



# GuardPLC™ Digital Input Module

(Catalog Numbers 1753-IB16)

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**Important User Information**

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://www.ab.com/manuals/gi>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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



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

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

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

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<p><b>WARNING</b></p> 	<p>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.</p>
<p><b>IMPORTANT</b></p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p><b>ATTENTION</b></p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:</p> <ul style="list-style-type: none"><li>• identify a hazard</li><li>• avoid a hazard</li><li>• recognize the consequence</li></ul>

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## Related Documentation

The table below provides a listing of publications that contain important information about GuardPLC systems.

For	Read this document	Publication number
Detailed information regarding the safety certification of the GuardPLC System.	<i>GuardPLC Systems Safety Reference Manual</i>	1755-RM001
Detailed information on installing, wiring, configuring, operating, maintaining, and troubleshooting GuardPLC systems.	<i>GuardPLC Systems User Manual</i>	1753-UM001
Information on installing GuardPLC 1600 controllers	<i>GuardPLC 1600 Controller Installation Instructions</i>	1753-IN001
Information on installing GuardPLC 1800 controllers	<i>GuardPLC 1800 Controller Installation Instructions</i>	1753-IN002
Information on installing GuardPLC 1753-IB20X0B8 Digital I/O Module	<i>GuardPLC Digital I/O Module Installation Instructions</i>	1753-IN003
Information on installing GuardPLC 1753-OB16 Digital Output Module	<i>GuardPLC Digital Output Module Installation Instructions</i>	1753-IN005

If you would like a manual, you can:

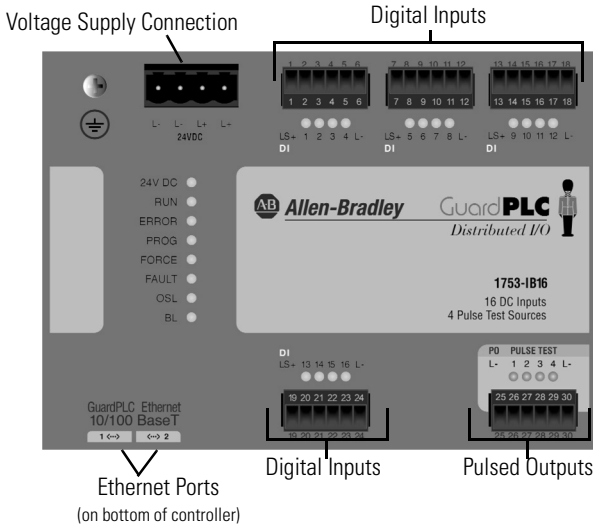
- download a free electronic version from the internet at **www.theautomationbookstore.com**
- purchase a printed manual by:
  - contacting your local distributor or Rockwell Automation representative
  - visiting **www.theautomationbookstore.com** and placing your order
  - calling 1.800.963.9548 (USA/Canada) or 001.330.725.1574 (Outside USA/Canada)

### IMPORTANT

For planning information, see the *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

## Description

The 1753-IB16 digital input module is a 16-channel input module for use with GuardPLC controllers.



## European Communities (EC) Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

### EMC Directive

This product is tested to meet the Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) by applying the following standards, in whole or in part:

- EN 50081-2 EMC — Generic Emission Standard, Part 2 — Industrial Environment
- EN 50082-2 EMC — Generic Immunity Standard, Part 2 — Industrial Environment
- EN 61131-2 — Programmable Controllers, Part 2 — Equipment Requirements and Tests
- EN 61000-6-2 EMC — Part 6-2, Generic Standards — Immunity for Industrial Environments

This product is intended for use in an industrial environment.

## Low Voltage Directive

The power supply of the GuardPLC Distributed I/O must meet Council Directive 73/23/EEC Low Voltage, by applying the requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests, as well as either of the following:

- EN 60950 - SELV (Safety Extra Low Voltage)
- EN 60204 - PELV (Protective Extra Low Voltage)

## General Safety

Open style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure.

## Preventing Electrostatic Discharge

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### ATTENTION



Electrostatic discharge can damage integrated circuits or semiconductors. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
  - Wear an approved wrist-strap grounding device.
  - If available, use a static-safe workstation.
  - When not in use, keep the GuardPLC controller in its static-shield box.
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## Mounting

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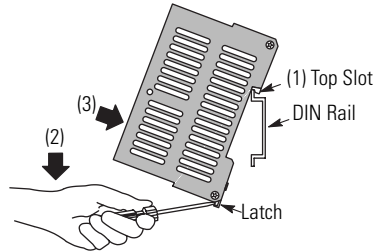
### IMPORTANT

For effective cooling:

- Mount the module horizontally.
  - Provide a gap of at least 100 mm (3.94 in.) above and below the module.
  - Select a location where air flows freely or use an additional fan.
  - Do not mount the module over a heating device.
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The GuardPLC digital input module cannot be panel-mounted. Mount the GuardPLC digital input module to a DIN rail by following the steps below.

