Installation Instructions

ControlLogix High Speed Counter Module

Catalog Number 1756-HSC

Use this document to install the ControlLogix™ High Speed Counter module.

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Obtain a User Manual

This product has a user manual (pub. no. 1756-UM007). To view or download it, visit www.rockwellautomation.com/literature. To purchase a printed manual, contact your local distributor or Rockwell Automation representative.

Publication 1756-IN018B-EN-P - August 2004

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.ab.com/manuals/gi) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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

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

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
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 • recognize the consequence
SHOCK HAZARD 	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be dangerous temperatures.

Environment and Enclosure

ATTENTION

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

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.

This equipment is supplied as "open type" equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The 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.

NOTE: See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

Prevent Electrostatic Discharge

ATTENTION

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.
- If available, use a static-safe workstation.
- When not in use, store the equipment in appropriate static-safe packaging.

Removal and Insertion Under Power

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.

European Hazardous Location Approval

If you install the module in a European Zone 2 location, consider:

European Zone 2 Certification (The following applies when the product bears the EEx Marking)

This equipment is intended for use in potentially explosive atmospheres as defined by European Union Directive 94/9/EC.

The LCIE (Laboratoire Central des Industries Electriques) certifies that this equipment 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 potentially explosive atmospheres, given in Annex II to this Directive. The examination and test results are recorded in confidential report No. 28 682 010.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with EN 50021.

IMPORTANT

When using this product, also consider the following:

- This equipment is not resistant to sunlight or other sources of UV radiation.
- The secondary of a current transformer shall not be open-circuited when applied in Class I, Zone 2 environments.
- Equipment of lesser Enclosure Type Rating must be installed in an enclosure providing at least IP54 protection when applied in Class I, Zone 2 environments.
- This equipment shall be used within its specified ratings defined by Allen-Bradley.
- Provision shall be made to prevent the rated voltage from being exceeded by transient disturbances of more than 40% when applied in Class I, Zone 2 environments.

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.

The following information applies when operating this equipment in hazardous locations:		**Informations sur l'utilisation de cet équipement en environnements dangereux:**	
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.	**AVERTISSEMENT** 	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.

Identify the Module Components

You received the following components with your order:

- 1756-HSC module
- Removable Terminal Block (RTB) door label

If you did not receive these components, contact your Rockwell Automation sales office.

This module mounts in a 1756 chassis and uses a separately-ordered RTB or a Bulletin 1492 Interface Module (IFM)[1] to connect all field-side wiring. This module uses one of the following RTBs:

- 1756-TBCH 36 position Cage clamp RTB
- 1756-TBS6H 36 position Spring clamp RTB

Use an extended-depth cover (1756-TBE) for applications with heavy gauge wiring or requiring additional routing space. When using an IFM to wire your module, consult the installation instructions that came with it to connect all wiring.

IMPORTANT

Before you install your module you should have:

- installed and grounded a 1756 chassis and power supply.
- ordered and received an RTB and its components for your application.

Note the Power Requirements

The module receives power from the 1756 chassis power supply and requires 2 sources of power from the ControlLogix backplane:

- 300mA at 5.1V
- 3mA at 24V.

Add this current/power value (1.6W) to the requirements of all other modules in the chassis to prevent overloading the power supply.

(1) The ControlLogix system has been agency certified using only the ControlLogix RTBs (i.e. 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.

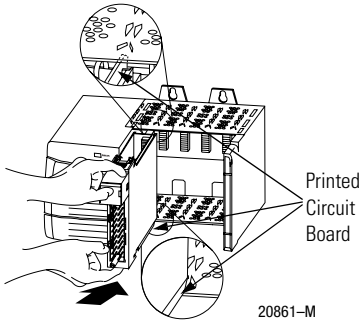
Install the Module

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

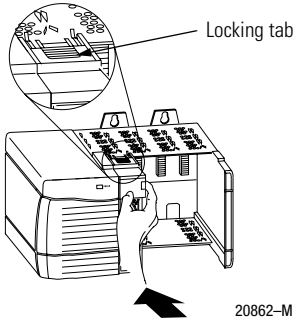
WARNING

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.

