplane of the remote chassis.

IMPORTANT	Do not use unscheduled communication to the counter module in a remote chassis over a ControlNet network.

In an EtherNet/IP network with a multicast connection, data may be sent over the network as fast as one quarter of the RPI. For example, if an I/O module is sending data every 10 ms and the RPI is set at 100 ms, the data transfer rate over the EtherNet/IP network will be every 30 ms.

IMPORTANT	In a peer control operation where the counter module provides peer input data directly to a 1756-OB16IEF module, both the counter module and 1756-OB16IEF module can reside in a remote chassis as long as they are both located in the same physical chassis. For more information about peer control, refer to the Peer I/O Control Application Technique, publication 1756-AT016.

Create a New Module

Before configuring a module, make sure you complete these procedures in RSLogix 5000 software:

- Create a controller project.
- If you plan to add the module to a remote chassis, add ControlNet or EtherNet/IP communication modules to both the local and remote chassis in the I/O Configuration tree.
  - For more information on ControlLogix ControlNet modules, see ControlNet Modules in Logix5000 Control Systems, publication CNET-UM001.
  - For more information on ControlLogix EtherNet/IP modules, see EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication ENET-UM001.

IMPORTANT	To configure the module, you must have the following: • RSLogix 5000 software, version 18.02.00 or later • The Add-on Profile (AOP) for the module available for download at http://support.rockwellautomation.com/controlflash/LogixProfiler.asp

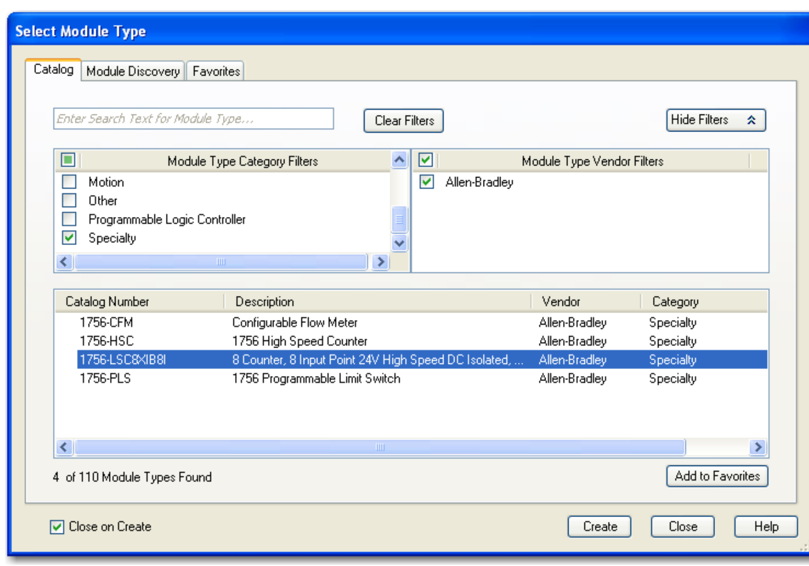
Follow these steps to add the module to a local or remote chassis.

1. To add the module to a local chassis, right-click the backplane and choose New Module.

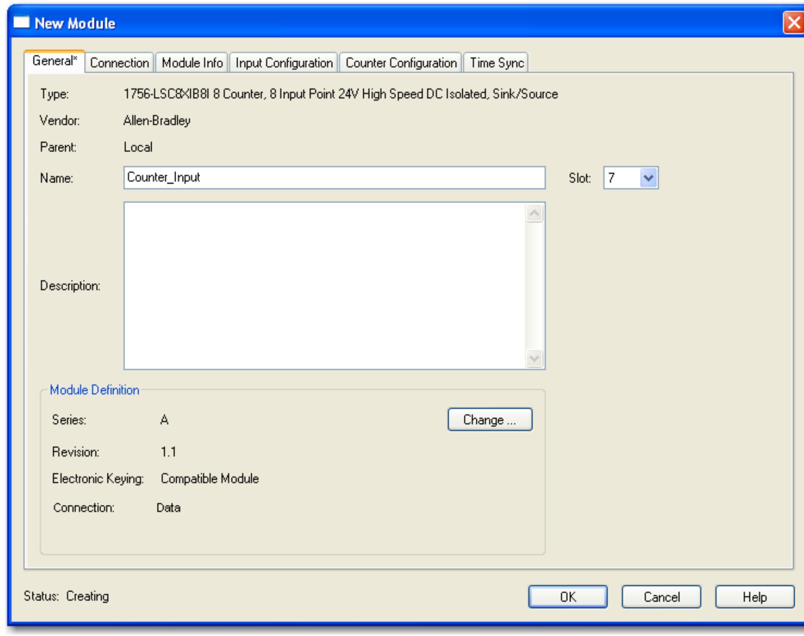
   or

   To add the module to a remote chassis, right-click the remote communication module, and choose New Module.

2. On the Select Module Type dialog box, select 1756-LSC8XIB8I and click Create.



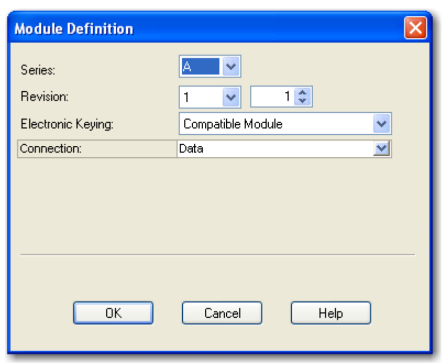
3. On the New Module dialog box, type a name and description for the module and enter the module's slot number.



4. Click Change.

5. On the Module Definition dialog box, define options for how the module will operate and click OK:

   - For information about choosing an electronic keying method, see Appendix A.
   - For information about choosing a connection format, see Connection Formats on page 48.



6. On the New Module dialog box, click OK.

Connection Formats

The initial configuration of a module requires you to choose a connection format. If needed, you can change the connection format when offline after the configuration is downloaded to the controller.

Multiple controllers can receive data being produced by a module. The connection format determines the following:

- Whether a controller configures or just listens to data
- The type of configuration options that are available
- The tags that are generated during the initial configuration

Table 4 describes the connection formats available for the counter module.

Table 4 - Counter Module Connection Formats

Connection Format	Description
Data	Results in two types of input data: • Count or frequency values from counters 0…7 • Counter control input data or general purpose input data from standard hardware inputs 0…7 Results in two types of output data: • Configuration data sent to the module from the owner-controller upon powerup reconfiguration • Output data for counter operation
Listen Only	Allows a controller to establish a Listen-only connection with the counter module. Results in two types of input data: • Count or frequency values from counters 0…7 • Counter control input data or general purpose input data from standard hardware inputs 0…7

Configure Connection Properties

Connection properties define controller-to-module behavior. When defining connection properties, you can do the following:

- Select an RPI. The RPI guarantees the slowest rate at which input tag data, including pulse count, pulse width, and pulse frequency values, are produced to the system. The module's actual data transfer rate may be faster than the RPI setting, but the RPI provides a defined, maximum period of time at which data is produced.

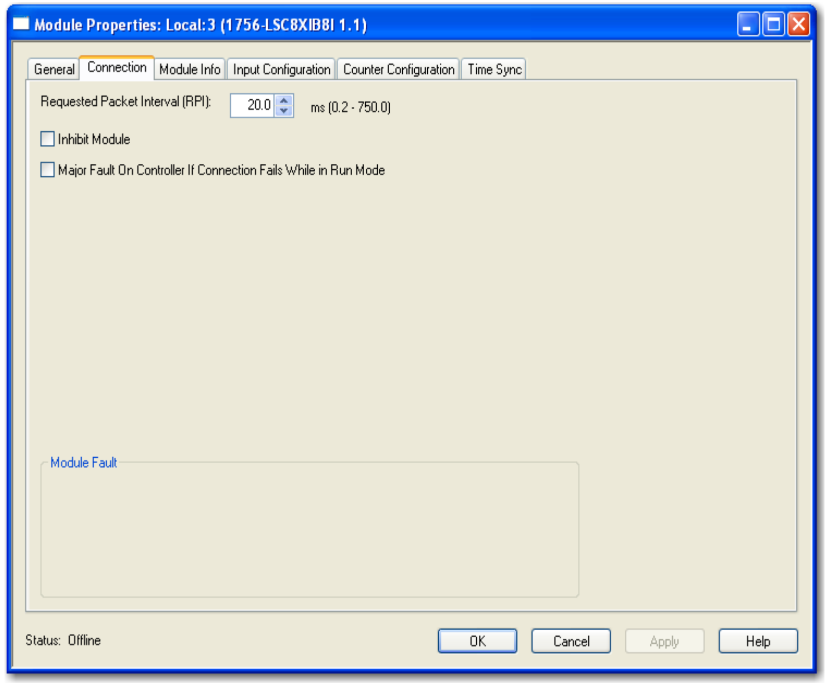
- Inhibit the module.

