Cat. No. W368-E1-03

SYSMAC
CS Series
CS1W-PTS01-V1/PTS02/PTS03/PTW01/ PDC01/PTR01/PTR02/PPS01/PMV01/PMV02
Analog I/O Units

OPERATION MANUAL

OMRON

CS Series

CS1W-PTS01-V1/PTS02/PTS03/PTW01/ PDC01/PTR01/PTR02/PPS01/PMV01/PMV02

Analog I/O Units

Operation Manual

Revised May 2002

Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

⚠DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠Caution Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1,2,3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

TABLE OF CONTENTS

About this Manual:

This manual describes the installation and operation of the CS-series Analog I/O Units and includes the sections described below.

In this manual, “Analog I/O Units” is a product group name for the following groups of Units.

Name	Model number
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1
Isolated-type Resistance Thermometer Input Unit	CS1W-PTS02
Isolated-type Resistance Thermometer Input Unit (Ni508.4 Ω)	CS1W-PTS03
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01
Isolated-type Analog Input Unit	CS1W-PDC01
Power Transducer Input Unit	CS1W-PTR01
Analog Input Unit	CS1W-PTR02
Isolated-type Pulse Input Unit	CS1W-PPS01
Isolated-type Analog Output Unit	CS1W-PMV01/PMV02

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the Analog I/O Units.

Section 1 presents an overview of the CS-series Analog I/O Units, and outlines their common features.

Section 2 describes each of the Analog I/O Units in detail.

Appendix A provides a supplementary explanation of Unit functions.

Appendix B provides an example of zero/span adjustment.

⚠ WARNING Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides general precautions for using the CS-series Programmable Controllers (PCs) and related devices.

The information contained in this section is important for the safe and reliable application of Programmable Controllers. You must read this section and understand the information contained before attempting to set up or operate a PC system.

1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.

2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.

Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

This manual provides information for programming and operating the Unit. Be sure to read this manual before attempting to use the Unit and keep this manual close at hand for reference during operation.

⚠WARNING It is extremely important that a PC and all PC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PC System to the above-mentioned applications.

3 Safety Precautions

⚠WARNING Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.

⚠WARNING Provide safety measures in external circuits (i.e., not in the Programmable Controller), including the following items, to ensure safety in the system if an abnormality occurs due to malfunction of the PC or another external factor affecting the PC operation. Not doing so may result in serious accidents.

- Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.
- Unless otherwise stated, the PC will turn OFF all outputs when its self-diagnosis function detects any error or when a severe failure alarm (FALS) instruction is executed. (The operation of outputs from Analog Output Units is described later in this manual.) As a countermeasure for such errors, external safety measures must be provided to ensure safety in the system.
- The PC outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.
- When the 24-VDC output (service power supply to the PC) is overloaded or short-circuited, the voltage may drop and result in the outputs being turned OFF. As a countermeasure for such problems, external safety measures must be provided to ensure safety in the system.

⚠WARNING Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.

- Mounting or dismounting the Power Supply Units, I/O Units, CPU Units, or any other Units.
- Assembling the Units.
- Setting DIP switches or rotary switches.
- Connecting cables or wiring the system.
- Connecting or disconnecting the connectors.

⚠WARNING Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

⚠Caution Execute online edit only after confirming that no adverse effects will be caused by extending the cycle time. Otherwise, input signals may not be readable.

4 Operating Environment Precautions

⚠Caution Do not operate the control system in the following locations:

- Locations subject to direct sunlight.
- Locations subject to temperatures or humidity outside the range specified in the specifications.
- Locations subject to condensation as the result of severe changes in temperature.
- Locations subject to corrosive or flammable gases.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

⚠Caution Take appropriate and sufficient countermeasures when installing systems in the following locations:

- Locations subject to static electricity or other forms of noise.
- Locations subject to strong electromagnetic fields.
- Locations subject to possible exposure to radioactivity.
- Locations close to power supplies.

⚠Caution The operating environment of the PC System can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PC System. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5 Application Precautions

Observe the following precautions when using the Analog I/O Unit.

- If any one of cold junction compensating elements is disconnected, no compensation will be performed, resulting in improper temperature measurement. Do not disconnect cold junction compensating elements. (Applicable to the CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit.)
- Each cold junction compensation element is calibrated for the individual Unit and connected circuit; do not use elements from other Units or replace two elements of the same Unit. Doing so will result in improper temperature measurement. Use elements attached at the time of product delivery. (Applicable to the CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit.)
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
  - Changing the operating mode of the PC.
  - Force-setting/force-resetting any bit in memory.
  - Changing the present value of any word or any set value in memory.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Be sure that the terminal blocks, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- Do not apply voltages to the input section in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the output section in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.

6 Conformance to EC Directives

6-1 Applicable Directives

- EMC Directives
- Low Voltage Directive

6-2 Concepts

EMC Directives

OMRON devices that comply with EC Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards (see the following note). Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer.

EMC-related performance of the OMRON devices that comply with EC Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Note Applicable EMC (Electromagnetic Compatibility) standards are as follows:

EMS (Electromagnetic Susceptibility): EN61000-6-2
EMI (Electromagnetic Interference): EN50081-2
(Radiated emission: 10-m regulations)

Low Voltage Directives

Always ensure that devices operating at voltages of 50 to 1,000 V AC and 75 to 1,500 V DC meet the required safety standards for the PC (EN61131-2).

6-3 Conformance to EC Directives

The CS-series PCs comply with EC Directives. To ensure that the machine or device in which a CS-series PC is used complies with EC Directives, the PC must be installed as follows:

- The CS-series PC must be installed within a control panel.
- You must use reinforced insulation or double insulation for the DC power supplies used for the communications power supply and I/O power supplies.
- CS-series PCs complying with EC Directives also conform to the Common Emission Standard (EN50081-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment complies with EC Directives.

SECTION 1
Overview and Features

This section presents an overview of the CS-series Analog I/O Units and outlines their features.

1-1 Overview of Analog I/O Units

There are nine Analog I/O Unit models, as shown in the following table.

Name	Model	Number of I/O	Field I/O isolation	I/O type	Main functions
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1	4 inputs	All inputs are isolated.	B, E, J, K, N, R, S, T, mV	• Variable range setting • Process value scaling • Process value alarm • Mean value processing • Rate-of-change calculation and alarm • Alarm-ON delay • Disconnection detection
Isolated-type Resistance Thermometer Input Unit	CS1W-PTS02	4 inputs	All inputs are isolated.	Pt100 (JIS, IEC), JPt100	• Variable range setting • Process value scaling • Process value alarm • Mean value processing • Rate-of-change calculation and alarm • Alarm-ON delay • Disconnection detection
Isolated-type Resistance Thermometer Input Unit (Ni508.4 Ω)	CS1W-PTS03	4 inputs	All inputs are isolated.	Ni508.4 Ω	• Variable range setting • Process value scaling • Process value alarm • Mean value processing • Rate-of-change calculation and alarm • Alarm-ON delay • Disconnection detection
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01	4 inputs	All inputs are isolated.	4 to 20 mA from 2-wire transmitter. 4 to 20 mA, 1 to 5 V	• Built-in power supply for 2-wire transmitter • Process value scaling • Process value alarm • Mean value processing • Rate-of-change calculation and alarm • Alarm-ON delay • Input error detection
Isolated-type Analog Input Unit	CS1W-PDC01	4 inputs	All inputs are isolated.	–10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, 1 to 5 V, ±10 V DC variable range, 4 to 20 mA, 0 to 20 mA	• Process value scaling • Square root • Process value alarm • Mean value processing • Rate-of-change calculation and alarm • Alarm-ON delay • Input error detection
Power Transducer Input Unit	CS1W-PTR01	8 inputs	No isolation between inputs	–1 to 1 mA, 0 to 1 mA	• Anti-overshooting at motor startup • Process value scaling • Process value alarm • Inrush input limit • Alarm-ON delay • Mean value processing
Analog Input Unit (100 mV)	CS1W-PTR02	8 inputs	No isolation between inputs	–100 to 100 mV, 0 to 100 mV	• Process value scaling • Process value alarm • Inrush input limit • Alarm-ON delay • Mean value processing

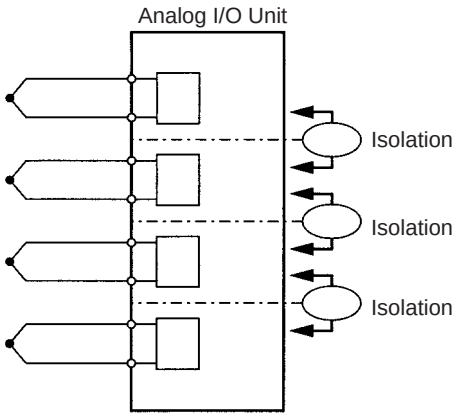
Name	Model	Number of I/O	Field I/O isolation	I/O type	Main functions
Isolated-type Pulse Input Unit	CS1W-PPS01	4 inputs	All inputs are isolated.	No-voltage semiconductor input or voltage input: 0 to 20,000 pulses/s Contact input: 0 to 20 pulses/s	• Sensor power supply: 12 V DC, built-in • Instantaneous value scaling • Mean value processing • Instantaneous value alarm • Alarm-ON delay • Accumulated value output
Isolated-type Analog Output Unit	CS1W-PMV01	4 outputs	All outputs are isolated.	4 to 20 mA, 1 to 5 V	• Output disconnection alarm • Answer input • Output rate-of-change limit • Output high/low limits • Output hold when CPU Unit error occurs • Output disconnection detection
Isolated-type Analog Output Unit	CS1W-PMV02	4 outputs	All outputs are isolated.	–10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, –1 to 1 V, 0 to 1 V	• Output rate-of-change limit • Output high/low limits • Output hold when CPU Unit error occurs

1-2 Features and Functions

I/O Isolation

The Analog I/O Units listed below have isolation between inputs or outputs. Therefore sneak circuits do not occur between thermocouples or between the power supply's common voltage inputs, so there is no need to utilize a signal converter to prevent sneak circuits.

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PPS01 Isolated-type Pulse Input Unit
CS1W-PMV01/PMV02 Isolated-type Analog Output Unit

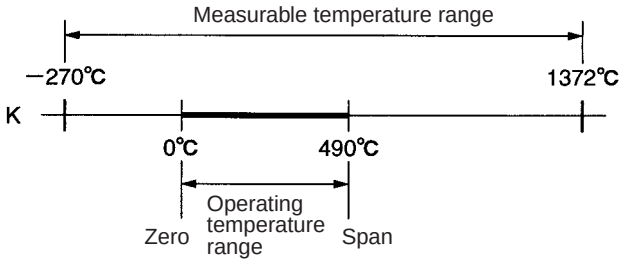


Variable Input Range Setting

For the Analog I/O Units listed below, the input range can be set by the user according to the application. The internal settings will be switched automatically, and measurements will be enabled within the appropriate operating range. This function applies to the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02 Isolated-type Resistance Thermometer Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit

Note The accuracy and resolution are the values for the internal range that is set.



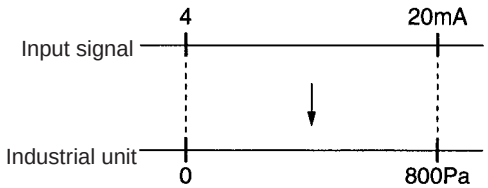
Process Value (or Instantaneous Value) Scaling in Industrial Units

This function takes the value scaled in industrial units with respect to the analog (or pulse) input signal's zero point and span point, and transfers it to the CPU Unit as the process value (or instantaneous value). Because of this, no ladder program is required at the CPU Unit for scaling.

Note It also possible to set the process value scaling zero/span point in reverse to create an inverse relationship.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit

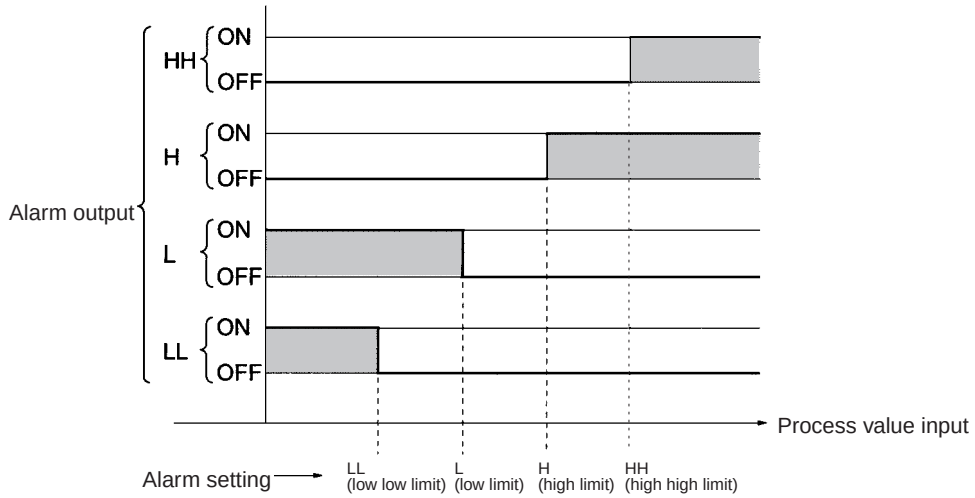


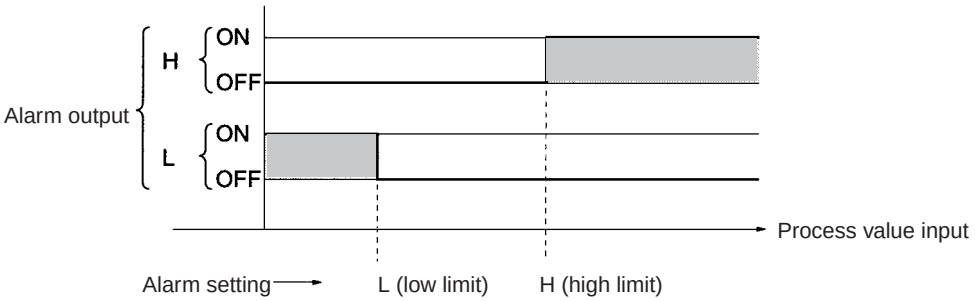
Process Value Alarm (2 or 4 Points)

Either a 2-point alarm (H and L limits) or a 4-point alarm (HH, H, L, and LL limits) is possible for the process value (or instantaneous value).

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1WPTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit



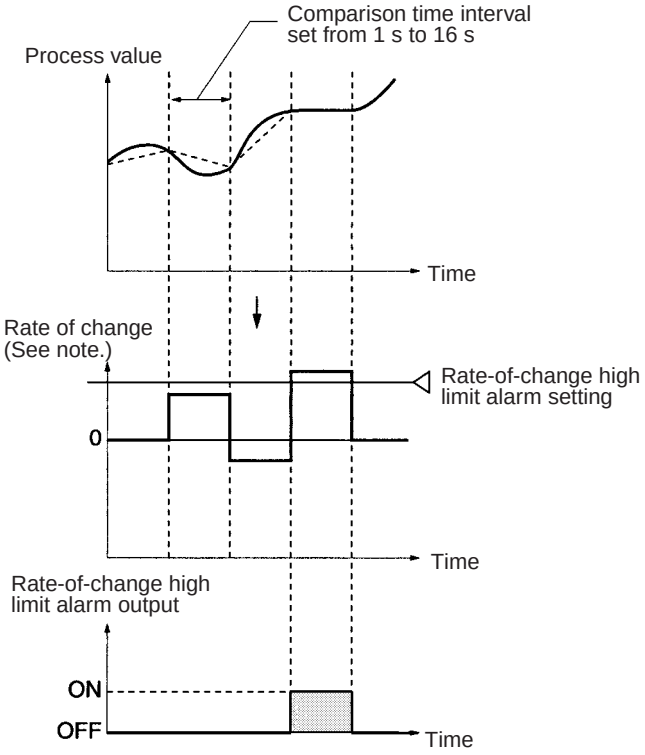


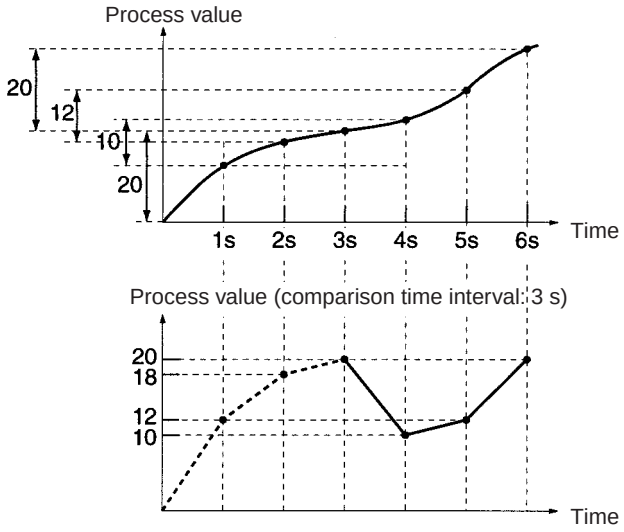
Rate-of-change Calculation and Alarm

The Analog I/O Units listed below calculate the rate of change for the process value, and output an alarm when the high or low limit is exceeded. The rate-of-change value is derived by taking the difference each second between the process value at that time and the process value before the comparison time interval. The comparison time interval can be set from 1 to 16 seconds. This allows even a small process value rate of change to be detected.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit





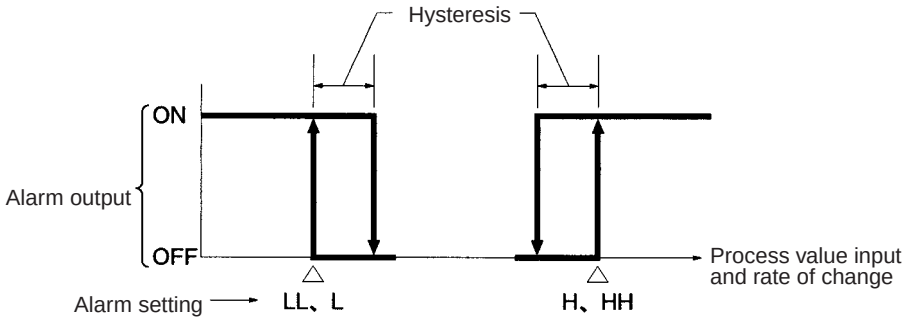
Note The rate of change is calculated every second (and not just once during the comparison time interval) so that even minute changes in the process value are detected.

Alarm Hysteresis

An hysteresis can be set for the process value (or instantaneous value) alarm and the rate-of-change alarm. The operation is as shown in the following diagram.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit

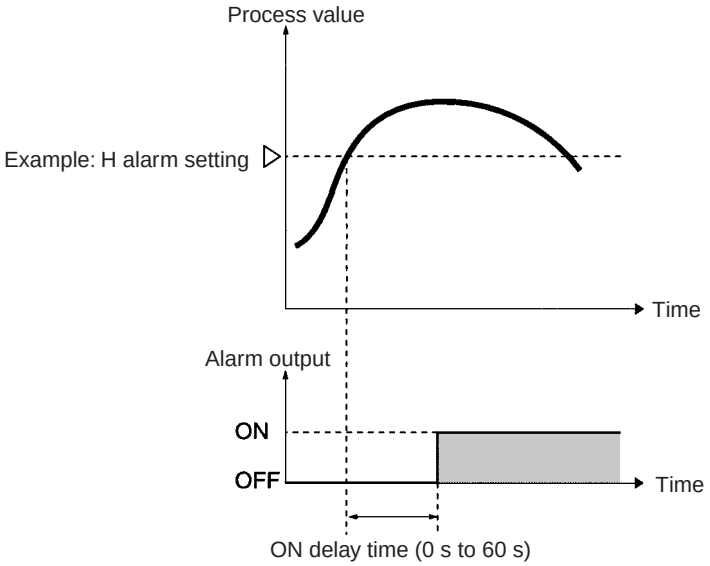


Alarm-ON Delay

This function can be used to set a given time period (0 s to 60 s) for delaying the turning ON of the alarm after the process value (or instantaneous value) alarm status or the alarm setting is reached. One alarm-ON delay is set for each input or output. The same setting is used for all process value alarms (HH, H, L, LL) and rate-of-change alarms (H, L).

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit



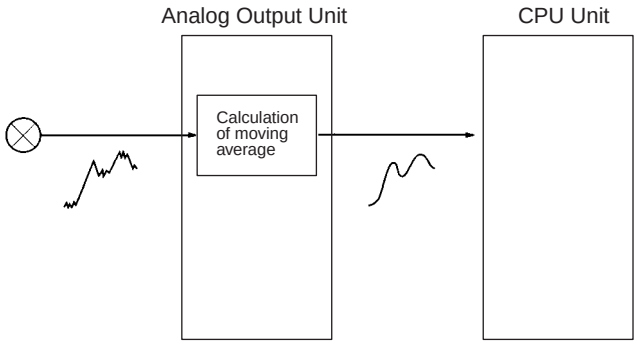
Mean Value Processing

The moving average of a specified number (from 1 to 16) of past process values (or instantaneous values) can be calculated and stored as the process value. An input noise filter can be installed if erroneous process values are obtained due to noise, or if the system has sudden voltage or current fluctuations.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit

Note For the CS1W-PTR01 and CS1W-PTR02, four process values are always averaged.

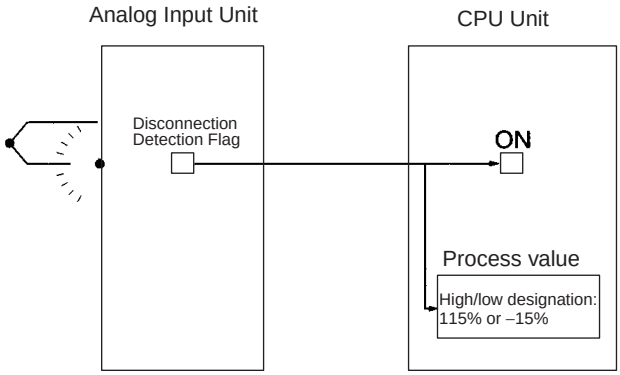


Input Disconnection Detection

Sensor disconnections can be detected for thermocouple input and resistance thermometer input. Either the high (115%) or low (–15%) direction can be specified for when a disconnection is detected.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit



Input Error Detection

For 2-wire transmitter input and analog input, errors resulting from exceeding the high or low limits can be detected.

This function is supported by the following Units:

CS1W-PTW01-V1 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit

Cold Junction Sensor Errors

If a Thermocouple Input Unit's cold junction sensor is disconnected, or if short-circuiting occurs, the Cold Junction Error Flag will turn ON and a temperature process value with no cold junction compensation will be stored in the CIO Area. (This applies only to CS1W-PTS01-V1 Isolated-type Thermocouple Input Units.)

Note If one of the two cold junction sensors (between A1 and A2, and A8 to A9) is disconnected as described above, cold junction compensation will be stopped for all inputs.

Square Root

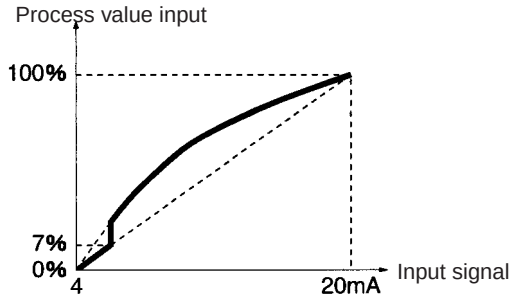
For 2-wire transmitter input and analog input, this function takes as the process value the square root of the analog input value. It is used for operations such as calculating momentary flow based on the differential pressure input from a differential pressure transmitter.

With linear characteristics at an output of approximately 7% or less, an on-site differential pressure transmitter's zero-point adjustment can be performed with this function enabled.

Note The square root function is enabled only when the maximum scaling value is greater than the minimum scaling value. Square root extraction will not be possible if the minimum scaling value is greater.

This function is supported by the following Units:

CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit

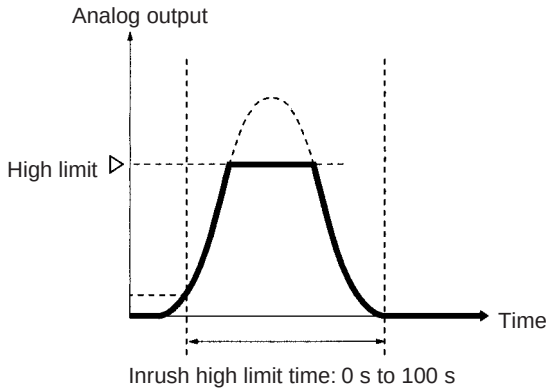


Inrush Input Limit

The inrush input limit function temporarily limits the process value input to a given set value when it increases from a low value (2%). This function is used for preventing a process value alarm from being generated by the inrush current, e.g., when the motor is started.

This function is supported by the following Units:

CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)

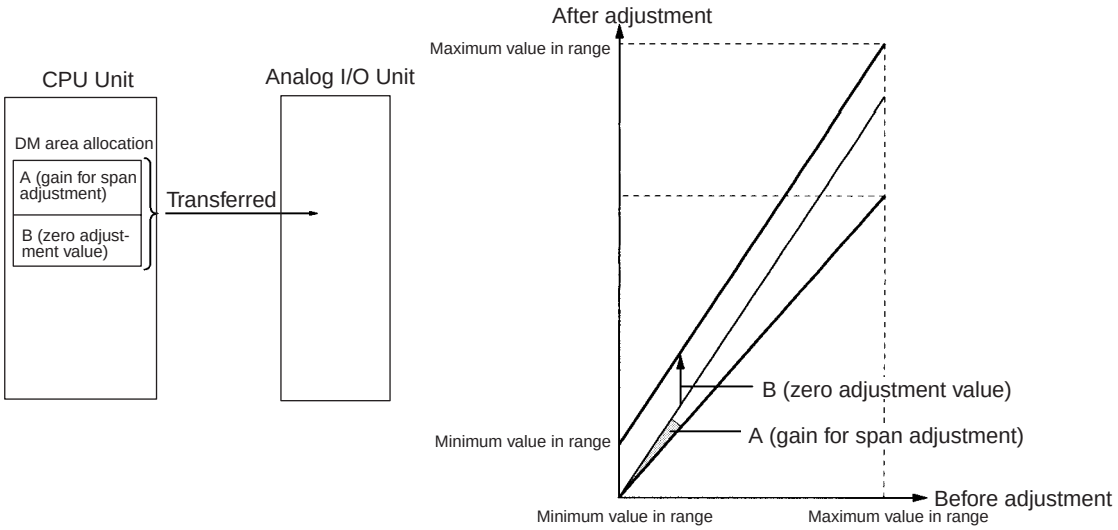


Zero/Span Adjustment

The zero point and span can be adjusted for the process value (or instantaneous value). The zero adjustment offsets the line plotting values before and after adjustment parallel to the original line. The span adjustment changes the inclination of the line (i.e., the gain) using the minimum value in the range as the fulcrum. The zero adjustment value and the span adjustment gain are set in the words allocated in the DM Area in the CPU Unit. With Analog I/O Units, these values can be changed during operation.

This function is supported by the following Units:

CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit
CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit
CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit
CS1W-PDC01 Isolated-type Analog Input Unit
CS1W-PTR01 Power Transducer Input Unit
CS1W-PTR02 Analog Input Unit (100 mV)
CS1W-PPS01 Isolated-type Pulse Input Unit
CS1W-PMV01/PMV02 Isolated-type Analog Output Unit



Stepdown

This function reduces the number of pulses by 1/10, 1/100, or 1/1,000. It only operates for an accumulating counter (and not for instantaneous values). Make this setting to prevent accumulating counter overflow. If the number of pulses is 3,000, for example, setting the stepdown rate to 1/100 will reduce the number to 30, and the totalizing will then be based on that value.

This function is supported by CS1W-PPS01 Isolated-type Pulse Input Units only.

Pulse Input Instantaneous Value Conversion

This function counts the number of pulses per time unit and converts the number to an instantaneous value (pulses/time unit). Any of the following time units can be selected: 1 s, 3 s, 10 s, 30 s, or 60 s. (These match the cycles for conversion to instantaneous values.)

When the number of pulses per time unit (i.e., pulse rate) is low, lengthen the time unit. The instantaneous value stored, however, can only be refreshed at intervals of this time unit.

If there is fluctuation in the instantaneous values, the moving average function can be used to even the values out through averaging. Calculate the moving average for the specified number of values, and then convert it to the number of pulses per time unit. To determine the number of values for averaging, observe the operating status.

This function is supported by CS1W-PPS01 Isolated-type Pulse Input Units only.

Pulse Accumulation

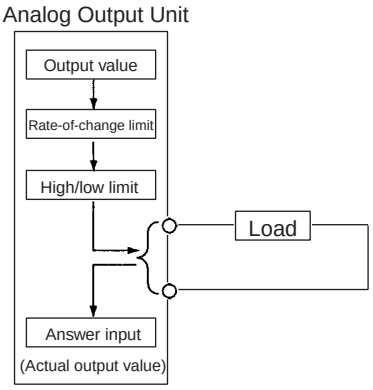
Pulse Input Units can accumulate pulses within a range of 0 to 9,999 (0000 to 270F Hex). With each accumulation conversion period, the number of input pulses after the stepdown is added. If the accumulated value exceeds 9,999, the number is carried to the next digit. There is no fifth digit, however, so an overflow can occur, but the value is retained only up to the fourth digit. When the power is turned ON or the Unit is restarted, the accumulated value is reset to 0 and the Accumulation Reset Flag turns ON for 10 seconds.

This function is supported by CS1W-PPS01 Isolated-type Pulse Input Units only.

Answer Input

During analog output, the actual analog output (current or voltage) signal can be checked by being read again from the analog output terminals. This function is used for checking for actual output load discrepancies due to external load resistance, or for checking actual analog signal values when an output rate-of-change limit is used.

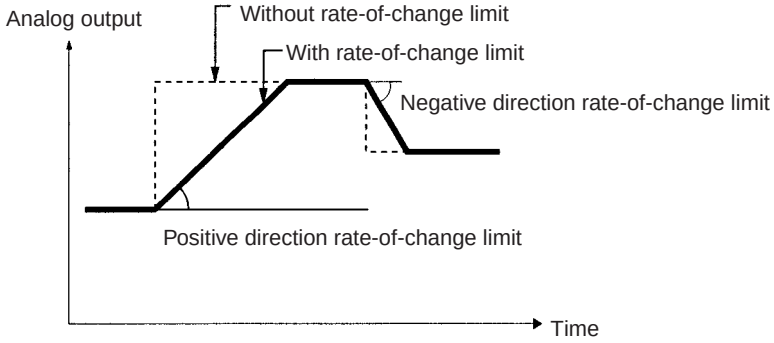
This function is supported by CS1W-PMV01 Isolated-type Analog Output Units only.



Output Rate-of-change Limit

With this function, the analog output value's rate of change can be limited separately for the positive and negative directions.

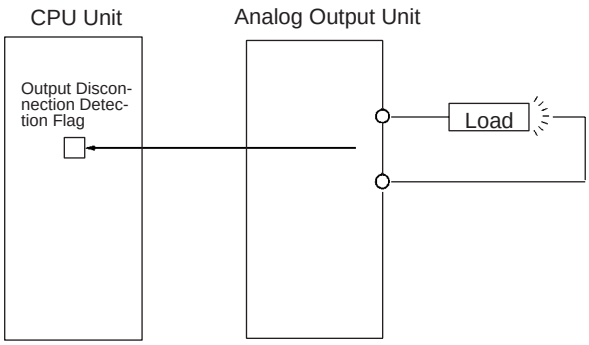
This function is supported by CS1W-PMV01/PMV02 Isolated-type Analog Output Units only.



Output Disconnection Detection

If a current loop is disconnected during analog output, this function will detect it.

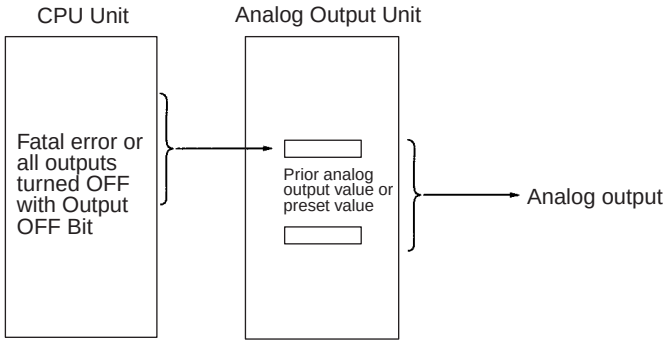
This function is supported by CS1W-PMV01 Isolated-type Analog Output Units only.



Output Hold When CPU Unit Error Occurs

When a fatal error (including user-defined FALS execution), or a CPU error in the CPU Unit occurs, or all outputs are turned OFF with the Output OFF Bit, this function can hold either a preset value or the analog output value prior to the error. When the CPU Unit is restored to normal operation, the output value in the CIO Area is output.

This function is supported by CS1W-PMV01/PMV02 Isolated-type Analog Output Units only.



1-3 System Configuration

System Configuration

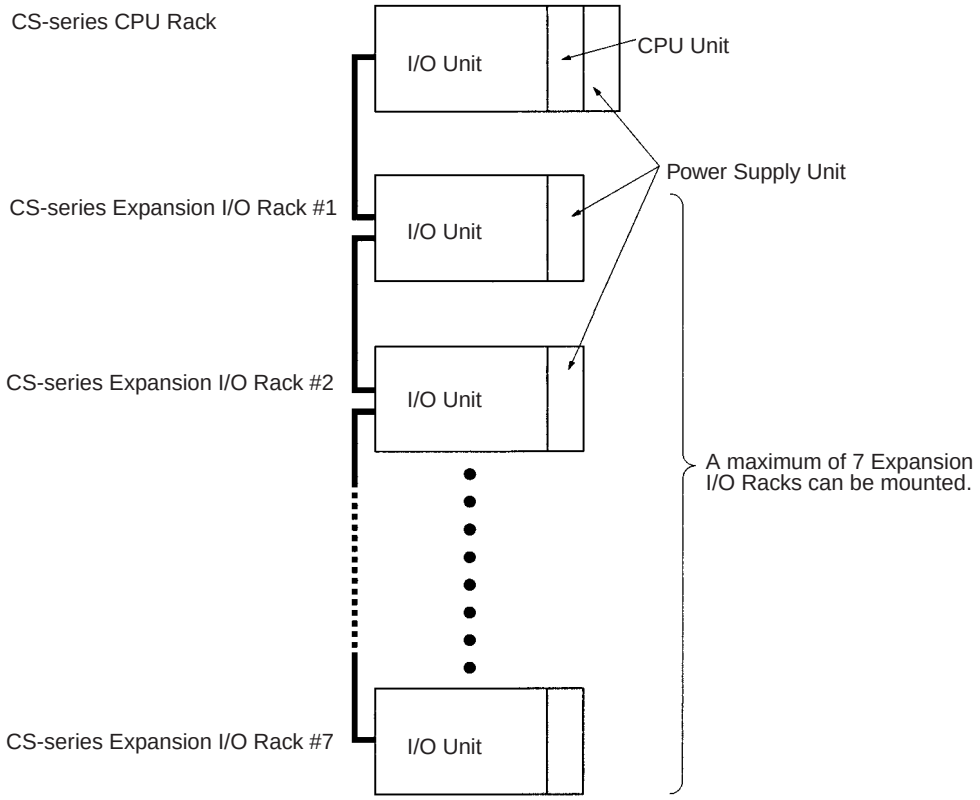
These Analog I/O Units belong to the CS-series Special I/O Unit group.

- They can be mounted to CS-series CPU Racks or Expansion I/O Racks.
- They cannot be mounted to C200H 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.



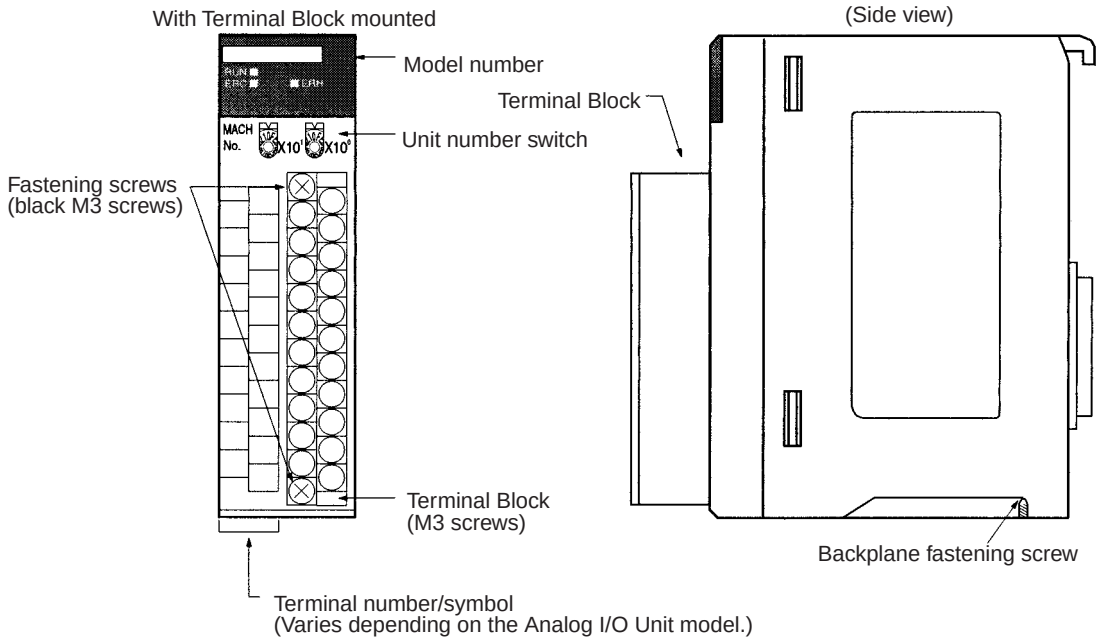
1-4 Specifications and Installation

1-4-1 Specifications

The specifications shown in the following table apply to all the Analog I/O Units. For specifications and installation procedures specific to each Unit, refer to the explanations in *SECTION 2 Individual Unit Descriptions*.

