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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Provides the functionality of isolators, power supplies, signal converters, and other devices.

- The Analog Input Unit converts analog input signals such as 1 to 5 V or 4 to 20 mA into digital values, and takes the values scaled in industrial units, and transfers it to the CPU Unit as the process value. Because of this, no ladder program is required at the CPU Unit for scaling.
- The Analog Output Unit converts analog output set values from the CPU Unit to analog output signals such as 4 to 20 mA or 1 to 5 V, and outputs them.
- The built-in functions, such as measurement value alarms, rate-of-change calculations, and square roots, have enabled major savings in cost and space compared with previous systems.
- High-resolution Models and 8-point Input Models are also available. By combining the Units, logging/monitoring systems can be constructed, or the Units can be used together with LCBs/LCUs to construct complete process control systems.
- Parameters can be easily displayed and set in an easy-to-understand form without special tools.



Features

Process Analog Input:

- Up to eight analog inputs can be connected for each Unit.
- There is isolation between input channels, so unwanted circuit paths between thermocouple inputs can be prevented. (Except for CS1W-PTR01/02)
- Output scaling ($\pm 32,000$)
- Process value alarms (HH, H, L, LL)
- Input disconnection alarm
- Rate-of-change calculation and alarm
- Top/bottom/valley hold (CS1W-PTS11/PTS12/PDC11 only)

Process Analog Output:

- Up to four analog set values can be output for each Unit.
- All outputs are isolated.
- Output rate-of-change limit
- Output high/low limits
- Output scaling ($\pm 32,000$)
- Control output answer input (CS1W-PMV01 only)

Isolated-type Pulse Input:

- Provides up to four pulses from a device such as a displacement flowmeter. The accumulated value can also be calculated at the same time and transferred to the CPU Unit at each cycle. (CS1W-PPS01)

System Configuration

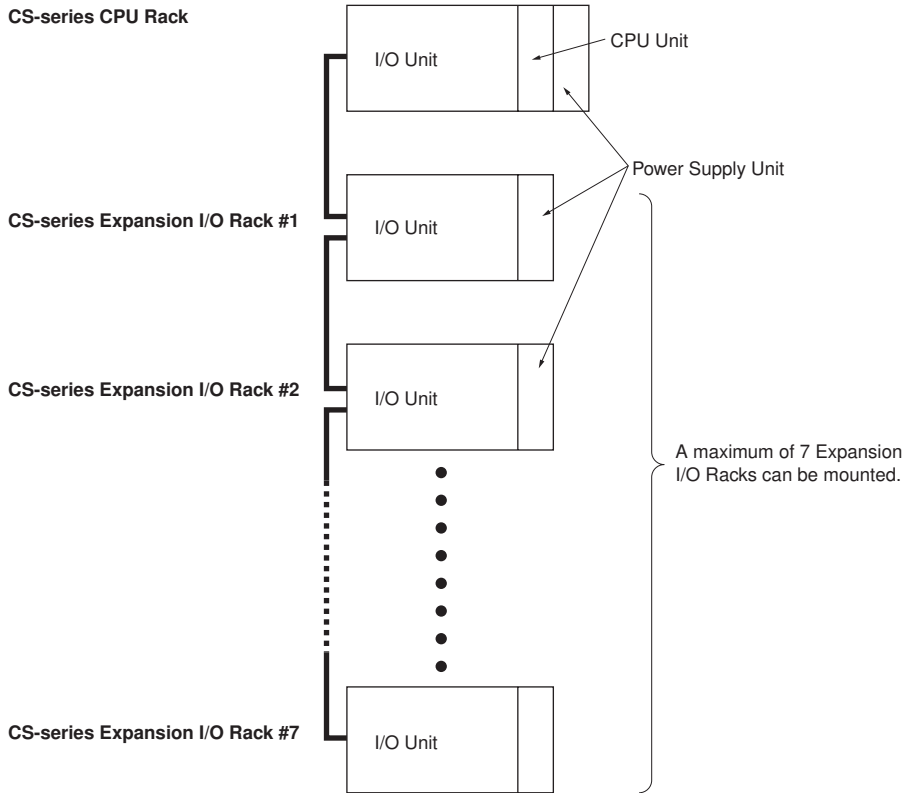
These Process Analog I/O Units belong to the CS-series Special I/O Unit group.

- They can be mounted to CS-series CPU Racks or Expansion I/O Racks.
- They cannot be mounted to C200H CPU Racks, Expansion I/O Racks, or SYSMAC BUS Remote I/O Slave Racks.

The number of Units that can be mounted to one Rack (either a CPU Rack or Expansion I/O Rack) depends upon the maximum current supplied by the Power Supply Unit and the current consumption by the other Units.

There are no restrictions on Rack position.


Note: I/O addresses for Special I/O Units are allocated according to the unit number set on the switches on the front panel, and not according to the slot position in which they are mounted.




Ordering Information

Process Analog I/O Units


Isolated-type Thermocouple Input Units

Unit type	Product name	Input points	Signal range selection	I/O type	Conversion speed	External connection	No. of unit numbers allocated	Current consumption (A)		Model	Standards
								5V	24V		
CS1 Special I/O Units		4 inputs	Set separately for each input	B, E, J, K, L, N, R, S, T, U, WRe5-26, PLII, ±100 mV	20 ms/4 inputs, 10 ms/2 inputs	Removable terminal block	1	0.12	0.08	CS1W-PTS11	UC1, N, CE
		4 inputs		R, S, K, J, T, L, B	250 ms/4 inputs			0.25	–	CS1W-PTS51	UC1, CE
		8 inputs		R, S, K, J, T, L, B	250 ms/8 inputs			0.18	0.06	CS1W-PTS55	
		4 inputs		B, E, J, K, N, R, S, T, ±80mV	150 ms/4 inputs			0.15	0.15	CS1W-PTS01-V1	


Isolated-type Resistance Thermometer Input Units

Unit type	Product name	Input points	Signal range selection	I/O type	Conversion speed (resolution)	External connection	No. of unit numbers allocated	Current consumption (A)		Model	Standards
								5V	26V		
CS1 Special I/O Units		4 inputs	Set separately for each input	Pt100, JPt100, Pt50, Ni508.4	20 ms/4 inputs, 10 ms/2 inputs	Removable terminal block	1	0.12	0.07	CS1W-PTS12	UC1, N, CE
		4 inputs		Pt100, JPt100	250 ms/4 inputs			0.25	–	CS1W-PTS52	UC1, CE
		8 inputs		Pt100, JPt100	250 ms/8 inputs			0.18	0.06	CS1W-PTS56	
		4 inputs		Pt100, JPt100	100 ms/4 inputs			0.15	0.15	CS1W-PTS02	
	Isolated-type Resistance Thermometer Input Units (Ni508.4 Ω)	4 inputs	Ni508.4	100 ms/4 inputs	0.15	0.15	CS1W-PTS03				


Isolated-type DC Input Units

Unit type	Product name	Input points	Signal range	Conversion speed (resolution)	External connection	No. of unit numbers allocated	Current consumption (A)		Model	Standards
							5V	26V		
CS1 Special I/O Units		4 inputs	4 to 20 mA, 0 to 20 mA, 0 to 10 V, ±10 V, 0 to 5 V, ±5 V, 1 to 5 V, 0 to 1.25 V, ±1.25 V	20 ms/4 inputs, 10 ms/2 inputs	Removable terminal block	1	0.12	0.12	CS1W-PDC11	UC1, N, CE
		8 inputs	4 to 20 mA, 0 to 10 V, 0 to 5 V, 1 to 5 V	250 ms/8 inputs			0.18	0.06	CS1W-PDC55	UC1, CE
		4 inputs	4 to 20 mA, 0 to 20 mA, 1 to 5 V, 0 to 5 V, ±5 V, 0 to 10 V, ±10 V	100 ms/4 inputs			0.15	0.16	CS1W-PDC01	
	Isolated-type 2-Wire Transmitter Input Unit	4 inputs	4 to 20 mA, 1 to 5 V	100 ms/4 inputs			0.15	0.16	CS1W-PTW01	UC1, CE
	Power Transducer Input Unit	8 inputs	0 to 1 mA, ±1 mA	200 ms/8 inputs			0.15	0.08	CS1W-PTR01	
Analog Input Unit (100 mV)	8 inputs	0 to 100 mV, ±100 mV	200 ms/8 inputs	0.15	0.08	CS1W-PTR02				

Isolated-type Analog Output Unit

Unit type	Product name	Output points	Signal range selection	Signal range	Conversion speed (resolution)	External connection	No. of unit numbers allocated	Current consumption (A)		Model	Standards
								5V	26V		
CS1 Special I/O Units		4 inputs	Set separately for each input	4 to 20 mA, 1 to 5 V	100 ms/4 inputs	Removable terminal block	1	0.15	0.16	CS1W-PMV01	UC1, CE
		4 inputs		0 to 10 V, ±10 V, 0 to 5 V, ±5 V, 0 to 1 V, ±1 V	40 ms/4 inputs			0.12	0.12	CS1W-PMV02	

Isolated-type Pulse Input Unit

Unit type	Product name	Input points	External connection	No. of unit numbers allocated	Current consumption (A)		Model	Standards
					5V	26V		
CS1 Special I/O Units		4 pulse inputs	Removable terminal block	1	0.20	0.16	CS1W-PPS01	UC1, CE

International Standards

- The standards indicated in the "Standards" column are those current for UL, CSA, cULus, cUL, NK, and Lloyd standards and EC Directives as of the end of September 2008. The standards are abbreviated as follows: U: UL, U1: UL (Class I Division 2 Products for Hazardous Locations), C: CSA, UC: cULus, UC1: cULus (Class I Division 2 Products for Hazardous Locations), CU: cUL, N: NK, L: Lloyd, and CE: EC Directives.
- Ask your OMRON representative for the conditions under which the standards were met.

General Specifications

The specifications shown in the following table apply to all the CS-series Process Analog I/O Units. For specifications specific to each Unit, refer to the explanations of the individual units.

