User's Manual

Model LL1200 PC-based Custom Computation Building Tool User's Reference

IM 5G1A11-02E

YOKOGAWA
Yokogawa Electric Corporation

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3rd Edition

Introduction

This instruction manual describes the computation modules, registers and other devices that are necessary when customizing the built-in computations and/or display functions using the LL1200 PC-based Custom Computation Building Tool (hereinafter simply referred to as the LL1200). Refer to this manual to familiarize yourself with the functions available in this tool or when you are not sure about the function of a particular module.
For details on the startup and operation of the LL1200, see the *Model LL1200 PC-based Custom Computation Building Tool* instruction manual (IM 5G1A11-01E).

■ Intended Readers

This manual is intended for people familiar with the functions of the US1000 Digital Indicating controller and capable of working with Windows 95 or Windows NT 4.0, such as instrumentation and control engineers and personnel in charge of maintaining instrumentation and control equipment.

■ Related Documents

The following instruction manuals all relate to the LL1200. Read them as necessary. The codes enclosed in parentheses are the document numbers.

- *US1000 Digital Indicating Controller–Operation* (IM 5D1A01-01E)
  Explains the basic operation of the US1000 controller.
  Supplied with the US1000 Digital Indicating Controller.
- *US1000 Digital Indicating Controller–Functions* (IM 5D1A01-02E)
  Explains the functions of the US1000 controller in detail.
  Supplied with the US1000 Digital Indicating Controller.
- *US1000 Digital Indicating Controller–Communication Functions* (IM 5D1A01-10E)
  An instruction manual for the communication function of the US1000 controller. Supplied with models having the optional communication function.
- *LL1100 PC-based Parameters Setting Tool* (IM 5G1A01-01E)
  An instruction manual for setting the parameters of the US1000 controller from a personal computer. Supplied with the LL1100 PC-Based Parameters Setting Tool.
- *LL1200 PC-based Custom Computation Building Tool* (IM 5G1A11-01E)
  An instruction manual for creating US1000 custom computations. The manual also presents some examples of custom computations. Note that this tool includes the entire functionality of the LL1100 PC-based Parameters Setting Tool. Supplied with the LL1200 PC-Based Custom Computation Building Tool.

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3rd Edition: Jun. 2004 (YK)

Documentation Conventions

■ Symbols

The following symbols are used in this manual.

●Symbols Used in the Main Text

NOTE

Draws attention to information that is essential for understanding the operation and/or features of the product.

TIP

Gives additional information to complement the present topic and/or describe terms specific to this document.

See Also

Gives reference locations for further information on the topic.

●Symbols Used in Figures and Tables

[NOTE]

Draws attention to information that is essential for understanding the features of the product.

[TIP]

Gives additional information to complement the present topic.

[See Also]

Gives reference locations for further information on the topic.

■ Description of Displays

(1) Some of the representations of product displays shown in this manual may be exaggerated, simplified, or partially omitted for reasons of convenience when explaining them.

(2) Figures and illustrations representing the controller's displays may differ from the real displays in regard to the position and/or indicated characters (upper-case or lower-case, for example), to the extent that they do not impair a correct understanding of the functions and the proper operation and monitoring of the system.

Notices

■ Regarding This Instruction Manual

(1) This manual should be passed on to the end user. Keep at least one extra copy of the manual in a safe place.
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(3) This manual is intended to describe the functions of this product. Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa) does not guarantee that these functions are suited to the particular purpose of the user.
(4) Under absolutely no circumstance may the contents of this manual, in part or in whole, be transcribed or copied without permission.
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(2) The following safety symbols are used on the product and/or in this manual.

●Symbols Used on the Product and in This Manual

CAUTION

This symbol on the product indicates that the operator must refer to an explanation in the instruction manual in order to avoid the risk of injury or death of personnel or damage to the instrument. The manual describes how the operator should exercise special care to avoid electrical shock or other dangers that may result in injury or loss of life.

Protective Grounding Terminal

This symbol indicates that the terminal must be connected to ground prior to operating the equipment.

Functional Grounding Terminal

This symbol indicates that the terminal must be connected to ground prior to operating the equipment.

●Symbol Used in This Manual Only

WARNING

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

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Contents

1. Overview

First read the *LL1200 PC-based Custom Computation Building Tool* instruction manual to familiarize yourself with the basic operation of the LL1200 and examples of custom computations. Then, re-read this manual when you actually configure your own custom computations and display functions.

This manual explains the computation modules you will use when customizing the built-in computations of the LL1200 PC-based Custom Computation Building Tool. It also discusses the display functions you will use when configuring customized display functions. See the following summary for information on what each chapter discusses and for what purpose it is written.

■ Information and Purpose Covered by Each Chapter

●Chapter 2 Diagrams of US1000 Computing Blocks
Shows the diagrams of custom computing blocks that are built in the US1000 controller as standard blocks. See this chapter when you configure custom computations using the LL1200's sample files. A single look at these diagrams allows you to easily understand the custom computing blocks for controller modes (US modes) 1 to 15.

●Chapter 3 Types and Ranges of Computation Data
Lists the types and Ranges of signals coming in and going out of input and output blocks. See this chapter when configuring custom computations since you must confirm the types and Ranges of signals that apply to the blocks.

●Chapter 4 List of Computation Modules and Their Functions
Explains the functions of the computation modules in detail, along with the number of inputs and the data types assigned to each computation module. See this chapter when you want to know the functions of modules you will use when creating customized computations.

●Chapter 5 US1000 Data Storage Areas (D Registers and I Relays)
Explains the data items stored in the US1000 controller.
The data storage areas are linked to both the inputs of the computation modules and the outputs from the computation modules. They also contain process data, parameter data and flag data. See this chapter when creating customized computations.

●Chapter 6 Custom Display Functions
Lists custom display functions, along with an explanation of them. See this chapter when configuring functions.

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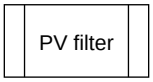
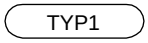
2. Diagrams of US1000 Computing Blocks

This chapter contains diagrams that explain the built-in custom computing blocks for the controller modes (US modes) included as standard on the US1000.
Refer to this chapter when configuring custom computations using the LL1200's sample files. You can readily understand the custom computing blocks for controller modes (US modes) 1 to 15, from a single look at their respective diagrams.

Figure 2.3 shows the US1000 control and computing section, focusing on signals that go in and out of the custom computing input and output blocks. This figure thus clarifies where the input and output blocks are positioned in the control and computing section.
Figures 2.4 to 2.16 are diagrams of the custom computing input and output blocks for each controller mode (US mode).

