



Installation Instructions

Analog Encoder (AE) Servo Module

(Catalog Number 1756-M02AE)

The Analog Encoder (AE) Servo Module mounts in a ControlLogix™ chassis and uses a removable terminal block (RTB) to connect all field-side wiring.

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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Preventing Electrostatic Discharge



ATTENTION: Electrostatic discharge can damage the servo board if you touch the circuitry or connector pins without taking precautions. Follow these guidelines when you handle the servo board:

- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch the connector or connector pins on the servo board.
 - Do not touch circuit components inside the servo board.
 - If available, use a static-safe work station.
-

Removing and Inserting Under Power (RIUP)



ATTENTION: 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 can cause an electrical arc. An electrical arc can cause personal injury or property damage because it can:

- Send an erroneous signal to your system 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 can create electrical resistance. For additional information on RIUP, please contact your local Allen-Bradley sales representative.

Understanding Compliance to the 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 50081-2EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2EMC - 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 Test.

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 for Noise Immunity, 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.

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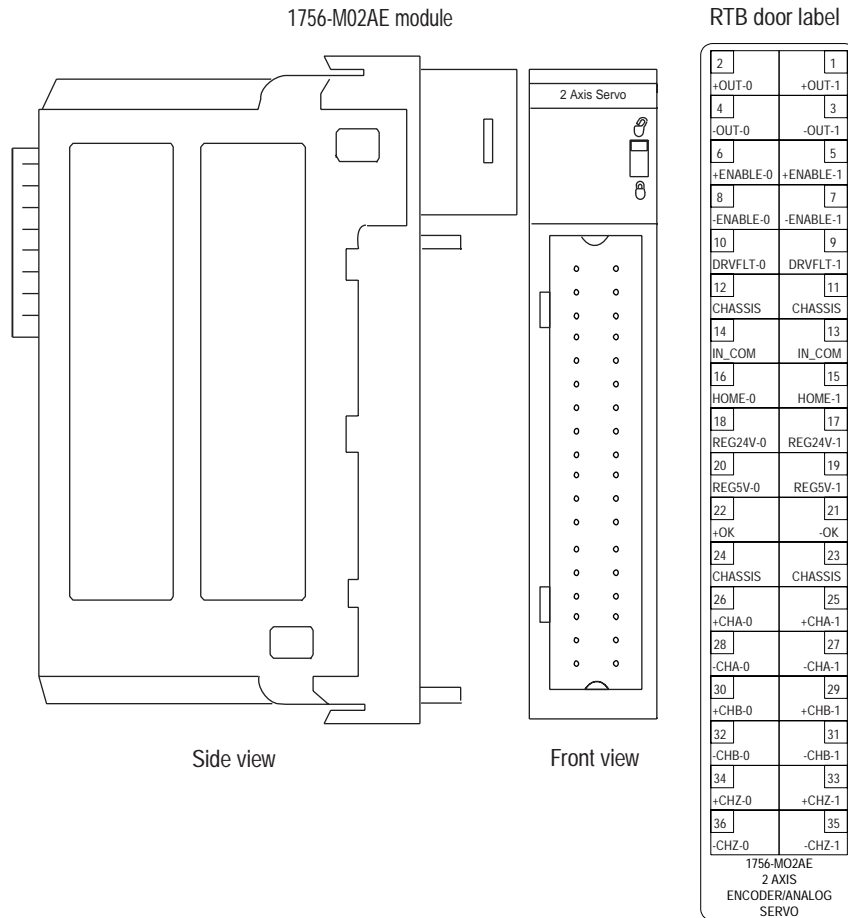
Determining the Power Requirements

This module receives power from the 1756 chassis power supply and requires two sources of power: 700mA at 5V and 2.5 mA at 24V from the backplane. Add this current to the requirements of all other modules in this chassis to prevent overloading the backplane power supply.

Identifying Module Components

You received two components with your order:

- 1756-M02AE module
- RTB door label



If you did not receive these components, contact your local Allen-Bradley representative.

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Removable Terminal Block and Housing

A separately-ordered RTB connects field-side wiring to the module. You cannot use your module without an RTB and its components.

Use one of the following RTBs with your module:

- 1756-TBCH 36-position cage clamp RTB
- 1756-TBS6H 36-position spring clamp RTB

You received the following components with your RTB:

- 1756-TBH standard-depth RTB housing
- wedge-shaped keying tabs and U-shaped keying bands
- RTB door label