- Configure the controller so that a loss of connection to this module causes a major fault.

- View information about the condition of the connection between the module and the controller.

Follow these steps to configure connection properties.

1. On the Module Properties dialog box, click the Connection tab.



2. Complete the fields as described below and click Apply.

Field	Description
Requested Packet Interval (RPI)	Enter an RPI value or use the default value.
Inhibit Module	Check the checkbox to prevent communication between the owner-controller and the module. This option allows for maintenance of the module without faults being reported to the controller.
Major Fault On Controller If Connection Fails While in Run Mode	Check the checkbox to create a major fault if there is a connection failure with the module while in Run mode. For more information on this checkbox, see the Logix5000 Controllers Information and Status Programming Manual, publication 1756-PM015.
Module Fault	If a fault occurs when the module is online, the type of connection fault appears in the Module Fault area. The Module Fault area is blank if you are offline.

Configure Counters 0…7

The configuration of counters 0…7 defines the following:

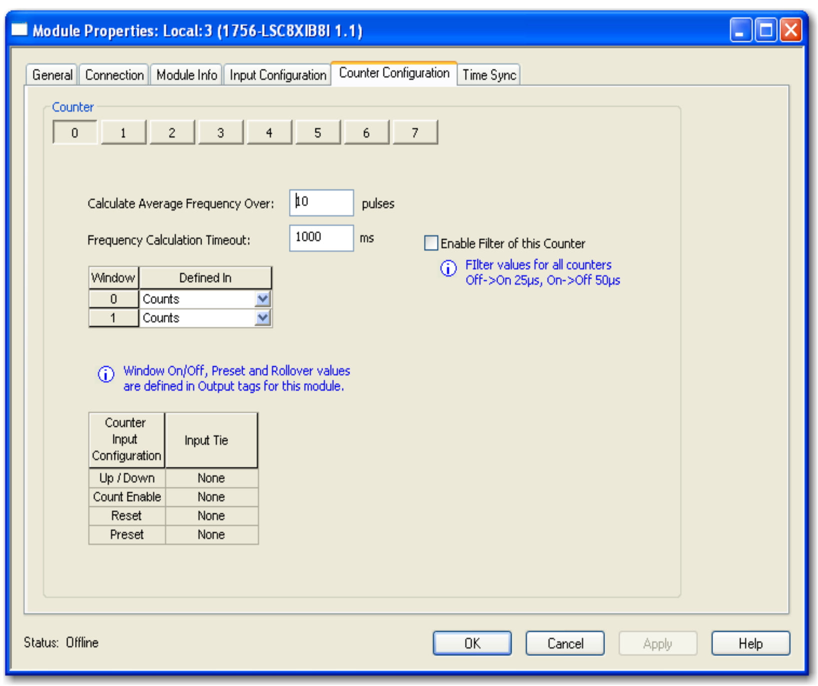
- The number of pulses over which to calculate average frequency
- The frequency time-out value
- Whether the On/Off windows use accumulated count, instantaneous frequency, or average frequency for output control
- Window On/Off, preset, and rollover values
- Whether to enable filtering for a counter

You can configure most of the above values on the Counter Configuration tab of the Module Properties dialog box. However, window On/Off, rollover, and preset values must be defined in the module's output tags.

For more information about the operation of counters, refer to Counters 0…7 on page 11.

Follow these steps to configure counters.

1. On the Modules Properties dialog box, click the Counter Configuration tab.



2. Click a numbered button to configure the corresponding counter.

3. Complete the fields as described in the table below and click Apply.

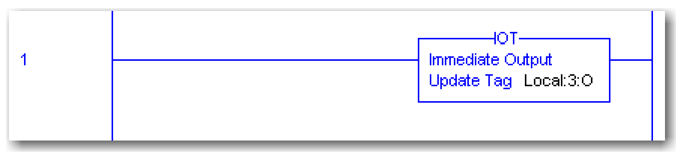
Field	Description	Configuration Tag
Calculate Average Frequency Over	Type the number of pulses to use to calculate average frequency. This value is also used to calculate average pulse width. For more information about how average frequency and average pulse width are calculated, see page 12. Valid values = 0…1, 000 Default = 10	Counter[*x*].FreqAveragePulseCount
Frequency Calculate Timeout	Type the amount of time in milliseconds the counter will wait between pulses before it sets the input frequency to zero. Valid values = 0…10, 000 ms Default = 1,000 ms	Counter[*x*].FreqTimeout
Enable Filter for this Counter	Check the checkbox to enable filtering. When filtering is enabled, transitions at a counter must remain in the new state for a configured length of time before the module begins counting. You can configure the filter time on the Input Configuration tab.	Counter[*x*]FilterEn
Window 0 Defined In	From the pull-down menu, choose the method window 0 will use to evaluate incoming pulses. Valid values: • Counts (default) • Frequency • Average Frequency	**Counts:** Counter[*x*].Window0UsesFreq = 0 and Counter[*x*].Window0FreqAverage = 0 **Frequency:** Counter[*x*].Window0UsesFeq = 1 and Counter[*x*].WindowFreqAverage = 0 **Average frequency:** Counter[*x*].Window0UsesFeq = 1 and Counter[*x*].WindowFreqAverage=1
Window 1 Defined In	From the pull-down menu, choose the method window1 will use to evaluate incoming pulses. Valid values: • Counts (default) • Frequency • Average Frequency	**Counts:** Counter[*x*].Window1UsesFreq = 0 and Counter[*x*].Window1FreqAverage = 0 **Frequency:** Counter[*x*].Window1UsesFeq = 1 and Counter[*x*].WindowFreqAverage = 0 **Average frequency:** Counter[*x*].Window0UsesFeq = 1 and Counter[*x*].WindowFreqAverage=1

4. Use program logic or the RSLogix 5000 tag editor to define the following values or counter control functions in the module's output tags.

Value or Counter Control Function	Output Tag
Window On/Off	Counter[*x*].Window0On, Counter[*x*].Window0Off Counter[*x*].Window1On, Counter[*x*].Window1Off
Preset	Counter[*x*].Preset
Rollover	Counter[*x*].Rollover
Count Enable	Counter[x].DisableCount
Reset Count	Counter[x].ResetCount
Preset Count	Counter[x].PresetCount
Up/Down Count	Counter[x].CountDown

IMPORTANT In RSLogix 5000 software, versions 18.02.00 and later, output tag information is sent to the counter module only at the RPI rate defined during configuration. For optimal performance, use an Immediate Output (IOT) instruction.

For example, the rung shown below contains an IOT instruction for a counter module in slot 3. Add a similar rung to your last routine within the Main Task to mimic normal output tag processing.



For more information about module tags, refer to Appendix B.

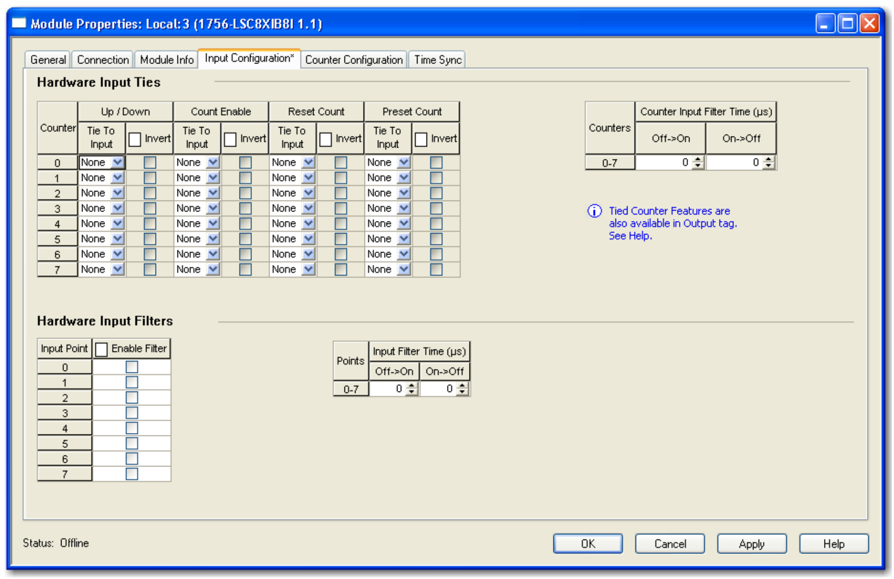
Configure Hardware Inputs 0…7

You can tie a counter control function for a designated counter to standard hardware inputs 0…7. This enables the state of an external input device to invoke a specific counter function. For more information about counter control functions, refer to Counter Control Functions on page 15.