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



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



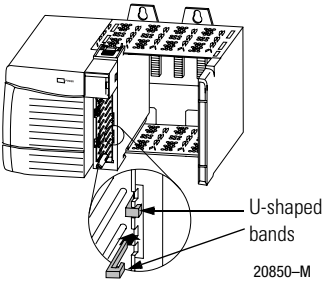
Key the Removable Terminal Block/Interface Module

Wedge-shaped keying tabs and U-shaped keying bands came with your RTB to prevent connecting the wrong wires to your module.

Key positions on the module that correspond to unkeyed positions on the RTB. For example, if you key the first position on the module, leave the first position on the RTB unkeyed.

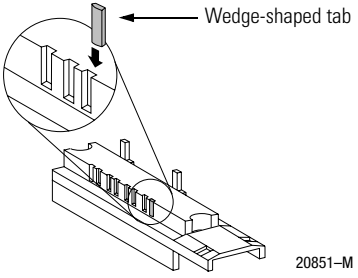
Key the Module

1. Insert the U-shaped band as shown.
2. Push the band until it snaps in place.



Key the RTB/IFM

1. Insert the wedge-shaped tab with rounded edge first.
2. Push the tab until it stops.



Reposition the tabs to rekey future module applications.

Wire the Removable Terminal Block

Wire the RTB with a 1/8 inch (3.2mm) maximum flat-bladed screwdriver before installing it onto the module. Shielded cable is required. For most applications, we recommend you use Belden 8761 cable.

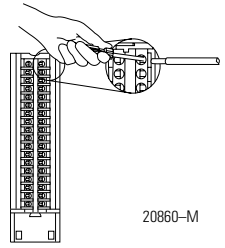
WARNING

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.

The RTB terminations can accommodate 22-14 AWM shielded wire.

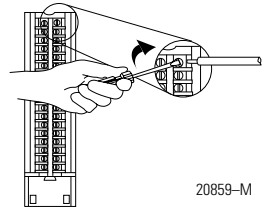
Spring Clamp RTB

1. Strip 7/16 inch (11mm) maximum length to wire your RTB.
2. Insert the screwdriver into the inner hole of the RTB.
3. Insert the wire into the open terminal.
4. Remove the screwdriver.



Cage Clamp RTB

1. Strip 5/16-3/8 inch (8-9.5mm) maximum length to wire your RTB.
2. Insert the wire into the open terminal.
3. Turn the screw clockwise to close the terminal on the wire.

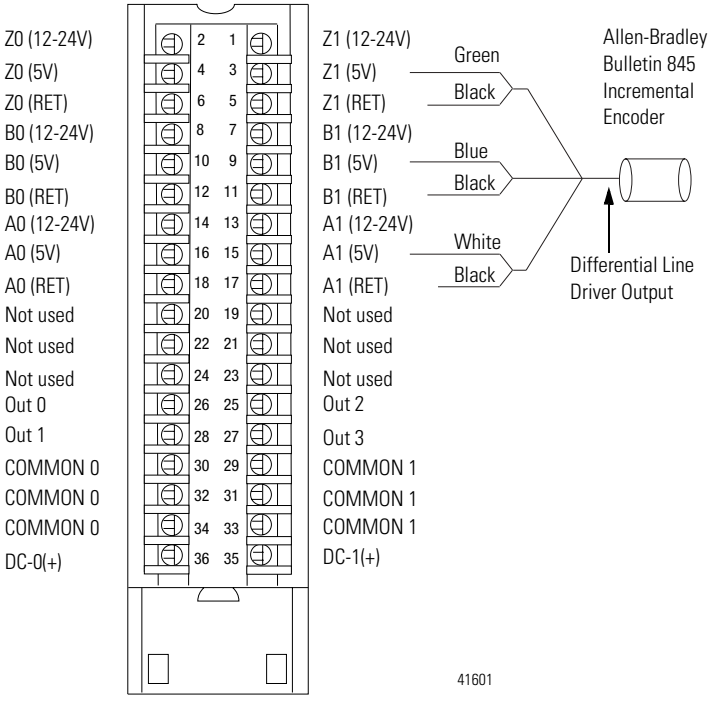


Wiring an Allen-Bradley 845 Incremental Encoder

Use Table 1 to connect the High Speed Counter module to an Allen-Bradley 845 incremental encoder:

