



SSI Servo Module

(Catalog Number 1756-M02AS)

The Synchronous Serial Interface (SSI) 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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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 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: <ul style="list-style-type: none">• identify a hazard• avoid a hazard• recognize the consequence
SHOCK HAZARD 	Labels may be located on or inside the drive to alert people that dangerous voltage may be present.
BURN HAZARD 	Labels may be located on or inside the drive 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.

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.

Preventing 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.

Note the Power Requirements

This module receives power from the 1756 chassis power supply and requires two sources of power from the backplane:

- 700mA at 5.1 V dc
- 2.5 mA at 24V dc

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-M02AS module
- RTB door label

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

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, consult the documentation that came with it to connect wiring.

IMPORTANT

Before you install your module, you should:

- install and ground a 1756 chassis and power supply.
 - order and receive an RTB or IFM, and its components, for your application.
-

⁽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.

Installing the Module

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

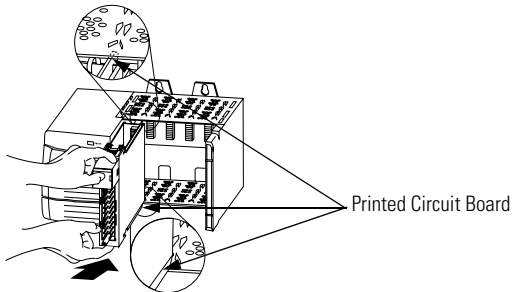
WARNING



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.

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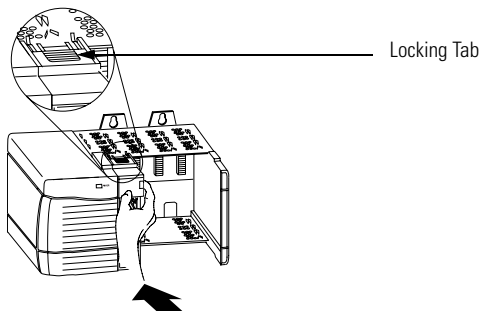
1. Align the circuit board with the top and bottom chassis guides.



20861-M

Figure 1 Circuit Board Alignment

- Slide the module into the chassis until module tabs 'click'.



20862-M

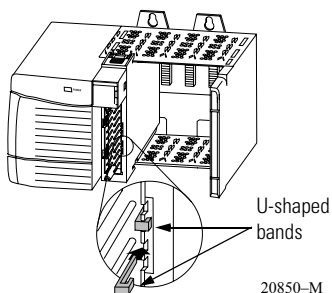
Figure 2 Module Locking Tabs

Keying the Module and Removable Terminal Block/Interface Module

Use the wedge-shaped keying tabs and U-shaped keying bands 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.

- To key the module, insert the U-shaped band, as shown.



20850-M

Figure 3 Keying Band

2. Push the band until it snaps in place.
3. To key the RTB or IFM, insert the wedge-shaped tab with rounded edge first, as shown.

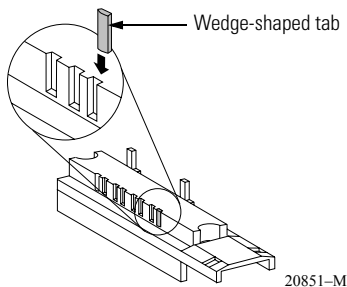


Figure 4 Keying Band

4. Push the tab until it stops.

Reposition the tabs to rekey future module applications.

Wiring a Removable Terminal Block (RTB)

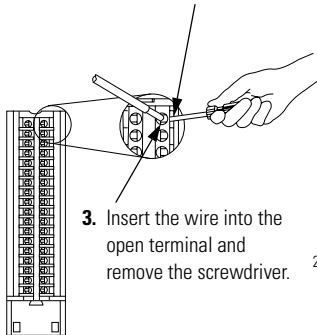
Your 1756-M02AS module uses two types of RTBs (each RTB comes with housing) to connect wiring.

