

## **CompactLogix Packaged Controllers**

Catalog Numbers 1769-L23E-QB1B, 1769-L23E-QBFC1B, 1769-L23-QBFC1B

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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://literature.rockwellautomation.com>) 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.



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

<b>WARNING</b> 	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.
<b>IMPORTANT</b>	Identifies information that is critical for successful application and understanding of the product.
<b>ATTENTION</b> 	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.
<b>SHOCK HAZARD</b> 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
<b>BURN HAZARD</b> 	Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

## 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>	
<p><b>WARNING</b></p> 	<p><b>EXPLOSION HAZARD -</b></p> <ul style="list-style-type: none"> <li>Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.</li> <li>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.</li> <li>Substitution of components may impair suitability for Class I, Division 2.</li> <li>If this product contains batteries, they must only be changed in an area known to be nonhazardous.</li> </ul>	<p><b>AVERTISSEMENT</b></p>  <p><b>RISQUE D'EXPLOSION –</b></p> <ul style="list-style-type: none"> <li>Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.</li> <li>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.</li> <li>La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2.</li> <li>S'assurer que l'environnement est classé non dangereux avant de changer les piles.</li> </ul>

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

## Prevent Electrostatic Discharge

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**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.
- 

## Before You Begin

This section contains information you should understand before installing the CompactLogix packaged controller.

### Restrictions

The maximum amount of expansion modules that can be used with the packaged controllers is two. Within that limit, the number of expansion I/O modules that can be attached to the packaged controller depends on the bus current draw of the modules being attached.

Each packaged controller has a specified amount of available bus current as shown in this table.

### Packaged Controller Bus Current and Expansion Module Limits

Cat. No.	Total Available 5V DC Bus Current
1769-L23E-QB1B	1 A (1000 mA)
1769-L23E-QBFC1B	450 mA
1769-L23-QBFC1B	800 mA

To determine the number of expansion I/O modules you can add, total the bus current draw (maximum) of your planned expansion I/O modules and the end cap. If your result is less than the packaged controller's maximum available bus current, you are within the expansion I/O limit of your packaged controller.

*Example of Expansion I/O Calculation:*

In this example, these expansion I/O modules and bus current draws are planned for use with the 1769-L23E-QBFC1B packaged controller.

<b>Planned Expansion I/O Module</b>	<b>Bus Current Draw, max<sup>(1)</sup></b>
1769-OV16 Sink Output Module	200 mA
1769-IF4 Analog Input Module	105 mA
1769-ECR End Cap	5 mA
<b>Total Bus Current Draw:</b>	<b>310 mA</b>

<sup>(1)</sup> The maximum bus current draw specification for each Compact I/O module is available in the Compact I/O Selection Guide, publication [1769-SG002](#). This publication also provides further explanation of and a table for the calculation of Compact I/O power supply requirements.

The total bus current draw of the Compact I/O modules (310 mA) is less than the total available bus current of the packaged controller (450 mA). These planned expansion I/O modules are within the limits of the 1769-L23E-QBFC1B packaged controller.

**Parts (included with the packaged controller)**

These components are included with your CompactLogix packaged controller.

<b>Cat. No.</b>	<b>Part</b>
1747-KY	Key
1769-BA	Battery
1769-ECR	End cap

**Parts (optional, not included with the packaged controller)**

In addition to the parts included with the packaged controller, you may choose to use these components specific to your application.

<b>If using</b>	<b>Then use this component</b>
RS-232 port to connect to the packaged controller.	1756-CP3 or 1747-CP3 serial cable.
EtherNet/IP port to connect to the packaged controller.	Standard Ethernet cable with an RJ45 connector, or, for industrial grade requirements, 1585J Ethernet connectivity media.
Panel mount method to install the packaged controller.	4...8 M4 or #8 panhead screws (depending on the number of expansion modules used).

### Replacement Parts

These CompactLogix packaged controller replacement parts are available for order.

Catalog No.	Description	Compatible Packaged Controllers
1769-BA	CompactLogix packaged controller battery	1769-L23E-QB1B, 1769-L23E-QBFC1B, and 1769-L23-QBFC1B
1769-ECR	Compact right end cap	1769-L23E-QB1B, 1769-L23E-QBFC1B, and 1769-L23-QBFC1B
1769-RDQB	CompactLogix packaged controller door	1769-L23E-QB1B
1769-RDQBFC	CompactLogix packaged controller door	1769-L23E-QBFC1B and 1769-L23-QBFC1B

### Required Tools

The only tool required for the installation of the CompactLogix packaged controller is a medium-sized Phillips-head screwdriver.

### Required System Components

Use these system components with your CompactLogix packaged controller.

Software Component	Version
RSLogix 5000	17.00 or later
RSLinx Classic	2.52 <sup>(1)</sup>

<sup>(1)</sup> You may use an earlier version of RSLinx software, however, if you do so, you must download and install the EDS files specific to these controllers. Also, if you are using Windows Vista, you must use RSLinx Classic software, version 2.54.

## Installation Checklist

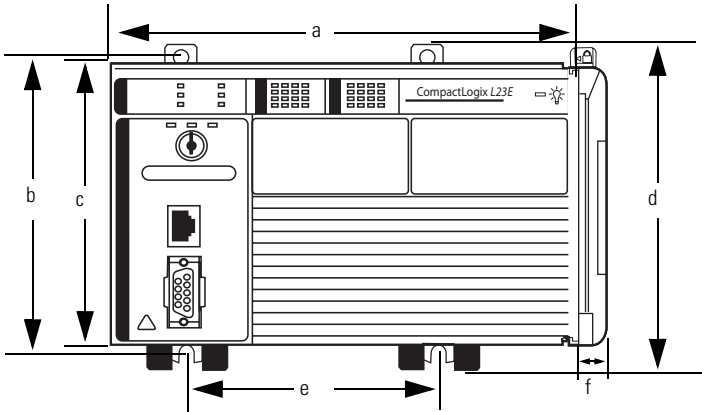
This table lists tasks that must be completed to fully install and begin using your packaged controller.

✓	<b>Installation Tasks</b>
	Install the Battery
	Connect Expansion Modules (optional)
	Panel Mount the System or DIN-rail Mount the System
	Minimum Spacing Requirements
	Grounding Considerations
	Wire the I/O Removable Terminal Blocks
	Connect Using the RS-232 Connection
	Download and Install EDS Files
	Download and Install Controller Firmware
	Use the AutoFlash Feature of RSLogix 5000 to Load Firmware or Use the ControlFlash Utility to Load Firmware

## Packaged Controller Dimensions

### 1769-L23E-QB1B Packaged Controller

The 1769-L23E-QB1B controller has these approximate dimensions.

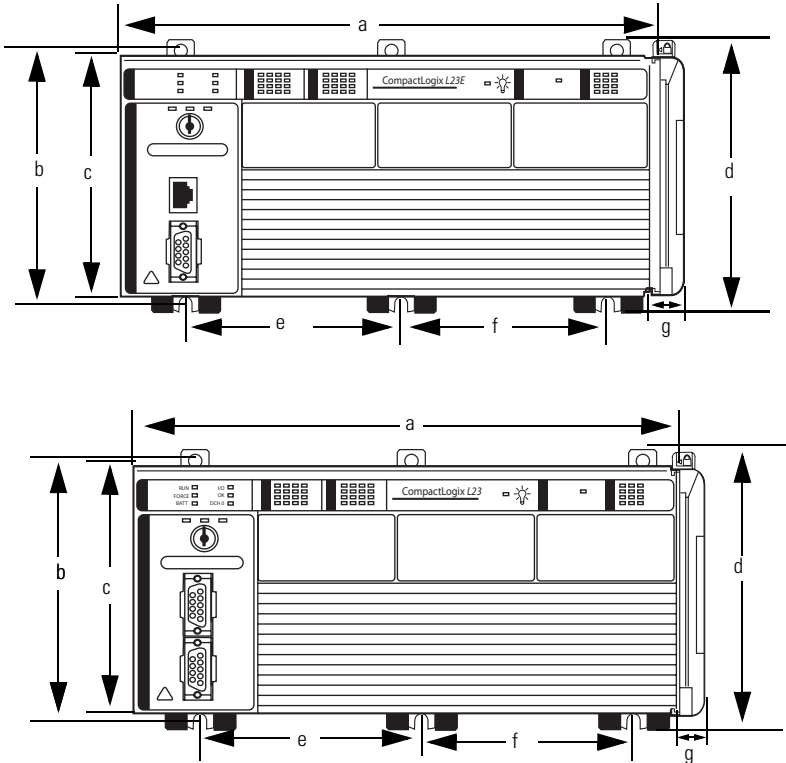


Measurement	Dimension, approx.
a	185.2 mm (7.29 in)
b	123.86 mm (4.88 in)
c	118 mm (4.65 in)
d	132 mm (5.20in)
e	132.9 mm (5.23 in)
f	18 mm (.71 in)



### 1769-L23E-QBFC1B and 1769-L23-QBFC1B Packaged Controllers

The 1769-L23E-QBFC1B and 1769-L23-QBFC1B packaged controllers have these approximate dimensions.



Measurement <sup>(1)</sup>	Dimension, approx.
a	249.25 mm (9.81 in)
b	123.86 mm (4.88 in)
c	118 mm (4.65 in)
d	132 mm (5.20 in)
e	98.475 mm (3.88 in)
f	98.475 mm (3.88 in)
g	18 mm (.71 in)

<sup>(1)</sup> Applies to both the 1769-L23E-QBFC1B and 1769-L23-QBFC1B packaged controllers.

## Install the Battery

Complete these steps to install the battery on your packaged controller.

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### WARNING

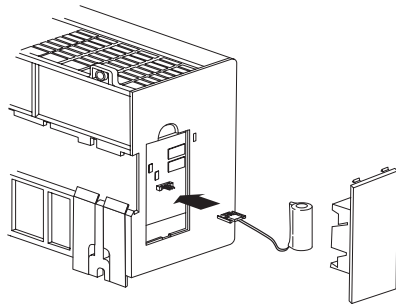
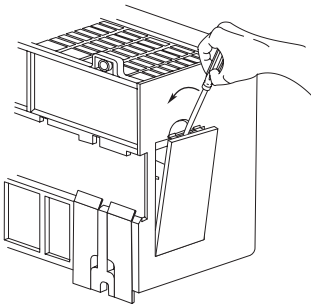


When you connect or disconnect the battery an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that the area is nonhazardous before proceeding.

For Safety information on the handling of lithium batteries, including handling and disposal of leaking batteries, see Guidelines for Handling Lithium Batteries, publication [AG 5-4](#).

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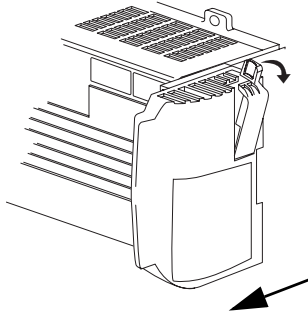
1. Open the battery door on the left side of the packaged controller.
2. Carefully attach the battery connector to the port located inside the packaged controller.
3. Insert the battery, wires down, in the slot on the battery door.
4. Close the battery door.