Item	Specification
Applicable PLC	CS-series PLCs
Unit type	CS-series Special I/O Unit
Structure	Backplane-mounted, single slot size
Dimensions	35 × 130 × 126 mm (W × H × D)
Weight	450 g max.
External connection terminals	<ul style="list-style-type: none"> CS1W-PTS55/-PTS56/-PDC55 24-point removable terminal block (with lever) (M3 screws, Tightening torque: 0.5 N·m) Other Units 21-point removable terminal block (M3 screws, Tightening torque: 0.5 N·m)
Unit number switch setting	00 to 95
Self-diagnosis function	Results of self-diagnosis shown on indicators.
Mountable Racks	CPU Rack or CS-series Expansion Rack
Maximum number of Units	80 Units (10 Units × 8 Racks) Confirm that the total current consumption of all the Units (including the CPU Unit) mounted to a single CPU Rack or Expansion Rack does not exceed the maximum power supply capacity of the Power Supply Unit.
Ambient operating temperature	0 to 55°C
Ambient operating humidity	10% to 90% (with no condensation)

Current consumption

Name	Model	Current consumption (power)	
		5 V	26 V
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1	0.15 A (0.75 W)	0.15 A (3.9 W)
	CS1W-PTS11	0.16 A (0.60 W)	0.08 A (2.08 W)
	CS1W-PTS51	0.25 A (1.25 W)	Not used.
	CS1W-PTS55	0.18 A (0.90 W)	0.06 A (1.56 W)
Isolated-type Resistance Thermometer Input Unit (Pt100, JPt100)	CS1W-PTS02	0.15 A (0.75 W)	0.15 A (3.9 W)
Isolated-type Resistance Thermometer Input Unit (Ni508.4)	CS1W-PTS03	0.15 A (0.75 W)	0.15 A (3.9 W)
Isolated-type Resistance Thermometer Input Unit (Pt100, JPt100, Pt50, Ni508.4)	CS1W-PTS12	0.12 A (0.60 W)	0.07 A (1.82 W)
Isolated-type Resistance Thermometer Input Unit (Pt100, JPt100)	CS1W-PTS52	0.25 A (1.25 W)	Not used.
	CS1W-PTS56	0.18 A (0.90 W)	0.06 A (1.56 W)
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01	0.15 A (0.75 W)	0.16 A (4.2 W)
Isolated-type Direct Current Input Unit	CS1W-PDC01	0.15 A (0.75 W)	0.16 A (4.2 W)
	CS1W-PDC11	0.12 A (0.60 W)	0.12 A (3.12 W)
	CS1W-PDC55	0.18 A (0.90 W)	0.06 A (1.56 W)
Power Transducer Input Unit	CS1W-PTR01	0.15 A (0.75 W)	0.08 A (2.1 W)
Analog Input Unit (100 mV)	CS1W-PTR02	0.15 A (0.75 W)	0.08 A (2.1 W)
Isolated-type Pulse Input Unit	CS1W-PPS01	0.20 A (1.00 W)	0.16 A (4.2 W)
Isolated-type Analog Output Unit	CS1W-PMV01	0.15 A (0.75 W)	0.16 A (4.2 W)
	CS1W-PMV02	0.12 A (0.60 W)	0.12 A (3.2 W)

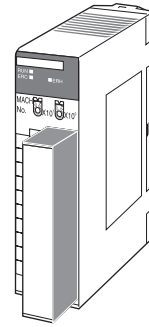
(Reference) Maximum current and total power supplied

Power Supply Unit	Maximum current supplied (power)			Maximum total power
	5 V	26 V	24 V	
C200HW-PA204	4.6 A (23 W)	0.6 A (15.6 W)	None	30 W
C200HW-PA204C	4.6 A (23 W)	0.6 A (15.6 W)	None	30 W
C200HW-PA204S	4.6 A (23 W)	0.6 A (15.6 W)	0.8 A (19.2 W)	30 W
C200HW-PA204R	4.6 A (23 W)	0.6 A (15.6 W)	None	30 W
C200HW-PD024	4.6 A (23 W)	0.6 A (15.6 W)	None	30 W
C200HW-PA209R	9 A (45 W)	1.3 A (33.8 W)	None	45 W
C200HW-PD025	5.3 A	1.3 A	None	40 W
CS1D-PA207R	7 A (35 W)	1.3 A (33.8 W)	None	35 W
CS1D-PD024	4.3 A (21.5 W)	0.56 A (14.6 W)	None	28 W
CS1D-PD025	5.3 A	1.3 A	None	40 W

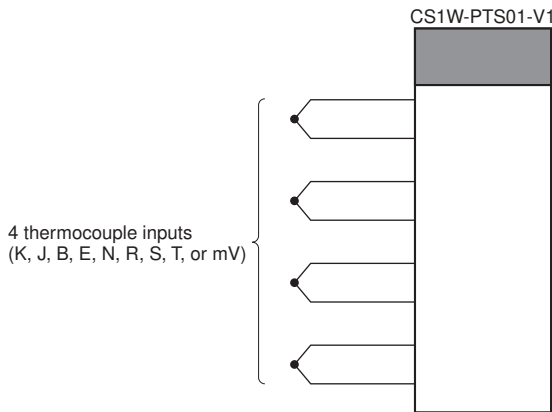
CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit

Overview

The CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit provides four direct thermocouple inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



System Configuration



Specifications

Item		Specifications
Model number		CS1W-PTS01-V1
Applicable PLC		CS Series
Unit type		CS-series Special I/O Unit
Mounting position		CS-series CPU Rack or CS-series Expansion Rack (Cannot be mounted to C200H Expansion I/O Rack or SYSMAC BUS Remote I/O Slave Rack.)
Maximum number of Units		80 (within the allowable current consumption and power consumption range)
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)
Areas for data exchange with CPU Unit	Special I/O Unit Area	10 words/Unit Thermocouple Input Unit to CPU Unit: All process values, process value alarms (LL, L, H, HH), rate-of-change values, rate-of-change alarms (L, H), disconnection alarms, cold junction sensor errors
	DM Area words allocated to Special I/O Units	100 words/Unit CPU Unit to Thermocouple Input Unit: Temperature sensor type, input range (user set), scaling of process value data to be stored in allocated words in CIO area, number of items for moving average, process value alarm setting (LL, L, H, HH), rate-of-change alarm setting (L, H), zero/span adjustment value, etc.
Number of temperature sensor inputs		4
Temperature sensor types		Thermocouple B, E, J, K, N, R, S, T or -80 to 80 mV. (Set separately for each of four inputs.) Sensor type, input range, and scaling to industrial units are separate for each of the 4 inputs. Note: Sensor type, input range, and scaling to industrial units are set in the DM Area.
Input ranges		The input range can be set within any of the measurable input ranges shown in Table 1 (below). Note: Internally, inputs are processed in five ranges (refer to Table 2 below), so accuracy and resolution accord with these internal ranges. Example: Thermocouple: K; input range: 0 to 500°C; industrial unit scaling: 0 to 500°C. DM Area settings are as follows: Thermocouple: 3 (0003 hex) Input signal maximum: 5000 (1388 hex) Input signal minimum: 0 (0000 hex)
Scaling in industrial units		Data to be stored in the allocated words in the CIO area must be scaled (with the minimum and maximum values set). Data can be stored at 0% to 100%. Industrial unit maximum value stored: 500 (01F4 hex) Industrial unit minimum value stored: 0 (0000 hex)
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the actual process data in the input range is stored in four digits hexadecimal (binary values) in the allocated words in the CIO Area. 1) Mean value processing → 2) Scaling → 3) Zero/span adjustment → 4) Output limits

Item	Specifications	
Accuracy (25°C)	±0.1% (of internal range full span) As shown in the following equation, the accuracy depends on the ratio of the selected internal range (0 to 4) span to the set input range span. $\text{Accuracy} = \pm 0.1\% \times \frac{\text{Internal range span (electromotive force conversion)}}{\text{Set input range span (electromotive force conversion)}}$	
Temperature coefficient	±0.015% /°C, for any of internal range numbers 0 to 4.	
Resolution	1/4,096 (of internal range full span) As shown in the following equation, the resolution depends on the ratio of the selected internal range (0 to 4) span to the set input range span. $\text{Resolution} = \frac{1}{4096} \times \frac{\text{Internal range span (electromotive force conversion)}}{\text{Set input range span (electromotive force conversion)}}$	
Cold junction compensation error	±1°C, at 20 ±10°C	
Warmup time	45 min	
Maximum signal input	-80 to 80 mV	
Input impedance	20 kΩ min.	
Input disconnection detection current	0.1 μA (typical)	
Response time	1 s (travel time from input 0% to 90%, for step input)	
Conversion period	150 ms/4 inputs	
Maximum time to store data in CPU Unit	Conversion period + one CPU Unit cycle	
Disconnection detection	Detects disconnections at each input and turns ON the Disconnection Detection Flag. Hardware detection time: Approx. 5 s The process value overrange direction for when a disconnection occurs can be specified. (High: 115% of set input range; low: -15% of set input range)	
Function	Mean value processing (input filter)	Calculates the moving average for the specified number of process values (1 to 16), and stores that value in the CIO Area as the process value.
	Process value alarm	Process value 4-point alarm (HH, H, LL, L), alarm hysteresis, and ON-delay timer (0 to 60 s) are available.
	Rate-of-change calculation	Calculates the amount of change per comparison time interval (1 to 16 s).
	Rate-of-change alarm	Rate-of-change 2-point alarm (H, L), alarm hysteresis (shared with process value alarm), and ON-delay timer (0 to 60 s, shared with process value alarm) are available.
Isolation	Between temperature inputs and between input terminals and PLC signals: Isolation by transformer	
Insulation resistance	20 MΩ (at 500 V DC) between inputs	
Dielectric strength	Between inputs: 1,000 V AC, at 50/60 Hz, for 1 min, leakage current 10 mA max.	
External connections	Terminal block (detachable)	
Unit number settings	Set by rotary switches on front panel, from 0 to 95.	
Indicators	Three LED indicators on front panel (for normal operation, errors detected at the Thermocouple Input Unit, and errors related to the CPU Unit).	
Front panel connector	Sensor input connector terminal block (detachable)	
Effect on CPU Unit cycle time	0.3 ms	
Current consumption	5 V DC at 150 mA max., 26 V DC at 150 mA max.	
Dimensions	35 × 130 × 126 mm (W × H × D) Note: The height including the Backplane is 145 mm.	
Weight	450 g max.	
Standard accessories	Two cold junction sensors (installed in terminal block)	

Sensor Types and Input Ranges

The temperature sensor (thermocouple) type and input range are set in the allocated words in the DM Area for every four inputs. The input range can be set anywhere within the measurable input ranges shown in Table 1.

Table 1: Measurable Input Ranges

Sensor type	DM Area setting	Measurable input range (See note.)
B	0	0 to 1,820°C
E	1	-270 to 1,000°C
J	2	-210 to 1,200°C
K	3	-270 to 1,372°C
N	4	-270 to 1,300°C
R	5	-50 to 1,768°C
S	6	-50 to 1,768°C
T	7	-270 to 400°C
mV	8	-80 to 80 mV

Note: Set the input range in the DM Area within this range.

Inputs are processed internally in five progressive ranges (numbers 0 to 4), as shown in the following table.

Table 2: Internal Ranges

Internal range number	Thermocouple electromotive force	Internal range span
0	-80 to 80 mV	160 mV
1	-40 to 40 mV	80 mV
2	-20 to 20 mV	40 mV
3	-10 to 10 mV	20 mV
4	-5 to 5 mV	10 mV

Therefore, the accuracy and resolution are determined by the ratio of the selected internal range (0 to 4) span to the set input range span (electromotive force converted value). For the internal range, a larger number is selected when both the minimum and maximum values of the range fall within that next range.