IMPORTANT	Each of the counter control functions can also be invoked via the output tags for real-time control. For more information about output tags, see Appendix B.

Follow these steps to configure the module's standard hardware inputs to invoke counter control functions.

1. On the Modules Properties dialog box, click the Input Configuration tab.



2. In the Hardware Input Ties area, assign counter control functions for individual counters to hardware inputs as described in the table below.

IMPORTANT	A single input can control functionality for multiple counters. For example, you can tie input 3 to the Up/Down Count function for all 8 counters. Only one type of counter control function can be assigned to a single input. For example, you cannot tie both the Count Enable and Reset Count functions to the same input.

Field	Description	Configuration Tag
	Up/Down Column	
Tie to Input	Choose the hardware input to control the up and down counting or frequency direction for the corresponding counter. **IMPORTANT:** The Counter[*x*].CountDown output tag is active only if the Up/Down Count function is not tied to Counter[*x*] via a hardware input. If a hardware input is tied to Counter[*x*], the hardware input overrides the value of the Counter[*x*].CountDown output tag.	Counter[*x*].UpDownTieToPt
Invert	Check the checkbox to invert the hardware input so that the corresponding counter counts up when the input is high and counts down when the input is low.	Counter[*x*].InvertUpDown
	Count Enable Column	
Tie to Input	Choose the hardware input to control when counting starts and stops for the corresponding counter. **IMPORTANT:** Either the Count Enable hardware input or the corresponding bit in the Counter[*x*]DisableCount output tag can determine whether counting is enabled or disabled. Counting is enabled under the following conditions: • Counter[*x*].CountEnTieToPt configuration tag = -1 (no tie) or 0…7 and the corresponding hardware input is non-inverted and high or inverted and low (level-sensitive) **and** • Counter[*x*]DisableCount output tag = 0 (level-sensitive) Counting is disabled under these conditions: • Counter[*x*].CountEnTieToPt configuration tag = 0…7 and the corresponding hardware input is non-inverted and low or inverted and high (level-sensitive) **or** • Counter[*x*]DisableCount output tag = 1 (level-sensitive)	Counter[*x*].CountEnTieToPt
Invert	Check the checkbox to invert the hardware input so that the corresponding counter starts counting only when the input is low and stops counting when the input is high.	Counter[*x*].InvertCountEn
	Reset Count Column	
Tie to Input	Choose the hardware input to control when the count is reset to zero for the corresponding counter. **IMPORTANT:** Either the Reset Count hardware input or the corresponding bit in the Counter[*x*]ResetCount output tag can determine whether the count is reset. Counting is reset to zero under the following conditions: • Counter[*x*].ResetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[*x*]ResetCount output tag = 1 (rising edge-sensitive)	Counter[*x*].ResetTieToPt
Invert	Check the checkbox to invert the hardware input so that the corresponding counter resets the count to zero only when the input transitions low.	Counter[*x*].InvertReset
	Preset Count Column	
Tie to Input	Choose the hardware input to control when the count is preset to the value defined in the Counter[*x*].Preset output tag. **IMPORTANT:** Either the Preset Count hardware input and the corresponding bit in the Counter[x]PresetCount output tag can determine whether the count is preset. The count is preset to the Counter[x].Preset value under the following conditions: • Counter[x].PresetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[x]PresetCount output tag = 1 (rising edge-sensitive)	Counter[*x*].PresetTieToPt
Invert	Check the checkbox to invert the hardware input so that the corresponding counter presets the value only when the input transitions low.	Counter[*x*].InvertPreset

3. If you enabled filtering for one or more counters on the Counter Configuration tab, configure the filter times under Counter Input Filter Time.

Field	Description	Configuration Tag
Off –>On	Enter how long an Off to On transition at a counter must remain in the On state before the module counts the transition. Valid filter time = 0…30,000 µs Default = 0	CounterFilterOffOn
On –>Off	Enter how long an On to Off transition at a counter must remain in the Off state before the module counts the transition. Valid filter time = 0…30,000 µs Default = 0	CounterFilterOnOff

4. In the Hardware Input Filters area, enable filtering for one or more hardware inputs.

Field	Description	Configuration Tag
Enable Filter (all input points)	Check the checkbox to enable filtering for hardware input points 0…7.	Not applicable
Enable Filter (points 0…7)	Check the checkbox next to one or more input point numbers to enable filtering on an individual point basis.	PtXFilterEn

5. If you enabled filtering for one or more hardware inputs, configure the filter times under Input Filter Time.

Field	Description	Configuration Tag
Off –>On	Enter how long an Off to On input transition must remain in the On state before the module recognizes the transition. Valid filter time = 0…30,000 µs Default = 0	PtFilterOffOn
On –>Off	Enter how long an On to Off input transition must remain in the Off state before the module recognizes the transition. Valid filter time = 0…30,000 µs Default = 0	PtFilterOnOff

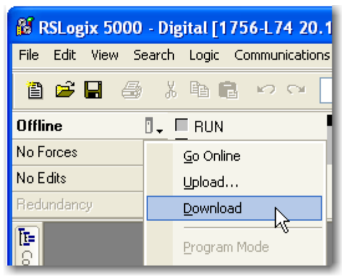
6. Click Apply.

Download the Configuration

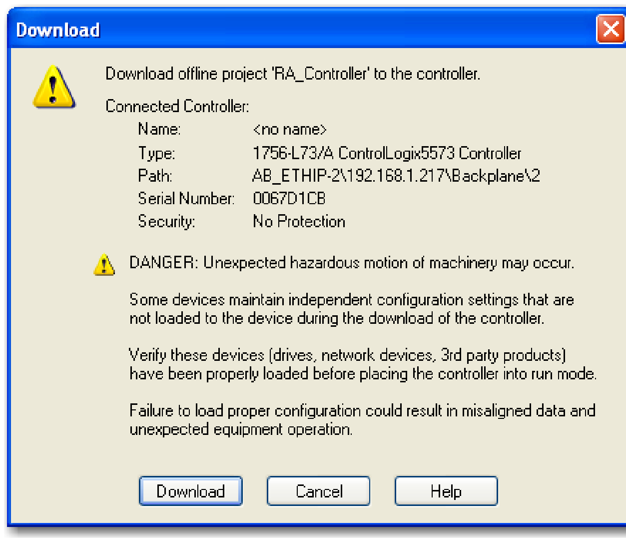
After you have changed the configuration for a module, the change does not take effect until you download the new configuration. The software downloads the entire program to the controller and overwrites any existing programs.

Follow these steps in RSLogix 5000 software to download a configuration.

1. In the upper-left corner of the RSLogix 5000 window, click the controller status icon and choose Download.



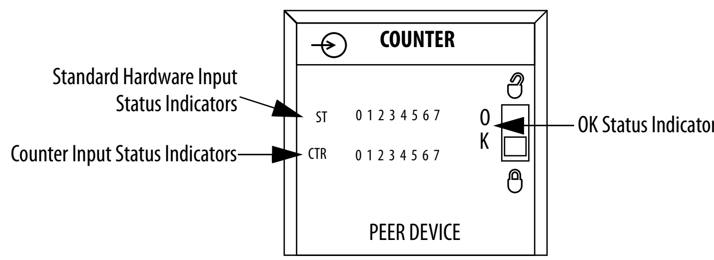
2. On the Download dialog box, click Download.



Troubleshoot the Module

Status Indicators

The module uses the status indicators shown below.