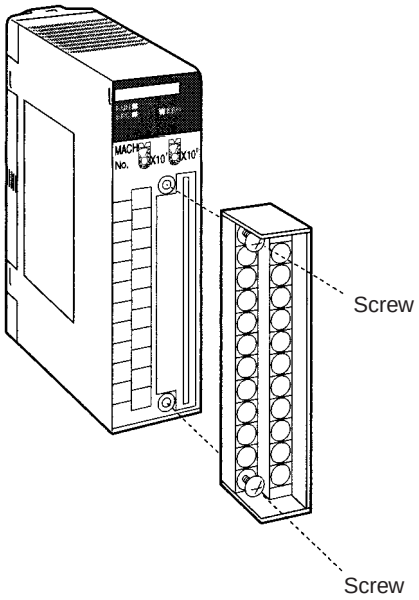
<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Unit classification</td><td colspan="5">CS-series Special I/O Unit</td></tr>
<tr><td>Structure</td><td colspan="5">Backplane-mounted, single slot size</td></tr>
<tr><td>Dimensions</td><td colspan="5">35 × 130 × 126 mm (W × H × D)</td></tr>
<tr><td>Weight</td><td colspan="5">450 g max.</td></tr>
<tr><td>External connection terminals</td><td colspan="5">21-terminal detachable terminal block (M3 screws; tightening torque: 0.5 N•m)</td></tr>
<tr><td>Unit number switch</td><td colspan="5">00 to 95</td></tr>
<tr><td>Self-diagnostic function</td><td colspan="5">Results shown by LED indicators.</td></tr>
<tr><td>Mounting position</td><td colspan="5">CS-series CPU Rack or CS-series Expansion Rack</td></tr>
<tr><td rowspan="17">Maximum number of Units</td><td colspan="5">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 supplied by the Power Supply Unit.</td></tr>
<tr><td colspan="2" rowspan="2">Name</td><td rowspan="2">Model</td><td colspan="2">Current consumption (power)</td></tr>
<tr><td>5 V</td><td>26 V</td></tr>
<tr><td colspan="2">Isolated-type Thermocouple Input Unit</td><td>CS1W-PTS01-V1</td><td>0.15 A (0.75 W)</td><td>0.15 A (3.9 W)</td></tr>
<tr><td colspan="2">Isolated-type Resistance Thermometer Input Unit</td><td>CS1W-PTS02</td><td>0.15 A (0.75 W)</td><td>0.15 A (3.9 W)</td></tr>
<tr><td colspan="2">Isolated-type Resistance Thermometer Input Unit (Ni508.4Ω)</td><td>CS1W-PTS03</td><td>0.15 A (0.75 W)</td><td>0.15 A (3.9 W)</td></tr>
<tr><td colspan="2">Isolated-type 2-Wire Transmitter Input Unit</td><td>CS1W-PTW01</td><td>0.15 A (0.75 W)</td><td>0.16 A (4.2 W)</td></tr>
<tr><td colspan="2">Isolated-type Analog Input Unit</td><td>CS1W-PDC01</td><td>0.15 A (0.75 W)</td><td>0.15 A (3.9 W)</td></tr>
<tr><td colspan="2">Power Transmitter Input Unit</td><td>CS1W-PTR01</td><td>0.15 A (0.75 W)</td><td>0.08 A (2.1 W)</td></tr>
<tr><td colspan="2">Analog Input Unit (100 mV)</td><td>CS1W-PTR02</td><td>0.15 A (0.75 W)</td><td>0.08 A (2.1 W)</td></tr>
<tr><td colspan="2">Isolated-type Pulse Input Unit</td><td>CS1W-PPS01</td><td>0.20 A (1.00 W)</td><td>0.16 A (4.2 W)</td></tr>
<tr><td colspan="2">Isolated-type Analog Output Unit</td><td>CS1W-PMV01</td><td>0.15 A (0.75 W)</td><td>0.16 A (4.2 W)</td></tr>
<tr><td colspan="2">Isolated-type Analog Output Unit</td><td>CS1W-PMV02</td><td>0.12 A (0.60 W)</td><td>0.12 A (3.2 W)</td></tr>
<tr><td colspan="5">(Reference) Maximum current and total power supplied</td></tr>
<tr><td rowspan="2">Power Supply Unit</td><td colspan="3">Maximum current supplied (power)</td><td rowspan="2">Maximum total power</td></tr>
<tr><td>5 V</td><td>26 V</td><td>24 V</td></tr>
<tr><td>C200HW-PA204</td><td>4.6 A (23 W)</td><td>0.6 A (15.6 W)</td><td>None</td><td>30 W</td></tr>
<tr><td>C200HW-PA204S</td><td>4.6 A (23 W)</td><td>0.6 A (15.6 W)</td><td>0.8 A (19.2 W)</td><td>30 W</td></tr>
<tr><td>C200HW-PA204R</td><td>4.6 A (23 W)</td><td>0.6 A (15.6 W)</td><td>None</td><td>30 W</td></tr>
<tr><td>C200HW-PD204</td><td>4.6 A (23 W)</td><td>0.6 A (15.6 W)</td><td>None</td><td>30 W</td></tr>
<tr><td>C200HW-PA209R</td><td>9 A (45 W)</td><td>1.3 A (33.8 W)</td><td>None</td><td>45 W</td></tr>
<tr><td>Ambient operating temperature</td><td colspan="5">0 to 55°C</td></tr>
<tr><td>Ambient operating humidity</td><td colspan="5">10% to 90% (with no condensation)</td></tr>
<tr><td>Isolation</td><td colspan="5">Between inputs or between outputs; between inputs or outputs and Backplane. (For the Power Transducer Input Unit and the Analog Input Unit (100 mV), there is no isolation between inputs.)</td></tr>
<tr><td>Insulation resistance</td><td colspan="5">20 MΩ (at 500 V DC) between insulated parts.</td></tr>
<tr><td>Dielectric strength</td><td colspan="5">1,000 V AC between insulated parts.</td></tr>
</table>

1-4-2 Nomenclature and Functions



Note

1. The Terminal Block is detachable, with connectors. It can be removed by loosening the two black screws (on the top and bottom).
2. Always confirm that the black Terminal Block mounting screws are tightened to a torque of 0.5 N•m.



Front Panel LED Indicators

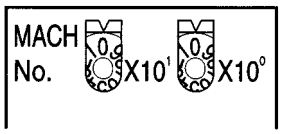
LED	Meaning	Indicator	Operating status
RUN (green)	Operating	Lit	Operating normally.
		Not lit	Unit has stopped exchanging data with the CPU Unit.
ERC (red)	Error detected by Unit	Lit	Data setting is out of range in the allocated portion of the DM Area.
		Not lit	Operating normally.
ERH (red)	Error in the CPU Unit	Lit	Error has occurred during data exchange with the CPU Unit, or Analog I/O Unit's unit number is set incorrectly, or there is a mounting error.
		Not lit	Operating normally.

Unit Number Switches

The CPU Unit and Analog Input Unit exchange data via words allocated to the Analog Input Unit as a Special I/O Unit. Words are allocated to Special I/O Units in both the CIO Area and the DM Area.

The words that each Analog I/O Unit uses are determined by the setting of the unit number switches on the front panel of the Unit.

Unit number switches



Unit No.	CIO Area addresses	DM Area addresses
0	CIO 2000 to CIO 2009	D20000 to D20099
1	CIO 2010 to CIO 2019	D20100 to D20199
2	CIO 2020 to CIO 2029	D20200 to D20299
3	CIO 2030 to CIO 2039	D20300 to D20399
4	CIO 2040 to CIO 2049	D20400 to D20499
5	CIO 2050 to CIO 2059	D20500 to D20599
6	CIO 2060 to CIO 2069	D20600 to D20699
7	CIO 2070 to CIO 2079	D20700 to D20799
8	CIO 2080 to CIO 2089	D20800 to D20899
9	CIO 2090 to CIO 2099	D20900 to D20999
10	CIO 2100 to CIO 2109	D21000 to D21099
to	to	to
n	CIO 2000 + n × 10 to CIO 2000 + n × 10 + 9	D20000 + n × 100 to D20000 + n × 100 + 99
to	to	to
95	CIO 2950 to CIO 2959	D29500 to D29599

Note If two or more Special I/O Units are assigned the same unit number, a "UNIT No. DPL ERR" error (in the Programming Console) will occur (A40113 will turn ON) and the PC will not operate.

1-4-3 Exchanging Data with the CPU Unit

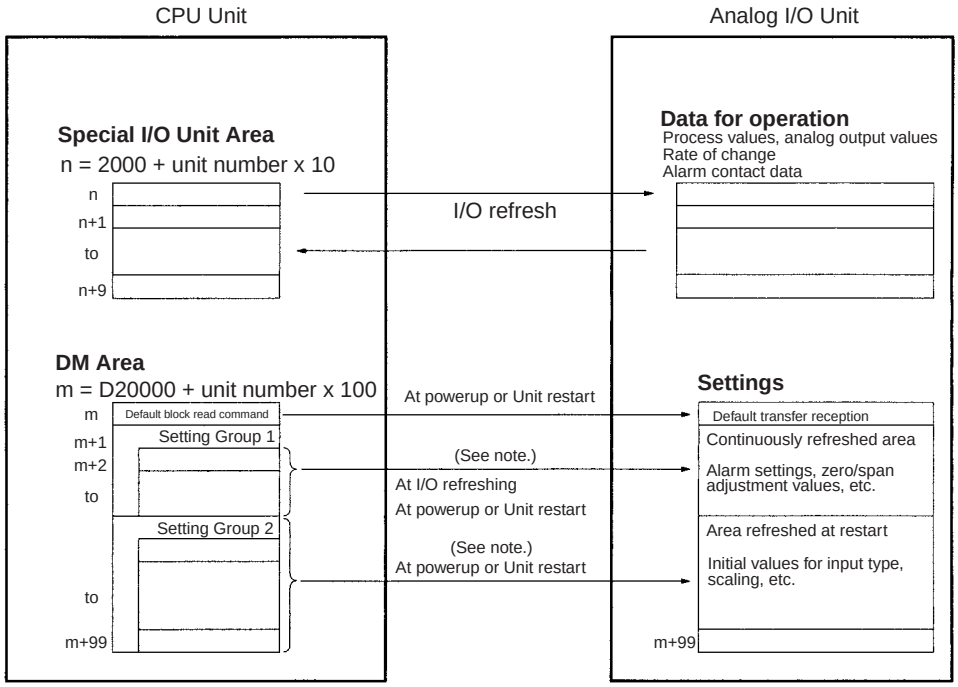
The Analog I/O Unit exchanges data with the CPU Unit via the allocated portions of the CPU Unit's Special I/O Unit Area and DM Area. The addresses allocated in these areas are determined as follows, according to the value (0 to 95) set by the unit number switch on the front panel of the Analog I/O Unit.

- Special I/O Unit Area: 10 words from beginning word n
  n = 2000 + unit number (0 to 95) x 10

- DM Area: 100 words from beginning word m
  m = D20000 + unit number (0 to 95) x 100

The following table shows the addresses allocated according to the unit number.

Unit No.	Special I/O Unit Area	DM Area
0	CIO 2000 to CIO 2009	D20000 to D20099
1	CIO 2010 to CIO 2019	D20100 to D20199
2	CIO 2020 to CIO 2029	D20200 to D20299
3	CIO 2030 to CIO 2039	D20300 to D20399
4	CIO 2040 to CIO 2049	D20400 to D20499
5	CIO 2050 to CIO 2059	D20500 to D20599
6	CIO 2060 to CIO 2069	D20600 to D20699
7	CIO 2070 to CIO 2079	D20700 to D20799
8	CIO 2080 to CIO 2089	D20800 to D20899
9	CIO 2090 to CIO 2099	D20900 to D20999
10	CIO 2100 to CIO 2109	D21000 to D21099
to	to	to
95	CIO 2950 to CIO 2959	D29500 to D29599



Note This applies when m is other than 12345 (3039 Hex), e.g., 0000 Hex. When m is 12345 (3039 Hex), the transfer direction will be reversed.

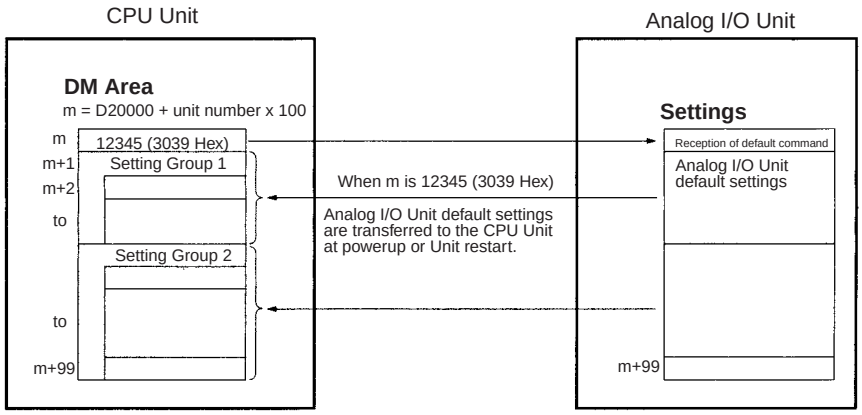
These areas have the following functions for Analog I/O Units.

Special I/O Unit Area	The data in for operation is continuously refreshed. The following types of data are transferred from Analog Input Units to the CPU Unit: Values scaled in industrial units for process values and rate-of-change values; alarm contact data, Input Disconnection Flag data, etc. Analog output values are transferred from the CPU Unit to Analog Output Units.	
DM Area	Data is set in this area. The allocated portion of the DM Area is divided into the three areas shown below. **Note** For details, refer to the explanations for the individual Units.	
	1) Default block read command	At PC powerup or Unit restarting, the default data in the Analog I/O Unit can be transferred back to the CPU Unit. Beginning word m is fixed. When m is 12345 (3039 Hex), then the data is transferred from the Analog I/O Unit to the CPU Unit. When m is less than 12345 (3039 Hex), such as 0 (0000 Hex), then data is transferred from the CPU Unit to the Analog I/O Unit as usual.
	2) Setting Group 1 (continuously refreshed area)	When the PC is ON (even if the CPU Unit is operating), this area is continuously refreshed. This area is refreshed at powerup or restarting. The area is refreshed regardless of the CPU Unit's operation mode (i.e., RUN, Monitor, or Program Mode). Alarm settings, zero/span adjustment values, and so on, are set here.
	3) Setting Group 2 (initial settings area)	Data is transferred once to this area from the CPU Unit at powerup or restarting. Input signal types, process value scaling, alarm supplementary functions, etc., are set here.

Note The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Data Range Error Address in the DM Area in four digits hexadecimal. When an error is made in Setting Group 1, the ERR indicator will light and the data range error address will be stored immediately. When an error is made in Setting Group 2, the ERC indicator will light at the next powerup or Unit restart and the data range error address will be stored at that time.

Transferring Analog I/O Unit Default Settings to the CPU Unit

When transferring the Analog I/O Unit's default settings to the CPU Unit's DM Area to be used for operation, store 12345 (3039 Hex) in word m and either power up or restart the Unit. After the default settings have been transferred, the value in word m will be automatically returned to 0 (0000 Hex). From that point onwards, the values stored in the DM Area will be transferred to the Analog I/O Unit for operation at powerup or when the Unit is restarted.



Restarting Special I/O Units

To restore operation after the contents of the DM Area have been changed, or after the cause of an error has been cleared, either power up the PC again or turn the Special I/O Unit Restart Bit ON and then OFF again.

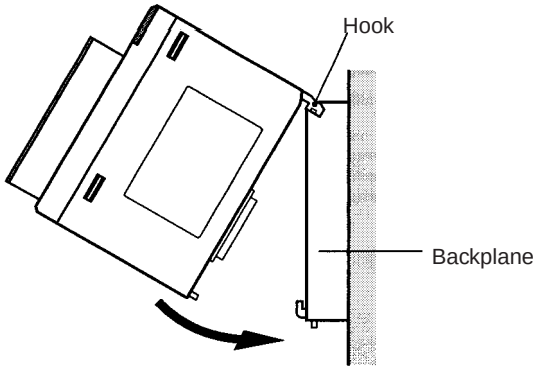
Unit No.	DM Area allocation
0	A50200
1	A50201
to	to
15	A50215
to	to
95	A50715

Note If an error is not cleared when the PC is powered up again or the Special I/O Unit Restart Bit is turned ON and then OFF again, replace the Unit.

1-4-4 Mounting the Units

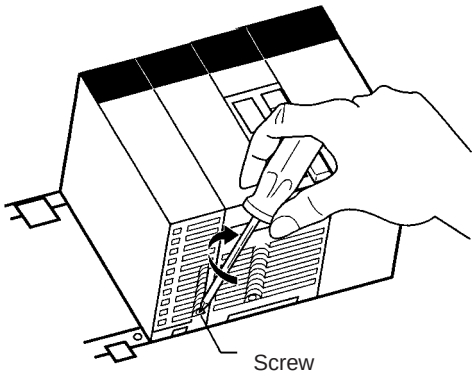
Use the following procedure to mount the Analog I/O Unit to the Backplane.

1,2,3... 1. Mount the Unit to the Backplane by attaching it with the top and bottom hooks.

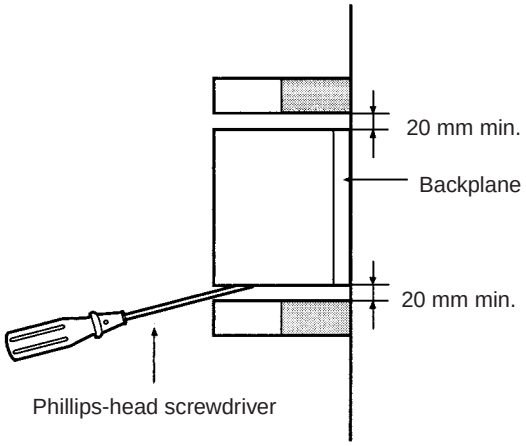


2. Properly insert each Unit into the Backplane connector, and tighten the screws on the bottom of the Unit to a torque of 0.4 N•m.

3. To remove a Unit, loosen the screws and lift it off.



Note To allow for mounting and removal of Units, leave at least 20 mm of space between Units, as shown in the following diagram.

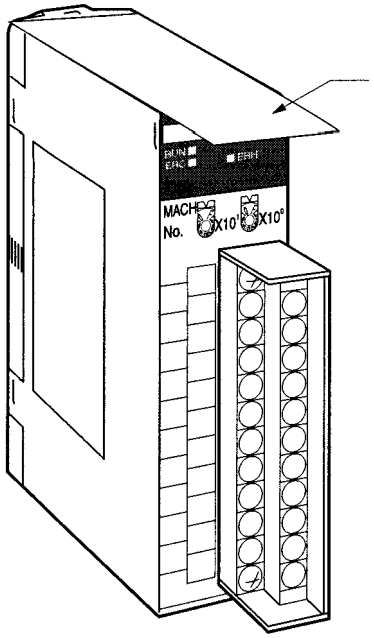


1-4-5 Precautions when Handling Units

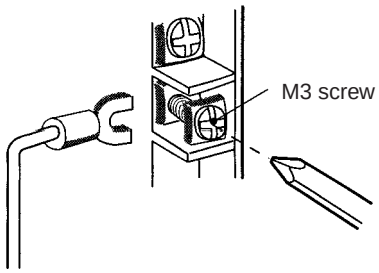
Turn OFF the power to the PC before mounting or removing Units, or connecting or disconnecting wiring.

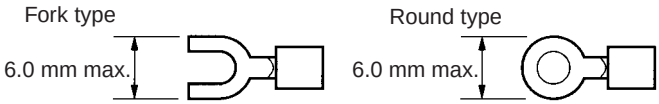
To prevent adverse effects from noise, place I/O wiring in separate ducts from high-voltage or power lines.

When wiring, leave the label on the Unit's top panel in place to prevent foreign objects such as wire clippings from dropping into the Unit. The label must be removed after wiring or the Unit will overheat.



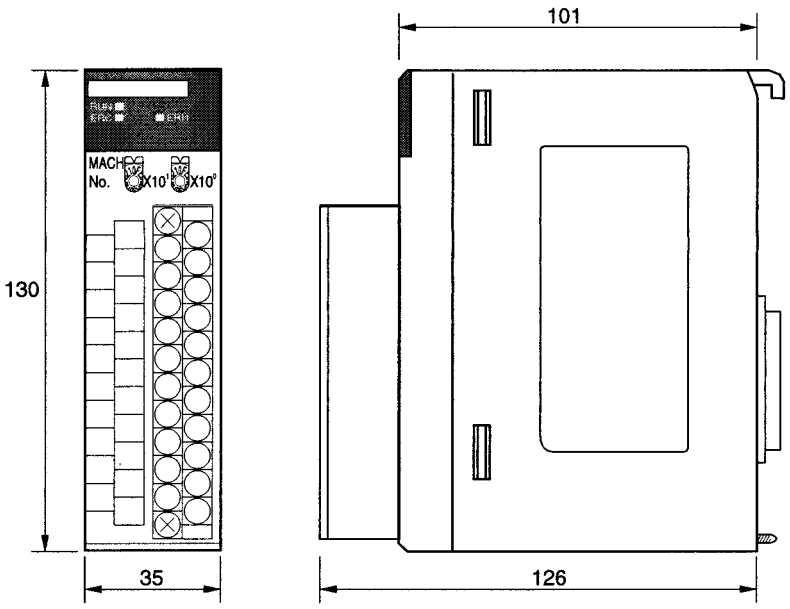
1-4-6 Connecting Crimp Terminals



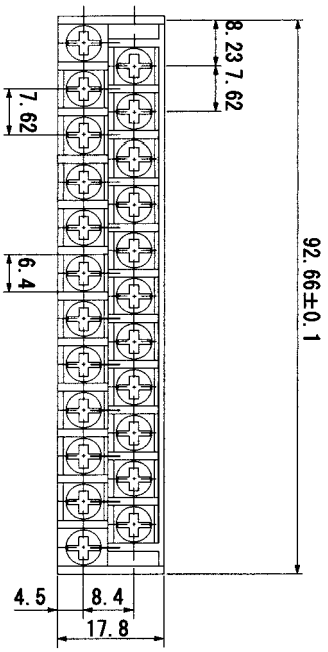


1-4-7 Dimensions

Unit: mm



Terminal Block Dimensions



1-5 Operating Procedures

Use the following procedures to operate the Analog I/O Unit. The procedures are the same for all models.

Initial Setup (Hardware)

1,2,3... 1. Set the unit number, using the rotary switches on the front panel of the Unit.

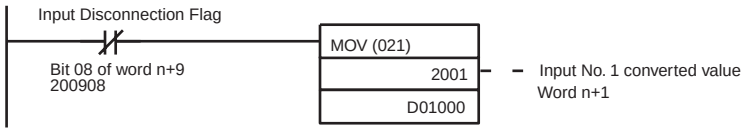
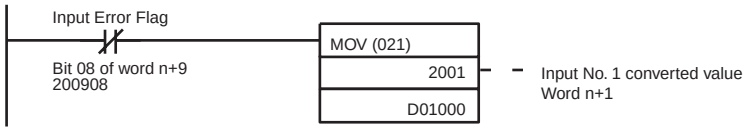
2. Mount the Unit to either a CS-series CPU Rack or CS-series Expansion Rack. A maximum of 96 Units can be mounted in a basic System (with no restrictions on mounting location).
3. Connect sensors or external control units.
4. Connect a Programming Device to the PC.
5. Turn ON the power to the PC.
6. Create the I/O tables.

Initial Software Setup

1,2,3...

1. Make the initial settings in the allocated portion of the DM Area (m to m+99).
   - When using the Unit's default values, set word m to 12345 (3039 Hex).
   - When using data from the CPU Unit's DM Area, set word m to a value other than 12345 (3039 Hex), such as 0000 Hex.
2. Turn the power OFF and then back ON again, or turn ON the Special I/O Unit Restart Bit.

Ladder Diagram Program

Name	Model	Basic ladder diagram programming
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1	Reading the converted value using MOV(021)with the Input Disconnection Flag's NC condition as the input condition. 
Isolated-type Resistance Thermometer Input Unit	CS1W-PTS02	
Isolated-type Resistance Thermometer Input Unit (Ni508.4Ω)	CS1W-PTS03	
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01	Reading the converted value using MOV(021) with the Input Error Flag's NC condition as the input condition. 
Isolated-type Analog Input Unit	CS1W-PDC01	
Power Transducer Input Unit	CS1W-PTR01	Reading the converted value using MOV(021).
Isolated-type Pulse Input Unit	CS1W-PPS01	
Analog Input Unit (100 mW)	CS1W-PTR02	
Isolated-type Analog Output Unit	CS1W-PMV01	Writing the value to convert using MOV(021). After writing, then checking of the answer input value and output disconnection.
Isolated-type Analog Output Unit	CS1W-PMV02	Writing the value to convert using MOV(021).

1-6 Error Processing

The following table shows the contents of the LED indicator displays on the front panel of the Analog I/O Unit. The contents shown here are the same for all models. For error processing specific to each Unit, refer to the explanations for the individual Units.

Errors Detected by the Analog I/O Unit

ERC LED (red)	RUN LED (green)	Contents	Probable cause	Unit operation	Remedy
Lit	Lit	Setting Group 1 (continuously refreshed area) error (See note 1.)	The Analog I/O Unit started up and was operating properly, but an out-of-range setting was made in Setting Group 1 in the DM Area.	The Unit continues operating with the Setting Group 1 data prior to the change.	Restore the set value to within the allowable range. (There is no need to power up again or to restart the Unit.)
	Not lit	Setting Group 1 (See note 1.) or Setting Group 2 (See note 2.) error	An out-of-range setting was made for either Setting Group 1 or Setting Group 2 in the DM Area.	The Unit will not start up.	Restore the set value to within the allowable range, and then either power up again or restart the Unit.

Note 1. The following table shows the processing and results for Setting Group 1.

Processing	Result	LED indicators on Unit	Data range error address stored in DM Area
When an out-of-range setting is made in Setting Group 1 during operation	The Unit continues to operate with the Setting Group 1 data prior to the change.	ERC indicator is lit. RUN indicator remains lit.	The lowest DM address where the out-of-range error occurred is stored, in four digits hexadecimal, as the offset value from m (i.e., the number of added words).
↓			
When the setting is changed within the allowable range during operation	The Unit operates with the Setting Group 1 data after the change.	ERC indicator is not lit. RUN indicator remains lit.	If there is no other error, 0000 Hex is stored. (If there is another error, the offset value for that DM address is stored.)
When the power is turned ON or the Unit is restarted with an error still in effect.	The Unit will not start up.	ERC indicator is lit. RUN indicator is not lit.	The lowest DM address where the out-of-range error occurred is stored, in four digits hexadecimal, as the offset value from m (i.e., the number of added words).
↓			
When the setting is made within the allowable range, and the power is turned ON or the Unit is restarted	The Unit starts up normally.	ERC indicator is not lit. RUN indicator is lit.	If there is no other error, 0000 Hex is stored. (If there is another error, the offset value for that DM address is stored.)

2. The following table shows the processing and results for Setting Group 2.

Processing	Result	LED indicators on Unit	Data range error address stored in DM Area
When an out-of-range setting is made in Setting Group 2 during operation	The Unit operates with the Setting Group 2 data prior to the change.	ERC indicator is not lit. RUN indicator remains lit.	If there is no other setting error, 0000 Hex remains stored. (If there is another setting error, the offset value for that DM address is stored.)
↓			
When the power is turned ON or when the Unit is restarted	The Unit will not start up.	ERC indicator is lit. RUN indicator is not lit.	The lowest DM address where the out-of-range error occurred is stored, in four digits hexa-decimal, as the off-set value from m (i.e., the number of added words).
↓			
When the setting is made within the allowable range, and the power is turned ON or the Unit is restarted	The Unit starts up normally.	ERC indicator is not lit. RUN indicator is lit.	If there is no other error, 0000 Hex is stored. (If there is another error, the offset value for that DM address is stored.)

Errors Related to the CPU Unit

The ERH indicator will be lit red for all of the following errors.

ERH LED (red)	RUN LED (green)	Contents	Probable cause	Error type	Detailed cause	Input Unit status (See note 1.)	Output Unit status (See note 2.)	Remedy
Lit	Lit	Error in data exchange with the CPU Unit	During normal operation, an I/O bus error, CPU Unit monitoring error, or WDT error occurred at the CPU Unit.	I/O bus error	A data transmission error occurred between the CPU Unit and the Analog I/O Unit.	Converted data becomes 0000 Hex.	Depending on the output hold status, either the set values prior to the error or preset values will be held.	Turn OFF the power supply and check the installation conditions and the cable connections between devices. Then turn the power back ON.
				CPU Unit monitoring error	The CPU Unit did not respond within a fixed period of time.	Maintains the status existing before the error.	Held at status existing before the error.	
				CPU Unit WDT error	WDT error has been generated at CPU Unit.	Changes to undefined state.	Depending on the output hold status, either the set values prior to the error or preset values will be held.	In PROGRAM Mode, turn the power OFF and then back ON.
	Not lit	Error in Analog I/O Unit's unit number or mounting	Either the unit number is set incorrectly or the Unit is mounted incorrectly.	Duplicate Unit Number	The same unit number has been assigned to more than one Unit or the unit number was set to a value other than 00 to 95.	Conversion does not start.	0 mA or 0 V will be output.	Reset the unit number so that it will not duplicate any other.
				Special I/O Unit Setting Error	The Analog I/O Units registered in the I/O table are different from the ones actually mounted.			Check the mounting positions, and either mount the Units according to the I/O table or correct the I/O table.
		Fatal error at CPU Unit after powerup						Take measures for CPU fatal error.

Note

1. Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01/PTR02 Analog Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit.
2. Applicable Unit: CS1W-PMV01 Isolated-type Analog Output Unit.

1-7 Specification Changes

The specifications of the following I/O Units with a lot number 000426 XXXX (manufactured on April 26, 2000) or later have been changed as shown in the table below.

Overview

Name	Model	Main changes
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1	• Improved effective resolution: From the equivalent of 10 bits to 1/4096 • Improved rate-of-change calculation: See note 1.
Isolated-type Resistance Thermometer Input Unit	CS1W-PTS02	• Improved effective resolution: From the equivalent of 10 bits to 1/4096 • Improved rate-of-change calculation: See note 1.
Isolated-type Resistance Thermometer Input Unit (Ni508.4 Ω)	CS1W-PTS03	• Improved effective resolution: From the equivalent of 11 bits to 1/4096 • Improved rate-of-change calculation: See note 1.
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01	• Improved effective resolution: From the equivalent of 10 bits to 1/4096 • Improved rate-of-change calculation: See note 1. • Reduced 26-V consumption current: 0.4 A to 0.16 A
Isolated-type Analog Input Unit	CS1W-PDC01	• Improved effective resolution: From the equivalent of 10 bits to 1/4096 • Improved rate-of-change calculation: See note 1. • Added input range: 0 to 20 mA (See note 2.)
Isolated-type Pulse Input Unit	CS1W-PPS01	• Changed instantaneous value setting method and added time unit setting function (See note 3.) • Reduction of 26 V consumption current: 0.22 A to 0.16 A
Isolated-type Analog Output Unit	CS1W-PMV01	• Improved resolution (answer back input): From the equivalent of 9 bits to 1/2000

Details

Improvement in Rate-of-change Calculation Method

Before Change

The current process value was compared with the value before the time set by the comparison time interval and the difference between them was divided by the comparison time interval to find the rate-of-change per second. When the difference was small, the calculated value turned out to be so small that it was hard to identify the change.

After Change

The current process value is compared with the value before the time set by the comparison time interval and the difference is output. When the difference is small, the comparison time interval can be set longer so that the change can be easily identified.

New Input Range (0 to 20 mA) for the CS1W-PDC01

Before Change

–10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, 1 to 5 V, 4 to 20 mA, optionally set voltages

After Change

–10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, 1 to 5 V, 4 to 20 mA, optionally set voltages, 0 to 20 mA (new)

The settings are shown below. (There is no need to change the setting unless the new setting is going to be used.)

- Before Change (m = D20000 + Unit number x 100)

Offset				Setting range	Setting name
Input No. 1	Input No. 2	Input No. 3	Input No. 4		
m+34	m+48	m+62	m+76	0 to 6	Input signal 0: –10 to +10 V, 1: 0 to 10 V, 2: –5 to 5 V, 3: 0 to 5 V, 4: 1 to 5 V, 5: 4 to 20 mA, 6: User-set voltages

- After Change (m = D20000 + Unit number x 100)

Offset				Setting range	Setting name
Input No. 1	Input No. 2	Input No. 3	Input No. 4		
m+34	m+48	m+62	m+76	0 to 7	Input signal 0: –10 to +10 V, 1: 0 to 10 V, 2: –5 to 5 V, 3: 0 to 5 V, 4: 1 to 5 V, 5: 4 to 20 mA, 6: User-set voltages 7: 0 to 20 mA

Instantaneous Value Measurement and Measurement Time Unit Setting for CS1W-PPS01

Instantaneous Value Measurement

Before Change

The number of pulses per second was output as an instantaneous value. To calculate the value, the number of pulses per 0.1 second was multiplied by 10. For pulses less than 10 Hz, 10 pulses/second and 0 pulses/second were alternately output due to inaccurate calculations.

After Change

The number of pulses per second is counted for that one second and output as is. This allows calculation of pulses down to 1 Hz.

Measurement Time Unit Setting

This new function allows setting of measurement time unit to enable measuring pulses with much slower frequencies. Measurement time unit can be set to 1, 3, 10, 30, or 60 s.

The settings are shown below. (There is no need to change the setting if the current unit of 1 s is going to be used.)

- Before Change (m = D20000 + Unit number x 100)

Offset				Setting range	Setting name
Input No. 1	Input No. 2	Input No. 3	Input No. 4		
m+30	m+38	m+46	m+54	Bits 00 to 03: 0 to 3	Decimal point position from right of instantaneous value conversion coefficient
				Bits 04 to 15: 0	Not used

- After Change (m = D20000 + Unit number x 100)

Offset				Setting range	Setting name
Input No. 1	Input No. 2	Input No. 3	Input No. 4		
m+30	m+38	m+46	m+54	Bits 00 to 03: 0 to 3	Decimal point from right of instantaneous value conversion coefficient
				Bits 04 to 07: 0 to 4	Instantaneous value time unit 0: 1 s 1: 3 s 2: 10 s 3: 30 s 4: 60 s
				Bits 08 to 15: 0	Not used

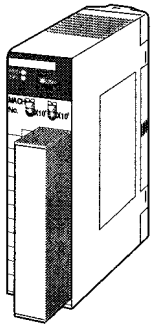
SECTION 2
Individual Unit Descriptions

This section describes each of the Analog I/O Units in detail.

2-1 CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit

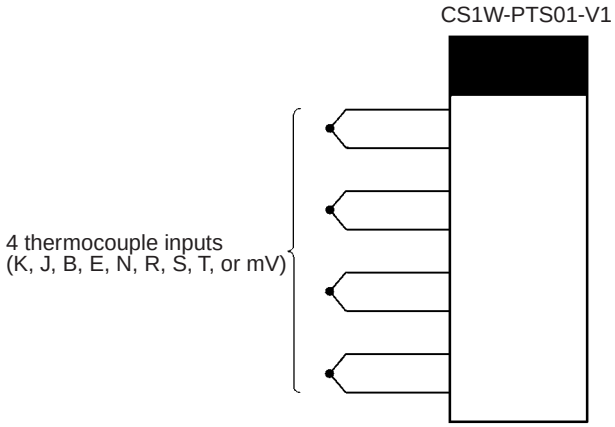
Overview

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.