■ Explanation of Symbols and Numbers Used in the Block Diagram of US1000 Control and Computing Section (Figure 2.3)

Names and symbols used in the block diagram of the control and computing section (Figure 2.3) are as summarized below:

	This symbol represents a function and, in this example, means a PV filter.
	This symbol represents a parameter (setup or operation parameter) and, in this example, means "analog input 1 (TYP1)."
	This symbol represents a signal fed to or from a custom computing input or output block and, in this example, means a signal (AIN1) fed to an input block.
	This symbol represents a process data or a computation data, in this example, means “Process variable for loop1.”

See Also

The *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E) for the functional tag names and the parameters; and Chapter 3 of this document, “Types and Range of Computation Data,” for the custom computing I/O signals.

■ Explanation of Symbols and Numbers Used in the Block Diagram of US1000 Custom Computation Input and Output Block

●Diagram of an Input Block

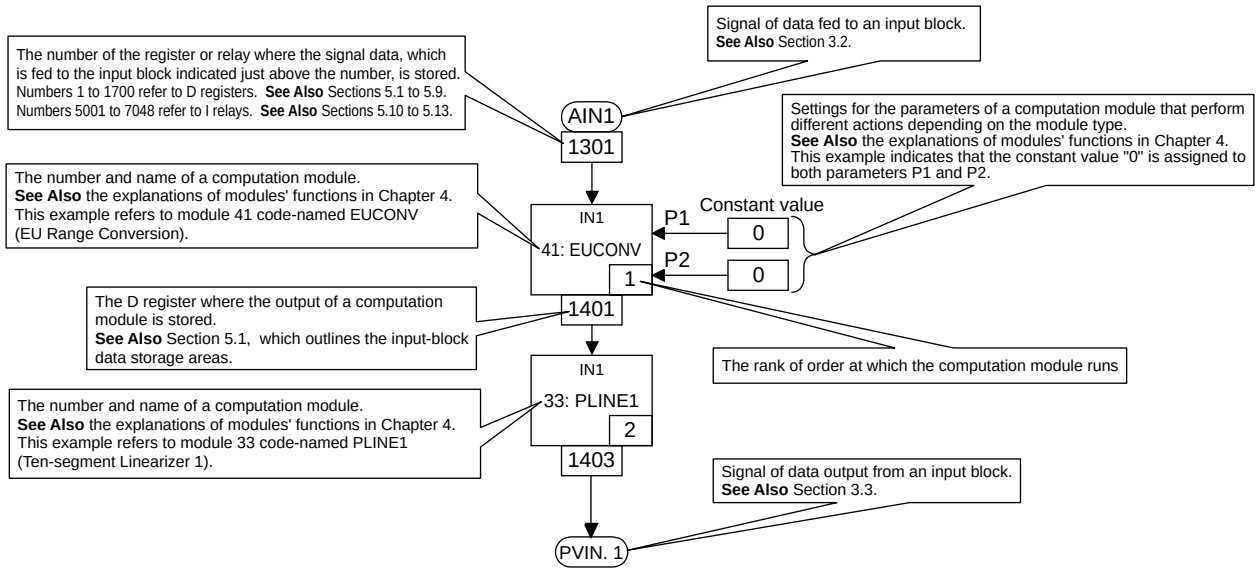


Figure 2.1 Illustrated Explanation of an Input Block

●Diagram of an Output Block

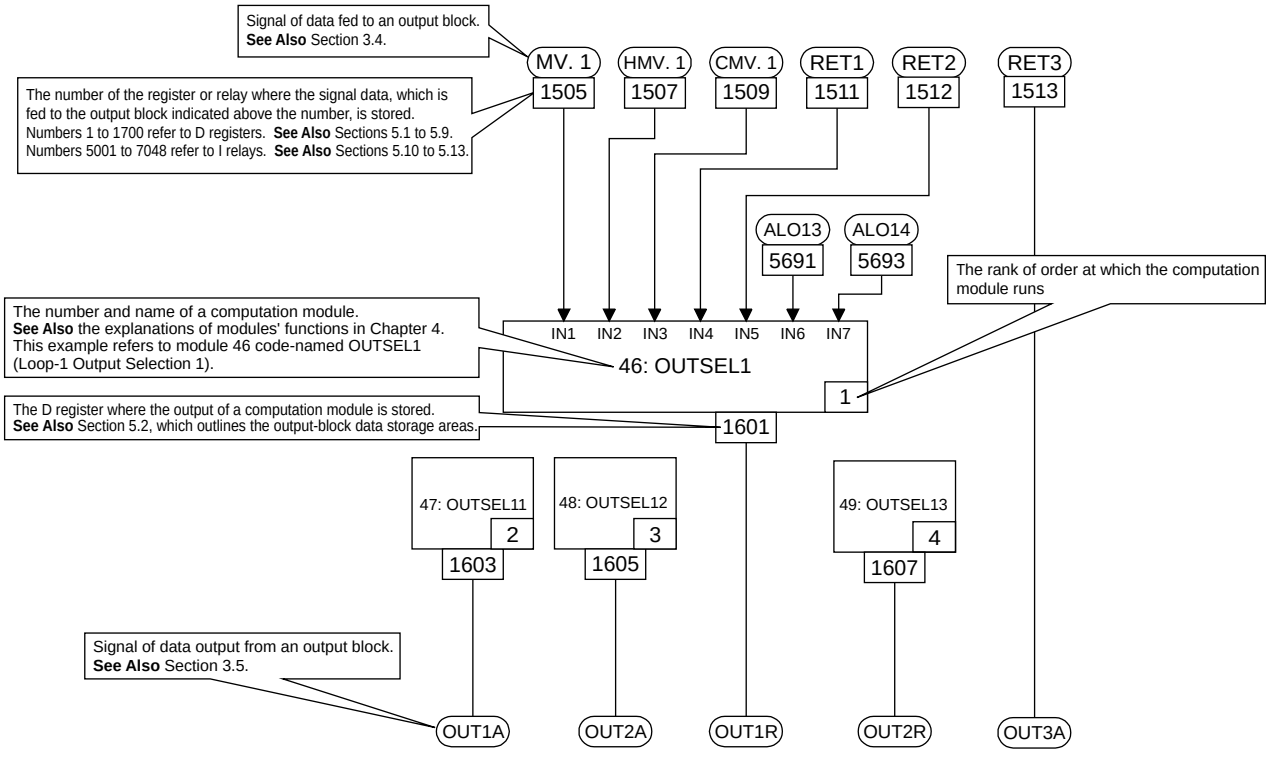
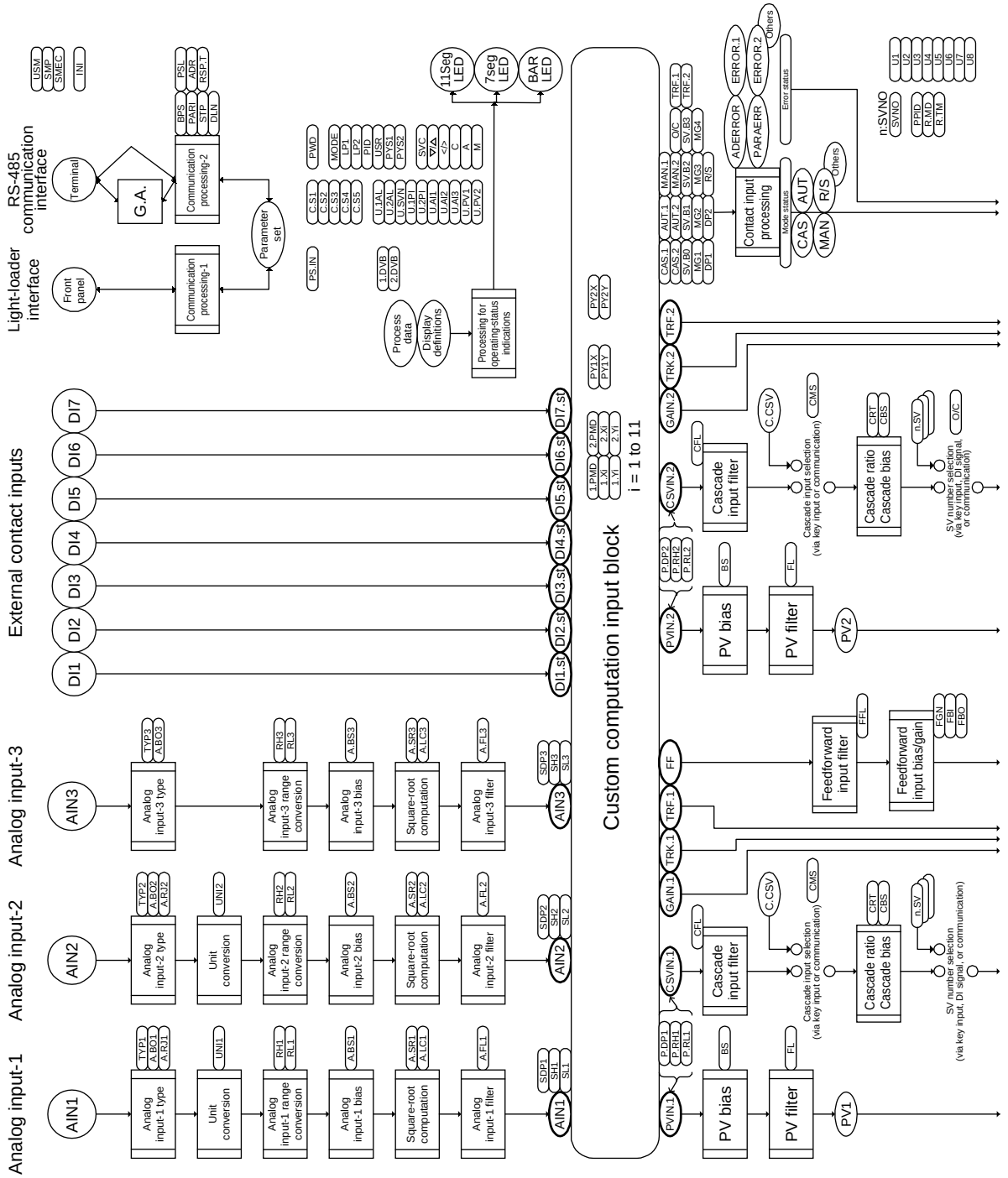


Figure 2.2 Illustrated Explanation of an Output Block

Figure 2.3 below shows a configuration diagram of the US1000 control and computing blocks.