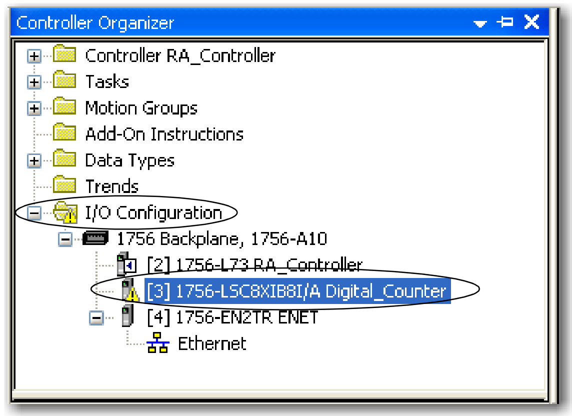
Indicator	Status	Description
OK Status	Steady green	The module is broadcasting inputs in a normal operating state.
	Flashing green	The module has passed internal diagnostics, but is not broadcasting inputs because a valid connection is not established, the controller is in Program mode, or the module is inhibited. Uninhibit the connection, transition the controller to Run mode, or establish a connection to enable communication to the module.
	Steady red	The module must be replaced.
	Flashing red	Previously established communication has timed out. Check the controller and chassis communication.
Standard Hardware Input Status	Yellow	The hardware input is On.
Counter Input Status	Yellow	The counter input is On.

Software Diagnostics

In addition to the status indicators on the module, RSLogix 5000 software alerts you to fault conditions. The software reports fault conditions in these ways:

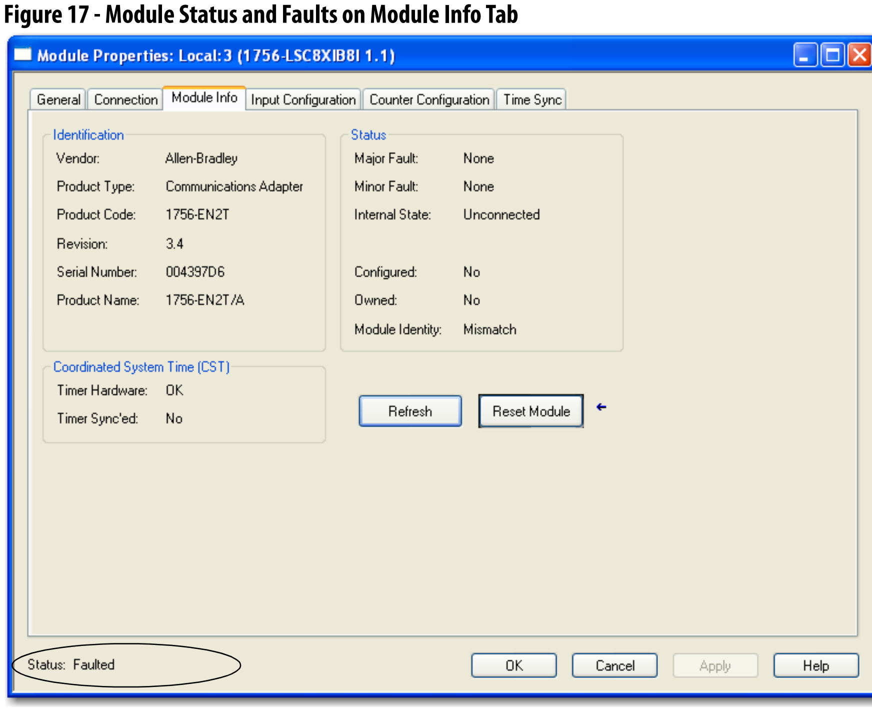
- A warning icon ⚠ appears next to the module in the I/O Configuration tree (Figure 16) when the controller-to-module connection is lost. If the connection between the counter module and a peer output module is lost, the counter module continues to communicate with the controller, and no fault indication appears.

Figure 16 - Fault Notification in I/O Configuration Tree



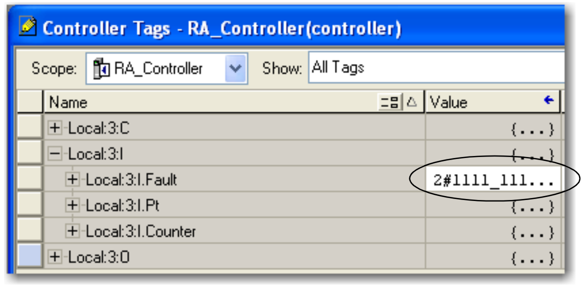
- The Module Info tab on the Module Properties dialog box displays the module's status along with major and minor faults (Figure 17).

Figure 17 - Module Status and Faults on Module Info Tab



- The Fault tag (Figure 18) shows all 32 bits as set when the connection to the module is lost.

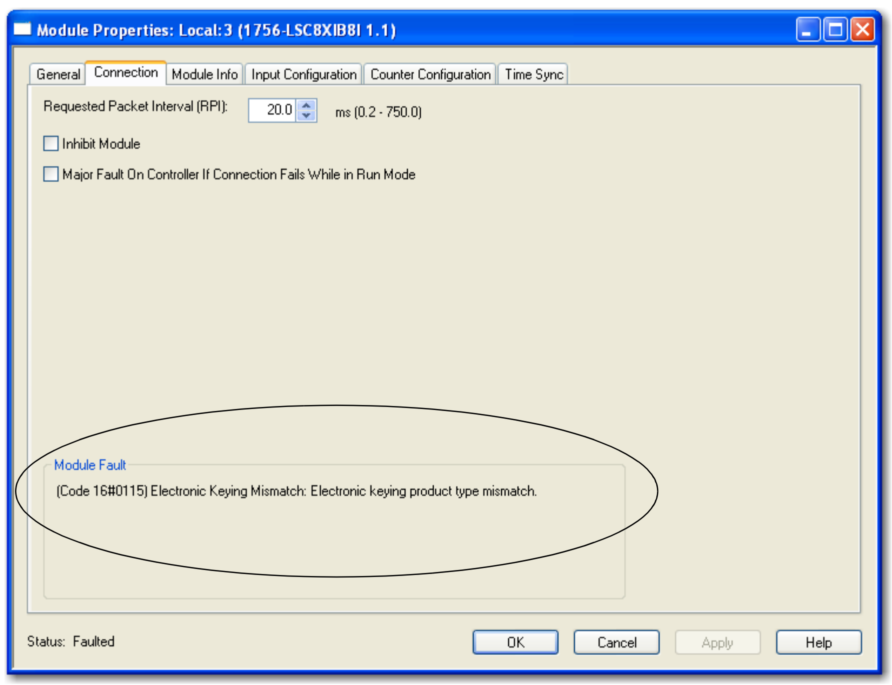
Figure 18 - Fault Tag



Fault Type Determination

When you are monitoring a module's configuration properties in RSLogix 5000 software and receive a Communication fault message, the Connection tab lists the type of fault in the Module Fault area (Figure 19). For a description of possible faults, see Module Error Codes on page 60.

Figure 19 - Faults on Connection Tab



Module Error Codes

In RSLogix 5000 software, errors appear in the Module Fault area on the Connection tab of the Module Properties dialog box (Figure 19). The table below lists possible errors.

Error Code	Description
0x100	**Connection in Use**—Typically occurs when the module detects a connection attempt, but never receives data resulting in a 60 second timeout. This scenario can be caused by an error with the communication module.
0x106	**Ownership Conflict**—The controller-to-module connection is already in use by another controller. Only one controller can own the connection to the counter module. All other controllers must use a Listen-only connection.
0x108	**Invalid Connection Type**—The module's owner-controller is not using multicast communication, so the module cannot establish a Listen-only multicast connection.
0x111	**RPI Not Supported**—The RPI is not within a valid range of 200 µs…750 ms.
0x114	**Product Code Mismatch**—Electronic keying error. The module catalog number, such as 1756-LSC8XIB8I, in the I/O Configuration tree does not match the catalog number of the corresponding physical module. For more information about electronic keying, see Appendix A.
0x115	**Product Type Mismatch**—Electronic keying error. The module product type, such as Multi-channel Digital, in the I/O Configuration tree does not match the product type of the corresponding physical module. For more information about electronic keying, see Appendix A.
0x116	**Revision Mismatch**—Electronic keying error. The cause of the error depends on which electronic keying option is specified on the General tab of the Module Properties dialog box: • If the Compatible Keying option is specified, the module revision number is incompatible with the revision number of the corresponding physical module. • If the Exact Match option is specified, the module revision number is not an exact match with the revision number of the corresponding physical module. For more information about electronic keying, see Appendix A.
0x119	**Controlling Connection Not Open**—The module cannot establish a Listen-only connection because there is currently no connection with the owner-controller.
0x02	**Resources Unavailable**—The module cannot establish a connection due to lack of resources.
0x25	**Key Failure**—The physical module does not match the electronic keying information. For more information about electronic keying, see Appendix A.

