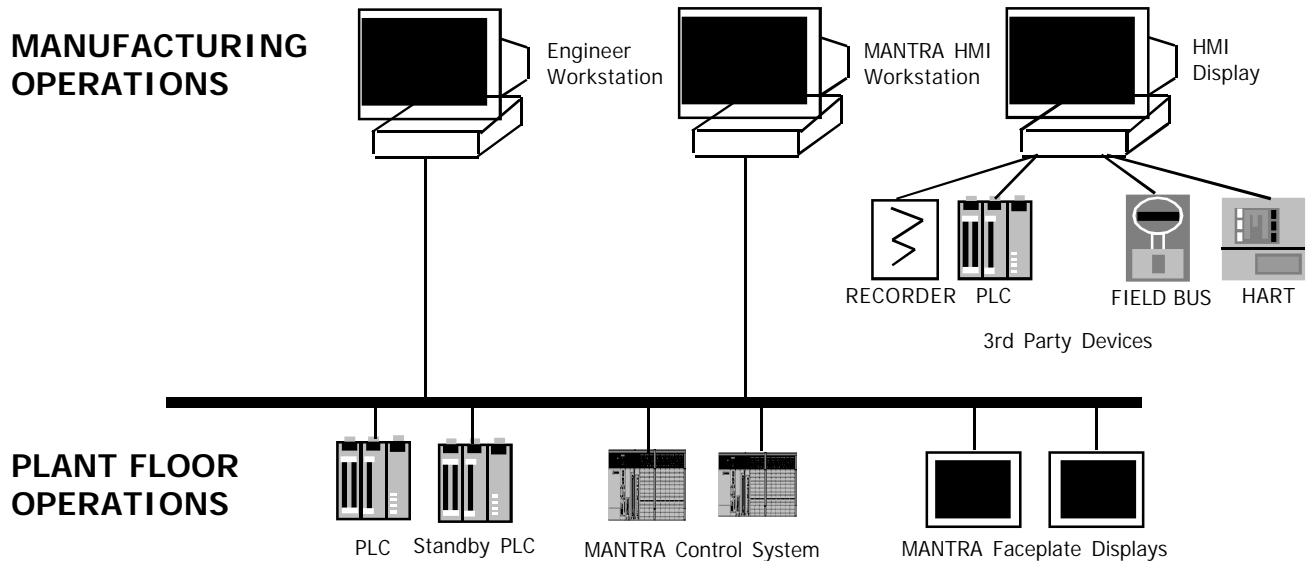


SYSTEM CONFIGURATION

The MANTRA 47 advanced process control system is modular in nature, and consists of a powerful CPU with a mix of analog and digital I/O.

Using a powerful CYRIX 100 MHz Pentium-equivalent processor based controller and smart I/O modules with electronic ID, the MANTRA 47 system hardware offers the form factor and ruggedness of an advanced PLC type system, while the configuration software and control technologies embedded within give it the power of a mini-DCS.

MANTRA 47 SYSTEM ARCHITECTURE



The main features of the MANTRA 47 system:

Controllers & I/O

Any number of controllers and associated I/O may be configured for a system limited only by network bandwidth and controller memory size.

Typically each modular control unit is ideal to handle up to a few dozen regulatory control loops and associated discrete logic.

Control Network

The MANTRA 47 control system uses DH+ or TCP/IP based control network, thus providing high speed and flexibility in interfacing to supported devices like Allen-Bradley PLCs.

Workstations

The MANTRA 47 system offers unlimited use of workstations for system configuration activities and graphics user interface.