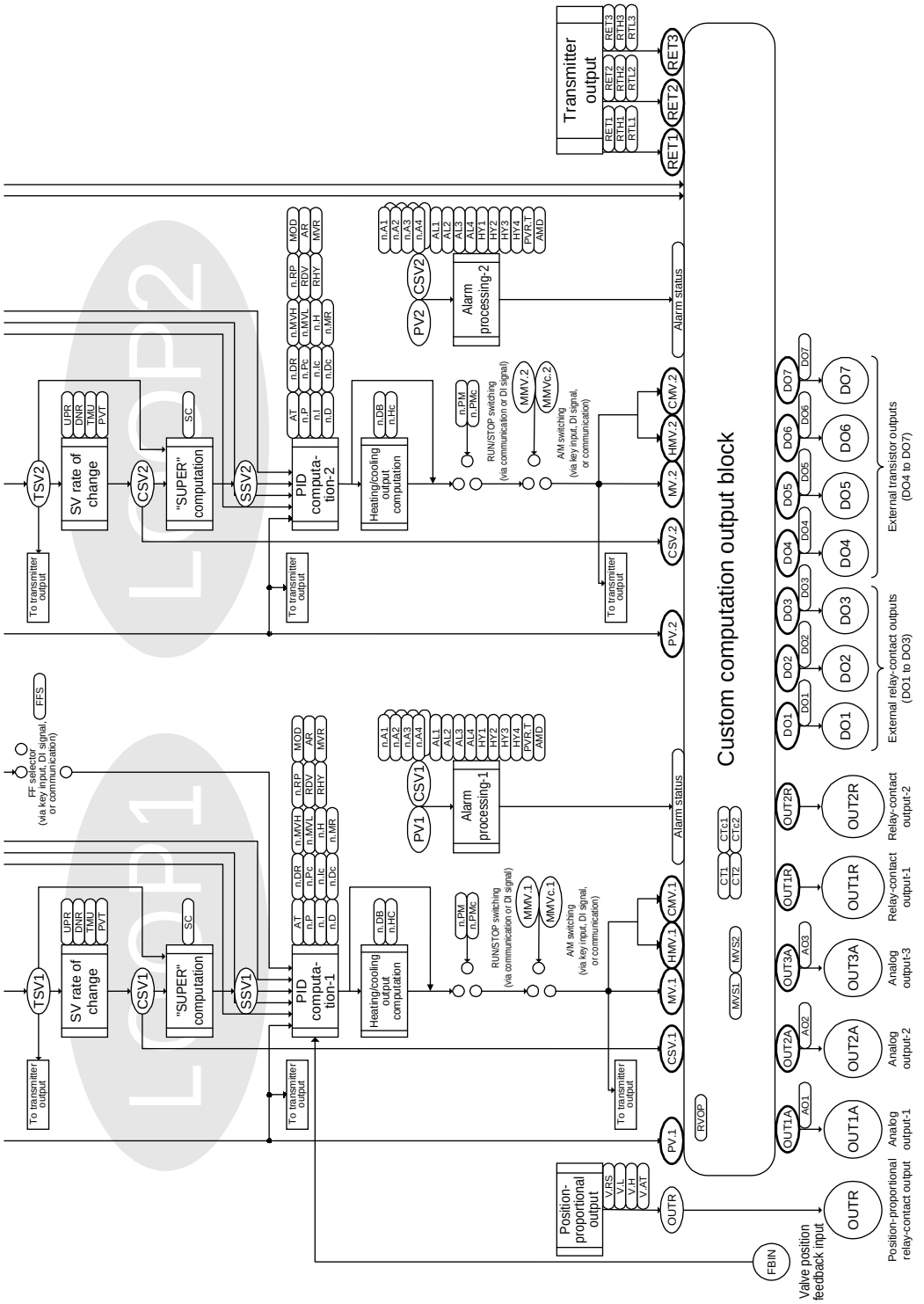


Figure 2.3 Block Diagram of US1000 Control and Computing Section

2.1 Diagram of Custom Computing blocks for Single-loop Control (US Mode 1)

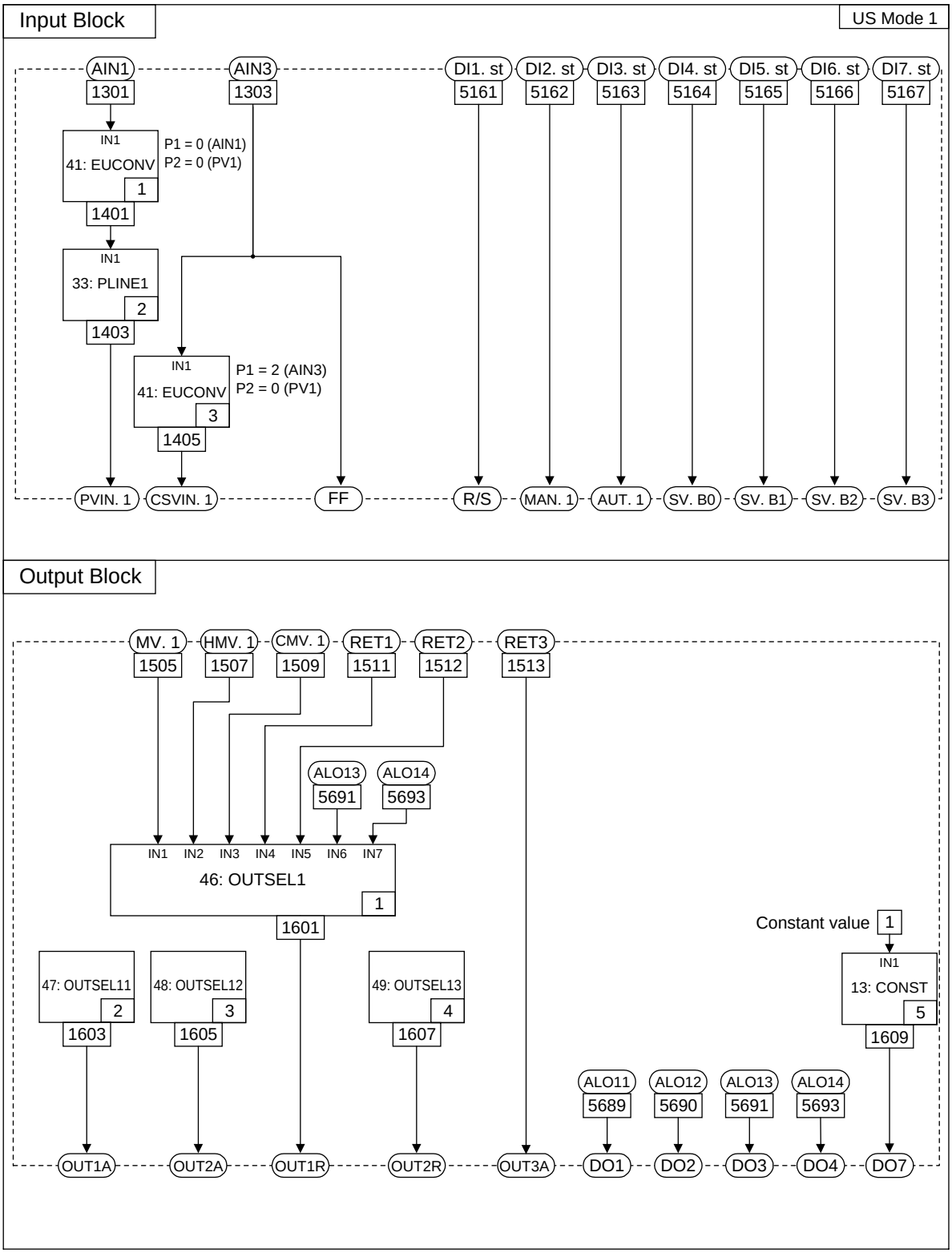


Figure 2.4 Diagram of Input and Output Block for Single-loop Control (US Mode 1)