1. Hook the top slot over the DIN rail.
2. Insert a flathead screwdriver into the gap between the housing and the latch and pull the latch downward.
3. Hold the latch down as you push the housing back onto the DIN rail.
4. Release the latch to lock the module onto the rail.



### TIP

To remove the module from the DIN rail, insert a flathead screwdriver into the gap between the housing and the latch and pull the latch downward as you lift the module off of the rail.

## IP Address Label

A transparent label shipped with the module can be used to note the IP address and system ID SRS (System-Rack-Slot).

### IMPORTANT

If you attach the label to the module, make sure you do not cover any of the ventilation slots.

## Wiring

### Grounding

You must provide an acceptable grounding path for each device in your application. For more information on proper grounding guidelines, refer to the *Industrial Automation Wiring and Grounding Guidelines*, publication number 1770-4.1.

The I/O module is grounded through its DIN rail connection and through a separate grounding screw, located on the upper left of the housing and marked with the grounding symbol  $\oplus$ . To improve EMC conditions, ground the module. Keep connection to earth ground as short as possible.

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## Connections for Safety-Related Communications

### *Ethernet Switch*

The module has two 10/100BaseT, RJ-45 connectors, located on the bottom of the unit, that provide communications to the GuardPLC controller via GuardPLC Ethernet. Because this is an Ethernet switch, you can daisy-chain connections from the GuardPLC to other distributed I/O blocks. The switch is auto-detect. Either cross-over or straight-through cabling can be used.

Star or line configurations are available. Make sure that a network loop is not generated. Data packets must only be able to reach a node via a single path.

### *MAC Address*

The Media Access Control (MAC) Address of the module can be found on the label positioned over both lower RJ-45 connections.

## Connecting the Voltage Supply

The 24V dc voltage supply must feature galvanic isolation (in accordance with EN 60950 or UL 1950) since inputs and outputs are not electrically isolated from the internal processor. It must also meet the requirements of the Safety Extra Low Voltage (SELV – EN 60950) and Protective Extra Low Voltage (PELV – EN 60204) guidelines.

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**IMPORTANT**

Protect the module with a slow-blowing 4A fuse.

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The supply voltage is connected via a 4-pin connector which accommodates wire sizes up to 2.5 mm<sup>2</sup> (14 AWG). You only need to connect one wire to L+ and one wire to L-. Both L+ and L- terminals are internally connected, so you can daisy-chain 24V dc power from the GuardPLC to other devices in the panel using the remaining terminal.

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**ATTENTION**

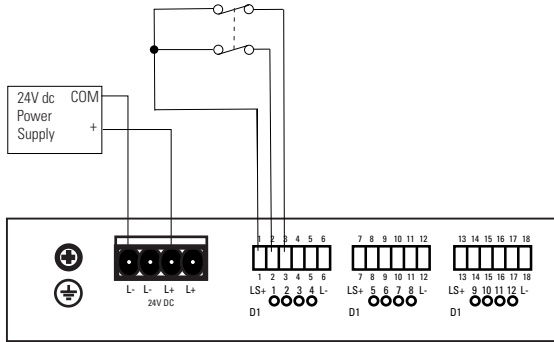
Do not reverse the L+ and L- terminals or damage to the module will result. There is no reverse polarity protection.



### Safety-Related Digital Inputs

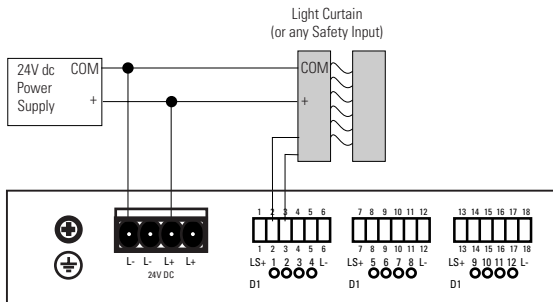
The module has 16 digital inputs (DI1 to DI16) and 4 pulsed test sources (PO1 to PO4) whose status is indicated via LEDs.