Electronic Keying

Electronic Keying

The electronic keying feature automatically compares the expected module, as shown in the RSLogix 5000 I/O Configuration tree, to the physical module before I/O communication begins. You can use electronic keying to help prevent communication to a module that does not match the type and revision expected.

For each module in the I/O Configuration tree, the user-selected keying option determines if, and how, an electronic keying check is performed. Typically, three keying options are available:

- Exact Match
- Compatible Keying
- Disable Keying

You must carefully consider the benefits and implications of each keying option when selecting between them. For some specific module types, fewer options are available.

Electronic keying is based on a set of attributes unique to each product revision. When a Logix5000 controller begins communicating with a module, this set of keying attributes is considered.

Attribute	Description
Vendor	The manufacturer of the module, for example, Rockwell Automation/Allen-Bradley.
Product Type	The general type of the module, for example, communication adapter, AC drive, or digital I/O.
Product Code	The specific type of module, generally represented by its catalog number, for example, 1756-LSC8XIB8I.
Major Revision	A number that represents the functional capabilities and data exchange formats of the module. Typically, although not always, a later, that is higher, Major Revision supports at least all of the data formats supported by an earlier, that is lower, Major Revision of the same catalog number and, possibly, additional ones.
Minor Revision	A number that indicates the module's specific firmware revision. Minor Revisions typically do not impact data compatibility but may indicate performance or behavior improvement.

You can find revision information on the General tab of a module's Properties dialog box.

Figure 20 - General Tab

IMPORTANT	Changing electronic keying selections online may cause the I/O communication connection to the module to be disrupted and may result in a loss of data.

Exact Match

Exact Match keying requires all keying attributes, that is, Vendor, Product Type, Product Code (catalog number), Major Revision, and Minor Revision, of the physical module and the module created in the software to match precisely to establish communication. If any attribute does not match precisely, I/O communication is not permitted with the module or with modules connected through it, as in the case of a communication module.

Use Exact Match keying when you need the system to verify that the module revisions are exactly as specified in the project, such as for use in highly-regulated industries.

Exact Match keying is also necessary to enable Automatic Firmware Update for the module via the Firmware Supervisor feature from a Logix5000 controller.

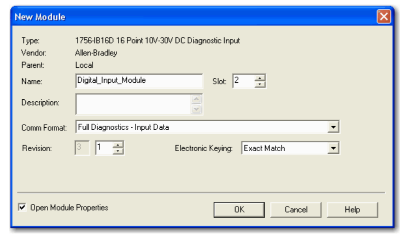
EXAMPLE

In the following scenario, **Exact Match keying prevents I/O communication**.

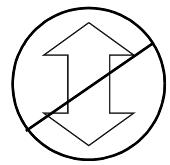
The module configuration is for a 1756-IB16D module with module revision 3.1. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is prevented because the Minor Revision of the module does not match precisely.

Module Configuration

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 1

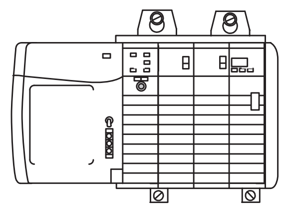


Communication is prevented.



Physical Module

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 2



IMPORTANT

Changing electronic keying selections online may cause the I/O Communication connection to the module to be disrupted and may result in a loss of data.

Compatible Keying

Compatible Keying indicates that the module determines whether to accept or reject communication. Different module families, communication adapters, and module types implement the compatibility check differently based on the family capabilities and on prior knowledge of compatible products.

Compatible Keying is the default setting. Compatible Keying allows the physical module to accept the key of the module configured in the software, provided that the configured module is one the physical module is capable of emulating. The exact level of emulation required is product and revision specific.

With Compatible Keying, you can replace a module of a certain Major Revision with one of the same catalog number and the same or later, that is higher, Major Revision. In some cases, the selection makes it possible to use a replacement that is a different catalog number than the original. For example, you can replace a 1756-CNBR module with a 1756-CN2R module.

Release notes for individual modules indicate the specific compatibility details.

When a module is created, the module developers consider the module's development history to implement capabilities that emulate those of the previous module. However, the developers cannot know future developments. Because of this, when a system is configured, we recommend that you configure your module by using the earliest, that is, lowest, revision of the physical module that you believe will be used in the system. By doing this, you can avoid the case of a physical module rejecting the keying request because it is an earlier revision than the one configured in the software.

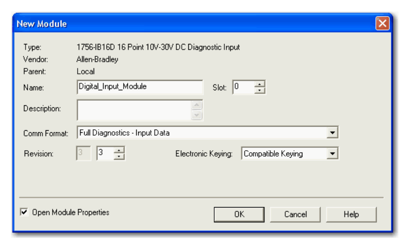
EXAMPLE

In the following scenario, **Compatible Keying prevents I/O communication**.

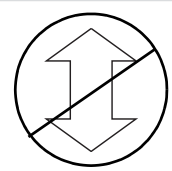
The module configuration is for a 1756-IB16D module with module revision 3.3. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is prevented because the minor revision of the module is lower than expected and may not be compatible with 3.3.

Module Configuration

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 3

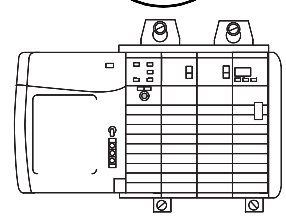


Communication is prevented.



Physical Module

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 2

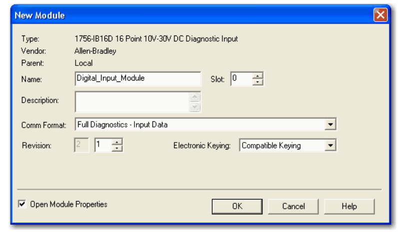


EXAMPLE In the following scenario, **Compatible Keying allows I/O communication**.

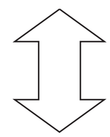
The module configuration is for a 1756-IB16D module with module revision 2.1. The physical module is a 1756-IB16D module with module revision 3.2. In this case, communication is allowed because the major revision of the physical module is higher than expected and the module determines that it is compatible with the prior major revision.

Module Configuration

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 2
Minor Revision = 1

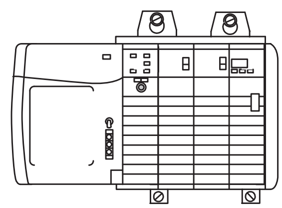


Communication is allowed.



Physical Module

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16D
Major Revision = 3
Minor Revision = 2



IMPORTANT Changing electronic keying selections online may cause the I/O communication connection to the module to be disrupted and may result in a loss of data.

Disabled Keying

Disabled Keying indicates the keying attributes are not considered when attempting to communicate with a module. Other attributes, such as data size and format, are considered and must be acceptable before I/O communication is established. With Disabled Keying, I/O communication may occur with a module other than the type specified in the I/O Configuration tree with unpredictable results. We generally do not recommend using Disabled Keying.

ATTENTION: Be extremely cautious when using Disabled Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.

If you use Disabled Keying, you must take full responsibility for understanding whether the module being used can fulfill the functional requirements of the application.

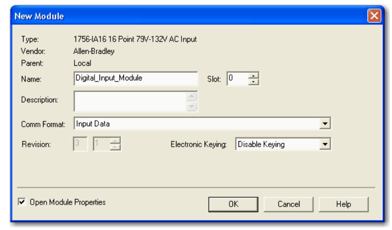
EXAMPLE

In the following scenario, **Disable Keying prevents I/O communication**.

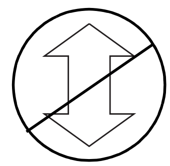
The module configuration is for a 1756-IA16 digital input module. The physical module is a 1756-IF16 analog input module. In this case, **communication is prevented because the analog module rejects the data formats that the digital module configuration requests**.

Module Configuration

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IA16
Major Revision = 3
Minor Revision = 1

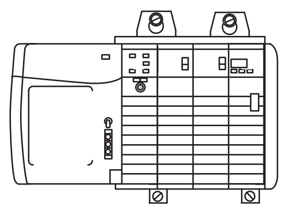


Communication is prevented.