CS1W-PTS01-V1

System Configuration



Features

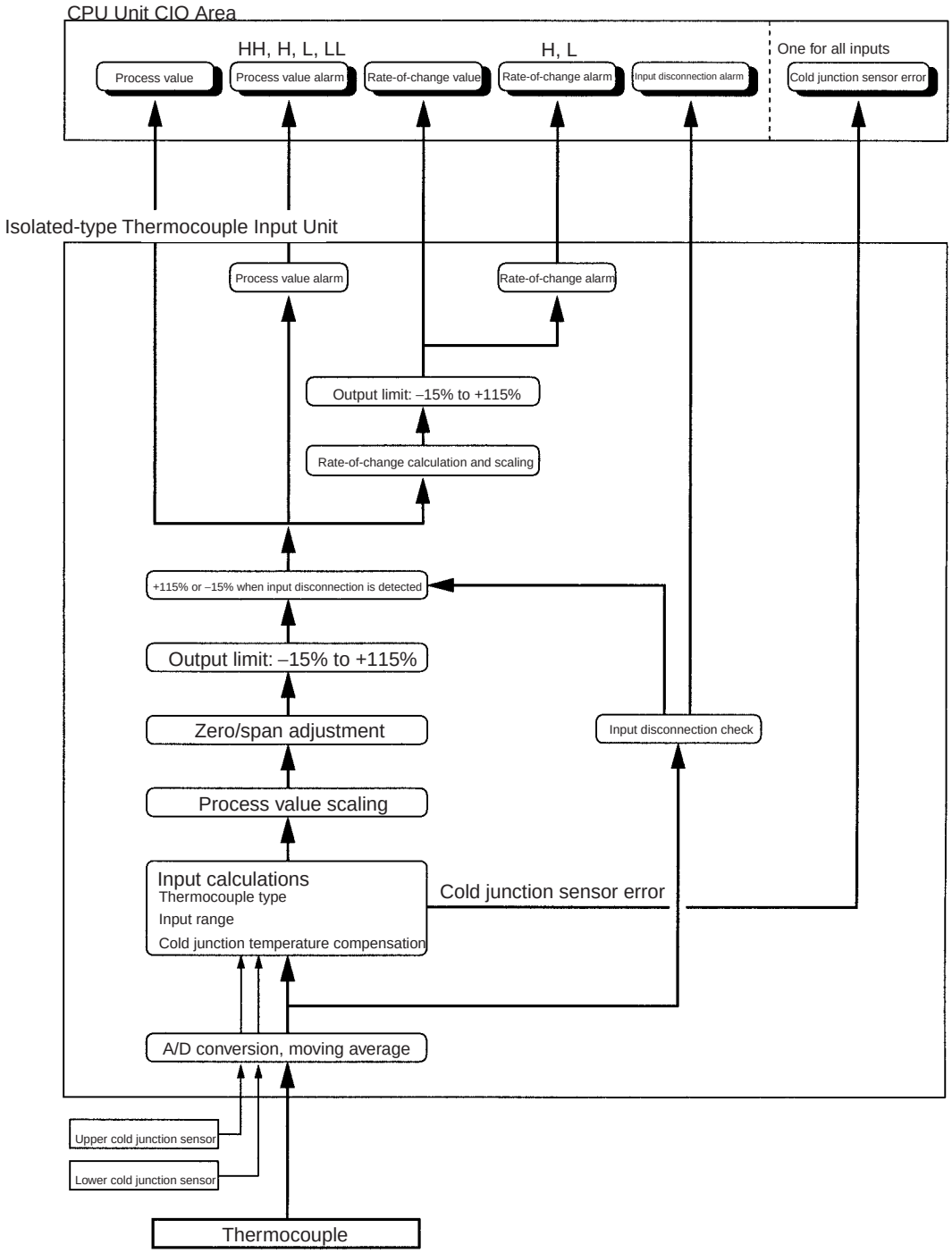
- Up to four thermocouples can be directly connected to each Unit (with four separate settings for temperature sensors and input ranges).
- Isolation between inputs prevents sneak circuits from occurring between thermocouple inputs.
- This Unit is suitable for a wide range of temperature specifications. K, J, B, E, N, R, S, or T can be selected.
- Temperature sensor values are transmitted to the CPU Unit in four digits hexadecimal.
- Variable input range setting.
- Four values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing.
- Rate-of-change calculation.
- Two values for each rate-of-change alarm input.
- Zero/span adjustment capability during operation.
- Disconnection detection.
- Maximum or minimum process value can be specified for when a disconnection is detected.

Model Information

Unit classification	Model number	Inputs	Temperature sensor types
CS-series Special I/O Unit	CS1W-PTS01-V1	4 max.	Thermocouple K, J, B, E, N, R, S, T, or mV.

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Specifications

Item		Specifications	
Model number		CS1W-PTS01-V1	
Applicable PC		CS Series	
Unit classification		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		96 (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	CIO Area words allocated for Special I/O Units	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 for 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) 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 (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		±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		1/4096 (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	
Maximum signal input		–80 to 80 mV	

Item		Specifications
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 PC 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)
Alarm time for 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 (Nos. 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.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

DM Area address				Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal		
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+93. • 12345 (3039 Hex): The default data at the left is transferred from the Thermocouple Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Thermocouple Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Process value alarm settings
m + 2	m + 10	m + 18	m + 26	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Process value HH (high high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 11	m + 19	m + 27	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 4	m + 12	m + 20	m + 28	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
m + 5	m + 13	m + 21	m + 29	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Process value LL (low low limit) alarm setting (Set at process value scaling value.)
							Rate-of-change value alarm settings
m + 6	m + 14	m + 22	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Rate-of-change value H (high limit) alarm setting (Set at rate-of-change scaling value.)
m + 7	m + 15	m + 23	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Rate-of-change value L (low limit) alarm setting (Set at rate-of-change scaling value.)
							Zero/span adjustment
m + 8	m + 16	m + 24	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 9	m + 17	m + 25	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Thermocouple Input Unit if m is other than 12345 when the PC is powered up or the Thermocouple Input Unit is restarted.							
m + 34	m + 49	m + 64	m + 79	0 to 8	0000 to 0008 Hex	3 (0003 Hex)	**Sensor type** 0: B, 1: E, 2: J, 3: K, 4: N, 5: R, 6: S, 7: T, 8: mV
							Process value input range settings
m + 35	m + 50	m + 65	m + 80	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Maximum input signal value (set value x 0.1°C/°F or mV)
m + 36	m + 51	m + 66	m + 81	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Minimum input signal value (set value x 0.1°C/°F or mV)
m + 37	m + 52	m + 67	m + 82	0, 1	0000, 0001 Hex	0 (0000 Hex)	Unit 0: °C, 1: °F
m + 38	m + 53	m + 68	m + 83	0, 1	0000, 0001 Hex	0 (0000 Hex)	Process value overrange direction at time of input disconnection 0: High; 1: Low
							Process value scaling
m + 39	m + 54	m + 69	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)
m + 40	m + 55	m + 70	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)
							Alarm supplementary functions
m + 41	m + 56	m + 71	m + 86	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value. Shared with process value alarm and rate-of–change alarm.)

DM Area address				Data range		Default (See note 1.)	Data contents	
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal			
m + 42	m + 57	m + 72	m + 87	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s) (Shared with process value alarm and rate-of–change alarm.)	
							Rate-of-change function	
m + 43	m + 58	m + 73	m + 88	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change range setting	Maximum rate-of-change value (Process value industrial unit; comparison time interval)
m + 44	m + 59	m + 74	m + 89	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–4000 (F060 Hex)		Minimum rate-of-change value (Process value industrial unit; comparison time interval)
m + 45	m + 60	m + 75	m + 90	1 to 16	0001 to 0010 Hex	1 (0001 Hex)	**Rate-of-change comparison time interval** (Unit: s)	
m + 46	m + 61	m + 76	m + 91	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change value scaling	Value stored for maximum value in range
m + 47	m + 62	m + 77	m + 92	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)		Value stored for minimum value in range
							Mean value processing function	
m + 48	m + 63	m + 78	m + 93	1 to 16	0001 to 0010 Hex	4 (0004 Hex)	Number of process values for calculating moving average for mean value processing	
Storage parameter								
m + 94	m + 95	m + 96	m + 97	0 to 93	0000 to 005D Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)	

Note

1. The default values are transferred from the Thermocouple Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

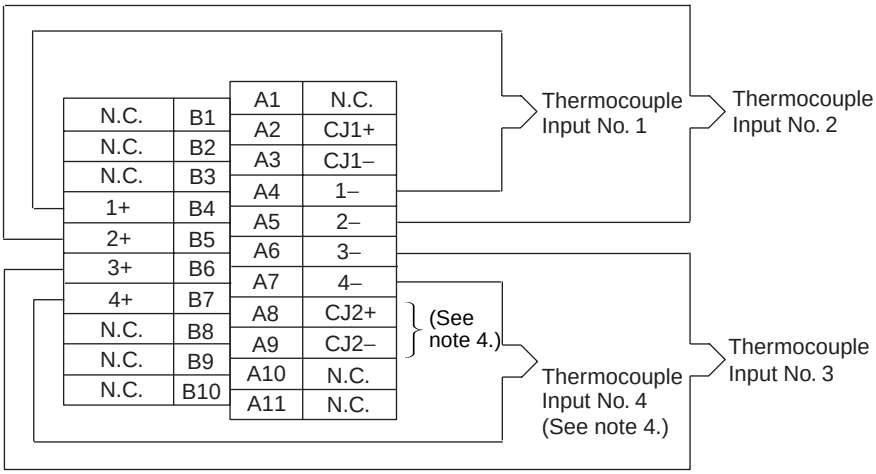
n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Thermocouple Input Unit to CPU Unit	n	00	Input No. 1	Process value LL (low low limit) alarm	0, 1	0: Process value > Set value 1: Process value ≤ Set value
		01		Process value L (low limit) alarm	0, 1	
		02		Process value H (high limit) alarm	0, 1	0: Process value < Set value 1: Process value ≥ Set value
		03		Process value HH (high high limit) alarm	0, 1	
		04	Input No. 2	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value L (low limit) alarm	0, 1	
		06		Process value H (high limit) alarm	0, 1	
		07		Process value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value L (low limit) alarm	0, 1	
		10		Process value H (high limit) alarm	0, 1	
		11		Process value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value L (low limit) alarm	0, 1	
		14		Process value H (high limit) alarm	0, 1	
		15		Process value HH (high high limit) alarm	0, 1	

Direction	Word	Bit	Name		Data range	Contents
Thermocouple Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The process value rate of change is stored according to the scaling set in the allocated words of the DM Area.
	n + 6	00 to 15	Input No. 2 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 3 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 4 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 9	00	Input No. 1	Rate-of-change value L (low limit) alarm	0, 1	0: Rate-of-change value > Set value 1: Rate-of-change value ≤ Set value
		01		Rate-of-change value H (high limit) alarm	0, 1	0: Rate-of-change value < Set value 1: Rate-of-change value ≥ Set value
		02	Input No. 2	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Rate-of-change value H (high limit) alarm	0, 1	
		04	Input No. 3	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Rate-of-change value H (high limit) alarm	0, 1	
		06	Input No. 4	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Rate-of-change value H (high limit) alarm	0, 1	
		08	Input No. 1 input disconnection		0, 1	0: Normal 1: Disconnection
		09	Input No. 2 input disconnection		0, 1	Same as for input No. 1.
		10	Input No. 3 input disconnection		0, 1	Same as for input No. 1.
		11	Input No. 4 input disconnection		0, 1	Same as for input No. 1.
		12	Cold junction sensor error		0, 1	0: Normal 1: Error

Terminal Connection Diagram

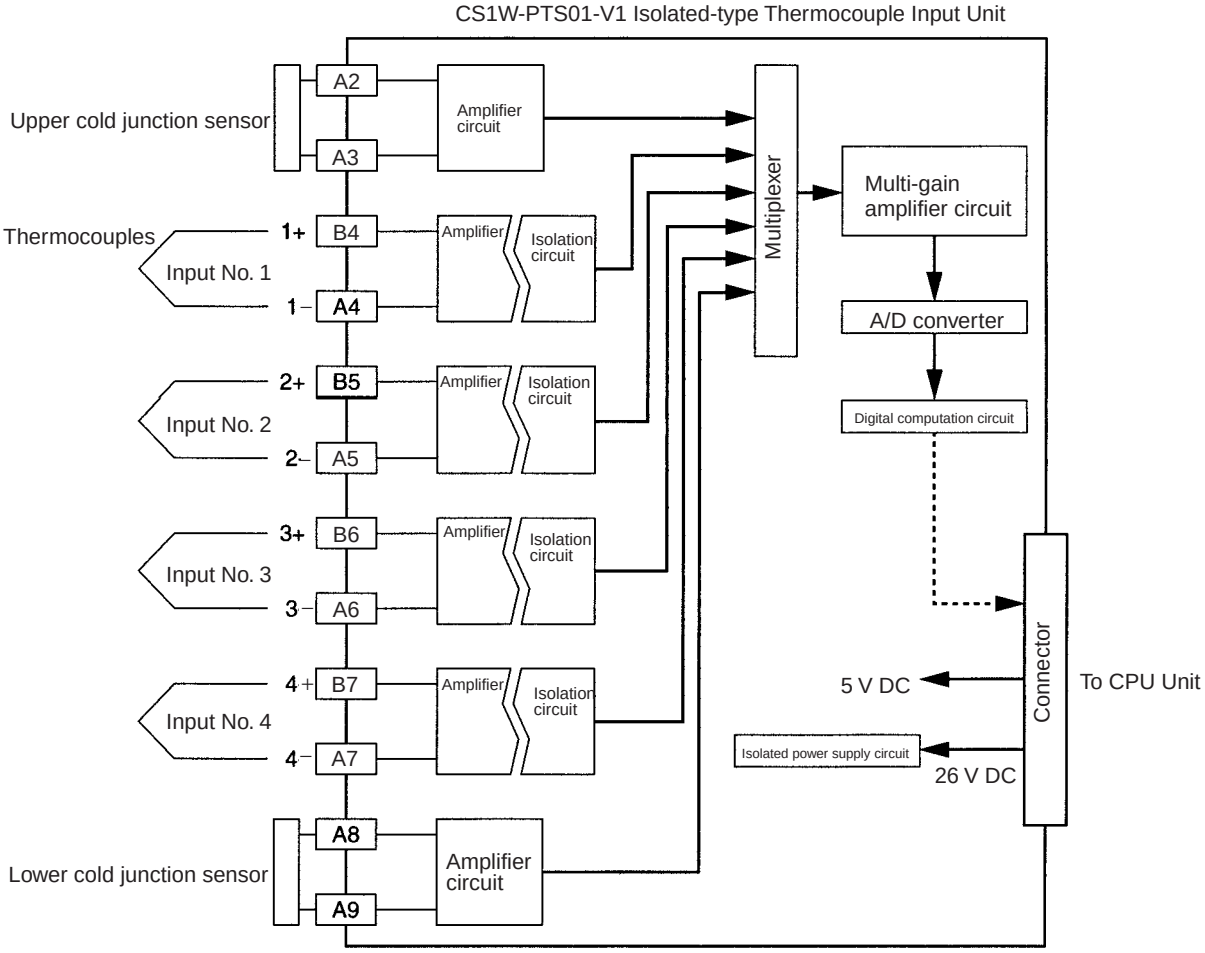
CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit



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



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage has changed. Check for faulty or disconnected wiring. Check whether a wiring disconnection has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
Cold junction compensation is not operating.	Check the Cold Junction Sensor Error Flag.
No compensation lead wire is being used, or another type of compensation lead wire is being used.	Use the correct compensation lead wire for thermocouples.
The input wiring is faulty. (The thermocouple or compensation lead wire polarity is wrong.)	Correct the input wiring.

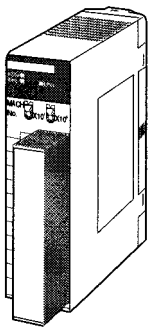
Converted Values are Unstable.

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the positive and negative input terminals.
	Increase the number of values for calculating the moving average in mean value processing.
The process value scaling value is greater than the Unit's resolution.	Reduce the process value scaling value.
The input signal range setting is too small.	Match the input signal range to the internal ranges.

2-2 CS1W-PTS02 Isolated-type Resistance Thermometer Input Unit

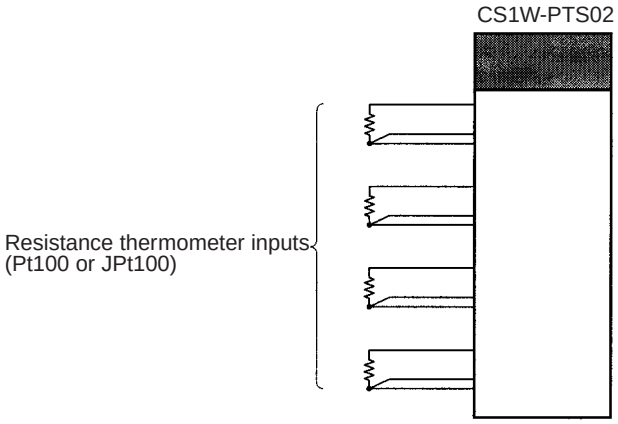
Overview

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.



CS1W-PTS02

System Configuration



Features

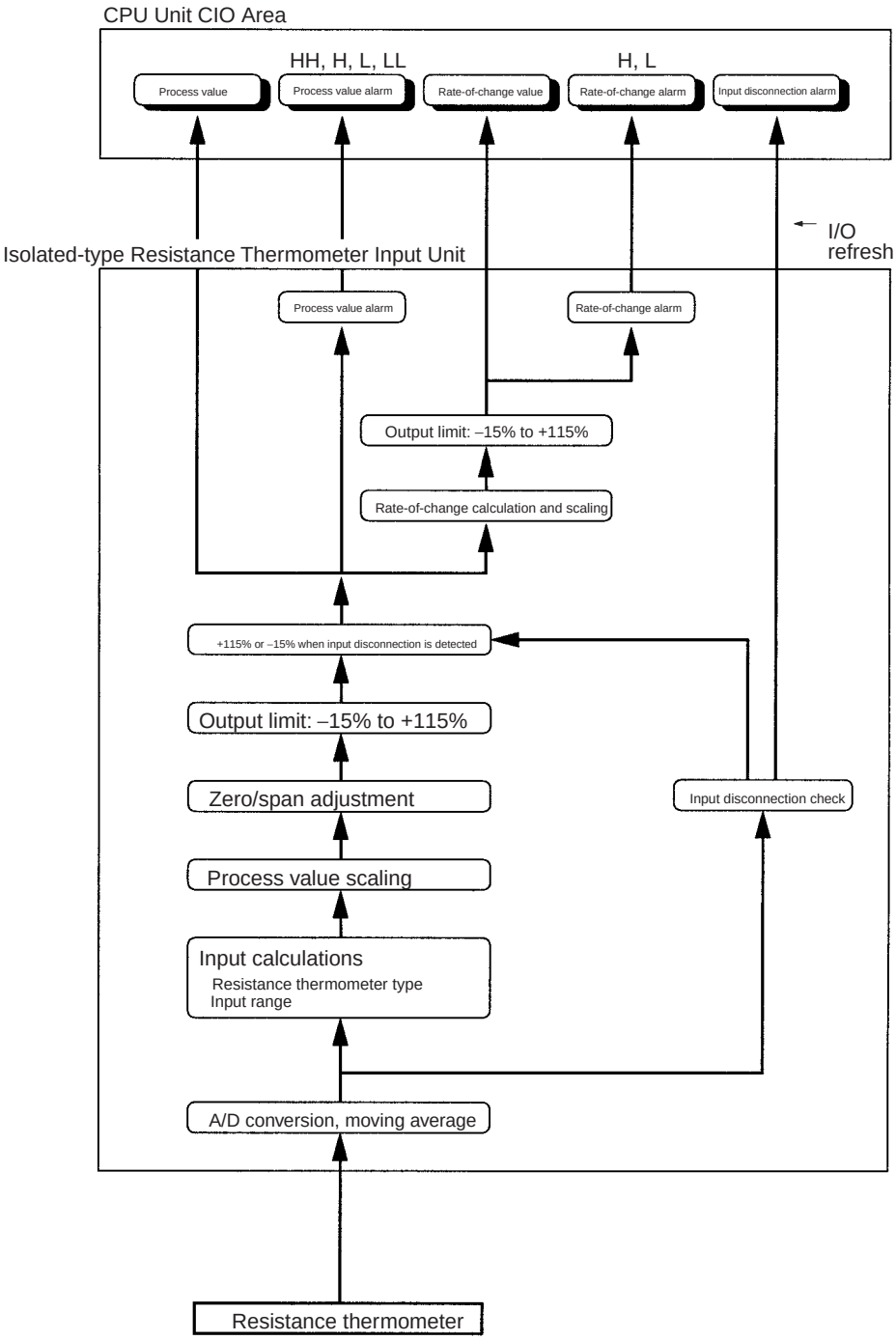
- Up to four platinum resistance thermometers can be connected for each Unit (with four separate settings for temperature sensors and input ranges).
- Pt100 (JIS, IEC) or JPt100 can be selected.
- Temperature sensor values are transmitted to the CPU Unit in four digits hexadecimal.
- Variable input range setting.
- Four values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing.
- Rate-of-change calculation.
- Two values for each rate-of-change alarm input.
- Zero/span adjustment capability during operation.
- Disconnection detection.
- Maximum or minimum process value can be specified for when a disconnection is detected.

Model Information

Unit classification	Model number	Inputs	Temperature sensor types
CS-series Special I/O Unit	CS1W-PTS02	4 max.	Platinum resistance thermometer Pt100 (JIS, IEC) or JPt100.

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Specifications

Item	Specifications
Model	CS1W-PTS02
Applicable PC	CS Series
Unit classification	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	96 (within the allowable current consumption and power consumption range)

Item		Specifications	
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)	
Areas for data exchange with CPU Unit	CIO Area words allocated for Special I/O Units	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 for Special I/O Units	100 words/Unit CPU Unit to Resistance Thermometer: 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		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 (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		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. $\text{Accuracy} = \pm 0.1\% \times \frac{\text{Internal range span}}{\text{Set input range span}}$ or 0.1°C, whichever is greater.	
Temperature coefficient		±0.015% /°C, for any of internal range numbers 0 to 4.	
Resolution		1/4096 (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	
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	

Item		Specifications
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 PC 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)
Alarm time for 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

Sensor Type and Input Range

The resistance thermometer 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.)
Pt100	0	–200 to 850°C
JPt100	1	–200 to 500°C

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

Internally inputs are processed in five progressive ranges (Nos. 0 to 4), as shown in the following table.

Table 2: Internal Ranges

Internal range number	Temperature range	Span
0	–200 to 850°C	1,050°C
1	–200 to 438°C	638°C
2	–200 to 211°C	411°C
3	–100 to 104°C	204°C
4	–51 to 52°C	103°C

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. For the inter-

nal 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 sensor type is Pt100 and the set input range is –100 to 400°C. Since both the minimum and maximum values fall within the limits for internal range No. 1 (–200 to 438°C), that range will be selected.

Note With Resistance Thermometer Input Units, process values can be scaled (e.g., 0% to 100%) 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.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

DM Area address				Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal		
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+93. • 12345 (3039 Hex): The default data at the left is transferred from the Resistance Thermometer Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Resistance Thermometer Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Process value alarm settings
m + 2	m + 10	m + 18	m + 26	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Process value HH (high high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 11	m + 19	m + 27	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 4	m + 12	m + 20	m + 28	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
m + 5	m + 13	m + 21	m + 29	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Process value LL (low low limit) alarm setting (Set at process value scaling value.)
							Rate-of-change value alarm settings
m + 6	m + 14	m + 22	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Rate-of-change value H (high limit) alarm setting (Set at rate-of-change scaling value.)
m + 7	m + 15	m + 23	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Rate-of-change value L (low limit) alarm setting (Set at rate-of-change scaling value.)
							Zero/span adjustment
m + 8	m + 16	m + 24	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 9	m + 17	m + 25	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Resistance Thermometer Input Unit if m is other than 12345 when the PC is powered up or the Resistance Thermometer Input Unit is restarted.							
m + 34	m + 49	m + 64	m + 79	0, 1	0000 to 0001 Hex	0 (0000 Hex)	**Sensor type** 0: Pt100; 1: JPt100
							Process value input range settings
m + 35	m + 50	m + 65	m + 80	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Maximum input signal value (set value x 0.1°C/°F)
m + 36	m + 51	m + 66	m + 81	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Minimum input signal value (set value x 0.1°C/°F)
m + 37	m + 52	m + 67	m + 82	0, 1	0000, 0001 Hex	0 (0000 Hex)	Unit 0: °C, 1: °F

DM Area address				Data range		Default (See note 1.)	Data contents	
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal			
m + 38	m + 53	m + 68	m + 83	0, 1	0000, 0001 Hex	0 (0000 Hex)	Process value overrange direction at time of input disconnection 0: High; 1: Low	
							Process value scaling	
m + 39	m + 54	m + 69	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)	
m + 40	m + 55	m + 70	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)	
							Alarm supplementary functions	
m + 41	m + 56	m + 71	m + 86	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value. Shared with process value alarm and rate-of–change alarm.)	
m + 42	m + 57	m + 72	m + 87	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s) (Shared with process value alarm and rate-of–change alarm.)	
							Rate-of-change function	
m + 43	m + 58	m + 73	m + 88	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change range setting	Maximum rate-of-change value (Process value industrial unit; comparison time interval)
m + 44	m + 59	m + 74	m + 89	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–4000 (F060 Hex)		Minimum rate-of-change value (Process value industrial unit; comparison time interval)
m + 45	m + 60	m + 75	m + 90	1 to 16	0001 to 0010 Hex	1 (0001 Hex)	**Rate-of-change comparison time interval** (Unit: s)	
m + 46	m + 61	m + 76	m + 91	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change value scaling	Value stored for maximum value in range
m + 47	m + 62	m + 77	m + 92	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)		Value stored for minimum value in range
							Mean value processing function	
m + 48	m + 63	m + 78	m + 93	1 to 16	0001 to 0010 Hex	4 (0004 Hex)	Number of process values for calculating moving average for mean value processing	
Storage parameter								
m + 94	m + 95	m + 96	m + 97	0 to 93	0000 to 005D Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)	

Note

1. The default values are transferred from the Resistance Thermometer Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

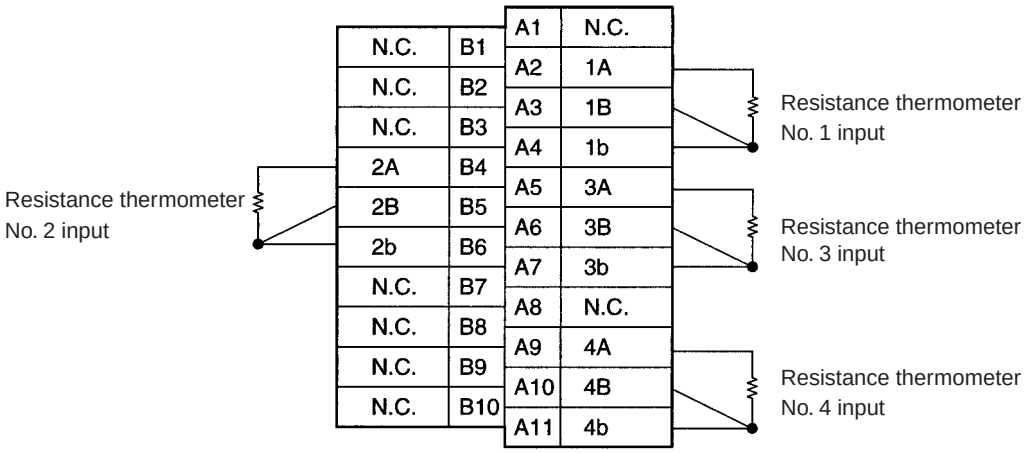
n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Resistance Thermometer Input Unit to CPU Unit	n	00	Input No. 1	Process value LL (low low limit) alarm	0, 1	0: Process value > Set value
		01		Process value L (low limit) alarm	0, 1	1: Process value ≤ Set value
		02		Process value H (high limit) alarm	0, 1	0: Process value < Set value
		03		Process value HH (high high limit) alarm	0, 1	1: Process value ≥ Set value
		04	Input No. 2	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value L (low limit) alarm	0, 1	
		06		Process value H (high limit) alarm	0, 1	
		07		Process value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value L (low limit) alarm	0, 1	
		10		Process value H (high limit) alarm	0, 1	
		11		Process value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value L (low limit) alarm	0, 1	
		14		Process value H (high limit) alarm	0, 1	
		15		Process value HH (high high limit) alarm	0, 1	

Direction	Word	Bit	Name		Data range	Contents
Resistance Thermometer Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The process value rate of change is stored according to the scaling set in the allocated words of the DM Area.
	n + 6	00 to 15	Input No. 2 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 3 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 4 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 9	00	Input No. 1	Rate-of-change value L (low limit) alarm	0, 1	0: Rate-of-change value > Set value 1: Rate-of-change value ≤ Set value
		01		Rate-of-change value H (high limit) alarm	0, 1	0: Rate-of-change value < Set value 1: Rate-of-change value ≥ Set value
		02	Input No. 2	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Rate-of-change value H (high limit) alarm	0, 1	
		04	Input No. 3	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Rate-of-change value H (high limit) alarm	0, 1	
		06	Input No. 4	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Rate-of-change value H (high limit) alarm	0, 1	
		08	Input No. 1 input disconnection		0, 1	0: Normal 1: Disconnection
		09	Input No. 2 input disconnection		0, 1	Same as for input No. 1.
		10	Input No. 3 input disconnection		0, 1	Same as for input No. 1.
		11	Input No. 4 input disconnection		0, 1	Same as for input No. 1.

Terminal Connection Diagram

CS1W-PTS02 Isolated-type Resistance Thermometer Unit

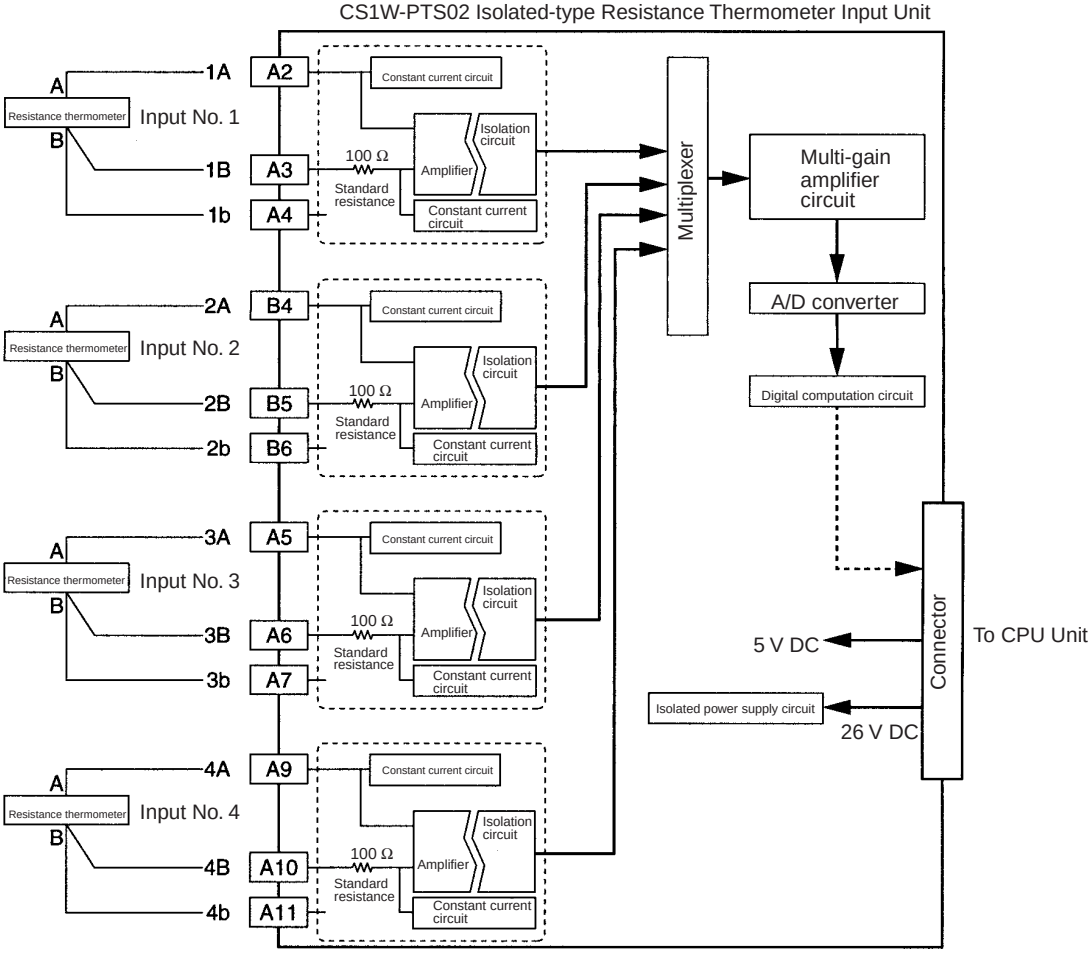


Note

1. Wire the same length to A, B, and b, so that the impedance will be the same. In particular, do not short circuit between B and b at the terminal block.
2. For unused input terminals, short-circuit between A–B and B–b (e.g., A2–A3 and A3–A4 for input No. 1) of the resistance thermometer inputs with the lead wire.

Terminal Block Diagram

CS1W-PTS02 Isolated-type Resistance Thermometer Input Unit



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage or current has changed. Check for faulty or disconnected wiring. Check whether a wiring disconnection has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The resistance thermometer input wiring is faulty.	Correct the input wiring.

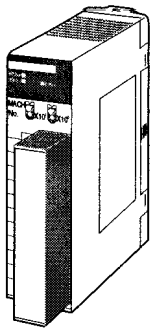
Converted Values are Unstable.

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Increase the number of values for calculating the moving average in mean value processing.
The process value scaling value is greater than the Unit's resolution.	Reduce the process value scaling value.
The input signal range setting is too small.	Match the input signal range to the internal ranges.

2-3 CS1W-PTS03 Isolated-type Resistance Thermometer Input Unit

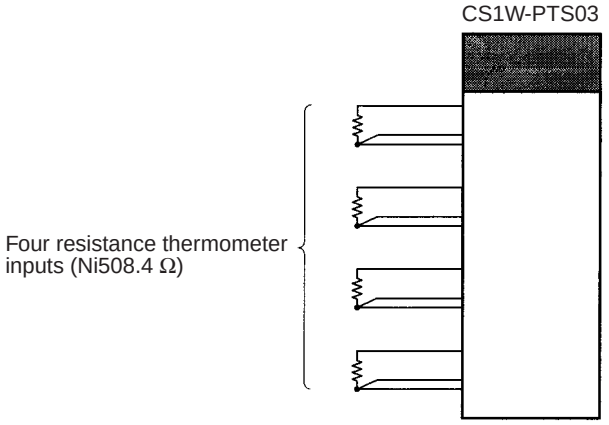
Overview

The CS1W-PTS03 Isolated-type Resistance Thermometer Input Unit provides four direct Ni thermometer inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



CS1W-PTS03

System Configuration



Features

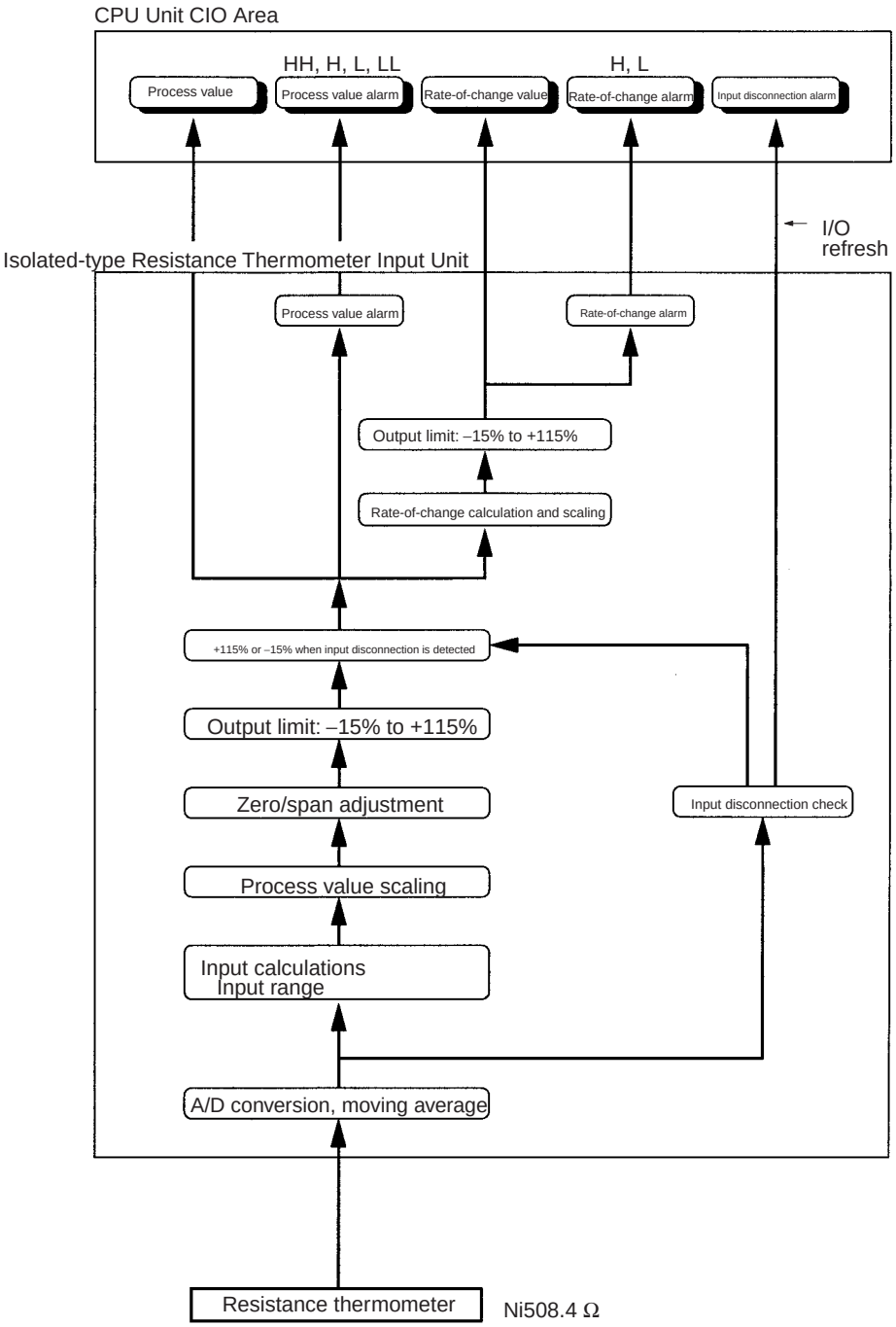
- Up to four Ni resistance thermometers (508.4 Ω) can be connected for each Unit (with four separate input ranges).
- Temperature sensor values are sent to the CPU Unit in four digits hexadecimal.
- Variable input range setting.
- Four values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing.
- Rate-of-change calculation.
- Two values for each rate-of-change alarm input.
- Zero/span adjustment capability during operation.
- Disconnection detection.
- Maximum or minimum process value can be specified for when a disconnection is detected.