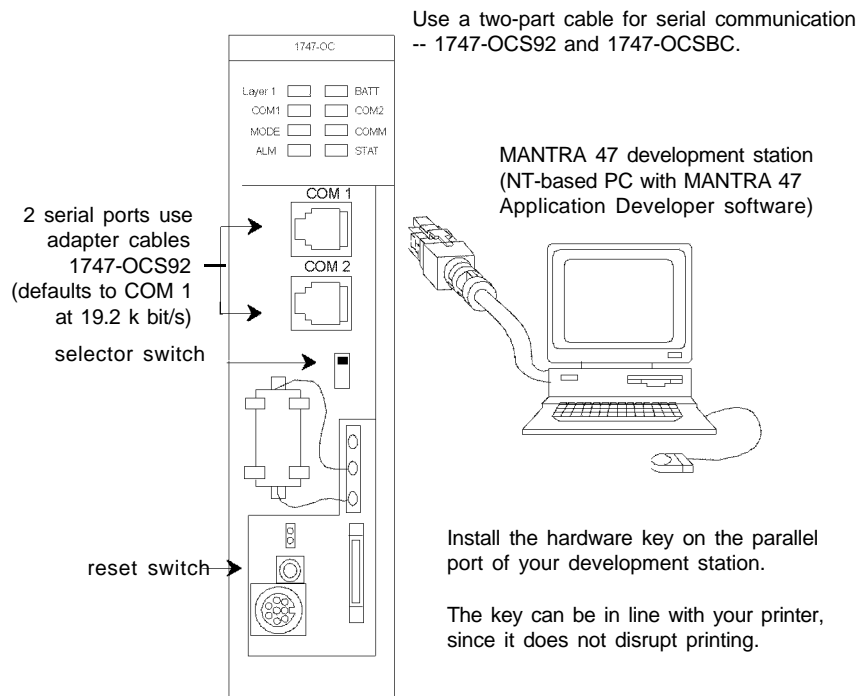
Controllers & I/O

The MANTRA 47 system offers a solution using a network of process controllers each with its associated local or remote I/O. The form factor is compact and the packaging is well proven to meet industrial installation and maintenance requirements.

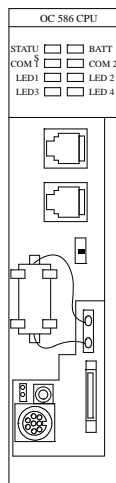
The controller uses powerful 32-bit microprocessors, solid state retention devices like Flash and DRAM memories, and is designed to support applications which require a maximum of 1,000 control blocks per controller.

The user can configure a free mix of I/O using different kinds of I/O interfaces supporting a full range of analog and discrete devices. Standard analog and discrete signal types are supported along with special modules such as RTD, Thermocouple, Position, etc.

The I/O can reside on local racks or can be located on the Remote I/O subnetwork.



MANTRA 47 CPU module



The **MANTRA 47** CPU module:

- resides in the left slot of any 1746 chassis (you need a series B or greater chassis if you plan to use any open controller option modules)
- can address any valid SLC local expansion chassis configuration (30 slot maximum)
- can address all 1746 I/O and communication modules (including the 1747-SN remote I/O and 1747-SDN DeviceNet scanners)
- supports system memory (DRAM) and non-volatile storage options (IDE-compatible FlashDrive™)

The **MANTRA 47** CPU module comes with:

- 1747-BA battery
- 1747-OCFAN1 chassis fan
- external watchdog wiring kit
- screws and ribbon cable to embed a FlashDrive within the CPU module (you can purchase the FlashDrive pre-installed in the module or separate from the module)
- diagnostic utility disk

functional specifications

Characteristic:	Description:
main PC-based CPU	5x86 @ 100 MHz
local I/O scanner	188 @ 33 MHz
battery backup	for 8K dual port RAM and real-time clock
BIOS	AMI BIOS
output	external watchdog contact

hardware specifications

Characteristic:	Description:
battery	1747-BA lithium battery (contains 0.23 g lithium) two (2) year life span (may vary based on temperature)
serial communication	two (2) isolated serial ports COM1 supports RS-232 COM2 supports RS-232, RS-422, or RS-485 configurable baud rates: 110, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, 115200 bits/sec
parallel communication	one (1) enhanced parallel port
keyboard connection	miniature PS/2 style DIN connector keyboard not required
LEDs	four (4) diagnostic/status LEDs four (4) user-definable LEDs (LED1 – LED4)
switches	reset of both the 5x86 CPU and the local I/O scanner user-definable 3-position switch
jumpers	3-position jumper for selecting the COM2 serial mode user-definable 2-position jumper

environmental specifications

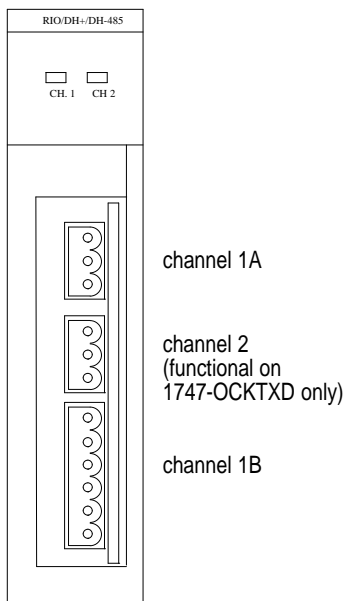
Characteristic:	Values/Ranges:
slot temperature operating	with chassis fan 0° to 60° C (32 to 140° F) without chassis fan 0° to 30° C (32 to 86° F)
storage	-40° to 85° C (-40 to 185° F)
relative humidity	5% to 95% noncondensing
vibration	10 to 500 Hz 2.0 G maximum peak acceleration .012 in (peak-to-peak) displacement
shock operating	30 G peak for 11ms
storage	50 G peak for 11ms
weight	14.0 oz (396.9 g)
power dissipation	2.25 A @ 5V dc
agency certification	UL A191 identified CE for all applicable directives CSA Class I, Div 2, Group A, B, C, D, Temp Code T5