- Cage clamp - Catalog number 1756-TBCH
- Spring clamp - Catalog number 1756-TBS6H

Connect the wires as shown below.

Spring Clamp RTB

1. Strip 7/16 inch (11mm) maximum length of wire.
2. Insert the screwdriver into the inner hole of the RTB.



Cage Clamp RTB

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

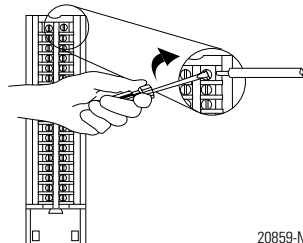
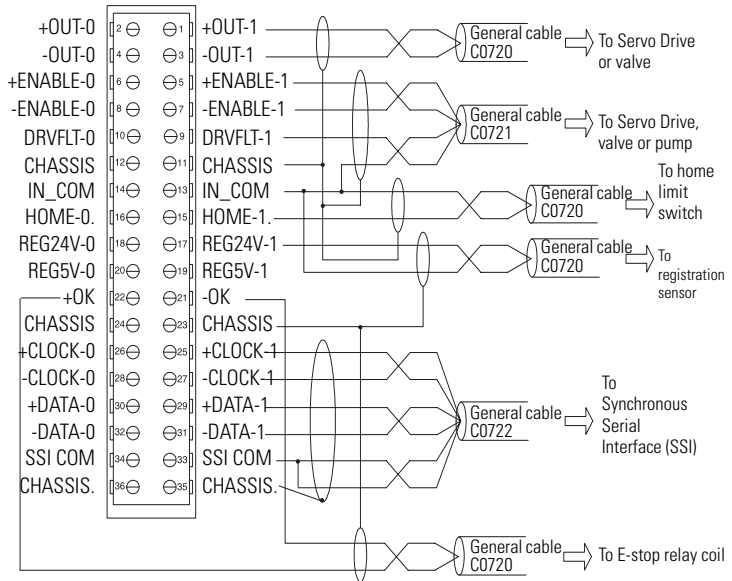


Figure 5 Connecting to Spring Clamp and Cage Clamp RTBs

Wiring to a Servo Module

Use the wiring example in the following figure to wire to your module.



43394

Figure 6 Wiring Example

NOTES:

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

Wiring Registration Sensors

The registration inputs to the servo module can support 24V dc or 5V dc registration sensors. These inputs should be wired to receive source current from the sensor. Current sinking sensor configurations are not allowed because the registration input common (IN_ COM) is shared with the other 24V dc servo module inputs.