2.2 Diagram of Custom Computing Blocks for Cascade Primary-loop Control (US Mode 2)

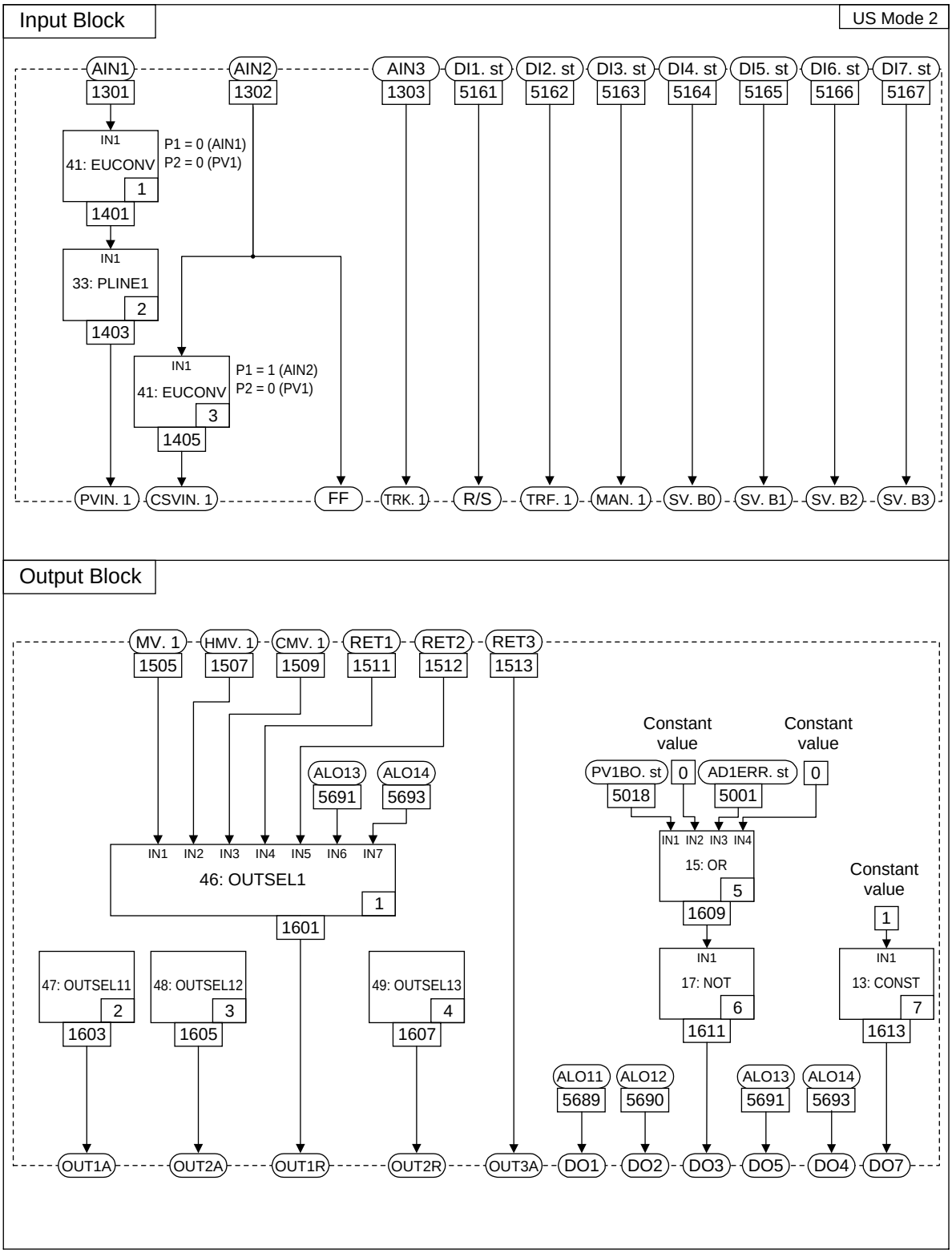


Figure 2.5 Diagram of Input and Output Block for Cascade Primary-loop Control (US Mode 2)

2.3 Diagram of Custom Computing Blocks for Cascade Secondary-loop Control (US Mode 3)

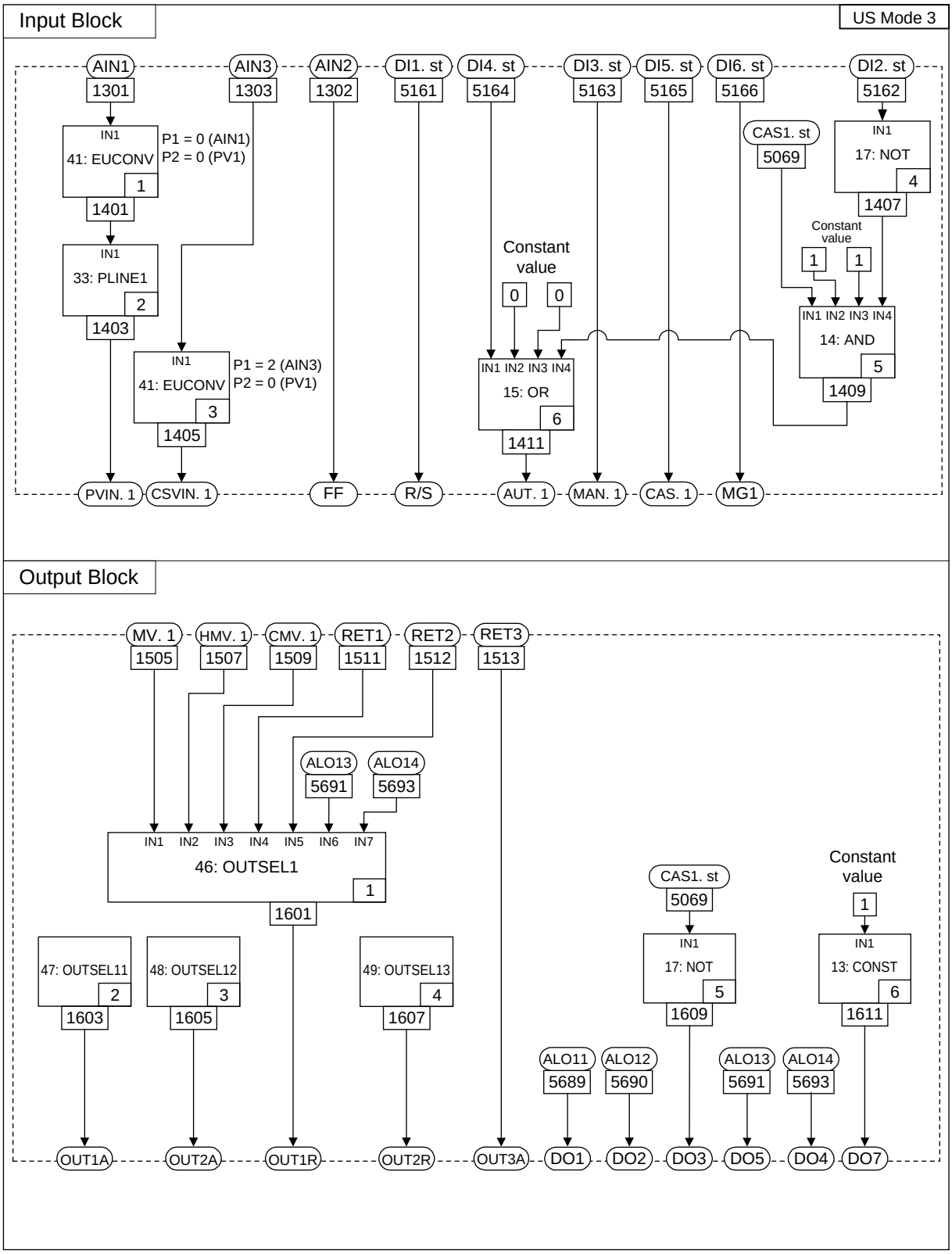


Figure 2.6 Diagram of Input and Output Block for Cascade Secondary-loop Control (US Mode 3)

