



SLC 500 8-Point Analog Output Module

(Catalog Numbers 1746-NO8I and 1746-NO8V)

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Important User Information



Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

Any illustrations, charts, sample programs, and layout examples shown in this publication are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

<p>WARNING</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>ATTENTION</p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.</p>
<p>IMPORTANT</p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>

For More Information

Related Publications

Table 1 List of Related Publications for 1746-NO8I and 1746-NO8V Modules

For	Refer to this Document	Pub. No.
A more detailed description on how to install and use your 1746-NO8 module.	SLC 500 8-Point Analog Output Module User Manual	1746-UM026
A more detailed description on how to install and use your modular SLC 500 system.	SLC 500 Modular Hardware Style User Manual	1747-UM011
A more detailed description on how to install and use your fixed SLC 500 system.	SLC 500 Fixed Hardware Style Installation and Operation Manual	1747-6.21
A reference manual that contains status file data, instruction set, and troubleshooting information.	SLC 500 Instruction Set Reference Manual	1747-RM001

How to Get More Information

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 001.330.725.1547 (Outside USA/Canada)

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING**EXPLOSION HAZARD**

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off.
- Do not connect or disconnect components unless power has been switched off.
- All wiring must comply with N.E.C. article 501-4(b).

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT**DANGER D'EXPLOSION**

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
 - Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée.
 - Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée.
-

Hardware Features

The module contains a removable terminal block, providing connection for 8 analog output channels, which are specifically designed to interface with analog current and voltage devices. The 1746-NO8I provides eight channels of current outputs, while the 1746-NO8V provides eight channels of voltage outputs. There are no input channels on the module.

The module is configured via the programming software. There are no DIP switches.

A jumper, J4, is used to select whether the 24V dc power is provided by the SLC backplane or an optional 24V dc external power supply.

The following illustration displays the main hardware features.

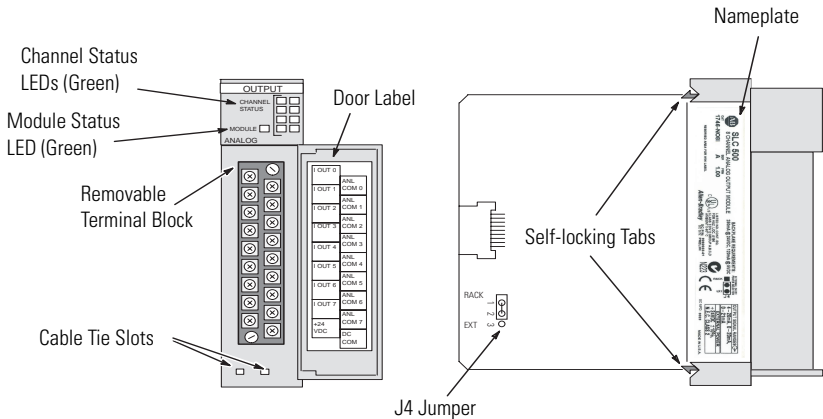


Table 2 1746-NO8 Hardware Features

Hardware Feature	Function
Channel Status LED Indicators	Displays channel operating and fault status.
Module Status LED	Displays module operating and fault status.
Side Label (Nameplate)	Provides module information.
Removable Terminal Block	Provides physical connection to input devices.
Door Label	Permits easy terminal identification.
Cable Tie Slots	Secures and routes wiring from the module.
Self-Locking Tabs	Secures module in the chassis slot.
J4 Jumper	Selects 24V dc power source.
Nameplate	Provides module information such as catalog number, backplane requirements, and output ranges.

Determining Power Requirements

The module receives its power through the SLC 500 chassis backplane from the +5V dc/+24V dc chassis power supply. The +5V dc backplane supply powers the SLC circuitry, and the +24V dc backplane supply powers the module analog circuitry. The maximum current drawn by the module is shown in the table below.