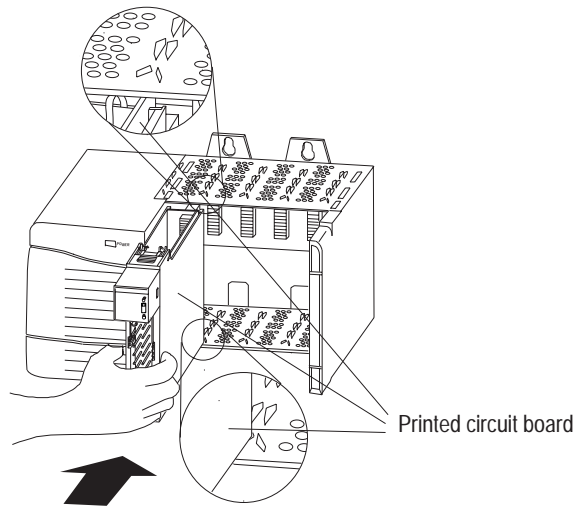
Installing the Module



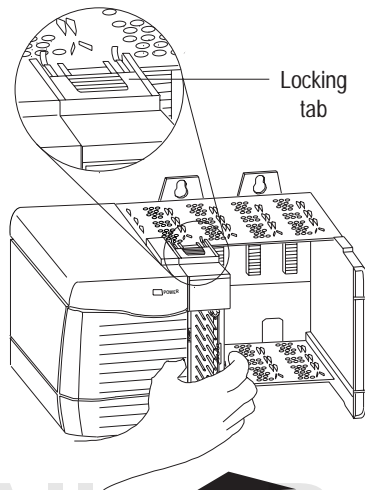
ATTENTION: When you remove or insert an RTB with field-side power applied, unintended machine motion or loss of process control can occur. Exercise extreme caution when power is applied. Failure to observe this caution can cause personal injury

To install the AE module:

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



2. Push evenly and firmly to seat the module in the chassis. It is seated when the top and bottom locking tabs have snapped into place.



Note: The 1756 chassis provides grounding for your module.

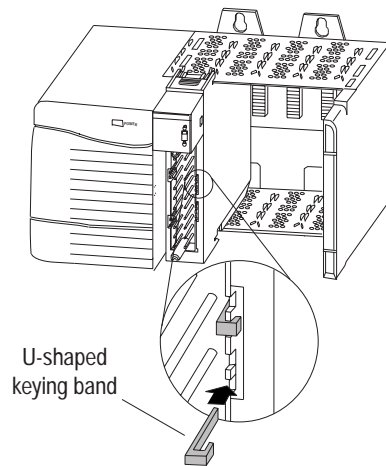
Keying the Removable Terminal Block

To identify the RTB that belongs with each module, you can use a module keying pattern. First, you can create a unique keying pattern for your module using the U-shaped keying bands that you received with your RTB. Then you can use the keying tabs to key the RTB with the same pattern as the module.

To prevent confusion, use a unique keying pattern to each module.

To key the module:

1. Insert the U-shaped keying band with the longer side near the terminals.

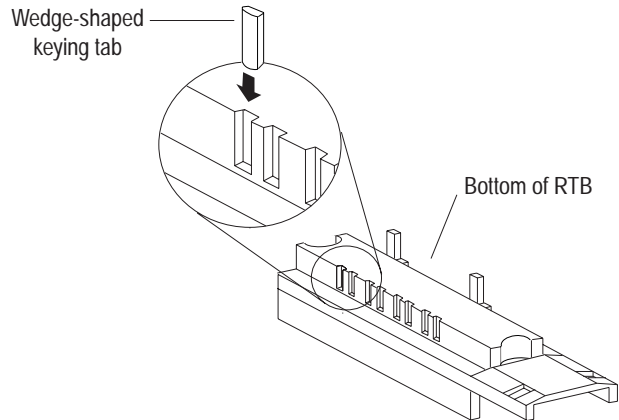


2. Push the keying band onto the module until it snaps into place.

To key your removable terminal block:

1. With the rounded edge first, insert the wedge-shaped keying tab on the RTB.

Note: Insert the wedge-shaped keying tabs in positions that correspond to unkeyed positions on the module.



2. Push the keying tab onto the RTB until it stops.

Note: To use the RTB in future module applications, you can reposition the keying tabs on the RTB.

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Wiring a Removable Terminal Block

There are two types of RTBs:

- spring clamp
- cage clamp

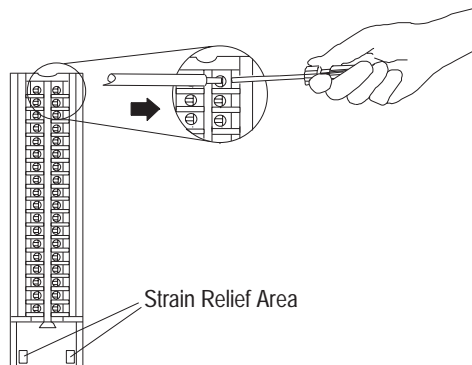
This section describes how to wire each type of RTB and shows wiring examples for the AE module.

Wire the RTB before installing it onto the module. Use a 1/8 inch (3.2mm) maximum flat-bladed screwdriver.

Wiring a Spring Clamp RTB

To wire a spring clamp RTB:

1. Strip a maximum of 7/16 inch (11mm) of insulation from the end of your wire.
2. Insert the screwdriver into the outer hole of the RTB.
3. Insert the wire into the open terminal and remove the screwdriver.

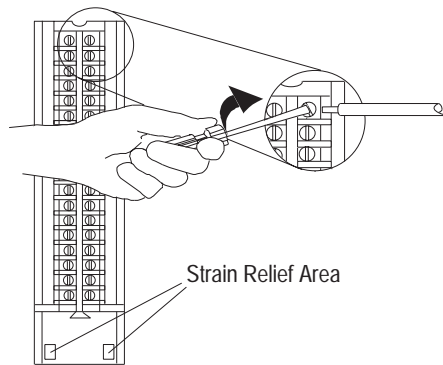


4. After you complete field-side wiring, secure the wires in the strain relief area with a cable-tie.

Wiring a Cage Clamp RTB

To wire a cage clamp RTB:

1. Strip 5/16 - 3/8 inch (8 - 9.5mm) of insulation from the end of your wire.
2. Insert the screwdriver into the open terminal.
3. Turn the screw clockwise to close the terminal on the wire. Use 5 lb-in. (0.5 Nm) maximum torque.