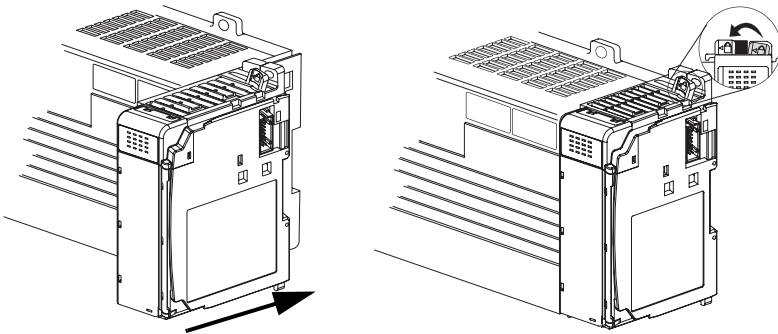
## Connect Expansion Modules (optional)

If using expansion modules with your packaged controller, complete these steps to attach the modules.

1. Remove the end cap by unlocking it and sliding it forward.

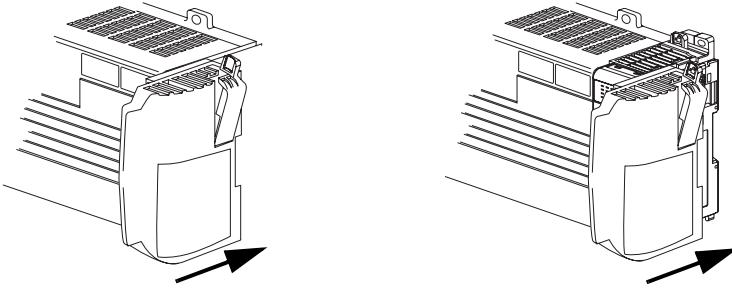


2. Align the tongue-and-groove slots of the expansion module with those on the right end of the packaged controller.
3. Slide the module onto the packaged controller.
4. Close the locking tab on the top of the module.

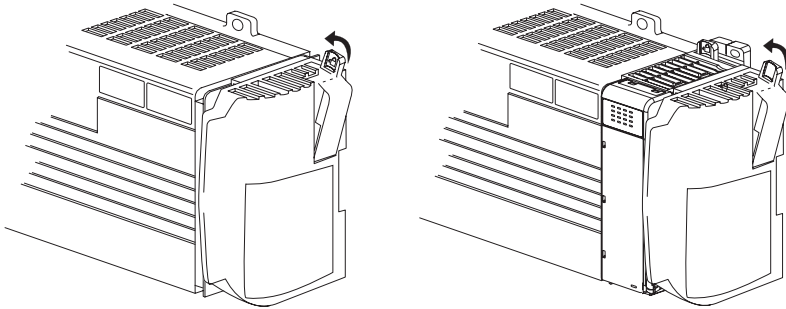


5. If using another expansion module, complete steps 2...4 for the second module.

- Align the tongue-and-groove slots of the end cap with those on the right of the packaged controller or expansion module.

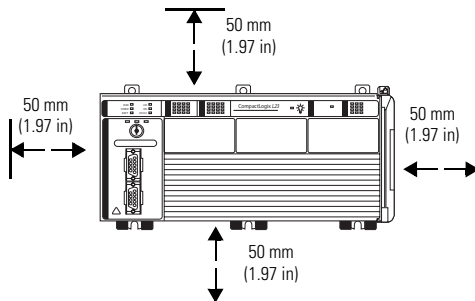


- Close the locking tab located on the top of the end cap.



## Minimum Spacing Requirements

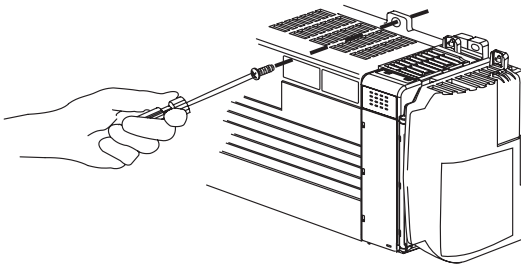
When using any of the CompactLogix packaged controllers, maintain spacing from enclosure walls, wireways, and adjacent equipment. Allow 50 mm (1.97 in.) of space on all sides, as shown. This provides ventilation and electrical isolation.



## Panel Mount the System

To mount your system to a panel, complete these steps.

1. Using the assembled system as a template, carefully mark the center of all mounting holes on the panel.
2. Remove the system and drill and tap the mounting holes for the recommended M4 or #8 screws.
3. Place the grounding panel (if used) and CompactLogix system on the panel to check for proper hole alignment.
4. Insert the recommended screws into the mounting tabs on the packaged controller and expansion modules (if used) and tighten.



## DIN-rail Mount the System

To mount your system on a DIN rail, complete these steps.

The packaged controller can be mounted on these DIN rails:

- EN 50 022 - 35 x 7.5 mm (1.38 x 0.30 in.)
- EN 50 022 - 35 x 15 mm (1.38 x 0.59 in.)

### ATTENTION

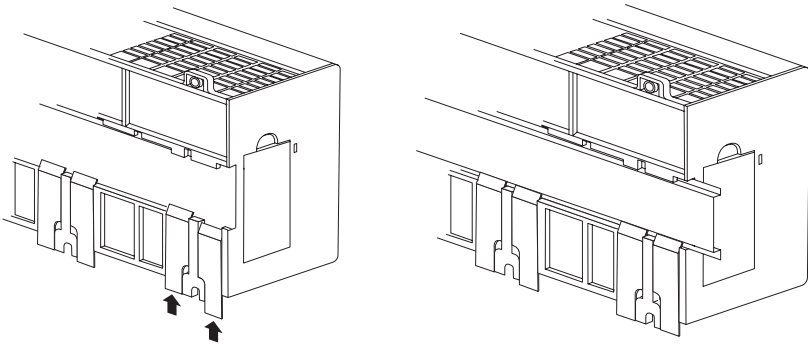


When this product is grounded through the DIN rail to chassis ground, use zinc plated yellow-chromate steel DIN rail to assure proper grounding. The use of other DIN rail materials (for example, aluminum or plastic) that can corrode, oxidize, or are poor conductors, can result in improper or intermittent grounding. Secure DIN rail to mounting surface approximately every 200 mm (7.8 in.) and use end-anchors appropriately.

1. Before mounting the packaged controller on a DIN rail, close the DIN-rail latches.

2. Press the DIN rail mounting area of the packaged controller against the DIN rail.

The latches momentarily open and lock into place on the DIN rail



3. Press the DIN rail mounting area of the packaged controller against the DIN rail.

The latches momentarily open and lock into place on the DIN rail.

## Grounding Considerations

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the packaged controller's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded.

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

## Wiring Power to the System

Use this diagram as a reference when wiring the required 24V DC power to your system.

### WARNING



- Do not connect directly to line voltage. Line voltage must be supplied by a suitable, approved isolating transformer or power supply having short-circuit capacity not exceeding 100 VA maximum or equivalent.
- Explosion hazard, do not remove or replace fuses on the packaged controller unless power has been disconnected or the area is known to be free of ignitable concentrations of flammable gases or vapors.

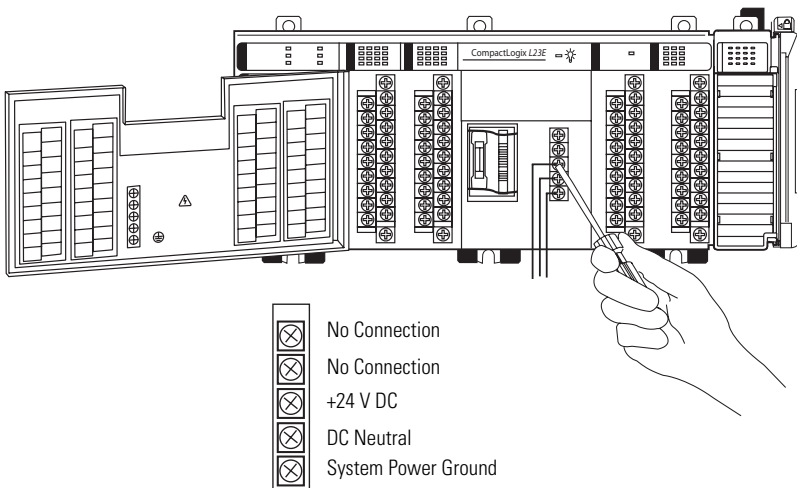
For more information about replacing the fuse, see the Fuse Replacement Procedure in the Compact Expansion Power Supplies installation instructions, publication [1769-IN028](#).

### IMPORTANT

To comply with the CE Low Voltage Directive (LVD), this equipment and all connected I/O must be powered from a source compliant with one of the following:

- Safety Extra Low Voltage (SELV).
- Protected Extra Low Voltage (PELV).

### Power Wiring Diagram



### Power Wire Size and Terminal Screw Torque

Wire Type	Wire Size	Terminal Screw Torque
Solid or stranded	Cu: 75 °C (167 °F) 0.25... 2.5 mm <sup>2</sup> (22...14 AWG)	1.27 Nm (11.24 in•lb)

## Wire the I/O Removable Terminal Blocks

### 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.
- If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations.

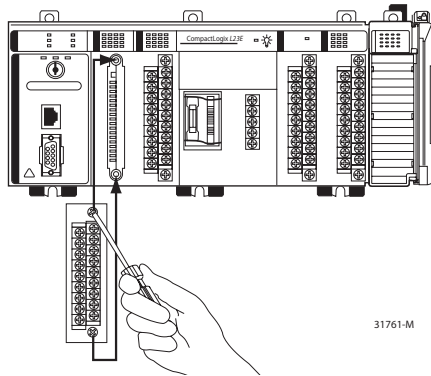
Be sure that power is removed or the area is nonhazardous before proceeding.

### ATTENTION



- Mis-wiring the removable terminal blocks to an AC power source causes damage to the packaged controller.
- Be careful when stripping wires. Wire fragments that fall into an removable terminal block could cause damage at power up. Once wiring is complete, ensure the removable terminal blocks are free of all metal fragments.
- When wiring I/O removable terminal blocks, tighten terminal screws with care. Excessive tightening can strip a screw.

To begin wiring your embedded I/O removable terminal blocks, loosen the screws at the top and bottom of the removable terminal block and remove the removable terminal block from the packaged controller.



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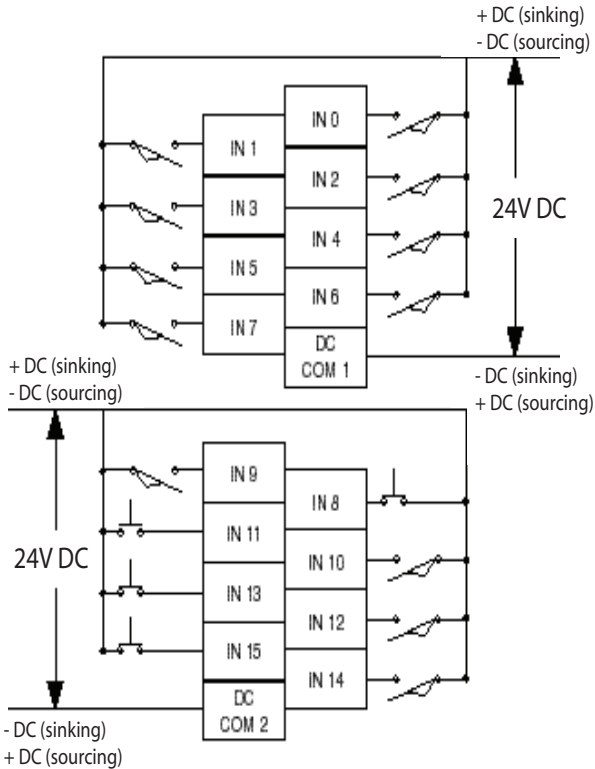
### I/O Removable Terminal Block Wire Size and Screw Torques

Wire Type	Wire Size	Terminal Screw Torque	Retaining Screw Torque
Solid or stranded	Cu: 75 °C (167 °F) 0.5... 0.8 mm <sup>2</sup> (20...18 AWG)	0.68 Nm (6 in•lb)	0.46 Nm (4.1 in•lb)

Reference the wiring diagrams specific to each type of embedded I/O as shown in the following pages.