Model Information

Unit classification	Model number	Inputs	Temperature sensor types
CS-series Special I/O Unit	CS1W-PTS03	4 max.	Resistance thermometer Ni508.4 Ω

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Specifications

Item	Specifications
Model	CS1W-PTS03
Applicable PC	CS Series
Unit classification	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	96 (within the allowable current consumption and power consumption range)

Item		Specifications	
Unit numbers		00 to 95 (Cannot duplicate Special I/O Unit numbers.)	
Areas for data exchange with CPU Unit	CIO Area words allocated for Special I/O Units	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	
	DM Area words allocated for 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 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		Ni508.4 Ω	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 a range of –50 to 150°C (variable setting). **Note** Internally, inputs are processed in the above range (refer to Table 2 below), so accuracy and resolution accord with this internal range.	Example: Input range: –50 to 100°C; industrial unit scaling: –50.0 to 100.0°C. DM Area settings are as follows: Input signal maximum: 1000 (03E8 Hex) Input signal minimum: –500 (FE0C Hex) Industrial unit maximum value stored: 1000 (03E8 Hex) Industrial unit minimum value stored: –500 (FE0C 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%.	
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		The greater of the following:±0.2% (of internal range full span) or 0.2°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. $\text{Accuracy} = \pm 0.2\% \times \frac{\text{Internal range span}}{\text{Set input range span}}$ or 0.2°C, whichever is greater.	
Temperature coefficient		±0.015% /°C, for any of internal range numbers 0 to 4.	
Resolution		1/4096 (of internal range full span) As shown in the following equation, the resolution depends on the ratio of the internal range 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	
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 high/low direction for when a disconnection occurs can be specified. (High: 115% of set input range; low: –15% of set input range)	

Item		Specifications
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 PC 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)
Alarm time for 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

Sensor Type and Input Range

The input range is set in the allocated words in the DM Area for every four inputs. It can be set anywhere within the measurable input range shown in Table 1.

Measurable Input Range

Sensor type	Measurable Input range (See note.)
Ni508.4 Ω	–50 to 150°C

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

Even if the input range is set more narrowly than the range of –50 to 150°C, internally inputs will be processed according to the internal range shown in the following table.

Internal range

Internal range temperatures	Internal range span
–50 to 150°C	200°C

Therefore, the accuracy and resolution are determined by the ratio of the internal range span to the set input range span.

Example: Even if the set input range is –50 to 100°C, internally inputs will be processed according to the internal range of –50 to 150°C.

Note With Resistance Thermometer Units (Ni508.4 Ω), process values can be scaled (e.g., 0% to 100%) in industrial units for the set input range. Generally, however, set the same values for process value scaling in industrial units as 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.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

DM Area address				Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal		
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+93. • 12345 (3039 Hex): The default data at the left is transferred from the Resistance Thermometer Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Resistance Thermometer Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Process value alarm settings
m + 2	m + 10	m + 18	m + 26	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Process value HH (high high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 11	m + 19	m + 27	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 4	m + 12	m + 20	m + 28	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
m + 5	m + 13	m + 21	m + 29	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Process value LL (low low limit) alarm setting (Set at process value scaling value.)
							Rate-of-change value alarm settings
m + 6	m + 14	m + 22	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Rate-of-change value H (high limit) alarm setting (Set at rate-of-change scaling value.)
m + 7	m + 15	m + 23	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Rate-of-change value L (low limit) alarm setting (Set at rate-of-change scaling value.)
							Zero/span adjustment
m + 8	m + 16	m + 24	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 9	m + 17	m + 25	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Resistance Thermometer Input Unit if m is other than 12345 when the PC is powered up or the Resistance Thermometer Input Unit is restarted.							
m + 34	m + 49	m + 64	m + 79	2	0002 Hex	2 (0002 Hex)	**Sensor type** 2: Ni508.4 Ω
							Process value input range settings
m + 35	m + 50	m + 65	m + 80	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	1000 (03E8 Hex)	Maximum input signal value (set value x 0.1°C/°F)
m + 36	m + 51	m + 66	m + 81	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–500 (FE0CH Hex)	Minimum input signal value (set value x 0.1°C/°F)
m + 37	m + 52	m + 67	m + 82	0, 1	0000, 0001 Hex	0 (0000 Hex)	Unit 0: °C, 1: °F
m + 38	m + 53	m + 68	m + 83	0, 1	0000, 0001 Hex	0 (0000 Hex)	Process value overrange direction at time of input disconnection 0: High; 1: Low
							Process value scaling
m + 39	m + 54	m + 69	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)
m + 40	m + 55	m + 70	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)
							Alarm supplementary functions
m + 41	m + 56	m + 71	m + 86	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value. Shared with process value alarm and rate-of–change alarm.)

DM Area address				Data range		Default (See note 1.)	Data contents	
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal			
m + 42	m + 57	m + 72	m + 87	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s) (Shared with process value alarm and rate-of–change alarm.)	
							Rate-of-change function	
m + 43	m + 58	m + 73	m + 88	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change range setting	Maximum rate-of-change value (Process value industrial unit; comparison time interval)
m + 44	m + 59	m + 74	m + 89	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–4000 (F060 Hex)		Minimum rate-of-change value (Process value industrial unit; comparison time interval)
m + 45	m + 60	m + 75	m + 90	1 to 16	0001 to 0010 Hex	1 (0001 Hex)	**Rate-of-change comparison time interval** (Unit: s)	
m + 46	m + 61	m + 76	m + 91	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change value scaling	Value stored for maximum value in range
m + 47	m + 62	m + 77	m + 92	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)		Value stored for minimum value in range
							Mean value processing function	
m + 48	m + 63	m + 78	m + 93	1 to 16	0001 to 0010 Hex	4 (0004 Hex)	Number of process values for calculating moving average for mean value processing	
Storage parameter								
m + 94	m + 95	m + 96	m + 97	0 to 93	0000 to 005D Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)	

Note

1. The default values are transferred from the Resistance Thermometer Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group 1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

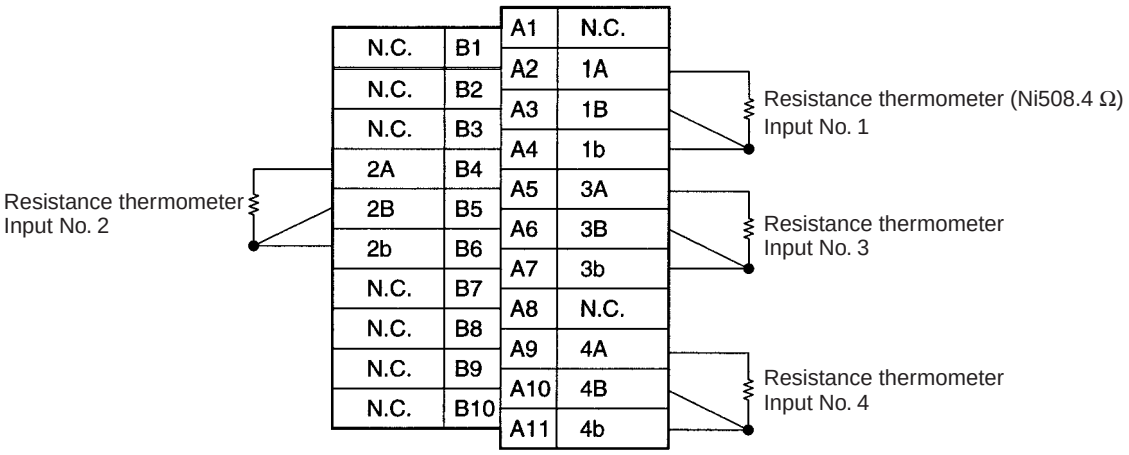
n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Resistance Thermometer Input Unit to CPU Unit	n	00	Input No. 1	Process value LL (low low limit) alarm	0, 1	0: Process value > Set value
		01		Process value L (low limit) alarm	0, 1	1: Process value ≤ Set value
		02		Process value H (high limit) alarm	0, 1	0: Process value < Set value
		03		Process value HH (high high limit) alarm	0, 1	1: Process value ≥ Set value
		04	Input No. 2	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value L (low limit) alarm	0, 1	
		06		Process value H (high limit) alarm	0, 1	
		07		Process value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value L (low limit) alarm	0, 1	
		10		Process value H (high limit) alarm	0, 1	
		11		Process value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value L (low limit) alarm	0, 1	
		14		Process value H (high limit) alarm	0, 1	
		15		Process value HH (high high limit) alarm	0, 1	

Direction	Word	Bit	Name		Data range	Contents
Resistance Thermometer Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The process value rate of change is stored according to the scaling set in the allocated words of the DM Area.
	n + 6	00 to 15	Input No. 2 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 3 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 4 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 9	00	Input No. 1	Rate-of-change value L (low limit) alarm	0, 1	0: Rate-of-change value > Set value 1: Rate-of-change value ≤ Set value
		01		Rate-of-change value H (high limit) alarm	0, 1	0: Rate-of-change value < Set value 1: Rate-of-change value ≥ Set value
		02	Input No. 2	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Rate-of-change value H (high limit) alarm	0, 1	
		04	Input No. 3	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Rate-of-change value H (high limit) alarm	0, 1	
		06	Input No. 4	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Rate-of-change value H (high limit) alarm	0, 1	
		08	Input No. 1 input disconnection		0, 1	0: Normal 1: Disconnection
		09	Input No. 2 input disconnection		0, 1	Same as for input No. 1.
		10	Input No. 3 input disconnection		0, 1	Same as for input No. 1.
		11	Input No. 4 input disconnection		0, 1	Same as for input No. 1.

Terminal Connection Diagram

CS1W-PTS03 Isolated-type Resistance Thermometer Unit

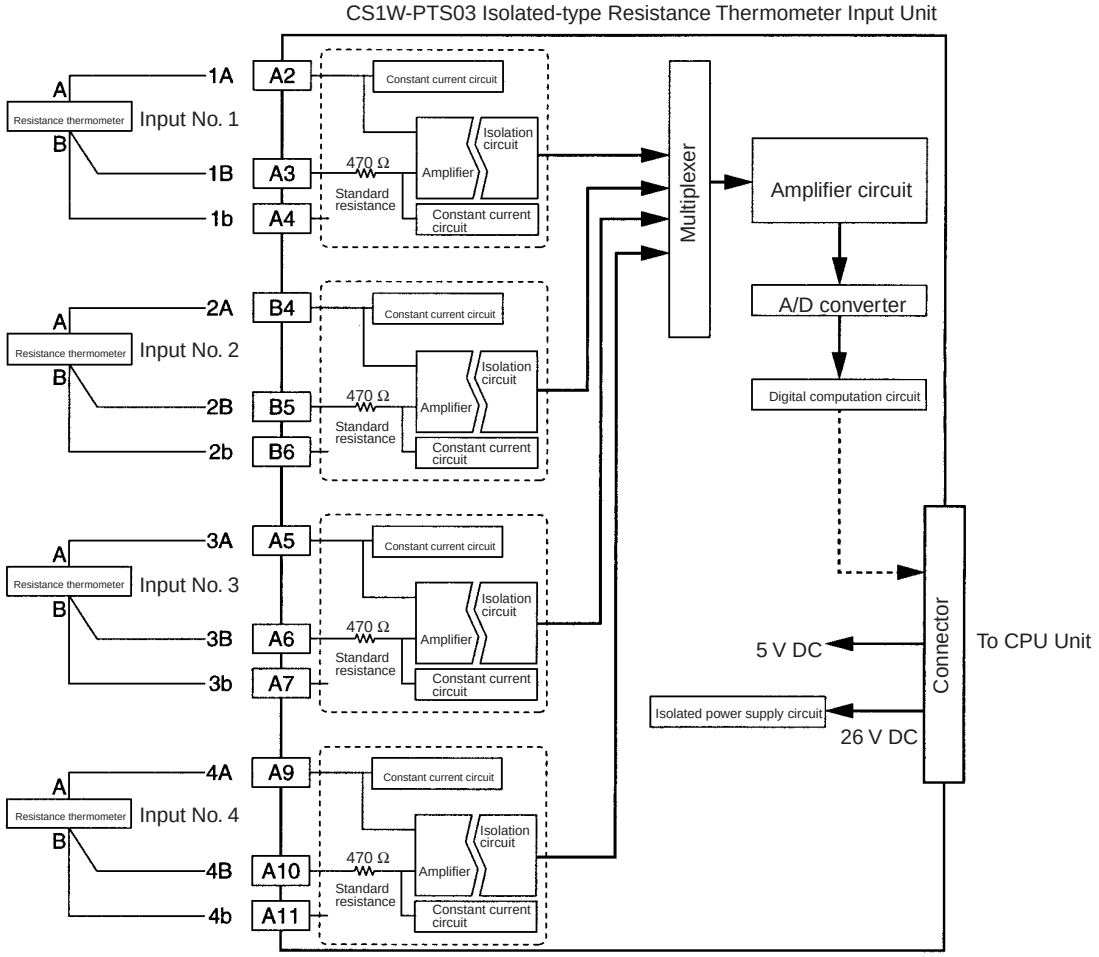


Note

1. Wire the same length to A, B, and b, so that the impedance will be the same. In particular, do not short circuit between B and b at the terminal block.
2. For unused input terminals, short-circuit between A–B and B–b (e.g., A2–A3 and A3–A4 for input No. 1) of the resistance thermometer inputs with the lead wire.

Terminal Block Diagram

CS1W-PTS03 Isolated-type Resistance Thermometer Input Unit



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage or current has changed. Check for faulty or disconnected wiring. Check whether a wiring disconnection has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The sensor type, input range, or process value scaling is not set correctly.	Check and correct the settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The resistance thermometer input wiring is faulty.	Correct the input wiring.

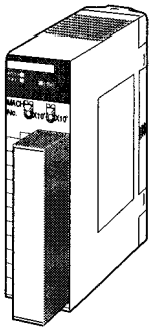
Converted Values are Unstable.

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Increase the number of values for calculating the moving average in mean value processing.
The process value scaling value is greater than the Unit's resolution.	Reduce the process value scaling value.
The input signal range setting is too small.	Match the input signal range to the internal ranges.

2-4 CS1W-PTW01 2-Wire Transmitter Input Unit

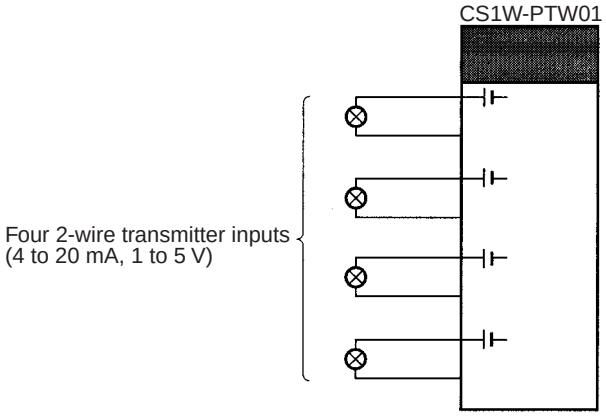
Overview

The CS1W-PTW01 2-Wire Transmitter Input Unit provides up to four inputs for unified signals (4 to 20 mA) from a transmitter, with no external DC power supply, and sends the data to the CPU Unit each cycle.



CS1W-PTW01

System Configuration



Features

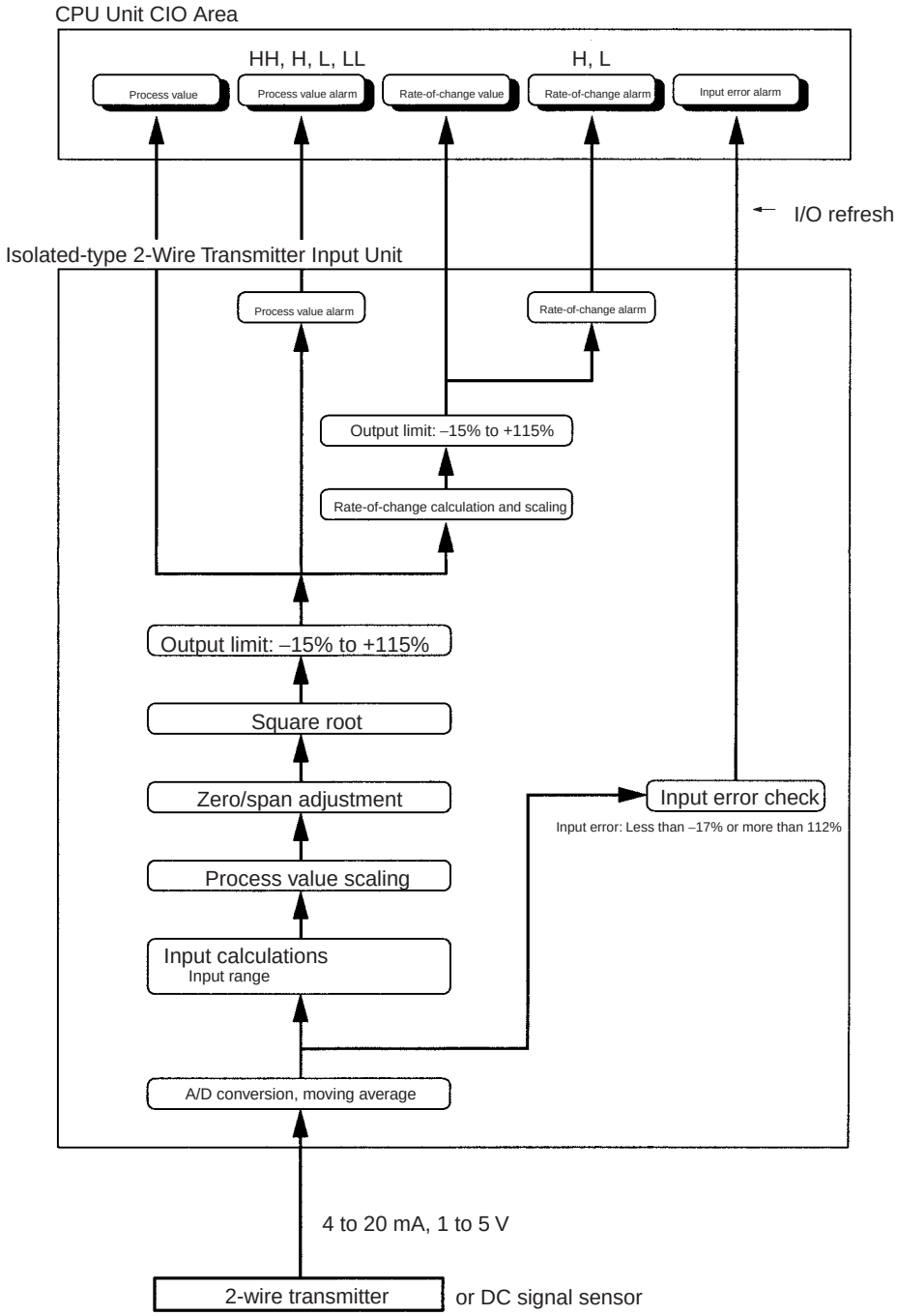
- Up to four inputs can be connected per Unit for unified signals from a 2-wire transmitter, such as pressure, differential pressure, etc.
- A built-in power supply (24 V DC) for a 2-wire transmitter for each input eliminates the need for an external power supply.
- Inputs of 4 to 20 mA and 1 to 5 V, are possible with no need to provide the usual DC power supply.
- Scaling values are sent to the CPU Unit in four digits hexadecimal.
- Square root function.
- Four values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing.
- Rate-of-change calculation.
- Two values for each rate-of-change alarm input.
- Input error detection.
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Inputs	Input types
CS-series Special I/O Unit	CS1W-PTW01	4 max.	From transmitter: unified signal (4 to 20 mA) or 4 to 20 mA, 1 to 5 V

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Item	Specifications
Model	CS1W-PTW01
Applicable PC	CS Series
Unit classification	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	96 (within the allowable current consumption and power consumption range)
Unit numbers	00 to 95 (Cannot duplicate Special I/O Unit numbers.)

Item		Specifications	
Areas for data exchange with CPU Unit	CIO Area words allocated for Special I/O Units	10 words/Unit 2-Wire Transmitter 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), input errors	
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to 2-Wire Transmitter Input Unit: Input signal type, scaling of process value data to be stored in allocated words in CIO area, square root function enable, rate-of-change value range, rate-of-change scaling, 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 inputs		4	
Input signal type		Unified signal from transmitter (4 to 20 mA), 4 to 20 mA, 1 to 5 V	Input signal type and scaling to industrial units are separate for each of the 4 inputs. **Note** Input signal type and scaling to industrial units are set in the DM Area. Example: Input signal type: 4 to 20 mA from 2-wire transmitter; industrial unit scaling: 0 to 500 m^3/h (after square root extraction). DM Area settings are as follows: Input signal type: 0 (0000 Hex) Industrial unit maximum value stored: 500 (01F4 Hex) Industrial unit minimum value stored: 0 (0000 Hex)
User-defined scaling in industrial units		Scaling required for 4 to 20 mA or 1 to 5 V. (Any minimum and maximum values can be set.) (4 inputs set separately.)	
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the process value data 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) Square root extraction → 5) Output limits	
Accuracy		±0.2% of full scale	
Temperature coefficient		±0.015%/°C of full scale	
Resolution		1/4096 of full scale	
Input signal range		–15 to 115%	
Power supply for 2-wire transmitter		Output voltage: 24 V DC ±15% for each input Current capacity: 22 mA max. for each input Short-circuit control current: 22 to 27 mA Allowable short-circuit time: Ambient temperature less than 40°C: No limit Ambient temperature 40 to 55°C: 10 min or less	
Input impedance		4 to 20 mA for 2-wire transmitter: 250 Ω; 4 to 20 mA: 250 Ω; 1 to 5 V: 1 MΩ 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	
Input error detection		Error detected when under –17.2% (4 to 20 mA: 1.25 mA; 1 to 5 V: 0.3125 V) or over 112.5% (4 to 20 mA: 22 mA; 1 to 5 V: 5.5 V).	
Operation at input disconnection		Process value of –15% stored.	
Input disconnection overrange time		Approx. 1 s	

Item		Specifications
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.
	Square root	When the process value scaling maximum value is A and the minimum value is B: Output = $\sqrt{(A-B)\ (Input-B)}$ +B Dropout: Output approx. 7% maximum linear (output = input) characteristics **Note** The square root function is only enabled when the maximum scaling value is greater than the minimum value. **Note** When square root processing is being performed, set the maximum and minimum scaling values to the values required after square root processing of the current or other input values.
Isolation		Between inputs and between input terminals and PC 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 2-Wire Transmitter Input Unit, and errors related to the CPU Unit).
Front panel connector		Sensor input connector terminal block (detachable)
Alarm time for CPU Unit cycle time		0.3 ms
Current consumption		5 V DC at 150 mA max., 26 V DC at 160 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

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+81. • 12345 (3039 Hex): The default data at the left is transferred from the 2-Wire Transmitter Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the 2-Wire Transmitter Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Process value alarm settings
m + 2	m + 10	m + 18	m + 26	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Process value HH (high high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 11	m + 19	m + 27	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 4	m + 12	m + 20	m + 28	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
m + 5	m + 13	m + 21	m + 29	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Process value LL (low low limit) alarm setting (Set at process value scaling value.)
							Rate-of-change value alarm settings
m + 6	m + 14	m + 22	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Rate-of-change value H (high limit) alarm setting (Set at rate-of-change scaling value.)
m + 7	m + 15	m + 23	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Rate-of-change value L (low limit) alarm setting (Set at rate-of-change scaling value.)
							Zero/span adjustment
m + 8	m + 16	m + 24	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 9	m + 17	m + 25	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the 2-Wire Transmitter Input Unit if m is other than 12345 when the PC is powered up or the 2-Wire Transmitter Input Unit is restarted.							
m + 34	m + 46	m + 58	m + 70	0, 1	0000 to 0001 Hex	0 (0000 Hex)	Input signal type 0: 4 to 20 mA, 1: 1 to 5 V
m + 35	m + 47	m + 59	m + 71	0, 1	0000 to 0001 Hex	0 (0000 Hex)	Square root extraction 0: Disable; 1: Enable
							Process value scaling
m + 36	m + 48	m + 60	m + 72	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)
m + 37	m +49	m + 61	m + 73	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)
							Alarm supplementary functions
m + 38	m + 50	m + 62	m + 74	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value. Shared with process value alarm and rate-of–change alarm.)
m + 39	m + 51	m + 63	m + 75	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s) (Shared with process value alarm and rate-of–change alarm.)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents	
							Rate-of-change function	
m + 40	m + 52	m + 64	m + 76	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change range setting	Maximum rate-of-change value (Process value industrial unit; comparison time interval)
m + 41	m + 53	m + 65	m + 77	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–4000 (F060 Hex)		Minimum rate-of-change value (Process value industrial unit; comparison time interval)
m + 42	m + 54	m + 66	m + 78	1 to 16	0001 to 0010 Hex	01 (0001 Hex)	**Rate-of-change comparison time interval** (Unit: s)	
m + 43	m + 55	m + 67	m + 79	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change value scaling	Value stored for maximum value in range
m + 44	m + 56	m + 68	m + 80	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)		Value stored for minimum value in range
							Mean value processing function	
m + 45	m + 57	m + 69	m + 81	1 to 16	0001 to 0010 Hex	4 (0004 Hex)	Number of process values for calculating moving average for mean value processing	
Storage parameter								
m + 82	m + 83	m + 84	m + 85	0 to 81	0000 to 0051 Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)	

Note

1. The default values are transferred from the 2-Wire Transmitter Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

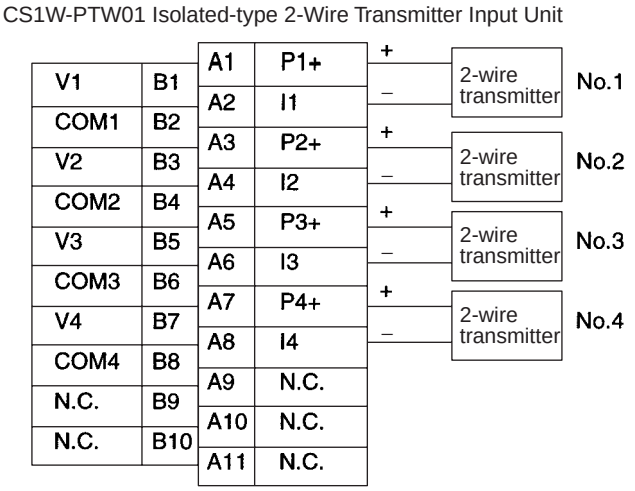
n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
2-Wire Transmitter Input Unit to CPU Unit	n	00	Input No. 1	Process value LL (low low limit) alarm	0, 1	0: Process value > Set value
		01		Process value L (low limit) alarm	0, 1	1: Process value ≤ Set value
		02		Process value H (high limit) alarm	0, 1	0: Process value < Set value
		03		Process value HH (high high limit) alarm	0, 1	1: Process value ≥ Set value
		04	Input No. 2	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value L (low limit) alarm	0, 1	
		06		Process value H (high limit) alarm	0, 1	
		07		Process value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value L (low limit) alarm	0, 1	
		10		Process value H (high limit) alarm	0, 1	
		11		Process value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value L (low limit) alarm	0, 1	
		14		Process value H (high limit) alarm	0, 1	
		15		Process value HH (high high limit) alarm	0, 1	

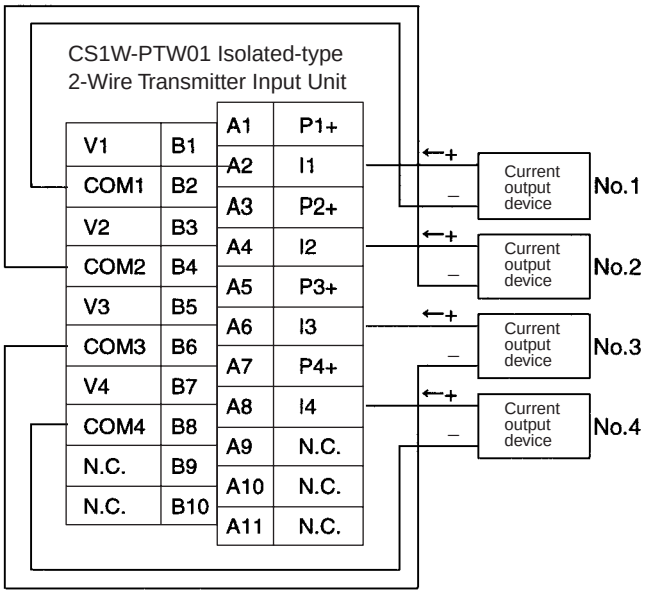
Direction	Word	Bit	Name		Data range	Contents
2-Wire Transmitter Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The process value rate of change is stored according to the scaling set in the allocated words of the DM Area.
	n + 6	00 to 15	Input No. 2 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 3 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 4 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 9	00	Input No. 1	Rate-of-change value L (low limit) alarm	0, 1	0: Rate-of-change value > Set value 1: Rate-of-change value ≤ Set value
		01		Rate-of-change value H (high limit) alarm	0, 1	0: Rate-of-change value < Set value 1: Rate-of-change value ≥ Set value
		02	Input No. 2	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Rate-of-change value H (high limit) alarm	0, 1	
		04	Input No. 3	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Rate-of-change value H (high limit) alarm	0, 1	
		06	Input No. 4	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Rate-of-change value H (high limit) alarm	0, 1	
		08	Input No. 1 input error		0, 1	0: Normal 1: Error (less than –17.2% or greater than 112.5%)
		09	Input No. 2 input error		0, 1	Same as for input No. 1.
		10	Input No. 3 input error		0, 1	Same as for input No. 1.
		11	Input No. 4 input error		0, 1	Same as for input No. 1.

Terminal Connection Diagram

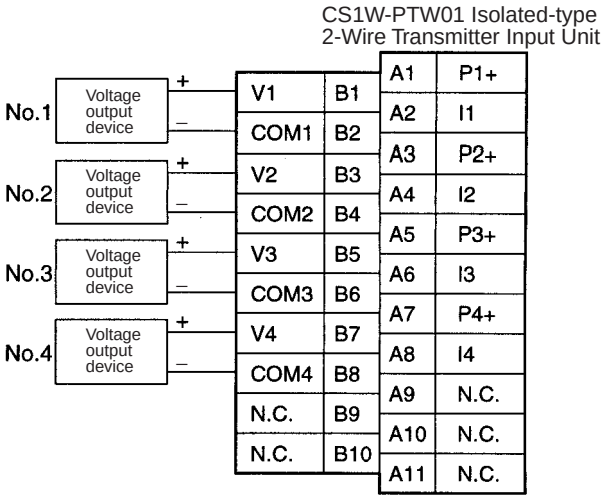
2-Wire Transmitter Input



Current Input

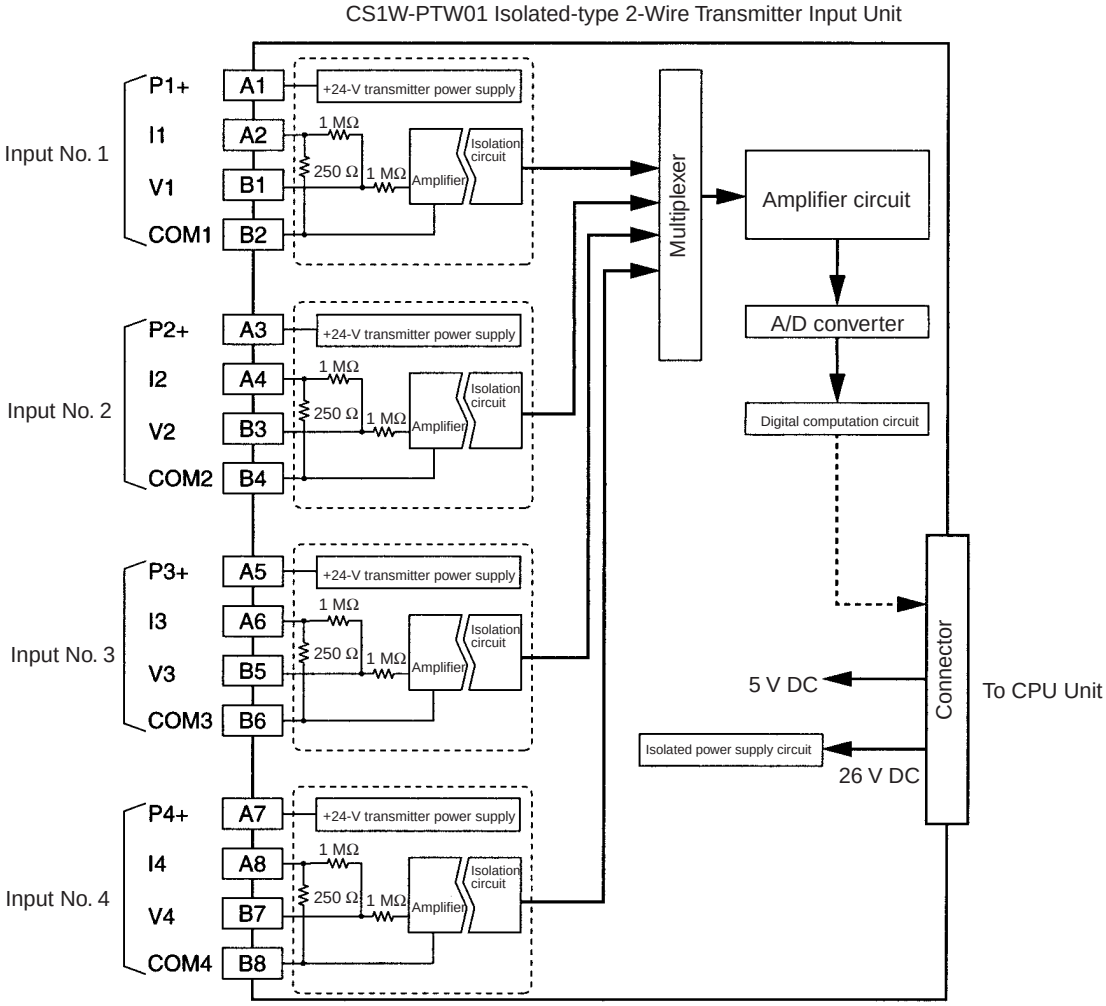


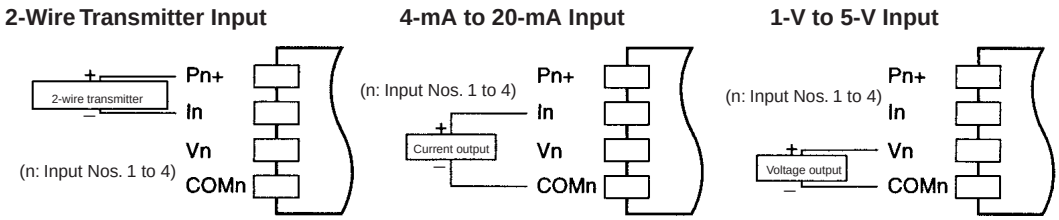
Voltage Input



Note In all of the above cases, leave all unused terminals open (e.g., terminals A1, A2, B1, and B2 for input No. 1).

Terminal Block Diagram





Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The input signal type or process value scaling is set incorrectly.	Check and reset the input signal type and the process value scaling settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage has changed. Check for faulty or disconnected wiring. Check whether an input error has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The input signal type or process value scaling is set incorrectly.	Check and reset the input signal type and the process value scaling settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The square root function is operating.	Set the square function so that it does not operate.

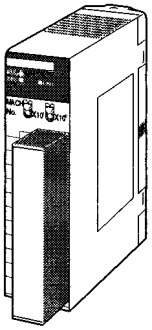
Converted Values are Unstable

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the I+ and COM, and between the V+ and COM input terminals.
	Increase the number of values for calculating the moving average in mean value processing.
The scaling value is greater than the Unit's resolution.	Reduce the scaling value.

2-5 CS1W-PDC01 Analog Input Unit

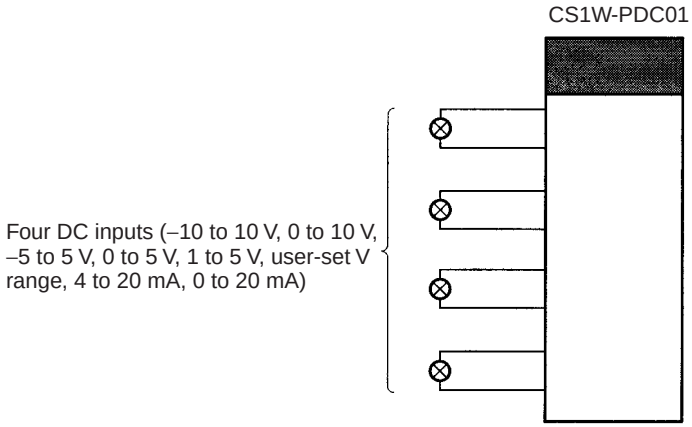
Overview

The CS1W-PDC01 Isolated-type Analog Input Unit provides four DC signal inputs, and sends the data to the CPU Unit each cycle. All inputs are isolated.