Table 3 1746-N08 Backplane Current Consumption

Specification	1746-N08I	1746-N08V
Backplane Current Consumption (maximum)	120 mA at 5V dc 250 mA at 24V dc	120 mA at 5V dc 160 mA at 24V dc
Backplane Current Consumption (maximum) when Using External 24V dc Power Supply ⁽¹⁾	120 mA at 5V dc 0 mA at 24V dc	120 mA at 5V dc 0 mA at 24V dc

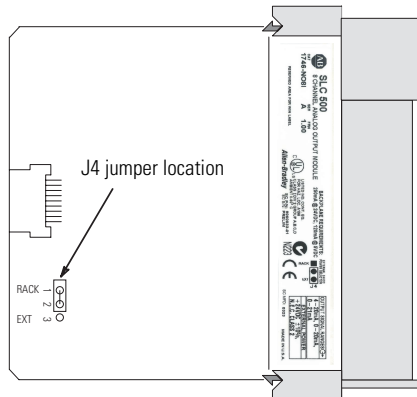
(1) The 1746-N08I and 1746-N08V output modules can use an external 24V dc power supply to reduce backplane loading. To use an external 24V dc power supply, you must set your module's jumper J4 as indicated in the following section. To comply with the U.L. regulation, the external power supply must be rated N.E.C. Class 2. Do not use the 24V dc user power terminal on the chassis power supply to power the analog output module.

NOTE: The external 24V dc power supply terminal block ground connection (DC COM) is connected to the SLC power supply ground.

Add the values shown in the table above to the requirements of all other modules in the SLC chassis to prevent overloading the chassis power supply. Refer to your controller's User Manual for power supply loading calculations and worksheets.

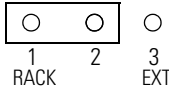
Using an External 24V dc Power Supply (optional)

The jumper, J4, is located in the bottom right corner of the module's circuit board next to the power supply.



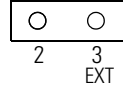
- With the jumper in the 1-2 shorted position, the module draws all of its power from the backplane of the SLC system.
- With the jumper in the 2-3 shorted position, the module draws its 24V dc power from the external power supply; however, the module still draws its 5V dc power from the backplane.

Module draws power from SLC backplane (factory setting)



The diagram shows three circular terminals labeled 1, 2, and 3. Terminals 1 and 2 are enclosed in a rectangular box, indicating they are shorted together. Terminal 3 is separate and labeled 'EXT'.

Module draws 24V dc power from external supply



The diagram shows three circular terminals labeled 1, 2, and 3. Terminals 2 and 3 are enclosed in a rectangular box, indicating they are shorted together. Terminal 1 is separate and labeled 'RACK'.

Important Notes about Using an External 24V dc Power Supply

ATTENTION



Before setting the jumper, all system power must be turned off. This includes the chassis power as well as any external 24V dc power supply.

IMPORTANT

If the module is configured to use an external 24V dc power supply, the supply must be turned on for the module to operate. If the external 24V dc power supply is turned off, the module's outputs will be turned off, and the module's processor will be reset until power is restored.

The module's LEDs will flash the 24V Power Fail blink code. See the troubleshooting section of the *SLC 500 8-Point Analog Output Modules User Manual*, publication 1746-UM026 for more information.

IMPORTANT

Do not use the 24V dc user power terminal on the chassis power supply to power the analog output module.

Installation

Install the SLC 500 system in a properly rated (i.e., NEMA) enclosure. Make sure that the SLC 500 system is properly grounded.

Choosing a Slot in the Chassis

Two factors determine where the analog module should be located in the chassis: ambient temperature and electrical noise. Consider the following conditions when selecting a slot for an analog module. Position the module:

- in a slot away from an ac or high voltage dc modules
- in the chassis closest to the bottom of the enclosure where the SLC 500 system is installed
- away from the chassis power supply if installed in a modular system

TIP

To use the advanced features of Class 3 operation, an SLC 5/02 or higher processor must be used, and the module must be located in the local chassis or in a remote ControlNet chassis with a 1747-ACN(R)15 adapter.

If the module is located in remote I/O chassis with a 1747-ASB adapter, it will operate in Class 1 mode, and you must use block transfer for configuration and data retrieval.

TIP

Remember that, in a modular system, a processor or adapter always occupies the first slot of the chassis.