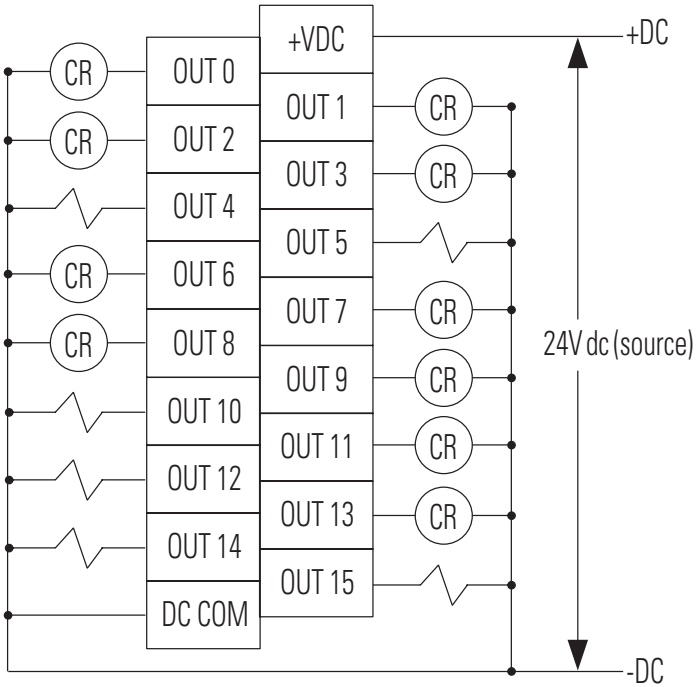


## DC Inputs Wiring Diagram<sup>(1)</sup>



<sup>(1)</sup> **Sinking/Sourcing Inputs** - Sourcing/sinking describes the current flow between the I/O and the field device. Sourcing I/O circuits supply (source) current to sinking field devices. Sinking I/O circuits are driven by a current sourcing field device. 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 circuits are the commonly used options.

**DC Outputs Wiring Diagram<sup>(1)(2)</sup>**



<sup>(1)</sup> Recommended Surge Suppression - 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, Allen-Bradley publication [1770-4.1](#).

<sup>(2)</sup> Sourcing Output - Source describes the current flow between the I/O 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 circuits are the commonly used options.

## Analog I/O Wiring Diagrams

Read and consider this information before wiring your analog I/O.

### ATTENTION



Analog outputs may fluctuate for less than a second when power is applied or removed. This characteristic is common to most analog outputs. While the majority of loads will not recognize the short signal, take preventive measures to ensure that connected equipment is not affected.

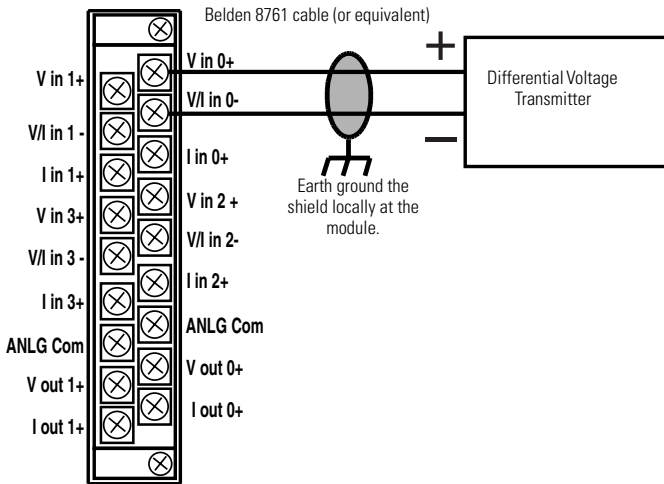
### IMPORTANT

In environments where high-frequency noise may be present, it may be necessary to directly ground cable shields to earth at the removable terminal block end and via a 0.1 $\mu$ F capacitor at the sensor end.

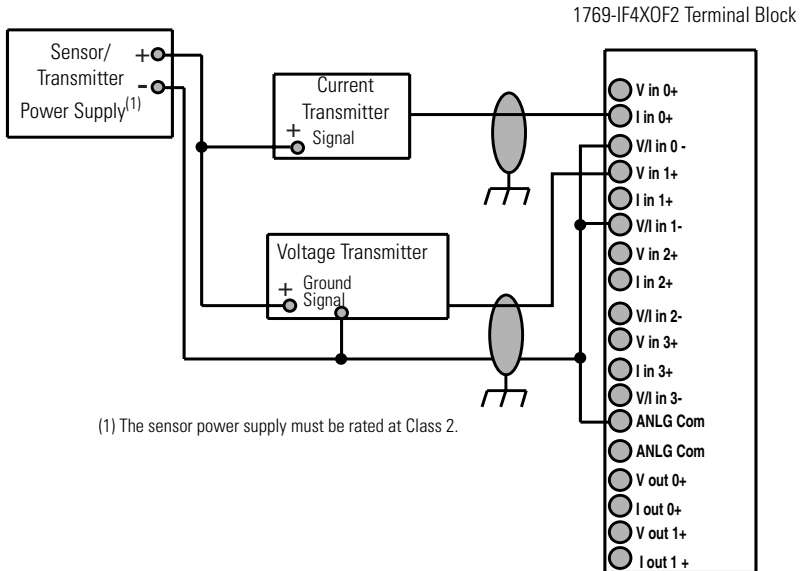
- All analog I/O commons (ANLG COM) are connected in the analog I/O card of the packaged controller. The analog common (ANLG COM) is not connected to earth ground inside the packaged controller.
- Analog I/O channels are not isolated from each other.
- Use Belden 8761 (or equivalent) shielded wire.
- Under normal conditions, the drain wire and shield junction must be connected to earth ground via a panel or DIN rail mounting screw at the analog I/O removable terminal block end. Keep the shield connection to ground as short as possible.
- To ensure optimum accuracy, limit overall cable impedance by keeping your cable as short as possible. Plan to place the packaged controller as close to your sensors or actuators as your application permits.<sup>(1)</sup>
- If multiple power supplies are used with analog inputs:
  - the power supply commons must be connected.
  - do not exceed the specified isolation voltage.
- The embedded analog I/O does not provide loop power for analog inputs. Use a power supply that matches the input transmitter specifications.
- Differential analog inputs are more immune to noise than single-ended analog inputs.
- Voltage outputs (Vout 0+ and Vout 1+) of the analog I/O are referenced to ANLG COM. Load resistance for a voltage output channel must be equal to or greater than 1 K $\Omega$ .
- Current outputs (Iout 0+ and Iout 1+) of the analog I/O source current that returns to ANLG COM. Load resistance for a current output channel must remain between 0...300  $\Omega$ .
- Voltages on Vin+, V/Iin-, and Iin+ of the analog I/O must be within 0 to +10V DC of analog common.

<sup>(1)</sup> Cable length over 50 m (164.04 ft) may impact accuracy. For details, refer to the Compact Combination Analog I/O Module, publication [1769-UM008](#).

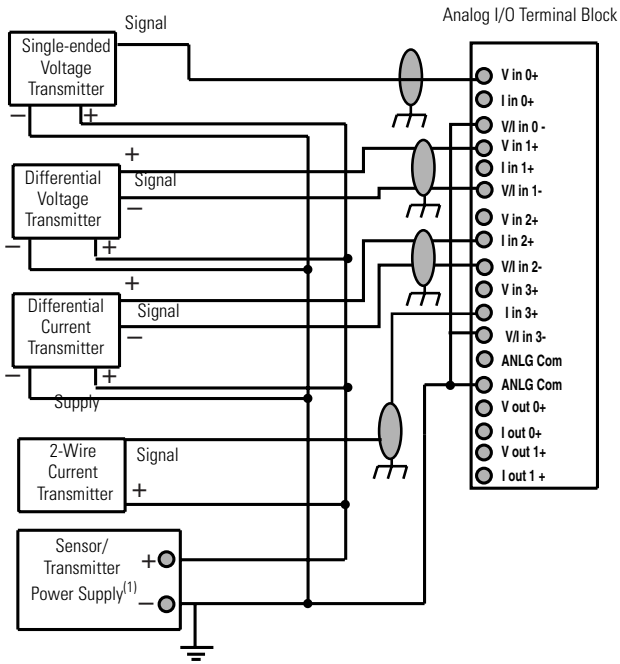
### Differential Input Wiring Diagram



### Single-ended Sensor/Transmitter Types Wiring Diagram

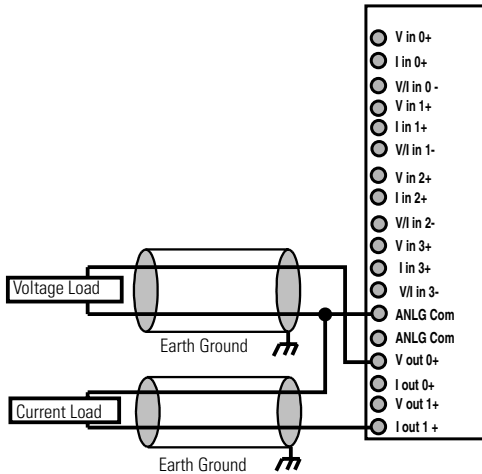


### Mixed-input Transmitter Wiring Diagram



(1) The sensor power supply must be rated at Class 2.

### Analog Outputs Wiring Diagram



## High-speed Counter Wiring Diagrams

Read and consider this information before wiring your high-speed counter.

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### ATTENTION



Disconnect power before wiring the HSC removable terminal block. This includes sensor and packaged controller power.

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- Input and output channels are isolated from the packaged controller. 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).
  - 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, ensure that they cross at right angles.
  - Make sure the system is properly grounded using these guidelines:
    - This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the packaged controller's mounting tabs or DIN rail (if used) are only required when the mounting surface is non-conductive and cannot be grounded.
    - Keep the shield connection to ground as short as possible.
    - Ground the shield drain wire only at the HSC input end, except where high-frequency noise is present.
- 

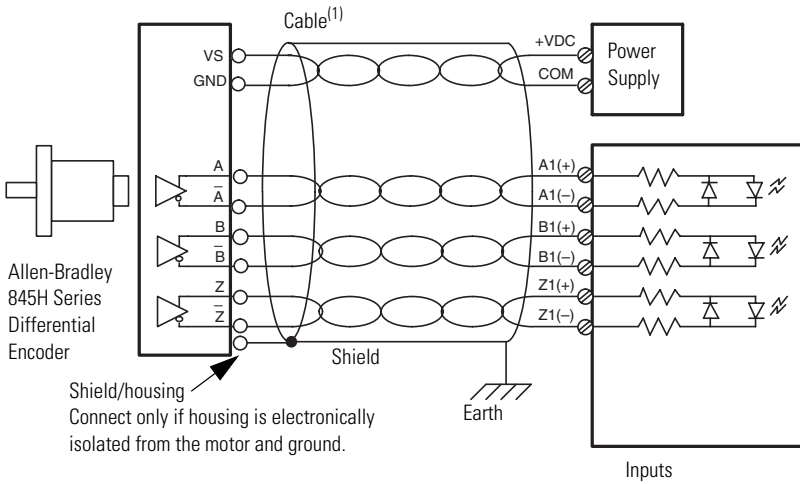
### IMPORTANT

In environments where high-frequency noise may be present, it may be necessary to directly ground cable shields to earth at the removable terminal block end and via a 0.1  $\mu$ F capacitor at the sensor end.