Table 1

Application:	A1 Connections:	B1 Connections:	Z1 Connections:
Differential Line Driver Output (40mA)	White - A1 (5V) Black of white - A1 (RET)	Blue - B1 (5V) Black of blue - B1 (RET)	Green - Z1 (5V) Black of green - Z1 (RET)

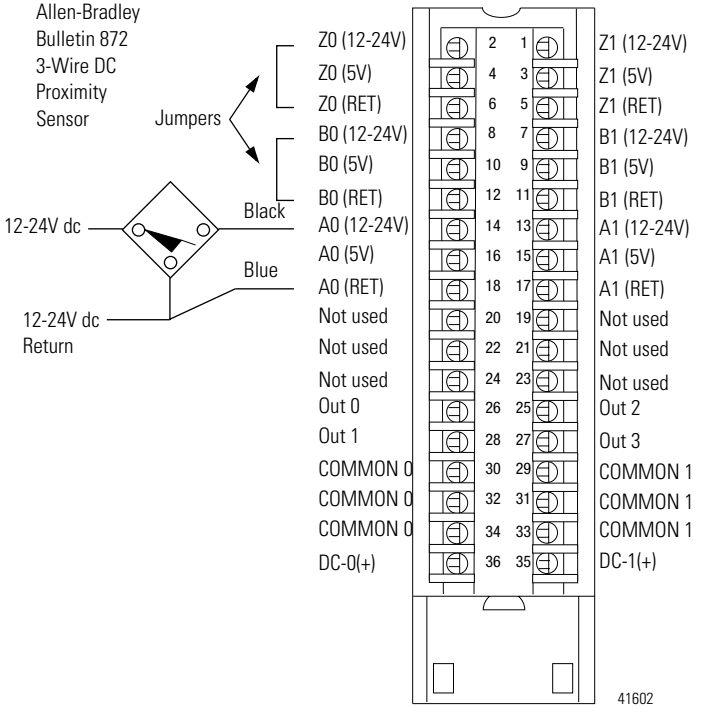


Wiring an Allen-Bradley Bulletin 872 3-Wire DC Proximity Sensor

Use Table 2 to connect the High Speed Counter module to an Allen-Bradley 872 3-wire DC proximity sensor:

Table 2

Application:	A0 Connections:	B0 Connections:	Z0 Connections:
PNP (Sourcing) N.O.	Black - A0 (12-24V) Blue, PS(-)- A0 (RET)	Jumper B0 (12-24V) to B0 (RET)	Jumper Z0 (12-24V) to Z0 (RET)

