



## *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-UM007A-EN-P). To view it, visit [www.ab.com/manuals](http://www.ab.com/manuals) or [www.theautomationbookstore.com](http://www.theautomationbookstore.com). You can also purchase a printed manual by:

- contacting your local distributor or Rockwell Automation representative
- visiting [www.theautomationbookstore.com](http://www.theautomationbookstore.com) and placing an order
- calling 800.963.9548 (USA/Canada) or 001.320.725.1574 (outside USA/Canada)

### 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 ControlLogix™ chassis and uses a Removable Terminal Block (RTB) or a Bulletin 1492 Interface Module (IFM) to connect all field-side wiring and uses one of these 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.

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**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.
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## Prevent Electrostatic Discharge

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**ATTENTION**

Electrostatic discharge can damage integrated circuits or semiconductors if you touch backplane connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
- Wear an approved wrist-strap grounding device.
- Do not touch the backplane connector or connector pins.
- Do not touch circuit components inside the module.
- If available, use a static-safe work station.
- When not in use, keep the module in its static-shield box.

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## Removal and Insertion Under Power (RIUP)

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**WARNING**

This module is designed so you can remove and insert it under backplane power and field-side power. When you remove or insert a module while field-side power is applied, you may cause an electrical arc. An electrical arc can cause personal injury or property damage because it may:

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

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

When you insert or remove the module while backplane power is on, or you connect or disconnect the 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 non-hazardous before proceeding.

### **Understand Compliance to European Union Directive**

If this product bears the CE marking, it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

#### **EMC Directive**

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2 EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2 EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

#### **Low Voltage Directive**

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1
- Automation Systems Catalog, publication B111

This equipment is classified as open equipment and must be installed (mounted) in an enclosure during operation as a means of providing safety protection.

## Note the Power Requirements

The backplane provides module power with 2 sources of power: 300mA at 5.1V and 3mA at 24V. Add this current to the requirements of all other modules in the chassis to prevent overloading the backplane power supply.

## Install the Module

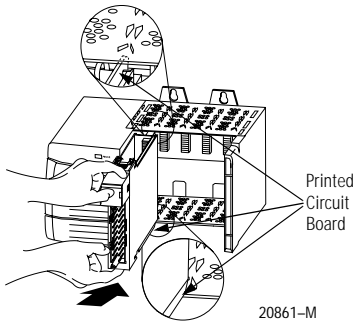
You can install or remove the module while chassis power is applied.

### WARNING

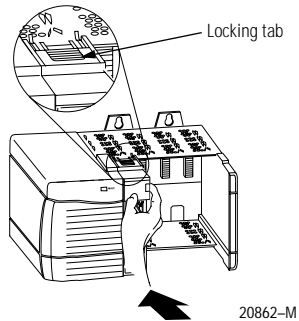


The module is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur**. Exercise extreme caution when using this feature.

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



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



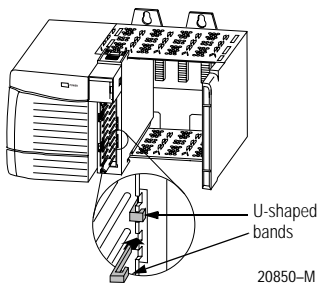
## Key the Removable Terminal Block/Interface Module

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.

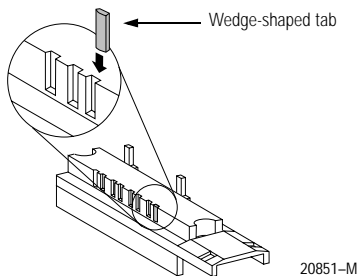
### Key the Module

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.

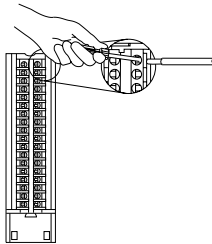
## Wire the Removable Terminal Block

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.

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

### Spring Clamp RTB

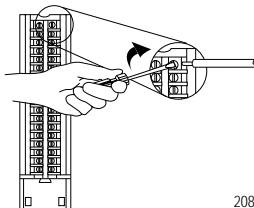
1. Strip 7/16 inch (11mm) maximum length to wire your RTB.
2. Insert the screwdriver into the inner hole of the RTB.
3. Insert the wire into the open terminal.
4. Remove the screwdriver.



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### 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.

