

Compact I/O High-speed Counter Module

Catalog Number 1769-HSC

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About the Module

The 1769-HSC module has six differential DC inputs that can be used as two to four high-speed counters. The module has 4 sourcing DC outputs and 12 additional 'virtual' outputs. The counters provide accumulated pulse counts to the input array of the module and can cause onboard outputs to react to input conditions at high speed.

The module is compatible with CompactLogix controllers, MicroLogix 1500 controllers, and the 1769-ADN DeviceNet adapter.

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





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

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

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

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard and recognize the consequences.
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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 m (6562 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR 11. Without appropriate precautions, there may be difficulties with electromagnetic compatibility in residential and other environments due to conducted and radiated disturbances.

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 enclosure must have suitable flame-retardant properties to prevent or minimize the spread of flame, complying with a flame spread rating of 5VA, V2, V1, V0 (or equivalent) if non-metallic. 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.

In addition to this publication, see:

- Industrial Automation Wiring and Grounding Guidelines, Rockwell Automation publication [1770-4.1](#), for additional installation requirements.
- NEMA Standard 250 and IEC 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.



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.
 - Use a static-safe workstation, if available.
 - Store the equipment in appropriate static-safe packaging when not in use.
-

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>
<div style="display: flex; align-items: center;">  <div> <p>WARNING: Explosion Hazard -</p> <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 any component 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. </div> </div>	<div style="display: flex; align-items: center;">  <div> <p>AVERTISSEMENT: Risque d'Explosion –</p> <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 tout composant 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. </div> </div>

Module Features

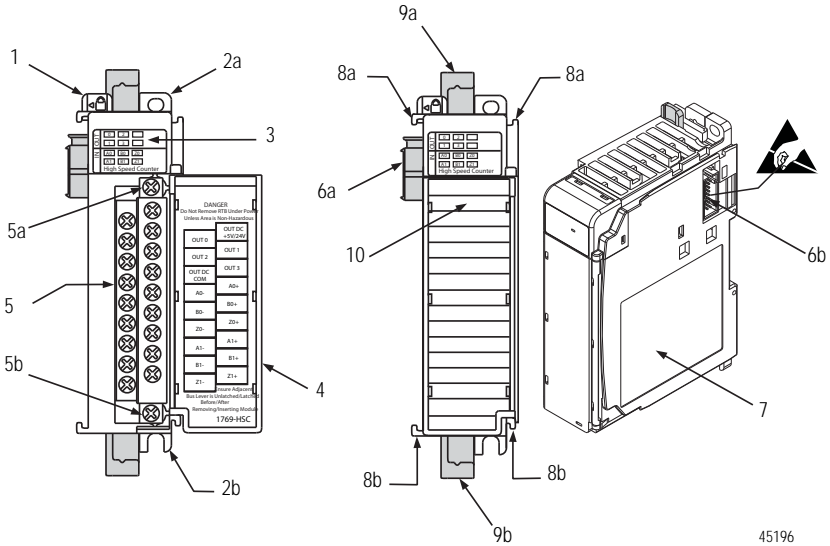
The 1769-HSC module is a 1 MHz counter/encoder input module with 4 onboard 5...30V DC sourcing outputs designed for high-speed control applications, such as flow control, measuring length, position, speed, frequency, or duration. The module can simultaneously interface with a maximum of two quadrature incremental encoders or four single-input count inputs from devices, such as proximity sensors, photo-eyes, single-pulse output encoders (with or without direction), or similar products used to monitor counting, flow, or frequency.

The input voltage range is 2.6...30V DC. The 1769-HSC module includes all of the standard 1769 I/O module features, such as rackless, removable terminal block, integrated high-speed bus/backplane, panel, or DIN rail mounting.

These are additional features:

- Two quadrature (ABZ) differential inputs alternately configurable for the following:
 - Pulse internal direction input (four counters in this configuration)
 - Pulse external direction input
 - Up and down pulse input
 - X1, X2, or X4 quadrature encoder input
- 32-bit count values (± 2 billion counts)
- 21-bit rate values (± 1 MHz)
- User-definable minimum and maximum count values
- Individual counter reset function (0 = reset enable (default); 1 = reset disable)
1769-HSC series B module only
- 16 user-defined ranges with each range individually assignable to 1 of the 4 counter channels
- User-definable preset
- Linear or ring counter operation
- Selectable input filters
- 5...30V DC counter/encoder inputs and control outputs
- 4 real (physical) outputs and 12 virtual (control bit) outputs
- Real outputs have electric overcurrent protection and rated current of 0.5 A per channel
- Safe State control options (options depend on which controller is used) to allow the module to operate during fault or program conditions

Hardware Description



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Item	Description
1	Bus lever
2a	Upper-panel mounting tab
2b	Lower-panel mounting tab
3	Module status indicators (6 Input, 4 Output, 1 Fuse, 1 OK)
4	Module door with terminal identification label
5	Removable terminal block (RTB) with finger-safe cover
5a	RTB upper-retaining screw
5b	RTB lower-retaining screw
6a	Movable bus connector (bus interface) with female pins
6b	Stationary bus connector (bus interface) with male pins
7	Nameplate label
8a	Upper tongue-and-groove slots
8b	Lower tongue-and-groove slots
9a	Upper DIN-rail latch
9b	Lower DIN-rail latch
10	Write-on label for user identification tags

Module Installation

The 1769-HSC module is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution Degree 2⁽¹⁾) and with circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

Removal and Insertion Under Power (RIUP)



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.

Removable Terminal Block (RTB) Under Power



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.