For example, suppose that the thermocouple type is K and the set input range is 0 to 800°C. The electromotive force for K 0 to 800°C is 0 to 33.277 mV. Since both the minimum and maximum values fall within the limits for internal range No. 1 (-40 to 40 mV), that range will be selected. The following table shows the set input ranges corresponding to the internal range numbers 0 to 4.

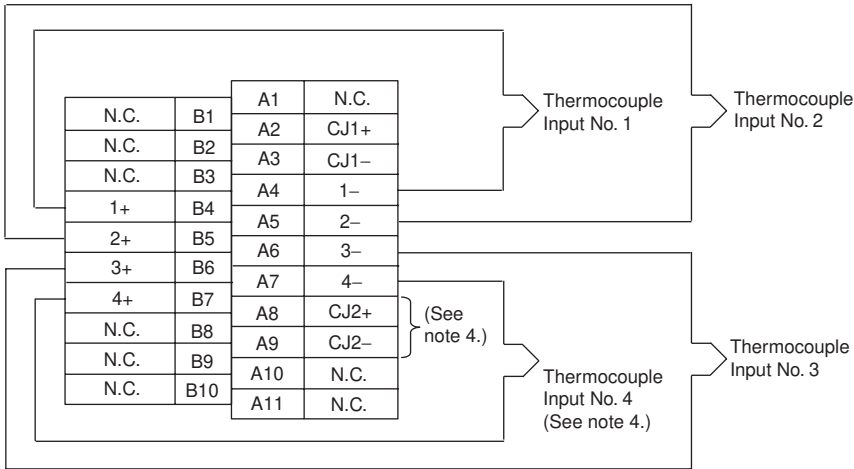
Table 3: Set Input Ranges Corresponding to Internal Ranges

Sensor type	Measurable Input range	Internal range No. 0	Internal range No. 1	Internal range No. 2	Internal range No. 3	Internal range No. 4
		-80 to 80 mV	-40 to 40 mV	-20 to 20 mV	-10 to 10 mV	-5 to 5 mV
B	0 to 1,820°C	Not used.	Not used.	0 to 1,820°C	0 to 1,496°C	0 to 1,030°C
E	-270 to 1,000°C	-270 to 1,000°C	-270 to 537°C	-270 to 286°C	-270 to 153°C	-94 to 80°C
J	-210 to 1,200°C	-210 to 1,200°C	-210 to 713°C	-210 to 366°C	-210 to 186°C	-100 to 95°C
K	-270 to 1,372°C	-270 to 1,372°C	-270 to 967°C	-270 to 484°C	-270 to 246°C	-153 to 121°C
N	-270 to 1,300°C	-270 to 1,300°C	-270 to 1,097°C	-270 to 584°C	-270 to 318°C	-270 to 171°C
R	-50 to 1,768°C	Not used.	-50 to 1,769°C	-50 to 1,684°C	-50 to 961°C	-50 to 548°C
S	-50 to 1,768°C	Not used.	Not used.	-50 to 1,769°C	-50 to 1,035°C	-50 to 576°C
T	-270 to 400°C	Not used.	-270 to 400°C	-270 to 385°C	-270 to 213°C	-166 to 115°C
mV	-80 to 80 mV	-80 to 80 mV	-40 to 40 mV	-20 to 20 mV	-10 to 10 mV	-5 to 5 mV

Note: With Thermocouple Input Units, process values can be scaled in industrial units for the set input range. It is possible to set the process value scaling higher than the resolution, but it will cause the values to be unstable.

Terminal Connection Diagram

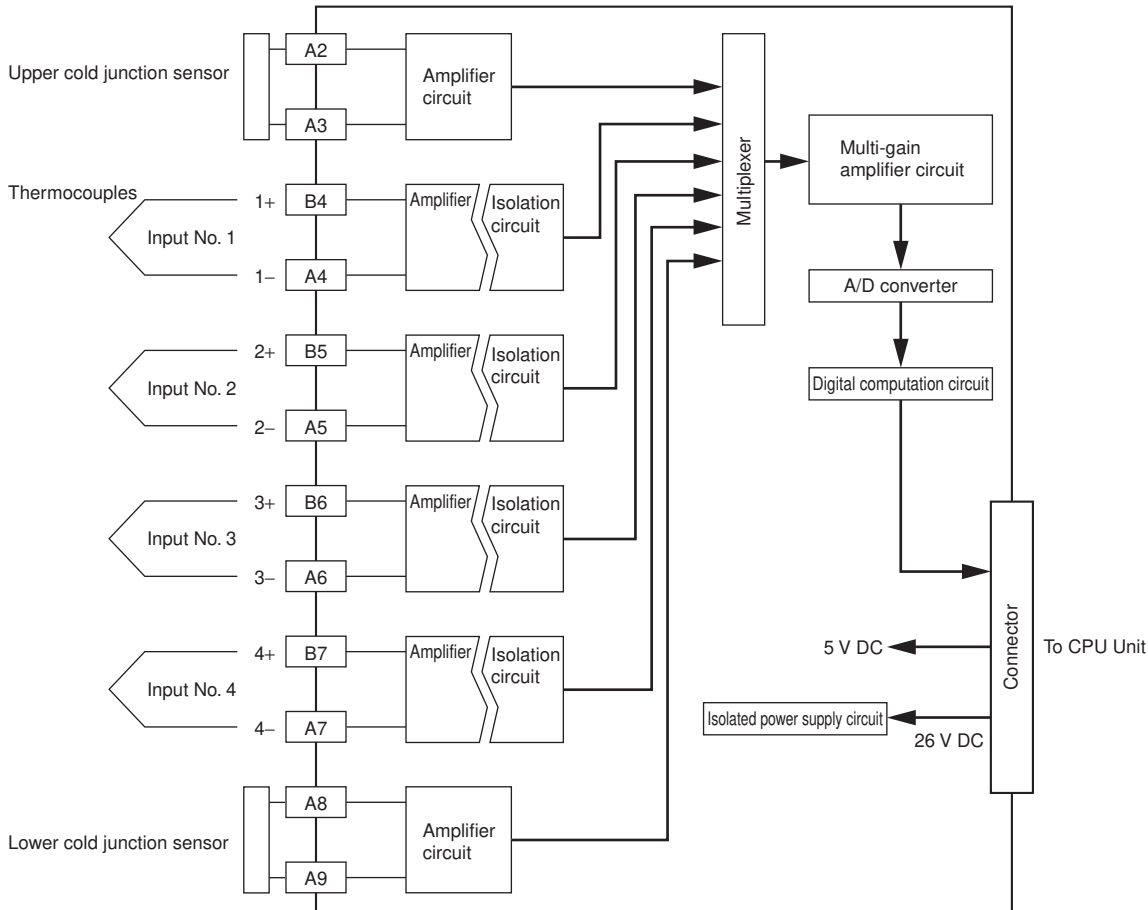
CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit



- Note:**
1. Cold junction sensors are installed between A2 and A3, and between A8 and A9 when the product is shipped. Do not remove them when using the Unit. If they are removed, temperatures cannot be measured correctly because there will be no compensation.
 2. Use the same cold junction sensors that come with the Unit, and leave them just as they are. They are provided specifically for this Unit and its circuitry, and temperatures cannot be measured correctly if they are switched around or if another Unit's sensors are used in their place.
 3. For unused input terminals, short-circuit the positive and negative sides (e.g., terminals A4 and B4 for input No. 1) of the thermocouple inputs with the lead wire.
 4. When connecting input No. 4, remove the cold junction sensor between CJ2+ and CJ2-, and then reconnect it after the input is connected. Attempting to connect the input without removing the cold junction sensor may result in damage to the sensor.

Terminal Block Diagram

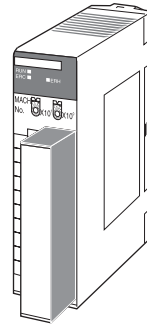
CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit



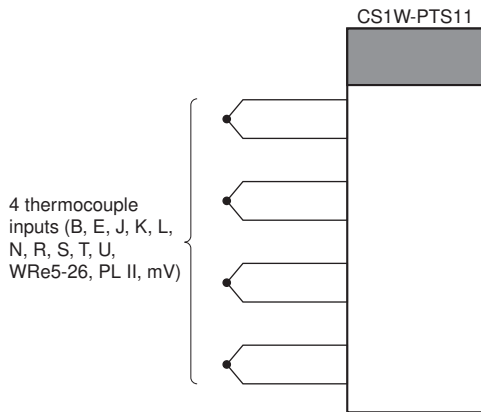
CS1W-PTS11 Isolated-type Thermocouple Input Unit

Overview

The CS1W-PTS11 Isolated-type Thermocouple Input Unit provides four direct thermocouple inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



System Configuration



Specifications

Item		Specifications
Model		CS1W-PTS11
Applicable PLC		CS Series
Unit type		CS-series Special I/O Unit
Mounting position		CS-series CPU Rack or CS-series Expansion Rack (Cannot be mounted to C200H Expansion I/O Rack or SYSMAC BUS Remote I/O Slave Rack.)
Maximum number of Units		80 (within the allowable current consumption and power consumption range)
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)
Areas for data exchange with CPU Unit	Special I/O Unit Area	10 words/Unit Thermocouple Input Unit to CPU Unit: All process values, process value alarms (LL, L, H, HH), rate-of-change values, rate-of-change alarms (L, H), disconnection alarms, cold junction sensor errors
	DM Area words allocated to Special I/O Units	100 words/Unit CPU Unit to Thermocouple Input Unit: Temperature sensor type, input range (user set), scaling of process value data to be stored in allocated words in CIO area, rate-of-change input range, scaling of rate-of-change data, number of items for moving average, process value alarm setting (LL, L, H, HH), rate-of-change alarm setting (L, H), zero/span adjustment value, etc.
	Expansion Control/Monitor Area	35 words/Unit CPU Unit to Thermocouple Input Unit: Designations and flags for beginning or resetting the hold function selection, adjustment period control, etc. Thermocouple Input Unit to CPU Unit: Adjustment period notices (with each input), peak and bottom values, top and valley values
	Expansion Setting Area	46 words/Unit CPU Unit to Thermocouple Input Unit: Expansion Control/Monitor Area settings, adjustment period control, peak and bottom detection, top and valley detection
Number of temperature sensor inputs		4
Temperature sensor types		The sensor type, input range, and scaling can be set individually for each of 4 inputs, which are each selectable from B, E, J, K, L, N, R, S, T, U, WR5-26, PL II, and mV.
Scaling		Data to be stored in the allocated words in the CIO area must be scaled (individually for each of the 4 inputs, with the minimum and maximum values set). Data can be stored at 0% to 100%.
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the actual process data in the input range is stored in four digits hexadecimal (binary values) in the allocated words in the CIO Area. 1) Mean value processing → 2) Scaling → 3) Zero/span adjustment → 4) Output limits
Accuracy (25°C)		±0.05% (Depends on the Sensor used and the measured temperature. Refer to <i>Accuracy by Sensor Type and Measured Temperature Range</i> on page 13 for details.)
Temperature coefficient		±0.01% /°C (For full scale of electromotive force. See note.)
Resolution		1/64,000
Cold junction compensation error		±1°C, at 20°C±10°C
Warmup time		45 min
Maximum signal input		±120 mV
Input impedance		20 kΩ min.
Input disconnection detection current		0.1 μA (typical)
Response time		100 ms (travel time from input 0% to 90%, for ±100 mV step input and with moving average for 4 samples)
Conversion period		20 ms/4 inputs, 10 ms/2 inputs. Can be switched in DM Area words allocated to the Unit as a Special I/O Unit.
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle
Disconnection detection		Detects disconnections at each input and turns ON the Disconnection Detection Flag. Hardware detection time: Approx. 0.5 s max. The process value overrange direction for when a disconnection occurs can be specified. (High: 115% of set input range; low: -15% of set input range)
Function	Mean value processing (input filter)	Calculates the moving average for the specified number of process values (1 to 128), and stores that value in the CIO Area as the process value.
	Process value alarm	Process value 4-point alarm (HH, H, LL, L), alarm hysteresis, and ON-delay timer (0 to 60 s) are available.
	Rate-of-change calculation	Calculates the amount of change per comparison time interval (1 to 16 s).
	Rate-of-change alarm	Rate-of-change 2-point alarm (H, L), alarm hysteresis (shared with process value alarm), and ON-delay timer (0 to 60 s, shared with process value alarm) are available.
	Adjustment period control	When zero/span adjustment is executed, the date is internally recorded at the Unit. When the preset zero/span adjustment period and number of days notice have elapsed, this function turns ON a warning flag to give notice that it is time for readjustment.
	Peak and bottom detection	This function detects the maximum (peak) and minimum (bottom) analog input values, from when the Hold Start Bit (output) allocated to the Expansion Control/Monitor Area turns ON until it turns OFF, and stores them in the Expansion Control/Monitor Area.
	Top and valley detection	This function detects the top and valley values for analog inputs, from when the Hold Start Bit (output) allocated to the Expansion Control/Monitor Area turns ON until it turns OFF, and stores them in the Expansion Control/Monitor Area.
Isolation		Between inputs and PLC signals, and between inputs: Isolation by transformer for power supply, and by photocoupler for signals.
Insulation resistance		20 MΩ (at 500 V DC) between inputs
Dielectric strength		Between inputs: 1,000 V AC, at 50/60 Hz, for 1 min, leakage current 10 mA max.