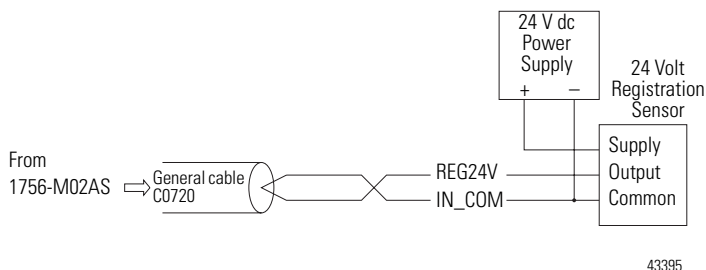


Figure 7 - 24V Registration Sensor

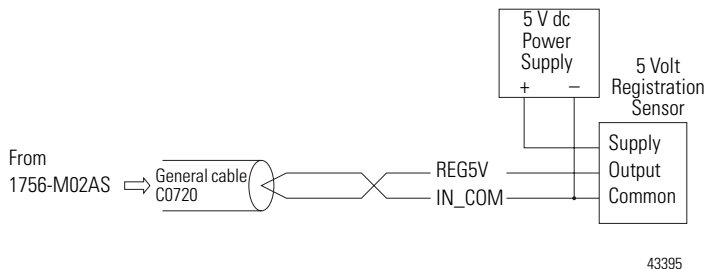


Figure 8 - 5V Registration Sensor

Wiring the Home Limit Switch Input

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

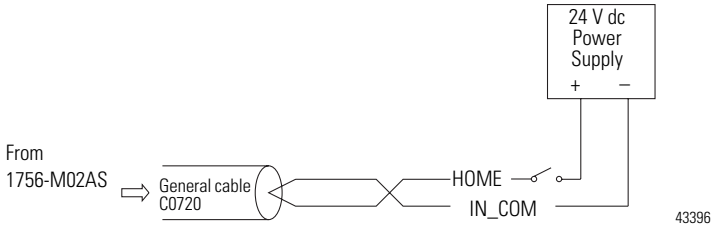


Figure 9 Home Limit Switch Input

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 pumps. The OK contacts are rated to drive an external 24V dc pilot relay (for example, Allen-Bradley 700- HA32Z24) whose contacts can be incorporated into the E- Stop string as in the following figure.

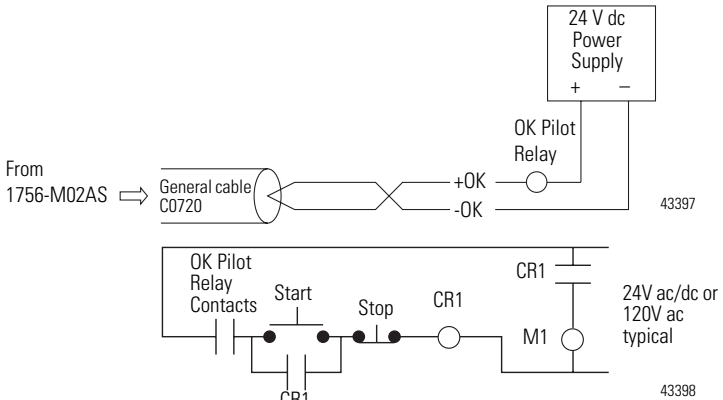
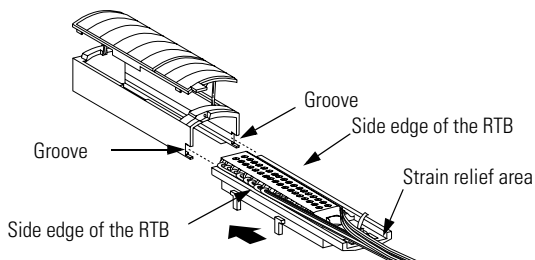


Figure 10 Wiring OK Contacts

Assembling the Removable Terminal Block and the Housing

1. Align the grooves at the bottom of the housing with the side edges of the RTB.



2. Slide the RTB into the housing until it snaps into place. 20858-M

Figure 11 RTB and Housing

Installing the Removable Terminal Block onto the Module

WARNING



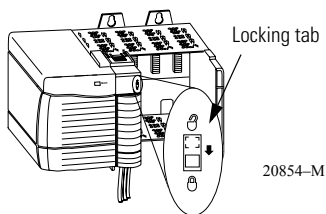
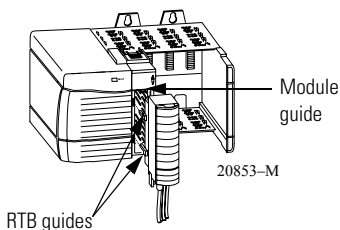
When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

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

Before installing the RTB, make certain:

- 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 module and RTB guides to make sure the module will seat properly.
2. Press quickly and evenly to seat the RTB until the latches snap into place.



3. To lock the RTB on the module, slide the locking tab down.

Figure 12 Seating the RTB

Checking the LED Indicators

The module uses a single bi-colored LED to indicate module OK status and bi-colored LED indicators to show individual feedback (FDBK) and drive (DRIVE) status for both axes.

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.