Hazardous Location Enclosure



WARNING: When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

- (1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.
- (2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.
- (3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

System Planning

There are several factors to consider when planning your system:

- A 1769-ECR (right-end cap) or 1769-ECL (left-end cap) is required to terminate the end of the Compact I/O bus.
- Each bank of Compact I/O modules must have its own power supply. (A MicroLogix 1500 base unit acts as the power supply for modules directly connected to it.)
- The module has a distance rating of four, therefore the module must be within four modules of the I/O bank's power supply.
- A Compact I/O power supply, or MicroLogix 1500 base unit, has limits in the amount of 5V DC and 24V DC current that it can supply to modules in its I/O bank. These limits depend on the catalog number (for example, 1769-PA2) of the supply. A bank of modules must not exceed the current limits of the I/O bank power supply or MicroLogix 1500 base unit.
- Refer to these publications for more information:
 - Compact I/O Expansion Power Supplies Installation Instructions, publication [1769-IN028](#)
 - MicroLogix 1500 Programmable Controllers User Manual, publication [1764-UM001](#)

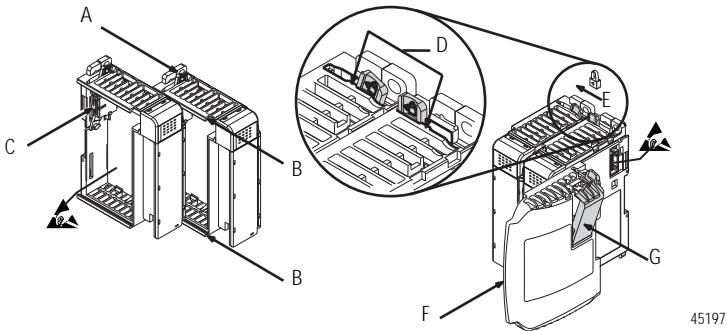
System Assembly

The module can be attached to an adjacent controller, power supply, or I/O module.

For mounting instructions, see 'Panel Mounting' on [page 10](#), or 'DIN Rail Mounting' on [page 12](#).

See 'Replacing a Single Module within a System' on [page 12](#) to work with a system that is already mounted.

Refer to the illustration when assembling the Compact I/O system. See [page 6](#) for a description of the module.



1. Disconnect the power.
2. Check that the bus lever of the module (A) is in the unlocked (fully right) position.
3. Use the upper and lower tongue-and-groove slots (B) to secure the modules together.
4. Move the module back along the tongue-and-groove slots until the bus connectors (C) line up with each other.
5. Use your fingers or a small screwdriver to push the bus lever back slightly to clear the positioning tab (D).
6. Move the module's bus lever fully to the left (E) until it clicks, making sure it's locked firmly in place.



ATTENTION: When attaching I/O modules, it's very important that the bus connectors are securely locked together to provide proper electrical connection.

7. Attach an end cap terminator (F) to the last module in the system by using the tongue-and-groove slots.
8. Lock the end cap bus terminator (G).

IMPORTANT A 1769-ECR or 1769-ECL right or left end cap must be used to terminate the end of the Compact I/O module.

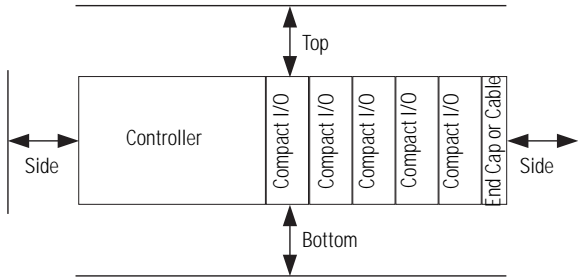
System Mounting



ATTENTION: This product is intended to be mounted to a well-grounded mounting surface, such as a metal panel. Additional grounding connections from the power supply's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#), for additional information.

Minimum Spacing

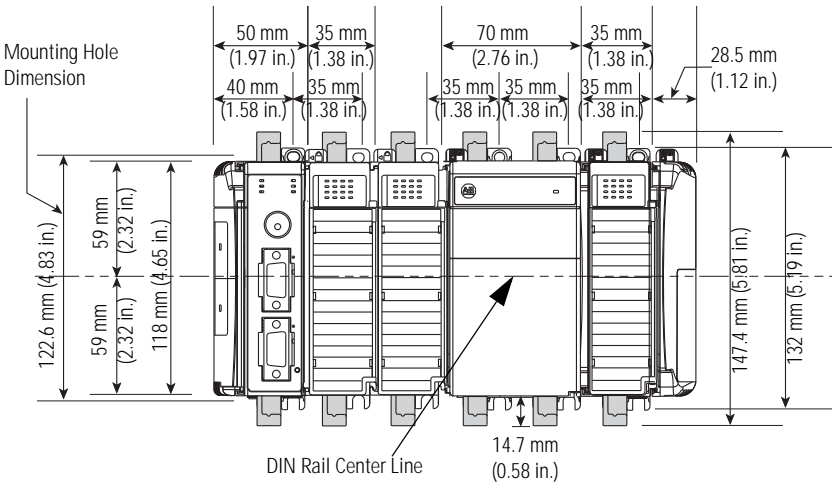
Maintain spacing from enclosure walls, wireways, adjacent equipment, and so forth. Allow 50 mm (2 in.) of space on all sides for adequate ventilation, as shown in the illustration.



Panel Mounting

Mount the module to a panel by using two screws per module. Use M4 or #8 panhead screws. Mounting screws are required on every module.

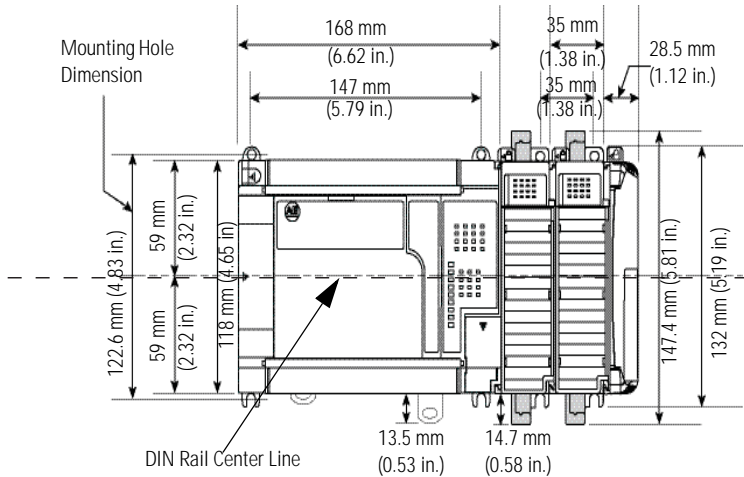
Figure 1 - Compact I/O Modules with CompactLogix Controller and Power Supply



Important: Hole spacing tolerance: ± 0.04 mm (0.016 in.).