Item	Specifications
External connections	Terminal block (detachable)
Unit number settings	Set by rotary switches on front panel, from 0 to 95.
Indicators	Three LED indicators on front panel (for normal operation, errors detected at the Thermocouple Input Unit, and errors related to the CPU Unit).
Front panel connector	Sensor input connector terminal block (detachable)
Effect on CPU Unit cycle time	0.3 ms
Current consumption (supplied from Power Supply Unit)	5 V DC at 120 mA max., 26 V DC at 80 mA max.
Dimensions	35 × 130 × 126 mm (W × H × D) Note: The height including the Backplane is 145 mm.
Weight	450 g max.
Standard accessories	Two cold junction sensors (mounted to terminal block)

Note: The method for calculating the error in temperature measurements, including the temperature coefficient, is given below. The "full scale of electromotive force" is the difference between the high limit and low limit converted to electromotive force for each thermocouple.

Example

Ambient temperature: 30 °C

Temperature Sensor: K thermocouple (-270 to 1,372 °C)

Measured temperature: 500 °C

From electromotive force table

-270 °C: -6.458 mV

1,372 °C: 54.86 mV

Full scale: 61.344

Electromotive conversion of temperature coefficient:

$61.344 \text{ mV} \times \pm 0.01\%/^{\circ}\text{C} = \pm 6.13 \text{ }\mu\text{V}/^{\circ}\text{C}$

Error in electromotive force at 30°C:

$\pm 6.13 \text{ }\mu\text{V}/^{\circ}\text{C} \times (30^{\circ}\text{C} - 25^{\circ}\text{C}) = 30.65 \text{ }\mu\text{V}/^{\circ}\text{C}$

Temperature difference between measurement point and terminals on Unit (ambient temperature) (based on ambient temperature of 30 °C and Measured temperature of 500 °C):

470 °C

Electromotive force per °C at a measured temperature of 470 °C (from the electromotive force tables for a K thermocouple):

43 $\mu\text{V}/^{\circ}\text{C}$

Error in temperature coefficient: $\pm 30.65 \text{ }\mu\text{V} \div 43 \text{ }\mu\text{V}/^{\circ}\text{C} = \pm 0.7^{\circ}\text{C}$

Error in measured temperature = Accuracy ± Error from temperature coefficient + Error in cold junction compensation = $\pm 0.8^{\circ}\text{C} + \pm 0.7^{\circ}\text{C} + \pm 1.0^{\circ}\text{C} = \pm 2.5^{\circ}\text{C}$

Sensor Type and Input Range

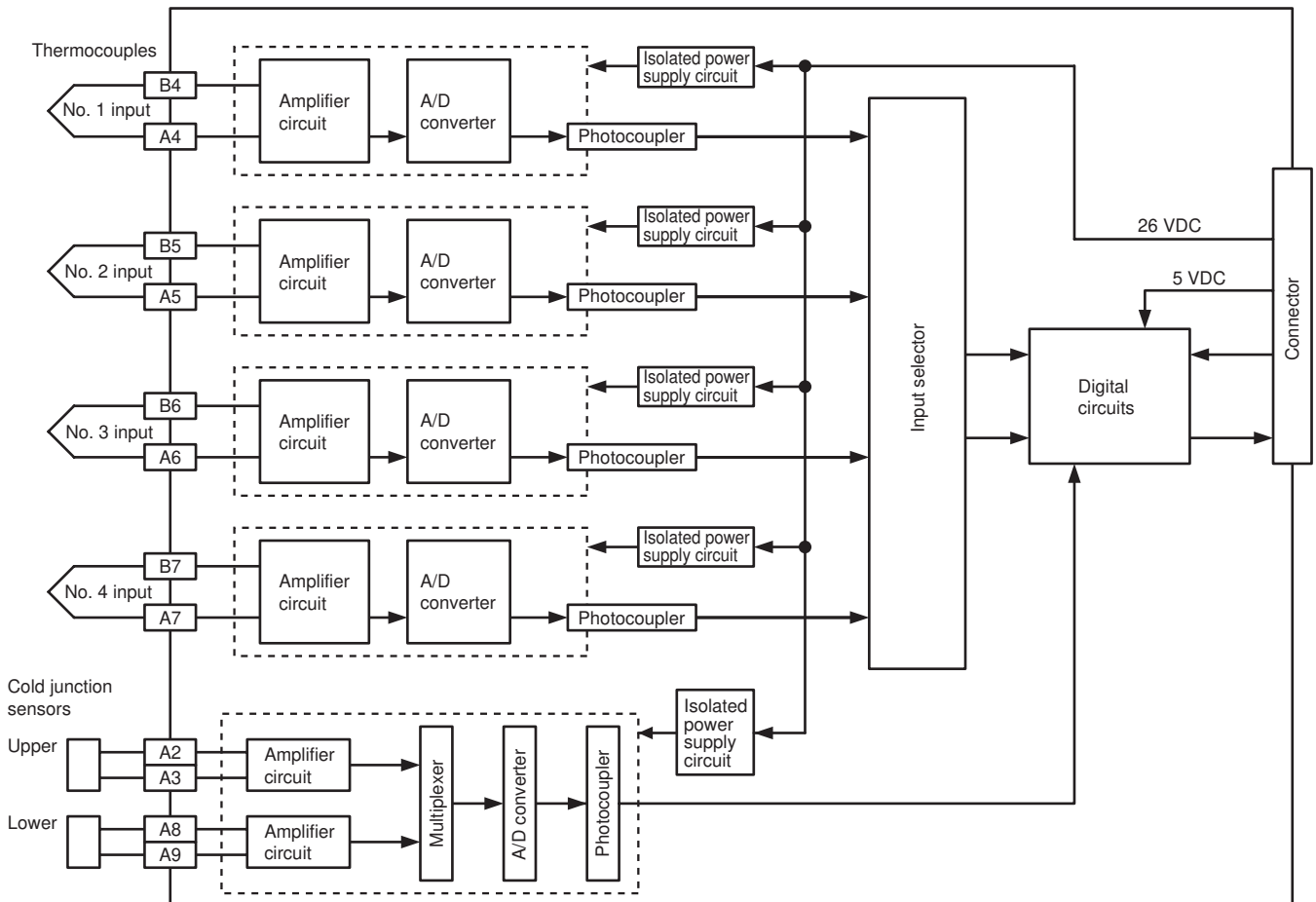
The Temperature Sensor type and input range are set in the allocated words in the DM Area for every four inputs. The input range can be set anywhere within the measurable input ranges shown in the following table. Accuracy and resolution, however, are not determined from the set input range, but rather from the measurable input range shown in the following table. Therefore, accuracy and resolution do not change even when a narrow input range is set.

Sensor type	DM Area setting	Measurable input range
B	0	0 to 1,820°C
E	1	-270 to 1,000°C
J	2	-210 to 1,200°C
K	3	-270 to 1,372°C
N	4	-270 to 1,300°C
R	5	-50 to 1,768°C
S	6	-50 to 1,768°C
T	7	-270 to 400°C
mV	8	-100 to 100 mV
L	9	-200 to 900°C
U	10	-200 to 600°C
WRe5-26	11	0 to 2,300°C
PLII	12	0 to 1,300°C

Accuracy by Sensor Type and Measured Temperature Range

Sensor type	Temperature range	Standard accuracy	Details
B	0 to 1,820°C	±1.8°C (±0.1%)	400 to 800°C: ±3°C Less than 400°C: Accuracy is not specified.
E	-270 to 1,000°C	±0.6°C (±0.05%)	-250 to 200°C: ±1.2°C Less than -250°C: Accuracy is not specified.
J	-210 to 1,200°C	±0.7°C (±0.05%)	
K	-270 to 1,372°C	±0.8°C (±0.05%)	-250 to 200°C: ±2°C Less than -250°C: Accuracy is not specified.
N	-270 to 1,300°C	±0.8°C (±0.05%)	-200 to 150°C: ±1.6°C Less than -200°C: Accuracy is not specified.
R	-50 to 1,769°C	±1.8°C (±0.1%)	0 to 100°C: ±2.5°C Less than 0°C: Accuracy is not specified.
S	-50 to 1,769°C	±1.8°C (±0.1%)	0 to 100°C: ±2.5°C Less than 0°C: 3.2°C
T	-270 to 400°C	±0.35°C (±0.05%)	-180 to 0°C: ±0.7°C -200 to -180°C: ±1.3°C Less than -200°C: Accuracy is not specified.
L	-200 to 900°C	±0.5°C (±0.05%)	
U	-200 to 600°C	±0.4°C (±0.05%)	-100 to 0°C: ±0.5°C Less than -100°C: ±0.7°C
WRe5-26	0 to 2,315°C	±1.2°C (±0.05%)	More than 2,200°C: ±1.4°C
PLII	0 to 1,395°C	±0.7°C (±0.05%)	