communication cables (not provided with the CPU)

Communication:	Specifications:
serial	catalog number 1747-OCS92 two 2 ft (0.61 m) RJ45 to 9-pin, D-shell converter cables Communication rate: RS-232 50 ft (15.24 m) RS-422 4000 ft (1219.20 m) RS-485 4000 ft (1219.20 m) Maximum cable length:
parallel	catalog number 1747-OCP252 one 2 ft (0.61 m) micro 25-pin to 25-pin D-shell converter cable maximum cable length 10 ft (3.05 m)

A-B communication interface module (remote I/O, DH+, DH-485)

catalog number 1747-OCKTX, 1747-OCKTXD



The A-B communication interface module can:

- communicate with nodes on DH+ networks
- communicate with nodes on DH-485 networks
- act as a remote I/O scanner

The 1747-OCKTX module is a single-channel interface to these networks. Connect channel 1A to a remote I/O or DH+ link or connect channel 1B to a DH-485 link.

The 1747-OCKTXD is a dual-channel interface. Connect channel 1A to a remote I/O or DH+ link or connect channel 1B to a DH-485 link. Connect channel 2 to a remote I/O or DH+ link.

functional specifications

Characteristic:	Description:
1747-OCKTX	CH 1A (3-pin Phoenix) runs DH+ and remote I/O CH 1B (6-pin Phoenix) runs DH-485
1747-OCKTXD	CH 1A (3-pin Phoenix) runs DH+ and remote I/O CH 1B (6-pin Phoenix) runs DH-485 CH 2 (3-pin Phoenix) runs DH+ and remote I/O
maximum line lengths and communication rates	DH+: 10,000 ft (3048 m) @ 57.6k bit/s 5,000 ft (1,524 m) @ 115.2 kbits/s 2,500 ft (762 m) @ 230.4 kbits/s
	DH-485: 4,000 ft (1219 m) @ 1200, 2400, 4800, 9600, or 19,200 bits/s
	remote I/O: 2,500 ft (762 m) @ 230.4K bit/s 5,000 ft (1524 m) @ 115.2k bit/s 10,000 ft (3048 m) @ 57.6k bit/s
bus communications	PCI requires 1747-OCPC1x to communicate with the open controller CPU module
LEDs	one (1) diagnostic/status LED per channel
number of modules per open controller system	dependent on: <ul style="list-style-type: none"> • available memory • available interrupts • available PCI bus slots • software drivers

environmental specifications

Characteristic:	Values:
slot temperature	operating 0° to 60° C (32 to 140° F)
	storage -40° to 85° C (-40 to 185° F)
relative humidity	5 to 95% without condensation
vibration	10 to 500 Hz
	2.0 G maximum peak acceleration .012 in (peak-to-peak) displacement
shock	operating 30 G peak for 11 ± 1 ms
	storage 50 G peak for 11 ± 1 ms
weight	11.0 oz (311.8 g)
power dissipation	1747-OCKTX 0.50 A @ 5V dc
	1747-OCKTXD 0.80 A @ 5V dc
agency certification	UL A191 identified CE for all applicable directives CSA Class I, Div 2, Group A, B, C, D, Temp Code T5

Analog I/O Modules

(Catalog Numbers 1746-FIO4I, -FIO4V, -NI4, -NI8, -NIO4I, -NIO4V, -NO4I, and -NO4V)

Product Data



The 1746- analog I/O modules offer you a wide range of solutions to your analog control applications.

The 1746-NI4, NIO4I, NIO4V, NO4I, and NO4V are 4-channel analog input, output, and combination modules. These modules provide high resolution (16-bit inputs, 14-bit outputs) and superior input filtering resulting in a high degree of noise immunity. Combination I/O modules help lower system cost and reduce chassis size by incorporating 2 analog inputs and 2 analog outputs on the same module.