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Figure 2 - Compact I/O Modules with MicroLogix 1500 Base Unit and Processor



Important: Hole spacing tolerance: ± 0.04 mm (0.016 in.).

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Panel Mounting Procedure by Using Modules as a Template

This procedure lets you to use the assembled modules as a template for drilling holes in the panel. Due to module mounting hole tolerance, it is important to do these steps.

1. On a clean work surface, assemble no more than three modules.
2. Using the assembled modules as a template, carefully mark the center of all module-mounting holes on the panel.
3. Return the assembled modules to the clean work surface, including any previously mounted modules.
4. Drill and tap the mounting holes for the recommended M4 or #8 screw.
5. Place the modules back on the panel, and check for proper hole alignment.
6. Attach the modules to the panel using the mounting screws.
7. Repeat [step 1](#) through [step 6](#) for any remaining modules.

DIN Rail Mounting

The module can be mounted on the following DIN rails:

- EN 50 022 - 35 x 7.5 mm (1.38 x 0.3 in.)
- EN 50 022 - 35 x 15 mm (1.38 x 0.59 in.)

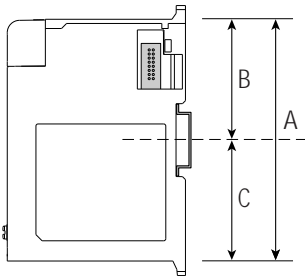


ATTENTION: During panel or DIN-rail mounting of all devices, be sure that all debris (metal chips, wire strands, and so forth) is kept from falling into the module. Debris that falls into the module could cause damage on powerup.

1. Before mounting the controller on a DIN rail, close the DIN rail latches.
2. Press the DIN rail mounting area of the controller against the DIN rail.

The latches will momentarily open and lock into place.

Figure 3 - DIN Rail Mounting Dimensions



Dimension	Height
A	118 mm (4.65 in.)
B	59 mm (2.325 in.)
C	59 mm (2.325 in.)

Replace the Module within a System

The module can be replaced while the system is mounted to a panel (or DIN rail).

1. Remove power, referring to Warnings on [page 7](#).
2. Remove terminal block or disconnect input and/or output wiring from the module.
3. Remove the upper and lower mounting screws from the module (or open the DIN latches by using a screwdriver).
4. On the module to be replaced and the right-side adjacent module (or end cap if the module is the last module in the bank), move the bus levers to the right (unlock) to disconnect the module from the adjacent modules.
5. Gently slide the disconnected module forward.

If you feel excessive resistance, make sure that you disconnected the module from the bus and that you removed both mounting screws (or opened the DIN latches).

TIP It may be necessary to rock the module slightly from front to back to remove it, or, in a panel-mounted system, to loosen the screws of adjacent modules.

6. Before installing the replacement module, be sure that the bus lever on the right-side adjacent module is in the unlocked (fully right) position.
7. Slide the replacement module into the open slot.
8. Connect the modules together by locking (fully left) the bus levers on the replacement module and the right-side adjacent module or end cap.
9. Replace the mounting screws (or snap the module onto the DIN rail).
10. Replace the terminal block or connect input and output wiring to the module.

Field Wiring Connections

Consider these system wiring guidelines when wiring your system.

General Guidelines

- Disconnect power to the module before wiring. This includes sensor power and 1769 bus power.
- Input and output channels are isolated from the 1769-Compact bus. Input channels are isolated from one another; output channels are not.
- Shielded cable is required for high-speed input signals A, B, and Z. Use individually shielded, twisted-pair cable (or the type recommended by the encoder manufacturer) for lengths up to 300 m (1000 ft).
- Group this module and other low voltage DC modules away from AC I/O or high voltage DC modules.
- Route field wiring away from any other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Routing field wiring in a grounded conduit can reduce electrical noise.
- If field wiring must cross AC or power cables, make sure that they cross at right angles.
- Make sure the system is properly grounded.

Grounding Guidelines

- This product is intended to be mounted to a well-grounded mounting surface, such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used) are required only when the mounting surface is non-conductive and cannot be grounded.
- Keep shield connection to ground as short as possible.
- Ground the shield drain wire at the 1769-HSC module's input end only.

Refer to the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#), for additional installation requirements

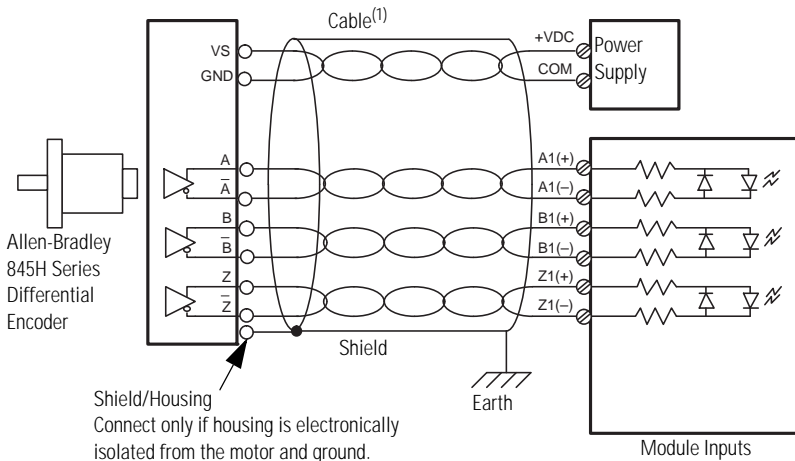
Terminal Block Guidelines

- For optimum accuracy, limit overall cable impedance by keeping cable as short as possible. Locate the module as close to input devices as the application permits.
- Tighten terminal screws with care. Excessive tightening can strip a screw.