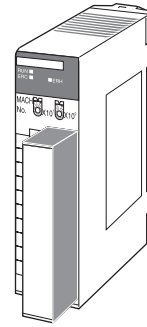
Terminal Block Diagram



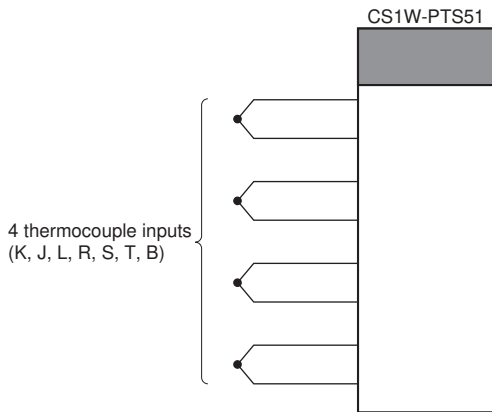
CS1W-PTS51 Isolated-type Thermocouple Input Unit

Overview

The CS1W-PTS51 Isolated-type Thermocouple Input Unit provides four direct thermocouple inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



System Configuration



Specifications

Item		Specifications
Model		CS1W-PTS51
Applicable PLC		CS Series
Unit type		CS-series Special I/O Unit
Mounting position		CS-series CPU Rack or CS-series Expansion Rack (Cannot be mounted to C200H Expansion I/O Rack or SYSMAC BUS Remote I/O Slave Rack.)
Maximum number of Units		80 (within the allowable current consumption and power consumption range)
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)
Areas for data exchange with CPU Unit	Special I/O Unit Area	10 words/Unit Isolated-type Thermocouple Input Unit to CPU Unit: All process values, process value alarms (L, H), conversion data enabled flags, sensor errors, cold junction sensor errors
	DM Area words allocated to Special I/O Units	100 words/Unit CPU Unit to Isolated-type Thermocouple Input Unit: Temperature sensor type, input range (user set), process value alarm setting (L, H), zero/span adjustment value.
Number of temperature sensor inputs		4
Temperature sensor types		The sensor type be set individually for each of 4 inputs, which are each selectable from K, J, L, R, S, T, B.
Data storage in the CIO Area		The actual process data in the input range is stored in four digits hexadecimal (binary or BCD values) in the allocated words in the CIO Area.
Accuracy (25°C) (See note.)		With Celsius selected: $\pm 0.3\%$ of PV or $\pm 1^\circ\text{C}$, whichever is greater, ± 1 digit max. With fahrenheit selected: $\pm 0.3\%$ of PV or $\pm 2^\circ\text{F}$, whichever is greater, ± 1 digit max. However, the accuracy of K and T at -100°C or lower and L is $\pm 2^\circ\text{C} \pm 1$ digit max. The accuracy of R and S at 200°C or lower is $\pm 3^\circ\text{C} \pm 1$ digit max. The accuracy of B at 400°C or lower is not specified. PV: Process value data
Temperature characteristic		Refer to <i>Temperature Characteristics According to Thermocouple Type</i> on page 16.
Warmup time		30 min
Conversion period		250 ms/4 inputs.
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle
Sensor error detection		Detects sensor error at each input and turns ON the Sensor error Flag. Hardware detection time: Approx. 0.5 s max. The process value overrange direction for when a sensor error occurs can be specified. (High: Set input range $+20^\circ\text{C}$ or $+20^\circ\text{F}$; low: Set input range -20°C or -20°F)

Item		Specifications
Functions	Process value alarm	Process value 2-point alarm (HH, H, LL, L), alarm hysteresis, and ON-delay timer (0 to 60 s) are available. External alarm outputs: One per input (H or L).
	External alarm outputs	NPN outputs (with short-circuit protection) External power supply voltage: 20.4 to 26.4 V DC Max. switching capacity: 100 mA (for one output) Leakage current: 0.3 mA max. Residual voltage: 3 V max.
Isolation		Between inputs and PLC signals: Transformer for power supply and photocoupler for signals. Between each input: Transformer for power supply and photocoupler for signals.
Insulation resistance		20 MΩ max. (at 500 V DC). Between all output and NC terminals and external AC terminals (Power Supply Unit) Between all input terminals and external AC terminals (Power Supply Unit) Between all input terminals and all output terminals Between all external DC terminals (input, output, and NC terminals) and FG plate Between all input and output terminals and all NC terminals
Dielectric strength		Between all output and NC terminals and external AC terminals (Power Supply Unit) 2,000 VAC, 50/60 Hz 1 min., detection current: 1 mA Between all input terminals and external AC terminals (Power Supply Unit) Between all input terminals and all output terminals Between all external DC terminals (input, output, and NC terminals) and FG plate 1,000 VAC, 50/60 Hz 1 min., detection current: 1 mA Between all channels 500 VAC, 50/60 Hz 1 min., detection current: 1 mA
External connections		Terminal block (detachable)
Unit number settings		Set by rotary switches on front panel, from 0 to 95.
Indicators		Seven LED indicators on front panel (for normal operation, errors detected at the Thermocouple Input Unit, errors related to the CPU Unit, and four indicators for external alarm outputs.)
Effect on CPU Unit cycle time		0.4 ms
Current consumption (supplied from Power Supply Unit)		5 V DC at 250 mA max.
Dimensions		35 × 130 × 126 mm (W × H × D) Note: The height including the Backplane is 145 mm.
Weight		450 g max.

Note: The heat generated by a Unit will dramatically change the accuracy specifications when more than one C200HW-PA209R or CS1W-ID291 Unit is mounted side-by-side.
The following accuracy specifications apply under such conditions.
With Celsius selected:
±0.3% of PV or ±1.3°C, whichever is greater, ±1 digit max.
With Fahrenheit selected:
±0.3% of PV or ±3°F, whichever is greater, ±1 digit max.
However, the accuracy of K and T at -100°C or less and L is ±3°C ±1 digit max. The accuracy of R and S at 200°C or less is ±4°C ±1 digit max.
The accuracy of B at 400°C or less is not specified.

Sensor Type and Input Range

The Temperature Sensor type and input range are set in the allocated words in the DM Area for every four inputs. The measurable data range is ±20 digits wider than the sensor input range.

Set-ting	Input	°C			°F		
		16-bit binary	BCD		16-bit binary	BCD	
			□□□□ indicates minus sign.	Leftmost bit indicates minus sign.		□□□□ indicates minus sign.	Leftmost bit indicates minus sign.
0	K: -200 to 1300°C (-300 to 2300°F)	FF38 to FFFF to 0514 (-200 to -1 to 1300)	F200 to 1300 (-200 to 1300)	8200 to 1300 (-200 to 1300)	FED4 to FFFF to 08FC (-300 to -1 to 2300)	F300 to 2300 (-300 to 2300)	F300 to 2300 (-300 to 2300)
1	K: 0.0 to 500°C (0.0 to 900.0°F)	0000 to 1388 (0.0 to 500.0)	0000 to 5000 (0.0 to 500.0)	0000 to 5000 (0.0 to 500.0)	0000 to 2328 (0.0 to 900.0)	0000 to 9000 (0.0 to 900.0)	0000 to 7999 (See note 3.) (0.0 to 799.9)
2	J: -100 to 850°C (-100 to 1500°F)	FF9C to FFFF to 0352 (-100 to -1 to 850)	F100 to 0850 (-100 to 850)	8100 to 0850 (-100 to 850)	FF9C to FFFF to 05DC (-100 to -1 to 1500)	F100 to 1500 (-100 to 1500)	8100 to 1500 (-100 to 1500)
3	J: 0.0 to 400.0°C (0.0 to 750.0°F)	0000 to 0FA0 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 1D4C (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)
4	T: -200 to 400°C (-300 to 700.0°F)	F830 to FFFF to 0FA0 (-200.0 to -0.1 to 400.0)	F999 to 4000 (See note 3.) (-99.9 to 400.0)	A000 to 4000 (-200.0 to 400.0)	F448 to FFFF to 1B58 (-300.0 to -0.1 to 700.0)	F999 to 7000 (See note 3.) (-99.9 to 700.0)	B000 to 7000 (-300.0 to 700.0)
5	L: -100 to 850°C (-100 to 1500°F)	FF9C to FFFF to 0352 (-100 to -1 to 850)	F100 to 0850 (-100 to 850)	8100 to 0850 (-100 to 850)	FF9C to FFFF to 05DC (-100 to -1 to 1500)	F100 to 1500 (-100 to 1500)	8100 to 1500 (-100 to 1500)
6	L: 0.0 to 400.0°C (0.0 to 750.0°F)	0000 to 0FA0 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 1D4C (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)
7	R: 0 to 1700°C (0 to 3000°F)	0000 to 06A4 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 0BB8 (0 to 3000)	0000 to 3000 (0 to 3000)	0000 to 3000 (0 to 3000)
8	S: 0 to 1700°C (0 to 3000°F)	0000 to 06A4 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 0BB8 (0 to 3000)	0000 to 3000 (0 to 3000)	0000 to 3000 (0 to 3000)
9	B: 400 to 1800°C (See note 2.) (750 to 3200°F)	0190 to 0708 (400 to 1800)	0400 to 1800 (400 to 1800)	0400 to 1800 (400 to 1800)	02EE to 0C80 (750 to 3200)	0750 to 3200 (750 to 3200)	0750 to 3200 (750 to 3200)

- Note:**
- If the indication range is exceeded, a sensor error will occur and the sensor error bit will turn ON. The process value will be clamped at the lower or upper limit of the indication range, depending on the setting for data direction at sensor error.
 - The lower limit for B thermocouples is 0°C/°F.
 - The indicator range for BCD display will be clamped at the lower (or upper) limit in the region between the lower (or upper) limit of the setting range and the point where a sensor error occurs.
 For 0.1°C/0.1°F indication with minus sign indicated by leftmost 4 bits (bits 12 to 15): Lower limit = -99.9, Upper limit = 999.9.
 For 0.1°C/0.1°F indication with minus sign indicated by leftmost bit (bit 15): Lower limit = -799.9, Upper limit = 799.9.