Prevent Electrostatic Discharge

ATTENTION



Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
 - Wear an approved wrist-strap grounding device.
 - Do not touch the bus connector or connector pins.
 - Do not touch circuit components inside the module.
 - If available, use a static-safe work station.
 - When not in use, keep the module in its static-shield box.
-

Remove Power

ATTENTION



Remove power before removing or installing this module. When you remove or install a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment
- causing permanent damage to the module's circuitry

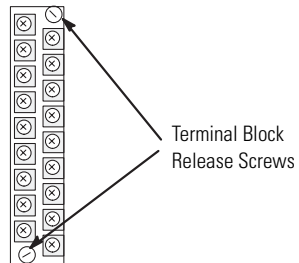
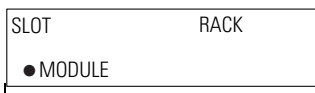
Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

Terminal Block Removal

When installing the module in a chassis, it is not necessary to remove the terminal block from the module. However, if the terminal block is removed, use the write-on label located on the side of the terminal block to identify the module location and type.

To remove the terminal block:

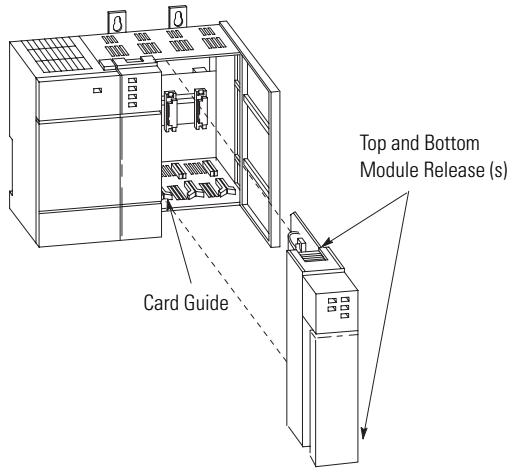
1. Loosen the two terminal block release screws.
2. Grasp the terminal block at the top and bottom and pull outward and down.



Module Installation and Removal

The module fits into any slot, except the processor slot (0), in either an SLC 500 modular system or an SLC 500 fixed system expansion chassis (1746-A2).

1. Align the circuit board of the analog module with the card guide of the chassis as shown below.
2. Slide the module in until both top and bottom retaining clips are secured.



To remove the module, depress the retaining clips at the top and bottom of the module and slide the module out of the chassis slot. Cover all unused slots with the Card Slot Filler, catalog number 1746-N2.

Wiring

Preliminary Considerations

Use the following guidelines in planning the system wiring for the analog modules:

ATTENTION

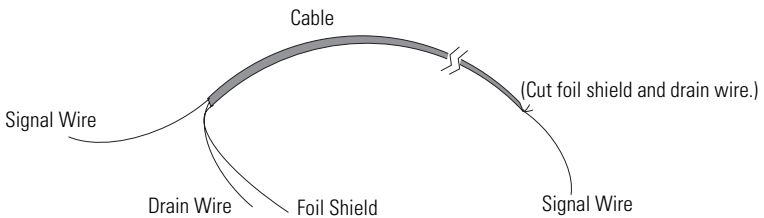
Before wiring any analog module, disconnect power from the SLC 500 system and from any other source to the analog module.

-
- Use Belden cable #8761 for wiring the analog modules making sure that the drain wire and foil shield are properly earth grounded.
 - Route the Belden cable separate from any other wiring. Additional noise immunity can be obtained by routing the cables in grounded conduit.
 - Ensure that the field wiring crosses AC or power cables at a right angle.
 - All analog common terminals (ANL COM) are electrically connected inside the module. ANL COM is *not* connected to earth ground inside the module.
 - Voltage outputs are referenced to ANL COM. Load resistance for a voltage output channel must be greater than or equal to 1K ohms.
 - Current output channels source current that returns to ANL COM. Load resistance for a current output channel must remain between 0 and 500 ohms.