LS+ is a voltage source that provides 24V dc for a group of four dry contact inputs. There are four groups on the GuardPLC Input module



Connection of Voltage Supply to Input Device

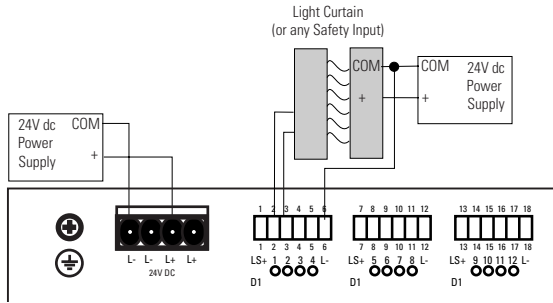
If devices require 24V dc to operate and use the same power source as the GuardPLC, then wire the outputs of the device directly to inputs on the GuardPLC.



Connection of Voltage Supply to Input Device



Devices with their own dedicated power supply can also be connected. Connect the reference pole of the external power supply to the L- reference pole of the input.

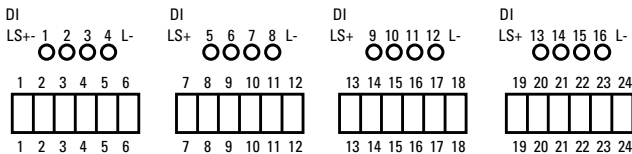


Connection of Devices with Dedicated Power Supplies

The safe state of an input is indicated by a 0-signal being passed to the user program. If the test routines detect a fault in the digital inputs, a 0-signal is processed in the user program for the defective channel. When a fault occurs, the inputs are switched off (0) and the FAULT LED is activated.

Follow the closed-circuit principle for external wiring when connecting sensors. To create a safe state in the event of a fault, the input signals revert to the de-energized state (0). Although the external line is not monitored, a wire break is interpreted as a safe (0) signal.

### Digital Input Terminals



Terminals accommodate wires up to 1.5 mm<sup>2</sup> (16 AWG). Digital inputs (DI) are connected to the following terminals:

<b>Terminal Number</b>	<b>Designation</b>	<b>Function</b>
1	LS+	Sensor supply for inputs 1 to 4
2	1	Digital input 1
3	2	Digital input 2
4	3	Digital input 3
5	4	Digital input 4
6	L-	Reference pole
7	LS+	Sensor supply for inputs 5 to 8
8	5	Digital input 5
9	6	Digital input 6
10	7	Digital input 7
11	8	Digital input 8
12	L-	Reference pole
13	LS+	Sensor supply for inputs 9 to 12
14	9	Digital input 9
15	10	Digital input 10
16	11	Digital input 11
17	12	Digital input 12
18	L-	Reference pole
19	LS+	Sensor supply for inputs 13 to 16
20	13	Digital input 13
21	14	Digital input 14
22	15	Digital input 15
23	16	Digital input 16
24	L-	Reference pole

LS+, not L+, should be used for short-circuit protection. Each LS+ features individual short-circuit and EMC protection that make it important to use LS+ for only its four related inputs.

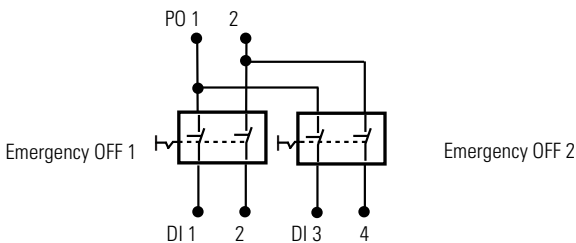
## Line Control

Line control is a short-circuit and line break monitoring system (i.e., E-Stop inputs) that are configured for the 1753-IB16 system.

For Line Control, the device has four digital pulse test sources (PO) connected to the following terminals:

Terminal Number	Designation	Function
25	L-	Reference pole
26	1	Pulsed source 1
27	2	Pulsed source 2
28	3	Pulsed source 3
29	4	Pulsed source 4
30	L-	Reference pole

The example below shows 2 pulse test sources connected to the digital inputs (DI) of the same system. As a result, the connections to the digital inputs (DI) are monitored.



When the following occurs, the Fault LED is on.

- short-circuit between two parallel connections
- reversal of two connections
- earth fault on one of the lines (only with earthed reference pole)
- line break or opening of the contacts (i.e., when one of the E-stop off switches is pressed in the example above), the Fault LED is on and the fault code is generated.

### IMPORTANT

For information on how to configure inputs and pulse test sources for line control, see the *GuardPLC™ System User Manual*, publication number 1753-UM001.

## Reset Pushbutton

You can use the reset button if you forget the password for connecting the programming software. The pushbutton is accessible through a small round hole at the top of the housing, approximately 4 to 5 cm (1.6 to 2.0 in.) from the left rim and recessed approximately 9.5 mm (0.375 in.).

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### **IMPORTANT**

Activate the reset pushbutton using an insulated pin to prevent short-circuits.