Temperature Characteristics According to Thermocouple Type

Thermocouple	Temperature range	Set value error when ambient temperature changes by 1°C
R	0 to 200°C	±0.43°C
	200 to 1,000°C	±0.29°C
	1,000 to 1,700°C	±285 ppm of PV
S	0 to 200°C	±0.43°C
	200 to 1,000°C	±0.29°C
	1,000 to 1,700°C	285 ppm of PV
B	400°C or less	Not specified.
	400 to 800°C	±0.43°C
	800 to 1,000°C	±0.29°C
	1,000 to 1,800°C	285 ppm of PV
K	-200 to -100°C	±0.29°C
	-100 to 400°C	±0.11°C
	400 to 1,300°C	±285 ppm of PV
J	-100 to 400°C	±0.11°C
	400 to 850°C	±285 ppm of PV
T	-200 to -100°C	±0.29°C
	-100 to 400°C	±0.11°C
L	-100 to 400°C	±0.11°C
	400 to 850°C	±285 ppm of PV

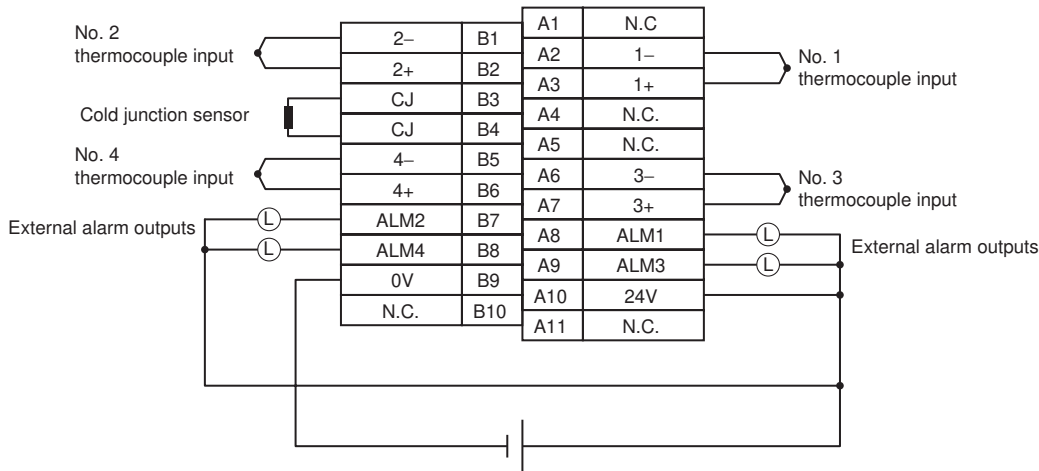
The measured temperature error is calculated as shown in the following example.

Item	Details
Ambient temperature	30°C
Thermocouple type	K
Measured temperature (PV)	500°C
Reference accuracy (25°C)	±0.3°C of PV or ±1°C, whichever is greater, ±1 digit. In this example, ±1.5°C.
Temperature characteristics	400 to 1,300°C: 285 ppm of PV. In this example, 285 ppm × 500°C = 0.143°C.
Change in ambient temperature	5°C (25 to 30°C).

Overall accuracy =

Reference accuracy + Temperature characteristic × Change in ambient temperature = ±1.5°C + ±0.143°C × 5 = Approx. ±2.2°C ± 1 digit.

Terminal Connection Diagram

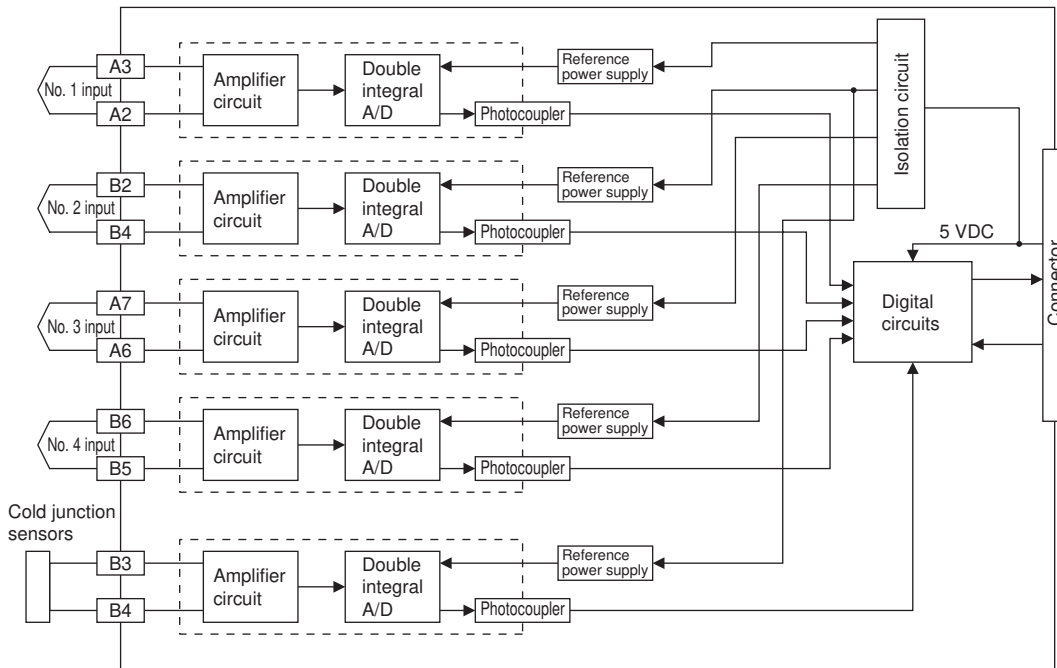


Note: Action for Unused Input Terminals

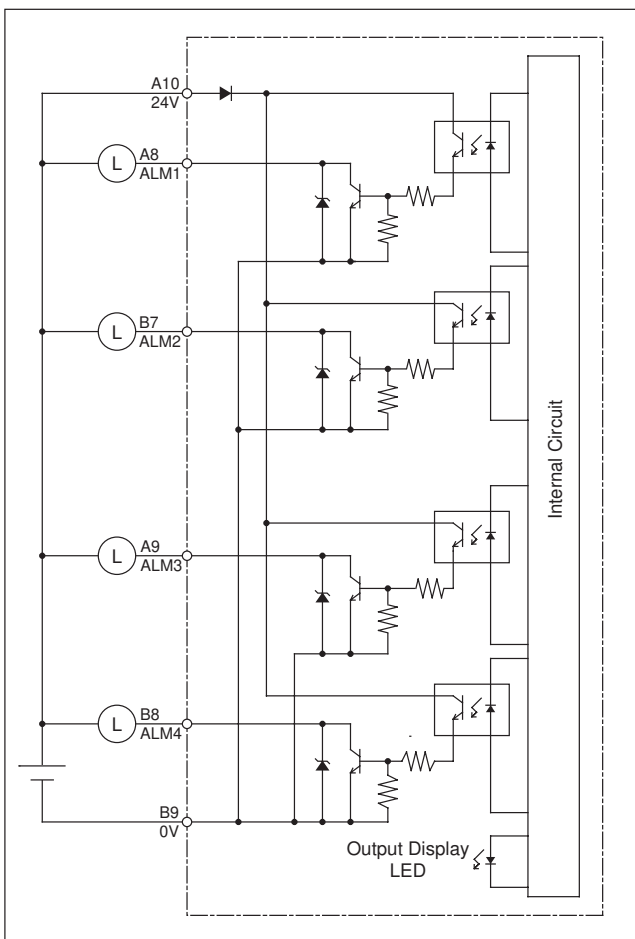
- Short-circuit the positive (+) and negative (-) sides of the thermocouple input section using a lead wire. For example, short terminals A3 and A2 for No. 1 thermocouple input.
- Cold junction sensors are mounted before shipment. If one of the cold junction sensors is disconnected, cold junction compensation will stop and correct measurement of temperatures cannot be made. Always make sure the cold junction sensors are connected when using the Units.
- Cold junction sensors are calibrated separately for each Unit and connected circuit, so correct temperatures will not be measured if a cold junction sensor from another Unit is used or if the two cold junction sensors in a Unit are swapped. Use the cold junction sensors as they are provided, without making any changes.
- Do not connect anything to NC terminals. Do not use NC terminals as relay terminals.
- Always ground the GR terminal on the Power Supply Unit of the PLC.
- If the input device uses a voltage generator, temperature compensator, or similar device, then ground the input device if it has a ground terminal.

Terminal Block Diagram

Input Circuits



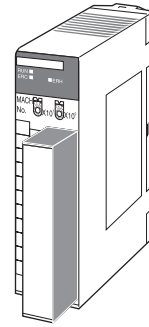
Output Circuits



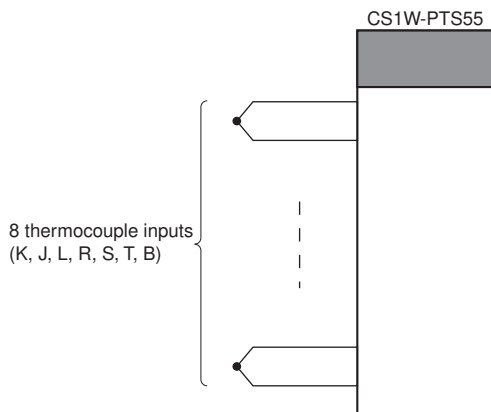
CS1W-PTS55 Isolated-type Thermocouple Input Unit

Overview

The CS1W-PTS55 Isolated-type Thermocouple Input Unit provides 8 direct thermocouple inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



System Configuration



Specifications

Item		Specifications
Model		CS1W-PTS55
Applicable PLC		CS Series
Unit type		CS-series Special I/O Unit
Mounting position		CS-series CPU Rack or CS-series Expansion Rack (Cannot be mounted to C200H Expansion I/O Rack or SYSMAC BUS Remote I/O Slave Rack.)
Maximum number of Units		80 (within the allowable current consumption and power consumption range)
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)
Areas for data exchange with CPU Unit	Special I/O Unit Area	10 words/Unit Isolated-type Thermocouple Input Unit to CPU Unit: All process values, process value alarms (L, H), conversion data enabled flags, sensor errors, cold junction sensor errors
	DM Area words allocated to Special I/O Units	100 words/Unit CPU Unit to Isolated-type Thermocouple Input Unit: Temperature sensor type, input range (user set), process value alarm setting (L, H), zero/span adjustment value.
	Expansion Setting Area	1 word/Unit CPU Unit to Isolated-type Thermocouple Input Unit: Process Value Alarm
Number of temperature sensor inputs		8
Temperature sensor types		The sensor type be set individually for each of 8 inputs, which are each selectable from K, J, L, R, S, T, B ("Not used" can be selected).
Data storage in the CIO Area		The actual process data in the input range is stored in four digits hexadecimal (binary or BCD values) in the allocated words in the CIO Area.
Accuracy (25°C)		With Celsius selected: $\pm 0.3\%$ of PV or $\pm 1^\circ\text{C}$, whichever is greater, ± 1 digit max. With Fahrenheit selected: $\pm 0.3\%$ of PV or $\pm 2^\circ\text{F}$, whichever is greater, ± 1 digit max. However, the accuracy of K and T at -100°C or lower and L is $\pm 2^\circ\text{C} \pm 1$ digit max. The accuracy of R and S at 200°C or lower is $\pm 3^\circ\text{C} \pm 1$ digit max. The accuracy of B at 400°C or lower is not specified. PV: Process value data
Temperature characteristic		Refer to <i>Temperature Characteristics According to Thermocouple Type</i> on page 21.
Warmup time		30 min
Conversion period		250 ms/8 inputs.
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle
Sensor error detection		Detects sensor error at each input and turns ON the Sensor error Flag. Hardware detection time: Approx. 0.5 s max. The process value overrange direction for when a sensor error occurs can be specified. (High: Set input range $+20^\circ\text{C}$ or $+20^\circ\text{F}$; low: Set input range -20°C or -20°F)
Functions	Process value alarm	Process value 2-point alarm (H, L), alarm hysteresis, and ON-delay timer (0 to 60 s) are available. Two alarms per input (H, L) can be output to addresses in the CIO Area specified in the Expansion Setting Area.
Isolation		Between inputs and PLC signals: Transformer for power supply and photocoupler for signals. Between each input: Transformer for power supply and photocoupler for signals.
Insulation resistance		20 M Ω max. (at 500 V DC). Between all input terminals and external AC terminals (Power Supply Unit) Between all external DC terminals (input and NC terminals) and FG plate Between all input and all NC terminals
Dielectric strength		Between NC terminals and external AC terminals (Power Supply Unit) 2,000 VAC, 50/60 Hz 1 min., detection current: 1 mA Between all input terminals and external AC terminals (Power Supply Unit) Between all external DC terminals (input and NC terminals) and FG plate 1000 VAC, 50/60 Hz 1 min., detection current: 1 mA Between all channels 500 VAC, 50/60 Hz 1 min., detection current: 1 mA
External connections		Terminal block (detachable)
Unit number settings		Set by rotary switches on front panel, from 0 to 95.
Indicators		Three LED indicators on front panel (for normal operation, errors detected at the Unit, errors related to the CPU Unit)
Effect on CPU Unit cycle time		0.4 ms
Current consumption (supplied from Power Supply Unit)		5 V DC at 180 mA max. 26 V DC at 60 mA max.
Dimensions		35 × 130 × 126 mm (W × H × D) Note: The height including the Backplane is 145 mm.
Weight		450 g max.