Wiring Procedure

To wire your module, follow these steps:

1. Determine the length of cable you need to connect a channel to its field device. Remember to include additional cable to route the shield wire and foil shield to their ground points.
2. At each end of the cable, strip some casing to expose the individual wires.
3. Trim the exposed signal wires to 50 mm (2 in.) lengths. Strip about 5 mm (3/16 in.) of insulation away to expose the end of each wire.
4. At one end of the cable, twist the shield wire and foil shield together, bend them away from the cable, and apply shrink wrap.
5. At the other end of the cable, cut the drain wire and foil shield back to the cable and apply shrink wrap.



Twist the drain wire and the foil shield together and connect to earth ground or to the chassis mounting screws.

6. Connect the wires to the terminal block and field device as shown in Figure 4 on page 13. The recommended maximum terminal screw torque is 0.7 to 0.9 Nm (6 to 8 in-lb) for all terminal screws. Excessive tightening can strip the terminal screw.
7. Repeat steps 1 through 6 for each channel on your module.

Terminal Block

The 1746-NO8 module contains an 18-position, removable terminal block. The terminal pin-out is shown below.

ATTENTION

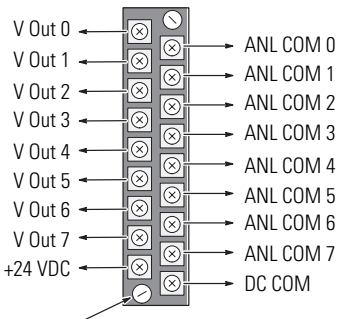


Disconnect power to the SLC before attempting to install, remove, or wire the removable terminal block.

To avoid cracking the removable terminal block, alternate the removal of the slotted terminal block release screws.

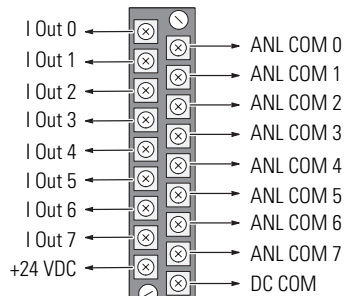
Figure 4 1746-NO8 Terminal Block Layout

1746-NO8V Analog Voltage Output Wiring



Terminal Block Release Screw
 Maximum Torque = 0.7 to 0.9 Nm (6 to 8 in.-lbs.)

1746-NO8I Analog Current Output Wiring



Terminal Block Release Screw
 Maximum Torque = 0.7 to 0.9 Nm (6 to 8 in.-lbs.)

Terminal Block Spare Part Catalog Number 1746-RT25G

IMPORTANT

Channels are not isolated from each other. All analog commons (ANL COM) are connected together internally.

Configuration

The module operates in Class 1 or Class 3 mode. This section describes how to configure the module for Class 1 operation. Class 1 provides basic data output with no user scaling. No configuration is required. This mode is compatible with the 1746-NO4 module.

TIP

Class 3 allows you to select data formats, scale limits, ramping, clamping, alarming, safe state options and alarm latching. For more information regarding these features, refer to the *SLC 500 8-Point Analog Output Modules User Manual*, publication 1746-UM026.

1. Using RSLogix 500, assign the module to a slot in the I/O Configuration.

TIP

If using Auto Configuration (allowed for SLC 5/03 and higher) to configure the chassis containing this module, the module will be in Class 1 mode.

TIP

RSLogix 500 version 6.10 (and later) includes an advanced configuration wizard to assist in configuring the 1746-NO8 module when Class 3 mode is used.

Select the module from the displayed list. If the module is not listed, select OTHER at the bottom of the list and enter the module's ID code, shown below.

Table 5 1746-NO8 Module ID Codes

Catalog Number	ID Code
1746-NO8I	Class 1 interface 3527 Class 3 interface 12727
1746-NO8V	Class 1 interface 3528 Class 3 interface 12728

2. Control each channel's signal level using Output Words 0 through 7 (addressed O:e.0 through O:e.7, where e is the slot number). The data values and corresponding signal levels are shown in the following table.

