



Installation Instructions

ControlLogix Voltage/Current Output Module

Catalog Number 1756-OF4

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Obtain a User Manual

This product also has a user manual (pub. no. 1756-UM009). To view it, visit www.ab.com/manuals or www.theautomationbookstore.com.

To purchase a manual, you can:

- contact your distributor or Rockwell Automation representative
- visit www.theautomationbookstore.com and place an order
- call 800.963.9548 (USA/Canada) or 001.320.725.1574 (outside USA/Canada)

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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.

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.
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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:
<p>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.</p>	<p>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.</p>

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The following information applies when operating this equipment in hazardous locations:		Informations sur l'utilisation de cet équipement en environnements dangereux:	
WARNING 	EXPLOSION HAZARD <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. 	AVERTISSEMENT 	RISQUE D'EXPLOSION <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.

Identify the Module Components

You received the following components with your order:

- 1756-OF4 module
- Removable Terminal Block (RTB) door label

If you did not receive these components, contact your local distributor 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-TBNH 20 position NEMA RTB
- 1756-TBSH 20 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.
-

Note the Power Requirements

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

- 150mA at 5.1V dc
- 120mA at 24V dc

Add this current/power value (3.65W) 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 the 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.

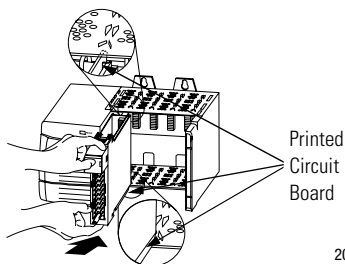
WARNING



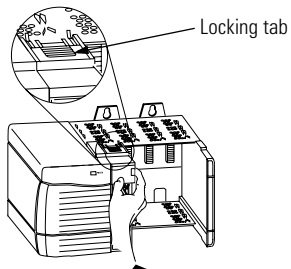
When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

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.

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



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

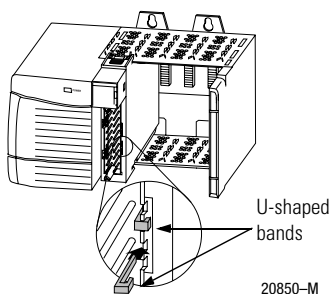


Key the Module and Removable Terminal Block/Interface Module

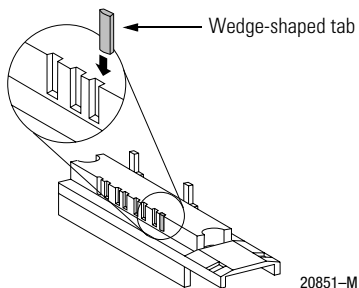
Use the wedge-shaped keying tabs and U-shaped keying bands to prevent connecting the wrong wires to your module.

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.

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



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.



4. Push the tab until it stops.

Reposition the tabs to rekey future module applications.

Wire the Removable Terminal Block

Wire the RTB with a 5/16 inch (8mm) maximum flat-bladed screwdriver before installing it onto the module.

WARNING



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

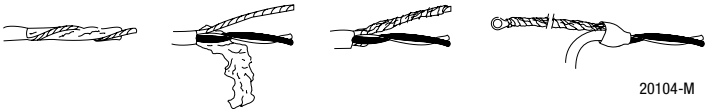
Be sure that power is removed or the area is nonhazardous before proceeding.

Shielded cable is required when using this module. We recommend using Belden 8761 cable to wire the RTB. The RTB terminations can accommodate #22 - 14 AWG shielded wire.

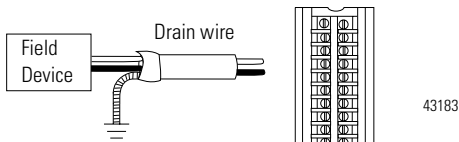
Connect grounded end of the cable

1. Prepare one end of the cable for grounding.

- 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.



2. Ground the drain wire. We recommend grounding the drain wire at the field device as shown below.



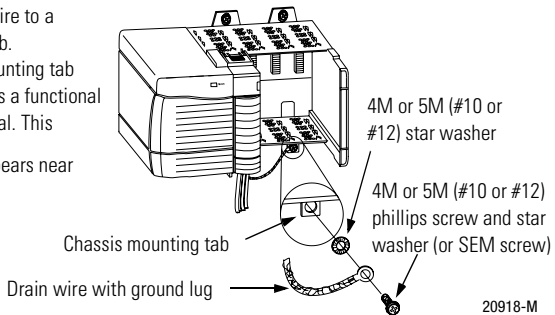
3. Connect the insulated wires to the field device.