Wire Diagrams

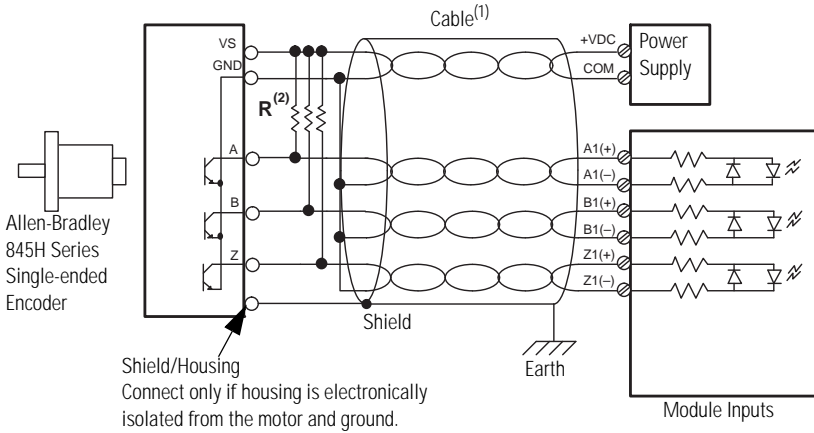
The following pages show wiring examples for a differential encoder, single-ended encoder, and discrete device.

Figure 4 - Differential Encoder Wiring



(1) Refer to your encoder manual for proper cable type. The type of cable used should be twisted-pair, individually shielded cable with a maximum length of 300 m (1000 ft).

Figure 5 - Single-Ended Encoder Wiring



- (1) Refer to your encoder manual for proper cable type. The type of cable used should be twisted-pair, individually shielded cable with a maximum length of 300 m (1000 ft).
- (2) External resistors are required if they are not internal to the encoder. The pull-up resistor (R) value depends on the power supply value. The table shows the maximum resistor values for typical supply voltages. To calculate the maximum resistor value, use the following formula:

$$R = \frac{VDC - Vmin}{Imin}$$

where:

R = maximum pull-up resistor value

V DC = power supply voltage

V min = 2.6V DC

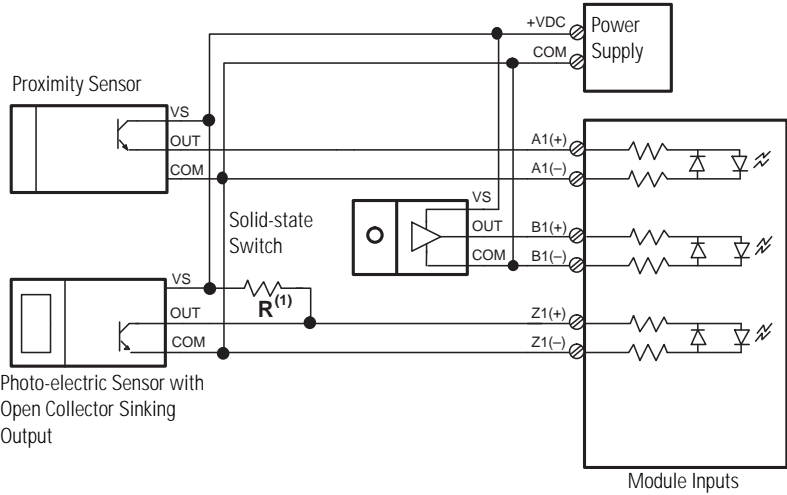
I min = 6.8 mA

Power Supply Voltage (V DC)	Pull-up Resistor Value (R), Max ⁽¹⁾
5V DC	352 Ω
12V DC	1382 Ω
24V DC	3147 Ω

- (1) Resistance values may change, depending upon your application.

The minimum resistor (R) value depends on the current sinking capability of the encoder. Refer to your encoder's documentation.

Figure 6 - Discrete Device Wiring



(1) External resistors are required if they are not internal to the sensor. The pull-up resistor (R) value depends on the power supply value. The table shows the maximum resistor values for typical supply voltages. To calculate the maximum resistor value, use the following formula:

$$R = \frac{(VDC - Vmin)}{Imin}$$

where:

- R = maximum pull-up resistor value
- V DC = power supply voltage
- V min = 2.6V DC
- I min = 6.8 mA

Power Supply Voltage (V DC)	Pull-up Resistor Value (R), Max ⁽¹⁾
5V DC	352 Ω
12V DC	1382 Ω
24V DC	3147 Ω

(1) Resistance values may change, depending upon your application.

The minimum resistor (R) value depends on the current sinking capability of the sensor. Refer to your sensor's documentation.

Output Wiring

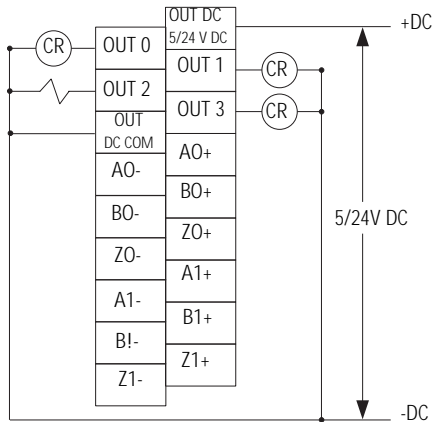
Basic wiring⁽¹⁾ of output devices⁽²⁾ to the module is shown in Figure 7.



ATTENTION: Follow these guidelines:

- Miswiring of the module to an AC power source or applying reverse polarity will damage the module.
- Be careful when stripping wires. Wire fragments that fall into a module could cause damage at powerup. Once wiring is complete, be sure that the module is free of all metal fragments.

Figure 7 - Output Device Wiring



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Remove the Finger-safe Terminal Block

When wiring field devices to the module, it is not necessary to remove the terminal block. If you remove the terminal block, use the write-on label on the side of the terminal block to identify the module slot location and type.