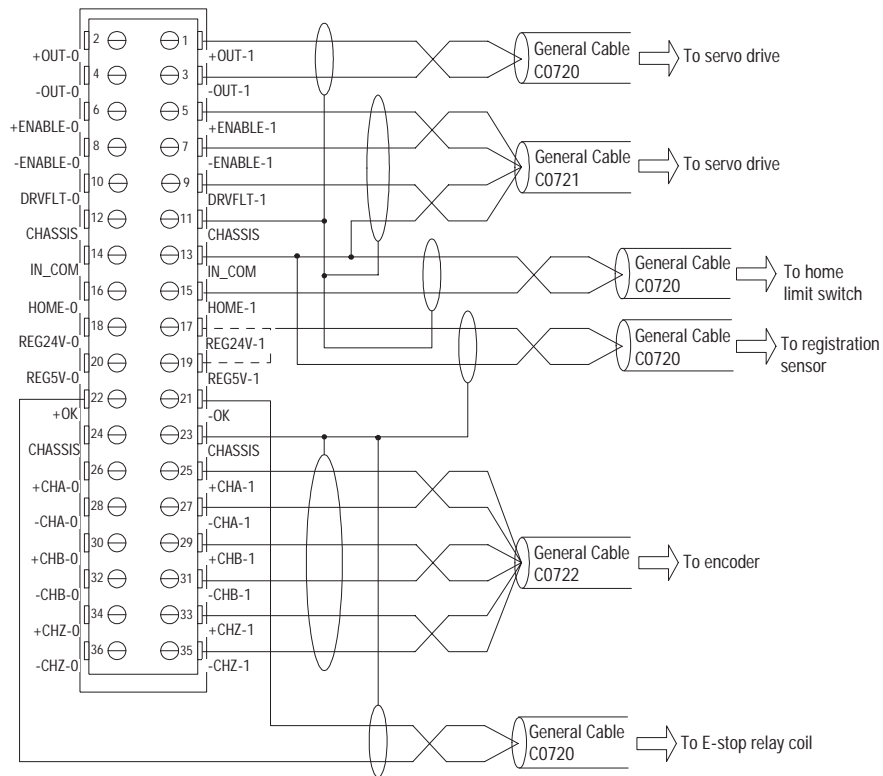


4. After you complete field-side wiring, secure the wires in the strain relief area with a cable-tie.

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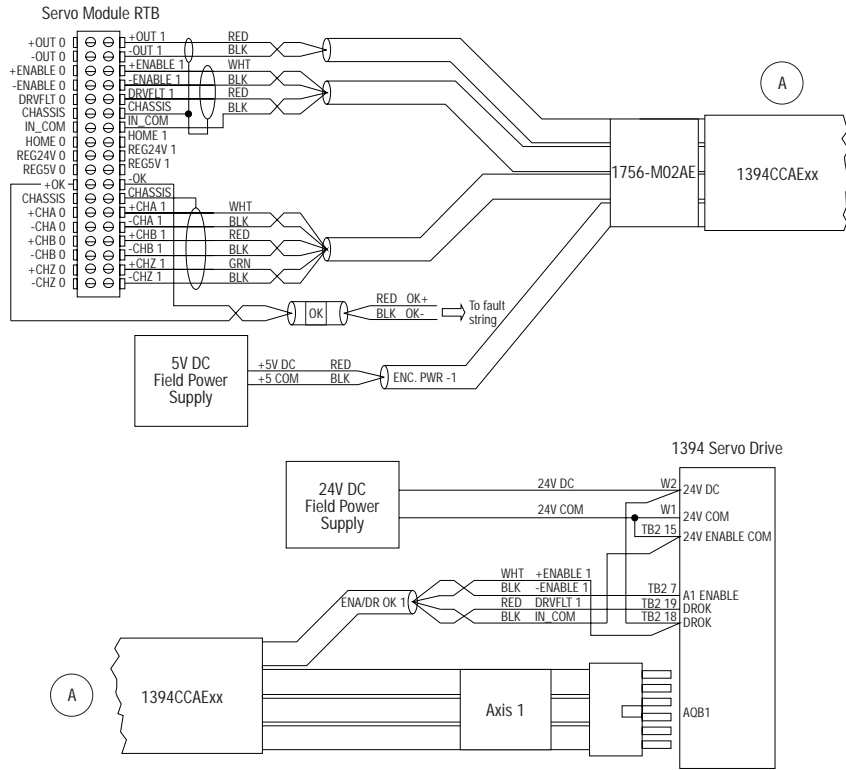
Wiring Examples

Wiring to a servo module RTB



Note: This is a general wiring example illustrating Axis 1 wiring only. Other configurations are possible with Axis 0 wiring identical to Axis 1.