If you cannot ground at the field device, follow these steps:

1. Prepare one end of the cable as shown in step 1.
2. Ground at an earth ground on the chassis as shown below. 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.

Connect the drain wire to a chassis mounting tab. Use any chassis mounting tab that is designated as a functional earth ground terminal. This

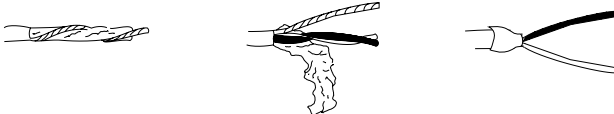
symbol  appears near the tab.



Connect the insulated wires to the RTB.

Connect ungrounded end of the cable

1. Prepare the non-grounded end of the cable.
 - 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. Cut foil shield and drain wire back to the cable casing and apply shrink wrap, exposing only the insulated wires.



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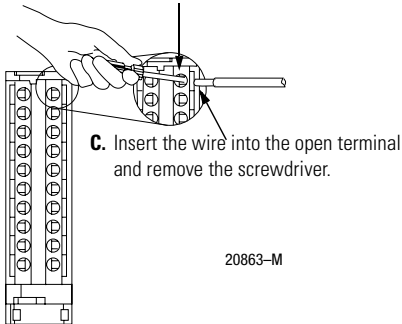
2. Connect the insulated wires to :
 - the RTB (as shown below) if the cable is grounded at the field device.

or

- the field device if the cable is grounded at the chassis.

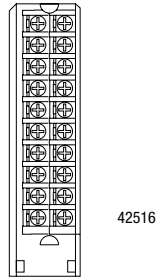
Spring Clamp RTB

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



NEMA Screw RTB

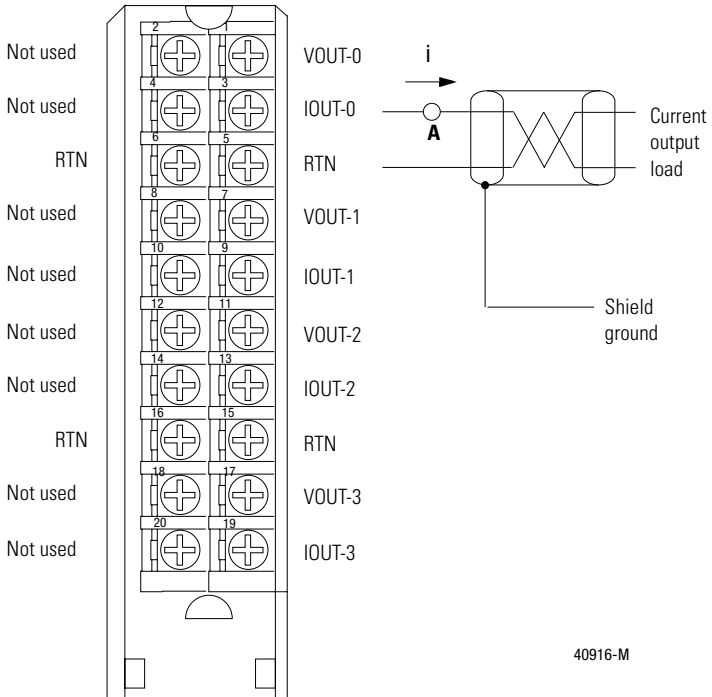
- A. Strip 5/16 inch (8mm) maximum length of wire.
- B. Turn the terminal screw counterclockwise.
- C. Insert stripped end of wire under plate on the terminal.
- D. Turn the terminal screw clockwise until wire is secured.



Wire the Module

You can only connect wiring to your module with an RTB or IFM.