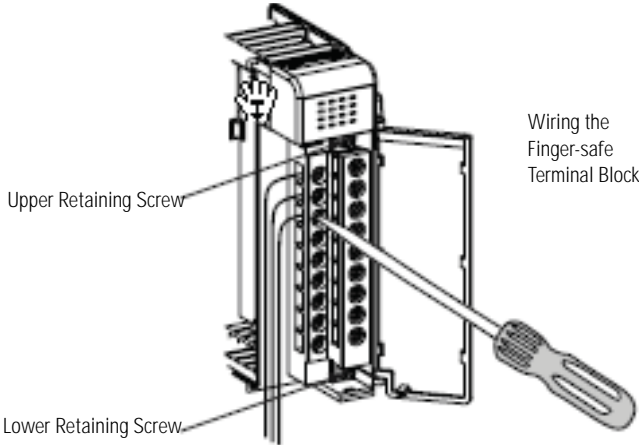


To remove the terminal block, loosen the upper and lower retaining screws. The terminal block will back away from the module as you remove the screws. When replacing the terminal block, torque the retaining screws to 0.46 N•m (4.1 lb•in).

- (1) Recommended Surge Suppression - The module has built-in suppression which is sufficient for most applications, however, for high-noise applications, use a 1N4004 diode reverse-wired across the load for transistor outputs switching 24V DC inductive loads. For additional details, refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).
- (2) Sourcing Output - Source describes the current flow between the I/O module and the field device. Sourcing output circuits supply (source) current to sinking field devices. Field devices connected to the negative side (DC Common) of the field power supply are sinking field devices. Field devices connected to the positive side (+V) of the field supply are sourcing field devices. **Europe:** DC sinking input and sourcing output module circuits are the commonly used options.

Wire the Finger-safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.



1. Loosen the terminal screws to be wired.
2. Route the wire under the terminal pressure plate.

You can use the bare wire or a spade lug. The terminals accept a 6.35 mm (0.25 in.) spade lug.

TIP The terminal screws are non-captive. Therefore, it's possible to use a ring lug (6.35 mm (0.25 in.) maximum outside diameter with 3.53 mm (0.139 in.) minimum inside diameter) with the module.

3. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.68 N•m (6 lb•in).

TIP If you need to remove the finger-safe cover, insert a screwdriver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with these restrictions.

Wire Type		Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid	Cu-90 °C (194 °F)	0.32... 2.1 mm ² (22...14 AWG)	0.68 N•m (6 lb•in)	0.46 N•m (4.1 lb•in)
Stranded	Cu-90 °C (194 °F)	0.32... 1.3 mm ² (22...16 AWG)	0.68 N•m (6 lb•in)	0.46 N•m (4.1 lb•in)

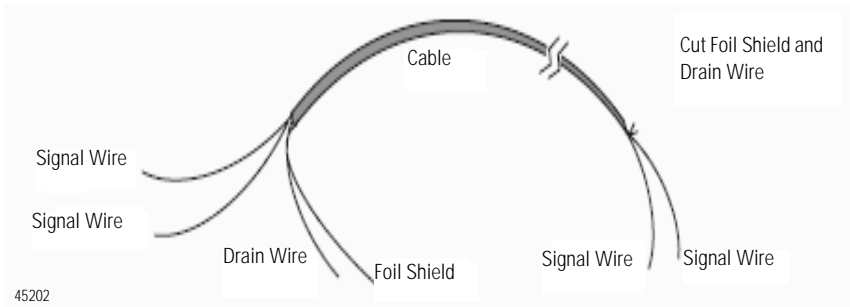
Wire the Modules

After the module is properly installed, wire the modules by using this procedure. To provide proper operation and high immunity to electrical noise, always use shielded wire.



ATTENTION: To prevent shock hazard, care should be taken when wiring the module to signal sources. Before wiring any module, disconnect power from the system power supply and from any other source to the module.

Do not wire more than two conductors on any single terminal.



Do these steps to wire your module.

1. At each end of the cable, strip some casing to expose the individual wires.
2. Trim the signal wires to 5 cm (2 in.) lengths, stripping about 5 mm (0.2 in.) of insulation away to expose the end of the wire.



ATTENTION: Be careful when stripping wires. Wire fragments that fall into a module could cause damage at powerup.

3. At the 1769-HSC module's input end of the cable, twist the drain wire and foil shield together, bending them away from the cable, and apply shrink wrap, grounding the shield at this end by using as short a lead-length as possible.
4. At the other end of the cable, cut the drain wire and foil shield back to the cable and apply shrink wrap.
5. Connect the signal wires to the terminal block, connecting the other end of the cable to the input device.
6. Repeat [step 1](#) through [step 5](#) for each channel on the module.

Output Operation

The four output terminals must be powered by a user-supplied external source. User-power range is from 5...30V DC. See Output Specifications on [page 27](#) for voltage and current levels.

There is no isolation between the outputs, but the outputs are isolated from the inputs and the 1769 Compact bus.

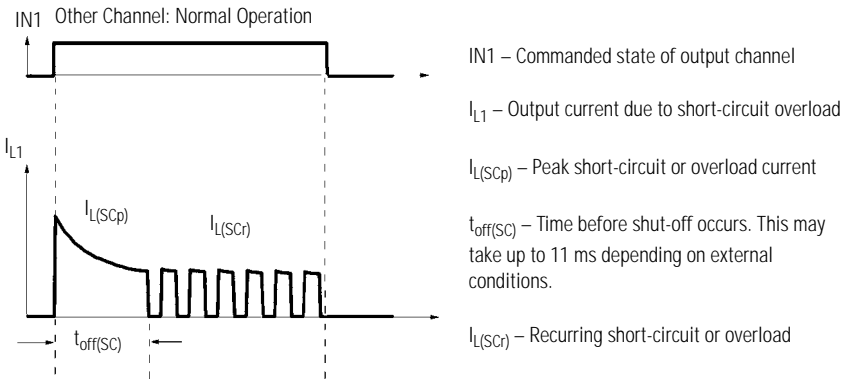
Electronic Protection

The electronic protection of the 1769-HSC module has been designed to provide protection from current overload and short-circuit conditions. The protection is based on a thermal cut-out principle. In the event of a short circuit or current-overload condition on an output channel, that channel will turn off within milliseconds after the thermal cut-out temperature has been reached.