The 1746-FIO4I and FIO4V are 2-input/2-output combination modules ideal for high speed applications with more rapidly changing analog signals. These fast response modules are best suited for control of pressure and position in equipment such as hydraulic presses and molding machines.

The 1746-NI8 module is a high density, 8-channel input module best suited for demanding process control applications with a large number of analog input signals. This module provides faster, more accurate measurement and is channel-to-channel configurable for added application flexibility.

Overview of Analog Modules

The catalog numbers are coded as follows:

F = faster-response combination analog module

N = higher-resolution 4- and 8-channel analog modules

I (prefix) = input

O (prefix) = output

n = total number of input and/or output channels

I (last) = current output

V (last) = voltage output

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						
	FIO4I	FIO4V	NI4	NI8	NIO4I	NIO4V
Number of inputs	2	2	4	8	2	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 only)			
Step response	100 µs	100 µs	60 ms	selectable see page 28	60 ms	60 ms
Input filter at 3 dB	7k Hz	7k Hz	10 Hz	selectable see page 26	10 Hz	10 Hz
Input A/D converter	12-bit	12-bit	16-bit	16-bit	16-bit	16-bit
Input resolution (I)	9.76 µA/bit	9.76 µA/bit	1.22 µA/LSB	1 µA/bit	1.22 µA/LSB	1.22 µA/LSB
Input resolution (V)	2.44 mV/LSB	2.44 mV/LSB	305.2 µV/LSB	1 mV/bit	305.2 µV/LSB	305.2 µV/LSB
Input coding (I)	0 to 2047	0 to 2047	± 16,384	depends on data format, see page 21	± 16,384	± 16,384
Input coding (V)	0 to 4095	0 to 4095	± 32,768		± 32,768	± 32,768
Input non-linearity	± 0.073% FS	± 0.073% FS	± 0.01% FS	± 0.01% FS	± 0.01% FS	± 0.01% FS
CMR at 60 Hz	50 dB	50 dB	105 dB	100 dB	105 dB	105 dB

Output Characteristics						
	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 (14-bit) Outputs. Provides for precision control of analog outputs.

Input Filtering. Provides higher immunity to electrical noise (Nxxx) or a faster input response (Fxxx 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. Provides flexibility to minimize the cost of power supplies.

UL 508 listed, CSA 22.2 142 Approved, and CE Compliant. Lets you install modules in those environments.

Unique Characteristics of 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:

Input Resolution	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

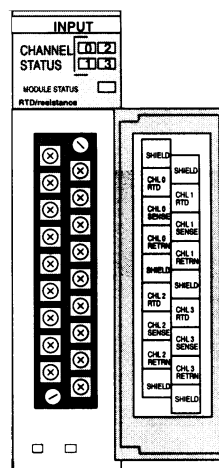
A resolution of 0 to 2047 counts is sufficient for many applications.

4-Channel RTD Resistance Input Module

The RTD module receives and stores digitally converted analog data from RTDs or other resistance inputs such as potentiometers into its image table for retrieval by all fixed and modular SLC 500 processors. An RTD consists of a temperature sensing element connected by 2, 3 or 4 wires that provide input to the RTD module. The module supports connections from any combination of up to 4 RTDs of various types (for example, platinum, nickel, copper, or nickel-iron) or other resistance inputs.

The RTD module supplies a small current to each RTD connected to the module inputs (up to 4 input channels). The module provides on-board scaling and converts RTD input to temperature (°C, °F) or reports resistance input in ohms.

Each input channel is individually configurable for a specific input device. Broken sensor detection (open or short circuit) is provided for each input channel. In addition, the module provides indication if the input signal is out of range.



1746-NR4

RTD Compatibility

Table 1.A lists the RTD types you can use with the RTD module and gives each type's associated temperature range, resolution, and repeatability specifications. Table 1.B shows the accuracy and temperature drift specifications for the RTDs.