Physical Module

Vendor = Allen-Bradley
Product Type = Analog Input Module
Catalog Number = 1756-IF16
Major Revision = 3
Minor Revision = 2



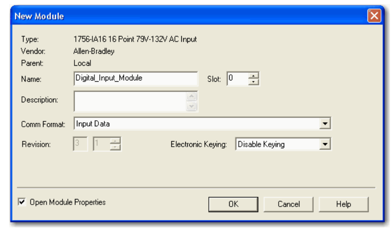
EXAMPLE

In the following scenario, **Disable Keying allows I/O communication**.

The module configuration is for a 1756-IA16 digital input module. The physical module is a 1756-IB16 digital input module. In this case, communication is allowed because the two digital modules share common data formats.

Module Configuration

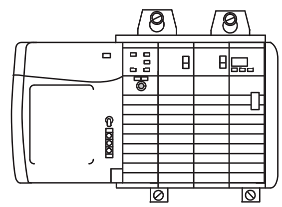
Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IA16
Major Revision = 2
Minor Revision = 1



Communication is allowed.

Physical Module

Vendor = Allen-Bradley
Product Type = Digital Input Module
Catalog Number = 1756-IB16
Major Revision = 3
Minor Revision = 2



Notes:

Tag Definitions

Module-specific tags and data types are created when you define a module in RSLogix 5000 software.

The counter module has three types of tags:

- Configuration—Defines the data structure sent from the controller to the module upon powerup.
- Output—Defines the data structure continually sent from the controller to the module that can modify the module's behavior during operation.
- Input—Defines the data structure continually sent from the module to the controller or peer output module containing the current operational state of the module's input points.

Configuration Tags

The configuration tags in Table 5 on page 71 define the module's configuration.

IMPORTANT	The Counter[*x*].CountDown output tag is active only if the Up/Down Count function is not tied to Counter[*x*] via a hardware input. If a hardware input is tied to Counter[*x*], the hardware input overrides the value of the Counter[*x*].CountDown output tag.

IMPORTANT	Either the Count Enable hardware input or the corresponding bit in the Counter[*x*]DisableCount output tag can determine whether counting is enabled or disabled. Counting is enabled under the following conditions: • Counter[*x*].CountEnTieToPt configuration tag = -1 (no tie) or 0…7 and the corresponding hardware input is non-inverted and high or inverted and low (level-sensitive) **and** • Counter[*x*]DisableCount output tag = 0 (level-sensitive) Counting is disabled under these conditions: • Counter[*x*].CountEnTieToPt configuration tag = 0…7 and the corresponding hardware input is non-inverted and low or inverted and high (level-sensitive) **or** • Counter[*x*]DisableCount output tag = 1 (level-sensitive)

IMPORTANT	Either the Reset Count hardware input or the corresponding bit in the Counter[*x*]ResetCount output tag can determine whether the count is reset. Counting is reset to zero under the following conditions: • Counter[x].ResetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[*x*]ResetCount output tag = 1 (rising edge-sensitive)

IMPORTANT	Either the Preset Count hardware input or the corresponding bit in the Counter[*x*]PresetCount output tag can determine whether the count is preset. The count is preset to the Counter[*x*].Preset value under the following conditions: • Counter[*x*].PresetTieToPt configuration tag = 0…7 (rising edge-sensitive) **or** • Counter[*x*]PresetCount output tag = 1 (rising edge-sensitive)

Table 5 - Counter Module Configuration Tags

Name	Data Type	Definition
PtFilterOffOn	INT	**Filter Time Off to On—**(Inputs 0…7 only). Defines how long an Off to On input transition must remain in the On state before the module recognizes the transition. Valid filter time = 0…30,000 µs Default = 0
PtFilterOnOff	INT	**Filter Time On to Off—**(Inputs 0…7 only). Defines how long an On to Off input transition must remain in the Off state before the module recognizes the transition. Valid filter time = 0…30,000 µs Default = 0
PtXFilterEn [X = 0…7]	BOOL	**Filter—**(Inputs 0…7 only). Indicates whether filtering is enabled for the standard hardware inputs. When filtering is enabled, transitions at the input point must remain in the new state for a configured length of time before the module recognizes the transition. The filter time is defined in the PtFilterOffOn and PtFilterOnOff tags. 0 = Disable (default) 1 = Enable
CounterFilterOffOn	INT	**Filter Time Off to On—**(Counters 0…7 only). Defines how long an Off to On transition at a counter must remain in the On state before the module counts that transition. Requires that the Counter[*x*].FilterEn configuration tag enables filtering on a per counter basis. Valid filter time = 0…30,000 µs Default = 0
CounterFilterOnOff	INT	**Filter Time On to Off—**(Counters 0…7 only). Defines how long an On to Off transition at a counter must remain in the Off state before the module counts that transition. Requires that the Counter[*x*].FilterEn configuration tag enables filtering on a per counter basis. Valid filter time = 0…30,000 µs Default = 0
Counter[*x*].Window0UsesFreq	BOOL	**Window 0 Uses Frequency—**Indicates whether window 0 evaluates incoming pulses in terms of frequency rather than accumulated count. 0 = The window evaluates incoming pulses in terms of accumulated count (default). 1 = The window evaluates incoming pulses in terms of frequency.
Counter[*x*].Window0FreqAverage	BOOL	**Window 0 Uses Average Frequency—**If window 0 is set to operate in terms of frequency via the Window0UsesFreq tag, this tag determines whether to use instantaneous frequency or average frequency. 0 = The window uses instantaneous frequency (default). 1 = The window uses average frequency.
Counter[*x*].Window1UsesFreq	BOOL	**Window 1 Uses Frequency—**Indicates whether window 1 evaluates incoming pulses in terms of frequency rather than accumulated count. 0 = The window evaluates incoming pulses in terms of accumulated count (default). 1 = The window evaluates incoming pulses in terms of frequency.
Counter[*x*].Window1FreqAverage	BOOL	**Window 1 Uses Average Frequency—**If window 1 is set to operate in terms of frequency via the Window1UsesFreq tag, this tag determines whether to use instantaneous frequency or average frequency. 0 = The window uses instantaneous frequency (default). 1 = The window uses average frequency.
Counter[*x*].InvertUpDown	BOOL	**Invert Up/Down Function—**When set, inverts the hardware input defined in the Counter[*x*].UpDownTieToPt tag, so that Counter[*x*] counts up when the input is high and counts down when the input is low. 0 = Not inverted. Counter[*x*] counts up when the input is low and down when the input is high (default). 1 = Inverted. Counter[*x*] counts up when the input is high and down when the input is low.
Counter[*x*].InvertCountEn	BOOL	**Invert Count Enable Function—**When set, inverts the hardware input defined in the Counter[*x*].CountEnTieToPt tag, so that Counter[*x*] counts only when the input is low. 0 = Not inverted. Counter[*x*] counts when the input is high (default). 1 = Inverted. Counter[*x*] counts when the input is low.
Counter[*x*].InvertReset	BOOL	**Invert Reset Count Function**—When set, inverts the hardware input defined in the Counter[*x*].ResetTieToPt tag, so that Counter[*x*] resets only when the input transitions low. 0 = Not inverted. Counter[*x*] resets when the input transitions high (default). 1 = Inverted. Counter[*x*] resets when the input transitions low.