2.4 Diagram of Custom Computing Blocks for Cascade Control (US Mode 4)

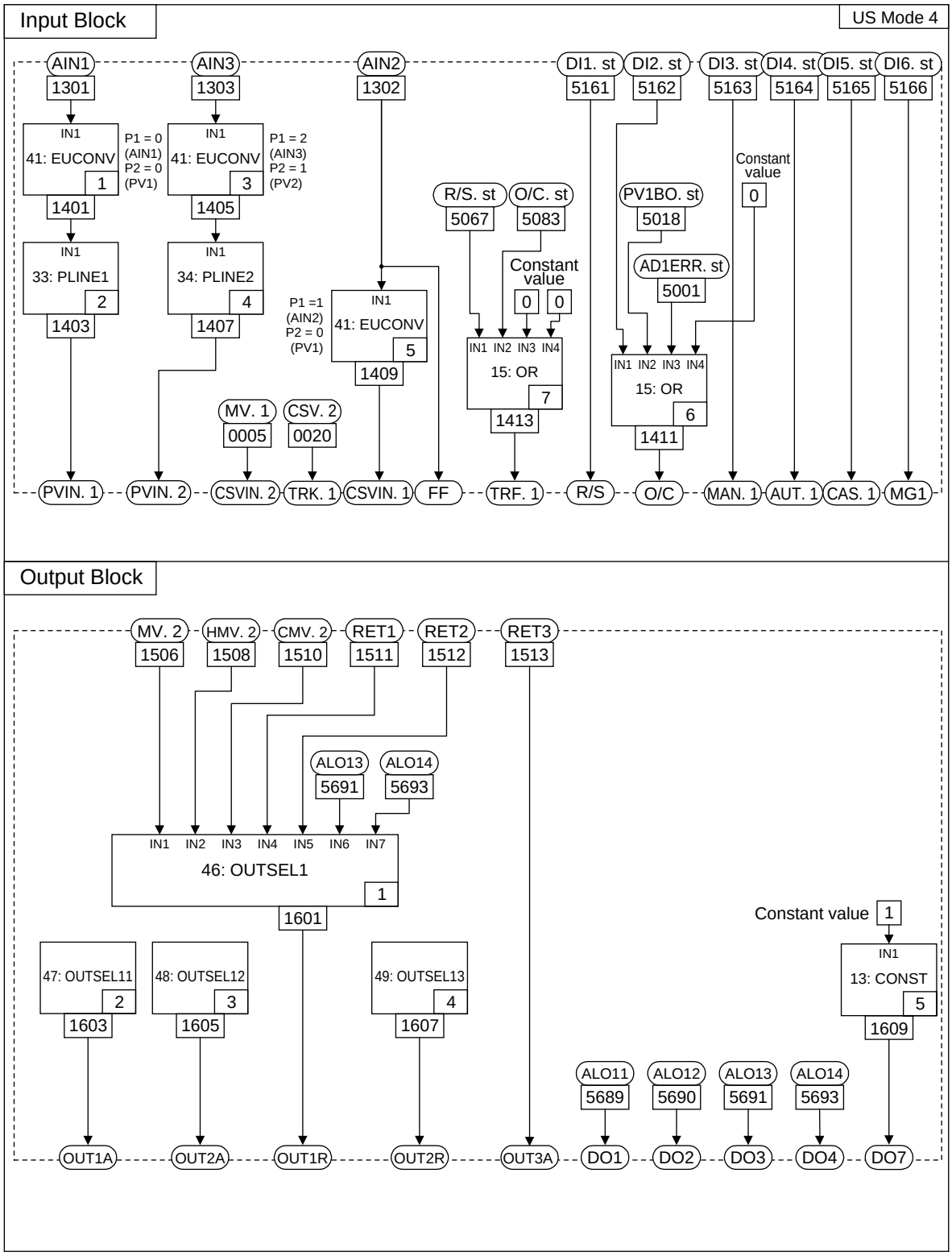


Figure 2.7 Diagram of Input and Output Block for Cascade Control (US Mode 4)