1756-OF4 current wiring example

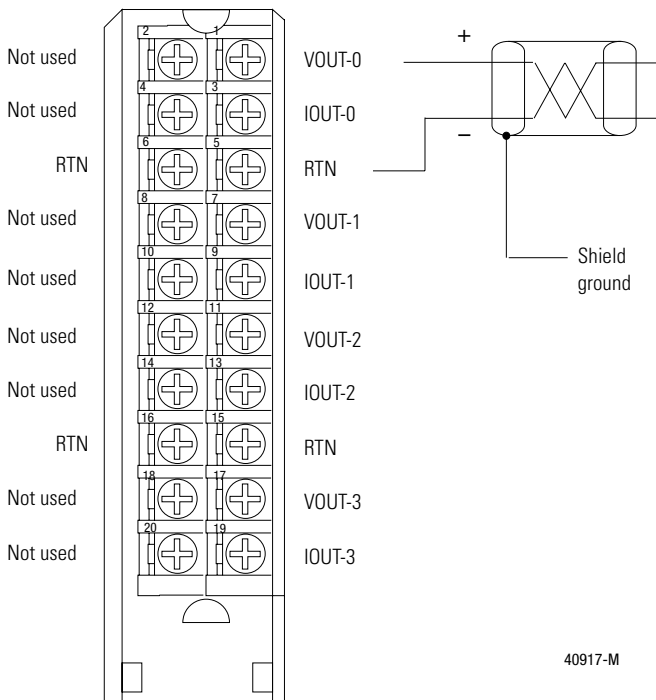


NOTES:

1. Place additional loop devices (e.g strip chart recorders) at the A location shown.
2. Do not connect more than 2 wires to any single terminal.
3. All terminals marked RTN are connected internally.

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1756-OF4 voltage wiring example



40917-M

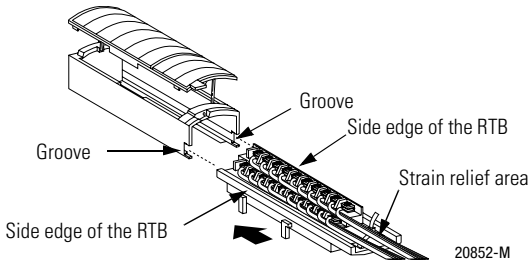
NOTES:

1. Do not connect more than 2 wires to any single terminal.
2. All terminals marked RTN are connected internally.

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

Assemble 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.

Install the Removable Terminal Block onto the Module

WARNING

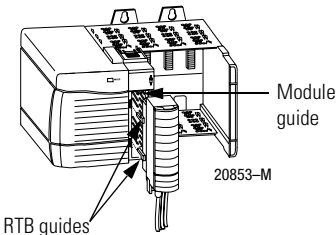


If you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations.

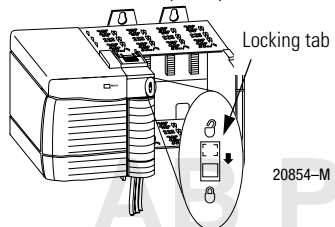
Before proceeding with RTB installation, make certain:

- 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.



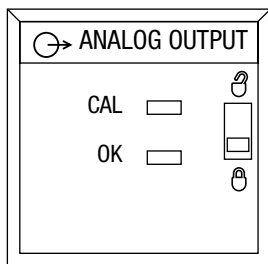
2. Press quickly and evenly to seat the RTB until the latches snap into place.



3. Slide the locking tab down.

Check the Indicators

The indicators show CAL status (green) and a bi-colored LED for module "OK" (red/green).



20965-M

During power up, an indicator test is done and the following occurs:

- The "OK" indicator turns red for 1 second and then turns to flashing green if it has passed the self-test.

LED indicators:	This display:	Means:	Take this action:
OK	Steady green light	The outputs are in a normal operating state.	None
OK	Flashing green light	<ol style="list-style-type: none"> 1. The module has passed internal diagnostics but is not actively controlled. 2. The controller is in Program mode. 	<ol style="list-style-type: none"> 1. Configure the module with RSLogix 5000. 2. If ready, switch the controller to Run mode.
OK	Flashing red light	Previously established communication has timed out.	Check controller and chassis communication
OK	Steady red light	The module must be replaced.	Replace the module.
CAL	Flashing green light	The module is in calibration mode.	None

This completes installation of the module. Use the following information to remove the module, if necessary.

Remove the Removable Terminal Block from the Module

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

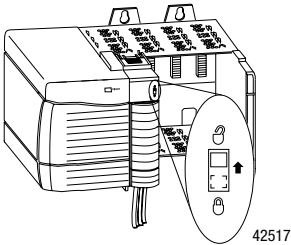
WARNING



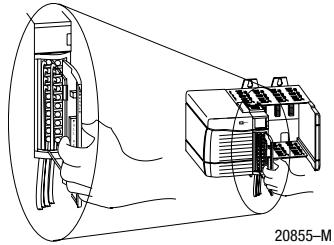
When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.

