Allen-Bradley 1746-NI16I

01 Current-loop and converter architecture

Allen-Bradley 1746-NI16I acquires sixteen analog current signals for an SLC 500 system. Selectable current ranges and data formats connect process transmitters to the controller input image.

Four conversion groups share the channel workload

Converter 1: channels 0–3

Filter owner: channel 0. Up to four input channels share this converter.

Converter 2: channels 4–7

Filter owner: channel 4. Up to four input channels share this converter.

Converter 3: channels 8–11

Filter owner: channel 8. Up to four input channels share this converter.

Converter 4: channels 12–15

Filter owner: channel 12. Up to four input channels share this converter.

External loop power and common reference

Each current loop terminates at a single-ended input referenced to analog common. The module measures the loop but does not power its transmitter. The two common terminals are internally connected, so they do not provide two isolated groups; source grounding and loop-supply arrangements must respect that shared reference.

Interface class changes data access

Class 1 multiplexes channel data and status through an eight-word image. Class 3 makes sixteen data words and sixteen status words available together and permits user-defined scaling. The processor and network interface must support the selected class, and the application must not interpret a status word as an analog measurement.

Enabled channels determine converter loading

Filter selection is shared by the four inputs on each converter. Only the selection in the first channel of each group controls that group. Distributing a reduced channel count across the four converters can improve update time, whereas merely disabling the last few channel numbers may leave the slowest converter workload unchanged.

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02 Electrical acquisition limits

Analog current inputs	16, single-ended
Selectable current ranges	±20 mA; 4–20 mA; 0–1 mA; 0–20 mA
Input impedance	249 Ω
A/D method	Sigma-delta
Converter arrangement	Four converters, each multiplexing four inputs
Filter selections	6, 10, 20, 40, 60, 80, 100 or 250 Hz
Input resolution	640 nA; data-format dependent
Engineering-unit increment	1 µA per count
Accuracy at 25 °C	Better than 0.15% of range
Error over 0–60 °C	±0.3%
Input offset drift	360 nA/°C
Gain drift	20 ppm/°C
Maximum input current	±30 mA between analog common and an input
Non-damaging signal voltage	±8 V between any two signal terminals
5 V backplane demand	125 mA
24 V backplane demand	75 mA
Maximum backplane power	2.425 W: 0.625 W at 5 V plus 1.8 W at 24 V

Power budget boundary

The 5 V and 24 V backplane loads belong to the chassis power budget. They do not represent the current required by external transmitters. Confirm adequate capacity for all installed chassis modules as well as a separate complete loop-supply calculation.

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03 Data image and converter workload

Class 1 module ID	3504
Class 3 module ID	10403
Class 1 I/O allocation	8 input words and 8 output words
Class 3 I/O allocation	32 input words and 32 output words
Class 3 measurement map	Data words 0–15; status words 16–31
Scaled-for-PID range	0–16383
Proportional-count range	−32768 to +32767
Custom scaling	Class 3 only

Timing example with a 40 Hz group filter

Sixteen enabled channels require 100 ms. Twelve channels arranged as three per converter require 75 ms; eight arranged as two per converter require 50 ms. These examples assume the same filter selection for all enabled channels.

Enabled layout	40 Hz module update
0–15: four per converter	100 ms
0–2, 4–6, 8–10, 12–14	75 ms
0, 1, 4, 5, 8, 9, 12, 13	50 ms

Filter response and controller scheduling

A filter attenuates signal frequency components; an update interval describes the rate at which new channel words arrive. Include both in process-response analysis. Faster program execution does not bypass the module acquisition path.

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04 Scaling, error and diagnostic reasoning

Calculated loop voltage demand

At 20 mA, 0.020 A × 249 Ω gives 4.98 V across the input. At 4 mA the calculated drop is 0.996 V. Add the rest of the circuit burden and transmitter operating headroom to assess supply compliance.

Resolution does not equal accuracy

The 640 nA input-resolution figure describes quantization. Accuracy, temperature drift, source quality and scaling contribute separately to the measurement result; additional displayed digits do not remove those limits.

Status belongs to the measurement

A value must be paired with the right channel status and enable state. In Class 1, verify bank and data/status selection; in Class 3, associate each data word with its matching status word.

Filter and update describe different things

Filter selection affects signal attenuation and settling. The module update interval also depends on converter loading. A faster controller scan cannot recover analog changes that acquisition and filtering have not yet delivered.

Observation	Engineering interpretation
0 mA on enabled 4–20 mA channel	Inspect open-circuit status and loop power
One group behaves differently	Review its first-channel filter setting
Plausible count, incorrect process value	Review range, data format and application scaling
Fault disappears when disabled	Status reset is not proof of repair

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05 Lifecycle and integration boundary

Status indicators	Four green channel-group LEDs and one green module LED
Removable terminal block	1746-RT25G
Maximum terminal wire size	Two 14 AWG wires per terminal
Recommended signal cable	Belden 8761 or equivalent
Operating temperature	0 to +60 °C
Storage temperature	−40 to +85 °C
Relative humidity	5–95%, non-condensing

Lifecycle and replacement scope

Discontinued since September 30, 2024. Replacement is an engineering migration rather than an automatic drop-in substitution. Review chassis compatibility, current-loop wiring, data format, channel status handling and application timing before selecting a new architecture.

Technical basis

Rockwell Automation SLC 500 Analog Input Modules, 1746-IN001B-US-P; 1746-NI16 User Manual, 1746-UM001A-US-P. Current-input ratings apply to 1746-NI16I. Interface class, enabled-channel distribution and group filter selection determine data access and module update time. Voltage-input ratings for NI16V do not apply.

Related automation references

Emerson KJ2005X1-BK1 12P4688X052 SE3007

Foxboro FBM232 P0926GW

Honeywell FC-PSU-UNI2450U V1.0

Separate product references, not substitutes for this module.