Overview

This chapter describes the 1746-NI16 analog input module and explains how the SLC 500 processor gathers analog input data from the module. Included is information about:

- the module's hardware and diagnostic features
- an overview of system operation

General Description

The module receives and stores digitally converted analog data into its image table for retrieval by all fixed and modular SLC 500 processors. The modules, 1746-NI16V and 1746-NI16I, support connections for up to 16 voltage or current analog sensors.

The 1746-NI16 is a multi-class (Class 1 or Class 3) single-slot module. Class 1[1] configuration utilizes 8 input words and 8 output words. Class 3 configuration utilizes 32 input words and 32 output words. Fixed and SLC 5/01 processors can only operate as Class 1. When the module is used in a remote I/O chassis with a 1747-ASB, it can only operate in Class 1 mode. The SLC 5/02, SLC 5/03, SLC 5/04 and SLC 5/05 processors can be configured for either Class 1 or Class 3. When the module is used in a remote ControlNet™ chassis with a 1747-ACN(R), it can also operate in either Class 1 or Class 3 mode. Operate the module in Class 3 mode whenever possible.

The 16 high-impedance input channels can be wired as single-ended inputs. The module provides a direct interface to the following input types:

- ±10V dc
- 1 to 5V dc
- 0 to 5V dc
- 0 to 10V dc
- 0 to 20 mA
- 4 to 20 mA
- ±20 mA
- 0 to 1 mA

[1] Requires use of block transfer in a remote configuration.

The data presented to the processor can be configured as:

- Engineering Units
- Scaled-for-PID
- Proportional Counts (-32,768 to +32,767 range)
- Proportional Counts with User Defined Range (Class 3 Only)
- 1746-NI4 Data Format

Each input channel also provides open-circuit, out-of-range, and invalid configuration indication via the LED's. These conditions are also displayed in the channel status word.

Hardware Features

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).

The module contains a removable terminal block, providing connection for 16 analog input channels, which are specifically designed to interface with analog current and voltage input signals. The channels can only be wired as single-ended inputs. There are no output channels on the module. The module is configured via the user program. The following graphic displays the main hardware features.

Channel Status LEDs (Green)

Label

Module Status LED (Green)

Removable Terminal Block

Cable Tie Slots

Self-locking Tabs
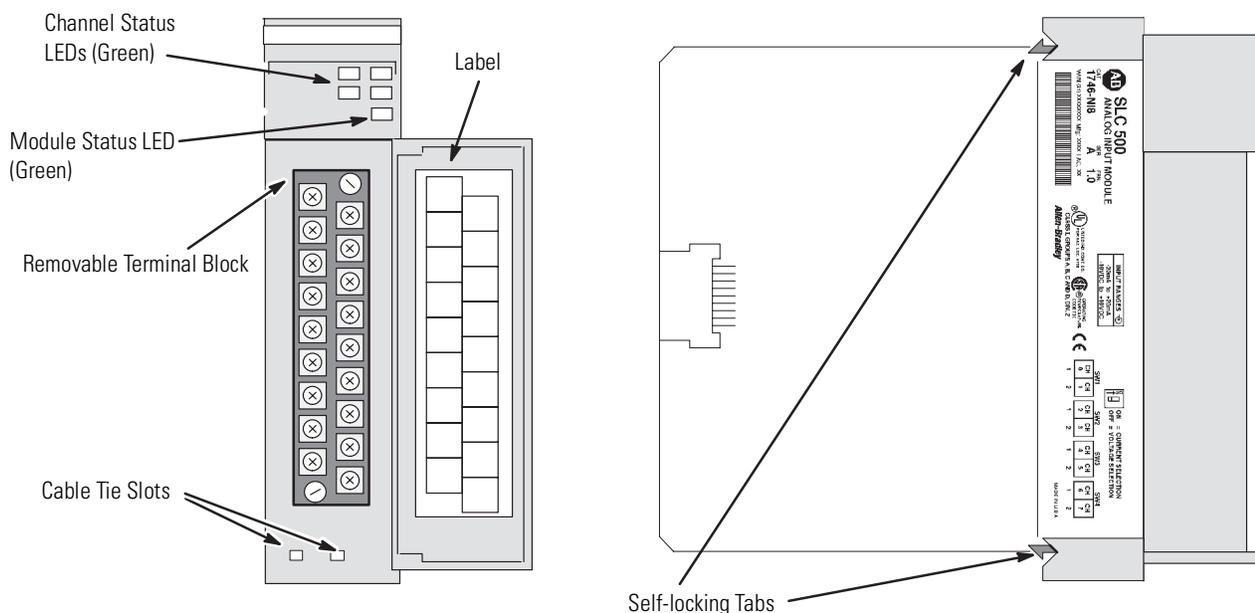
Hardware Feature	Function
Channel Status LED Indicators	Displays channel operating and fault status.
Module Status LED	Displays module operating and fault status.
Side Label (Nameplate)	Provides module information.
Removable Terminal Block	Provides physical connection to input devices.
Door Label	Permits easy terminal identification.
Cable Tie Slots	Secures and routes wiring from the module.
Self-Locking Tabs	Secures module in the chassis slot.