Table 1.A
RTD Temperature Ranges, Resolution, and Repeatability

RTD Type		Temp. Range (0.5 mA Excitation) ^②	Temp. Range (2.0 mA Excitation) ^②	Resolution	Repeatability
Platinum (385) ^①	100Ω	-200 °C to +850 °C (-328 °F to +1562 °F)	-200 °C to +850 °C (-328 °F to +1562 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	200Ω	-200 °C to +850 °C (-328 °F to +1562 °F)	-200 °C to +850 °C (-328 °F to +1562 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	500Ω	-200 °C to +850 °C (-328 °F to +1562 °F)	-200 °C to +850 °C (-328 °F to +1562 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	1000Ω	-200 °C to +850 °C (-328 °F to +1562 °F)	-200 °C to +240 °C (-328 °F to +464 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
Platinum (3916) ^①	100Ω	-200 °C to +630 °C (-328 °F to +1166 °F)	-200 °C to +630 °C (-328 °F to +1166 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	200Ω	-200 °C to +630 °C (-328 °F to +1166 °F)	-200 °C to +630 °C (-328 °F to +1166 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	500Ω	-200 °C to +630 °C (-328 °F to +1166 °F)	-200 °C to +630 °C (-328 °F to +1166 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
	1000Ω	-200 °C to +630 °C (-328 °F to +1166 °F)	-200 °C to +230 °C (-328 °F to +446 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
Copper (426) ^{①③}	10Ω	Not allowed. ^⑤	-100 °C to +260 °C (-148 °F to +500 °F)	0.1 °C (0.2 °F)	± 0.2 °C (± 0.4 °F)
Nickel (618) ^{①④}	120Ω	-100 °C to +260 °C (-148 °F to +500 °F)	-100 °C to +260 °C (-148 °F to +500 °F)	0.1 °C (0.2 °F)	± 0.1 °C (± 0.2 °F)
Nickel (672) ^①	120Ω	-80 °C to +260 °C (-112 °F to +500 °F)	-80 °C to +260 °C (-112 °F to +500 °F)	0.1 °C (0.2 °F)	± 0.1 °C (± 0.2 °F)
Nickel Iron (518) ^①	604Ω	-100 °C to +200 °C (-148 °F to +392 °F)	-100 °C to +200 °C (-148 °F to +392 °F)	0.1 °C (0.2 °F)	± 0.1 °C (± 0.2 °F)

^① The digits following the RTD type represent the temperature coefficient of resistance (α), which is defined as the resistance change per ohm per °C. For instance, *Platinum 385* refers to a platinum RTD with $\alpha = 0.00385$ ohms/ohm-°C or simply 0.00385 /°C.

^② The temperature range for the 1000Ω RTD is dependant on the excitation current.

^③ Actual value at 0 °C is 9.0429 per SAMA standard RC21-4-1966.

^④ Actual value at 0 °C is 1009 per DIN standard.

^⑤ To maximize the relatively small RTD signal, only 2 mA excitation current is allowed.

Important: The exact signal range valid for each input type is dependent upon the excitation current magnitude that you select when configuring the module.

Table 1.B
RTD Accuracy and Temperature Drift Specifications

RTD Type		Accuracy ^② (0.5 mA Excitation)	Accuracy ^② (2.0 mA Excitation)	Temperature Drift ^⑥ (0.5 mA Excitation)	Temperature Drift ^⑥ (2.0 mA Excitation)
Platinum (385) ^①	100Ω	± 1.0 °C ^⑦ (± 2.0 °F)	± 0.5 °C (± 0.9 °F)	± 0.034 °C/°C (± 0.061 °F/°F)	± 0.014 °C/°C (± 0.025 °F/°F)
	200Ω	± 1.0 °C ^⑦ (± 2.0 °F)	± 0.5 °C (± 0.9 °F)	± 0.034 °C/°C (± 0.061 °F/°F)	± 0.014 °C/°C (± 0.025 °F/°F)
	500Ω	± 0.6 °C (± 1.1 °F)	± 0.5 °C (± 0.9 °F)	± 0.017 °C/°C (± 0.031 °F/°F)	± 0.014 °C/°C (± 0.025 °F/°F)
	1000Ω	± 0.6 °C (± 1.1 °F)	± 0.5 °C (± 0.9 °F)	± 0.017 °C/°C (± 0.031 °F/°F)	± 0.014 °C/°C (± 0.025 °F/°F)
Platinum (3916) ^①	100Ω	± 1.0 °C ^⑦ (± 2.0 °F)	± 0.4 °C (± 0.7 °F)	± 0.034 °C/°C (± 0.061 °F/°F)	± 0.011 °C/°C (± 0.020 °F/°F)
	200Ω	± 1.0 °C ^⑦ (± 2.0 °F)	± 0.4 °C (± 0.7 °F)	± 0.034 °C/°C (± 0.061 °F/°F)	± 0.011 °C/°C (± 0.020 °F/°F)
	500Ω	± 0.5 °C (± 0.9 °F)	± 0.4 °C (± 0.7 °F)	± 0.014 °C/°C (± 0.025 °F/°F)	± 0.011 °C/°C (± 0.020 °F/°F)
	1000Ω	± 0.5 °C (± 0.9 °F)	± 0.4 °C (± 0.7 °F)	± 0.014 °C/°C (± 0.025 °F/°F)	± 0.011 °C/°C (± 0.020 °F/°F)
Copper (426) ^{①③}	10Ω	Not allowed. ^⑤	± 0.6 °C (± 1.1 °F)	Not allowed. ^⑤	± 0.017 °C/°C (± 0.031 °F/°F)
Nickel (618) ^{①④}	120Ω	± 0.2 °C (± 0.4 °F)	± 0.2 °C (± 0.4 °F)	± 0.008 °C/°C (± 0.014 °F/°F)	± 0.008 °C/°C (± 0.014 °F/°F)
Nickel (672) ^①	120Ω	± 0.2 °C (± 0.4 °F)	± 0.2 °C (± 0.4 °F)	± 0.008 °C/°C (± 0.014 °F/°F)	± 0.008 °C/°C (± 0.014 °F/°F)
Nickel Iron (518) ^①	604Ω	± 0.3 °C (± 0.5 °F)	± 0.3 °C (± 0.5 °F)	± 0.010 °C/°C (± 0.018 °F/°F)	± 0.010 °C/°C (± 0.018 °F/°F)