When this occurs, the module's fuse status indicator will turn on. You have the option to allow the protection device to automatically reset, or to be reset under program control. The automatic reset function occurs after the thermal protection device cools. If the current overload or short-circuit condition still exists, the automatic reset cycle repeats until it is removed.

TIP Correct short-circuit and overload conditions as soon as possible. If short-circuit and overload conditions occur for extended periods, damage can occur.

Figure 8 - Timing Diagram for Over-current and/or Short-circuit Shutdown and Restart



Under-voltage Condition

If the field supply voltage falls below a value of approximately 4V DC, all of the 1769-HSC module's outputs shut down and remain off until the field supply voltage returns to a value within the module's normal operating range.

Transistor Output Transient Pulses

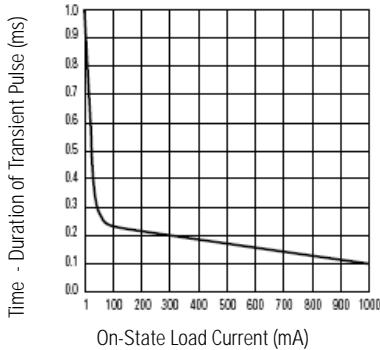
The maximum duration of the transient pulse occurs when minimum load is connected to the output. However, for most applications, the energy of the transient pulse is not sufficient to energize the load.



ATTENTION: A transient pulse occurs in transistor outputs when the external DC supply voltage is applied to the output common terminals (for example, via the master control relay). The sudden application of voltage creates this transient pulse. This condition is inherent in transistor outputs and is common to solid state devices. A transient pulse can occur regardless of the controller having power. Refer to your controller's user manual to reduce the chance of inadvertent operation.

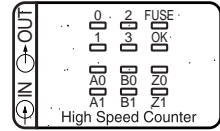
Figure 9 illustrates that the duration of the transient pulse is proportional to the load current. Therefore, as the on-state load current increases, the transient pulse decreases. Power-up transients do not exceed the time duration for the amount of loading indicated at 60 °C (140 °F).

Figure 9 - Transient Pulse Duration as a Function of Load Current



Module Powerup

At module powerup, a series of internal diagnostic tests are performed. These diagnostic tests must be successfully completed or the module OK status indicator remains off or red, and a module error is reported to the controller.



Diagnostic Indicators

Status Indicator	Color	Indicates	Status Indicator	Color	Indicates
0 OUT	Amber	ON/OFF logic status of output 0	A0	Amber	ON/OFF status of input A0
1 OUT	Amber	ON/OFF logic status of output 1	A1	Amber	ON/OFF status of input A1
2 OUT	Amber	ON/OFF logic status of output 2	B0	Amber	ON/OFF status of input B0
3 OUT	Amber	ON/OFF logic status of output 3	B1	Amber	ON/OFF status of input B1
FUSE	Red	Overcurrent	Z0	Amber	ON/OFF status of input Z0
OK	Off	No power is applied	Z1	Amber	ON/OFF status of input Z1
	Red (briefly)	Performing self-test			
	Solid green	Normal operating condition			
	Flashing green	OK, in Program or Fault mode			
	Solid red or amber	Hardware error. Cycle power to the module. If problem persists, replace the module			
	Flashing red	Recoverable fault. Reconfigure, reset, or perform error recovery. Refer to the Compact I/O High-speed Counter User Manual, publication 1769-UM006			
ALL ON	Possible causes for all status indicators to be On include the following: <ul style="list-style-type: none"> • Bus error has occurred: Controller hard fault. Cycle power. • During upgrade of controller: Normal. Do not cycle power during the upgrade. 				

Default Configuration

When the module is powered up for the first time, it uses the following default configuration values. All counters are disabled and all outputs are off. The module's Default Safe State configuration is all zero's, resulting in the following:

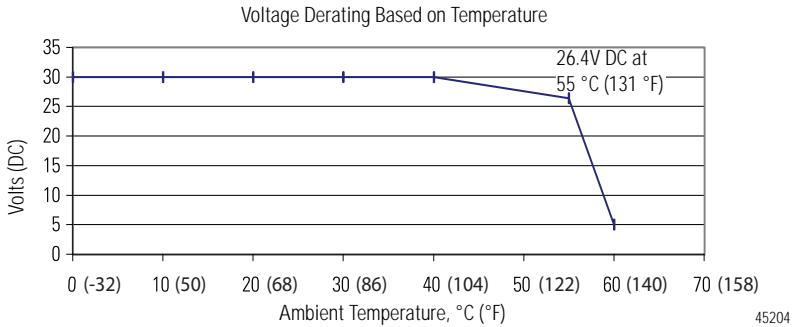
- Program State = UDSS (user-defined safe state)
- Program Value = OFF
- ProgramStateRun = No
- Fault State = UDSS (user-defined safe state)
- Fault Value = OFF
- FaultStateRun = No
- PFE (Program to Fault Enable) = leave program value applied.

Refer to the Compact I/O High-speed Counter User Manual, publication [1769-UM006](#), and use your programming software to change the configuration.

Temperature Derating

The following graphs indicate how much current can be drawn from the power supply at the indicated case temperature without damaging it.