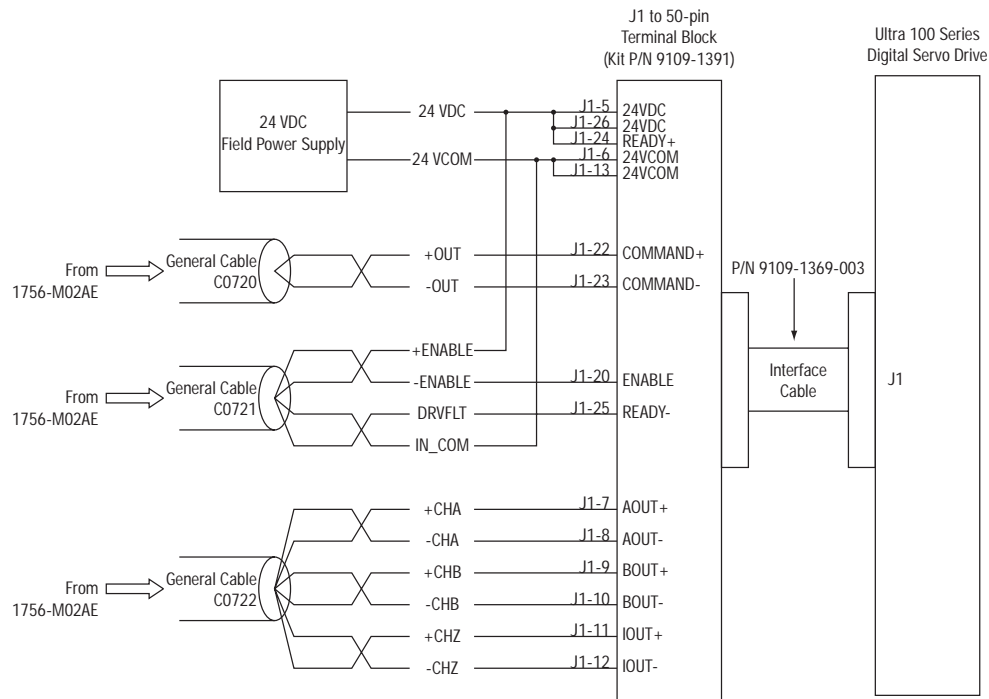
Wiring to a 1394 Servo Drive (in Torque Mode only)



- Note: The wiring diagram illustrates Axis 1 wiring only. Other configurations are possible.
- Note: The 1394CCAExx cable is wired to connect to torque command reference input pins.
- Note: An external +5V power supply is required to power the encoder driver circuit of the 1394 servo drive. Because this connection is shared by all four axis encoder driver circuits, only one connection is needed to the +5V field supply.
- Note: The xx in the cable number is the length of the cable. Options are 5, 10, 25, and 50 feet.

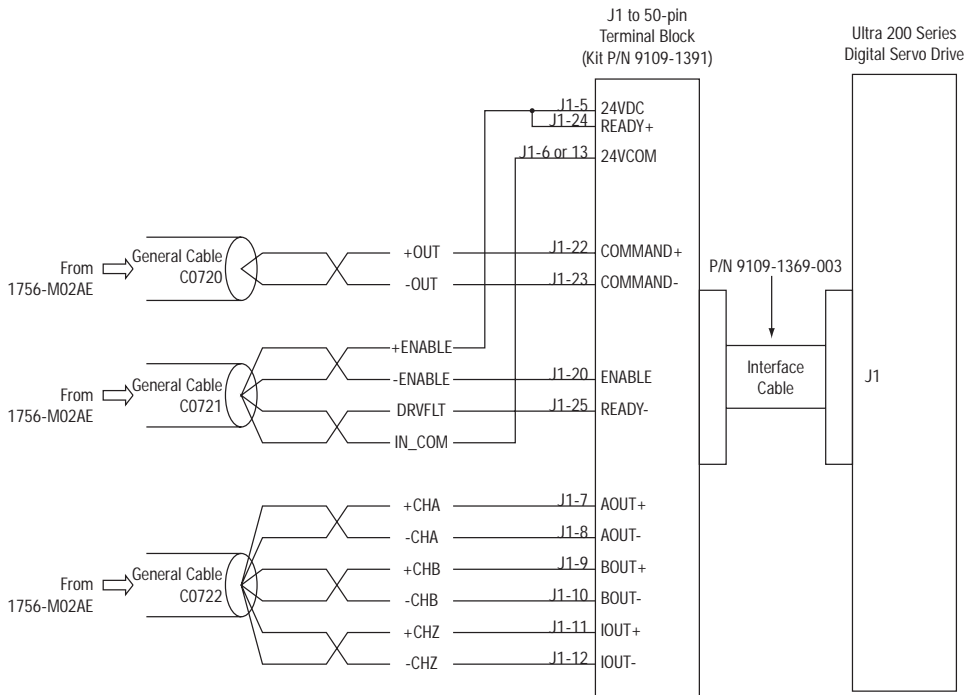
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Wiring to an Ultra 100 Series Drive



Note: This is a general wiring example only. Other configurations are possible. For more information, refer to the *Ultra 100 Series Installation Manual*, publication number 1398-5.2.