2.5 Diagram of Custom Computing Blocks for Loop Control for Backup (US Mode 5)

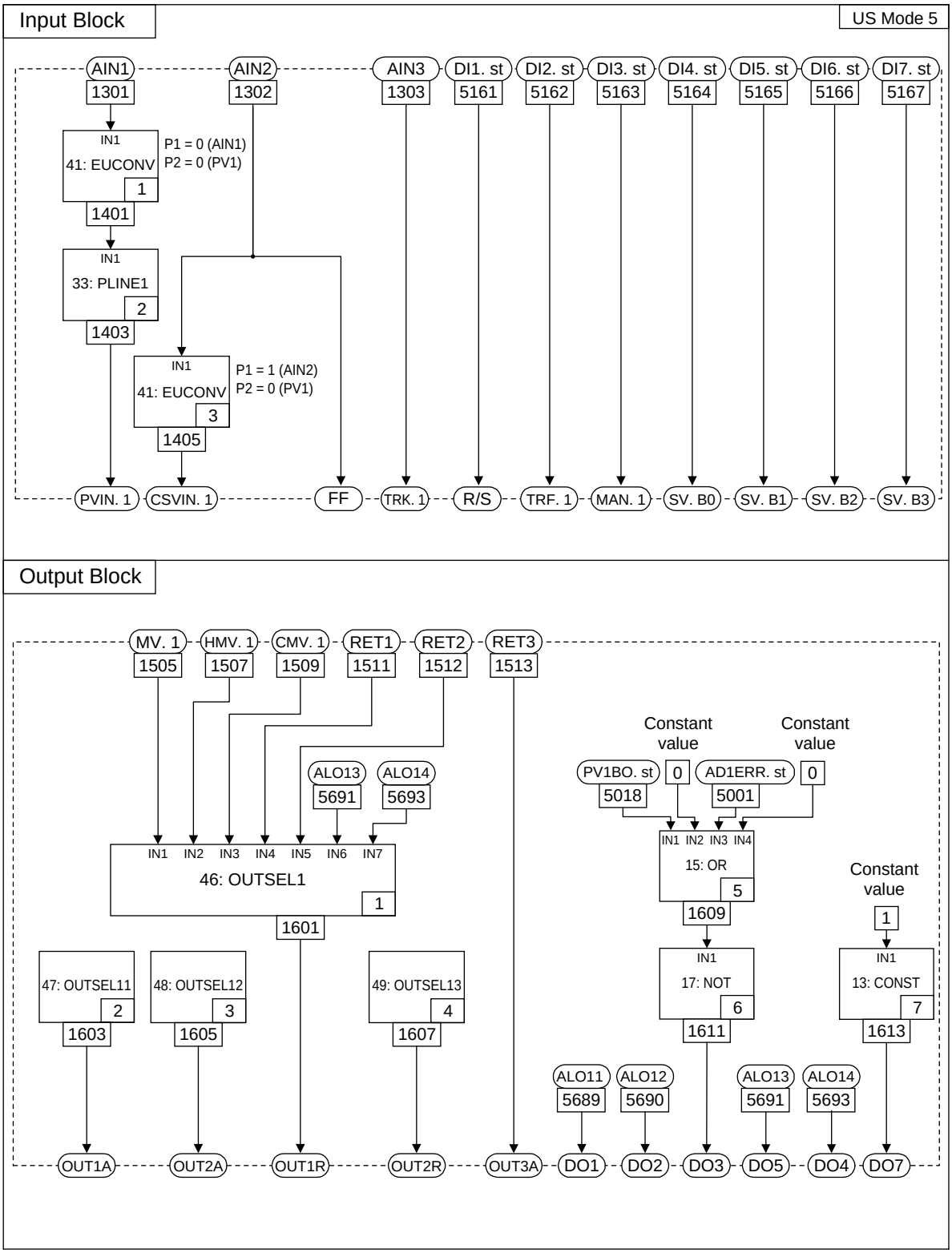


Figure 2.8 Diagram of Input and Output Block for Loop Control for Backup (US Mode 5)

2.6 Diagram of Custom Computing Blocks for Loop Control with PV Switching (US Mode 6)

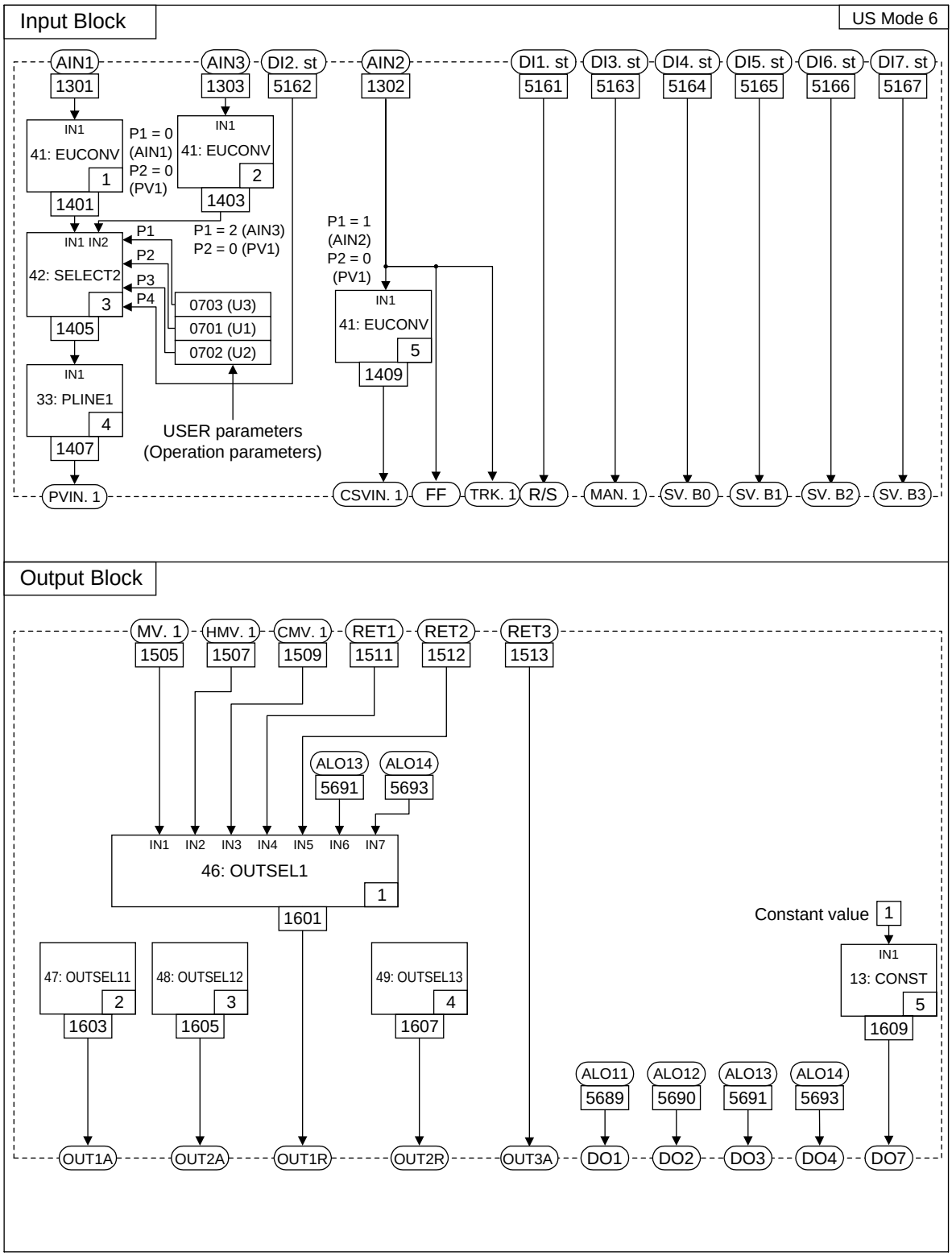


Figure 2.9 Diagram of Input and Output Block for Loop Control with PV Switching (US Mode 6)