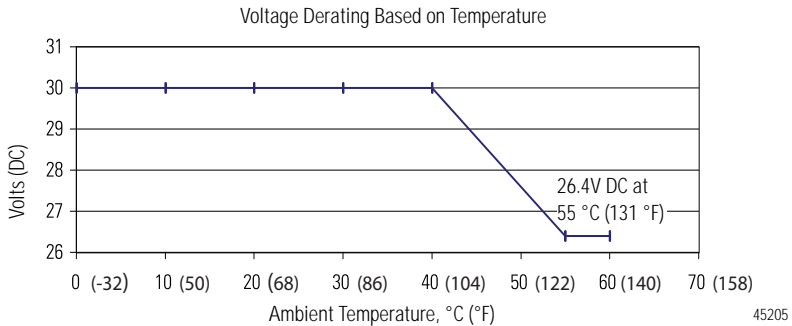
Maximum Input Voltage - 24V DC Operation



Temperature	Derated Voltage ⁽¹⁾
0...40 °C (-32...104 °F)	30V DC
55 °C (131 °F)	26.4VDC
60 °C (140 °F)	5V DC

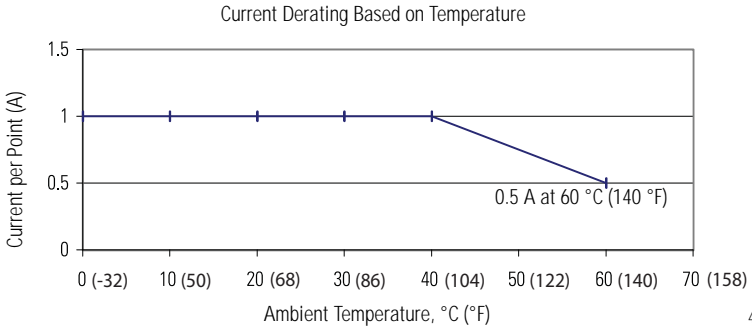
- (1) Input voltage derating between 55...60 °C (131...140 °F) is achieved by using a dropping resistor.
 For 24V DC input voltage, use a 2.4 k Ω ½ W resistor.
 For input voltages other than 24V DC, use a ½ W resistor with value: 125 x (V_{in} - 5V).

Maximum Output Voltage - 24V DC Operation



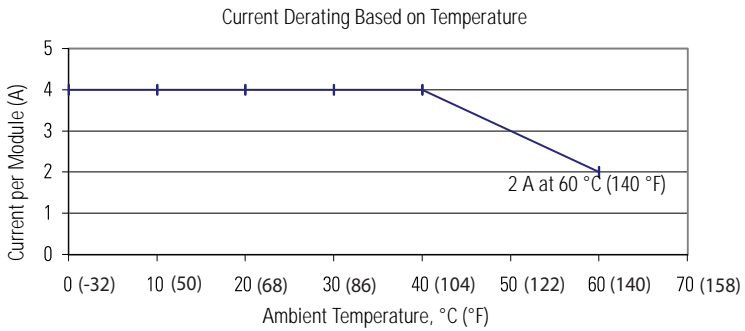
Temperature	Derated Voltage
0...40 °C (-32...104 °F)	30V DC
55...60 °C (131...140 °F)	26.4V DC

Maximum Output Current per Point - 5V DC Operation



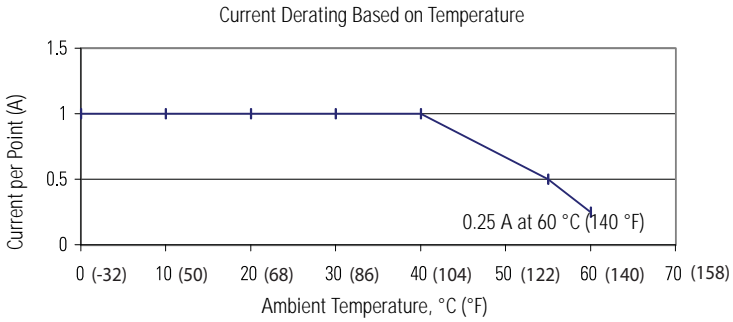
Temperature	Derated Current
0...40 °C (-32...104 °F)	1 A
60 °C (140 °F)	0.5 A

Maximum Output Current per Module - 5V DC Operation



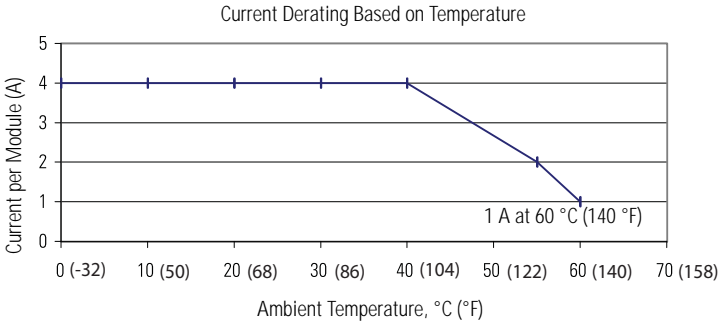
Temperature	Derated Current
0...40 °C (-32...104 °F)	4 A
60 °C (140 °F)	2.0 A

Maximum Output Current per Point - 24V DC Operation



Temperature	Derated Current
0...40 °C (-32...104 °F)	1 A
55 °C (131 °F)	0.5 A
60 °C (140 °F)	0.25 A

Maximum Output Current per Module - 24V DC Operation



Temperature	Derated Current
0...40 °C (-32...104 °F)	4 A
55 °C (131 °F)	2 A
60 °C (140 °F)	1 A

