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SLC 500 SYSTEMS

SELECTION GUIDE





BULLETIN 1746 AND 1747

ALLEN-BRADLEY • ROCKWELL SOFTWARE

Rockwell Automation

Combination I/O Modules

Specifications	1746-IO4	1746-IO8	1746-IO12	1746-IO12DC
Number of inputs	2	4	6	6
Number of outputs	2	4	6	6
Points per common	2	4	6	6
Voltage category	120V AC (inputs) 100/120V AC (relay contact outputs)			10…30V DC (inputs) 5…265V AC @ 47…63 Hz / 5…125V DC (outputs)
Operating voltage range	85…132V AC @ 47…63 Hz (inputs) 5…265V AC @ 47…63 Hz / 5…125V DC (outputs)			10…30V DC (inputs) 5…265V AC @ 47…63 Hz / 5…125V DC (outputs)
Backplane current (mA) @ 5V	30 mA	60 mA	90 mA	80 mA
Backplane current (mA) @ 24V	25 mA	45 mA	70 mA	60 mA
Continuous current per point	See Relay Contact Ratings for 1746-OW4 on page 16		See Relay Contact Ratings for 1746-OW16 on page 16	
Continuous current per module	4 A	8 A	8 A	8 A

1746-SIM Input Simulator

The 1746-SIM Input Simulator is designed for use on 16-channel 24V DC sinking and sourcing modules with removable terminal blocks, including 1746-IB16, 1746-ITB16, 1746-IV16, 1746-ITV16, and 1746-IN16 modules. The input simulator provides 16 switches for simulating inputs to the SLC 500.

1746 Analog I/O Modules

Analog I/O modules feature user-selectable voltage or current inputs, backplane isolation, removable terminal blocks, and diagnostic feedback.

The 1746-NI4, 1746-NIO4I, and 1746-NIO4V input channels are filtered to reject high frequency noise and provide 14- to 16-bit (range-dependent) resolution.

All 4-channel analog output modules provide 14-bit resolution and a 2.5 ms conversion rate.

The 1746-FIO4I and 1746-FIO4V modules have less input filtering and can sense more rapidly changing inputs. However, their input resolution is only 12-bit. Because the input filter on the 1746-FIO4I or 1746-FIO4V module may pass more electrical noise, you should thoroughly ground and shield the input transducer, its power supply, and cables.

The 1746-NI8 module provides high accuracy and fast analog signal conversion. The 1746-NI8, 1746-NI16I and 1746-NI16V modules are high density analog input modules that are software configurable.

The 1746-NO8I (current output) and 1746-NO8V (voltage output) modules are high density, analog output modules that provide 8 individually configurable output channels with 16-bit resolution.

Analog I/O Module Overview

Catalog Number	Description	Voltage Category	For specifications, see
1746-NI4	High Resolution (4) Analog Input Module	-20…+20 mA (or) -10…+10V DC	page 19: General Input Specifications page 19: Current Loop Input Specifications page 20: Voltage Input Specifications
1746-NI8	High Resolution (8) Analog Input Module	-20…+20 mA (or) -10…+10V DC	page 22: General input specifications page 22: Input step response page 23: Current loop input specifications page 23: Voltage input specifications
1746-NI16I(1)	High Resolution (16) Analog Input Module	-20…+20 mA	page 25: General input specifications page 26: Module update times
1746-NI16V(1)	High Resolution (16) Analog Input Module	-10…+10V DC	
1746-NIO4I	High Resolution (2) Analog Input, (2) Analog Current Output Module	-20…+20 mA (or) -10…+10V DC (inputs) 0…20 mA (outputs)	page 19: General Input Specifications page 19: Current Loop Input Specifications page 20: Voltage Output Specifications
1746-NIO4V	High Resolution (2) Analog Input, (2) Analog Voltage Output Module	20…+20 mA (or) -10…+10V DC (inputs) -10…+10V DC (outputs)	
1746-FIO4I	(2) Fast Analog Input, (2) Analog Current Output Module	0…20 mA (or) 0…10V DC (inputs) 0…20 mA (outputs)	page 19: General Input Specifications page 19: Current Loop Input Specifications page 20: Voltage Input Specifications
1746-FIO4V	(2) Fast Analog Input, (2) Analog Voltage Output Module	0…20 mA	page 20: Output specifications
1746-NIO4I	(4) Analog Current Output Module	-10…+10V DC	page 20: Output specifications
1746-NIO4V	(4) Analog Voltage Output Module	0…20 mA	page 20: Output specifications
1746-NO8I	(8) Analog Current Output Module	-10…+10V DC	page 24: Output specifications
1746-NO8V	(8) Analog Voltage Output Module	-10…+10V DC	page 24: Output specifications

(1) Single-ended connections only.