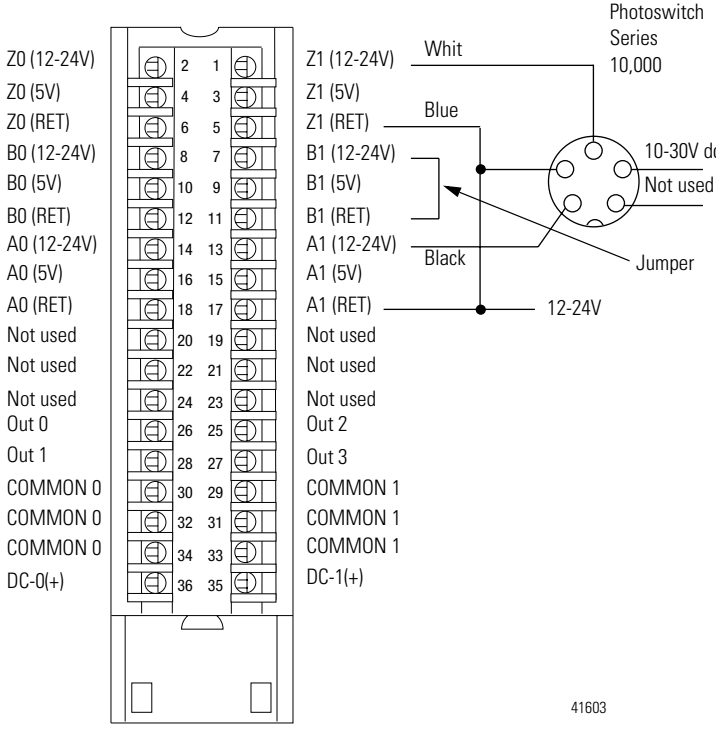


Wiring a Photoswitch Series 10,000 Photoelectric Sensor

Use Table 3 to connect wiring to a series 10,000 photoelectric sensor:

Table 3

Application:	A1 Connections:	B1 Connections:	Z1 Connections:
Any	Black - A1 (12-24V) Blue - A1 (RET)	Jumper B1 (12-24V) to B1 (RET)	White - Z1 (12-24V) Blue - Z1 (RET)



Ground the Module

When grounding the module, follow these guidelines:

- Ground the cable at the chassis mounting tab, as described below.
- The shield on your cable should extend the length of the cable to the point of termination, exposing just enough cable to adequately terminate the inner conductors at the chassis and RTB.
- Use heat shrink or another suitable insulation where the wire exists the cable jacket (shown below).

Connect grounded end of the cable

1. Ground the drain wire at the chassis mounting tab.

A. Remove a length of cable jacket from the connecting cable.

B. Pull the foil shield and bare drain wire from the insulated wire.

C. Twist the foil shield and drain wire together to form a single strand.

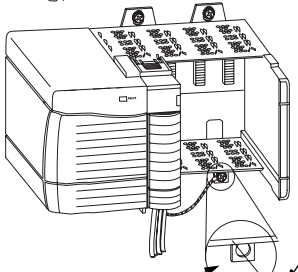
D. Attach a ground lug and apply heat shrink tubing to the exit area.

20104-M

E. Connect the drain wire to a chassis mounting tab.

Use any chassis mounting tab that is designated as a functional earth ground terminal.

This symbol appears near the tab.



20918-M

4M or 5M (#10 or #12) star washer

Chassis mounting tab

4M or 5M (#10 or #12) phillips screw and star washer (or SEM screw)

Drain wire with ground lug

2. Connect the insulated wires to the RTB (see page 10).

Connect ungrounded end of the cable

1. Cut the foil shield and drain wire back to the cable casing. To insulate them from electrical contact, tape exposed shield and drain wire with electrical tape.
2. Connect the insulated wires to the field-side device.

Cable Considerations

We recommend using Belden 8761 for your High Speed Counter module, for most applications. For demanding applications (e.g., applications with frequencies of +100KHz and cable length of +100 ft), we recommend using Belden 9182 cable. When wiring your application, consider cable length, impedance, capacitance and frquency and totem-pole devices.

Cable Length

Long cables can result in changes in duty cycle, rise and fall times, and phase relationships. For applications using a differential line driver, we recommend 250ft or less of cable. For applications using an open collector, or other single-ended driver, we recommend 250 ft or less of any of the following 5V line drivers:

- DM8830
- DM88C30
- 75ALS192

Cable Impedance

We recommend 150Ω Belden 9182 cable for use with encoder and module input circuits.

IMPORTANT Termination of one, or both ends, of the cable with a fixed resistor whose value is equal to the cable impedance will not necessarily improve 'reception' at the end of the cable. It will increase the dc load seen by the cable driver, though.

Cable Capacitance

High capacitance cable rounds off incoming square wave edges and uses driver current to charge and discharge. Also, remember that increasing cable length causes a linear increase in capacitance.