- ① The digits following the RTD type represent the temperature coefficient of resistance (α), which is defined as the resistance change per ohm per °C. For instance, *Platinum 385* refers to a platinum RTD with $\alpha = 0.00385$ ohms/ohm-°C or simply 0.00385 /°C.
- ② The accuracy values assume that the module was calibrated within the specified temperature range of 0°C to 60°C (32°F to 140°F).
- ③ Actual value at 0 °C is 9.0429 per SAMA standard RC21-4-1966.
- ④ Actual value at 0 °C is 1009 per DIN standard.
- ⑤ To maximize the relatively small RTD signal, only 2 mA excitation current is allowed.
- ⑥ Temperature drift specifications apply to a module that has not been calibrated.
- ⑦ Module accuracy, using 100 Ω or 200 Ω platinum RTDs with 0.5 mA excitation current, depends on the following criteria:
- (a) Module accuracy is ± 0.6 °C after you apply power to the module or perform an autocalibration at 25 °C ambient with module operating temperature at 25 °C.
 - (b) Module accuracy is $\pm (0.6$ °C + 4 T \times 0.034 °C/°C) after you apply power to the module or perform an autocalibration at 25 °C ambient with the module operating temperature between 0° to 60 °C.
 - where 4 T is the temperature difference between the actual operating temperature of the module and 25 °C and 0.034 °C/°C is the temperature drift shown in Table 1.B for 100 Ω or 200 Ω platinum RTDs.
 - (c) Module accuracy is ± 1.0 °C after you apply power to the module or perform an autocalibration at 60 °C ambient with module operating temperature at 60 °C.

Thermocouple/Millivolt Module

The thermocouple/mV module receives and stores digitally converted thermocouple and/or millivolt (mV) analog data into its image table for retrieval by all fixed and modular SLC 500 processors. The module supports connections from any combination of up to four thermocouple or mV analog sensors.

The following tables define thermocouple types and their associated full scale temperature ranges and also list the millivolt analog input signal ranges that each 1746-NT4 channel will support.

NT4 Module Thermocouple Temperature Ranges

Type	°C Temperature Range	°F Temperature Range
	-210°C to 760°C	-346°F to 1400°F
	-270°C to 1370°C	-454°F to 2498°F
T	-270°C to 400°C	-454°F to 752°F
B	300°C to 1820°C	572°F to 3308°F
E	-270°C to 1000°C	-454°F to 1832°F
R	0°C to 1768°C	32°F to 3214°F
S	0°C to 1768°C	32°F to 3214°F
N	0°C to 1300°C	32°F to 2372°F
C C Sensor	0°C to 85°C	32°F to 185°F

