Overview of Analog Modules

The catalog numbers are coded as follows:

Code	Position	Description
1746-	**prefix**	bulletin number
F	**first letter**	faster-response combination analog module
N		higher-resolution 4-, 8-, and 16-channel analog modules
I	**second letter**	input
O		output
n	**number**	total number of input and/or output channels
I	**last letter**	current output (current input for 1746-NI16I)
V		voltage output (voltage input for 1746-NI16V)

For example, the 1746-FIO4I is a faster input/output module with 2 inputs (voltage and/or current selectable) and 2 current outputs.

Module Selection Tables are provided below:

Input Characteristics

1746-	FIO4I and FIO4V	NI4	NI8	NI16I and NI16V	NIO4I and NIO4V
Number of Inputs	2	4	8	16	2
Voltage Input Ranges *Select a current or voltage signal for each channel.*	0 to 10V dc - 1 LSB, includes: • 0 to 5V dc • 1 to 5V dc	±10V dc - 1 LSB, includes: • 0 to 10V dc • 0 to 5V dc • 1 to 5V dc			
Current Input Ranges *Select a current or voltage signal for each channel.*	0 to 21 mA, includes: • 0 to 20 mA • 4 to 20 mA	±20 mA, includes: • 0 to 20 mA • 4 to 20 mA • 0 to 1 mA (NI8 and NI16I only)			
Step response/channel update time	100 µs	60 ms	selectable see page 28	variable see p. 40	60 ms
Input filter at 3 dB	7k Hz	10 Hz	selectable see page 26	selectable see p. 38	10 Hz
Input A/D converter	12-bit	16-bit	16-bit	16-bit	16-bit
Input resolution (I)	9.76 µA/bit	1.22 µA/LSB	1 µA/bit	640 nA/bit	1.22 µA/LSB
Input resolution (V)	2.44 mV/LSB	305.2 µV/LSB	1 mV/bit	312 µV/bit	305.2 µV/LSB
Input coding (I)	0 to 2047	±16,384	depends on data format, see page 25		±16,384
Input coding (V)	0 to 4095	±32,768			±32,768
Input non-linearity, FS = full scale	±0.073% FS	±0.01% FS	±0.01% FS	±0.0015% FS	±0.01% FS
Common Mode Rejection at 60 Hz	50 dB	105 dB	100 dB	≥100 dB	105 dB

Output Characteristics

1746-	FIO4I	NIO4I	NO4I	FIO4V	NIO4V	NO4V
Number of Outputs	2	2	4	2	2	4
Output range	0 to 21 mA -1 LSB, includes: • 0 to 20 mA • 4 to 20 mA			±10V dc -1 LSB, includes: • 0 to 10V dc • 0 to 5V dc • 1 to 5V dc		
Output D/A converter	14-bit	14-bit	14-bit	14-bit	14-bit	14-bit
Output coding 0 to 21 mA	0 to 32,764	0 to 32,764	0 to 32,764	n/a	n/a	n/a
Output coding ±10V dc	n/a	n/a	n/a	±32,764	±32,764	±32,764

4-Channel Modules Features and Benefits

Single-Slot Module. Compact I/O structure for your control system.

User Selectable Inputs. Lets you configure each input channel for a voltage or current signal from the sensor.

High Resolution, 16-Bit Inputs and 14-Bit Outputs. Provides for precision control of analog signals.

Input Filtering. Provides higher immunity to electrical noise (1746-Nxxx modules) or a faster input response (1746-FIO4x modules).

Automatic End-of-Scan I/O Updates. No need to program special commands to access analog data, reducing programming time.

Backplane Isolation. Isolates input signals from the backplane.

Removable Terminal Blocks. Lets you replace a module quickly without removing the wiring.

Choice of Backplane Power or External Power Supply for 1746-NO4I and -NO4V Analog Output Modules. Provides flexibility to minimize the 24V dc backplane current draw from SLC power supply.

UL 508 listed, CSA 22.2 142 Approved Class I Division 2, and CE Compliant. Lets you install modules in these environments.

Unique Characteristics of 1746-FIO4I and FIO4V Modules

FIO4I and FIO4V modules respond faster because the input filter has been modified to allow for higher frequency signals. As a result, the filter may pass more electrical noise.You must take precautions to thoroughly ground and shield the input transducer, its power supply, and cables. Input characteristics of the 1746 analog modules are shown below:

Characteristic	FIO4I and FIO4V	NI4, NIO4I, NIO4V	NI8
Input Filter at 3 dB	7k Hz	10 Hz	selectable
Common-Mode Rejection at 60 Hz	50 dB	105 dB	≥100 dB

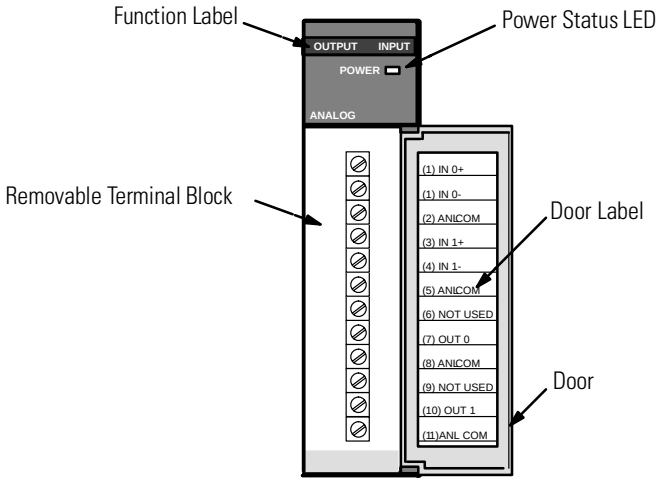
Also, the input resolution of FIO4I and FIO4V modules is considerably less (fewer counts per full scale input) compared to NI4, NI8, NIO4I, and NIO4V modules. For example:

Characteristic	FIO4I and FIO4V	NI4, NIO4I, NIO4V	NI8
0 to 20 mA inputs	0 to 2047 counts	0 to 16,384 counts	±32,768 counts
0 to 10V dc inputs	0 to 4095 counts	0 to 32,767 counts	±32,768 counts

A resolution of 0 to 2047 counts is sufficient for many applications.

4-Channel Modules Hardware Features

The module contains a removable terminal block providing connection for the analog input and/or output channels, which is specifically designed to interface with analog current and voltage input signals. The channels can be wired as either single-ended or differential inputs. There are DIP switches on the circuit board for selecting voltage or current input.



Hardware Feature	Function
Function Label	Indicates input, output, or both.
Power Status LED	Indicates when backplane power is applied to the module.
Removable Terminal Block	Provides physical connection to input devices.
Door Label	Permits easy terminal identification.
Door	Protects terminal connections and label.

4-Channel Modules Operation

4-Channel Modules Characteristics of the Input A/D Converter

The NI4, NIO4I, and NIO4V modules have different A/D converter characteristics than the FIO4I and FIO4V modules. Differences include:

- input signal ranges
- decimal representation of the analog signal (in the input image table)
- number of significant bits to store the decimal representation
- resolution of the input signal