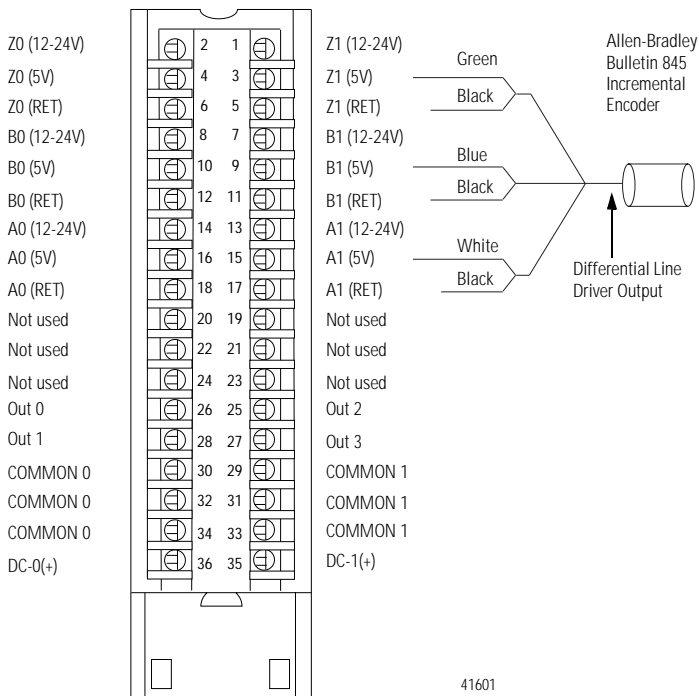


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## Wiring an Allen-Bradley 845 Incremental Encoder

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

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

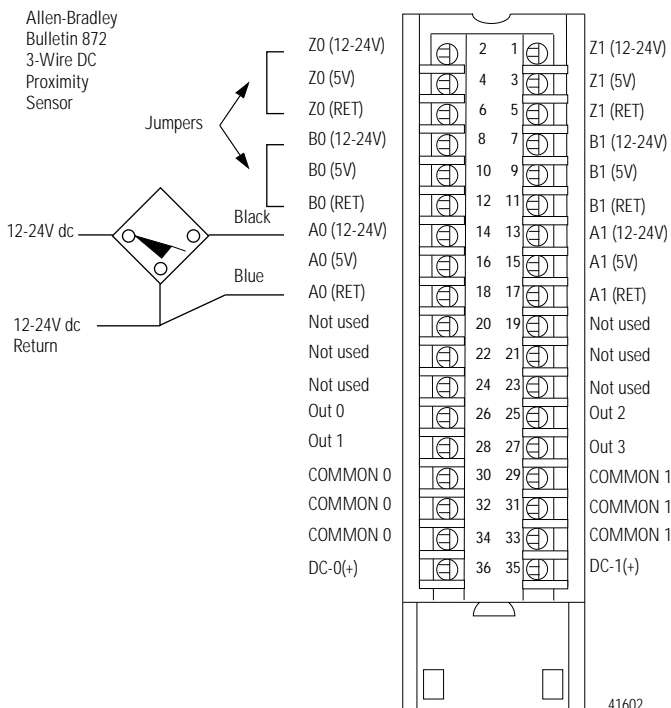




## Wiring an Allen-Bradley Bulletin 872 3-Wire DC Proximity Sensor

Use the following table and diagram to connect the High Speed Counter module to an Allen-Bradley 872 3-wire DC proximity sensor:

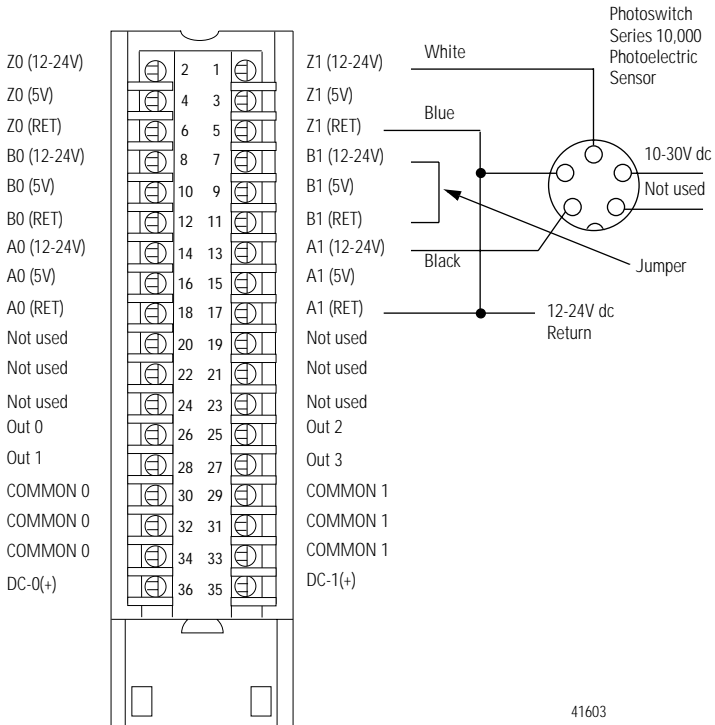
Application:	A0 Connections:	B0 Connections:	Z0 Connections:
PNP (Sourcing) N.O.	Black - A0 (12-24V) Blue, PS(-)- A0 (RET)	Jumper B0 (12-24V) to B0 (RET)	Jumper Z0 (12-24V) to Z0 (RET)