Cable Frequency

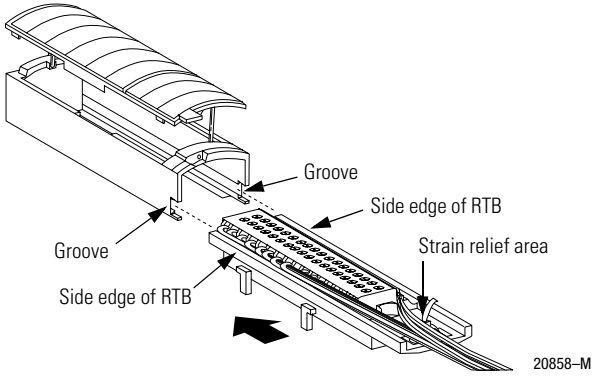
The maximum encoder input of 250KHz is designed to work with Allen-Bradley Bulletin 845H or similar incremental encoders with a quadrature specification of 90^{o} ($\pm 22^{o}$) and a duty cycle specification of 50%($\pm$10%). Additional phase or duty cycle changes caused by the cable will reduce the specified 250KHz specification.

Totem-pole Output Devices

Standard TTL totem-pole output devices, usually rated to source 400µA at 2.4V in the high logic state, will not turn on the High Speed Counter module. We recommend using a high current 5V differential line driver when choosing an encoder.

Assemble the Removable Terminal Block and the Housing

1. Align the groove at the bottom of each side of the housing with the side edges of the R



Install the Removable Terminal Block onto the Module

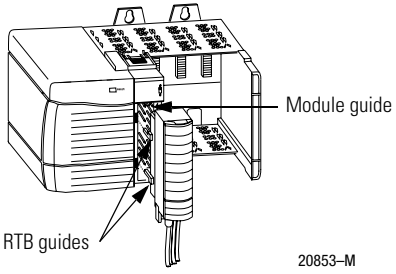
WARNING

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.

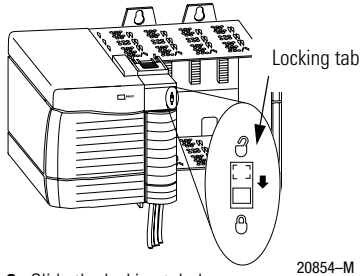
Before proceeding with RTB installation, make certain:

- power is removed or the area is nonhazardous.
- field-side wiring of the RTB has been completed.
- the RTB housing is snapped in place on the RTB.
- the RTB housing is closed.
- the locking tab at the top of the module is unlocked.

1. Align the side and top, bottom guides.



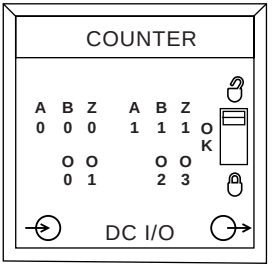
2. Press quickly and evenly to seat the RTB until the latches snap into place.



3. Slide the locking tab down.

Check the Indicators

The 1756-HSC module uses the following status indicators.



LED indicator	This display:	Means:	Take this action:
Input (A, B, Z)	Off	Input turned off Input not currently used Wire disconnected	If you need to use the input, check wiring connections
	On/Yellow	Input turned on	None
Output (0, 1, 2, 3)	Off	Output turned off Output not currently used	If you need to use the output, check input wiring connections and your ladder application.
	On/Yellow	Output turned on	None

This completes installation of the module. Use the information below to remove the module.

Remove the Removable Terminal Block from the Module

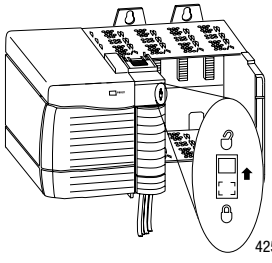
If you need to remove the module, you must remove the RTB first.

WARNING

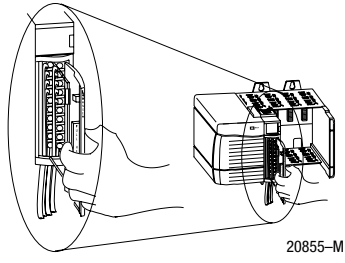
When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Before removing the module, you must remove the RTB.