Sensor Type and Input Range

The Temperature Sensor type and input range are set in the allocated words in the DM Area for every four inputs.

The measurable data range is ± 20 digits wider than the sensor input range.

Set-ting	Input	°C			°F		
		16-bit binary	BCD		16-bit binary	BCD	
			□□□□ indicates minus sign.	Leftmost bit indicates minus sign.		□□□□ indicates minus sign.	Leftmost bit indicates minus sign.
0	K: -200 to 1300°C (-300 to 2300°F)	FF38 to FFFF to 0514 (-200 to -1 to 1300)	F200 to 1300 (-200 to 1300)	8200 to 1300 (-200 to 1300)	FED4 to FFFF to 08FC (-300 to -1 to 2300)	F300 to 2300 (-300 to 2300)	F300 to 2300 (-300 to 2300)
1	K: 0.0 to 500°C (0.0 to 900.0°F)	0000 to 1388 (0.0 to 500.0)	0000 to 5000 (0.0 to 500.0)	0000 to 5000 (0.0 to 500.0)	0000 to 2328 (0.0 to 900.0)	0000 to 9000 (0.0 to 900.0)	0000 to 7999 (See note 3.) (0.0 to 799.9)
2	J: -100 to 850°C (-100 to 1500°F)	FF9C to FFFF to 0352 (-100 to -1 to 850)	F100 to 0850 (-100 to 850)	8100 to 0850 (-100 to 850)	FF9C to FFFF to 05DC (-100 to -1 to 1500)	F100 to 1500 (-100 to 1500)	8100 to 1500 (-100 to 1500)
3	J: 0.0 to 400.0°C (0.0 to 750.0°F)	0000 to 0FA0 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 1D4C (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)
4	T: -200 to 400°C (-300 to 700.0°F)	F830 to FFFF to 0FA0 (-200.0 to -0.1 to 400.0)	F999 to 4000 (See note 3.) (-99.9 to 400.0)	A000 to 4000 (-200.0 to 400.0)	F448 to FFFF to 1B58 (-300.0 to -0.1 to 700.0)	F999 to 7000 (See note 3.) (-99.9 to 700.0)	B000 to 7000 (-300.0 to 700.0)
5	L: -100 to 850°C (-100 to 1500°F)	FF9C to FFFF to 0352 (-100 to -1 to 850)	F100 to 0850 (-100 to 850)	8100 to 0850 (-100 to 850)	FF9C to FFFF to 05DC (-100 to -1 to 1500)	F100 to 1500 (-100 to 1500)	8100 to 1500 (-100 to 1500)
6	L: 0.0 to 400.0°C (0.0 to 750.0°F)	0000 to 0FA0 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 4000 (0.0 to 400.0)	0000 to 1D4C (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)	0000 to 7500 (0.0 to 750.0)
7	R: 0 to 1700°C (0 to 3000°F)	0000 to 06A4 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 0BB8 (0 to 3000)	0000 to 3000 (0 to 3000)	0000 to 3000 (0 to 3000)
8	S: 0 to 1700°C (0 to 3000°F)	0000 to 06A4 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 1700 (0 to 1700)	0000 to 0BB8 (0 to 3000)	0000 to 3000 (0 to 3000)	0000 to 3000 (0 to 3000)
9	B: 400 to 1800°C (See note 2.) (750 to 3200°F)	0190 to 0708 (400 to 1800)	0400 to 1800 (400 to 1800)	0400 to 1800 (400 to 1800)	02EE to 0C80 (750 to 3200)	0750 to 3200 (750 to 3200)	0750 to 3200 (750 to 3200)

Note: 1. If the indication range is exceeded, a sensor error will occur and the sensor error bit will turn ON. The process value will be clamped at the lower or upper limit of the indication range, depending on the setting for data direction at sensor error.

2. The lower limit for B thermocouples is 0°C/°F.

3. The indicator range for BCD display will be clamped at the lower (or upper) limit in the region between the lower (or upper) limit of the setting range and the point where a sensor error occurs.

For 0.1°C/0.1°F indication with minus sign indicated by leftmost 4 bits (bits 12 to 15): Lower limit = -99.9, Upper limit = 999.9.

For 0.1°C/0.1°F indication with minus sign indicated by leftmost bit (bit 15): Lower limit = -799.9, Upper limit = 799.9.

Temperature Characteristics According to Thermocouple Type

Thermocouple	Temperature range	Set value error when ambient temperature changes by 1°C
R	0 to 200°C	$\pm 0.43^\circ\text{C}$
	200 to 1,000°C	$\pm 0.29^\circ\text{C}$
	1,000 to 1,700°C	± 285 ppm of PV
S	0 to 200°C	$\pm 0.43^\circ\text{C}$
	200 to 1,000°C	$\pm 0.29^\circ\text{C}$
	1,000 to 1,700°C	285 ppm of PV
B	400°C or less	Not specified.
	400 to 800°C	$\pm 0.43^\circ\text{C}$
	800 to 1,000°C	$\pm 0.29^\circ\text{C}$
	1,000 to 1,800°C	285 ppm of PV
K	-200 to -100°C	$\pm 0.29^\circ\text{C}$
	-100 to 400°C	$\pm 0.11^\circ\text{C}$
	400 to 1,300°C	± 285 ppm of PV
J	-100 to 400°C	$\pm 0.11^\circ\text{C}$
	400 to 850°C	± 285 ppm of PV
T	-200 to -100°C	$\pm 0.29^\circ\text{C}$
	-100 to 400°C	$\pm 0.11^\circ\text{C}$
L	-100 to 400°C	$\pm 0.11^\circ\text{C}$
	400 to 850°C	± 285 ppm of PV

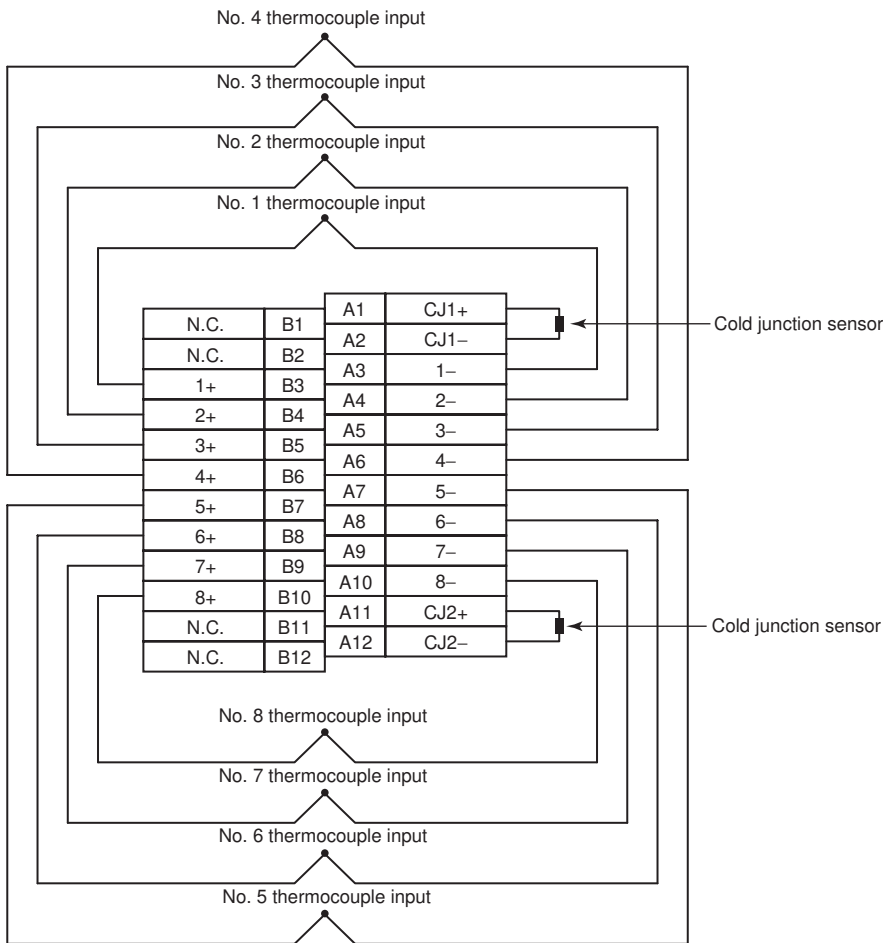
The measured temperature error is calculated as shown in the following example.

Item	Details
Ambient temperature	30°C
Thermocouple type	K
Measured temperature (PV)	500°C
Reference accuracy (25°C)	±0.3°C of PV or ±1°C, whichever is greater, ±1 digit. In this example, ±1.5°C.
Temperature characteristics	400 to 1,300°C: 285 ppm of PV. In this example, 285 ppm × 500°C = 0.143°C.
Change in ambient temperature	5°C (25 to 30°C).

Overall accuracy =

Reference accuracy + Temperature characteristic × Change in ambient temperature = ±1.5°C + ±0.143°C × 5 = Approx. ±2.2°C ±1 digit.