Specifications

Technical Specifications - 1769-HSC

Attribute	1769-HSC
Dimensions (H x W x D), approx.	118 x 35 x 87 mm (4.65 x 1.38 x 3.43 in.) Height including mounting tabs is 138 mm (5.43 in.)
Shipping weight (with carton), approx.	309 g (0.681 lb)
Bus current draw, max	425 mA at 5V DC 0 mA at 24V DC
Heat dissipation	6.21 W The Watts per point, plus the minimum Watts, with all points energized
Isolation voltage	75V (continuous), reinforced insulation type, channel-to-system and channel-to-channel Type tested at 1200V AC for 2 s
All supply power and/or current ratings	Input: 30 V DC, 40 °C (104 °F) Output: 1 A per channel, 4 A per module, 30 V DC, 40 °C (104 °F)
Power supply distance rating	Module cannot be more than four modules away from a system power supply
Recommended cable	Individually shielded, twisted-pair cable (or the type recommended by the encoder or sensor manufacturer)
Wire size	0.32... 2.1 mm ² (22...14 AWG) solid copper wire or 0.32... 1.3 mm ² (22...16 AWG) stranded copper wire rated at 90 °C (194 °F) insulation max
Wiring category	2 - on signal ports ⁽¹⁾
Vendor ID code	1
Product type code	109
Product code	19
Enclosure type rating	None (open-style)
North American temp code	T3C

(1) Use this Conductor Category information for planning conductor routing. Refer to the Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#)

Input Specifications - 1769-HSC

Attribute	1769-HSC
No. of inputs	2 quadrature (ABZ) differential inputs
Input voltage range	2.6...30V DC ⁽¹⁾
On-state voltage, max	30V DC ⁽¹⁾

Input Specifications - 1769-HSC

Attribute	1769-HSC
On-state voltage, min	2.6V DC
On-state current, min	6.8 mA
Off-state voltage, max	1.0V DC
Off-state current, max	1.5 mA
Off-state leakage current, max	1.5 mA
Input current, max	15 mA
Input current, min	6.8 mA
Input impedance, nom	1950 Ω
Pulse width, min	250 ns
Pulse separation, min	131 ns
Input frequency, max	1 MHz

(1) See [Maximum Input Voltage - 24V DC Operation](#) temperature derating on [page 23](#).

Output Specifications - 1769-HSC

Attribute	1769-HSC
No. of outputs	16 total, 4 physical and 12 virtual
Output voltage range	5...30V DC ⁽¹⁾
On-state voltage, max	User power - 0.1V DC
On-state current, max	1 A per point ⁽²⁾ 4 A per module ⁽³⁾
On-state current, min	1 mA
On-state voltage drop, max	0.5V DC
Off-state leakage current, max	5 μ A
Turn-on time, max	400 μ s ⁽⁴⁾
Turn-off time, max	200 μ s
Reverse polarity protection	30V DC

(1) See [Maximum Output Voltage - 24V DC Operation](#) temperature derating on [page 23](#).

(2) See [Maximum Output Current per Point - 5V DC Operation](#) temperature derating on [page 24](#) and [Maximum Output Current per Point - 24V DC Operation](#) temperature derating on [page 25](#).

(3) See [Maximum Output Current per Module - 5V DC Operation](#) temperature derating on [page 24](#) and [Maximum Output Current per Module - 24V DC Operation](#) temperature derating on [page 25](#).

(4) Maximum turn-on time applies to an output voltage range of 5...7V DC. For output voltages greater than 7V DC, the maximum turn-on time is 200 μ s.

Environmental Specifications - 1769-HSC

Attribute	1769-HSC
Temperature, operating 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...60 °C (32...140 °F)
Temperature, surrounding air, max	40 °C (104 °F)
Temperature, nonoperating IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)	-40...85 °C (-40...185 °F)
Relative humidity IEC 60068-2-30 (Test Db, Unpackaged Damp Heat)	5...95% noncondensing
Vibration, operating IEC 60068-2-6 (Test Fc, Operating)	5 g @ 10...500 Hz, peak-to-peak
Vibration, relay operation IEC 60068-2-6	2 g @ 10...500 Hz ⁽¹⁾
Shock, operating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	30 g, 11 ms panel mounted 20 g, 11 ms DIN rail mounted
Shock, nonoperating IEC 60068-2-27 (Test Ea, Unpackaged Shock)	40 g, panel mounted 30 g, DIN rail mounted
Emissions CISPR 11	Group 1, Class A
ESD immunity IEC 61000-4-2	6 kV contact discharges 8 kV air discharges
Radiated RF immunity IEC 61000-4-3	10V/m with 1 kHz sine-wave 80% AM from 80...2000 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 900 and 1890 MHz 10V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz

Environmental Specifications - 1769-HSC

Attribute	1769-HSC
EFT/B immunity IEC 61000-4-4	±2 kV at 5 kHz on power ports ±2 kV at 5 kHz on signal ports
Surge transient immunity IEC 61000-4-5	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports ±1 kV line-earth (CM) on shielded ports
Conducted RF immunity IEC 61000-4-6	10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz

(1) This rating applies for your system if a relay module, such as the 1769-0W8, is used.

Certifications - 1769-HSC⁽¹⁾

Certification ⁽²⁾	1769-HSC
c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. and Canada. See UL File E65584
c-UL-us	UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E321922
CE	European Union 2004/108/EC EMC Directive, compliant with: <ul style="list-style-type: none"> • EN 61000-6-2; Industrial Immunity • EN 61000-6-4; Industrial Emissions • EN 61131-2; Programmable Controllers (Clause 8, Zone A & B)
C-Tick	Australian Radiocommunications Act, compliant with: <ul style="list-style-type: none"> • AS/NZS CISPR 11; Industrial Emissions

(1) When product is marked.

(2) See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Compact High-speed Counter Module User Manual, publication 1769-UM006	Detailed description of how to use your High-speed Counter Module.
ControlLogix System User Manual, publication 1756-UM001	Detailed description of how to use your ControlLogix operating system.
MicroLogix 1500 Programmable Controllers User Manual, publication 1764-UM001 .	Information on how to use your MicroLogix 1500 system.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	More information on proper wiring and grounding techniques.
Product Certifications website, publication http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

If you need more information on these products, contact your local Rockwell Automation distributor or sales office. The documentation listed in the Related Documentation table is available at <http://www.rockwellautomation.com/literature>.

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://www.rockwellautomation.com/support/>, 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://www.rockwellautomation.com/support/>.

Installation Assistance

If you experience a problem 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 product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/support/americas/phone_en.html , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

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

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

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