CS1W-PDC01

System Configuration



Features

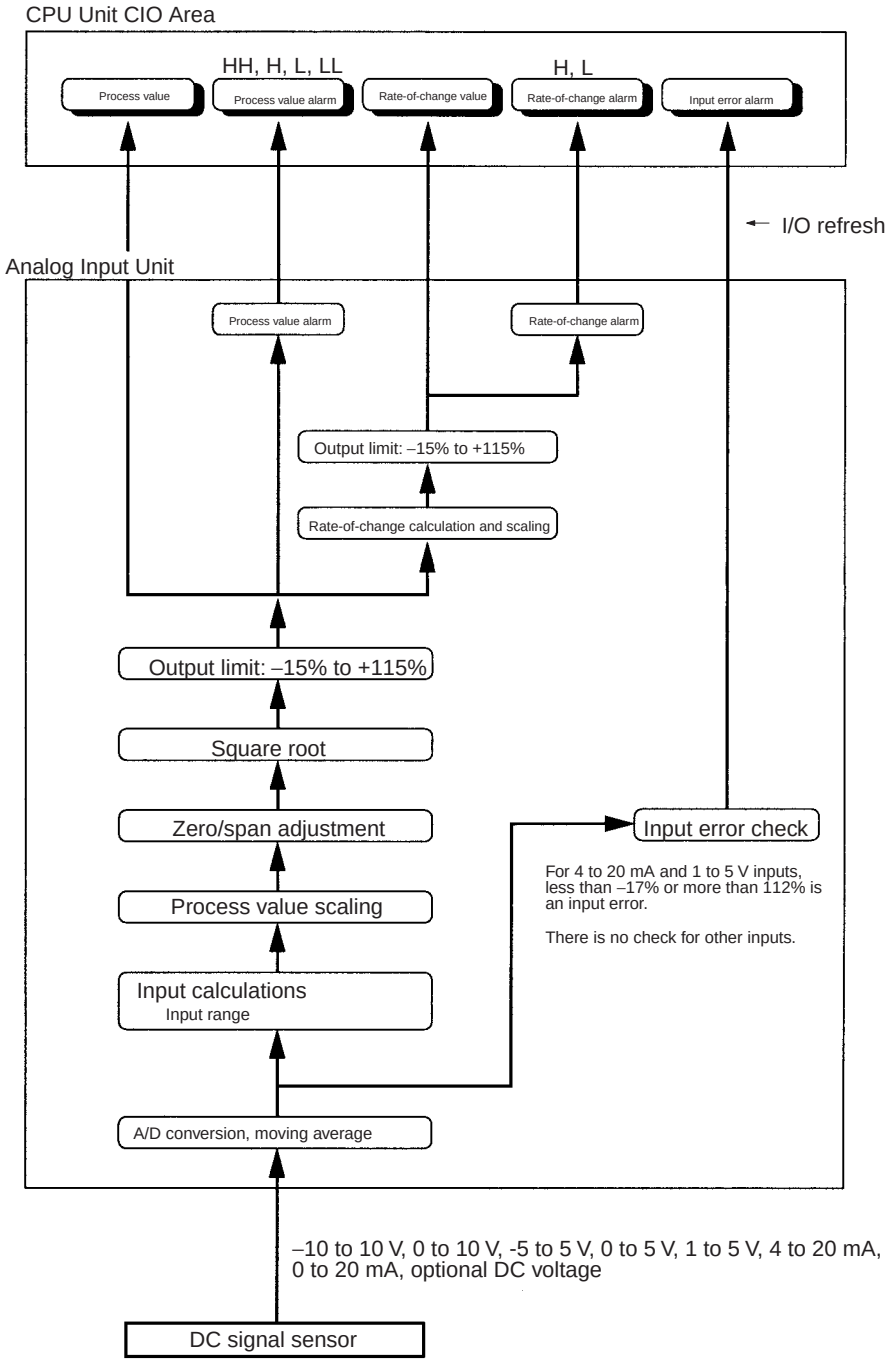
- Up to four DC signal inputs can be connected per Unit. Any of the following can be selected separately for the four inputs: 4 to 20 mA, 0 to 20 mA, –10 to 10 V, 0 to 10 V, –5 to 5 V, 1 to 5 V, 0 to 5 V, or ±10-V user-set range.
- Scaling values are sent to the CPU Unit in four digits hexadecimal.
- Isolation between analog inputs can prevent sneak circuits from occurring between input signals.
- Square root function.
- Four values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing.
- Rate-of-change calculation.
- Two values for each rate-of-change alarm input.
- Input error detection.
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Inputs	Input types
CS-series Special I/O Unit	CS1W-PDC01	4 max.	The following can be selected separately: 4 to 20 mA, 0 to 20 mA, –10 to 10 V, 0 to 10 V, –5 to 5 V, 1 to 5 V, 0 to 5 V, or ±10-V user-set range

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Specifications

Item	Specifications
Model	CS1W-PDC01
Applicable PC	CS-series Series
Unit classification	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	96 (within the allowable current consumption and power consumption range)
Unit numbers	00 to 95 (Cannot duplicate Special I/O Unit numbers.)

Item		Specifications	
Areas for data exchange with CPU Unit	CIO Area words allocated for Special I/O Units	10 words/Unit Analog 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), input errors	
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Analog Input Unit: Input signal type, scaling of process values in industrial units, square root function enable, rate-of-change value range, rate-of-change scaling, 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 inputs		4	
Input signal type		4 to 20 mA, 0 to 20 mA, –10 to 10 V, 0 to 10 V, –5 to 5 V, 1 to 5 V, 0 to 5 V, or ±10-V user-set range. The ±10-V user-set range can be specified within –10.000 to 10.000 V.	Input signal type and scaling to industrial units are separate for each of the 4 inputs. **Note** Input signal type and scaling to industrial units are set in the DM Area. Example: Input signal type: 4 to 20 mA; industrial unit scaling: 0 to 500 m^3/h (after square root extraction). DM Area settings are as follows: Input signal type: 5 (0005 Hex) Industrial unit maximum value stored: 500 (01F4 Hex) Industrial unit minimum value stored: 0 (0000 Hex)
User-defined scaling in industrial units		Scaling required for the above input signals, such as 4 to 20 mA or 1 to 5 V. (Any minimum and maximum values can be set.) (4 inputs set separately.)	
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the process value data 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) Square root extraction → 5) Output limits	
Accuracy		±0.1% of full scale For the ±10-V user-set range, however, as shown in the following equation, the accuracy depends on the ratio of the selected internal range (0 to 4) span to the user-set range span. $\text{Accuracy} = \pm 0.1\% \times \frac{\text{Internal range span}}{\text{User-set range span}}$	
Temperature coefficient		±0.015% /°C with respect to full scale. For the ±10-V user-set range, however: ±0.015% /°C with respect to the internal range.	
Resolution		1/4096 of full scale For the ±10-V user-set range, however, as shown in the following equation, the resolution depends on the ratio of the selected internal range (0 to 4) span to the user-set range span. $\text{Resolution} = \frac{1}{4096} \times \frac{\text{Internal range span}}{\text{User-set range span}}$	
Input signal range		For inputs of 4 to 20 mA, 0 to 20 mA, 0 to 10 V, 1 to 5 V, 0 to 5 V: –15 to 115% For inputs of –10 to 10 V or –5 to 5 V: –7.5 to 107.5% For ±10-V user-set range: –7.5 to 107.5% of internal range	
Input impedance		For current input: 250 Ω For voltage input: 1 MΩ max.	
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	
Input error detection		Checks are conducted for only 4 to 20 mA and 1 to 5 V. Error detected when under –17.2% (1.25 mA, 0.3125 V) or over 112.5% (22 mA, 5.5 V).	
Operation at input disconnection		4 to 20 mA, 1 to 5 V: Process value of –15% stored. 0 to 20 mA, 0 to 5 V, 0 to 10 V, –10 to 10 V: The same value is stored as when 0 V or 0 mA is input.	

Item		Specifications
Input disconnection overrange time		Approx. 1 s
Function	Mean value processing (input filter)	Calculates the moving average for the specified number of past 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, L, LL), 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.
	Square root	When the process value scaling maximum value is A and the minimum value is B: Output = $\sqrt{(A-B)\ (Input-B)}$ +B Dropout: Output approx. 7% maximum linear (output = input) characteristics **Note** The square root function is only enabled when the maximum scaling value is greater than the minimum value. **Note** When square root processing is being performed, set the maximum and minimum scaling values to the values required after square root processing of the current or other input values.
Isolation		Between analog inputs and between input terminals and PC 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 Analog Input Unit, and errors related to the CPU Unit).
Front panel connector		Sensor input connector terminal block (detachable)
Alarm time for CPU Unit cycle time		0.3 ms
Current consumption		5 V DC at 150 mA max., 26 V DC at 160 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

Accuracy and Resolution for ±10V User-set Range

With the ±10-V user-set range, the input signal zero and span can be set anywhere within a range of –10.000 to 10.000. Internally, however, inputs are processed in five progressive ranges (Nos. 0 to 4), as shown in the following table.

Table 1: Internal Ranges

Internal range number	Measurable voltage	Internal range span
0	–10.000 to 10.000 V	20.000 V
1	–5.000 to 5.000 V	10.000 V
2	–2.500 to 2.500 V	5.000 V
3	–1.250 to 1.250 V	2.500 V
4	–0.625 to 0.625 V	1.250 V

Therefore, the accuracy and resolution of the set range span are determined by the ratio of the internal range (0 to 4) span to the set input range span. 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 set input range is 0.000 to 3.000 V. Since both the minimum and maximum values fall within the limits for internal range No. 1 (–5.000 to 5.000 V), that range will be selected.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+89. • 12345 (3039 Hex): The default data at the left is transferred from the Analog Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Analog Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Process value alarm settings
m + 2	m + 10	m + 18	m + 26	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Process value HH (high high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 11	m + 19	m + 27	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 4	m + 12	m + 20	m + 28	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
m + 5	m + 13	m + 21	m + 29	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Process value LL (low low limit) alarm setting (Set at process value scaling value.)
							Rate-of-change value alarm settings
m + 6	m + 14	m + 22	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Rate-of-change value H (high limit) alarm setting (Set at rate-of-change scaling value.)
m + 7	m + 15	m + 23	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Rate-of-change value L (low limit) alarm setting (Set at rate-of-change scaling value.)
							Zero/span adjustment
m + 8	m + 16	m + 24	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 9	m + 17	m + 25	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents	
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Analog Input Unit if m is other than 12345 when the PC is powered up or the Analog Input Unit is restarted.								
							Input signal type	
m + 34	m + 48	m + 62	m + 76	0 to 7	0000 to 0007 Hex	1 (0001 Hex)	Input signal type 0: –10 to 10 V, 1: 0 to 10 V, 2: –5 to 5 V, 3: 0 to 5 V, 4: 1 to 5 V, 5: 4 to 20 mA, 6: ±10-V user-set range (set to the range below), 7: 0 to 20 mA	
m + 35	m + 49	m + 63	m + 77	–10000 to 10000	D8F0 to 2710 Hex	10000 (2710 Hex)	±10-V user-set range	Maximum value in range (set value x 0.001 V)
m + 36	m + 50	m + 64	m + 78	–10000 to 10000	D8F0 to 2710 Hex	0 (0 Hex)		Minimum value in range (set value x 0.001 V)
							Square root function	
m + 37	m + 51	m + 65	m + 79	0, 1	0000 to 0001 Hex	0 (0000 Hex)	Square root extraction (when maximum scaling value > minimum scaling value) 0: Disable; 1: Enable	
							Process value scaling	
m + 38	m + 52	m + 66	m + 80	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)	
m + 39	m + 53	m + 67	m + 81	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)	
							Alarm supplementary functions	
m + 40	m + 54	m + 68	m + 82	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value. Shared with process value alarm and rate-of–change alarm.)	
m + 41	m + 55	m + 69	m + 83	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s) (Shared with process value alarm and rate-of–change alarm.)	
							Rate-of-change function	
m + 42	m + 56	m + 70	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change range setting	Maximum rate-of-change value (Process value industrial unit; comparison time interval)
m + 43	m + 57	m + 71	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–4000 (F060 Hex)		Minimum rate-of-change value (Process value industrial unit; comparison time interval)
m + 44	m + 58	m + 72	m + 86	1 to 16	0001 to 0010 Hex	1 (0001 Hex)	**Rate-of-change comparison time interval** (Unit: s)	
m + 45	m + 59	m + 73	m + 87	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Rate-of-change value scaling	Value stored for maximum value in range
m + 46	m + 60	m + 74	m + 88	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)		Value stored for minimum value in range
							Mean value processing function	
m + 47	m + 61	m + 75	m + 89	1 to 16	0001 to 0010 Hex	4 (0004 Hex)	Number of process values for calculating moving average for mean value processing	
Storage parameter								
m + 90	m + 91	m + 92	m + 93	0 to 89	0000 to 0059 Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)	

Note

1. The default values are transferred from the Analog Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

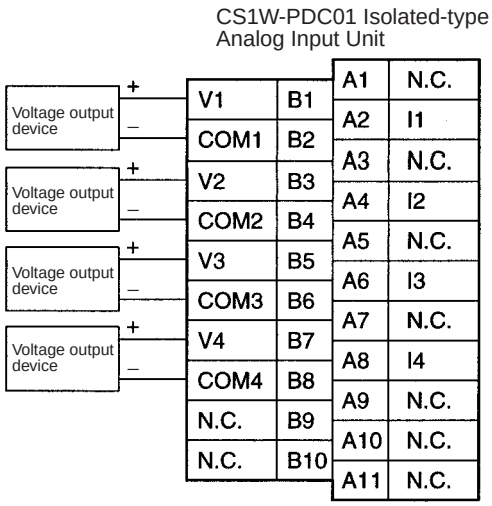
n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Analog Input Unit to CPU Unit	n	00	Input No. 1	Process value LL (low low limit) alarm	0, 1	0: Process value > Set value 1: Process value ≤ Set value
		01		Process value L (low limit) alarm	0, 1	
		02		Process value H (high limit) alarm	0, 1	0: Process value < Set value 1: Process value ≥ Set value
		03		Process value HH (high high limit) alarm	0, 1	
		04	Input No. 2	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value L (low limit) alarm	0, 1	
		06		Process value H (high limit) alarm	0, 1	
		07		Process value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value L (low limit) alarm	0, 1	
		10		Process value H (high limit) alarm	0, 1	
		11		Process value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Process value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value L (low limit) alarm	0, 1	
		14		Process value H (high limit) alarm	0, 1	
		15		Process value HH (high high limit) alarm	0, 1	

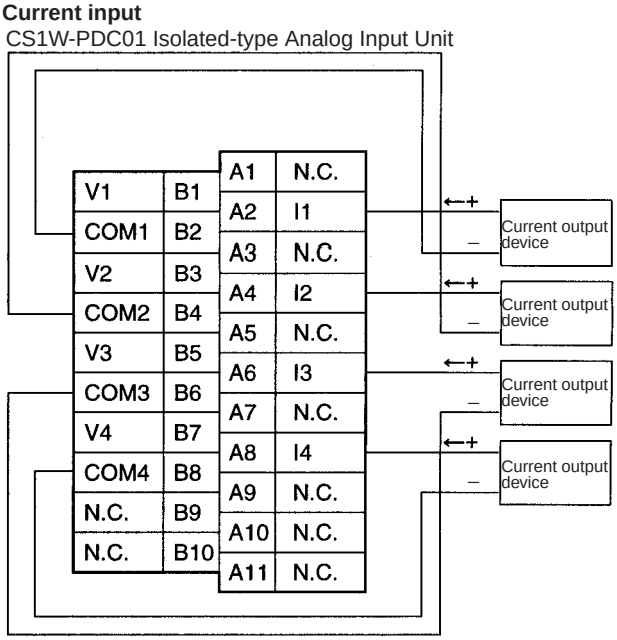
Direction	Word	Bit	Name		Data range	Contents
Analog Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The process value rate of change is stored according to the scaling set in the allocated words of the DM Area.
	n + 6	00 to 15	Input No. 2 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 3 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 4 rate-of-change value		–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 9	00	Input No. 1	Rate-of-change value L (low limit) alarm	0, 1	0: Rate-of-change value > Set value 1: Rate-of-change value ≤ Set value
		01		Rate-of-change value H (high limit) alarm	0, 1	0: Rate-of-change value < Set value 1: Rate-of-change value ≥ Set value
		02	Input No. 2	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Rate-of-change value H (high limit) alarm	0, 1	
		04	Input No. 3	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Rate-of-change value H (high limit) alarm	0, 1	
		06	Input No. 4	Rate-of-change value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Rate-of-change value H (high limit) alarm	0, 1	
		08	Input No. 1 input error		0, 1	0: Normal 1: Error (less than –17.2% or greater than 112.5%) **Note** Checks are conducted for inputs of 4 to 20 mA and 1 to 5 V.
		09	Input No. 2 input error		0, 1	Same as for input No. 1.
		10	Input No. 3 input error		0, 1	Same as for input No. 1.
		11	Input No. 4 input error		0, 1	Same as for input No. 1.

Terminal Connection Diagram

Voltage input

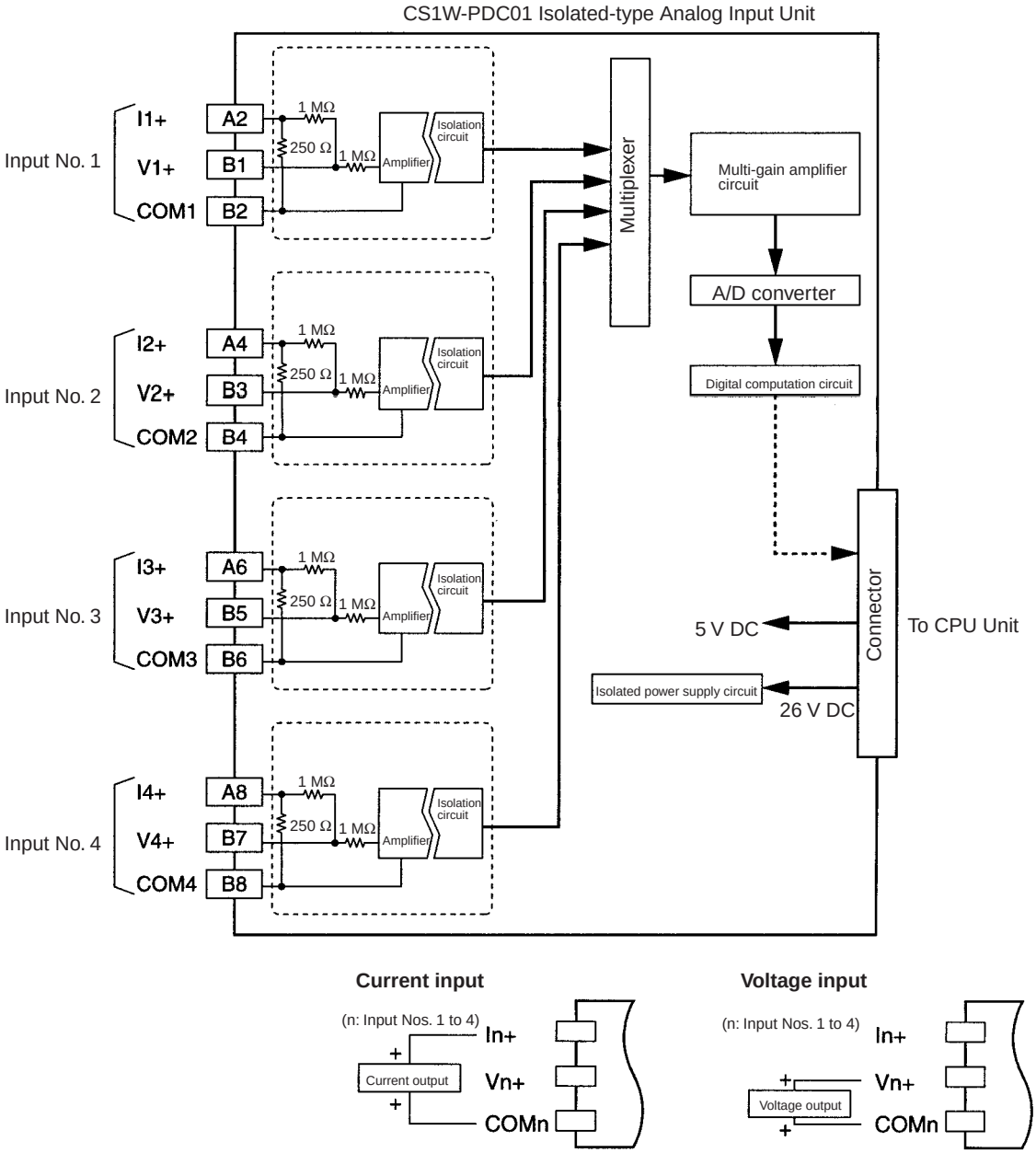


Current input



Note In both of the above cases, leave all unused inputs open between the positive and negative terminals (e.g., between B1 and B2 for voltage input No. 1).

Terminal Block Diagram



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The input signal type or process value range is set incorrectly.	Check and reset the input signal type and the process value range settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage has changed. Check for faulty or disconnected wiring. Check whether an input error has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The input signal type or process value scaling is set incorrectly.	Check and reset the input signal type and the process value scaling settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The square root function is operating.	Set the square function so that it does not operate.

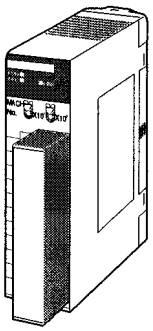
Converted Values are Unstable

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the I+ and COM, and between the V+ and COM input terminals.
	Increase the number of values for calculating the moving average in mean value processing.
The scaling value is greater than the Unit's resolution.	Reduce the scaling value.

2-6 CS1W-PTR01 Power Transducer Input Unit

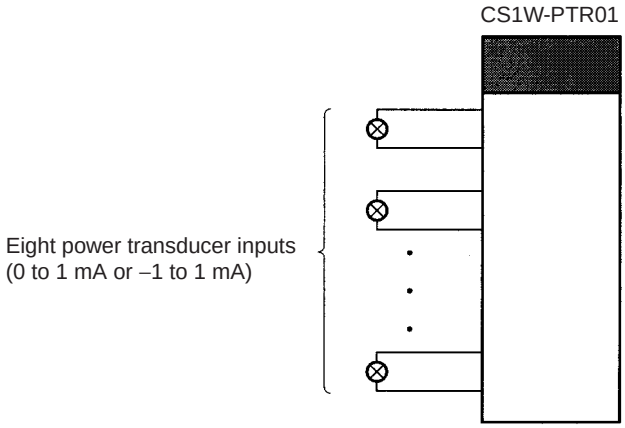
Overview

The CS1W-PTR01 Power Transducer Input Unit provides up to eight inputs of 0 to 1 mA or –1 to 1 mA from power transducers, and sends the data to the CPU Unit each cycle.



CS1W-PTR01

System Configuration



Features

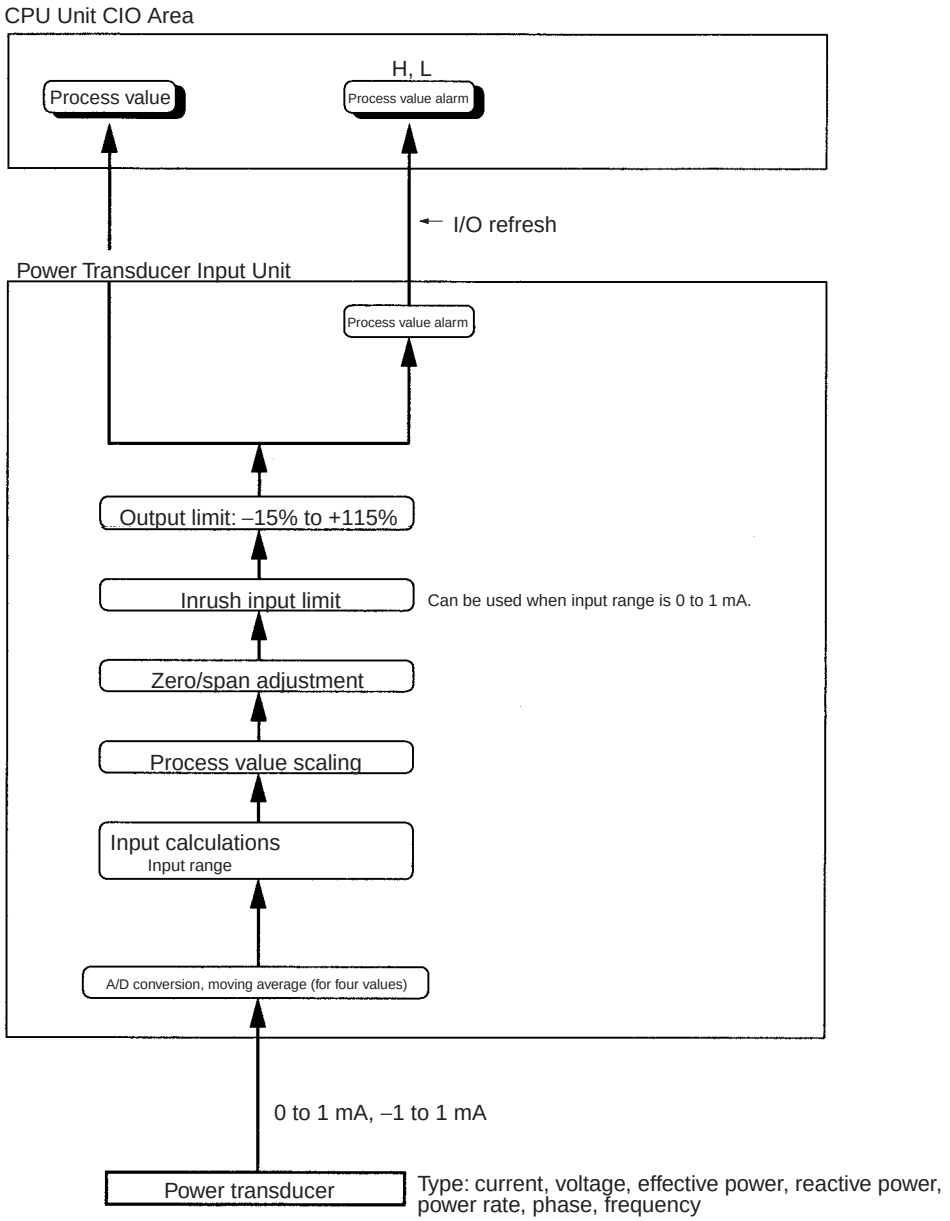
- Up to eight inputs of 0 to 1 mA or –1 to 1 mA from a power transducer can be separately connected.
- Scaling values are sent to the CPU Unit in four digits hexadecimal.
- The inrush input limit function temporarily limits the process value input to a given set value when it increases from a low value (2%), in order to prevent process values from being jumped up by an inrush current when the motor is started up, and so on. (This function is available for inputs of 0 to 1 mA only.)
- Two values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing (for four values).
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Inputs	Input types
CS-series Special I/O Unit	CS1W-PTR01	8 max.	Either of the following can be selected separately: 0 to 1 mA, or –1 to 1 mA.

Block Diagram (Order of Processing)

The processing for the eight inputs is as shown in the following diagram.



Specifications

Item	Specifications
Model	CS1W-PTR01
Applicable PC	CS Series
Unit classification	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	96 (within the allowable current consumption and power consumption range)
Unit numbers	00 to 95 (Cannot duplicate Special I/O Unit numbers.)

Item		Specifications	
Areas for data exchange with CPU Unit	CIO Area words allocated for Special I/O Units	10 words/Unit Power Transducer Input Unit to CPU Unit: All process values, process value alarms (L, H)	
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Power Transducer Input Unit: Input signal type, scaling of process value in industrial units, process value alarm setting (L, H), inrush input upper limit, inrush input upper limit time, zero/span adjustment value, etc.	
Number of inputs		8	
Input signal type		Either 0 to 1 mA or –1 to 1 mA.	Input signal type and scaling to industrial units are separate for each of the 8 inputs. **Note** Input signal type and scaling to industrial units are set in the DM Area. Example: Input signal type: 0 to 1 mA from power transducer; industrial unit scaling: 0 to 500 W. DM Area settings are as follows: Input signal type: 0 (0000 Hex) Industrial unit maximum value stored: 500 (01F4 Hex) Industrial unit minimum value stored: 0 (0000 Hex)
User-defined scaling in industrial units		Scaling required for the above input signals. (Any minimum and maximum values can be set.) (8 inputs set separately.)	
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the process value data 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) Inrush input limit → 5) Output limits	
Accuracy		±0.2% of full scale	
Temperature coefficient		±0.015%/°C of full scale	
Resolution		1/4,096 of full scale	
Input signal range		For 0 to 1 mA: –15 to 115%; for –1 to 1 mA: –7.5 to 107.5%	
Input impedance		100 Ω (typical)	
Response time		1.2 s (travel time from input 0% to 90%, for step input)	
Conversion period		200 ms/8 inputs	
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle	
Input error detection		None.	
Operation at input disconnection		Process value corresponding to 0 mA stored.	
Function	Inrush input limit	When the process value is increased from 2% or less, the inrush input limit function limits the increase for a set time. (It is available only for inputs of 0 to 1 mA.) This function can be used to prevent sudden process value increases due to inrush currents caused by motor startup and so on. Upper limit value: –32,000 to 32,000 Upper limit time: 0 to 100 s	
	Process value alarm	Process value 2-point alarm (H, L), hysteresis, and ON-delay timer (0 to 60 s) are available.	
	Mean value processing (input filter)	Calculates the moving average for the past four process values (every 200 ms), and stores that value in the CIO Area as the process value.	
Isolation		Between inputs: No isolation Between input terminals and PC signals: Isolation by transformer and photocoupler	
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 Power Transducer Input Unit, and errors related to the CPU Unit).	
Front panel connector		Sensor input connector terminal block (detachable)	

Item	Specifications
Alarm time for CPU Unit cycle time	0.3 ms
Current consumption	5 V DC at 150 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	None

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

DM Area address								Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Input No. 5	Input No. 6	Input No. 7	Input No. 8	Decimal	Hexadecimal		
m								12345, 0	3039 Hex, 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+89. • 12345 (3039 Hex): The default data at the left is transferred from the Power Transducer Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Power Transducer Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)											
											Process value alarm settings
m + 2	m + 6	m + 10	m + 14	m + 18	m + 22	m + 26	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 7	m + 11	m + 15	m + 19	m + 23	m + 27	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
											Zero/span adjustment
m + 4	m + 8	m + 12	m + 16	m + 20	m + 24	m + 28	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 5	m + 9	m + 13	m + 17	m + 21	m + 25	m + 29	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Power Transducer Input Unit if m is other than 12345 when the PC is powered up or the Power Transducer Input Unit is restarted.											
m + 34	m + 41	m + 48	m + 55	m + 62	m + 69	m + 76	m + 83	0, 1	0000 to 0001 Hex	0 (0000 Hex)	**Input signal type** 0: 0 to 1 mA 1: –1 to 1 mA
											Process value scaling
m + 35	m + 42	m + 49	m + 56	m + 63	m + 70	m + 77	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)
m + 36	m + 43	m + 50	m + 57	m + 64	m + 71	m + 78	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)
											Alarm supplementary functions
m + 37	m + 44	m + 51	m + 58	m + 65	m + 72	m + 79	m + 86	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value.)
m + 38	m + 45	m + 52	m + 59	m + 66	m + 73	m + 80	m + 87	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s)

DM Area address								Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Input No. 5	Input No. 6	Input No. 7	Input No. 8	Decimal	Hexadecimal		
											Inrush input limit function
m + 39	m + 46	m + 53	m + 60	m + 67	m + 74	m + 81	m + 88	0 to 100	0000 to 0064 Hex	0 (0000 Hex)	Inrush upper limit time (Unit: s) 0: No limit
m + 40	m + 47	m + 54	m + 61	m + 68	m + 75	m + 82	m + 89	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Inrush upper limit value
Storage parameter											
m + 90	m + 91	m + 92	m + 93	m + 94	m + 95	m + 96	m + 97	0 to 89	0000 to 0059 Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)

Note

1. The default values are transferred from the Power Transducer Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

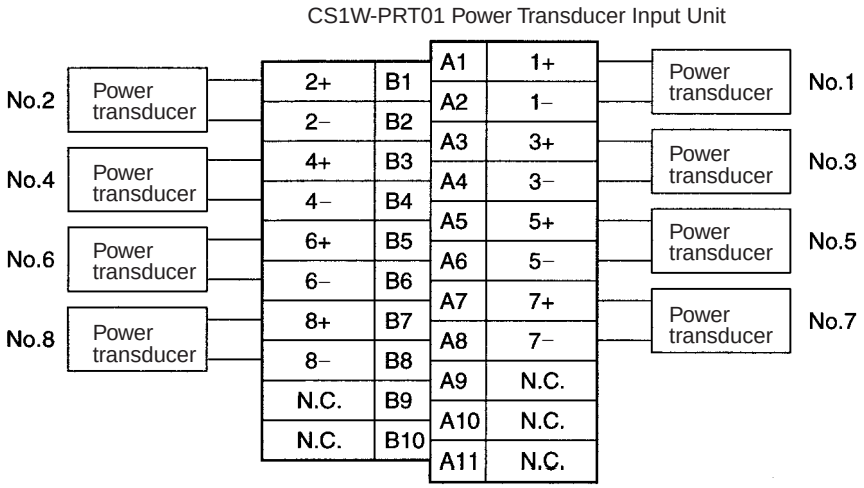
CIO Area Allocations

n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Power Transducer Input Unit to CPU Unit	n	00	Input No. 1	Process value L (low limit) alarm	0, 1	0: Process value > Set value 1: Process value ≤ Set value
		01		Process value H (high limit) alarm	0, 1	0: Process value < Set value 1: Process value ≥ Set value
		02	Input No. 2	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Process value H (high limit) alarm	0, 1	
		04	Input No. 3	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value H (high limit) alarm	0, 1	
		06	Input No. 4	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Process value H (high limit) alarm	0, 1	
		08	Input No. 5	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value H (high limit) alarm	0, 1	
		10	Input No. 6	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		11		Process value H (high limit) alarm	0, 1	
		12	Input No. 7	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value H (high limit) alarm	0, 1	
		14	Input No. 8	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		15		Process value H (high limit) alarm	0, 1	

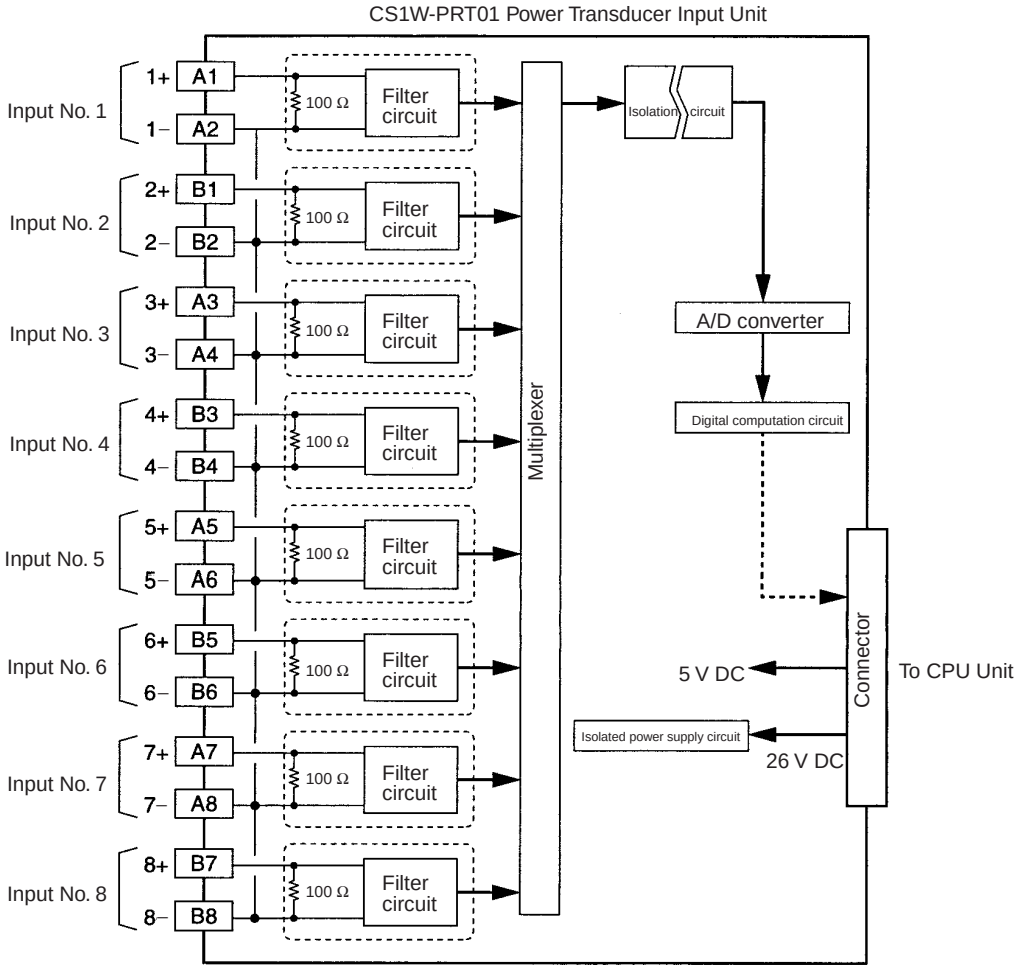
Direction	Word	Bit	Name	Data range	Contents
Power Transducer Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 5 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 6	00 to 15	Input No. 6 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 7 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 8 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	

Terminal Connection Diagram



Note Leave all unused inputs open between the positive and negative terminals (e.g., between A1, and A2 for input No. 1). (They can, however, be short-circuited with the lead wire.)