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To reset, press and hold the pushbutton for 20 seconds while rebooting the device by cycling power. Pressing the Reset pushbutton during operation has no affect.

With activation of the reset button:





- all accounts are deleted except for the default account
- IP address and system ID (SRS) are set to default values

## Troubleshooting with LED Indicators

Indicator	State	Condition
24V dc	On	24V dc operating voltage present.
	Off	No operating voltage.
RUN	On	This is the normal status of the controller. A routine, which has been loaded into the controller, is executed. The controller processes input and output signals, carries out communication and performs hardware and software tests.
	Flashing	The controller is in STOP mode and is not executing a routine. All system outputs are reset. STOP mode can be triggered by setting the <i>Emergency stop</i> system variable to TRUE in the routine, or by direct command from the programming software.
	Off	The controller is in ERROR_STOP (see ERROR).
ERROR	On	<ul style="list-style-type: none"> <li>A hardware error has been detected by the controller. The controller goes to ERROR_STOP and the execution of the routine is halted. Hardware errors are errors in the controller, errors in one or more of the digital input and output modules, or errors in the counters.</li> <li>A software error in the operating system has been detected by the controller.</li> <li>The watchdog has reported an error due to exceeded cycle time.</li> </ul> All system outputs will be reset and the controller ceases all hardware and software tests. The controller can only be restarted by a command from the programming software.
	Off	No errors are detected.
PROGRESS	On	The upload of a new controller configuration is in progress.
	Flashing	The upload of a new operating system into the Flash ROM is in progress.
	Off	No upload of controller configuration or operating system in progress.
FORCE	On	The controller is executing a routine (RUN) and FORCE mode is activated by the user.
	Flashing	The controller is in STOP, but Forcing has been initiated and will be activated when the controller is started.
	Off	Forcing is OFF.
FAULT	On	<ul style="list-style-type: none"> <li>The routine (logic) has caused an error.</li> <li>The controller configuration is faulty.</li> <li>The upload of a new operating system was not successful and the operating system is corrupted.</li> </ul>
	Flashing	An error has occurred during a Flash ROM write cycle. One or more I/O errors have occurred.
	Off	None of the above errors has occurred.
OSL	Flashing	Emergency Operating System Loader is active.
BL	Flashing	Boot Loader unable to load operating system or unable to start COMM operating system loader.

Controller status can be interrogated through the programming software. For more information, refer to the *GuardPLC™ System User Manual* (1753-UM001).

## Specifications

<b>General</b>	
Interfaces: GuardPLC Ethernet	2 x RJ-45, 10/100BaseT (with 100 Mbit/s) with integrated switch
Operating Voltage	24V dc, -15% to +20%, $w_{ss}$ 15% from a power supply with protective separation, conforming to IEC 61131-2 requirements
Response Time	≥ 10 ms
Battery Backup	none
Current Consumption	max. 0.8A (with max. load), 0.4A idle current
<b>Digital Inputs</b>	
No. of Inputs	16 (not electrically isolated)
1 Signal	Voltage: 15V to 30V dc, Current Consumption: ≥ 2 mA @ 15V
0 Signal	Voltage: max. 5V dc, Current Consumption: max 1.5 mA (1 mA @ 5V)
Switching Point	typically 7.5V
Switching Time	typically 250 micro seconds
Sensor Supply	4 x 19.2V / 40 mA @ 24V short-circuit proof
<b>Pulse Test Sources</b>	
Number of Pulse Test Sources	4 (not electrically isolated)
Output Voltage Range	approximately 24V
Output Current	60 mA
Minimum Current Load	none
Response to Overload	4 x ≥ 19.2V, short circuit current 60 mA @ 24V
<b>Environmental Conditions</b>	
Storage Temperature	-40° C to +85° C (-40° F to +185° F) without backup battery
Operating Temperature	0° C to +60° C (+32° F to +140° F)
<b>Mechanical Dimensions</b>	
Width	152 mm (5.99 in.) including housing screws
Height	114 mm (4.49 in.) including latch
Depth	66 mm (2.60 in.) including grounding bolt
Weight	0.7 kg (1.54 lb)
<b>Agency Certifications</b> (when product is marked)	 C-UL Listed Industrial Control Equipment  Marked for all applicable directives  Marked for all applicable acts  Functional Safety 1002D (AK 1 to 6, SIL 1 to 3, according to DIN V 19250 and IEC 61508 respectively) Category 1 to 4, according to EN954-1



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**Corporate Headquarters**

Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

**Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions**

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

Europe: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36-BP 3A/B, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

**Headquarters for Dodge and Reliance Electric Products**

Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4900, Fax: (1) 864.281.2433

Europe: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741

Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 351 6723, Fax: (65) 355 1733

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