Wiring to an Ultra 200 Series Drive



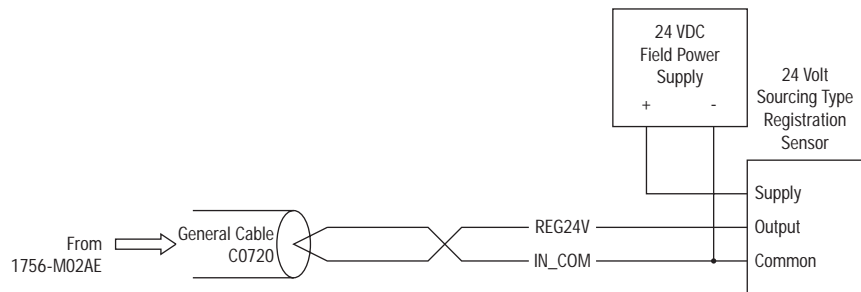
Note: This is a general wiring example only. Other configurations are possible. For more information, refer to the *Ultra 200 Series Installation Manual*, publication number 1398-5.0.

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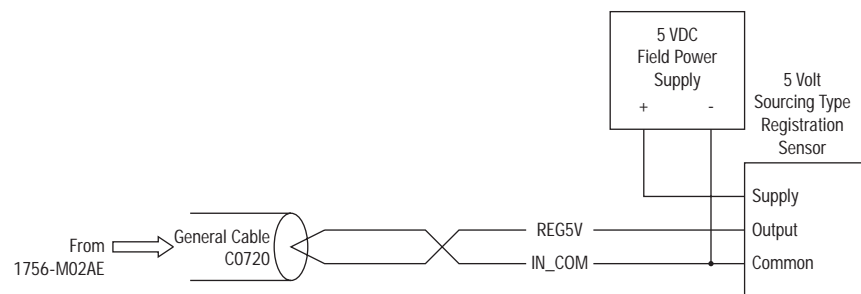
Wiring Registration Sensors

The registration inputs to the servo module can support 24V or 5V registration sensors. These inputs must be wired to receive source current from the sensor. Only use sourcing type registration sensors. Current sinking sensor configurations are not allowed because the registration input common (IN_COM) is shared with the other 24V servo module inputs.

24V Registration Sensor

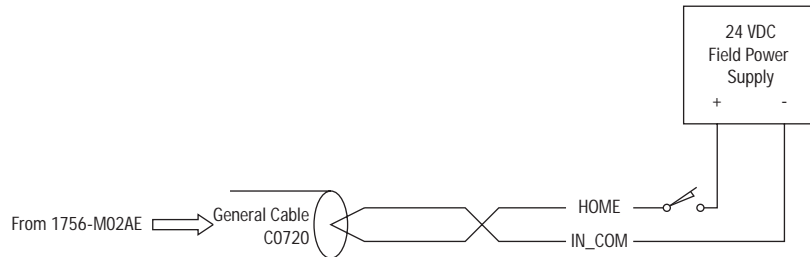


5V Registration Sensor



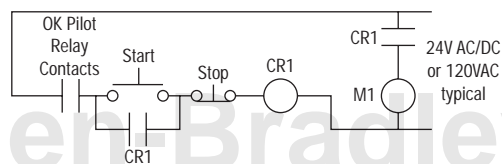
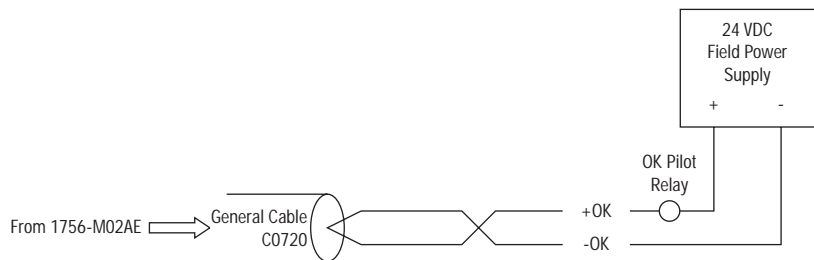
Wiring the Home Limit Switch Input

The home limit switch inputs to the servo module are designed for 24V nominal operation. These inputs should be wired for current sourcing operation.



Wiring the OK Contacts

A set of isolated solid-state OK relay contacts is provided for optional interface to an E-stop string, which controls power to the associated drives. The OK contacts are rated to drive an external 24V pilot relay (for example, Allen-Bradley 700-HA32Z24) whose contacts can be incorporated into the E-Stop string as shown below.

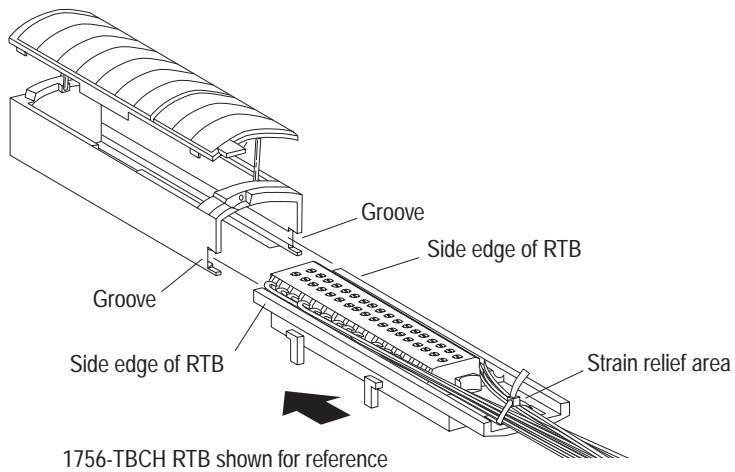


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Assembling the Removable Terminal Block and Housing

To assemble the removable terminal block and 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.