Terminal Block Diagram



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The input signal type or process value range is set incorrectly.	Check and reset the input signal type and the process value range settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage or current has changed. Check for faulty or disconnected wiring.

Values are Not Converted as Intended.

Probable cause	Remedy
The input signal type or process value scaling is set incorrectly.	Check and reset the input signal type and the process value scaling settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The inrush input limit function is operating.	Set the inrush input limit function so that it does not operate.

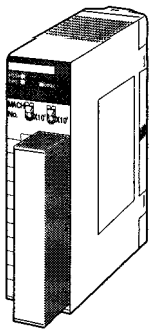
Converted Values are Unstable

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the positive and negative input terminals.
The scaling value is greater than the Unit's resolution.	Reduce the scaling value.

2-7 CS1W-PTR02 Analog Input Unit

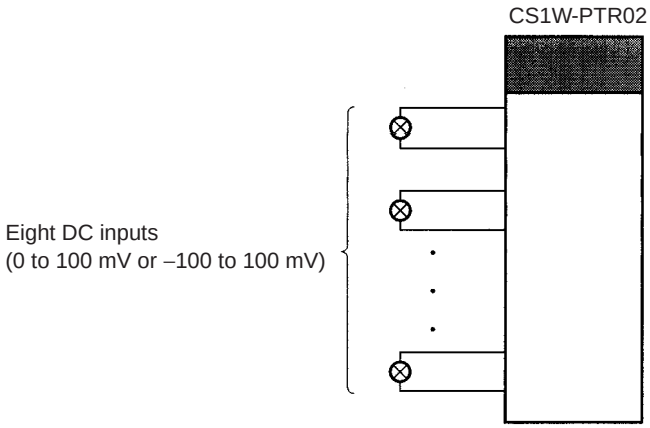
Overview

The CS1W-PTR02 Analog Input Unit provides up to eight inputs of 0 to 100 mV or –100 to 100 mA, and sends the data to the CPU Unit each cycle.



CS1W-PTR02

System Configuration



Features

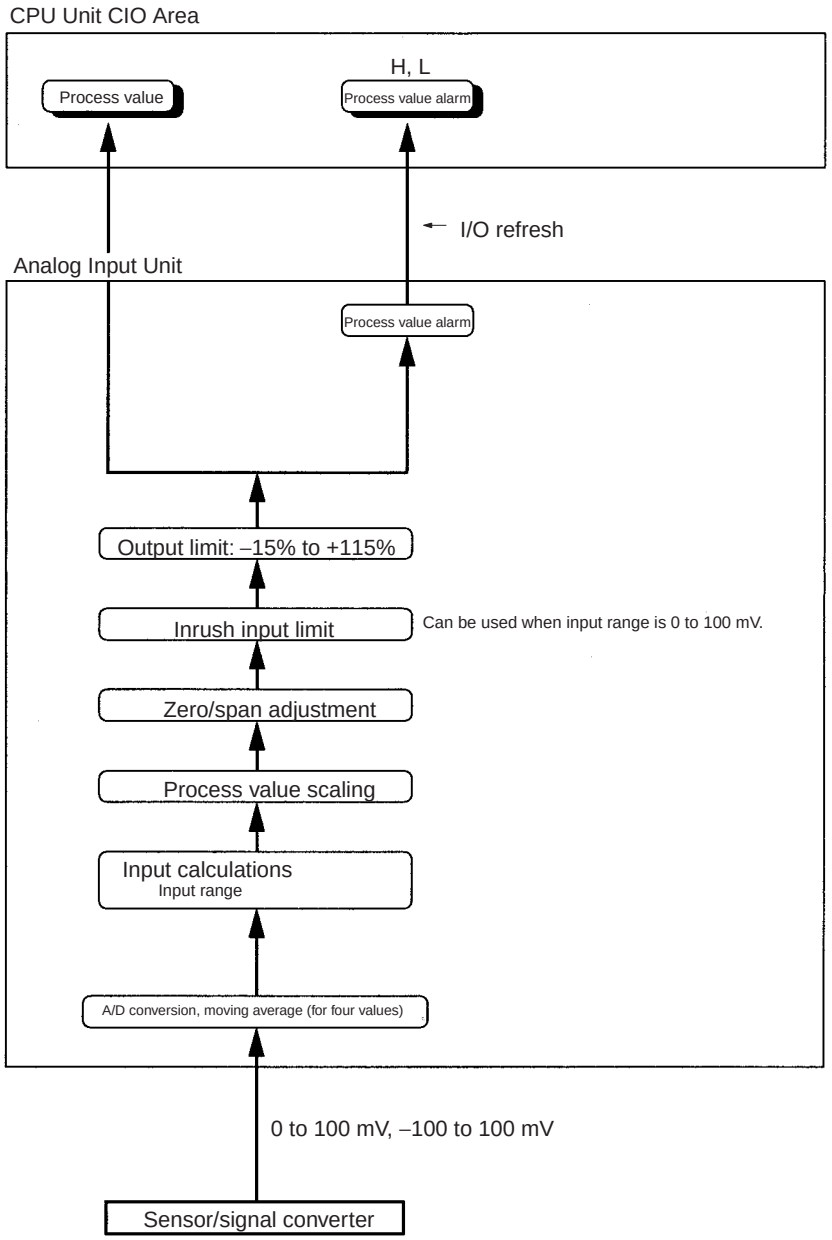
- Up to eight inputs of 0 to 100 mV or –100 to 100 mV can be separately connected.
- Scaling values are sent to the CPU Unit in four digits hexadecimal.
- The inrush input limit function temporarily limits the process value input to a given set value when it increases from a low value (2%), in order to prevent process values from being jumped up by an inrush current when the motor is started up, and so on. (This function is available for inputs of 0 to 100 mV only.)
- Two values for each process value alarm input.
- ON-delay timer for process value alarm.
- Mean value processing (for four values).
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Inputs	Input types
CS-series Special I/O Unit	CS1W-PTR02	8 max.	Either of the following can be selected separately: 0 to 100 mV, or –100 to 100 mV.

Block Diagram (Order of Processing)

The processing for the eight inputs is as shown in the following diagram.



Specifications

Item		Specifications	
Model		CS1W-PTR02	
Applicable PC		CS Series	
Unit classification		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		96 (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	CIO Area words allocated for Special I/O Units	10 words/Unit Analog Input Unit to CPU Unit: All process values, process value alarms (L, H)	
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Analog Input Unit: Input signal type, scaling of process value in industrial units, process value alarm setting (L, H), inrush input upper limit, inrush input upper limit time, zero/span adjustment value, etc.	
Number of inputs		8	
Input signal type		Either 0 to 100 mV or –100 to 100 mV.	Input signal type and scaling to industrial units are separate for each of the 8 inputs. **Note** Input signal type and scaling to industrial units are set in the DM Area. Example: Input signal type: 0 to 100 mV; industrial unit scaling: 0 to 500. DM Area settings are as follows: Input signal type: 0 (0000 Hex) Industrial unit maximum value stored: 500 (01F4 Hex) Industrial unit minimum value stored: 0 (0000 Hex)
User-defined scaling in industrial units		Scaling required for the above input signals. (Any minimum and maximum values can be set.) (8 inputs set separately.)	
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the process value data 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) Inrush input limit → 5) Output limits	
Accuracy		±0.2% of full scale	
Temperature coefficient		±0.015%/°C of full scale	
Resolution		1/4,096 of full scale	
Input signal range		For 0 to 100 mV: –15 to 115%; for –100 to 100 mV: –7.5 to 107.5%	
Input impedance		Balanced: 1 MΩ (typical); unbalanced: 20 kΩ (typical)	
Response time		1.2 s (travel time from input 0% to 90%, for step input)	
Conversion period		200 ms/8 inputs	
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle	
Input error detection		None.	
Operation at input disconnection		Undefined.	
Function	Inrush input limit	When the process value is increased from 2% or less, the inrush input limit function limits the increase for a set time. (It is available only for inputs of 0 to 100 mV.) This function can be used to prevent sudden process value increases due to inrush currents caused by motor startup and so on. Upper limit value: –32,000 to 32,000 Upper limit time: 0 to 100 s	
	Process value alarm	Process value 2-point alarm (H, L), hysteresis, and ON-delay timer (0 to 60 s) are available.	
	Mean value processing (input filter)	Calculates the moving average for the past four process values (every 200 ms), and stores that value in the CIO Area as the process value.	

Item	Specifications
Isolation	Between inputs: No isolation Between input terminals and PC signals: Isolation by transformer and photocoupler.
Insulation resistance	20 MΩ (at 500 V DC) between inputs and internal PC signals.
Dielectric strength	Between inputs and internal PC signals: 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 Analog Input Unit, and errors related to the CPU Unit).
Front panel connector	Sensor input connector terminal block (detachable)
Alarm time for CPU Unit cycle time	0.3 ms
Current consumption	5 V DC at 150 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	None

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

DM Area address								Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Input No. 5	Input No. 6	Input No. 7	Input No. 8	Decimal	Hexadecimal		
m								12345, 0	3039 Hex, 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+89. • 12345 (3039 Hex): The default data at the left is transferred from the Analog Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Analog Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)											
											Process value alarm settings
m + 2	m + 6	m + 10	m + 14	m + 18	m + 22	m + 26	m + 30	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (0FA0 Hex)	Process value H (high limit) alarm setting (Set at process value scaling value.)
m + 3	m + 7	m + 11	m + 15	m + 19	m + 23	m + 27	m + 31	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Process value L (low limit) alarm setting (Set at process value scaling value.)
											Zero/span adjustment
m + 4	m + 8	m + 12	m + 16	m + 20	m + 24	m + 28	m + 32	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 5	m + 9	m + 13	m + 17	m + 21	m + 25	m + 29	m + 33	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at process value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Analog Input Unit if m is other than 12345 when the PC is powered up or the Analog Input Unit is restarted.											
m + 34	m + 41	m + 48	m + 55	m + 62	m + 69	m + 76	m + 83	0, 1	0000 to 0001 Hex	0 (0000 Hex)	**Input signal type** 0: 0 to 100 mV 1: –100 to 100 mV
											Process value scaling

DM Area address								Data range		Default (See note 1.)	Data contents
Input No. 1	Input No. 2	Input No. 3	Input No. 4	Input No. 5	Input No. 6	Input No. 7	Input No. 8	Decimal	Hexadecimal		
m + 35	m + 42	m + 49	m + 56	m + 63	m + 70	m + 77	m + 84	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Value stored for maximum value in range (span)
m + 36	m + 43	m + 50	m + 57	m + 64	m + 71	m + 78	m + 85	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Value stored for minimum value in range (zero)
											Alarm supplementary functions
m + 37	m + 44	m + 51	m + 58	m + 65	m + 72	m + 79	m + 86	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at process value scaling value.)
m + 38	m + 45	m + 52	m + 59	m + 66	m + 73	m + 80	m + 87	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s)
											Inrush input limit function
m + 39	m + 46	m + 53	m + 60	m + 67	m + 74	m + 81	m + 88	0 to 100	0000 to 0064 Hex	0 (0000 Hex)	Inrush upper limit time (Unit: s) 0: No limit
m + 40	m + 47	m + 54	m + 61	m + 68	m + 75	m + 82	m + 89	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0FA0 Hex)	Inrush upper limit value
Storage parameter											
m + 90	m + 91	m + 92	m + 93	m + 94	m + 95	m + 96	m + 97	0 to 89	0000 to 0059 Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)

Note

1. The default values are transferred from the Analog Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

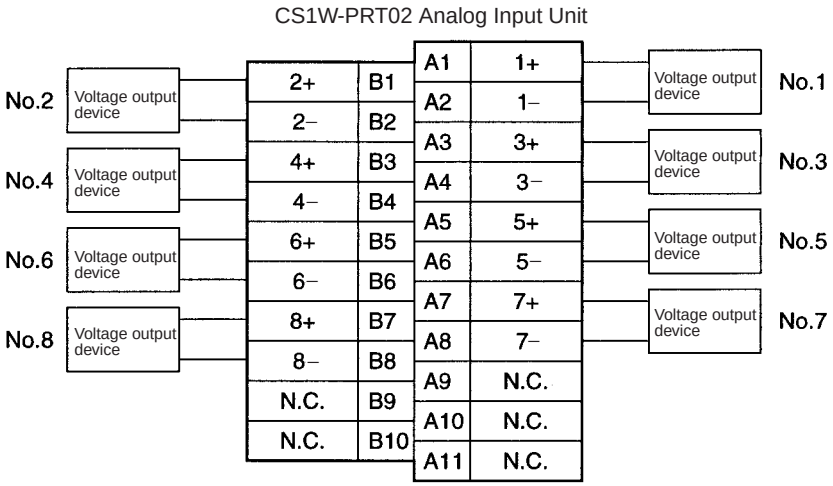
CIO Area Allocations

n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Analog Input Unit to CPU Unit	n	00	Input No. 1	Process value L (low limit) alarm	0, 1	0: Process value > Set value 1: Process value ≤ Set value
		01		Process value H (high limit) alarm	0, 1	0: Process value < Set value 1: Process value ≥ Set value
		02	Input No. 2	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		03		Process value H (high limit) alarm	0, 1	
		04	Input No. 3	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		05		Process value H (high limit) alarm	0, 1	
		06	Input No. 4	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		07		Process value H (high limit) alarm	0, 1	
		08	Input No. 5	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		09		Process value H (high limit) alarm	0, 1	
		10	Input No. 6	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		11		Process value H (high limit) alarm	0, 1	
		12	Input No. 7	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		13		Process value H (high limit) alarm	0, 1	
		14	Input No. 8	Process value L (low limit) alarm	0, 1	Same as for input No. 1.
		15		Process value H (high limit) alarm	0, 1	

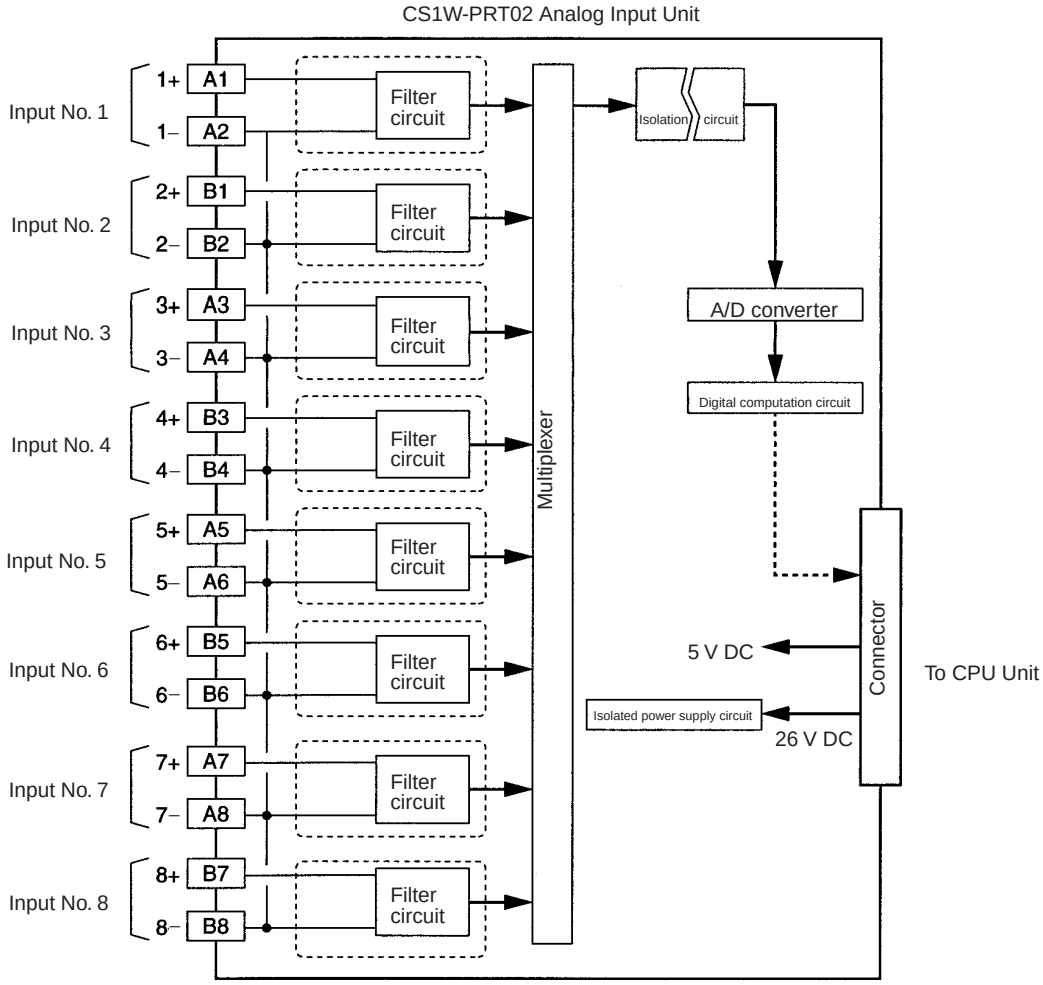
Direction	Word	Bit	Name	Data range	Contents
Analog Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present process value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 5 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 6	00 to 15	Input No. 6 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 7	00 to 15	Input No. 7 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 8	00 to 15	Input No. 8 process value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	

Terminal Connection Diagram



Note Short-circuit all unused inputs between the positive and negative terminals (e.g., between A1, and A2 for input No. 1) with the lead wire.

Terminal Block Diagram



Error Processing

Conversion Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The minimum and maximum values for process value scaling are either the same or are set extremely low.	Set the minimum and maximum values correctly.
The input signal type or process value range is set incorrectly.	Check and reset the input signal type and the process value range settings.
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage or current has changed. Check for faulty or disconnected wiring.

Values are Not Converted as Intended.

Probable cause	Remedy
The input signal type or process value scaling is set incorrectly.	Check and reset the input signal type and the process value scaling settings.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
The inrush input limit function is operating.	Set the inrush input limit function so that it does not operate.

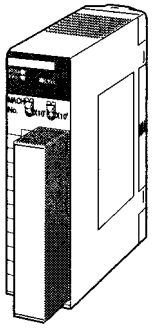
Converted Values are Unstable.

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the positive and negative input terminals.
The scaling value is greater than the Unit's resolution.	Reduce the scaling value.

2-8 CS1W-PPS01 Isolated-type Pulse Input Unit

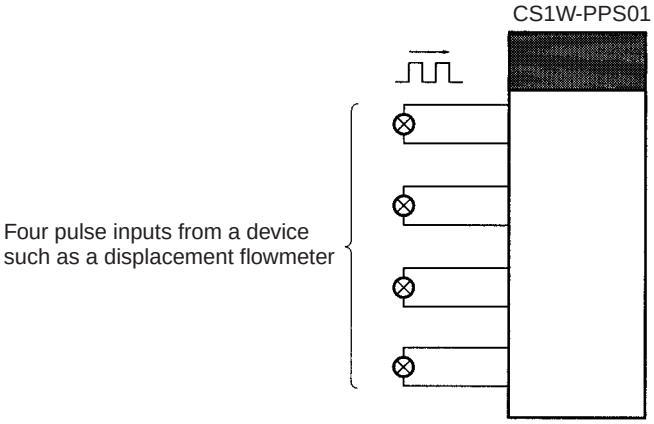
Overview

The CS1W-PPS01 Isolated-type Pulse Input Unit provides up to four pulses from a device such as a displacement flowmeter, and sends scaled instantaneous values (pulses/time unit) to the CPU Unit each cycle.



CS1W-PPS01

System Configuration



Features

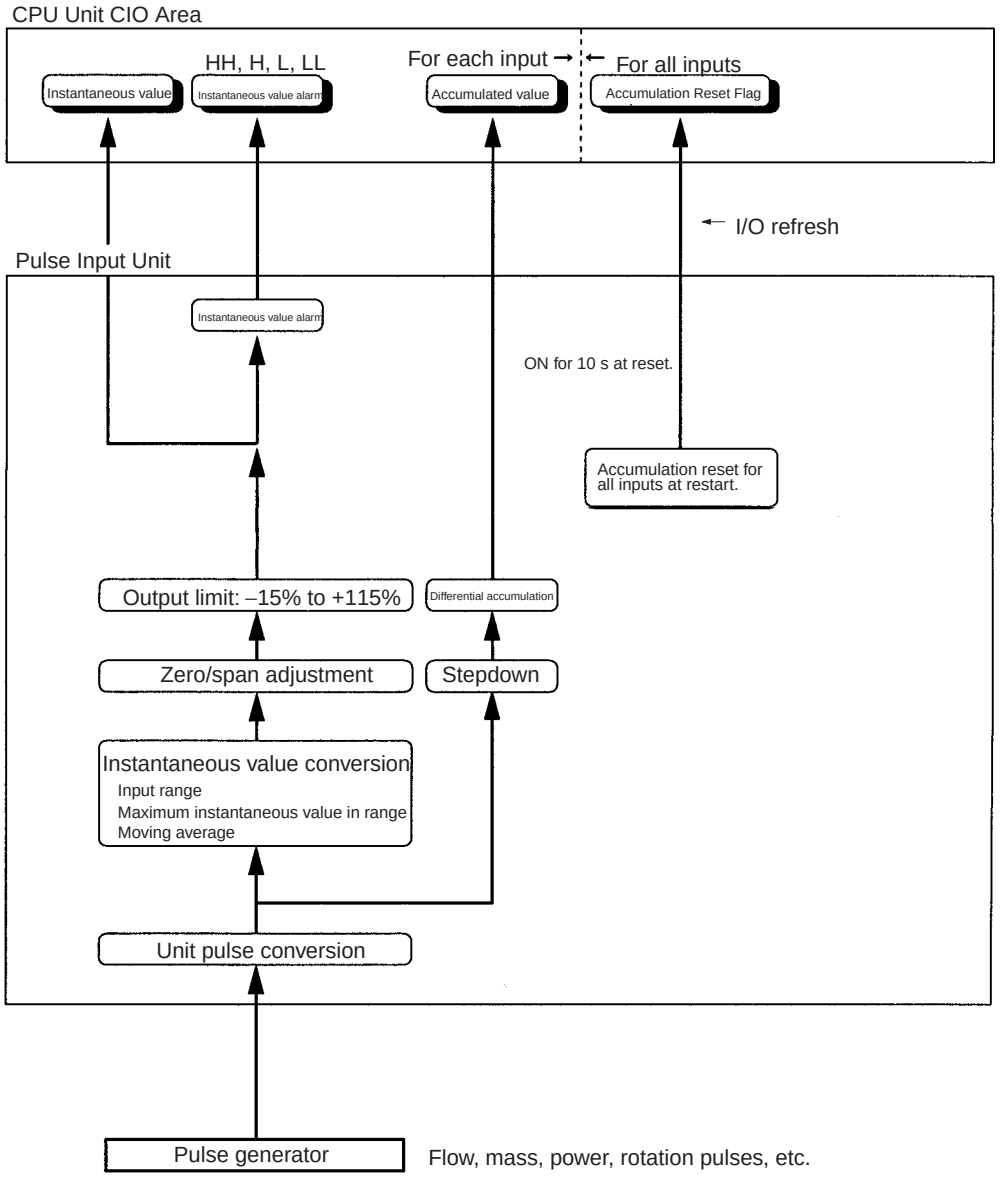
- Up to four pulse inputs can be connected per Unit.
- Instantaneous values (pulses/time unit) are scaled and sent to the CPU Unit in four digits hexadecimal.
- Four values for each instantaneous value alarm input.
- ON-delay timer for instantaneous value alarm.
- Mean value processing.
- Zero/span adjustment capability during operation.
- Accumulated value output.

Model Information

Unit classification	Model number	Inputs	Input types
CS-series Special I/O Unit	CS1W-PPS01	4 max.	Pulse inputs of 0 to 20,000 pulses/s or 0 to 20 pulses/s

Block Diagram (Order of Processing)

The processing for the four inputs is as shown in the following diagram.



Specifications

Item		Specifications
Model		CS1W-PPS01
Applicable PC		CS-series Series
Unit classification		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		96 (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	CIO Area words allocated for Special I/O Units	10 words/Unit Pulse Input Unit to CPU Unit: All process values, process value alarms (LL, L, H, HH), accumulated values, Accumulation Reset Flag
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Pulse Input Unit: Instantaneous value conversion coefficient, instantaneous value scaling, pulse weight, number of values for moving average, instantaneous value alarm settings (LL, L, H, HH), zero/span adjustment, etc.
Number of pulse inputs		4
Pulse input type		Voltage input, no-voltage semiconductor input, contact input (selected individually for each of 4 inputs, according to connection terminals)
		No-voltage semiconductor input: Connected to voltage input terminals (between Fn+ and COMn). Maximum coefficient speed: 20,000 pulses/s (duty ratio: 50%) Detection voltage: 4 V DC Short-circuit current between terminals: 1.2 mA DC ON resistance: 0.8 kΩ max. OFF resistance: 5.0 kΩ min.
		Voltage input: Connected to voltage input terminals (between Fn+ and COMn). Waveform: Square wave Maximum coefficient speed: 20,000 pulses/s (duty ratio: 50%) ON voltage: 0 to 1 V OFF voltage: 3 to 30 V
		Contact input: Connected to contact input terminals (between Sn+ and COMn). Maximum coefficient speed: 20 pulses/s (duty ratio: 50%) Detection voltage: 8 V DC Short-circuit current between terminals: 2.4 mA DC ON resistance: 0.8 kΩ max. OFF resistance: 5.0 kΩ min.
Sensor power supply		For no-voltage semiconductor inputs, etc., a 12-V DC power supply can be provided for the sensors that are the pulse sources. Output voltage: 12 V DC ±15% Current capacity: 30 mA max. Limit current when short-circuited: 31 to 55 mA Allowable short-circuit time: No limit
Conversion to instantaneous values		This function can be used to count the number of pulses per time unit, and to convert the values to instantaneous values (pulses/time unit). Any of the following can be selected as the time unit: 1 s, 3 s, 10 s, 30 s, or 60 s. (The time unit is set in the DM Area.) **Note** Errors and fluctuations will increase when the input signal pulse rate is low, so specify a longer time unit. The instantaneous value is only refreshed at intervals of the time unit set. Therefore, when the Unit is restarted, the instantaneous value will be 0000 until the time set as the time unit has elapsed.

Item		Specifications	
Instantaneous value scaling		This function can be used for scaling instantaneous values (pulses/time unit), i.e., setting data with respect to a maximum value, and storing them in the allocated words of the CIO Area. When instantaneous value (pulses/time unit) is 100% input: Can be set from 0.001 pulses/time unit to 32,000 pulses/time unit. Instantaneous value scaling (industrial units): Scaling of the above instantaneous value (100% input) is possible from –32,000 to 32,000 (8300 to FFFF, 0000 to 7D00 Hex).	Example: To obtain a pulse input of 0 to 2,000 pulses/s for a flow of 0 to 300.0 ml/s: Time unit: 1 s Instantaneous value 100% input: 2,000 Maximum value for instantaneous value scaling (industrial units): 3,000
Data storage in the CIO Area		The value derived from carrying out the following processing in order of the instantaneous value (pulses/time unit) 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	
Accumulation conversion period		100 ms/4 inputs	
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle	
Function	Mean value processing (input filter)	Calculates the moving average for the specified number of past instantaneous values (1 to 16), and stores that value in the CIO Area as the instantaneous value.	
	Instantaneous value alarm	Instantaneous value 4-point alarm (HH, H, L, LL), hysteresis, and ON-delay timer (0 to 60 s) are available.	
	Pulse weight conversion	When this function is used, the actual number of pulse inputs is multiplied by a set value from 0.1 to 3.2, and the product is input as the instantaneous value and accumulated value. This function is not normally used. Use it only for converting the weight for a pulse to an exponent of 10 of the industrial unit. For 0.25 ml/pulse (1 ml/4 pulses), for example, if the pulse weight is set to 0.25, every four pulse inputs will be multiplied by 0.25 and regarded as a single instantaneous value pulse.	
	Accumulated value	The accumulated number of pulses (0 to 9,999 pulses) for each input is stored in the allocated words of the CIO Area. When 9,999 is exceeded, the value returns to 0 and starts counting again.	
	Stepdown	When the accumulated value is used, this function prevents accumulated value overflow by reducing the number of input pulses. The actual number of input pulses is multiplied by one of four factors (x1, x0.1, x0.01, or x0.001), and the number of input pulses accumulated is then based on that value. **Note** This stepdown function operates only for accumulated values, and not for instantaneous values.	
Isolation		Between inputs and between input terminals and PC signals: Isolation by transformer and photocoupler	
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 Pulse Input Unit, and errors related to the CPU Unit).	
Front panel connector		Sensor input connector terminal block (detachable)	
Alarm time for CPU Unit cycle time		0.3 ms	
Current consumption		5 V DC at 200 mA max., 26 V DC at 160 mA max.	

Item	Specifications
Dimensions	35 × 130 × 126 mm (W × H × D) **Note** The height including the Backplane is 145 mm.
Weight	450 g max.
Standard accessories	None

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+57. • 12345 (3039 Hex): The default data at the left is transferred from the Pulse Input Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Pulse Input Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Instantaneous value alarm settings
m + 2	m + 8	m + 14	m + 20	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4200 (1068 Hex)	Instantaneous value HH (high high limit) alarm setting (Set at instantaneous value scaling value.)
m + 3	m + 9	m + 15	m + 21	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	4000 (0FA0 Hex)	Instantaneous value H (high limit) alarm setting (Set at instantaneous value scaling value.)
m + 4	m + 10	m + 16	m + 22	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	0 (0000 Hex)	Instantaneous value L (low limit) alarm setting (Set at instantaneous value scaling value.)
m + 5	m + 11	m + 17	m + 23	–32768 to 32767	8000 to FFFF Hex, 0000 to 7FFF Hex	–200 (FF38 Hex)	Instantaneous value LL (low low limit) alarm setting (Set at instantaneous value scaling value.)
							Zero/span adjustment
m + 6	m + 12	m + 18	m + 24	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (Set value x 0.0001)
m + 7	m + 13	m + 19	m + 25	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Zero adjustment value (Set at instantaneous value scaling value.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Pulse Input Unit if m is other than 12345 when the PC is powered up or the Pulse Input Unit is restarted.							
m + 26	m + 34	m + 42	m + 50	1000 to 32000	03E8 to 7D00 Hex	10000 (2710 Hex)	Pulse weight Set value x 0.0001 (0.1 to 3.2) The product of multiplying the actual number of pulses input x the value set here is input as the instantaneous value and accumulated value.
m + 27	m + 35	m + 43	m + 51	0 to 3	0000 to 0003 Hex	0 (0000 Hex)	Accumulated value stepdown 0: x1; 1: x0.1; 2: x0.01; 3: x0.001 The product of multiplying the actual number of pulses input x the pulse weight x the stepdown ratio set here is input as the accumulated value.
m + 28	m + 36	m + 44	m + 52	1 to 16	0001 to 0010 Hex	1 (0001 Hex)	Number of process values for calculating moving average for mean value processing
							Instantaneous value conversion function
m + 29	m + 37	m + 45	m + 53	0 to 32000	0000 to 7D00 Hex	1000 (03E8 Hex)	Instantaneous value when 100% input **Note** Pulses/time unit multiplied by pulse weight
m + 30	m + 38	m + 46	m + 54	---	Bit 00 to 03: 0 to 3 Hex	0 (0 Hex)	Decimal point position (from right) for instantaneous value when 100% input
				---	Bit 04 to 07: 0 to 4 Hex	0 (0 Hex)	Instantaneous value time unit (matching conversion period) 0: 1 s; 1: 3 s: 2: 10 s; 3: 30 s; 4: 60 s
				---	Bit 08 to 15: 00 Hex	00 Hex	Not used.

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m + 31	m + 39	m + 47	m + 55	–32000 to 32000	8300 to FFFF Hex 0000 to 7D00 Hex	4000 (0FA0 Hex)	Maximum instantaneous value scaling value Data stored in allocated words of CIO Area when instantaneous value is 100% input as above
							Alarm supplementary functions
m + 32	m + 40	m + 48	m + 56	0 to 32000	0000 to 7D00 Hex	40 (0028 Hex)	Alarm hysteresis (Set at instantaneous value scaling value.)
m + 33	m + 41	m + 49	m + 57	0 to 60	0000 to 003C Hex	0 (0000 Hex)	Alarm ON-delay time (Unit: s)
Storage parameter							
m + 58	m + 59	m + 60	m + 61	0 to 57	0000 to 0039 Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)

Note

1. The default values are transferred from the Pulse Input Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Word	Bit	Name		Data range	Contents
Pulse Input Unit to CPU Unit	n	00	Input No. 1	Instantaneous value LL (low low limit) alarm	0, 1	0: Instantaneous value > Set value 1: Instantaneous value ≤ Set value
		01		Instantaneous value L (low limit) alarm	0, 1	
		02		Instantaneous value H (high limit) alarm	0, 1	0: Instantaneous value < Set value 1: Instantaneous value ≥ Set value
		03		Instantaneous value HH (high high limit) alarm	0, 1	
		04	Input No. 2	Instantaneous value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		05		Instantaneous value L (low limit) alarm	0, 1	
		06		Instantaneous value H (high limit) alarm	0, 1	
		07		Instantaneous value HH (high high limit) alarm	0, 1	
		08	Input No. 3	Instantaneous value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		09		Instantaneous value L (low limit) alarm	0, 1	
		10		Instantaneous value H (high limit) alarm	0, 1	
		11		Instantaneous value HH (high high limit) alarm	0, 1	
		12	Input No. 4	Instantaneous value LL (low low limit) alarm	0, 1	Same as for input No. 1.
		13		Instantaneous value L (low limit) alarm	0, 1	
		14		Instantaneous value H (high limit) alarm	0, 1	
		15		Instantaneous value HH (high high limit) alarm	0, 1	

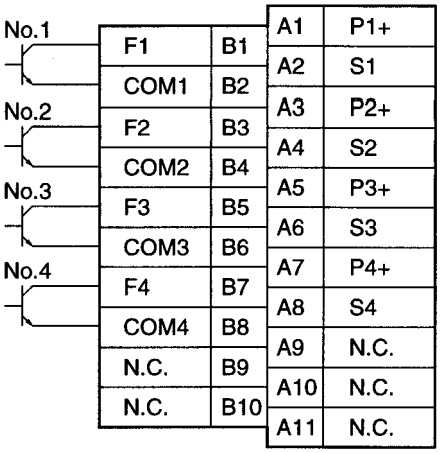
Direction	Word	Bit	Name	Data range	Contents
Pulse Input Unit to CPU Unit	n + 1	00 to 15	Input No. 1 instantaneous value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	The present instantaneous value is stored according to the scaling set in the allocated words of the DM Area.
	n + 2	00 to 15	Input No. 2 instantaneous value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 3	00 to 15	Input No. 3 instantaneous value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 4	00 to 15	Input No. 4 instantaneous value	–32768 to 32767 (8000 to FFFF Hex, 0000 to 7FFF Hex)	
	n + 5	00 to 15	Input No. 1 accumulated value	0 to 9999 (0000 to 270F Hex)	The accumulated value for the number of pulses (after step-down) is stored here.
	n + 6	00 to 15	Input No. 2 accumulated value	0 to 9999 (0000 to 270F Hex)	
	n + 7	00 to 15	Input No. 3 accumulated value	0 to 9999 (0000 to 270F Hex)	
	n + 8	00 to 15	Input No. 4 accumulated value	0 to 9999 (0000 to 270F Hex)	
	n + 9	00	Accumulation Reset Flag	0, 1	When the accumulated value is reset, this flag turns ON for 10 s. (See note.)

Note The accumulated value is reset when the PC is powered up or when the Pulse Input Unit is restarted.