Module Status Using the OK Indicator

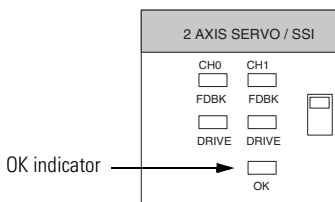


Figure 13 OK Indicator LED

The table below provides an explanation of the OK indicator.

If the OK LED displays:	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 in 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-M02AS Properties dialog box.
Steady green light	One of the following: <ul style="list-style-type: none"> • Module is exchanging axis data. • The module is in the normal operating state. 	None
Flashing red light	One of the following: <ul style="list-style-type: none"> • A major recoverable failure has occurred. • A communication fault, timer fault, or non-volatile memory storage (NVS) update is in progress. • The OK contact has opened. 	If an NVS update is in progress, complete the NVS update. If an NVS update is not in progress: <ul style="list-style-type: none"> • Check the Servo Fault word for the source of the error. • Clear the servo fault condition via Motion Axis Fault Reset instruction. • Resume normal operation. • If the flashing persists, reconfigure the module.

If the OK LED displays:	The module status is:	Take this action:
Steady red light	One of the following: <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.

Module Status Using the FDBK Indicator

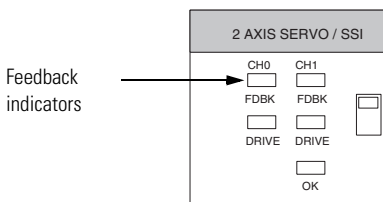


Figure 14 FDBK Indicator LED

The table below provides an explanation of the FDBK indicator.

If the FDBK LED displays:	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 axis state can be changed by executing motion instructions.

If the FDBK LED displays:	The module status is:	Take this action:
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.
Steady red light	An axis SSI feedback fault has occurred.	<ul style="list-style-type: none"> • Correct the source of the problem by checking the SSI device and power connections. • Clear the servo fault condition using the Motion Axis Fault Reset instruction. • Resume normal operation.

Module Status Using the DRIVE Indicator

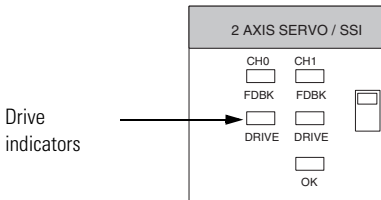


Figure 15 Drive Indicator LED

The table below provides an explanation of the DRIVE indicator.

If the DRIVE LED displays:	The module status is:	Take this action:
Off	One of the following: <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.

If the DRIVE LED displays:	The module status is:	Take this action:
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 Motion Axis Shutdown Reset instruction. • Resume normal operation.
Steady 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 dc is applied, this is the normal condition.

Removing the Removable Terminal Block from the Module

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

WARNING

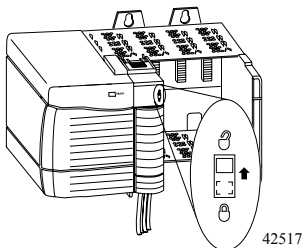


When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied; an electrical arc can occur. This could cause an explosion in hazardous location installations.

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

You must remove the RTB before removing the module.

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



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

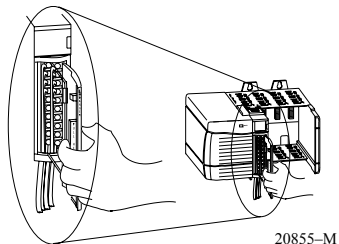
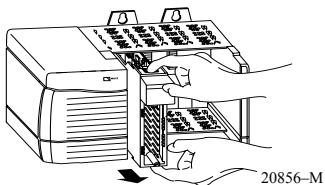