4-Channel Analog I/O Modules

General Input Specifications for 4-Channel Modules

Specification	1746-NI4	1746-NIO4I	1746-NIO4V	1746-FIO4I	1746-FIO4V
Backplane current (mA) @ 5V	25 mA	55 mA	55 mA	55 mA	55 mA
Backplane current (mA) @ 24V	85 mA	145 mA	115 mA	150 mA	120 mA
Number of inputs	4	2	2	2	2
Backplane isolation	500V AC and 710V DC withstand for 1 minute				
Step response	60 ms			100 µs	

General Input Specifications for 4-Channel Modules

Specification	1746-NI4	1746-NIO4I	1746-NIO4V	1746-FIO4I	1746-FIO4V
Conversion method	sigma-delta modulation			successive approximation	
Converter resolution	16 bit			12 bit	
Conversion time	N/A			7.5 μs every 512 μs (nominal)	
Module throughput delay	512 μs (nominal)			1.10 ms (maximum)(1) 512 μs (typical)	

(1) Worst-case throughput occurs when the module just misses an event.

Current Loop Input Specifications for 4-Channel Modules

Specification	1746-NI4	1746-NIO4I	1746-NIO4V	1746-FIO4I	1746-FIO4V
Full scale	20 mA	20 mA	20 mA	20 mA	20 mA
Input range	±20 mA (nominal) ±30 mA (maximum)			0…20 mA (nominal) for 0…30 mA (maximum)	
Current input coding	±16,384 for ±20mA			0…2047 counts for 0…20 mA	
Absolute maximum input voltage	±7.5V DC or 7.5V AC RMS				
Input Impedance	250 Ω (nominal)			250 Ω (nominal)	
Resolution	1.22070 μA per LSB			9.7656 μA per bit	
Overall accuracy @ 25 °C (77 °F)	±0.365% of full scale			±0.510% of full scale	
Overall accuracy, 0…60 °C (32…140 °F)	±0.642% of full scale (maximum)			±0.850% of full scale	
Overall accuracy drift	+79 ppm/°C of full scale			+98 ppm/°C of full scale (maximum)	
Gain error @ 25 °C (77 °F)	+0.323% (maximum)			+0.400% (maximum)	
Gain error, 0…60 °C (32…140 °F)	+0.556% (maximum)			+0.707% of full scale	
Gain error drift	±67 ppm/°C			±89 ppm/°C (maximum)	

Voltage Input Specifications for 4-Channel Modules

Specification	1746-NI4	1746-NIO4I	1746-NIO4V	1746-FIO4I	1746-FIO4V
Full Scale	10V DC	10V DC	10V DC	10V DC	10V DC
Input Range	±10V DC -1 LSB			0…10V DC -1 LSB	
Input Impedance	1 MΩ				
Overvoltage Protection (IN+ to -IN)	220V DC or AC RMS continuously			220V dc or ac RMS continuously	
Resolution	305.176 μV per LSB			2.4414 mV per LSB (nominal)	
Voltage input coding	-32,768…+32,767 for +10V DC			0…4095 counts for 0…10V DC	
Overall accuracy @ 25 °C (77 °F)	±0.284% of full scale			±0.440% of full scale	
Overall Accuracy, 0…60 °C (32…140 °F)	±0.504% of full scale			±0.750% of full scale	

Voltage Input Specifications for 4-Channel Modules

Specification	1746-NI4	1746-NIO4I	1746-NIO4V	1746-FIO4I	1746-FIO4V
Overall accuracy drift (maximum)	+63 ppm/°C of full scale (maximum)			+88 ppm/°C (maximum)	
Gain error @ 25 °C (77 °F)	+0.263% (maximum)			+0.323% of full scale	
Gain error, 0…60 °C (32…140 °F)	+0.461% (maximum)			+0.530% of full scale	
Gain error drift	±57 ppm/°C			±79 ppm?/°C	