Terminal Connection Diagram

No-voltage semiconductor input

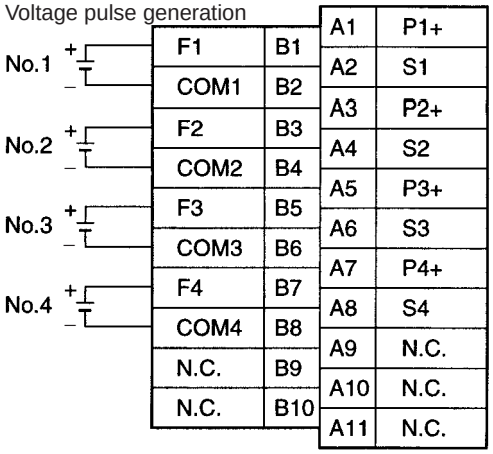
CS1W-PPS01 Isolated-type Pulse Input Unit



Voltage input

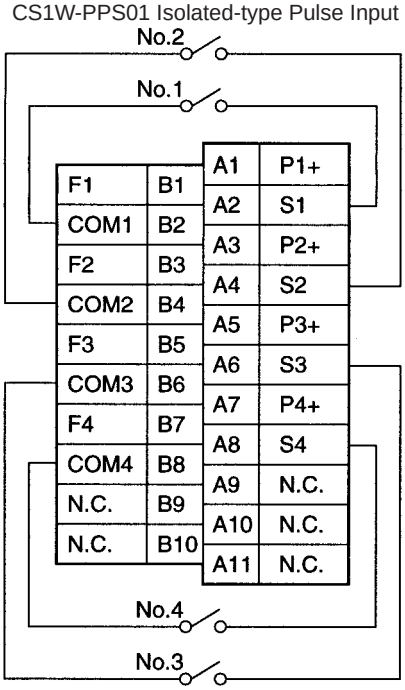
CS1W-PPS01 Isolated-type Pulse Input Unit

Voltage pulse generation



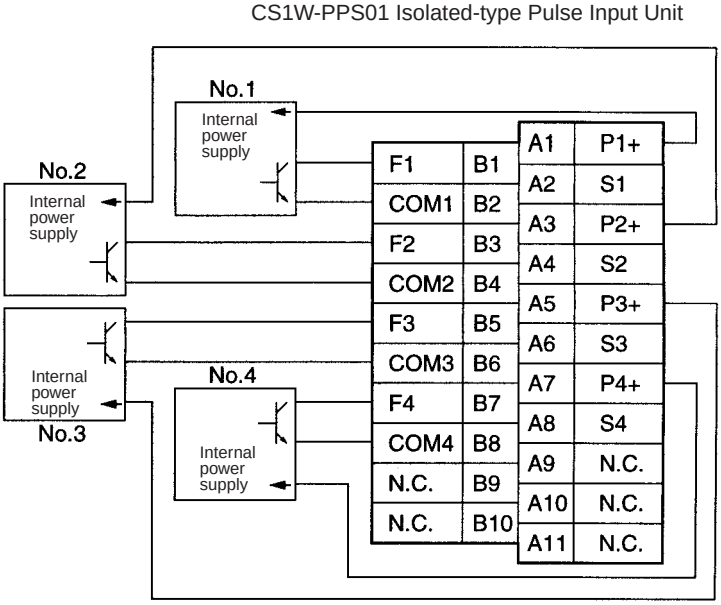
Contact input

CS1W-PPS01 Isolated-type Pulse Input Unit



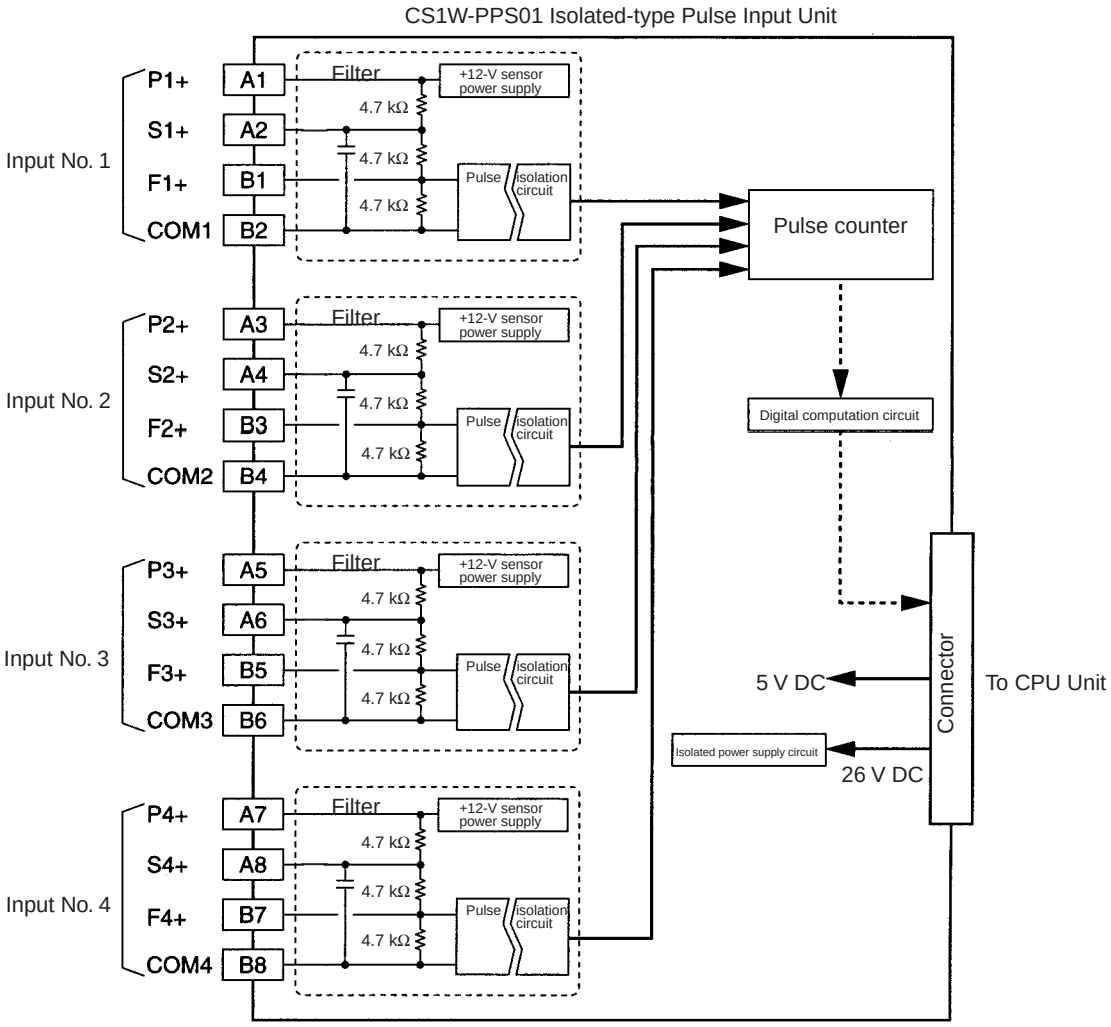
3-wire sensor input

CS1W-PPS01 Isolated-type Pulse Input Unit

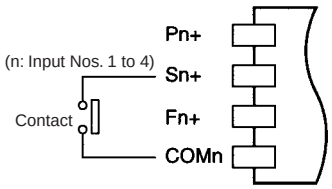


Note In all of the above cases, leave all unused inputs open between the terminals (e.g., between B1 and B2 for no-voltage semiconductor input No. 1).

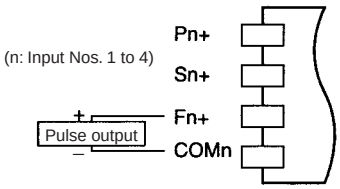
Terminal Block Diagram



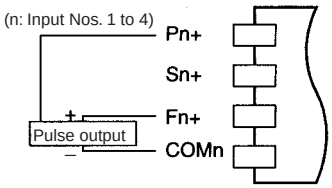
Contact input (for metal contacts)



Voltage pulse input



Sensor power supply (connected to 3-wire sensor)



Error Processing

Accumulated Values Do Not Change.

Probable cause	Remedy
An input device is malfunctioning, input wiring is faulty, or wiring is disconnected.	Check whether the input voltage has changed to exceed the minimum OFF voltage or the maximum ON voltage.
	Check for faulty or disconnected wiring.

Accumulation Data is Different from the Number of Pulses Input.

Probable cause	Remedy
Input signals are being affected by external noise.	Change the connection paths of the input signal lines. (Separate them from sources of noise or use shielded cable.)
	Insert 0.01-μF to 0.1-μF ceramic capacitors between the positive and negative input terminals.
The pulse weight or accumulation stepdown settings are incorrect.	Check the pulse weight and accumulation stepdown settings.
Pulses exceeding the allowable frequency are being input.	Check the input signal waveform and correct them for the entire system.
Pulses with defects such as chattering are being input.	Check the input signal waveform and remove chattering from external circuitry.

Instantaneous Values Do Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
The instantaneous value when input 100%, or the maximum instantaneous value in the range, is set to 0.	Set the instantaneous value when input 100%, and the maximum instantaneous value in the range, to a value other than 0.

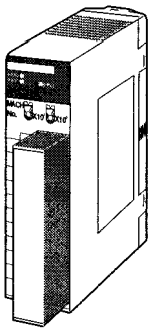
Instantaneous Values are Not Converted as Intended.

Probable cause	Remedy
The instantaneous value when input 100%, or the maximum instantaneous value scaling value, is incorrect.	Check the instantaneous value when input 100%, the decimal point position, and the maximum instantaneous value scaling value.
The zero/span adjustment data is incorrect.	Check and correct the zero/span adjustment settings.
Input pulses are too slow (i.e., the pulse rate is to low).	Lengthen the instantaneous value time unit (conversion period).
There is pulsating in the instantaneous value.	Set the number of values for moving average processing.

2-9 CS1W-PMV01 Isolated-type Analog Output Unit

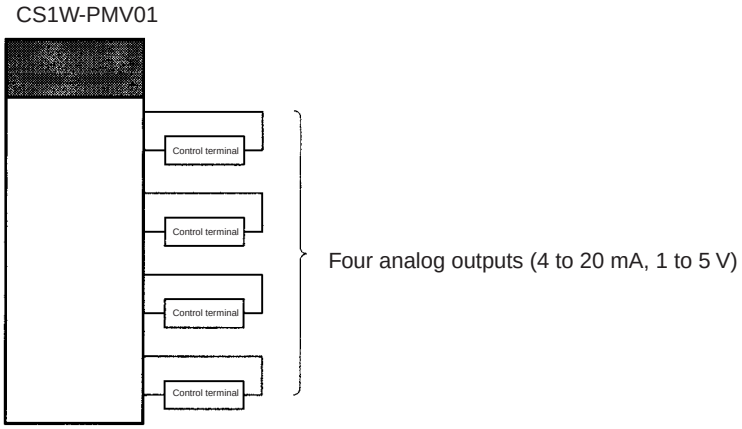
Overview

Each cycle, the CS1W-PMV01 Isolated-type Analog Output Unit converts up to four analog output set values from the CPU Unit to either 4 to 20 mA or 1 to 5 V, and outputs them. It can also provide answer back for checking actual output values.



CS1W-PMV01

System Configuration



Features

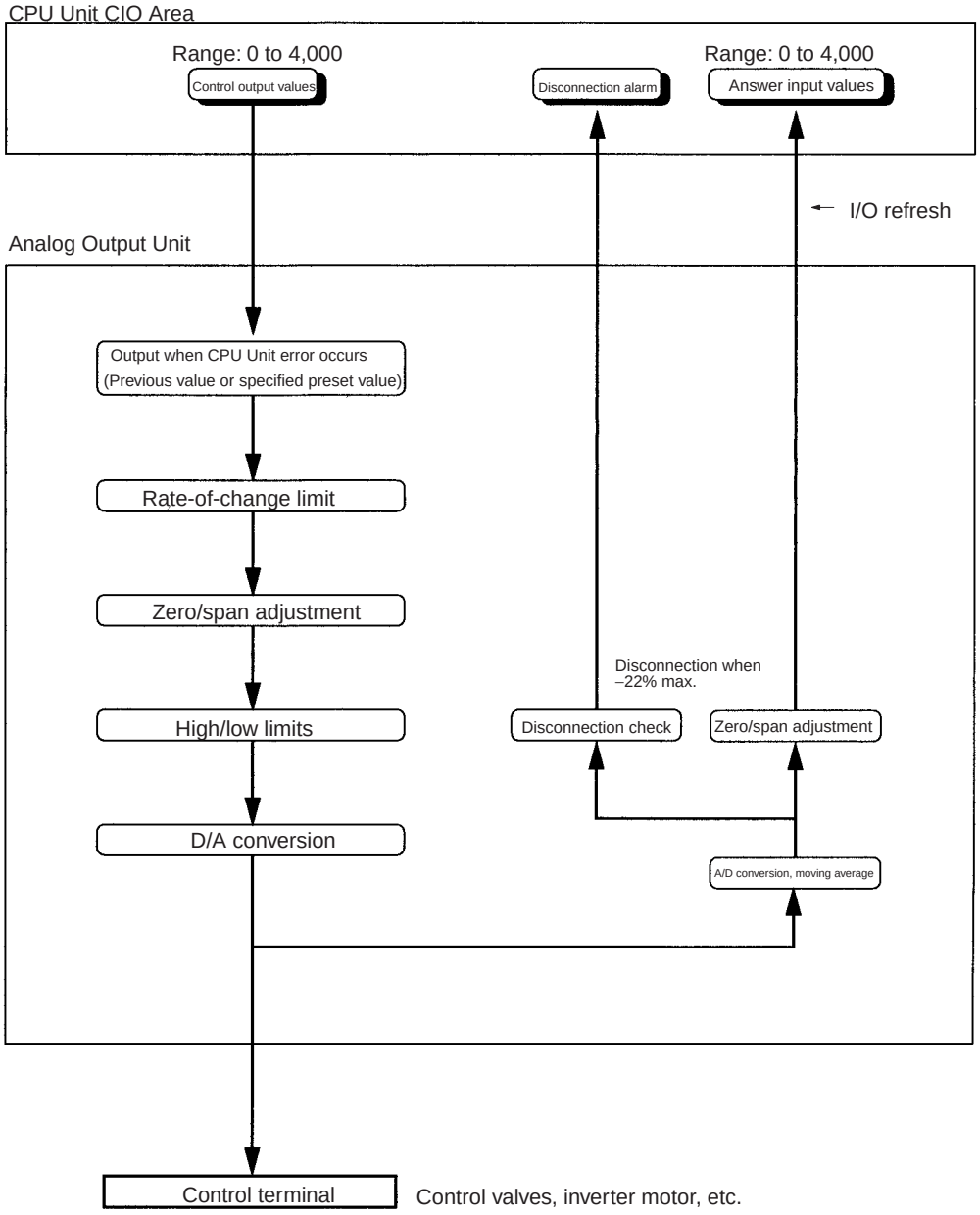
- Outputs in either 4 to 20 mA or 1 to 5 V (set separately for each of the four outputs) the analog output values set in the allocated words of the CPU Unit's CIO Area.
- Answer input function.
  Actual output signals of 4 to 20 mA or 1 to 5 V are checked by being read again from the output circuit, and are stored in the allocated words in the CIO Area. Mean value processing is also possible.
- Output disconnection detection function (current output only).
- Output high/low limit function.
- Rate-of-change limit function.
- Output hold function when CPU Unit errors occur.
  When a CPU Unit fatal error (including FALS execution), or a CPU error in the CPU Unit occurs, or all outputs are turned OFF with the Output OFF Bit, this function can hold either a preset value or the analog output value prior to the error.
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Outputs	Outputs
CS-series Special I/O Unit	CS1W-PMV01	4 max.	4 to 20 mA, 1 to 5 V (separate for each of four outputs)

Block Diagram (Order of Processing)

The processing for the four outputs is as shown in the following diagram.

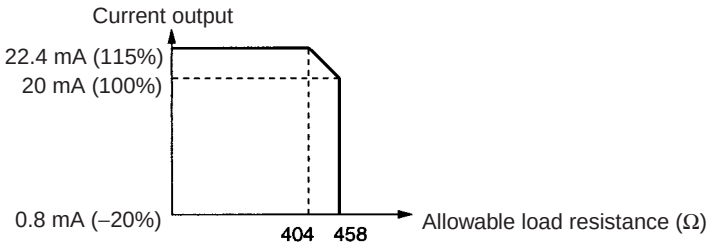


Specifications

Item		Specifications
Model		CS1W-PMV01
Applicable PC		CS Series
Unit classification		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		96 (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	CIO Area words allocated for Special I/O Units	10 words/Unit CPU Unit to Analog Output Unit: Analog output values for each output Analog Output Unit to CPU Unit: Answer input values for each output, output disconnection
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Analog Output Unit: Output hold for when CPU Unit error occurs, high/low limit values, rate-of-change limit values (positive and negative directions), number of values for answer input moving average, zero/span adjustment for control outputs and answer inputs, etc.
Number of outputs		4
Output signal types		Either 4 to 20 mA or 1 to 5 V (separate for each of the four outputs). Switched according to the connection terminals.
User-defined scaling in industrial units		None
Data storage in the CIO Area		0 to 4,000 (0000 to 0FA0 Hex), fixed 0: 4 mA or 1 V; 4,000: 20 mA or 5 V The values derived from carrying out the following processing in order of the values in the allocated words in the CIO Area are output in analog. 1) Output hold → 2) Rate-of-change limit → 3) Zero/span adjustment → 4) High/low limits Therefore, the values after processing are confirmed by analog inputs.
Accuracy		When 4 to 20 mA: ±0.1% of full scale When 1 to 5 V: ±0.2% of full scale
Temperature coefficient		±0.015%/°C of full scale
Resolution		1/4,000 of full scale
Output response time		0.2 s (travel time from output 0% to 100%, for step output)
D/A conversion period		100 ms/4 outputs
Maximum time to store data in CPU Unit		Conversion period + one CPU Unit cycle
Output signal range		Approx. –20 to 115%
Allowable load resistance		When 4 to 20 mA: 404 Ω max. (when output range is –20 to 115%) or 458 Ω max. (when output range is –20 to 100%) (Refer to note.) When 1 to 5 V: 250 kΩ max.
Output impedance		When 1 to 5 V: 250 Ω (typical)
Voltage when open between terminals		Approx. 15 V
Answer input function		The actual analog output values (4 to 20 mA or 1 to 5 V) from the Unit's output terminals can be read. Data stored to allocated words of CIO Area: 0 to 4,000 (0000 to 0FA0 Hex), fixed. (When 4 mA or 1 V: 0; when 20 mA or 5 V: 4,000) Accuracy: ±0.2% of full scale Resolution: 1/2000 Temperature coefficient: ±0.015%/°C
Current output disconnection detection function		When the actual output of 4 to 20 mA from the Analog Output Unit's output terminals is 0.5 mA or less, it is regarded as an external output circuit current loop disconnection, and the Output Disconnection Flag turns ON.

Item		Specifications
Function	Rate-of-change limit	This function can be used to control the speed of up and down changes in analog output values.
	Output high/low limits	This function can be used to place high and low limits on analog output values.
	Output hold	This function holds the analog output value to the previous value or to a specified preset value when any of the following CPU Unit errors occurs, and outputs the analog output value in the CIO Area when the error is cleared. • CPU Unit fatal error (including FALS execution) • CPU error in CPU Unit • All outputs turned OFF with Output OFF Bit
Isolation		Between outputs and between output terminals and PC signals: Isolation by transformer and photocoupler
Insulation resistance		20 MΩ (at 500 V DC) between outputs
Dielectric strength		Between outputs: 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 Analog Output Unit, and errors related to the CPU Unit).
Front panel connector		Output connector terminal block (detachable)
Alarm time for CPU Unit cycle time		0.3 ms
Current consumption		5 V DC at 150 mA max., 26 V DC at 160 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

Note The following diagram shows the relationship between the allowable load resistance and the current output.



Output Values According to CPU Unit Status

Analog output values from the Analog Output Unit will be as shown in the following table, depending on the status of the CPU Unit.

CPU Unit status	Analog output values from Unit	
Fatal error (including FALS(007) execution)	The output hold function holds the previous value or a specified preset value.	
CPU error		
All outputs turned OFF with Output OFF Bit		
Change of operation mode from RUN or Monitor to Program (See note.)	When the CPU Unit's I/O Memory Hold Flag (A50012) is OFF.	The output value in the CIO Area is cleared, and that value (0000 Hex) is output refreshed.
	When the CPU Unit's I/O Memory Hold Flag (A50012) is ON.	The output value in the CIO Area is held at the value prior to the operation mode change, and that is output refreshed.
Fatal error or CPU standby after powerup	Either 0 mA or 0 V is output.	
Special I/O Unit cyclic refresh disabled	Outputs can be refreshed by means of IORF(097) in the ladder diagram program.	

Note Regardless of the CPU Unit's operation mode (including Program Mode), the analog output value in the allocated words of the CIO Area is always output refreshed. As shown in the above table, however, when the operation mode is changed to Program Mode, the analog output value in the CIO Area is either cleared or held depending on the status of the CPU Unit's I/O Memory Hold Flag (A50012). In particular, be careful when this flag is ON, because the value prior to the mode change will be held and that value will be output refreshed.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+45. • 12345 (3039 Hex): The default data at the left is transferred from the Analog Output Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Analog Output Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Analog output zero/span adjustment
m + 2	m + 6	m + 10	m + 14	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 3	m + 7	m + 11	m + 15	–4000 to 4000	F060 to FFFF Hex, 0000 to 0FA0 Hex	0 (0000 Hex)	Zero adjustment value (Set in units of analog output value resolution.)
							Analog input zero/span adjustment
m + 4	m + 8	m + 12	m + 16	0 to 32000	0000 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 5	m + 9	m + 13	m + 17	–4000 to 4000	F060 to FFFF Hex, 0000 to 0FA0 Hex	0 (0000 Hex)	Zero adjustment value (Set in units of analog output value resolution.)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Analog Output Unit if m is other than 12345 when the PC is powered up or the Analog Output Unit is restarted.							
							Output hold function
m + 18	m + 25	m + 32	m + 39	0, 1	0000 to 0001 Hex	1 (0001 Hex)	Output hold value 0: Hold at previous value. 1: Hold at specified preset value (below).
m + 19	m + 26	m + 33	m + 40	–800 to 4600	FCE0 to FFFF Hex, 0000 to 11F8 Hex	–800 (FCE0 Hex)	Preset output value for output hold function
							High/low limit function
m + 20	m + 27	m + 34	m + 41	–800 to 4600	FCE0 to FFFF Hex, 0000 to 11F8 Hex	4600 (11F8 Hex)	High limit
m + 21	m + 28	m + 35	m + 42	–800 to 4600	FCE0 to FFFF Hex, 0000 to 11F8 Hex	–800 (FCE0 Hex)	Low limit
							Rate-of-change limit function
m + 22	m + 29	m + 36	m + 43	0 to 32000	0000 to 7D00 Hex	32000 (7D00 Hex)	Positive rate-of-change limit (unit: 1 s)
m + 23	m + 30	m + 37	m + 44	0 to 32000	0000 to 7D00 Hex	32000 (7D00 Hex)	Negative rate-of-change limit (unit: 1 s)
							Answer input mean value processing
m + 24	m + 31	m + 38	m + 45	1 to 16	0001 to 0100 Hex	4 (0004 Hex)	Number of values for answer input moving average
Storage parameter							
m + 46	m + 47	m + 48	m + 49	0 to 45	0000 to 002D Hex	0 (0000 Hex)	Address of Data Range Error (See note 2.)

Note

1. The default values are transferred from the Analog Output Unit to the CPU Unit when m is 12345 (3039 Hex).
2. The ERC indicator on the Unit's front panel will light if an out-of-range setting is made in either Setting Group1 or 2. The offset from m of the first DM word containing the out-of-range error will be stored as the Address of Data Range Error in the DM Area in four digits hexadecimal. For more information, refer to *1-6 Error Processing*.

CIO Area Allocations

n = 2000 + unit number × 10 (unit number: 0 to 95)

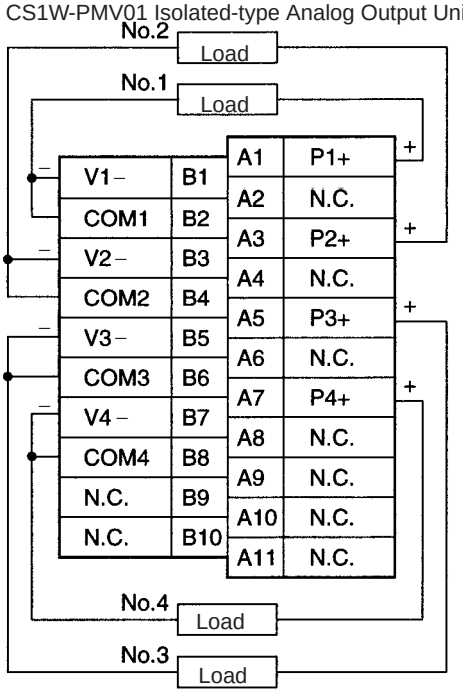
Direction	Wd	Bit	Name	Data range	Contents
CPU Unit to Analog Output Unit	n	00 to 15	Not used.	---	---
	n + 1	00 to 15	No. 1 analog output value	–800 to 4600 (FCE0 to 11F8 Hex)	Set from 0 to 4,000 (0000 to 0FA0 Hex). This value is processed as follows: Output hold → rate-of-change limit → zero/span adjustment → high/low limit. Then an analog signal is output as either 4 to 20 mA or 1 to 5 V.
	n + 2	00 to 15	No. 2 analog output value	–800 to 4600 (FCE0 to 11F8 Hex)	
	n + 3	00 to 15	No. 3 analog output value	–800 to 4600 (FCE0 to 11F8 Hex)	
	n + 4	00 to 15	No. 4 analog output value	–800 to 4600 (FCE0 to 11F8 Hex)	

Direction	Wd	Bit	Name	Data range	Contents
Analog Output Unit to CPU Unit	n + 5	00 to 15	No. 1 answer input value	–800 to 4600 (FCE0 to 11F8 Hex)	The actual analog output signal is input and stored as a value from 0 to 4,000 (0000 to 0FA0 Hex), for either 4 to 20 mA or 1 to 5 V.
	n + 6	00 to 15	No. 2 answer input value	–800 to 4600 (FCE0 to 11F8 Hex)	
	n + 7	00 to 15	No. 3 answer input value	–800 to 4600 (FCE0 to 11F8 Hex)	
	n + 8	00 to 15	No. 4 answer input value	–800 to 4600 (FCE0 to 11F8 Hex)	
	n + 9	00	No. 1 output disconnection	0, 1	0: Normal 1: Disconnection
		01	No. 2 output disconnection	0, 1	
		02	No. 3 output disconnection	0, 1	
		03	No. 4 output disconnection	0, 1	

Terminal Block Diagram

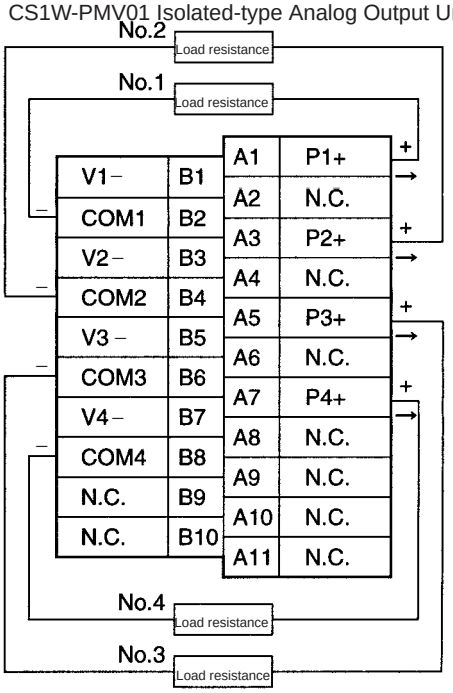
Voltage output

CS1W-PMV01 Isolated-type Analog Output Unit



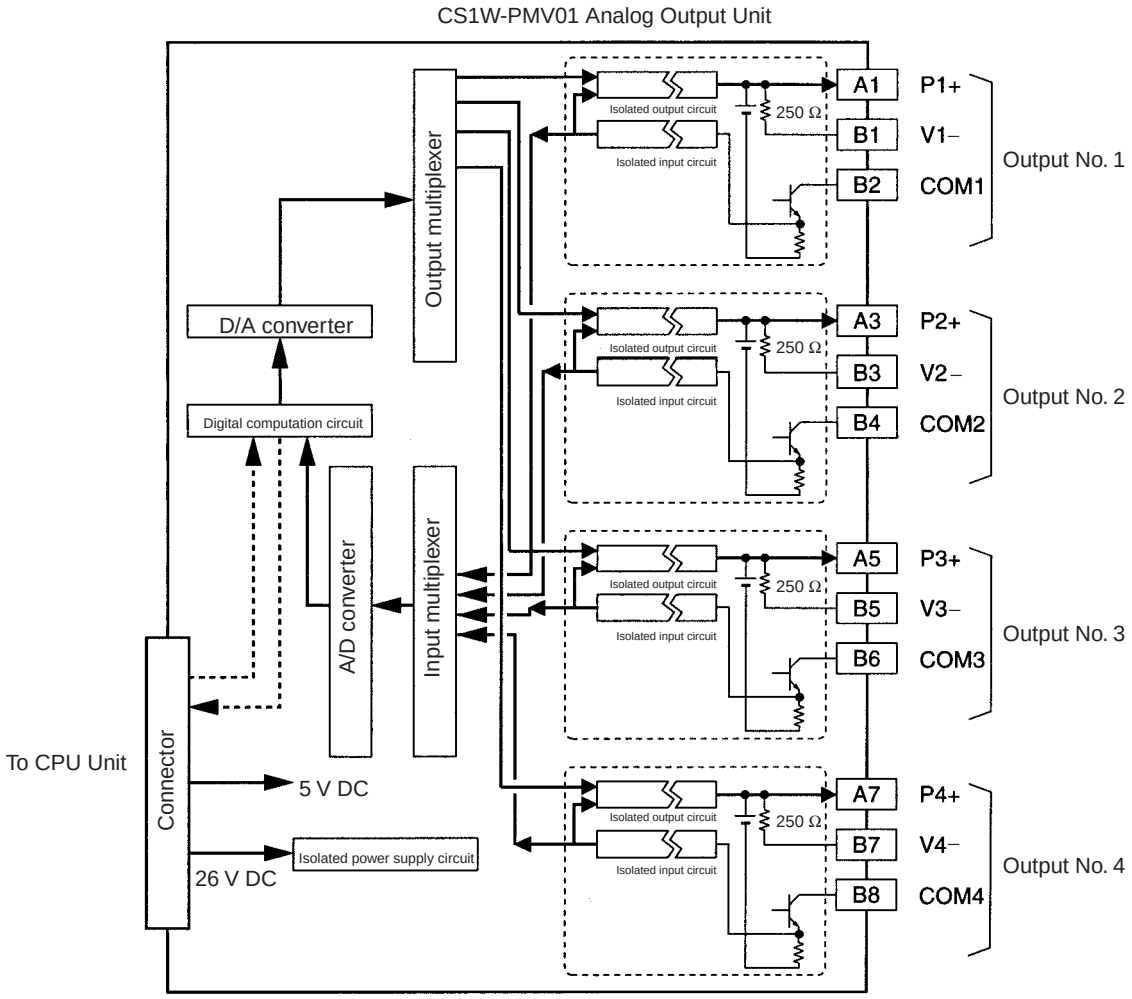
Current output

CS1W-PMV01 Isolated-type Analog Output Unit

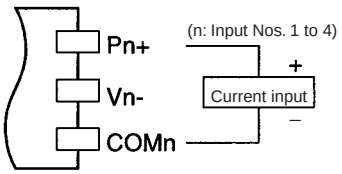


Note In both of the above cases, short-circuit all unused inputs between V□ and COM□ (e.g., between terminals B1 and B2 for output No. 1) with the lead wire.

Terminal Block Diagram

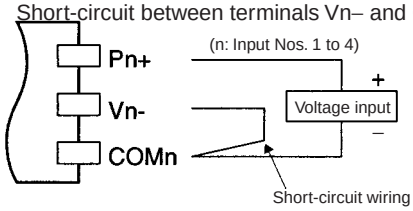


4- to 20-mA output



1- to 5-V output

Short-circuit between terminals Vn– and COMn–.



Error Processing

Outputs Do Not Change.

Probable cause	Remedy
The span adjustment value in the output zero/span adjustment is set to 0.	Set the span adjustment to the Unit's default value.
The high/low limit is operating.	Set the high/low limit to the Unit's default value.
The output data is set out of range.	Correct the data so that it falls within the range.
All outputs have been turned OFF with the Output OFF Bit.	Turn OFF the Output OFF Bit.

Outputs are Not Converted as Intended.

Probable cause	Remedy
The zero/span adjustment or high/low limit value is incorrect.	Check and correct the settings.
An output device's I/O specifications do not conform.	Check the load impedance Change the remote device.
The rate-of-change limit is too low, and the change is too slow.	Correct the rate-of-change limit setting.

Outputs are Unstable.

Probable cause	Remedy
Output signals are being affected by external noise.	Change the connection paths of the output signal lines. (Separate them from sources of noise or use shielded cable.)

Answer Input Data Does Not Change.

Probable cause	Remedy
The gain for span adjustment is set to 0.	Set the gain for span adjustment to a value other than 0.
An output device is malfunctioning, output wiring is faulty, or wiring is disconnected.	Check whether the output voltage or current has changed. Check for faulty or disconnected wiring. Check whether a disconnection has been detected in the I/O Area.

Values are Not Converted as Intended.

Probable cause	Remedy
The zero/span adjustment, high/low limit, or rate-of-change value is incorrect.	Check and correct the settings.
An output device's I/O specifications do not conform.	Check the load impedance Change the remote device.

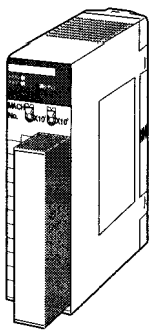
Converted Values are Unstable.

Probable cause	Remedy
Output signals are being affected by external noise.	Change the connection paths of the output signal lines. (Separate them from sources of noise or use shielded cable.)
	Increase the number of values for calculating the moving average in mean value processing.

2-10 CS1W-PMV02 Isolated-type Analog Output Unit

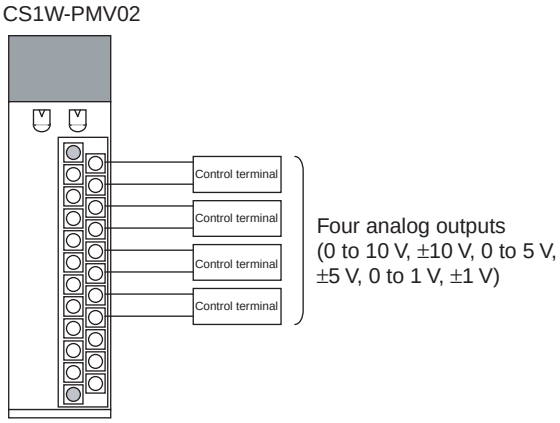
Overview

Each cycle, the CS1W-PMV02 Isolated-type Analog Output Unit converts up to four analog output set values from the CPU Unit to analog voltage signals and outputs them.



CS1W-PMV02

System Configuration



Features

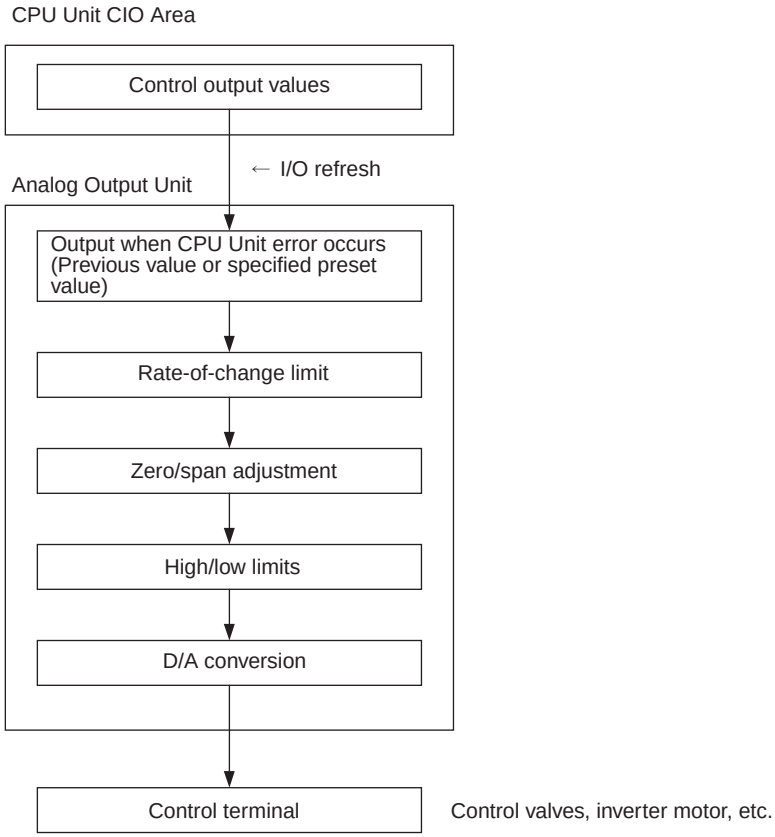
- Outputs the analog output values set in the allocated words of the CPU Unit's CIO Area. (Supported output ranges: –10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, –1 to 1 V, 0 to 1 V.)
- Output high/low limit function.
- Rate-of-change limit function.
- Output hold function when CPU Unit errors occur.
  When a CPU Unit fatal error (including FALS execution), or a CPU error in the CPU Unit occurs, or all outputs are turned OFF with the Output OFF Bit, this function can hold either a preset value or the analog output value prior to the error.
- Zero/span adjustment capability during operation.

Model Information

Unit classification	Model number	Outputs	Outputs
CS-series Special I/O Unit	CS1W-PMV02	4 max.	–10 to 10 V, 0 to 10 V, –5 to 5 V, 0 to 5 V, –1 to 1 V, 0 to 1 V

Block Diagram (Order of Processing)

The processing for the four outputs is as shown in the following diagram.