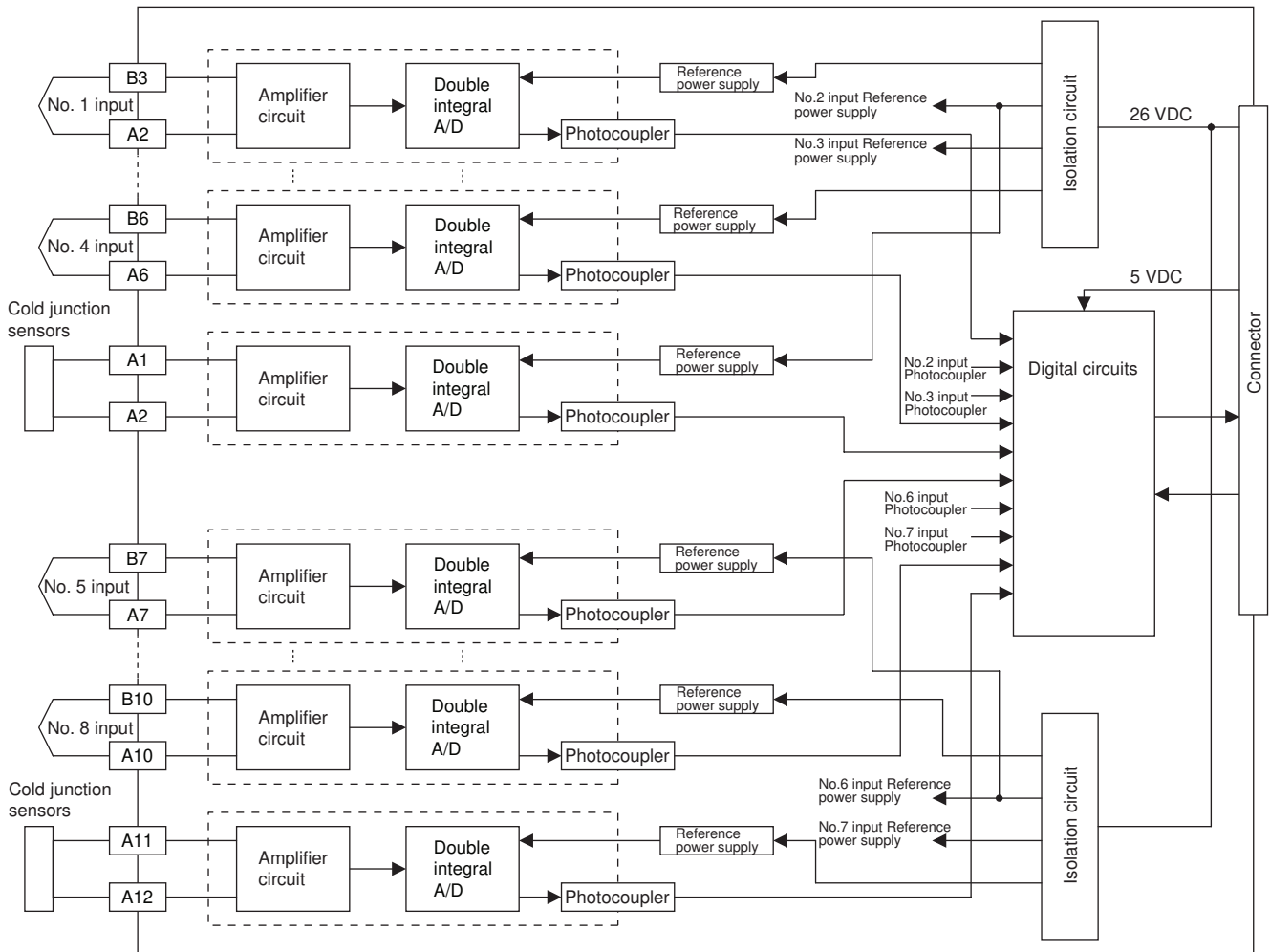
Terminal Connection Diagram



- Note:**
- Set the *Sensor type* in Setting Group 2 in the DM Area to "Not used" for any thermocouple inputs that are not used.
 - Cold junction sensors are mounted before shipment. If one of the cold junction sensors is disconnected, cold junction compensation will stop and correct measurement of temperatures cannot be made. Always make sure the cold junction sensors are connected when using the Units.
 - Cold junction sensors are calibrated separately for each Unit and connected circuit, so correct temperatures will not be measured if a cold junction sensor from another Unit is used or if the two cold junction sensors in a Unit are swapped. Use the cold junction sensors as they are provided, without making any changes.
 - Do not connect anything to NC terminals. Do not use NC terminals as relay terminals.
 - Always ground the GR terminal on the Power Supply Unit of the PLC.
 - If the input device uses a voltage generator, temperature compensator, or similar device, then ground the input device if it has a ground terminal.

Terminal Block Diagram

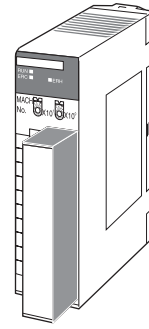
Input Circuits



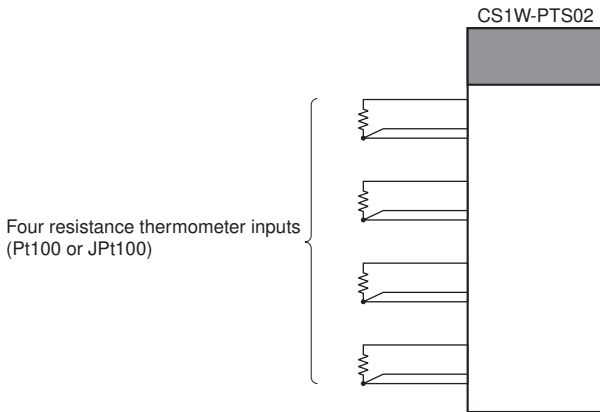
CS1W-PTS02 Isolated-type Resistance Thermometer Input Unit (Pt100 or JPt100)

Overview

The CS1W-PTS02 Isolated-type Resistance Thermometer Input Unit provides four direct platinum resistance thermometer inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



System Configuration



Specifications

Item		Specifications
Model		CS1W-PTS02
Applicable PLC		CS Series
Unit type		CS-series Special I/O Unit
Mounting position		CS-series CPU Rack or CS-series Expansion Rack (Cannot be mounted to C200H Expansion I/O Rack or SYSMAC BUS Remote I/O Slave Rack.)
Maximum number of Units		80 (within the allowable current consumption and power consumption range)
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)
Areas for data exchange with CPU Unit	Special I/O Unit Area	10 words/Unit Resistance Thermometer Input Unit to CPU Unit: All process values, process value alarms (LL, L, H, HH), rate-of-change values, rate-of-change alarms (L, H), disconnection alarms, cold junction sensor errors
	DM Area words allocated to Special I/O Units	100 words/Unit CPU Unit to Resistance Thermometer Input Unit: Temperature sensor type, input range (user set), scaling of process value data to be stored in CIO area, number of items for moving average, process value alarm setting (LL, L, H, HH), rate-of-change alarm setting (L, H), zero/span adjustment value, etc.
Number of temperature sensor inputs		4
Temperature sensor types		Pt100 (JIS, IEC) or JPt100 Sensor type, input range, and scaling to industrial units are separate for each of the 4 inputs. Note: Sensor type, input range, and scaling to industrial units are set in the DM Area.
Input ranges		The input range can be set within any of the measurable input ranges shown in Table 1 (below). Note: Internally, inputs are processed in five ranges (refer to Table 2 below), so accuracy and resolution accord with these internal ranges. Example: Sensor type: Pt100; input range: 0 to 500°C; industrial unit scaling: 0.0 to 500°C. DM Area settings are as follows: Sensor type: 0 (0000 hex) Input signal maximum: 5000 (1388 hex) Input signal minimum: 0 (0000 hex) Industrial unit maximum value stored: 500 (01F4 hex) Industrial unit minimum value stored: 0 (0000 hex)
Scaling in industrial units		Data to be stored in the allocated words in the CIO area must be scaled (individually for each of 4 inputs, with the minimum and maximum values set). Data can be stored at 0% to 100%. Input signal maximum: 5000 (1388 hex) Input signal minimum: 0 (0000 hex) Industrial unit maximum value stored: 500 (01F4 hex) Industrial unit minimum value stored: 0 (0000 hex)
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the actual process data in the input range is stored in four digits hexadecimal (binary values) in the allocated words in the CIO Area. 1) Mean value processing → 2) Scaling → 3) Zero/span adjustment → 4) Output limits

Item		Specifications
Accuracy (25°C)		The greater of the following: ±0.1% (of internal range full span) or 0.1°C As shown in the following equation, the accuracy depends on the ratio of the selected internal range (0 to 4) span to the set input range span. $\text{Accuracy} = \pm 0.1\% \times \frac{\text{Internal range span}}{\text{Set input range span}} \text{ or } 0.1^\circ\text{C, whichever is greater.}$
Temperature coefficient		±0.015% /°C, for any of internal range numbers 0 to 4.
Resolution		1/4,096 (of internal range full span) As shown in the following equation, the resolution depends on the ratio of the selected internal range (0 to 4) span to the set input range span. $\text{Resolution} = \frac{1}{4096} \times \frac{\text{Internal range span}}{\text{Set input range span}}$
Sensing method		3-wire method
Allowable lead wire resistance		20 Ω max. per wire
Input detection current		0.25 mA
Warmup time		10 min
Response time		0.5 s (travel time from input 0% to 90%, for step input)
Conversion period		100 ms/4 inputs
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle
Disconnection detection		Detects disconnections at each input and turns ON the Disconnection Detection Flag. Hardware detection time: Approx. 1 s The process value overrange direction for when a disconnection occurs can be specified. (High: 115% of set input range; low: -15% of set input range)
Function	Mean value processing (input filter)	Calculates the moving average for the specified number of process values (1 to 16), and stores that value in the CIO Area as the process value.
	Process value alarm	Process value 4-point alarm (HH, H, LL, L), alarm hysteresis, and ON-delay timer (0 to 60 s) are available.
	Rate-of-change calculation	Calculates the amount of change per comparison time interval (1 to 16 s).
	Rate-of-change alarm	Rate-of-change 2-point alarm (H, L), alarm hysteresis (shared with process value alarm), and ON-delay timer (0 to 60 s, shared with process value alarm) are available.
Isolation		Between temperature inputs and between input terminals and PLC signals: Isolation by transformer
Insulation resistance		20 MΩ (at 500 V DC) between inputs
Dielectric strength		Between inputs: 1,000 V AC, at 50/60 Hz, for 1 min, leakage current 10 mA max.
External connections		Terminal block (detachable)
Unit number settings		Set by rotary switches on front panel, from 0 to 95.
Indicators		Three LED indicators on front panel (for normal operation, errors detected at the Resistance Thermometer Input Unit, and errors related to the CPU Unit).
Front panel connector		Sensor input connector terminal block (detachable)
Effect on CPU Unit cycle time		0.3 ms
Current consumption		5 V DC at 150 mA max., 26 V DC at 150 mA max.
Dimensions		35 × 130 × 126 mm (W × H × D) Note: The height including the Backplane is 145 mm.
Weight		450 g max.
Standard accessories		None