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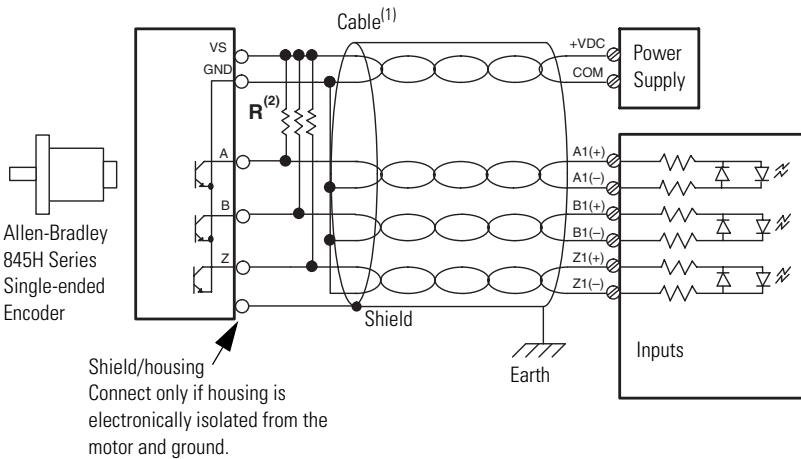
- To establish optimum accuracy, limit overall cable impedance by keeping cable as short as possible. Locate the packaged controller as close to input devices as your application permits.

## HSC 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.).

### HSC Single-ended Encoder Wiring Diagram



- (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 below shows the maximum resistor values for typical supply voltages. To calculate the maximum resistor value, use this formula:

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

Where:

- R = maximum pull-up resistor value
- VDC = power supply voltage
- Vmin = 2.6V DC
- Imin = 6.8 mA

Power Supply Voltage (V DC)	Maximum Pull-up Resistor Value (R) <sup>(1)</sup>
5V DC	352 Ω
12V DC	1382 Ω
24V DC	3147 Ω

<sup>(1)</sup> 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 for more information.





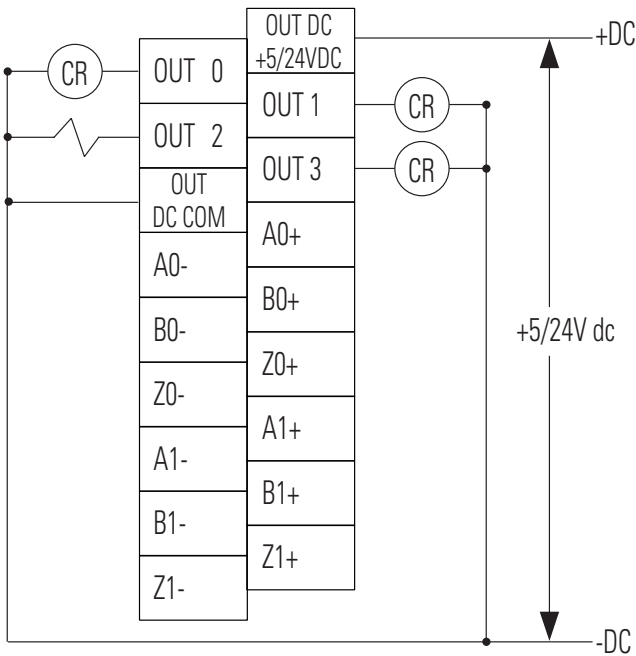
## HSC Output Wiring

Basic wiring<sup>(1)</sup> of HSC outputs<sup>(2)</sup> is shown below.

**ATTENTION**



Mis-wiring the embedded HSC to an AC power source or applying reverse polarity causes damage to the embedded HSC.



<sup>(1)</sup> Recommended Surge Suppression - The embedded HSC 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, Allen-Bradley publication [1770-4.1](#).

<sup>(2)</sup> Sourcing Output - Source describes the current flow between the I/O 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 circuits are the commonly used options.

## Expansion Module Wiring

Use the wiring diagrams specific to your expansion module.

Module wiring diagrams are available at <http://literature.rockwellautomation.com>.

## Connect Using the RS-232 Connection

*1769-L23E-QB1B, 1769-L23-QBFC1B, and 1769-L23E-QBFC1B controllers*

---

**WARNING**

If you connect or disconnect the serial cable with power applied to this module or the serial device on the other end of the cable, 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.

---

To connect to your controller using the RS-232 (serial) connection, simply connect the 9-pin female end of the serial cable to the serial port of the controller.

## Connect Using the Ethernet Connection

1769-L23E-QB1B and 1769-L23E-QBFC1B controllers

Complete these steps to connect to the controller using the Ethernet connection.

### WARNING



If you connect or disconnect the Ethernet cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.

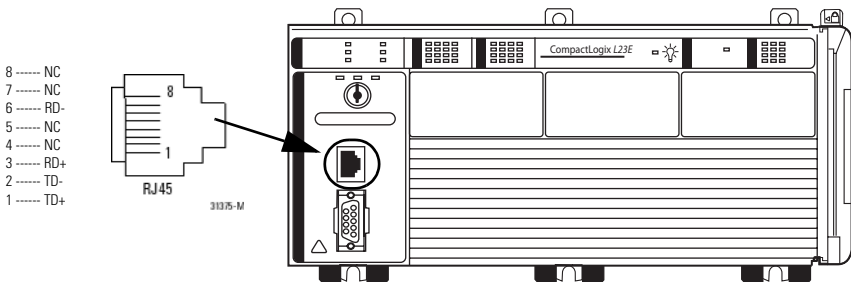
Be sure that power is removed or the area is nonhazardous before proceeding.

### ATTENTION



Do not plug a DH-485 network cable or a NAP port cable into the Ethernet port. Undesirable behavior and/or damage to the port may result.

1. Insert the RJ45 connector of the Ethernet cable into the Ethernet port located on the front of the controller.



2. Use the BOOTP utility or RSLogix 5000 software to assign an IP address to the controller.

The controller ships with BOOTP functionality enabled. This means that no extra steps must be taken to make the controller work with a BOOTP utility.

For more information about setting the controller's IP address (a network parameter), see the EtherNet/IP Modules in Logix5000 Control Systems User Manual, publication [ENET-UM001](#).

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## Download and Install EDS Files

If you have RSLinx software, version 2.52 or later, the most current EDS files were installed with the software.

If you are using an earlier version of RSLinx software, you need to download and install EDS files specific to each component of the packaged controller. This includes firmware and icons specific to the packaged controller, its Ethernet interface, virtual backplane, virtual adapter, and embedded I/O.

EDS files are available on the RSLogix 5000 software, version 17 CD, at <http://support.rockwellautomation.com>, and at <http://www.ab.com/networks/eds>.

## Download Packaged Controller Firmware

Packaged controller firmware is available on the RSLogix 5000 software CD or you can download it from <http://support.rockwellautomation.com>.

## Use the AutoFlash Feature of RSLogix 5000 to Load Firmware

RSLogix 5000 lets you update your packaged controller firmware without having to open the ControlFlash utility. You can load firmware via an Ethernet (preferred) or serial connection.

---

**IMPORTANT**

When upgrading your packaged controller firmware, it is extremely important to allow the upgrade to complete without interruption.

If you interrupt the firmware upgrade either in the software or by disturbing the physical media, you may render the packaged controller inoperable.

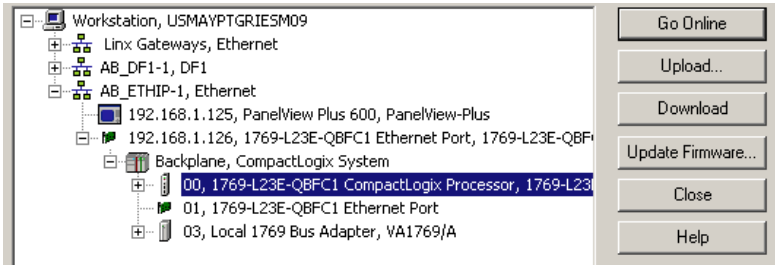
For more information about upgrading your CompactLogix packaged controller firmware, see information posted at <http://www.rockwellautomation.com/knowledgebase/>.

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1. Make sure the appropriate network connection is made and your network driver is configured in RSLinx software.
2. Use RSLogix 5000 programming software to create a packaged controller project.
3. Click RSWho to specify the controller path.

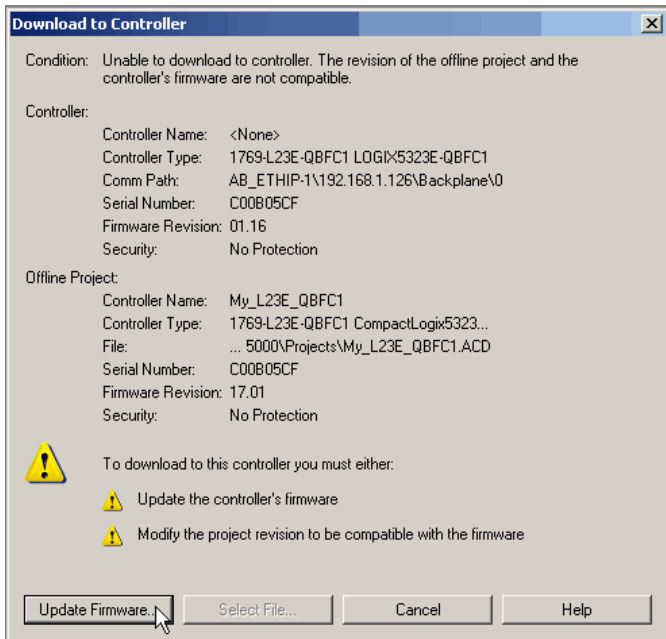


4. Select your packaged controller and click Download.



You may also choose to click Update Firmware to complete this process. If you do so, skip to step 8.

A dialog box displays indicating that the project revision and controller firmware revision are different.

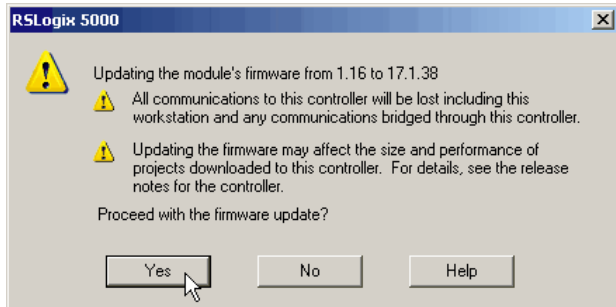


5. Click Update Firmware.

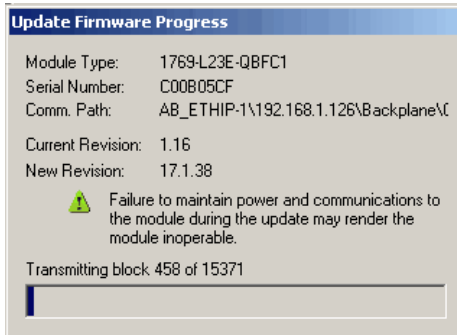
- Use the checkbox and pull-down to select your controller and firmware revision.