Table 6 1746-NO8 Data Format Definitions for 1746-NO4 Data Format

Selected Output Range	Data Value (counts)		Corresponding Signal	
	Min.	Max.	Min.	Max.
±10V dc	-32768	+32764	-10V dc	+10V dc
0 to 10V dc	0	+32764	0V dc	+10V dc
0 to 5V dc	0	+16384	0V dc	+5V dc
1 to 5V dc	+3277	+16384	+1V dc	+5V dc
0 to 20 mA	0	+31208	0 mA	20 mA
0 to 21 mA	0	+32764	0 mA	21 mA
4 to 20 mA	+6242	+31208	4 mA	20 mA

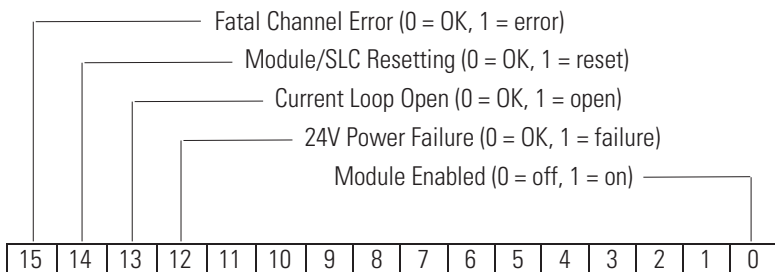
3. In Class 1 mode, the 1746-NO8 provides one status input word per channel. Consideration should be given to implementation of user program logic to monitor the status of the module. When a channel is disabled, its status word is set to 0.

Check each channel's configuration and status using Input Words 0 through 7. The Channel Status Words are addressed as follows:

1746-NO8 Status Word Addressing

- I:e.0 - Slot e, Channel 0 Status Word
- I:e.1 - Slot e, Channel 1 Status Word
- I:e.2 - Slot e, Channel 2 Status Word
- I:e.3 - Slot e, Channel 3 Status Word
- I:e.4 - Slot e, Channel 4 Status Word
- I:e.5 - Slot e, Channel 5 Status Word
- I:e.6 - Slot e, Channel 6 Status Word
- I:e.7 - Slot e, Channel 7 Status Word

In Class 1 mode, each channel status word contains the following useful status information:



Bits 1 through 11 provide additional status information when Class 3 mode is configured. For more definition of status word bit use, refer the *SLC 500 8-Point Analog Output Modules User Manual*, publication 1746-UM026.

Specifications

Table 7 General Specifications

Specification	1746-N08I	1746-N08V
I/O Chassis Location	Any 1746 chassis slot except slot 0	
Backplane Current Consumption (maximum)	120 mA at 5V dc 250 mA at 24V dc (J4 jumper set to RACK) 0 mA at 24V dc (J4 jumper set to EXT)	120 mA at 5V dc 160 mA at 24V dc (J4 jumper set to RACK) 0 mA at 24V dc (J4 jumper set to EXT)
Backplane Power Consumption (typical)	5.6W	
Optional External 24V dc Power Supply	<p>N.E.C. Class 2 required: operating voltage: +24V dc \pm10% minimum output current: 200 mA for 1746-N08V, 300 mA for 1746-N08I</p> <p>NOTE: The external 24V dc power supply terminal block ground connection (DC COM) is connected to the SLC power supply ground.</p> <p>IMPORTANT: Do not use the 24V dc user power terminal on the chassis power supply to power the analog output module.</p>	
Number Of Channels	8 single-ended	
LED Indicators	Eight green channel status indicators, one for each channel One green module status indicator	
Calibration	Factory calibrated	
Thermal Dissipation	6.6W	
Field Wiring to Backplane Isolation	500V dc	
Recommended Cable	Belden 8761 (shielded, twisted-pair) or equivalent	
Wire Size (maximum)	Two 14 to 24 AWG wire per terminal	
Grounding Wire (optional)	¼ inch wide (minimum) braid	
Terminal Block	Removable (supplied) Replacement Catalog Number 1746-RT25G	