### Wiring a Photoswitch Series 10,000 Photoelectric Sensor

Use the following table and diagram to connect wiring to a series 10,000 photoelectric sensor:

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)



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## Ground the Module

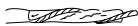
### Connect grounded end of the cable

1. Ground the drain wire.

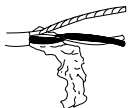
#### IMPORTANT

We recommend grounding the drain wire at the field-side. If you cannot ground at the field-side, ground at an earth ground on the chassis as shown below.

- 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.



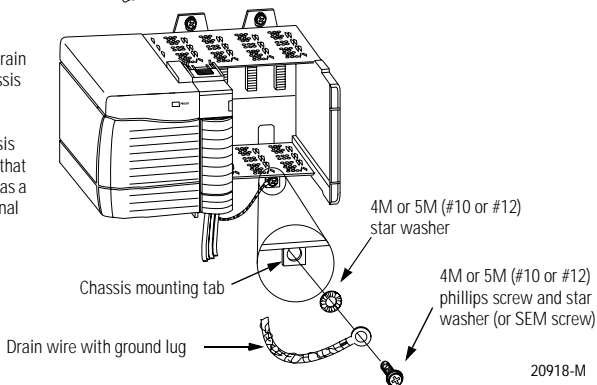
- d. Attach a ground lug and apply heat shrink tubing to the exit area.



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- e. Connect the drain wire to a chassis mounting tab.

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



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2. Connect the insulated wires to the field-side.

### Connect ungrounded end of the cable

1. Cut the foil shield and drain wire back to the cable casing and apply shrink wrap.
2. Connect the insulated wires to the RTB (see page 8).

### 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. Consider the following when wiring your application:

- cable length
- cable impedance
- cable capacitance
- cable frequency
- 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.

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**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.

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## 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

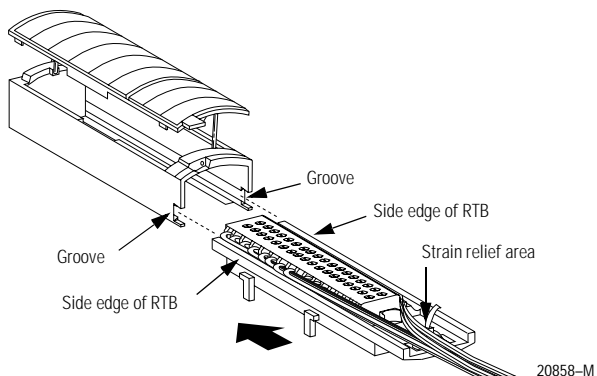
The maximum encoder input of 250KHz is designed to work with Allen-Bradley Bulletin 845H or similar incremental encoders with a quadrature specification of  $90^\circ (\pm 22^\circ)$  and a duty cycle specification of  $50\% (\pm 10\%)$ . Additional phase or duty cycle changes caused by the cable will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

## Totem-pole Output Devices

Standard TTL totem-pole output devices, usually rated to source  $400\mu\text{A}$  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



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## Install the Removable Terminal Block onto the Module

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**WARNING**



The RTB is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur**. Exercise extreme caution when using this feature. It is recommended that field-side power be removed before installing the RTB onto the module.

When you remove or insert a module while field-side power is applied, you may cause an electrical arc. An electrical arc can cause personal injury or property damage because it may:

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

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

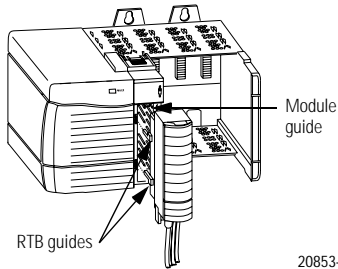
When you insert or remove the module while backplane power is on, or you connect or disconnect the RTB with field-side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is non-hazardous before proceeding.

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Before installing the RTB, make certain:

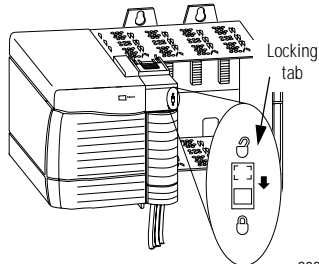
- field-side wiring of the RTB has been completed.
- the RTB housing is snapped into place on the RTB.
- the RTB housing door is closed.
- the locking tab at the top of the module is unlocked.