Output Specifications for 4-Channel Modules

Specification	1746-FIO4I	1746-NIO4I	1746-NO4I	1746-FIO4V	1746-NIO4V	1746-NO4V
Number of outputs	2	2	4	2	2	4
Backplane current (mA) @ 5V	55 mA	55 mA	55 mA	55 mA	55 mA	55 mA
Backplane current (mA) @ 24V	150 mA	145 mA	195 mA(1)	120 mA	115 mA	145 mA
Isolation voltage	Tested @ 500V AC and 710V DC for 60 seconds					
Full scale	21 mA			10V DC		
Output range (normal)	0…20 mA -1 LSB			±10V DC -1 LSB		
Output coding	0…32,764 for 0…21 mA			-32,768…+32,764 for ±10V DC		
Output resolution (per LSB)	2.56348 μA			1.22070 mV		
Converter resolution	14-bit			14-bit		
Conversion method	R-2R ladder			R-2R ladder		
Step response	2.5 ms (5…95%)			2.5 ms (normal)		
Load range	0…500 Ω			1K…? Ω		
Load current, max	N/A			10 mA		
Overrange capability	5% (0…21 mA -1 LSB)			N/A		
Overall accuracy @ 25 °C (77 °F)	±0.298% of full scale			±0.208% of full scale		
Overall Accuracy, 0…60 °C (32…140 °F)	±0.541% of full scale			±0.384% of full scale		
Overall accuracy drift, max	±70 ppm/°C of full scale			±0.384% of full scale		
Gain error @ 25 °C (77 °F)	±298% of full scale			±208% of full scale		
Gain Error, 0…60 °C (32…140 °F)	±516% of full scale			±374% of full scale		
Gain error drift, max	±62 ppm/°C of full scale			±47 ppm/°C of full scale		

(1) The 1746-NO4I and 1746-NO4V analog output modules have connections for user-supplied 24V dc power supplies. When external 24V DC power is used, the module only draws 5V DC current from the SLC backplane. If an external 24V DC power supply is required, the tolerance must be 24V ±10% (26.6…26.4V DC). The user power supplies for SLC 500 modular systems, 1746-P1, 1746-P2, 1746-P5, and 1746-P6 power supplies do not meet this specification.

8-Channel Input Modules

General Input Specifications for 1746-NI8

Specification	1746-NI8
Backplane current (mA) @ 5V	200 mA
Backplane current (mA) @ 24V	100 mA
Backplane power consumption	3.4 W maximum (1.0 W @ 5V DC, 2.4 W @ 24V DC)
Number of inputs	8
Converter resolution	16-bit
Type of input (selectable)	±10V DC 0…5V DC 0…20 mA ±20 mA 1…5V DC 0…10V DC 4…20 mA 0…1 mA
Type of data (selectable)	Engineering Units Scaled for PID Proportional Counts (-32,768…32,767 range) Proportional Counts (User-Defined Range, Class 3 only) 1746-NI4 Data Format
A/D conversion method	Successive approximation, switched capacitor
Input filter frequencies	1 Hz 2 Hz 5 Hz 10 Hz 20 Hz 50 Hz 75 Hz
Time to detect open circuit	1 module scan
Common mode voltage range	±10.5V (15V maximum between any two input signal terminals when connected in a single-ended configuration)
Isolation voltage	Tested @ 500V AC and 710V DC for 60 s
Module update time	0.75 ms per enabled channel
Channel turn-on time, max	101…107 ms
Channel turn-off time, max	1…7 ms
Channel reconsideration time, max	101…107 ms
Calibration	Module performs continuous autocalibration

Input Step Response for 1746-NI8

Filter Frequency	Step Response for 1746-NI8		
	1% Accuracy(1)	0.1% Accuracy(1)	0.05% Accuracy(1)
1 Hz	730 ms + module update time	1100 ms + module update time	1200 ms + module update time
2 Hz	365 ms + module update time	550 ms + module update time	600 ms + module update time
5 Hz	146 ms + module update time	220 ms + module update time	240 ms + module update time