Installing the Removable Terminal Block onto the Module



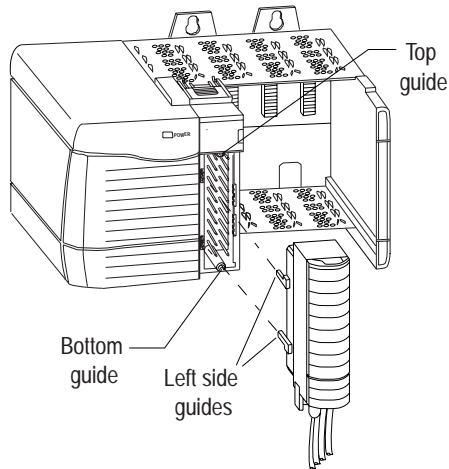
ATTENTION: A shock hazard exists. If the RTB is installed onto the module while the field-side power is applied, the RTB is electrically live. Do not touch the RTB terminals. Failure to observe this caution can cause personal injury.

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.

To install the removable terminal block onto the module:

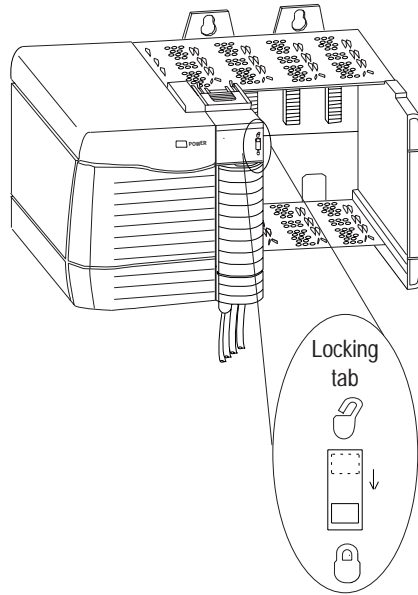
1. Align the top, bottom, and left side guides of the RTB with the guides on the module.



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

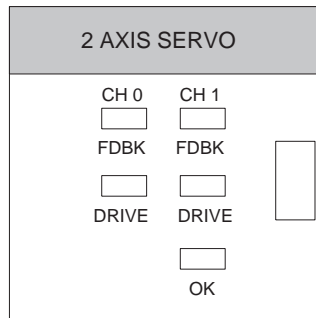
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- Slide the locking tab down to lock the RTB onto the module.



Checking the LED Indicators

The module provides bi-colored LED indicators to show individual drive and feedback status for both axes and a single bi-colored LED for module OK.



During power up, the module completes an indicator test. The OK indicator turns red for 1 second and then turns to flashing green if the module passes all its self tests.

This completes the installation of the module.

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Understanding Module Status Using the OK Indicator

If the OK LED displays:	Then the module status is:	Take this action:
Off	The module is not operating.	<ul style="list-style-type: none"> • Apply chassis power. • Verify the module is completely inserted into the chassis and backplane.
Flashing green light	The module has passed internal diagnostics, but it is not communicating axis data over the backplane.	<ul style="list-style-type: none"> • None, if you have not configured the module. • If you have configured the module, check the slot number in the 1756-M02AE Properties dialog box.
Steady green light	<ul style="list-style-type: none"> • Axis data is being exchanged with the module. • The module is in the normal operating state. 	None. The module is ready for action.
Flashing red light	<ul style="list-style-type: none"> • A major recoverable failure has occurred. • A communication fault, timer fault, or NVS update is in progress. • The OK contact has opened. 	<p>If an NVS update is in progress, complete the NVS update.</p> <p>If an NVS update is not in progress:</p> <ul style="list-style-type: none"> • Check the Servo Fault word for the source of the error. • Clear the servo fault condition using the Motion Axis Fault Reset instruction. • Resume normal operation. • If the flashing persists, reconfigure the module.
Solid red light	<ul style="list-style-type: none"> • A potential non-recoverable fault has occurred. • The OK contact has opened. 	<ul style="list-style-type: none"> • Reboot the module. • If the solid red persists, replace the module.

Understanding Module Status Using the FDBK Indicator

If the FDBK LED displays:	Then the module status is:	Take this action:
Off	The axis is not used.	<ul style="list-style-type: none"> • None, if you are not using this axis. • If you are using this axis, make sure the module is configured and an axis tag has been associated with the module.
Flashing green light	The axis is in the normal servo loop inactive state.	None. The servo axis state can be changed by executing motion instructions.
Steady green light	The axis is in the normal servo loop active state.	None. The servo can may be changed by executing motion instructions.
Flashing red light	The axis servo loop error tolerance has been exceeded.	<ul style="list-style-type: none"> • Correct the source of the problem. • Clear the servo fault condition using the Motion Axis Fault Reset instruction. • Resume normal operation.
Solid red light	An axis encoder feedback fault has occurred.	<ul style="list-style-type: none"> • Correct the source of the problem by checking the encoder and power connections. • Clear the servo fault condition using the Motion Axis Fault Reset instruction. • Resume normal operation.