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



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

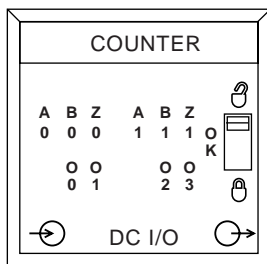


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3. Slide the locking tab down to lock the RTB onto the module.

## Check the Indicators

The 1756-HSC module uses the following status indicators.



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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.



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## Remove the Removable Terminal Block from the Module

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**WARNING**

**Shock hazard exists.** If the RTB is removed from the module while the field-side power is applied, the module will be electrically live. Do not touch the RTB's terminals. Failure to observe this caution may cause personal injury.

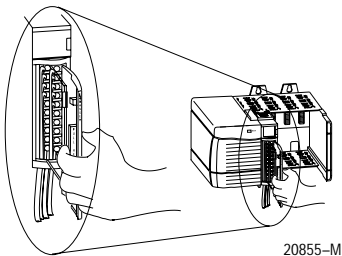
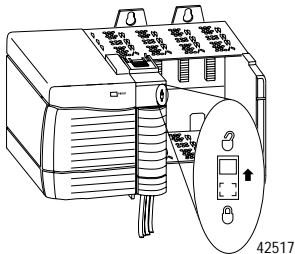
The RTB is designed to support Removal and Insertion Under Power (RIUP). However, when you remove or insert an RTB with field-side power applied, **unintended machine motion or loss of process control can occur.** Exercise extreme caution when using this feature. It is recommended that field-side power be removed before removing the module.

When you insert or remove the module while backplane power is on, or you connect or disconnect the 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 non-hazardous before proceeding.

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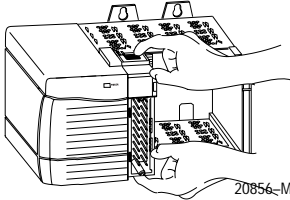
Before removing the module, you must remove the RTB.

1. Unlock the locking tab at the top of the module.
2. Open the RTB door and pull the RTB off the module.

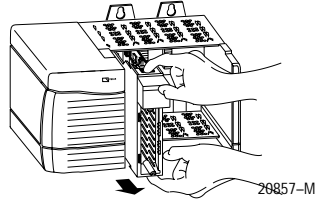


## Remove the Module

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 (1.6 W)
Maximum Power Dissipation	5.6 W @ 60°C
Thermal Dissipation	19.1 BTU/hr
Module Input Current	$\frac{\text{Input} - 2V}{16\Omega}$
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	4.5-5.5V dc
12-24V Inputs	10-26.4V dc
Input Current	
Typical	15mA
Minimum	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	300 $\mu$ A/point
Output Delay Time Off to On On to Off	20 $\mu$ s typical (50 $\mu$ s maximum) 60 $\mu$ s typical (300 $\mu$ s 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	100% tested at 1700V dc for 1s (125 Vac max continuous between groups) 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

## 20 ControlLogix High Speed Counter Module

RTB and Housing	36 Position RTB (1756-TBCH or TBS6H) <sup>1</sup>
Environmental Conditions Operating Temperature Storage Temperature Relative Humidity	0 to 60°C (32 to 140°F) -40 to 85°C (-40 to 185°F) 5 to 95% non-condensing
Conductors Wire Size Category	22-14 gauge (2mm 2) stranded <sup>1</sup> 3/64 inch (1.2 mm) insulation maximum <sub>1 2,3</sub>
Screwdriver Width for RTB	1/8 inch (3.2mm) maximum
Agency Certification (when product is marked)	 Listed Industrial Control Equipment  Certified Process Control Equipment Certified Class I, Division 2, Group A, B, C, D  Approved Class I, Division 2, Group A, B, C, D  Marked for all applicable directives  Marked for all applicable acts N223

<sup>1</sup> Maximum wire size will require extended housing - 1756-TBE.

<sup>2</sup> Use this conductor category information for planning conductor routing as described in the system level installation manual.

<sup>3</sup> Refer to publication 1770-4.1 "Industrial Automation Wiring and Grounding Guidelines".

### Additional Notes

The ControlLogix system must be mounted within a suitable enclosure to prevent personal injury resulting from accessibility to live parts. The interior of this enclosure must be accessible only by the use of a tool.

This industrial control equipment is intended to operate in a Pollution Degree 2 environment, in overvoltage category II applications, as defined in IEC publication 664A, at altitudes up to 2000 meters without derating.

## Hazardous Location information

**The following information applies when operating this equipment in hazardous locations:**

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.

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**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.
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## Informations sur l'utilisation de cet équipement en environnements dangereux :

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.

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### 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 1, Division 2.
  - S'assurer que l'environnement est classé non dangereux avant de changer les piles.
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