Specifications

Item		Specifications
Model		CS1W-PMV02
Applicable PC		CS Series
Unit classification		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		96 (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	CIO Area words allocated for Special I/O Units	10 words/Unit CPU Unit to Analog Output Unit: Analog output values for each output Analog Output Unit to CPU Unit: None
	DM Area words allocated for Special I/O Units	100 words/Unit CPU Unit to Analog Output Unit: Output hold for when CPU Unit error occurs, high/low limit values, rate-of-change limit values, zero/span adjustment for control outputs, etc.
Number of outputs		4
Output signal types		0 to 10 V, 0 to 5 V, 0 to 1 V, –10 to 10 V, –5 to 5 V, –1 to 1 V (Each output point can be set individually.)
User-defined scaling in industrial units		Scaling is possible for each of the above signal types individually. (The data corresponding to the minimum and maximum output values can be set freely.)
Data storage in the CIO Area		±32,000 (8300 to FFFF Hex, 0000 to 7D00 Hex)
Accuracy		±0.1% of full scale
Temperature coefficient		±0.015%/°C of full scale
Resolution		–10 to 10 V, –1 to 1 V: 1/16,000 of full scale 0 to 10 V, 0 to 1 V, –5 to 5 V: 1/8,000 of full scale 0 to 5 V: 1/4,000 of full scale
Output response time		50 ms max. (travel time from output 0% to 90%, for step output)
D/A conversion period		40 ms/4 outputs
Maximum output delay time		Output response time + conversion period + one CPU Unit cycle
Output signal range		–15 to 115% (–7.5 to 107.5% for ±10-V and ±1-V ranges)
Allowable load resistance		10 kΩ min.
Output impedance		0.5 Ω max.
Voltage when open between terminals		---
Answer input function		None
Current output disconnection detection function		None
Function	Rate-of-change limit	This function can be used to control the speed of up and down changes in analog output values.
	Output high/low limits	This function can be used to place high and low limits on analog output values.
	Output hold	This function holds the analog output value to the previous value or to a specified preset value when any of the following CPU Unit errors occurs. Normal operation is restored when the CPU Unit error is cleared. • CPU Unit fatal error (including FALS execution) • CPU error in CPU Unit • CPU Unit's load interrupted
Isolation		Between outputs and between output terminals and PC signals: Isolation by transformer and photocoupler
Insulation resistance		20 MΩ (at 500 V DC) between outputs

Item	Specifications
Dielectric strength	Between outputs: 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 Analog Output Unit, and errors related to the CPU Unit).
Front panel connector	Output connector terminal block (detachable)
Alarm time for CPU Unit cycle time	0.3 ms
Current consumption	5 V DC at 120 mA max., 26 V DC at 120 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

Output Values According to CPU Unit Status

Analog output values from the Analog Output Unit will be as shown in the following table, depending on the status of the CPU Unit.

<table>
<tr><th>CPU Unit status</th><th colspan="2">Analog output values from Unit</th></tr>
<tr><td>Fatal error (including FALS(007) execution)</td><td colspan="2" rowspan="3">The output hold function holds the previous value or a specified preset value.</td></tr>
<tr><td>CPU error</td></tr>
<tr><td>All outputs turned OFF with Output OFF Bit</td></tr>
<tr><td rowspan="2">Change of operation mode from RUN or Monitor to Program
(See note.)</td><td>When the CPU Unit's I/O Memory Hold Flag (A50012) is OFF.</td><td>The output value in the CIO Area is cleared, and that value (0000 Hex) is output refreshed.</td></tr>
<tr><td>When the CPU Unit's I/O Memory Hold Flag (A50012) is ON.</td><td>The output value in the CIO Area is held at the value prior to the operation mode change, and that is output refreshed.</td></tr>
<tr><td>Fatal error or CPU standby after powerup</td><td colspan="2">0 V is output.</td></tr>
<tr><td>Special I/O Unit cyclic refresh disabled</td><td colspan="2">Outputs can be refreshed by means of IORF(097) in the ladder diagram program.</td></tr>
</table>

Note Regardless of the CPU Unit's operation mode (including Program Mode), the analog output value in the allocated words of the CIO Area is always output refreshed. As shown in the above table, however, when the operation mode is changed to Program Mode, the analog output value in the CIO Area is either cleared or held depending on the status of the I/O Memory Hold Flag (A50012). In particular, be careful when this flag is ON, because the value prior to the mode change will be held and that value will be output refreshed.

DM Area Allocations

m = D20000 + unit number × 100 (unit number: 0 to 95)

Input No. 1	Input No. 2	Input No. 3	Input No. 4	Decimal	Hexadecimal	Default (See note 1.)	Data contents
m				12345, 0	3039 Hex 0000 Hex	0000 Hex	Default block read command Specifies the direction of data transfer at PC powerup or Unit restarting for DM words m+2 to m+45. • 12345 (3039 Hex): The default data at the left is transferred from the Analog Output Unit to the CPU Unit. When the transfer is completed, the value will become 0000 Hex. • Other than 12345 (such as 0000 Hex): The data in the allocated words of DM Area is transferred from the CPU Unit to the Analog Output Unit.
Setting Group 1 (continuously refreshed area): Parameters that are continuously refreshed during PC operation (regardless of the CPU Unit's operation mode)							
							Analog output zero/span adjustment
m + 2	m + 6	m + 10	m + 14	1 to 32000	0001 to 7D00 Hex	10000 (2710 Hex)	Gain for span adjustment (set value x 0.0001)
m + 3	m + 7	m + 11	m + 15	–16000 to 16000	C180 to FFFF Hex, 0000 to 3E80 Hex	0 (0000 Hex)	Zero adjustment value (Set in units of analog output value resolution.)
Setting Group 2 (initial settings area): Parameters that are transferred one time from the CPU Unit to the Analog Output Unit if m is other than 12345 when the PC is powered up or the Analog Output Unit is restarted.							
							Output hold function
m + 18	m + 25	m + 32	m + 39	0, 1	0000 to 0001 Hex	1 (0001 Hex)	Output hold value 0: Hold at previous value. 1: Hold at specified preset value (below).
m + 19	m + 26	m + 33	m + 40	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–600 (FDA8 Hex)	Preset output value for output hold function
							High/low limit function
m + 20	m + 27	m + 34	m + 41	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4600 (11F8 Hex)	High limit
m + 21	m + 28	m + 35	m + 42	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	–600 (FDA8 Hex)	Low limit
							Rate-of-change limit function
m + 22	m + 29	m + 36	m + 43	0 to 32000	0000 to 7D00 Hex	32000 (7D00 Hex)	Positive rate-of-change limit (unit: 1 s)
m + 23	m + 30	m + 37	m + 44	0 to 32000	0000 to 7D00 Hex	32000 (7D00 Hex)	Negative rate-of-change limit (unit: 1 s)
Display Parameter							
m + 46	m + 47	m + 48	m + 49	0 to 61	0000 to 003D	0 (0000 Hex)	**Address display for data range error**
Expansion Settings (initial settings area): Parameters that are transferred one time from the CPU Unit to the Analog Output Unit if m is other than 12345 when the PC is powered up or the Analog Output Unit is restarted.							
							Output signal type
m + 50	m + 53	m + 56	m + 59	0, 1, 2, 3, 8, 9	0000 Hex 0001 Hex 0002 Hex 0003 Hex 0008 Hex 0009 Hex	1 (0001 Hex)	0: –10 to 10 V 1: 0 to 10 V 2: –5 to 5 V 3: 0 to 5 V 8: –1 to 1 V 9: 0 to 1 V
							Output data scaling
m + 51	m + 54	m + 57	m + 60	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	4000 (0000 Hex)	Setting data that corresponds to maximum output value (span)
m + 52	m + 55	m + 58	m + 61	–32000 to 32000	8300 to FFFF Hex, 0000 to 7D00 Hex	0 (0000 Hex)	Setting data that corresponds to minimum output value (zero)

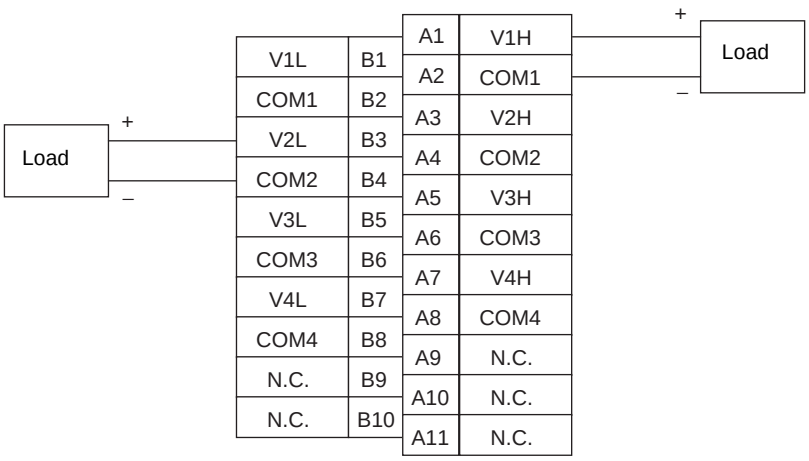
CIO Area Allocations

n = 2000 + unit number × 10 (unit number: 0 to 95)

Direction	Wd	Bit	Name	Data range	Contents
CPU Unit to Analog Output Unit	n	00 to 15	Not used.	---	---
	n + 1	00 to 15	No. 1 analog output value	–32000 to 32000 (8300 to FFFF Hex, 0000 to 7D00 Hex)	Set from –32000 to 32000 (8300 to FFFF Hex, 0000 to 7D00 Hex). This value is processed as follows: Output hold → rate-of-change limit → zero/span adjustment → high/low limit. Then an analog signal is output.
	n + 2	00 to 15	No. 2 analog output value	–32000 to 32000 (8300 to FFFF Hex, 0000 to 7D00 Hex)	
	n + 3	00 to 15	No. 3 analog output value	–32000 to 32000 (8300 to FFFF Hex, 0000 to 7D00 Hex)	
	n + 4	00 to 15	No. 4 analog output value	–32000 to 32000 (8300 to FFFF Hex, 0000 to 7D00 Hex)	
Analog Output Unit to CPU Unit	n + 5	00 to 15	Not used.	---	---
	n + 6	00 to 15			
	n + 7	00 to 15			
	n + 8	00 to 15			
	n + 9	00 to 15			

Terminal Connection Diagram

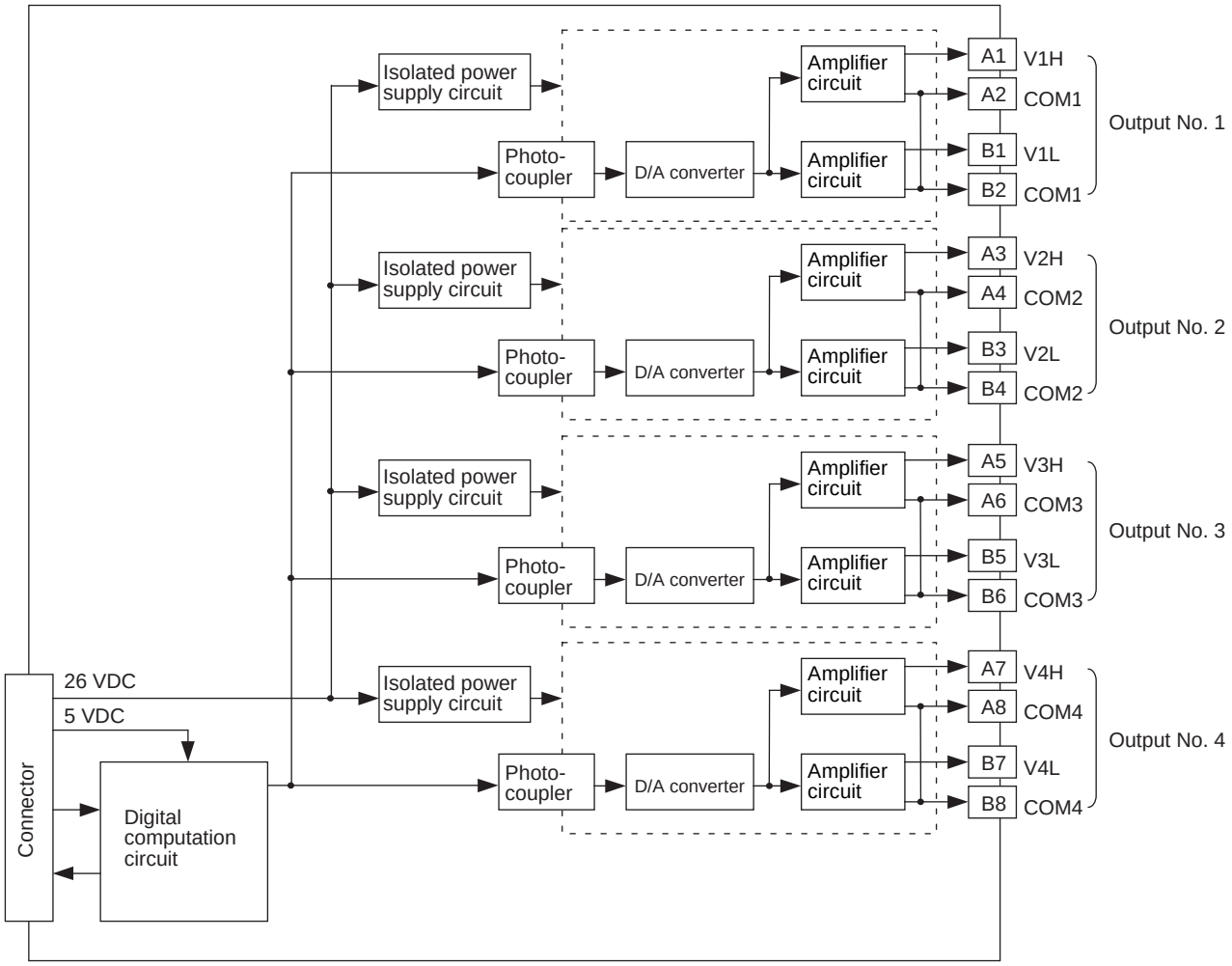
B terminals: 0 to 1 V, ±1 V; A terminals: 0 to 10 V, 0 to 5 V, ±10 V, ±5 V



Note

1. Although signals 1/10 of the size of the A-row terminal output signals are output to the B terminals, simultaneous use of A (L) and B (H) terminals of the same number is prohibited.
2. Do not connect V□□ and COM□□ for all unused output numbers.

Terminal Block Diagram



Error Processing

Outputs Do Not Change.

Probable cause	Remedy
The span adjustment value in the output zero/span adjustment is set to 0.	Set the span adjustment to the Unit's default value.
The high/low limit is operating.	Set the high/low limit to the Unit's default value.
The output data is set out of range.	Correct the data so that it falls within the range.
All outputs have been turned OFF with the Output OFF Bit.	Turn OFF the Output OFF Bit.

Outputs are Not Converted as Intended.

Probable cause	Remedy
The zero/span adjustment or high/low limit value is incorrect.	Check and correct the settings.
An output device's I/O specifications do not conform.	Check the load impedance Change the remote device.
The rate-of-change limit is too low, and the change is too slow.	Correct the rate-of-change limit setting.

Outputs are Unstable.

Probable cause	Remedy
Output signals are being affected by external noise.	Change the connection paths of the output signal lines. (Separate them from sources of noise or use shielded cable.)

Values are Not Converted as Intended.

Probable cause	Remedy
The zero/span adjustment, high/low limit, or rate-of-change value is incorrect.	Check and correct the settings.
An output device's I/O specifications do not conform.	Check the load impedance Change the remote device.

Appendix A

Supplementary Explanation of Functions

The following supplements the explanation given in *1-2 Features and Functions*.

Changing Set Values During Output of Process Value (or Instantaneous Value) Alarm or Rate-of-change Alarm

HH (High High Limit) and H (High Limit) Alarms

When the alarm set value is raised while the alarm output is ON, the alarm output will be turned OFF when the following condition is satisfied.

Input value < (alarm set value after change – hysteresis)

The alarm output will first turn OFF when the input value falls below the set value (with the hysteresis included).

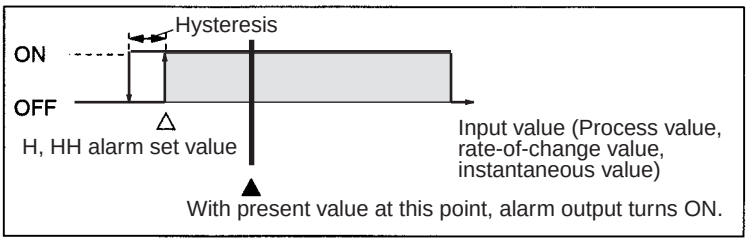
LL (Low Low Limit) and L (Low Limit) Alarms

When the alarm set value is lowered while the alarm output is ON, the alarm output will be turned OFF when the following condition is satisfied.

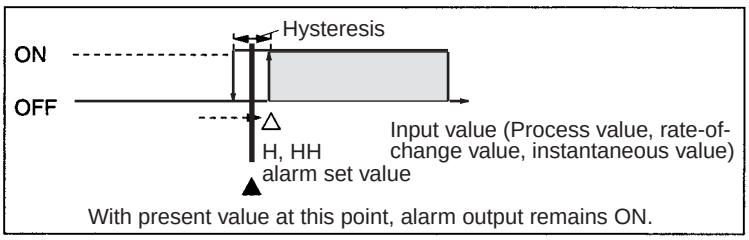
Input value > (alarm set value after change + hysteresis)

When the hysteresis part alone of the input value is greater than the set value, the alarm output will turn OFF for the first time.

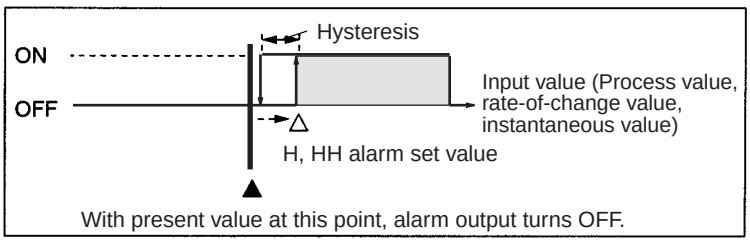
Example: HH and H Limit Alarms



Alarm set value raised.



Alarm set value further raised.



Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit.

Alarm Operation when Upper Limit is Less Than Lower Limit

Process value (instantaneous value) and rate-of-change value alarm set values can be set freely regardless of the relative sizes of HH > H > L > LL.

Example: H < L, or HH < H.

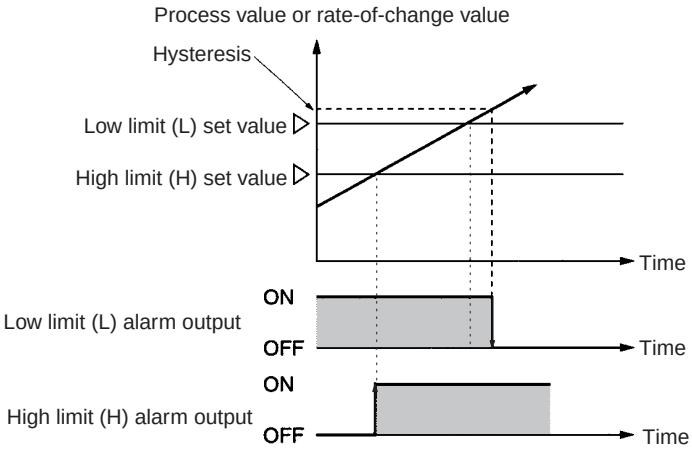
The alarm output operation is determined purely by the relative sizes of the input value (screening value) and alarm set value, as shown below.

HH and H Limit Alarms

When the input value is greater than the alarm set value, the alarm output is turned ON.

LL and L Limit Alarms

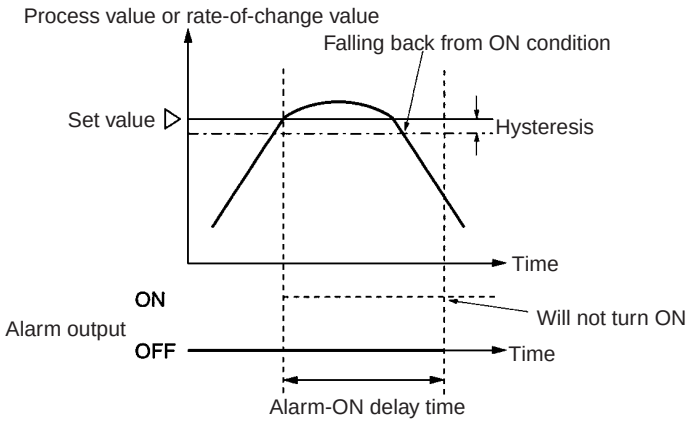
When the input value is less than the alarm set value, the alarm output is turned ON.



Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit.

Alarm Output Operation when Falling Back from Alarm Condition Before Alarm-ON Delay Time Elapses

If inputs fall back from the alarm-ON condition (including hysteresis) before the alarm-ON delay time has elapsed, the alarm output will not turn ON.



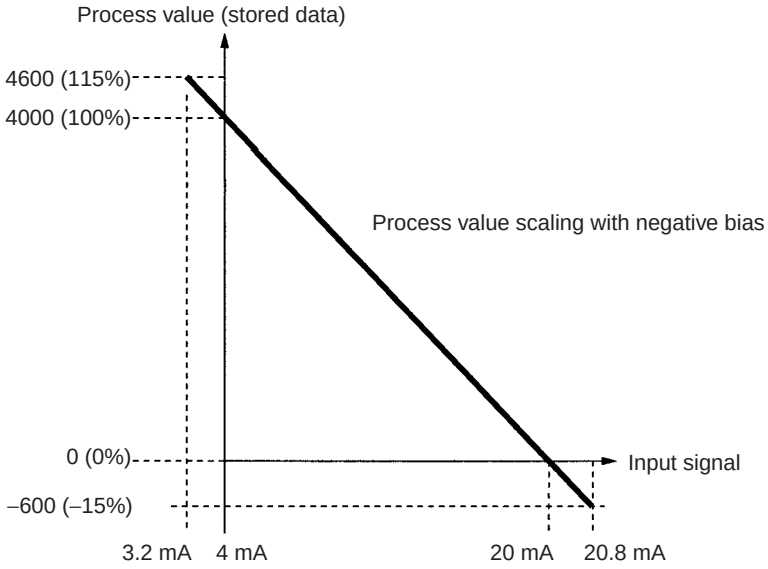
Applicable Units: CS1WPTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit.

Setting Process Value Scaling with Negative Bias

With process value scaling in industrial units, a negative bias can be set by reversing the maximum and minimum values in the range.

Example: CS1W-PDC01 Isolated-type Analog Input Unit

The following values can be set for an input signal of 4 to 20 mA: Maximum process value in range = 0, minimum process value in range = 4000.



Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit.

Alarm Operation during Process Value Scaling with Negative Bias

During process value scaling with negative bias, the alarm operates on the process value after scaling, and not on the input signal. Consequently, the operation is the same as for normal bias, as shown below.

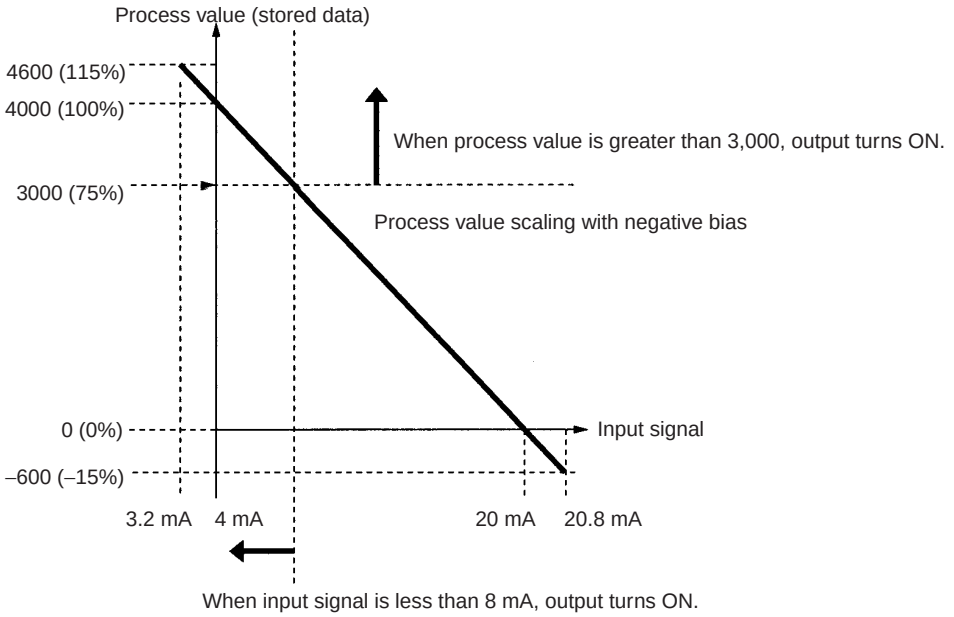
HH and H Limit Alarms

When the input value is greater than the alarm set value, the alarm output is turned ON.

LL and L Limit Alarms

When the input value is less than the alarm set value, the alarm output is turned ON.

Example: If the maximum process value in the range is 0 and minimum process value in the range is 4,000 for an input signal of 4 to 20 mA, and if the H (high limit) alarm set value is 3,000, the alarm output will turn ON when the process value is greater than 3,000 (when the input signal is less than 8 mA).



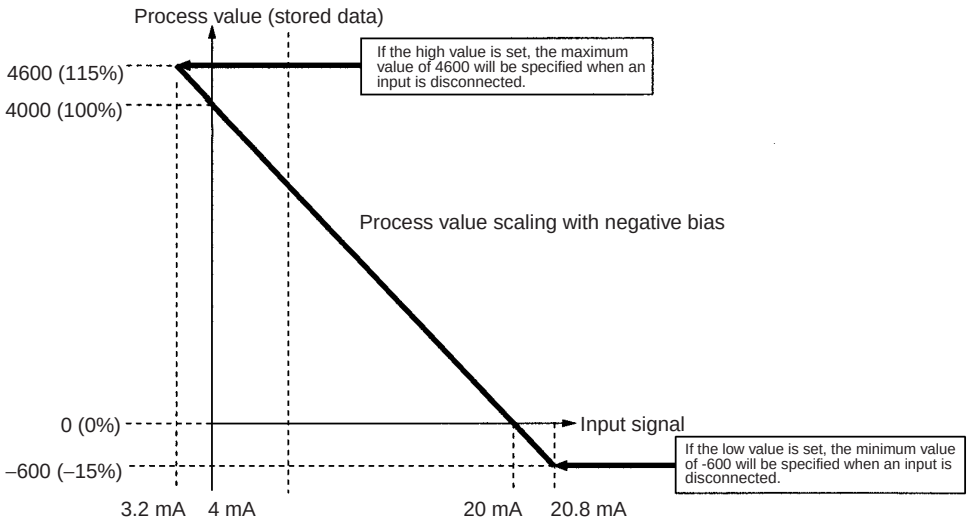
Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit, CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit, CS1W-PPS01 Isolated-type Pulse Input Unit, CS1W-PTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit.

Maximum/Minimum Value for when Input Disconnection Occurs during Process Value Scaling with Negative Bias

If an input is disconnected during process value scaling with negative bias, either the maximum or minimum process value will be specified.

If the process value overrange direction is high, the maximum process value will be specified.

If the process value overrange direction is low, the minimum process value will be specified.



Applicable Units: CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, CS1W-PTS02/PTS03 Isolated-type Resistance Thermometer Input Unit.

Output Hold when CPU Unit Error Occurs

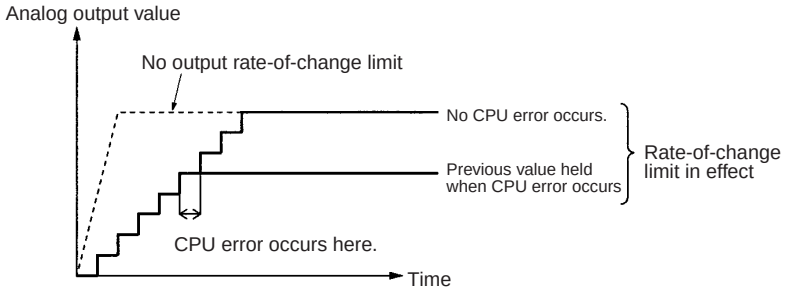
In the following cases, the CS1W-PMV01/PMV02 Isolated-type Analog Output Unit will hold either a specified preset value or the analog output value prior to the error for output when the CPU Unit is restored to normal operation.

- A fatal error (including user-defined FALS execution) occurs
- A CPU error occurs
- A load break occurs

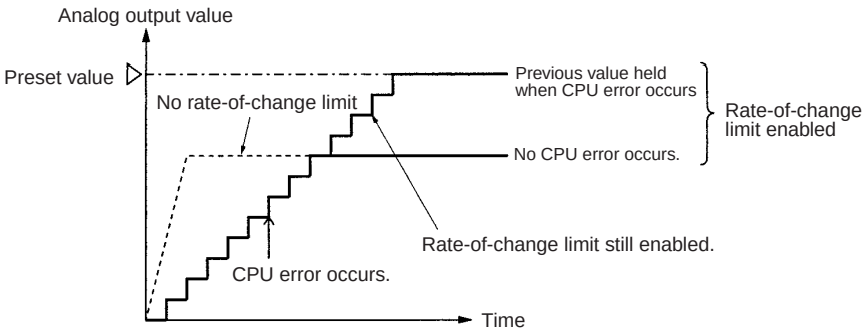
When the CPU Unit is restored to normal operation, the output value in the CIO Area will be output.

Note If a CPU error occurs while the output rate-of-change limit function is operating, the output hold function will operate as follows:

- If previous value hold has been specified, then the value prior to the CPU error will be held for output.



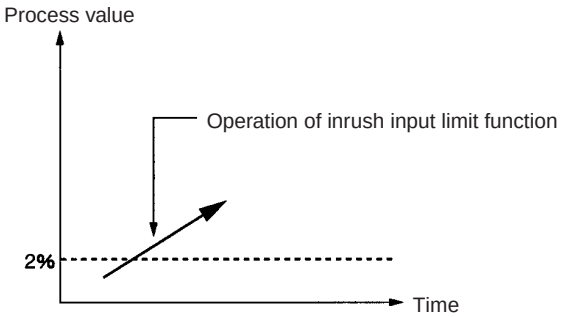
- When preset value hold has been specified, the output rate-of-change limit will remain in effect even during the change to the preset value, and the rate of change will be limited.



Applicable Unit: CS1W-PMV01/PMV02 Isolated-type Analog Output Unit.

Inrush Input Limit Function

The inrush input limit function will not operate if the process value is already greater than 2% when the power supply to the PC is turned ON. The inrush input limit function will operate only when the process value rises above 2% from less than 2% at startup.



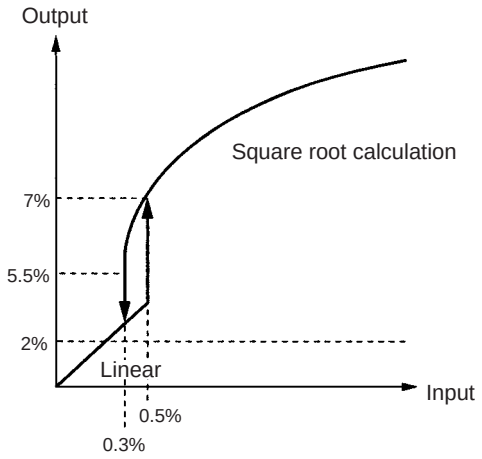
Applicable Units: CS1WPTR01 Power Transducer Input Unit, CS1W-PTR02 Analog Input Unit

Hysteresis during Square Root Calculations

During square root calculations, outputs of approximately 7% or less have linear characteristics (i.e., output = input). Hysteresis exists, however, when switching between square root characteristics and linear characteristics, as shown below.

During input rise: Switching from linear characteristics to square root characteristics at 0.5% input (output of approximately 7%).

During input fall: Switching from square root characteristics to linear characteristics at 0.3% input (output of approximately 5.5%).



Applicable Units: CS1W-PTW01 Isolated-type 2-Wire Transmitter Input Unit, CS1W-PDC01 Isolated-type Analog Input Unit

Appendix B

Zero/Span Adjustment Example

The Analog I/O Unit's zero/span adjustment can be performed as described below using a calibration device.

1,2,3... 1. Connect the Programming Device to the CPU Unit.

2. Connect a suitable calibration device as shown in the following table to the Analog I/O Unit.

Name	Model	Calibration device
Isolated-type Thermocouple Input Unit	CS1W-PTS01-V1	Voltage and current generator
Isolated-type Resistance Thermocouple Input Unit	CS1W-PTS02	Variable resistor
Isolated-type Resistance Thermocouple Input Unit (Ni508.4 W)	CS1W-PTS03	Variable resistor
Isolated-type 2-Wire Transmitter Input Unit	CS1W-PTW01	Voltage and current generator
Isolated-type Analog Input Unit	CS1W-PDC01	Voltage and current generator
Analog Input Unit (100 mV)	CS1W-PTR02	Voltage generator
Power Transducer Input Unit	CS1W-PTR01	Voltage generator
Isolated-type Pulse Input Unit	CS1W-PPS01	Pulse generator
Isolated-type Analog Output Unit	CS1W-PMV01	Voltage and current meter
Isolated-type Analog Output Unit	CS1W-PMV02	Voltage meter

3.Turn ON the power to the PC, and wait approximately 10 minutes for the Unit to warm up.

4.Make the adjustments.

Input Units

1,2,3... 1. Input a signal equivalent to 0% from the calibration device, and check the process value in the CPU Unit's CIO Area using the Programming Device. If the value is abnormal, change the zero adjustment value in the DM Area, and adjust the offset (parallel movement) value.

2. Input a signal equivalent to 100% from the calibration device, and check the process value in the CPU Unit's CIO Area using the Programming Device. If the value is abnormal, change the span adjustment gain value in the DM Area, and adjust the gain (bias).

Note For the CS1W-PTS01-V1 Isolated-type Thermocouple Input Unit, short between the terminals of the cold junction sensor on the top of the Isolated-type Thermocouple Input Unit. This will stop the Isolated-type Thermocouple Input Unit to discontinue cold junction compensation. Then input a standard thermocouple value of 0°C (standard thermal power generation value, IEC60584-1) to the calibration mV signal.

Output Units

1,2,3... 1. Set an analog output value equivalent to 0% in the CPU Unit's CIO Area. Check the signal using the calibration device. If the value is abnormal, change the zero adjustment value in the DM Area, and adjust the offset (parallel movement) value.

2. Set an analog output value equivalent to 100% in the CPU Unit's CIO Area. Check the signal using the calibration device. If the value is abnormal, change the span adjustment gain value in the DM Area, and adjust the gain (bias).

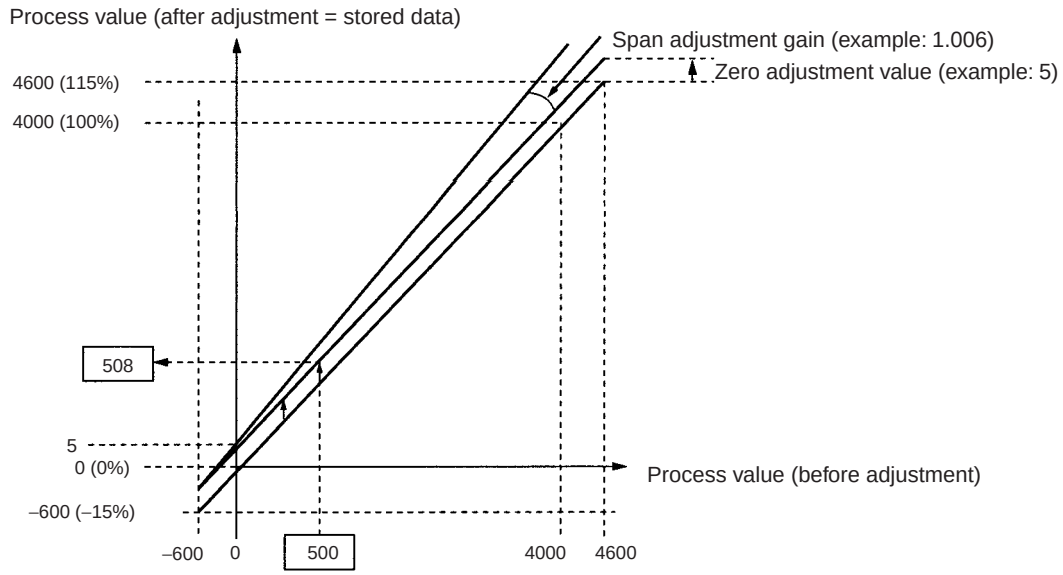
Adjust the zero/span according to the following equation.

Process value after adjustment = (input value – minimum process value in range) x DM Area span adjustment gain value + minimum process value in range + DM Area zero adjustment value

Example: Minimum process value in range = 0; maximum process value in range = 4,000; span adjustment gain = 10060 x 0.0001 = 1.0060; zero adjustment value = 5

If the input value is 500, the process value after adjustment will be as follows:

Process value after adjustment = (500 – 0) x 1.0060 + 0 + 5 = 508.



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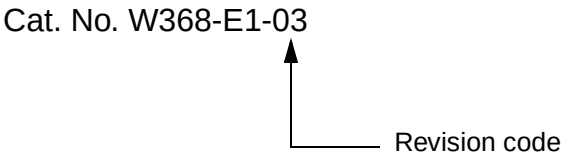
Revision History

A manual revision code appears as a suffix to the catalog number on the front cover of the manual.



The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	April 2000	Original production
02	January 2002	“CS1 Series” was changed to “CS Series” and “-V1” was added to the model number CS1W-PTS01 throughout the manual. In addition, the following changes were made. **Page 39:** Changes made to diagram and notes 1 and 2, and another note added. **Page 40:** Terminal numbers changed **Page 128:** Changes made to equations in 3 places.
03	May 2002	Information on the CS1W-PMV02 Isolated-type Analog Output Unit was added throughout the manual.

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