NT4 Module Millivolt Input Ranges

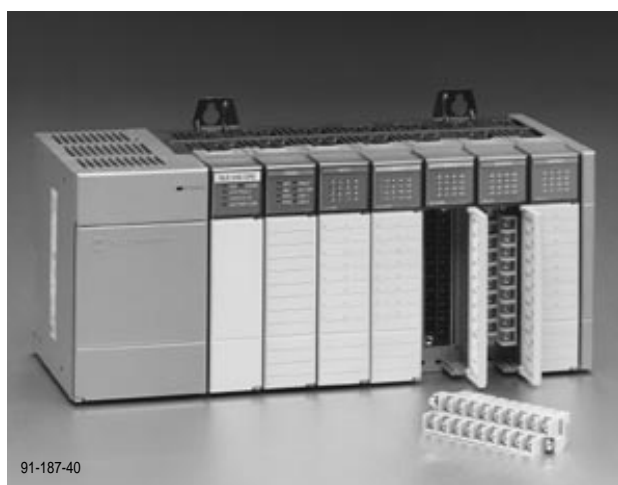
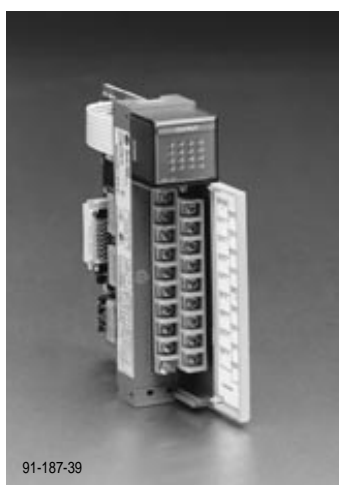
Millivolt Input Type	Range
±50 mV	-50 mV dc to +50 mV dc
±100 mV	-100 mV dc to +100 mV dc

Each input channel is individually configurable for a specific input device and provides open-circuit, over-range, and under-range detection and indication.

Discrete Input and Output Modules

(Catalog Numbers 1746-IA4, -IA8, -IA16, -IB8, -IB16, -IB32, -IC16, -IG16, -IH16, -IM4, -IM8, -IM16, -IN16, -ITB16, -ITV16, -IV8, -IV16, -IV32, -OA8, -OA16, -OAP12, -OB8, -OBP8, -OB16, -OB16E, -OBP16, -OB32, -OG16, -OV8, -OV16, -OVP16, -OV32, -OW4, -OW8, -OW16, -OX8, -IO4, -IO8, -IO12)

Product Data



Our wide variety of input, output, and combination modules makes the SLC 500™ family the smart choice for all of your small PLC applications. I/O modules are available in a wide variety of densities including 4-, 8-, 16-, and 32-point and can interface to AC, DC, and TTL voltage levels. Output modules are available with solid state AC, solid state DC, and relay contact type outputs. For added flexibility, combination modules are also available in 2-input/2-output, 4-input/4-output, and 6-input/6-output versions.

Designed and tested for industrial applications, our modules are of the highest quality. The modules feature input filtering, optical isolation, and built-in surge protection to enhance the reliability of operation in noisy industrial environments.

Class I, Division 2 certified by UL and CSA. CE compliant. All modules are UL 508 listed and CSA 22.2 142 approved and meet Class I, Division 2 hazardous location requirements of both Underwriter's Laboratory and the Canadian Standards Association (except for those noted in the module summary on the next page). For use within the European Union or EEA regions, most modules have been tested to meet Council Directive 89/336 Electromagnetic Compatibility (exceptions are listed on next page).