Table 5 - Counter Module Configuration Tags (continued)

Name	Data Type	Definition
Counter[*x*].InvertPreset	BOOL	**Invert Preset Count Function—**When set, inverts the hardware input defined in the Counter[*x*].PresetTieToPt tag, so that Counter[*x*] is preset only when the input transitions low. 0 = Not inverted. Counter[*x*] sets the count to the value stored in the Counter[*x*].Preset output tag when the input transitions high (default). 1 **=** Inverted. Counter[*x*] sets the count to the value stored in the Counter[*x*].Preset output tag when the input transitions low.
Counter[*x*].FilterEn	BOOL	**Filter—**(Counters 0…7 only). Enables filtering on the counter. When filtering is enabled, transitions at a counter must remain in the new state for a configured length of time before the module recognizes the transition. The filter time is defined in the CounterFilterOffOn and CounterFilterOnOff tags. 0 = Disable (default) 1 = Enable
Counter[*x*].UpDownTieToPt	SINT	**Tie Up/Down Function to a Counter—**Defines which standard hardware input (0…7), if any, will control up and down counting for Counter[*x*]. Counter[*x*] counts up when the designated standard hardware input is low and counts down when the designated standard hardware input is high. If disabled, the Counter[*x*].CountDown output tag determines the count direction. Valid values: • 0…7 = The standard hardware input number to perform the Up/Down control function for Counter[*x*]. • -1 = Disabled. The Counter[*x*].CountDown output tag determines the count direction (default).
Counter[*x*].CountEnTieToPt	SINT	**Tie Count Enable Function to a Counter—**Defines which standard hardware input (0…7), if any, will control when Counter[*x*] starts and stops counting. Counter[*x*] starts counting when the designated standard hardware input is high and stops counting when the designated standard hardware input is low. Both the Counter[*x*].CountEnTieToPt configuration tag and the Counter[*x*].DisableCount output tag can inhibit counting. Valid values: • 0…7 = The standard hardware input number to perform the Count Enable control function for Counter[*x*]. • -1 = Disabled. Only the Counter[*x*].DisableCount output tag can disable counting (default).
Counter[*x*].ResetTieToPt	SINT	**Tie Reset Count Function to a Counter—**Defines which standard hardware input (0…7), if any, will control when Counter[*x*] resets the count to zero. Counter[*x*] will reset when the designated standard hardware input detects a rising pulse edge. Valid values: • 0…7 = The standard hardware input number to perform the Reset control function for Counter[*x*]. • -1 = Disabled. Only the Counter[*x*].ResetCount output tag can reset the count (default).
Counter[*x*].PresetTieToPt	SINT	**Tie Preset Count Function to a Counter—**Defines which standard hardware input (0…7), if any, will control when Counter[*x*] sets the count to the preset value stored in the Counter[*x]*.Preset output tag. Counter[*x*] sets the count to the preset value on a rising pulse edge. Valid values: • 0…7 = The standard hardware input number to perform the Preset control function for Counter[*x*]. • -1 = Disabled. Only the Counter[*x*].PresetCount output tag can trigger a preset (default).
Counter[*x*].FreqAveragePulseCount	INT	**Pulse Count for Average Frequency—**Defines the number of pulses to use for calculating average frequency by using the formula (Number of Pulses defined Counter[*x*].FreqAveragePulseCount)/(Time required to count the number of pulses defined in Counter[*x*].FreqAveragePulseCount). Valid values = 0…1, 000 Default = 10
Counter[*x*].FreqTimeout	INT	**Frequency Timeout—**Defines the maximum amount of time in milliseconds the counter waits before calculating frequency if the number of pulses specified in the Counter[*x*].FreqAveragePulseCount tag **have not been received**. Valid values = 0…10, 000 ms Default = 1,000 ms

Input Tags

The input tags in Table 6 indicate the current status of input points. The input module sends this data to the controller or peer output module for processing.

Table 6 - Counter Module Input Tags

Name	Data Type	Definition
Fault	DINT	**Fault—**Indicates whether a fault has occurred. The controller sets all 32 bits upon a connection loss. Fault bits 8…15 are also set by these conditions: • Negative values in one or more of the Counter[*x*].Rollover, Counter[*x*].Preset, Counter[*x*].Window0On, Counter[*x*].Window0Off, Counter[*x*].Window1On, or Counter[*x*].Window1Off output tags • Preset value >rollover value
Pt[*x*].Data	BOOL	**Data—**Indicates the current On/Off value of the corresponding hardware input. 0= Off 1 = On
Counter[*x*].Count	DINT	**Accumulated Count—**Indicates the accumulated count value currently detected by Counter[*x*]. Valid values are 0…2^{31}
Counter[*x*].Frequency	REAL	**Instantaneous Frequency—**Indicates the frequency of the last pulse detected by a counter. Valid values are ≥ 0.0 For details about how the module calculates instantaneous frequency, see Table 3 on page 12.
Counter[*x*].FreqAverage[(1)]	REAL	**Average Frequency—**Indicates the average frequency of pulses detected by Counter[*x*]. The modules calculates average frequency over the number of pulses defined in the Counter[*x*].FreqAveragePulseCount configuration tag. Valid values are ≥ 0.0 For details about how the module calculates average frequency, see Table 3 on page 12.
Counter[*x*].PulseWidth	REAL	**Instantaneous Pulse Width—**Indicates the duration in microseconds of the last rising pulse edge to falling pulse edge. The accuracy of the instantaneous pulse width is always ± -11 µs regardless of the actual pulse width. Valid values are ≥ 0.0
Counter[*x*].PulseWidthAverage[(1)]	REAL	**Average Pulse Width—**Indicates the average width of pulses. The module calculates average pulse width over the same number of pulses used to calculate the average frequency of pulses. Valid values are ≥ 0.0 For details about how the module calculates average pulse width, see Table 3 on page 12.
Counter[*x*].CountSequence	SINT	**Count Sequence—**Stores a rolling sequence number for each new count. The value increments each time a new count is broadcast to the backplane. Valid values are -128…127
Counter[*x*].FrequencySequence	SINT	**Frequency Sequence—**Stores a rolling sequence number for each new average frequency. The value increments each time a new average frequency is calculated. Valid values are -128…127
Counter[*x*].PulseWidthSequence	SINT	**Pulse Width Sequence—**Stores a rolling sequence number for each new average pulse width. The value increments each time a new average pulse width is calculated. Valid values are -128…127
Counter[*x*].Data	BOOL	**Data—**Indicates the current On/Off value of the corresponding counter input. 0= Off 1 = On

Table 6 - Counter Module Input Tags (continued)

Name	Data Type	Definition
Counter[*x*].InWindow0	BOOL	**Window 0 Input—**Indicates whether the accumulated count or frequency value of Counter[*x*] is within the parameters defined by the Counter[*x*].Window0On and Counter[*x*].Window0Off output tags. A change in window status triggers a Change of State (COS) message to be sent to the owner-controller or peer module. 0 = Counter[*x*] value is not within window 0. 1 = Counter[*x*] value is within window 0.
Counter[*x*].InWindow1	BOOL	**Window 1 Input—**Indicates whether the accumulated count or frequency value of Counter[*x*] is within the parameters defined by the Counter[*x*].Window1On and Counter[*x*].Window1Off output tags. A change in window status triggers a Change of State (COS) message to be sent to the owner-controller or peer module. 0 = Counter[*x*] value is not within window 1. 1 = Counter[*x*] value is within window 1.
Counter[*x*].Direction	BOOL	**Direction—**Indicates the direction of the last count or instantaneous frequency. 0 = Direction of the last count was down. 1 = Direction of the last count was up.

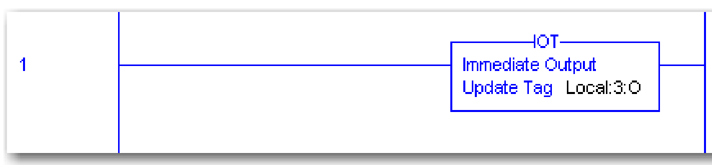
(1) The average frequency and average pulse width cannot be calculated on the same pulse due to frequency timeouts.

Output Tags

The output tags in Table 7 on page 75 provide real-time control over the module's operation.

IMPORTANT In RSLogix 5000 software, versions 18.02.00 and later, output tag information is sent to the counter module only at the RPI rate defined during configuration. For optimal performance, use an Immediate Output (IOT) instruction.

For example, the rung shown below contains an IOT instruction for a counter module in slot 3. Add a similar rung to your last routine within the Main Task to mimic normal output tag processing.



IMPORTANT	Keep in mind the following when using frequency as a window comparison method: • When configured to compare frequency values, window On/Off values are still DINT (32-bit signed integers) while the returned frequency values are REAL (32-bit IEEE float). As a result, the frequency triggers for On/Off windows can only be defined in 1 Hz increments. • Fluctuations in high frequency values across window parameters could cause the window to transition on each pulse if the input frequency is at a window parameter and you are using instantaneous frequency as the comparison method. In this case, the module will produce a COS message on the backplane with each input. This high traffic could result in system communication issues. • For example, if you set a window Off value at 18 kHz, and the input is at 18 kHz, the instantaneous frequency calculation could result in frequency fluctuations for each pulse between 17998.0 Hz and 18002.0 Hz. This fluctuation would cause a COS message to be sent every 55 µs. If this situation occurs for all eight counters, the module can generate a large amount of backplane traffic possibly resulting in system communication issues.