Understanding Module Status Using the DRIVE Indicator

If the DRIVE LED displays:	Then the module status is:	Take this action:
Off	<ul style="list-style-type: none"> • The axis is not used. • The axis is a position-only axis type. 	<ul style="list-style-type: none"> • None, if the axis is not used or is a position-only type. • Otherwise, make sure the module is configured, an axis tag has been associated with the module, and the axis type is servo.
Flashing green light	The axis drive is in the normal disabled state.	None. The servo axis state can be changed by executing motion instructions.
Steady green light	The axis drive is in the normal enabled state.	None. The servo axis state can be changed by executing motion instructions.
Flashing red light	The axis drive output is in the shutdown state.	<ul style="list-style-type: none"> • Check for faults that may have generated this state. • Execute the Shutdown Reset motion instruction. • Resume normal operation.
Solid red light	The axis drive is faulted.	<ul style="list-style-type: none"> • Check the drive status. • Clear the Drive Fault condition at the drive. • Clear the servo fault condition using the Motion Axis Fault Reset instruction. • Resume normal operation. • Check the configuration for the Drive Fault. <ul style="list-style-type: none"> - If configured to be normally open and there is no voltage, this is the normal condition. - If configured to be normally closed and 24V is applied, this is the normal condition.

Removing the Removable Terminal Block from the Module

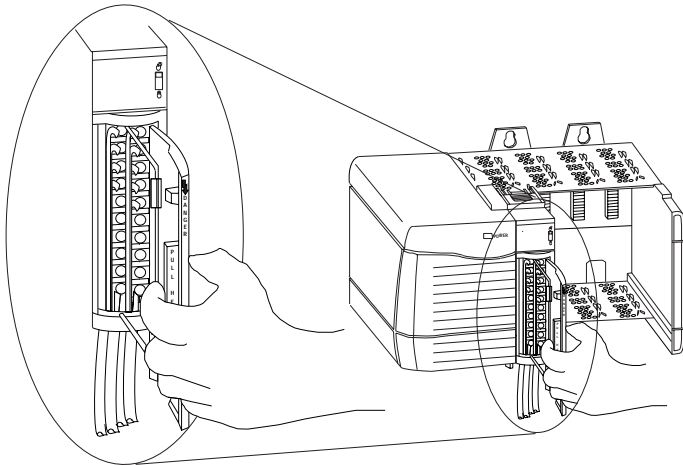


ATTENTION: A shock hazard exists. If the RTB is removed from the module while the field-side power is applied, the module is electrically live. Do not touch the RTB's terminals. Failure to observe this caution can cause personal injury.

You must remove the RTB before you can remove the module.

To remove the RTB from the module:

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

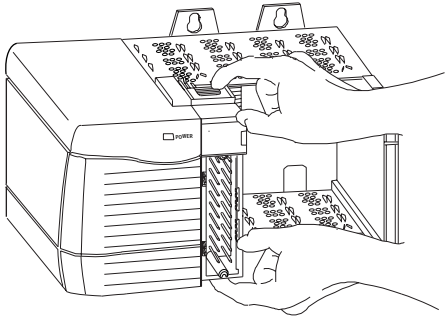


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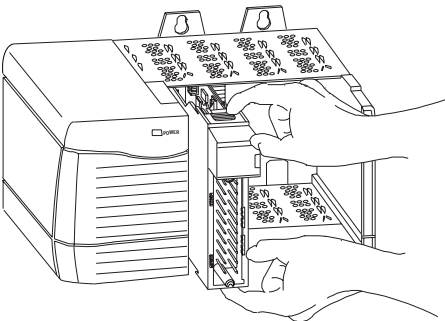
Removing the Module from the Chassis

To remove the module from the chassis:

1. If the RTB is on the module, unlock the RTB and remove it. For more information, refer to *Removing the Removable Terminal Block from the Module*.
2. Push in and hold the top and bottom locking tabs on the module.



3. Pull the module out of the chassis.



Understanding the Module Specifications




Number of axes	2 axes maximum
Servo loop	
Type	Nested PI digital position and velocity servo
Gain resolution	32-bit floating point
Absolute position range	±1,000,000,000 encoder counts
Rate	5 kHz
Module location	1756 ControlLogix chassis
Module keying	Electronic
Power dissipation	5.5W maximum
Backplane current	5V dc @ 700 mA and 24V dc @ 2.5 mA
Encoder input	
Type	Incremental AB quadrature with marker
Mode	4X quadrature
Rate	4 MHz counts per second maximum
Electrical interface	Optically isolated 5V differential
Voltage range	
On state	3.4V to 5.0V
Off state	0V to 1.8V
Input impedance	531 Ohms differential
Registration inputs	
Type	Optically isolated, current sinking input
24V input voltage	+24V dc nominal
Maximum	26.4V
Minimum on	18.5V
Maximum off	3.5V
5V input voltage	+5V dc nominal
Maximum	5.5V
Minimum on	3.7V
Maximum off	1.5V
Input impedance	
24V input	1.2 kOhms
5V input	9.5 kOhms
Response time (position latched)	1μs