	Module Name	Parent Name : Module Address	Module Type	Firmware Revision	
				In Module	Update To
<input checked="" type="checkbox"/>	My_L23E_QBFC1	Local:0	1769-L23E-QBFC1 CompactLogi...	1.16	17.1.38 <input type="button" value="Browse..."/>

- Click Update.
- Click Yes.



The firmware upgrade begins.

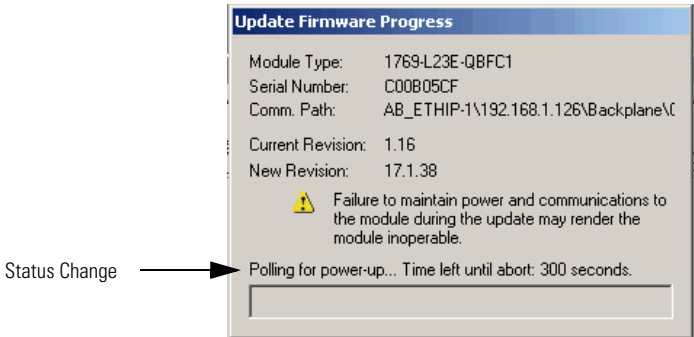


### IMPORTANT

#### DO NOT INTERRUPT THE FIRMWARE UPGRADE ONCE IT HAS BEGUN.

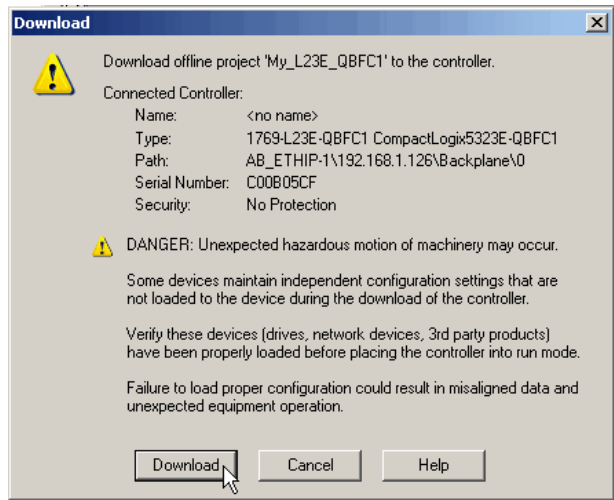
Interrupting the firmware upgrade may result in an inoperable packaged controller.

During the firmware upgrade you see the status change as shown below.



Continue to allow the firmware upgrade to complete without interruption.

When the firmware upgrade is complete, the Download dialog displays and you may continue by downloading your project to the packaged controller.





## Use the ControlFlash Utility to Load Firmware

You can use the ControlFlash utility to load firmware via an Ethernet (preferred) or serial connection.

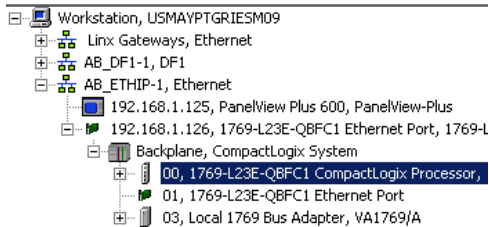
### IMPORTANT

When upgrading your packaged controller firmware, it is extremely important to allow the upgrade to complete without interruption.

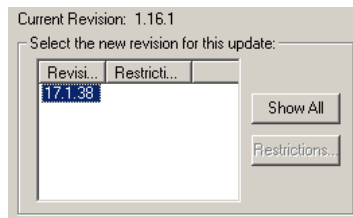
If you interrupt the upgrade either in ControlFlash software or by disturbing the physical media, you may render the packaged controller inoperable.

For more information about upgrading your CompactLogix packaged controller firmware, see information posted at <http://www.rockwellautomation.com/knowledgebase/>.

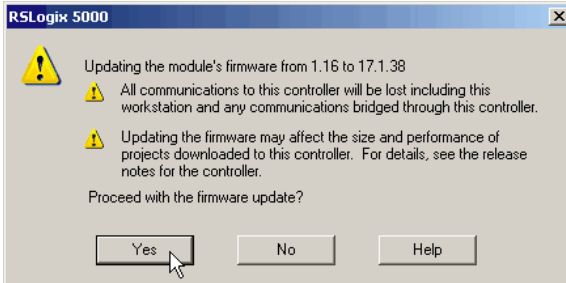
1. Make sure the appropriate network connection is made and your network driver is configured in RSLinx software.
2. Start the ControlFlash utility.
3. When the Welcome dialog appears, click Next.
4. Choose the catalog number of the packaged controller and click Next.
5. Expand the network until you see your packaged controller and select it.



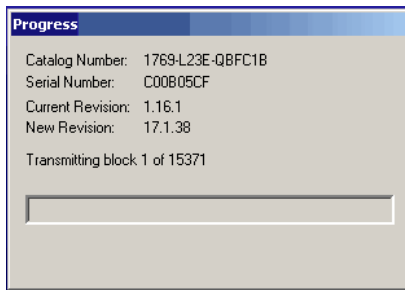
6. Click OK.
7. Choose the revision level to which you want to update the packaged controller and click Next.



8. Click Finish and then click Yes.



The firmware upgrade begins.

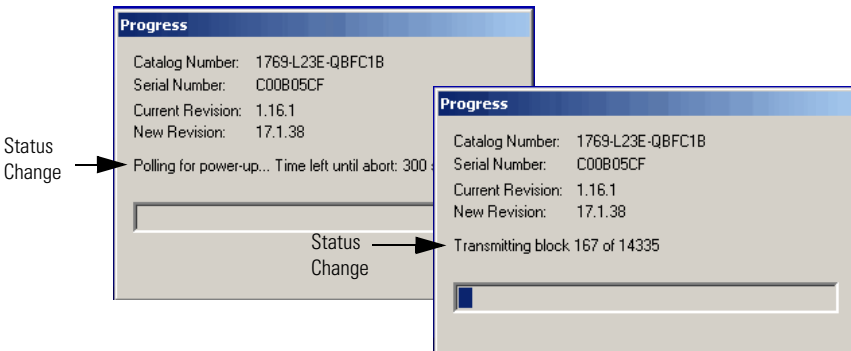


**IMPORTANT**

**DO NOT INTERRUPT THE FIRMWARE UPGRADE ONCE IT HAS BEGUN.**

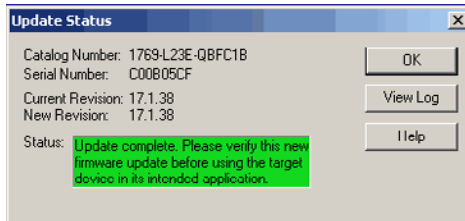
Interrupting the firmware upgrade may result in an inoperable packaged controller.

During the firmware upgrade you see the status change as shown below.



Continue to allow the firmware upgrade to complete without interruption.

The Upgrade Status dialog box indicates that the firmware upgrade has been successfully completed.



9. Click OK.
10. To close the ControlFlash utility, click Cancel and then click Yes.

## Select the Packaged Controller's Operating Mode

Use the keyswitch on the front panel of the packaged controller to select the packaged controller's operating mode.

This table explains the three modes (keyswitch positions) available on the front panel of the packaged controller.

### Operating Mode Selection

Use this operating mode	To achieve these tasks
RUN	<ul style="list-style-type: none"> <li>• Upload projects.</li> <li>• Run the program and enable outputs.</li> </ul> <p>Note: When the keyswitch is in the RUN position, you cannot change the operating mode by using the Controller Status menu in RSLogix 5000 software.</p>
PROG	<ul style="list-style-type: none"> <li>• Disable outputs.</li> <li>• Upload/download projects.</li> <li>• Create, modify, and delete tasks, programs, or routines.</li> <li>• Stop the execution (scanning) of tasks. That is, the packaged controller does not execute (or scan) tasks while the keyswitch is in the Prog position.</li> </ul> <p>Note: When the keyswitch is in the PROG position, you cannot change the operating mode by using the Controller Status menu in RSLogix 5000 software.</p>
REM	<ul style="list-style-type: none"> <li>• Upload/download projects.</li> <li>• Switch between Remote Program, Remote Test, and Remote Run modes by using the Controller Status menu in RSLogix 5000 programming software.               <ul style="list-style-type: none"> <li>– These Remote modes are can be selected using the Controller Status menu:                   <ul style="list-style-type: none"> <li><b>Remote Run</b> - In this mode, the controller executes (scans) tasks, enables outputs, and enables online edits.</li> <li><b>Remote Program</b> - In this mode, the controller: disables outputs, allows program and task edits while online, downloads projects, and inhibits execution (scanning) of tasks.</li> <li><b>Remote Test</b> - In this mode, the controller executes tasks with outputs disabled and enables online editing.</li> </ul> </li> </ul> </li> </ul>

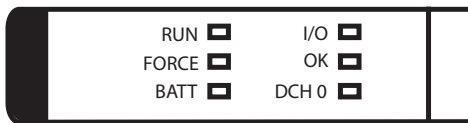
## Power Supply Status Indicator

The green power supply status indicator is located next to the lightbulb symbol and indicates these power states.

- ON = +5 and +24V DC current available from power supply
- Off = No input power, power-fail enabled, or overvoltage exceeded/protection enabled

## Packaged Controller Status Indicators

The six packaged controller status indicators are located at the top left corner of the CompactLogix packaged controller. Use this table as a reference when interpreting all six of the packaged controller status indicators.



### TIP

When power is first applied to the controller, the OK, NS, MS, and LNK status indicators display a complex sequence of varying red and green states. This sequence indicates the power-up self test and takes approximately 1...2 minutes for the packaged controller to complete.

### Controller Status Indicators

Indicator	Status	Description
RUN	Off	The packaged controller is in program or test mode.
	Steady green	The packaged controller is in run mode.
FORCE	Off	Either: <ul style="list-style-type: none"> <li>• No tags contain I/O force values.</li> <li>• I/O forces are inactive (disabled).</li> </ul>
	Steady amber	Either: <ul style="list-style-type: none"> <li>• I/O forces are active (enabled).</li> <li>• I/O force values may or may not exist.</li> </ul>
	Flashing amber	One or more input or output addresses have been forced to an On or Off condition, but the forces have not been enabled.