1. Unlock the locking tab at the top of the module.

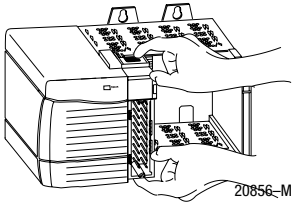


2. Open the RTB door and pull the RTB off the module.

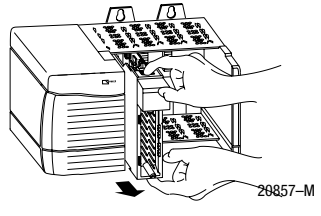


Remove the Module

1. Push in top and bottom locking tabs.



2. Pull module out of the chassis.



1756-HSC Specifications

Module Location	1756 ControlLogix Chassis
Backplane Current	300mA @ 5.1V dc , 3mA @ 24V dc
Backplane Power	1.9W
Maximum Power Dissipation (Module)	5.6 W @ 60°C
Thermal Dissipation	19.1 BTU/hr
Module Input Current	Input - 2V – 16Ω
Number of Counters	2
Inputs per Counter	3 (A, B, Z for Gate/Reset)
Maximum Input Frequency	1 MHz in counter modes (A input) 500 KHz in rate measurement mode (A input) 250 KHz in encoder mode (A/B inputs, X1 or X4) 50Hz with debounce filter enabled
Count Range	0 - 16,777, 214
Input Voltage Range 5V Inputs 12-24V Inputs	 4.5-5.5V dc 10-26.4V dc
Input Current Nominal Minimum	 15mA 4mA
Number of Outputs	4 (2 outputs/common)
Output Voltage Range	4.5-5.5V dc 10-31.2V dc
Output Current Rating (per point)	20mA @ 4.5-5.5V dc 1.0A @ 10-31.2V dc
Surge Current/Point	2A for 10 ms every 1s @ 60°C
Output Control	Any number of outputs is assignable to each counter channel. Each output can have 2 “turn-on” and “turn-off” preset values.

Minimum Load Current	3mA/point (5V operation) 40mA/point (12-24V operation)
Maximum On-state Voltage Drop/Output	0.55V
Maximum Off-State Leakage Current/Output	300µA/point
Output Delay Time Off to On On to Off	 20µs typical (50µs maximum) 60µs typical (300µs maximum)
Current Limit	<4A
Output Short Circuit Protection	Electronic – Remove load and toggle output On-Off to restore
Reverse Polarity Protection	Yes (If wired incorrectly, module outputs may be permanently disabled)
Isolation Group to Group User to System	 125 V continuous between groups (100% tested at 1700V dc for 1s) 125V continuous (100% tested at 1700V dc for 1s)
Module Keying (Backplane)	Software configurable
RTB Screw Torque (Cage clamp)	4.4 inch-pounds (0.4Nm)
RTB Keying	User defined mechanical keying
RTB and Housing	36 Position RTB (1756-TBCH or TBS6H)
Conductors Wire Size Wire Type Category	 #22 to #14 AWG (0.324 to 2.08 sq. mm) stranded[2] 3/64 inch (1.2mm) insulation maximum Copper 1[3]
Screwdriver Width for RTB	1/8 inch (3.2mm) maximum

Environmental Conditions	
Operational Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5 to 95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
Operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30g
Non-operating Shock	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50g
Emissions	CISPR 11: Group 1, Class A
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 30MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±4kV at 2.5kHz on power ports ±4kV at 2.5kHz on signal ports

Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on power ports ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports ±2kV line-earth(CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz
Enclosure Type Rating	None (open-style)
Certifications[1] (when product is marked)	UL UL Listed Industrial Control Equipment CSA CSA Certified Process Control Equipment CSA CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations CE European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions C-Tick Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions EEx European Union 94/9/EC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (Zone 2)

(1) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

(2) Maximum wire size will require extended housing - 1756-TBE.

(3) Use this Conductor Category information for planning conductor routing. Refer to Publication 1770-4.1, "Industrial Automation Wiring and Grounding Guidelines".

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using its products. At http://support.rockwellautomation.com, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

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

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

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

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

www.rockwellautomation.com

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