Figure 16 Removing the RTB

Removing the Module

1. Push in top and bottom locking tabs.



2. Pull module out of the chassis.

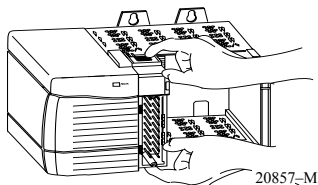


Figure 17 Removing the Module

1756-M02AS Specifications

Number of axes	2 axes maximum
Servo loop Type	
External Drive = Torque	Position Loop: PID with Velocity Feedforward Velocity Loop: PI with Accel Feedforwr (nested); with Directional Scaling and Friction Compensation
External Drive = Velocity or Hydraulic	Position Loop: PID with Velocity Feedforward and Accel Feedforward with Directional Scaling and Friction Compensation Velocity Loop: N/A (handled by Drive or Valve).
Gain resolution	32- bit floating point
Absolute position range	2^{32} (4,294,967,296) transducer counts
Rate	500Hz, 666.7Hz, 1kHz, 2kHz, 4kHz (Selectable)
Update Period	250µsec, 500µsec, 1msec, 1.5msec, 2msec
Module location	1756 ControlLogix chassis
Module keying	Electronic
Power dissipation	5.5W maximum
Thermal dissipation	18.77 BTU/hr
Backplane current	5.1V dc @ 700mA and 24V dc @ 2.5mA
SSI input	
Type	Synchronous Serial Interface
Resolution	8 to 31 Bits
Electrical Interface	Isolated 5V differential (RS-422 signal)
Input impedance	215 Ohm differential
Output Load	100 Ohm minimum
Transducer	Binary or Gray code
Clock Frequency	205kHz or 625kHz

Registration inputs	
Type	Optically isolated, current sinking input
24V dc input voltage	+24V dc nominal
Maximum	26. 4V dc
Minimum on	18. 5V dc
Maximum off	3.5V dc
5V dc input voltage	+5V dc nominal
Maximum	5.5V dc
Minimum on	3.7V dc
Maximum off	1.5V dc
Input impedance	
24V dc input	9.5 k Ω
5V dc input	1.2 k Ω
Response time (position latched)	1 servo update period - Servo update period is the period at which the position and/or velocity feedback is sampled and a new servo loop is closed to generate a new servo output. The time of this period is a user-defined setting from 250 μ s to 2000 μ s.
All other inputs	
Type	Optically isolated, current sinking input
Input voltage	+24V dc nominal
Maximum	26. 4V dc
Minimum on	17. 0V dc
Maximum off	8.5V dc
Input impedance	7.5 k Ω
Servo output	
Type	Analog voltage
Voltage range	\pm 10V dc
Voltage resolution	16 bits
Load	5.6 kOhms resistive minimum
Maximum offset	25 mV
Gain error	\pm 4%
All other outputs	
Type	Solid-state isolated relay contacts
Operating voltage	+24V dc nominal
Maximum	26. 4V dc
Operating current	75 mA



Isolation Voltage User to System	30V continuous
RTB keying	User-defined
Field wiring arm	36-position RTB (1756-TBCH or -TBS6H) ⁽¹⁾
RTB screw torque (cage clamp)	4.4 inch-pounds (0.4Nm) maximum
Conductors Wire size	#22 to #14 AWG (0.324 to 2.08 sq. mm) stranded ⁽¹⁾ 3/ 64 inch (1.2 mm) insulation maximum
Category	2 ⁽²⁾
Screwdriver blade width for RTB	1/8 inch (3.2mm) maximum
Environmental Conditions	
Operating 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	IEC60068-2-6 (Test Fc, Operating): 2g @ 10-500Hz
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30g Non-operating 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 80MHz to 2000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ± 2 kV at 5kHz on signal ports
Surge Transient Immunity	IEC 61000-4-5: ± 2 kV 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 (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 ⁽³⁾ 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 ⁽³⁾ Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions

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

(2) Use the conductor category information for planning conductor routing as described in the system level installation manual. Refer to Industrial Automation Wiring and Grounding Guidelines, publication number 1770-4.1.

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

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	AVERTISSEMENT	RISQUE D'EXPLOSION
	<ul style="list-style-type: none"> 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. 		<ul style="list-style-type: none"> 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.

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our 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 our 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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