**Controller Status Indicators**

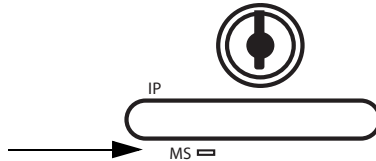
Indicator	Status	Description
BATT	Off	The battery supports memory.
	Steady red	The battery is either: <ul style="list-style-type: none"> <li>• not installed.</li> <li>• 95% discharged and should be replaced.</li> </ul>
I/O	Off	Either: <ul style="list-style-type: none"> <li>• There are no devices in the I/O configuration of the packaged controller.</li> <li>• The packaged controller does not contain a project.</li> </ul>
	Steady green	The packaged controller is communicating with all the devices in its I/O configuration.
	Flashing green	One or more devices in the I/O configuration of the packaged controller are not responding.
	Flashing red	Either: <ul style="list-style-type: none"> <li>• The packaged controller is not communicating with any devices.</li> <li>• The packaged controller is faulted.</li> </ul>
OK	Off	No power is applied.
	Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> <li>• The packaged controller requires a firmware update.</li> <li>• A major recoverable fault occurred on the packaged controller. To clear the fault, perform this procedure.</li> <li>• Turn the packaged controller keyswitch from PROG to RUN to PROG.</li> <li>• Go online with RSLogix 5000 software.</li> <li>• A nonrecoverable major fault occurred on the packaged controller. In this case, the packaged controller:                             <ol style="list-style-type: none"> <li>a. OK indicator initially displays steady red.</li> <li>b. Resets, clearing the project from memory.</li> <li>c. Sets the OK indicator to flashing red.</li> <li>d. Produces a major recoverable fault.</li> <li>e. Generates a fault code in the RSLogix 5000 project.</li> </ol> </li> </ul> <p>The fault code displayed in RSLogix 5000 software and the subsequent fault recovery method depends upon your system.</p>

**Controller Status Indicators**

<b>Indicator</b>	<b>Status</b>	<b>Description</b>
OK (con't)	Steady red	<p>Upon power-up, the OK indicator is steadily red for a few moments. This is normal behavior and is not a fault.</p> <p>If the OK indicator is steadily red for more than a few moments or changes to steadily red while in use, then a nonrecoverable major fault has occurred and project memory has been cleared.</p> <p>To recover from a major fault, cycle power to the packaged controller, re-download the project, and put the packaged controller in Run mode.</p> <p>If the OK indicator remains steadily red, contact your Rockwell Automation representative or local distributor.</p>
	Steady green	Packaged controller is OK.
	Flashing green	The packaged controller is storing or loading a project to or from nonvolatile memory.

## Module Status (MS) Indicator

The Module Status (MS) indicator is located under the space provided for you to write the IP address of the packaged controller and is one of the Ethernet/IP network status indicators.



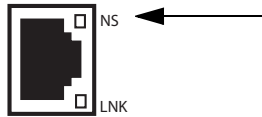
Use this table as a reference when interpreting your MS indicator.

Status	Description	Take this action
Off	The packaged controller does not have power.	Check the controller power supply.
Flashing green	The port is in standby mode; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
Steady green	The port is operating correctly.	Normal operation - no action is required.
Steady red	The packaged controller is holding the port in reset or the packaged controller has faulted.	Clear the fault. If the fault will not clear, replace the packaged controller.
	The port is performing its power-up self test.	Normal operation - no action is required.
	A nonrecoverable fault has occurred.	Cycle power to the controller. If the fault will not clear, replace the packaged controller.
Flashing red	The port firmware is being updated.	Normal operation - no action is required.



## Network Status (NS) Indicator

The Network Status (NS) indicator is located to the right of the Ethernet port and is one of the EtherNet/IP status indicators.

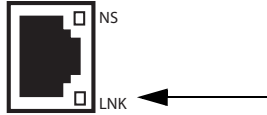


Use this table as a reference when interpreting the NS indicator.

Status	Description	Take this action
Off	The port is not initialized; it does not have an IP address and is operating in BOOTP mode.	Verify that the BOOTP server is running.
Flashing green	The port has an IP address, but no CIP connections are established.	If no connections are configured, no action is required.  If connections are configured, check connection originator for connection error code.
Steady green	The port has an IP address and CIP connections (Class 1 or Class 3) are established.	Normal operation - No action is required.
Steady red	The port has detected that the assigned IP address is already in use.	Verify that all IP addresses are unique.
Flashing red/green	The port is performing its power-up self test.	Normal operation - No action is required.

## Link Status (LNK) LED Indicator

The Link (LNK) status indicator is also located to the right of the Ethernet port, below the NS indicator. It is also an EtherNet/IP network status indicator.

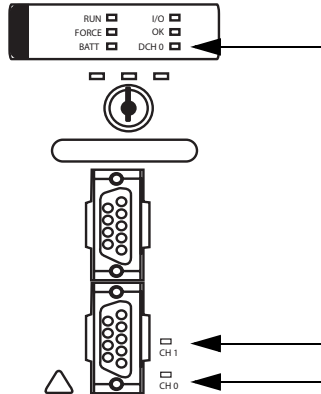


Use this table as a reference when interpreting your LNK indicator.

Status	Description	Take this action
Off	The port is not connected to a powered Ethernet device. Therefore, the port cannot communicate on Ethernet.	Verify that all Ethernet cables are connected. Verify that Ethernet switch is powered.
Flashing green	The port is performing its power-up self-test. The port is communicating on Ethernet.	Normal operation - no action is required.
Steady green	The port is connected to a powered Ethernet device. Therefore, the port can communicate on Ethernet.	

## RS-232 Serial Port Status Indicators

Two serial port status indicators (the 1769-L23-QBFC1B has three) are present on the left side of each CompactLogix packaged controller.

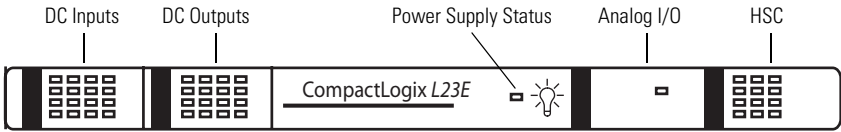


Use this table as a reference when interpreting any of the serial port status indicators.

Indicator	Status	Description
DCH0	Off	Channel 0 configuration differs from the default serial configuration.
	Steady green	Channel 0 has the default serial configuration.
CH0	Off	No RS-232 activity.
	Flashing green	RS-232 activity.
CH1 (1769-L23-QBFC1B only)	Off	No RS-232 activity.
	Flashing green	RS-232 activity.

## I/O Status Indicators

Use this section to interpret your I/O status indicators.



### Digital Inputs Status Indicators

There is one status indicator for each digital input point of the CompactLogix packaged controller. When an input is ON, the corresponding input light is on (amber).

### Digital Outputs Status Indicators

There is one status indicator for each digital output point of the CompactLogix packaged controller. When an output is ON, the corresponding output light is on (amber).

### Analog I/O Status Indicator

The analog I/O have one status indicator - the OK status indicator. If the indicator is green, the analog I/O have power, have passed internal diagnostics, and are communicating properly. If analog I/O OK indicator is off, a fault is present.

### High-speed Counter Status Indicators

The high-speed counters have 12 status indicators. Use this table to interpret the HSC status indicators.

Indicator	Status	Description
0,1,2, and 3	Amber	The corresponding output is ON.
A0, A1, B0, B1, Z0, and Z1	Amber	The corresponding input is ON (amber).
FUSE	Red	An overcurrent condition is present.
OK	Off	No power to the HSC.
	Flashing red, brief	The HSC is testing itself (this usually occurs at start-up).
	Steady green	The HSC is operating normally.
	Flashing green	The HSC is not in Run mode.
	Steady red	A fault has occurred.
	Flashing red, continuous	A HSC configuration error exists.

## Specifications

### Packaged Controller Specifications

Attribute	Value for 1769-L23E-QB1B	Value for 1769-L23E-QBFC1B	Value for 1769-L23-QBFC1B
Serial communication ports	CH0 - RS-232 RS-232 DF1, DH-485, ASCII Fully isolated 38.4 Kbps max		CH0 - RS-232 RS-232 DF1, DH-485, ASCII Fully isolated 38.4 Kbps max  CH1 - RS-232 RS-232 DF1, DH-485 Non-isolated 38.4 Kbps max
User memory	512 KB		
Number of expansion I/O modules, max	2 (also limited by current draw of expansion module) <sup>(2)</sup>		
Backplane current at 5V DC	1 A (1000 mA)	450 mA	800 mA
Backplane current at 24V DC	700 mA	500 mA	600 mA
Power dissipation	7.01 W	13.58 W	10.73 W
North American temp code	T3C		
Battery	1769-BA		
Weight, approx.	0.91 kg (2 lb)	1.22 kg (2.7 lb)	1.22 kg (2.7 lb)
Panel-mounting screw torque	1.1...1.8 Nm (10...16 in•lb) - use M4 or #8 screws		
Wire size, Ethernet connection	RJ45 connector according to IEC 60603-7, 2 or 4 pair Category 5e minimum cable according to TIA 568-B.1 or Category 5 cable according to ISO/IEC 24702		n/a
Wire size, DC power connections	0.25... 2.5 mm <sup>2</sup> (22...14 AWG) solid or stranded copper wire rated at 75 °C (167 °F) or greater, 1.2 mm (3/64 in.) insulation max		
Wire size, discrete I/O connections	0.5... 0.8 mm <sup>2</sup> (20...18 AWG) solid or stranded copper wire rated at 75 °C (167 °F) or greater, 1.2 mm (3/64 in.) insulation max		

## Packaged Controller Specifications

Attribute	Value for 1769-L23E-QB1B	Value for 1769-L23E-QBFC1B	Value for 1769-L23-QBFC1B
Wire size, embedded analog and HSC I/O connections	0.5... 0.8 mm <sup>2</sup> (20...18 AWG) solid or stranded shielded copper wire rated at 75 °C (167 °F) or greater, 1.2 mm (3/64 in.) insulation max		
Wiring category <sup>(1)</sup>	2 - on signal ports 2 - on power ports 2 - on communications ports		
Isolation voltage	30V (continuous), Basic Insulation Type  Type tested at 710V DC for 60 s; RS232 to System Backplane, ENET to System Backplane, and RS232 to ENET		30V (continuous), Basic Insulation Type  Type tested at 710V DC for 60 s; RS232 Channel 0 to System Backplane, No isolation between RS232 Channel 1 and system

<sup>(1)</sup> Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1. Also use this Conductor Category information for planning conductor routing as described in the appropriate System Level Installation Manual

<sup>(2)</sup> See the Before You Begin section on [page 4](#) for more information about calculating the current draw of expansion modules.

## Embedded DC Input Specifications

Attribute	Value
Voltage category	24V DC (sink/source <sup>(1)</sup> )
Operating voltage range	10 to 30V DC at 30 °C (86°F) 10 to 26.4V DC at 60 °C (140°F)
Number of inputs	16
Digital filter	OFF to ON: 0 s, 100 µs, 500 µs, 1 ms, 2 ms ON to OFF: 0 s, 100 µs, 500 µs, 1 ms, 2 ms
Hardware delay	OFF to ON: 100 µs (typical), 300 µs (max) ON to OFF: 250 µs (typical), 1 ms (max)
Off-State voltage, max	5V DC
Off-State current, max	1.5 mA
On-State voltage, min	10V DC
On-State current, min	2.0 mA
Inrush current, max	250 mA
Nominal impedance	3K Ω
IEC input compatibility	Type 3

## Embedded DC Input Specifications

Attribute	Value
Isolated groups	Group 1: inputs 0 to 7 Group 2: inputs 8 to 15 Isolated groups operate in either sink or source configurations.
Isolation voltage	75V (continuous), Basic Insulation Type Type tested at 1200V AC for 60 s; Inputs to System Backplane and Input Group to Input Group

(1) **Sinking/Sourcing Inputs** - Sourcing/sinking describes the current flow between the I/O and the field device. Sourcing I/O circuits supply (source) current to sinking field devices. Sinking I/O circuits are driven by a current sourcing field device. 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 circuits are the commonly used options.