Table 7 - Counter Module Output Tags

Name	Data Type	Definition
Counter[*x*].DisableCount	BOOL	**Disable Count—**When set, Counter[*x*] will not count. 0 = Counting occurs unless the Counter[*x*].CountEnTieToPt configuration tag prevents counting. 1 = Counting is disabled.
Counter[*x*].ResetCount	BOOL	**Reset Count—**Resets the count back to zero on a rising edge. The Counter[*x*].ResetTieToPt configuration tag can also trigger a count reset on a rising edge. 0 = Disabled 1 = Enabled
Counter[*x*].PresetCount	BOOL	**Preset Count—**Sets the count to the preset value stored in the Counter[*x*].Preset output tag on a rising edge. The Counter[*x*].PresetTieToPt configuration tag can also transition the count to the preset value on a rising edge. 0 = Disabled 1 = Enabled. The count transitions to the preset value on a rising edge.
Counter[*x*].CountDown	BOOL	**Count Down—**Controls the direction of a count if the Counter[*x*].UpDownTieToPt input tag is not enabled for the corresponding counter. 0 = The count direction is up (default). 1 = The count direction is down.
Counter[*x*].Rollover	DINT	**Rollover—**Defines how many counts accumulate before the count rolls over to zero. The count rolls over to zero on the rollover value. The default rollover value is a maximum count of 2^{31}.
Counter[*x*].Preset	DINT	**Preset—**Defines the starting value for a count. The preset value must be less than the rollover value. If the preset value is greater than or equal to the rollover value, the default preset value is used. The default preset value is zero.
Counter[*x*].Window0On	DINT	**Window 0 On—**Defines the count or frequency value that results in an On status for window 0. The status for window 0 is stored in the Counter[*x*].InWindow0 input tag. This tag is used in conjunction with the Counter[*x*].Window0Off tag to create an On/Off window. If the values in the Counter[*x*].Window0On and Counter[*x*].Window0Off tags are the same, the window is disabled.

Table 7 - Counter Module Output Tags (continued)

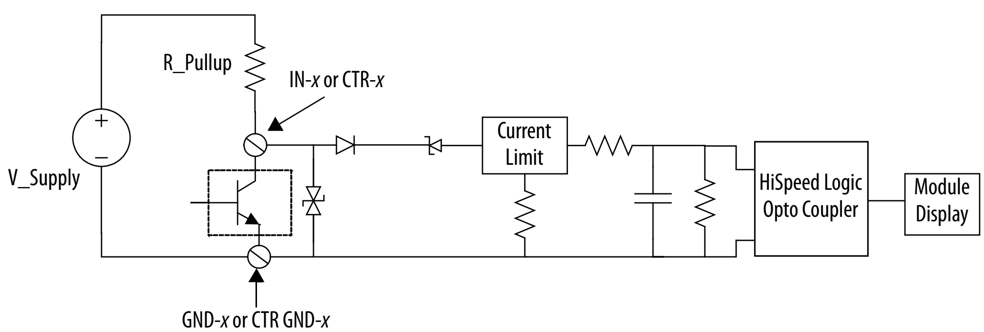
Name	Data Type	Definition
Counter[*x*].Window0Off	DINT	**Window 0 Off—**Defines the count or frequency value that results in an Off status for window 0. The status for window 0 is stored in the Counter[*x*].InWindow0 input tag. This tag is used in conjunction with the Counter[*x*].Window0On tag to create an On/Off window. If the values in the Counter[*x*].Window0On and Counter[*x*].Window0Off tags are the same, the window is disabled.
Counter[x].Window1On	DINT	**Window 1 On—**Defines the count or frequency value that results in an On status for window 1. The status for window 1 is stored in the Counter[*x*].InWindow1 input tag. This tag is used in conjunction with the Counter[*x*].Window1Off tag to create an On/Off window. If the values in the Counter[*x*].Window1On and Counter[*x*].Window1Off tags are the same, the window is disabled.
Counter[x].Window1Off	DINT	**Window 1 Off—**Defines the count or frequency value that results in an Off status for window 1. The status for window 1 is stored in the Counter[*x*].InWindow1 input tag. This tag is used in conjunction with the Counter[x].Window1On tag to create On/Off window. If the values in the Counter[*x*].Window1On and Counter[*x*].Window1Off tags are the same, the window is disabled.

Alternate Wiring for Non-IEC Type 3 Sensors

The following sections provide recommendations on how to use your counter module with an open collector sensor that is not IEC compliant.

Module Input Circuit

Refer to the input circuit shown below to wire a counter module to an open collector sensor that requires an external pull-up resistor.



Input Specifications

Refer to the module's input specifications in Table 8 to choose an appropriate a pull-up resistor as described on page 78.

Table 8 - Counter Module without External Resistor

Voltage across Terminals	Input Current @ 25 °C (77 °F)
Off ≤ 5V(1)	< 1.5 mA
Turn-on at 8.9V	2.5 mA
10V(2)	3.8 mA
24V	4.8 mA
30V	5.0 mA

(1) 5V or less across the input terminals for a module Off state.
(2) 10V minimum required across input terminals for a module On state.

Choose a Pull-up Resistor for an Open Collector Sensor

To choose a pull-up resistor for an open collector sensor, use the module's nominal input current specifications in Table 8 and the transistor's current rating to calculate the voltage drop across the pull-up resistor when the transistor is Off and On:

- Choose a pull-up resistor that provides a minimum of 10V at the module terminals when the transistor is Off (input module is On).
- Choose a pull-up resistor that provides a maximum of 5V at the module terminals when the transistor is On (input module is Off).

Table 9 shows examples of two pullup resistor values with various power supply voltages and their actual measured values.

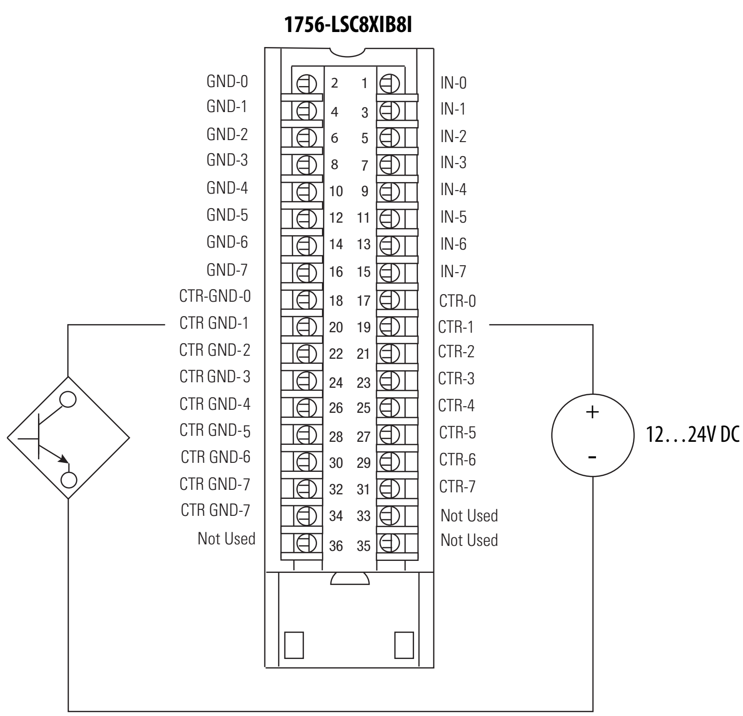
Table 9 - Pull-up Resistor Examples for Open Collector Sensors (actual measured values)

R_Pullup (Ohms)	V_Supply (Volts)	V_Terminals (Volts)	V_R_Pullup (Volts)	I_R_Pullup (mA)	P_R_Pullup (Watts)
499	12	10.1	1.9	3.8	0.00722
499	24	21.6	2.4	4.8	0.01152
499	30	27.5	2.5	5	0.0125
1000	12	9.2(1)	2.8	2.8	0.00784
1000	24	19.3	4.7	4.7	0.02209
1000	30	25.1	4.9	4.9	0.02401

(1) A 1000 ohm pull-up resistor is not recommended for 12V applications because it does not provide a minimum of 10V at the terminals.

Open Collector Wiring without a Resistor

If the off-state current of your open collector device complies with the module's off-state current specification of <1.5 mA max, the device may be wired as shown below. The module's input impedance will function as the pull-up resistor.



O

Notes:

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, 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. You can also visit our Knowledgebase at http://www.rockwellautomation.com/knowledgebase for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

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.

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