Before removing the module, you must remove the RTB.

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

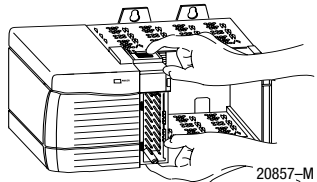
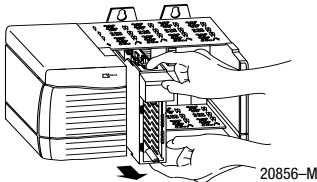


2. Open the RTB door and pull the RTB off the module.



Remove the Module

1. Push in top and bottom locking tabs.
2. Pull module out of the chassis.



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1756-OF4 Specifications

Number of Outputs	4 voltage or current outputs
Module Location	1756 ControlLogix Chassis
Backplane Current	150mA @ 5.1V dc & 120mA @ 24V dc
Backplane Power	5.8W
Power Dissipation within Module	3.2W – 4 channel current
Thermal Dissipation	10.91 BTU/hr.
Output Range	+/- 10.4V 0 to 21mA
Resolution	15 bits across 10.4V - 320 μ V/bit – Voltage 15 bits across 21mA - 650nA/bit – Current
Data Format	Left justified, 2s complement – Integer mode IEEE 32 bit – Floating point
Open Circuit Detection	Current output only (Output must be set to >0.1mA)
Output Overvoltage Protection	24V dc
Output Short Circuit Protection	Electronically current limited to 21mA or less
Drive Capability	>2000 Ω – Voltage 0-750 Ω – Current
Output Settling Time	<2ms to 95% of final value with resistive loads
Calibrated Accuracy	Better than 0.05% of range from 4mA to 21mA, -10.4V to 10.4V
Calibration Interval	Twelve months – Typical
Output Offset Drift with Temperature	50 μ V/ $^{\circ}$ C 100nA/ $^{\circ}$ C
Gain Drift with Temperature	25 ppm/ $^{\circ}$ C – Voltage 520 μ V/ $^{\circ}$ C 50 ppm/ $^{\circ}$ C – Current 1050 μ A/ $^{\circ}$ C
Module Error over Full Temperature Range	0.15% of range – Voltage 0.3% of range – Current
Module Scan Time for all Channels	12ms minimum – Floating point 8ms minimum – Integer
Isolation Voltage User to system	100% tested at 2550V dc for 1 second 125V continuous
Module Conversion Method	R-Ladder DAC, monotonicity with no missing codes

RTB Screw Torque (NEMA)	7-9 inch-pounds (0.8-1Nm)
Module Keying (Backplane)	Electronic
RTB Keying	User defined
RTB and Housing	20 Position RTB (1756-TBNH or TBSH) ⁽¹⁾
Conductors	
Wire Size	#22 to #14 AWG (0.324 to 2.08 sq. mm) stranded ⁽¹⁾ 3/64 inch (1.2mm) insulation maximum
Category	2 ⁽²⁾ , 3 ⁽³⁾
Screwdriver Width for RTB	5/16 inch (8mm) 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
Operating Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): 30g
Non-operating Shock	IEC60068-2-27 (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: ±2kV at 5kHz on signal ports

Surge Transient Immunity	IEC 61000-4-5: ±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 (when product is marked)	UL CSA CSA FM CE ⁽⁴⁾ C-Tick ⁽⁴⁾ EEx ⁽⁴⁾	UL Listed Industrial Control Equipment CSA Certified Process Control Equipment CSA Certified Process Control Equipment for Class I, Division 2 Group A,B,C,D Hazardous Locations FM Approved Equipment for use in Class I Division 2 Group A,B,C,D Hazardous Locations 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 Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions European Union 94/9/EEC ATEX Directive, compliant with: EN 50021; Potentially Explosive Atmospheres, Protection "n" (zone 2)

- (1) Maximum wire size requires extended housing - 1756-TBE.
- (2) Use this conductor category information for planning conductor routing as described in the system level installation manual.
- (3) Refer to publication 1770-4.1 *Industrial Automation Wiring and Grounding Guidelines*.
- (4) See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

www.rockwellautomation.com

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