## Embedded DC Output Specifications

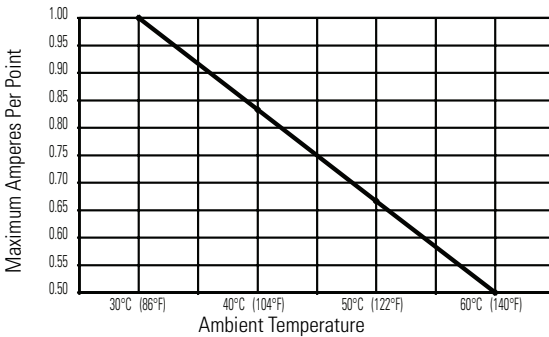
Attribute	Value
Voltage category	24V DC
Operating voltage range	20.4V DC to 26.4V DC (source <sup>(1)</sup> )
Number of outputs	16
Signal delay, max – resistive load	Turn on = 0.1 ms Turn off = 1.0 ms
Off-State leakage, max <sup>(2)</sup>	1.0 mA at 26.4V DC
On-State current, min	1.0 mA
On-State voltage drop, max	1.0V DC at 1.0 A
Continuous current per point, max	0.5A at 60 °C (140 °F) 1.0A at 30 °C (86 °F) Also see the derating graphs on page 48.
Continuous current per module, max	4.0A at 60°C (140 °F) 8.0A at 30 °C (86 °F) Also see the derating graphs on page 48.
Surge current, max <sup>(3)</sup>	2.0 A (Repeatability is once every 2 seconds for a duration of 10 ms.)
Isolated groups	Group 1: outputs 0 to 15 (internally connected to common)
Isolation voltage	75V (continuous), Basic Insulation Type Type tested at 1200V AC for 60 s; Outputs to System Backplane
Pilot duty rating	0.5 A 24V DC at 60 °C 1.0A 24V DC at 30 °C

- (1) Sourcing Output - Source describes the current flow between the I/O 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 circuits are the commonly used options.
- (2) **Typical Loading Resistor** - To limit the effects of leakage current through solid state outputs, a loading resistor can be connected in parallel with your load. Use a 5.6K ohm, ½ watt resistor for transistor outputs, 24V DC operation.
- (3) Recommended Surge Suppression - 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, Allen-Bradley publication [1770-4.1](#).

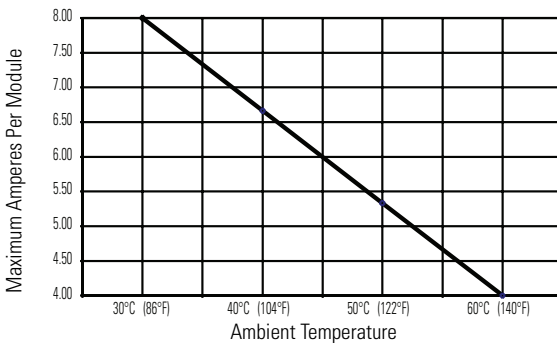
## Embedded DC Output Temperature Derating

The area within the curves represents the safe operating range for the embedded DC outputs under various conditions of user supplied voltages and ambient temperatures.

### Embedded DC Outputs Maximum Amperes Per Point versus Temperature



### Embedded DC Outputs Maximum Amperes Per Module versus Temperature





## Embedded Analog Input Specifications

Attribute	Value
Number of inputs	4 differential or single-ended
Analog normal operating ranges <sup>(1)</sup>	Voltage: 0 to 10V DC Current: 0 to 20 mA
Full Scale Analog Ranges <sup>(1)</sup>	Voltage: 0 to 10.5V DC Current: 0 to 21 mA
Converter type	Successive approximation
Resolution, max	8 bits plus sign (Sign is always positive.)
Response speed per channel	5 ms
Rated working voltage <sup>(2)</sup>	30V AC/30V DC
Common mode voltage <sup>(3)</sup>	10V DC maximum per channel
Common mode rejection	Greater than 60 dB at 60 Hz at 10V between inputs and analog common
Normal mode rejection ratio	None
Input impedance	Voltage Terminal: 150K $\Omega$ (nominal) Current Terminal: 150 $\Omega$ (nominal)
Accuracy, overall at 25°C <sup>(4)</sup>	Voltage Terminal: $\pm 0.7\%$ full scale Current Terminal: $\pm 0.6\%$ full scale
Accuracy, overall at 0 to 60°C	Voltage Terminal: $\pm 0.9\%$ full scale Current Terminal: $\pm 0.8\%$ full scale
Accuracy Drift with Temperature	Voltage Terminal: $\pm 0.006\%$ per °C Current Terminal: $\pm 0.006\%$ per °C
Calibration	Not required. Accuracy is guaranteed by components.
Non-linearity (in percent full scale)	$\pm 0.4\%$
Repeatability <sup>(5)</sup>	$\pm 0.4\%$
Input channel configuration	Via wiring of devices and the analog I/O Module Properties dialog box in RSLogix 5000 software.
Maximum overload at input terminals <sup>(6)</sup>	Voltage Terminal: 20V continuous, 0.1 mA Current Terminal: 32 mA continuous, +5V DC
Channel Diagnostics	Over-range by bit reporting
Isolation voltage	30V (continuous), Basic Insulation Type Type tested at 500V AC for 60 s; Inputs to System Backplane and Outputs to System Backplane

<sup>(1)</sup> The over-range flag will come on when the normal operating range is exceeded. The embedded HSC will continue to convert the analog input up to the maximum full scale range. The flag automatically resets when within the normal operating range.

- (2) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential (for example, 10V DC input signal and 20V DC potential above ground).
- (3) For proper operation, both the plus and minus input terminals must be within 0 to +10V DC of analog common.
- (4) Includes offset, gain, non-linearity and repeatability error terms.
- (5) Repeatability is the ability of the input embedded HSC to register the same reading in successive measurements for the same input signal.
- (6) Damage may occur to the input circuit if this value is exceeded.

### Embedded Analog Output Specifications

Attribute	Value
Number of outputs	2 single-ended
Analog normal operating ranges <sup>(1)</sup>	Voltage: 0 to 10V DC Current: 0 to 20 mA
Full-scale analog ranges <sup>(1)</sup>	Voltage: 0 to 10.5V DC Current: 0 to 21 mA
Converter type	Resistor String
Resolution, max	8 bits plus sign (Sign is always positive, Bit 15 = 0.)
Response speed per channel	0.3 ms for rated resistance and rated inductance 3.0 ms for rated capacitance
Current load on voltage output	10 mA max.
Resistive load on current output	0 to 300 $\Omega$ (includes wire resistance)
Load range on voltage output	> 1 k $\Omega$ at 10V DC
Inductive load, max (Current Outputs)	0.1 mH
Capacitive load, max (Voltage Outputs)	1 $\mu$ F
Accuracy, overall at 25°C <sup>(2)</sup>	Voltage Terminal: $\pm$ 0.5% full scale Current Terminal: $\pm$ 0.5% full scale
Accuracy overall at 0 to 60°C	Voltage Terminal: $\pm$ 0.6% full scale Current Terminal: $\pm$ 1.0% full scale
Accuracy drift with temperature	Voltage Terminal: $\pm$ 0.01% full scale per °C Current Terminal: $\pm$ 0.01% full scale per °C
Output ripple <sup>(3)</sup> range 0 to 50 kHz (referred to output range)	$\pm$ 0.05%
Non-linearity	$\pm$ 0.4% (in percent full scale)
Repeatability <sup>(4)</sup>	$\pm$ 0.05% (in percent full scale)
Output impedance	10 $\Omega$ (nominal)

## Embedded Analog Output Specifications

Attribute	Value
Open and short-circuit protection	Yes
Maximum short-circuit	Current: 40 mA
Maximum open circuit	Voltage: 15V
Output response at system power-up and power-down	+2.0V DC to -1.0V DC spike for less than 6 ms
Isolation voltage	30V (continuous), Basic Insulation Type Type tested at 500V AC for 60 s; Inputs to System Backplane and Outputs to System Backplane
Channel diagnostics	Over-range by bit reporting

(1) The over-range flag will come on when the normal operating range is exceeded. The will continue to convert the analog output up to the maximum full scale range. The flag automatically resets when within the normal operating range.

(2) Includes offset, gain, drift, non-linearity and repeatability error terms.

(3) Output ripple is the amount a fixed output varies with time, assuming a constant load and temperature.

(4) Repeatability is the ability of the output to reproduce output readings when the same value is applied to it consecutively, under the same conditions and in the same direction.

## Embedded HSC Input Specifications

Attribute	Value
Input voltage range	-30 to +30V DC <sup>(1)</sup>
On-state voltage, max	30V DC
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 (nominal)	1950 $\Omega$
Pulse width, min	2.5 $\mu$ sec
Phase separation, min	1.084 $\mu$ sec
Input frequency, max	250 kHz
Isolation voltage	75V (continuous), Basic Insulation Type Type tested at 1200V AC for 60 s; Inputs to System Backplane and Input to Input

(1) See Maximum Input Voltage - 24V DC Operation temperature derating.

## Embedded HSC Output Specifications

Attribute	Value
Output voltage range	5 to 30V DC <sup>(1)</sup>
On-state voltage, max	User Power - 0.1V DC
On-state output current, max	1A per point <sup>(2)</sup>
	4A per module <sup>(3)</sup>
On-state output current, min	1 mA
On-state voltage drop, max	0.5V DC
Off-state leakage current, max	5 $\mu$ A
Turn-on time, max	400 $\mu$ s <sup>(4)</sup>
Turn-off time, max	200 $\mu$ s
Reverse polarity protection	30V DC
Isolation voltage	75V (continuous), Basic Insulation Type
	Type tested at 1200V AC for 60 s; Inputs to System Backplane and Input to Input
Pilot duty rating	Not rated

<sup>(1)</sup> See Maximum Output Voltage - 24V DC Operation temperature derating.

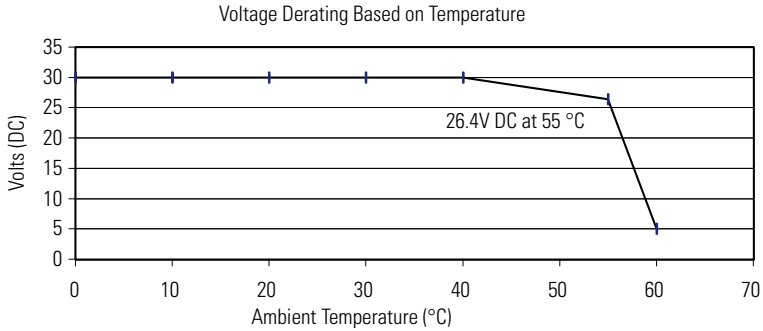
<sup>(2)</sup> See Maximum Output Current per Point - 5V DC Operation temperature derating on page 54 and Maximum Output Current per Point - 24V DC Operation temperature derating on page 55.

<sup>(3)</sup> See Maximum Output Current per Module - 5V DC Operation temperature derating on page 54 and Maximum Output Current per Module - 24V DC Operation temperature derating on page 55.

<sup>(4)</sup> Maximum turn-on time applies to output voltage range of 5 to 7V DC. For output voltages greater than 7V DC, the maximum turn-on time is 200  $\mu$ s.