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All other inputs	
Type	Optically isolated, current sinking input
Input voltage	+24V dc nominal
Maximum	26.4V
Minimum on	17.0V
Maximum off	8.5V
Input impedance	7.5 kOhms
Servo output	
Type	Analog voltage
Isolation	200 kOhms
Voltage range	±10V
Voltage resolution	16 bits
Load	5.6 kOhms resistive minimum
Maximum offset	25 mV
Gain error	±4%
All other outputs	
Type	Solid-state isolated relay contacts
Operating voltage	+24V dc nominal (Class 2 source)
Maximum	26.4V
Operating current	75 mA
RTB keying	User-defined
Field wiring arm	36-position RTB (1756-TBCH or -TBS6H) ¹
RTB screw torque (cage clamp)	5 lb-in. (0.5 Nm) maximum

(continued)

Conductors	
Wire size	22 gauge (3.1mm ²) minimum to copper ¹ 3/64 inch (1.2 mm) insulation maximum
Category	1,2,3
Screwdriver blade width for RTB	1/8 inch (3.2 mm) maximum
Environmental conditions	
Operating temperature	0 to 60°C (32 to 140°F)
Storage temperature	-40 to 85°C (-40 to 185°F)
Relative humidity	5 to 95% noncondensing
Agency certification (when product or packaging is marked)	  Class 1, Division 2, hazardous location  marked for all applicable directives

¹ Maximum wire size will require the extended depth RTB housing (1756-TBE).

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

³ Refer to *Industrial Automation Wiring and Grounding Guidelines*, publication number 1770-4.1.

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Understanding the CSA Hazardous Location Approval

CSA certifies products for general use as well as for use in hazardous locations. Actual CSA certification is indicated by the product label as shown below, and not by statements in any user documentation.

Example of the CSA certification product label



To comply with CSA certification for use in hazardous locations, the following information becomes a part of the product literature for CSA-certified Allen-Bradley industrial control products.

- This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D, or non-hazardous locations only.
- The products having the appropriate CSA markings (that is, Class I, Division 2, Groups A, B, C, D) are certified for use in other equipment where suitability of combination (that is, application or use) is determined by the CSA or the local inspection office having jurisdiction.

Important: Due to the modular nature of a PLC control system, the product with the highest temperature rating determines the overall temperature code rating of a PLC control system in a Class I, Division 2 location. The temperature code rating is marked on the product label as shown.

Temperature Code Rating



Look for temperature
code rating here

The following warnings apply to products having CSA certification for use in hazardous locations.



ATTENTION: Explosion hazard—

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components unless power has been switched off or the area is known to be non-hazardous.
- Do not disconnect equipment unless power has been switch off or the area is known to be non-hazardous.
- Do not disconnect connectors unless power has been switched off or the area is known to be non-hazardous. Secure any user-supplied connectors that mate to external circuits on an Allen-Bradley product using screws, sliding latches, threaded connectors, or other means such that any connection can withstand a 15 Newton (3.4 lb) separating force applied for a minimum of one minute.

La CSA certifie les produits d'utilisation générale aussi bien que ceux qui s'utilisent dans des emplacements dangereux. La certification CSA en vigueur est indiquée par l'étiquette du produit et non par des affirmations dans la documentation à l'usage des utilisateurs.

Exemple d'étiquette de certification d'un produit par la CSA



Pour satisfaire à la certification de la CSA dans des endroits dangereux, les informations suivantes font partie intégrante de la documentation des produits industriels de contrôle Allen-Bradley certifiés par la CSA.

- Cet équipement convient à l'utilisation dans des emplacements de Classe 1, Division 2, Groupes A, B, C, D, ou ne convient qu'à l'utilisation dans des endroits non dangereux.
- Les produits portant le marquage approprié de la CSA (c'est à dire, Classe 1, Division 2, Groupes A, B, C, D) sont certifiés à l'utilisation pour d'autres équipements où la convenance de combinaison (application ou utilisation) est déterminée par la CSA ou le bureau local d'inspection qualifié.

Important: Par suite de la nature modulaire du système de contrôle PLC, le produit ayant le taux le plus élevé de température détermine le taux d'ensemble du code de température du système de contrôle d'un PLC dans un emplacement de Classe 1, Division 2. Le taux du code de température est indiqué sur l'étiquette du produit.

Taux du code de température



Le taux du code de
température est indiqué ici.

Les avertissements suivants s'appliquent aux produits ayant la certification CSA pour leur utilisation dans des emplacements dangereux.



AVERTISSEMENT: Risque d'explosion—

- La substitution de composants peut rendre ce matériel inacceptable pour les emplacements de Classe 1, Division 2.
- Couper le courant ou s'assurer que l'emplacement est désigné non dangereux avant de remplacer les composants.
- Avant de débrancher l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux.
- Avant de débrancher les connecteurs, couper le courant ou s'assurer que l'emplacement est reconnu non dangereux. Attacher tous connecteurs fournis par l'utilisateur et reliés aux circuits externes d'un appareil Allen-Bradley à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens permettant aux connexions de résister à une force de séparation de 15 newtons (3,4 lb. - 1.5 kg) appliquée pendant au moins une minute.

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Publication 1756-5.47 – December 1998
Supersedes Publication 1756-5.47 – July 1998

955134-05

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