Discrete I/O Module Summary

ID Code	Voltage Category	Cat. No.	Input/Output	I/O Points	Module Description	Page
AC Modules						
100	100/120V ac	1746-IA4	Input	4	120V ac Input Module	16
300	100/120V ac	1746-IA8	Input	8	120V ac Input Module	16
500	100/120V ac	1746-IA16	Input	16	120V ac Input Module	16
101	200/240V ac	1746-IM4	Input	4	240V ac Input Module	16
301	200/240V ac	1746-IM8	Input	8	240V ac Input Module	16
501	200/240V ac	1746-IM16	Input	16	240V ac Input Module	16
2703	100/120V ac	1746-OA8	Output	8	120/240V ac Output Module	18
2903	100/120V ac	1746-OA16	Output	16	120/240V ac Output Module	18
2803	120/240V ac	1746-OAP12 ^①	Output	12	High Current 120/240V ac Output Module	18
DC Modules						
306	24V dc	1746-IB8	Input	8	Current Sinking DC Input Module	20
506	24V dc	1746-IB16	Input	16	Current Sinking DC Input Module	20
706	24V dc	1746-IB32 ^①	Input	32	Current Sinking DC Input Module	20
519	24V dc	1746-ITB16	Input	16	Fast Response DC Sinking Input Module	20
509	48V dc	1746-IC16	Input	16	Current Sinking DC Input Module	20
507	125V dc	1746-IH16	Input	16	Current Sinking DC Input Module	20
320	24V dc	1746-IV8	Input	8	Current Sourcing DC Input Module	24
520	24V dc	1746-IV16	Input	16	Current Sourcing DC Input Module	24
720	24V dc	1746-IV32 ^①	Input	32	Current Sourcing DC Input Module	24
518	24V dc	1746-ITV16	Input	16	Fast Response DC Sourcing Input Module	24
515	5V dc/TTL	1746-IG16 ^②	Input	16	Current Sourcing TTL Input Module	28
2713	24V dc	1746-OB8	Output	8	Current Sourcing DC Output Module	29
2913	24V dc	1746-OB16	Output	16	Current Sourcing DC Output Module	29
2920	24V dc	1746-OB16E ^{①③}	Output	16	Current Sourcing DC Output Module	29
3113	24V dc	1746-OB32 ^①	Output	32	Current Sourcing DC Output Module	29
2721	24V dc	1746-OBP8 ^③	Output	8	High Current Sourcing DC Output Module	32
2921	24V dc	1746-OBP16 ^①	Output	16	High Current Sourcing DC Output Module	32
2714	24V dc	1746-OV8	Output	8	Current Sinking DC Output Module	34
2914	24V dc	1746-OV16	Output	16	Current Sinking DC Output Module	34
3114	24V dc	1746-OV32 ^①	Output	32	Current Sinking DC Output Module	34
2922	24V dc	1746-OVP16 ^①	Output	16	High Current Sinking DC Output Module	37
2915	5V dc/TTL	1746-OG16 ^②	Output	16	Current Sinking TTL Output Module	38

MANTRA 47 advanced process control system -- SYSTEM CONFIGURATION

ID Code	Voltage Category	Cat. No.	Input/Output	I/O Points	Module Description	Page
AC/DC Modules						
510	24V ac/dc	1746-IN16	Input	16	24V ac/dc Input Module	39
2500	AC/DC Relay	1746-OW4 ^①	Output	4	Relay (Hard Contact) Output Module	40
2700	AC/DC Relay	1746-OW8 ^①	Output	8	Relay (Hard Contact) Output Module	40
2900	AC/DC Relay	1746-OW16 ^①	Output	16	Relay (Hard Contact) Output Module	40
2701	AC/DC Relay	1746-OX8 ^①	Output	8	Isolated Relay Output Module	40
800	Inputs – 120V ac Outputs – AC/DC Relay	1746-IO4 ^①	Input/Output	2 Inputs 2 Outputs	Combination Input/Output Module	42
1100	Inputs – 120V ac Outputs – AC/DC Relay	1746-IO8 ^①	Input/Output	4 Inputs 4 Outputs	Combination Input/Output Module	42
1500	Inputs – 120V ac Outputs – AC/DC Relay	1746-IO12 ^①	Input/Output	6 Inputs 6 Outputs	Combination Input/Output Module	42

① Certified for Class I, Division 2 hazardous location by CSA only.

② Not CE marked.

③ These modules carry the C-UL mark and are certified by UL per CSA requirements.

**Spectrum Controls, Inc.
Modules**

These modules are sold and supported by Spectrum Controls Inc., Bellevue, Washington. For additional information, contact Spectrum at (206) 746-9481.

ID Code	Voltage Category	Cat. No.	Input/Output	I/O Points	Module Description
AC Modules					
2705	120/240V ac	1746sc-OAP8I	Output	8	Isolated ac Output Module
DC Modules					
324	24V dc	1746sc-IB8I	Input	8	Isolated DC Input Module
324	48V dc	1746sc-IC8I	Input	8	48V Isolated DC Input Module
AC/DC Modules					
303	120V ac/dc	1746sc-IA8I	Input	8	Isolated ac/dc Input Module
304	220V ac/dc	1746sc-IM8I	Input	8	Isolated ac/dc Input Module

Workstations

MANTRA 47 workstations which are non-proprietary high performance PCs running Windows NT operating system are used for engineering and GUI development purposes.

On the engineering workstation, the user can develop control and sequence logic programs which are downloaded and run on the target controller nodes. The engineering workstation also runs system diagnostic tools and watch list--a Microsoft Windows explorer type function which lets the user search and pick block parameters of one's choice to monitor.

The GUI workstations run full-function SCADA software, and offer other utilities such as trending, historian, recipe management, alarm management, and other utilities.

Data servers are available to provide open integration to third-party software tools on the Workstation.