## Embedded HSC Temperature Derating

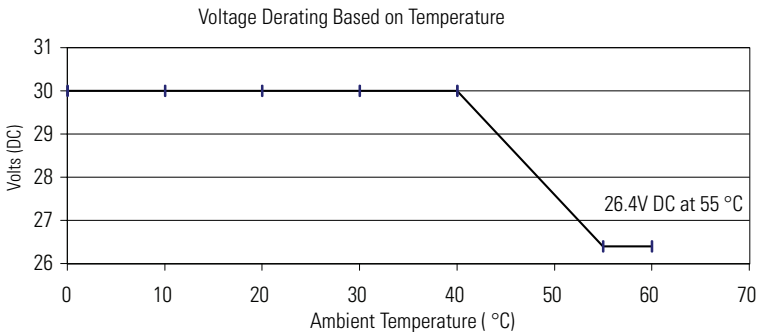
### Maximum Input Voltage - 24V DC Operation



Temperature	Derated Voltage <sup>(1)</sup>
0 °C to 40 °C (-32 °F to 104 °F)	30V DC
55 °C (131 °F)	26.4V DC
60 °C (140 °F)	5V DC

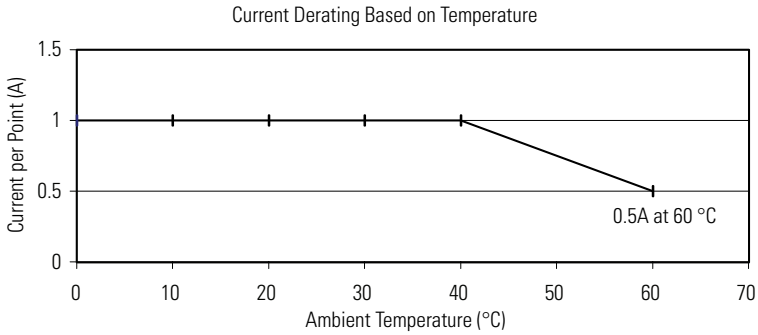
- <sup>(1)</sup> Input voltage derating between 55 °C and 60 °C is achieved by using a dropping resistor. For 24V DC input voltage, use a 2.4 k $\Omega$  ½ Watt resistor. For input voltages other than 24V DC, use a ½ Watt resistor with value:  $125 \times (V_{in} - 5V)$ .

### Maximum Output Voltage - 24V DC Operation



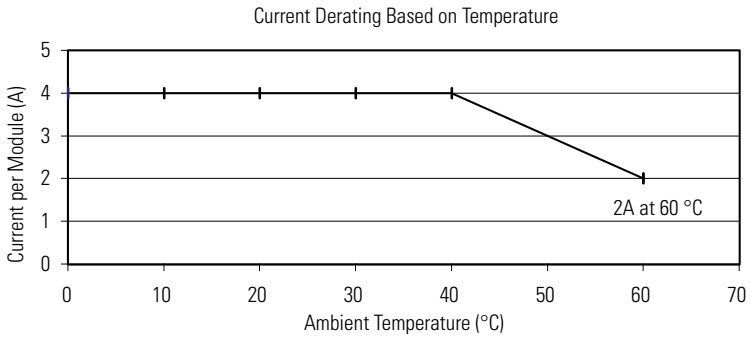
Temperature	Derated Voltage
0°C to 40°C (-32°F to 104°F)	30V DC
55°C to 60°C (131°F to 140°F)	26.4V DC

Maximum Output Current per Point - 5V DC Operation



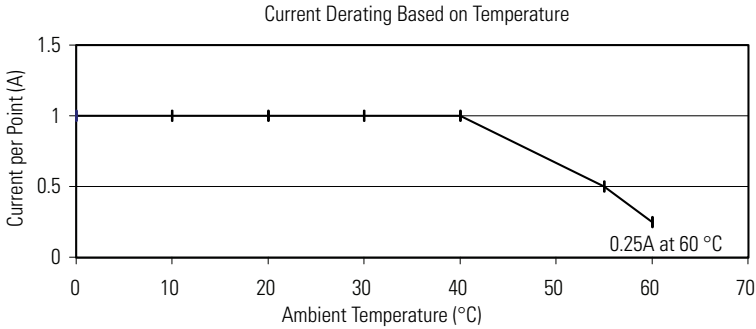
Temperature	Derated Current
0°C to 40°C (-32°F to 104°F)	1A
60°C (140°F)	0.5A

Maximum Output Current per Module - 5V DC Operation



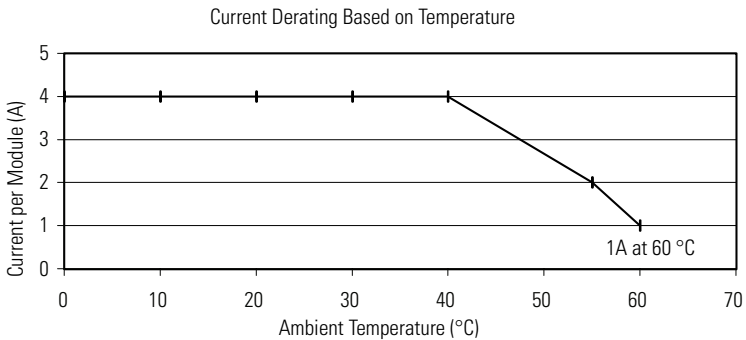
Temperature	Derated Current
0°C to 40°C (-32°F to 104°F)	4A
60°C (140°F)	2.0A

### Maximum Output Current per Point - 24V DC Operation



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

### Maximum Output Current per Module - 24V DC Operation



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

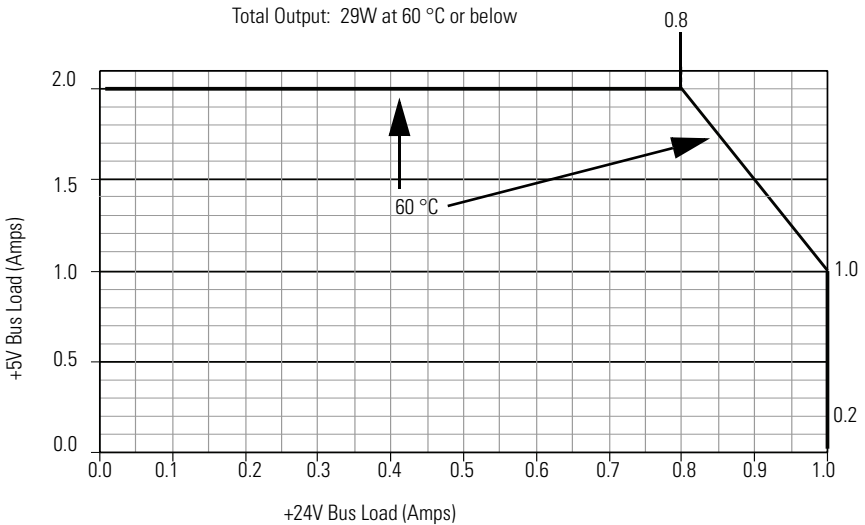
## Embedded Power Supply

Attribute	Value
Nominal supply voltage	24V DC
Voltage range	19.2 to 31.2V DC
Line requirement, max	50 VA at 24V DC
Available 5V DC bus current <sup>(1)</sup>	1769-L23E-QB1B: 1 A (1000 mA) 1769-L23E-QBFC1B: 450 mA 1769-L23-QBFC1B: 800 mA
Maximum inrush	30A at 31.2V DC
Line loss ride through	10 ms (minimum) to 10s (maximum)
Output bus current capacity (0°C to +55°C)	2A at 5V DC 0.8A at 24V DC
Output bus current capacity (55°C to +60°C)	Refer to the temperature derating graphs on page 57.
Minimum load current	0 mA at 5V DC 0 mA at 24V DC
24V DC user power capacity (0°C to +55°C)	NA
24V DC user power capacity (>+55°C to +60°C)	NA
+24V DC user voltage range	NA
Short circuit protection	Front Access Fuse (Replacement part number: Wickmann 19193-6.3A)
+5V 1769 bus overvoltage protection	Yes
+24V 1769 bus overvoltage protection	Yes
Isolation voltage	75V (continuous), Basic Insulation Type Type tested at 1200V AC for 60 s; Power to System Backplane

<sup>(1)</sup> See the Before You Begin section on [page 4](#) for more information about calculating the current draw of expansion modules.



## Embedded Power Supply Temperature Derating



## Environmental Specifications

Attribute	Value
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, non-operating	IEC 60068-2-1 (Test Ab, Unpackaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Non-operating Thermal Shock): -40...85 °C (-40...185 °F)
Relative humidity	IEC 60068-2-30 (Test Db, Unpackaged Damp Heat): 5...95% non-condensing
Vibration	IEC 60068-2-6 (Test Fc, Operating): 2 g @ 2...500 Hz
Shock, operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 30 g
Shock, non-operating	IEC 60068-2-27 (Test Ea, Unpackaged Shock): 50 g

## Environmental Specifications

Attribute	Value
Emissions	CISPR 11: Group 1, Class A (with appropriate enclosure)
ESD immunity	IEC 61000-4-2: 4 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 MHz 10V/m with 200 Hz 50% Pulse 100% AM at 1890 MHz 1V/m with 1 kHz sine-wave 80% AM from 2000...2700 MHz
EFT/B immunity	IEC 61000-4-4: $\pm 2$ kV at 5 kHz on power ports $\pm 2$ kV at 5 kHz on signal ports $\pm 2$ kV at 5 kHz on communications ports
Surge transient immunity	IEC 61000-4-5: $\pm 1$ kV line-line(DM) and $\pm 2$ kV line-earth(CM) on power ports $\pm 1$ kV line-line(DM) and $\pm 2$ kV line-earth(CM) on signal ports $\pm 2$ kV line-earth(CM) on shielded ports $\pm 2$ kV line-earth(CM) on communications ports
Conducted RF immunity	IEC 61000-4-6: 10V rms with 1 kHz sine-wave 80% AM from 150 kHz...80 MHz
Magnetic field immunity	IEC 61000-4-8: 100A/m long duration at 0, 16.7, and 50 Hz
Magnetic pulse immunity	IEC 61000-4-9: 100A/m pulse
Enclosure type rating	Meets IP20
Voltage variation	IEC 61000-4-29: 10ms interruption on DC supply ports

## Certifications<sup>(1)</sup>

Certifications <sup>(2)</sup>	Value
c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada. See UL File E65584.  UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada. See UL File E194810.
CE	European Union 89/336/EEC EMC Directive, compliant with: <ul style="list-style-type: none"> <li>• EN 61326-1; Meas./Control/Lab., Industrial Requirements</li> <li>• EN 61000-6-2; Industrial Immunity</li> <li>• EN 61000-6-4; Industrial Emissions</li> <li>• EN 61131-2; Programmable Controllers (Clause 8, Zone A &amp; B)</li> </ul>
C-Tick	Australian Radio Communications Act, compliant with:  AS/NZS CISPR 11; Industrial Emissions
EtherNet/IP	ODVA conformance tested to EtherNet/IP specifications.

<sup>(1)</sup> When product is marked.

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

## Additional Resources

These resources provide information related to the CompactLogix packaged controller.

Resource	Description
CompactLogix Packaged Controllers Quick Start and User Manual, publication <a href="#">IASIMP-QS010</a>	Provides procedures for using your CompactLogix packaged controller as well as additional reference information.
CompactLogix Packaged Controllers Release Notes, publication <a href="#">1769-RN012</a>	Provides information about packaged controller firmware - including known and corrected anomalies, restrictions, and enhancements.
CompactLogix Controllers Selection Guide, publication <a href="#">1769-SG001</a>	Provides specifications and other information related to the selection of CompactLogix controllers.
Compact I/O Selection Guide, publication <a href="#">1769-SG002</a>	Provides information about calculating the number of expansion I/O that can be used with your packaged controller.
ControlFlash Firmware Upgrade Kit, publication <a href="#">1756-QS105</a>	Provides information and procedures for upgrading your packaged controller firmware using the ControlFlash utility.

You can view or download publications at:  
<http://www.literature.rockwellautomation.com>.

# Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its 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 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	1.440.646.3434 Monday – Friday, 8 a.m. – 5 p.m. EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

## 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 in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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