General Diagnostic Features

The 1746-NI16 module contains diagnostic features to help identify the source of problems that may occur during power-up or during normal channel operation. These power-up and channel diagnostics are explained in Chapter 6, *Module Diagnostics and Troubleshooting.*

The module communicates to the SLC 500 processor through the parallel backplane interface and receives power from the SLC 500 power supply through the backplane. The +5V dc backplane supply powers the SLC circuitry and the +24V dc backplane supply powers the module analog circuitry. No external power supply is required. You may install as many 1746-NI16 analog modules in a 1746 chassis as the chassis power supply can support.

System Overview

The NI16I can only receive current inputs. The NI16V can only receive voltage inputs.

System Operation

At power-up, the module performs a check of its internal circuits, memory, and basic functions. During this time, the module status LED remains off. If no faults are found during the power-up diagnostics, the module status LED is turned ON.

After power-up checks are complete, the module waits for valid channel configuration data from the SLC ladder logic program (channel status LEDs off). After configuration data is written to one or more channel configuration words and the channel enable status bits are set, the channel status LEDs are turned ON and the module continuously converts the analog input to a value within the range selected in the configuration word.

Each time a channel is read by the module, that data value is tested by the module for a fault condition (i.e., open-circuit, over-range, and under-range). If a fault condition is detected, a unique bit is set in the channel status word and the channel status LED blinks.

The SLC processor reads the converted analog data from the module at the end of the program scan or when commanded by the ladder program. If the processor and module determine that the backplane data transfer was made without error, the data is used in your ladder program. A graphic representation of this is shown below.

Data Transfer Between the Module and Processor (shown for one channel)
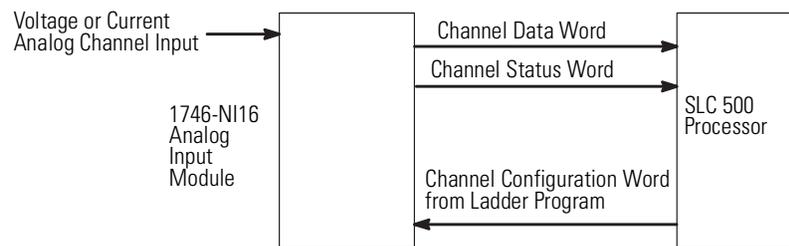
Module Operation

The 1746-NI16 module's input circuitry consists of four analog-to-digital (A/D) converters. Each of the 4 A/D converters multiplex 4 inputs for a total of 16 single-ended inputs.

The A/D converters read the selected input signal and convert it to a digital value. The multiplexer sequentially switches each input channel to the module's A/D converter. Multiplexing provides an economical means for a single A/D converter to convert multiple analog signals. However, multiplexing also affects the speed at which an input signal can change and still be detected by the converter.

Module Calibration

The 1746-NI16 module is already factory calibrated and ready for use. Although factory calibration is suitable for most applications, the module can be calibrated by the user. See Appendix D for more information on calibration.