Table 8 Analog Output Specifications

Specification	1746-N08I	1746-N08V
Number of Outputs	8	8
Output Type	Current	Voltage
Output Range	0 to 21.5 mA	$\pm 10.25V$ dc
Output Coding (proportional scaling)	0 to 32,767	-32,768 to +32,767
Output D/A Converter Resolution	16-bit 366 nA/count	16-bit 320 μV /count
Location of LSB in I/O Image Word	0000 0000 0000 0001 (for 1746-N04 compatible data format; does not apply to other data formats)	
Non-Linearity	0.06% of full scale	
DAC Conversion Method	R-2R Ladder Network	
Output Step Response Time	1 ms (0 to 95% of full scale)	
Channel Update Time (typical)	Class 1: 5 ms to update all 8 channels Class 3: 10 ms to update all 8 channels	
Load Range	0 to 500 ohm	1K ohm and greater
Load Current	n/a	10 mA (maximum)
Load Reactance	1 μH (maximum)	1 μF (maximum)
Output Impedance	Greater than 1M ohm	Less than 1.0 ohm
Over-Range Capability	7.5% (21.5mA)	2.5% ($\pm 10.25V$)
Overall Accuracy	0.1% of full scale at 25°C 0.2% of full scale at 60°C	0.1% of full scale at 25°C 0.2% of full scale at 60°C
Overall Accuracy Drift	± 33 ppm/°C of full scale (maximum)	± 33 ppm/°C of full scale (maximum)
Gain Error	0.08% of full scale at 25°C 0.15% of full scale at 60°C	0.08% of full scale at 25°C 0.15% of full scale at 60°C
Gain Error Drift	± 25 ppm/°C of full scale (maximum)	± 25 ppm/°C of full scale (maximum)
Offset Error	± 12 LSB at 25°C (typical) ± 29 LSB at 60°C (typical)	± 13 LSB at 25°C (typical) ± 32 LSB at 60°C (typical)
Offset Error Drift	± 0.48 LSB/°C (maximum)	± 0.53 LSB/°C (maximum)

Table 9 Configuration and Status Specifications

Specification	1746-NO8I	1746-NO8V
Module ID Code	Class 1: 3527 Class 3: 12727	Class 1: 3528 Class 3: 12728
Number of Output Channels	8	8
Current Output Ranges (selectable for each channel)	<ul style="list-style-type: none"> • 4 to 20 mA • 0 to 20 mA • 0 to 21 mA • 0 to 21.5 mA 	n/a
Voltage Output Ranges (selectable for each channel)	n/a	<ul style="list-style-type: none"> • -10 to +10V dc • -10.25 to +10.25V dc • 0 to 10V dc • 0 to 5V dc • 1 to 5V dc
SLC Data Formats (selectable for each channel)	<ul style="list-style-type: none"> • Scaled engineering units • Scaled for PID • Proportional counts • 1746-NO4 format • User-defined scale 	
Optional Output Data Parameters	<ul style="list-style-type: none"> • User defined scale limits • Output clamping limit • Output alarm limits • Ramp rate/limit • Preset fault value • Output behavior under fault condition (reset, hold, preset) • Alarms latch • Reset latched alarms 	
Error Reporting	<ul style="list-style-type: none"> • 24V power failure • Open current loop • Module/SLC resetting • Fatal channel error 	

Table 10 Environmental Specifications

Specification	1746-N08I	1746-N08V
Operating Temperature	0°C to +60°C (+32°F to +140°F)	
Storage Temperature	-40°C to +85°C (-40°F to +185°F)	
Operating Humidity	5 to 95% non-condensing	
Vibration	Operating: 5.0G at 10 to 500Hz, One Octave/min sweep, 10 sweeps	
Shock	Operating: 30G (3 pulses, 11 ms) Non-Operating: 50G (3 pulses, 11 ms)	
Free Fall (drop test)	Portable, 2.268 kg (5 lbs) or less at 0.762 m (30 in.) (six drops) Portable, 2.268 kg (5 lbs) or more at 0.1016 m (4 in.) (three flat drops)	
Noise Immunity	NEMA standard ICS 2-230	
Agency Certification	<ul style="list-style-type: none"> • UL/C-UL: UL Listed Industrial Control Equipment UL Listed Industrial Control Equipment for use in Canada UL Listed Industrial Control Equipment for use in Class 1, Division 2 Hazardous Locations Groups A, B, C, D • CE marked for all applicable directives • C-Tick marked for all applicable acts 	

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For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

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Outside United States	Please contact your local Rockwell Automation representative for return procedure.

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