Digital Combination Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1746-IO4	30 mA	25 mA	0.270 W per input point 0.133 W per output point	0.75 W	1.60 W
1746-IO8	60 mA	45 mA	0.270 W per input point 0.133 W per output point	1.38 W	3.00 W
1746-IO12	90 mA	70 mA	0.270 W per input point 0.133 W per output point	2.13 W	4.60 W
1746-IO12DC	80 mA	60 mA	0.200 W per input point 0.133 W per output point	1.84 W	3.90 W

Analog Input Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1746-NI4	25 mA	85 mA	N/A	2.17 W	2.20 W
1746-NI8	200 mA	100 mA	N/A	3.4 W	3.4 W
1746-NI16I	125 mA	75 mA	N/A	2.43 W	2.43 W
1746-NI16V	125 mA	75 mA	N/A	3.76 W	3.8 W

Analog Output Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1746-NO4I	55 mA	195 mA	N/A	4.96 W	5.00 W
1746-NO4V	55 mA	145 mA	N/A	3.04 W	3.80 W
1746-NO8I	120 mA	250 mA(1)	N/A	3.76 W	6.6 W
1746-NO8V	120 mA	160 mA(1)	N/A	3.04 W	4.44 W

(1) With jumper set to RACK, otherwise 0.000.

Analog Combination Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1746-FIO4I	55 mA	150 mA	N/A	3.76 W	3.80 W
1746-FIO4V	55 mA	120 mA	N/A	3.04 W	3.10 W
1746-NIO4I	55 mA	145 mA	N/A	3.76 W	3.80 W
1746-NIO4V	55 mA	115 mA	N/A	3.04 W	3.10 W

Specialty Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1746-BAS-T	150 mA	40 mA(1)	N/A	3.75 W	3.80 W
1746-BLM	110 mA	85 mA	N/A	5.00 W	5.00 W
1746-BTM	110 mA	85 mA	N/A	2.59 W	2.59 W
1746-HSCE	320 mA	0 mA	N/A	1.60 W	1.60 W
1746-HSCE2	250 mA	0 mA	N/A	1.25 W	1.25 W
1746-HSRV	300 mA	0 mA	N/A	1.50 W	1.50 W
1746-HSTP1	200 mA	90 mA	N/A	1.50 W	1.50 W
1746-INT4	110 mA	85 mA	N/A	1.26 W	1.26 W
1746-NR4	50 mA	50 mA	N/A	1.50 W	1.50 W
1746-NR8	100 mA	55 mA	N/A	1.82 W	1.82 W
1746-NT4	60 mA	40 mA	N/A	0.80 W	0.80 W
1746-NT8	120 mA	70 mA	N/A	2.28 W	2.28 W
1746-QS	1000 mA	200 mA	N/A	9.80 W	9.80 W
1746-QV	250 mA	0 mA	N/A	1.075 W	1.075 W

(1) When using the 1747-BAS or 1747-KE modules to supply power to an AIC, add 0.085 A (the current loading for the AIC) to the 1747-BAS or 1747-KE module's power supply loading value at 24V DC.

Communication Modules

Catalog Number	Backplane Current (mA) @ 5V	Backplane Current (mA) @ 24V	Watts per point	Thermal dissipation, min.	Thermal dissipation, max.
1747-ACN15	900 mA	0 mA	N/A	4.50 W	4.50 W
1747-ACNR15	900 mA	0 mA	N/A	4.50 W	4.50 W
1747-ASB	375 mA	0 mA	N/A	1.875 W	1.875 W
1747-BSN	800 mA	0 mA	N/A	4.00 W	4.00 W
1747-DCM	360 mA	0 mA	N/A	1.80 W	1.80 W
1747-KE	150 mA	40 mA(1)	N/A	3.75 W	3.80 W
1747-KFC15	640 mA	0 mA	N/A	3.20 W	3.20 W
1747-SCNR	900 mA	0 mA	N/A	4.50 W	4.50 W
1747-SDN	500 mA	-- mA	N/A	2.50 W	2.50 W
1747-SN	600 mA	0 mA	N/A	4.50 W	4.50 W

(1) When using the 1747-BAS or 1747-KE modules to supply power to an AIC, add 0.085 A (the current loading for the AIC) to the 1747-BAS or 1747-KE module's power supply loading value @ 24V DC.