2.7 Diagram of Custom Computing Blocks for Loop Control with PV Auto-selector (US Mode 7)

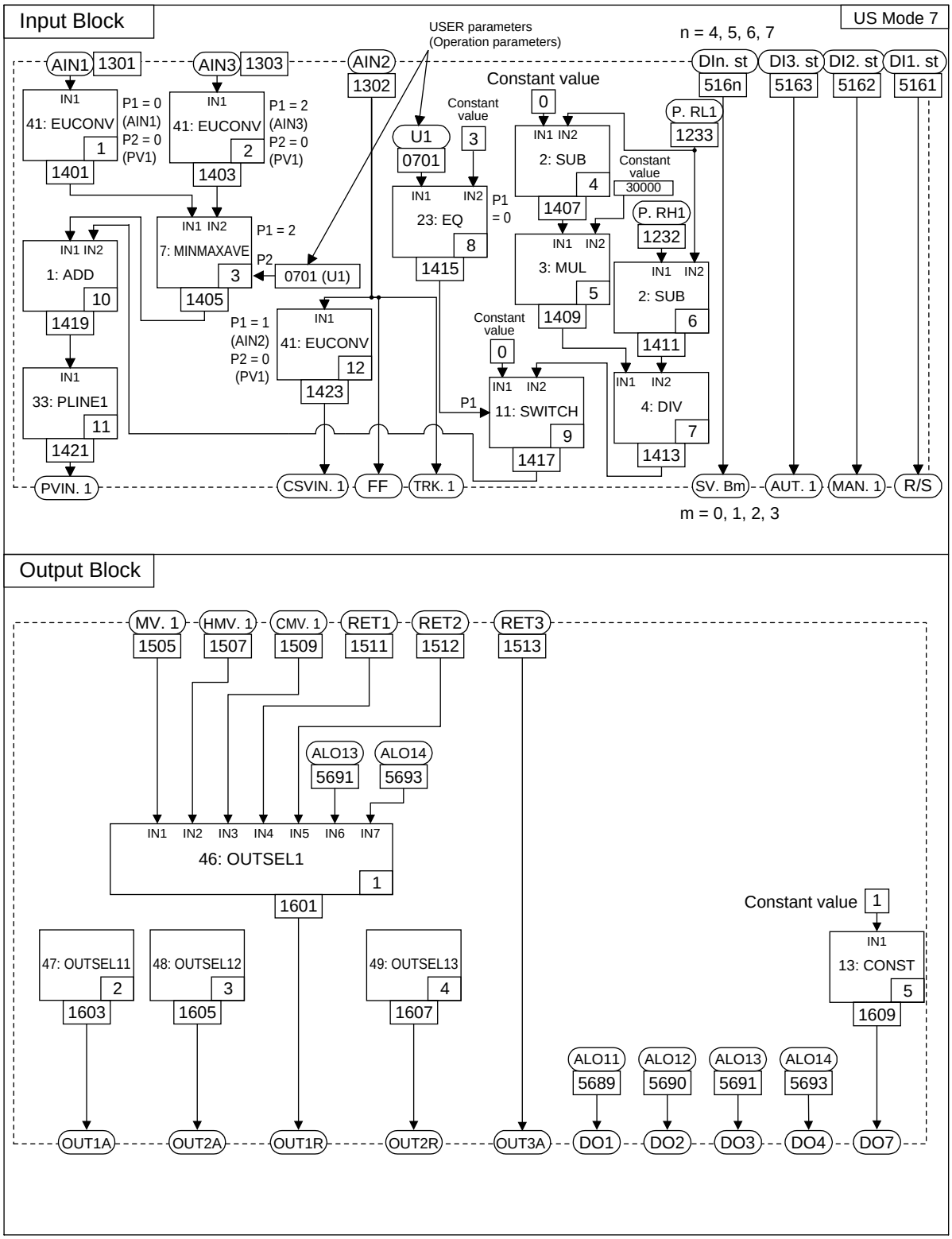


Figure 2.10 Diagram of Input and Output Block for Loop Control with PV Auto-selector (US Mode 7)

2.8 Diagram of Custom Computing Blocks for Loop Control with PV-hold Function (US Mode 8)

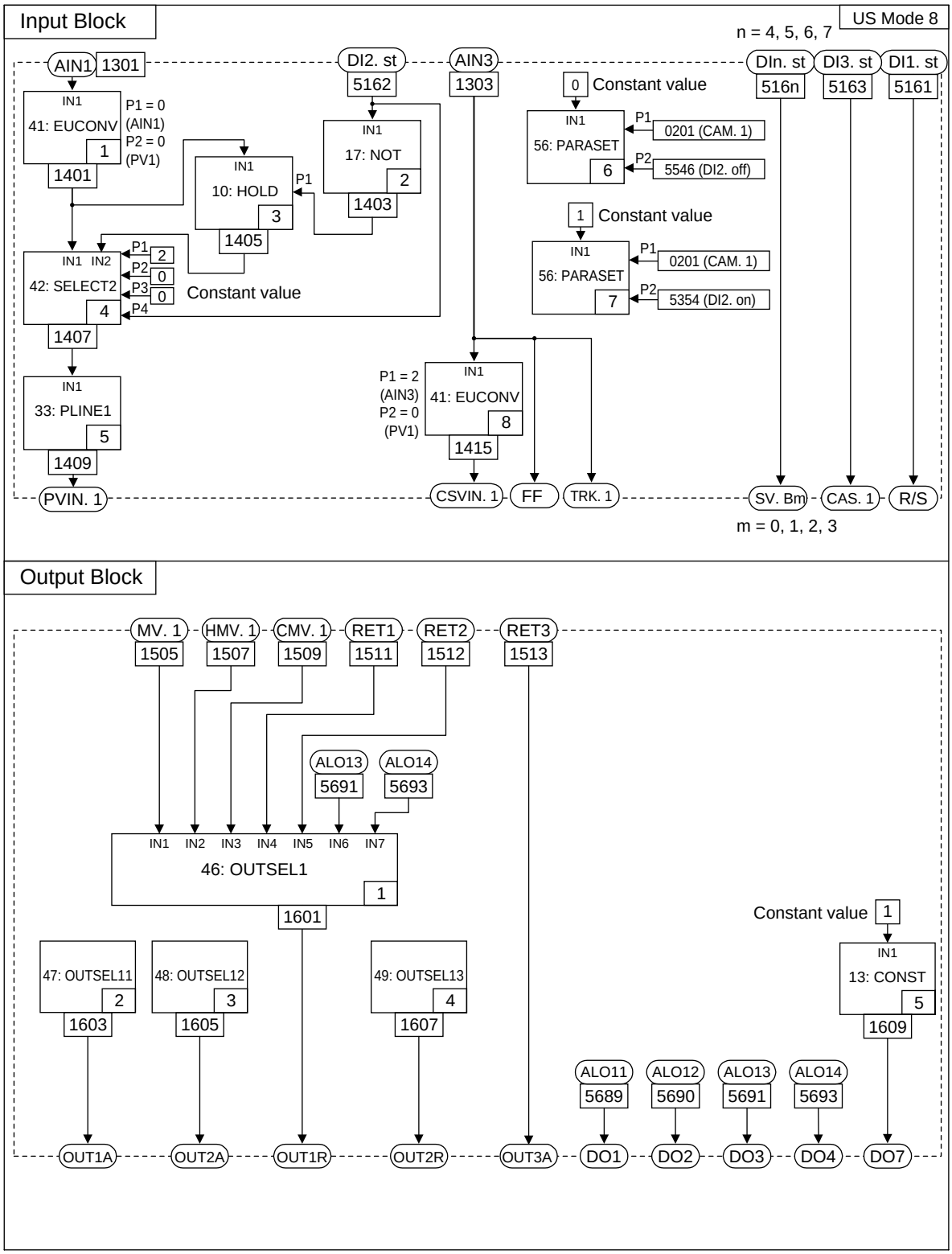


Figure 2.11 Diagram of Input and Output Block for Loop Control with PV-hold Function (US Mode 8)

2.9 Diagram of Custom Computing Blocks for Dual-loop Control (US Mode 11)

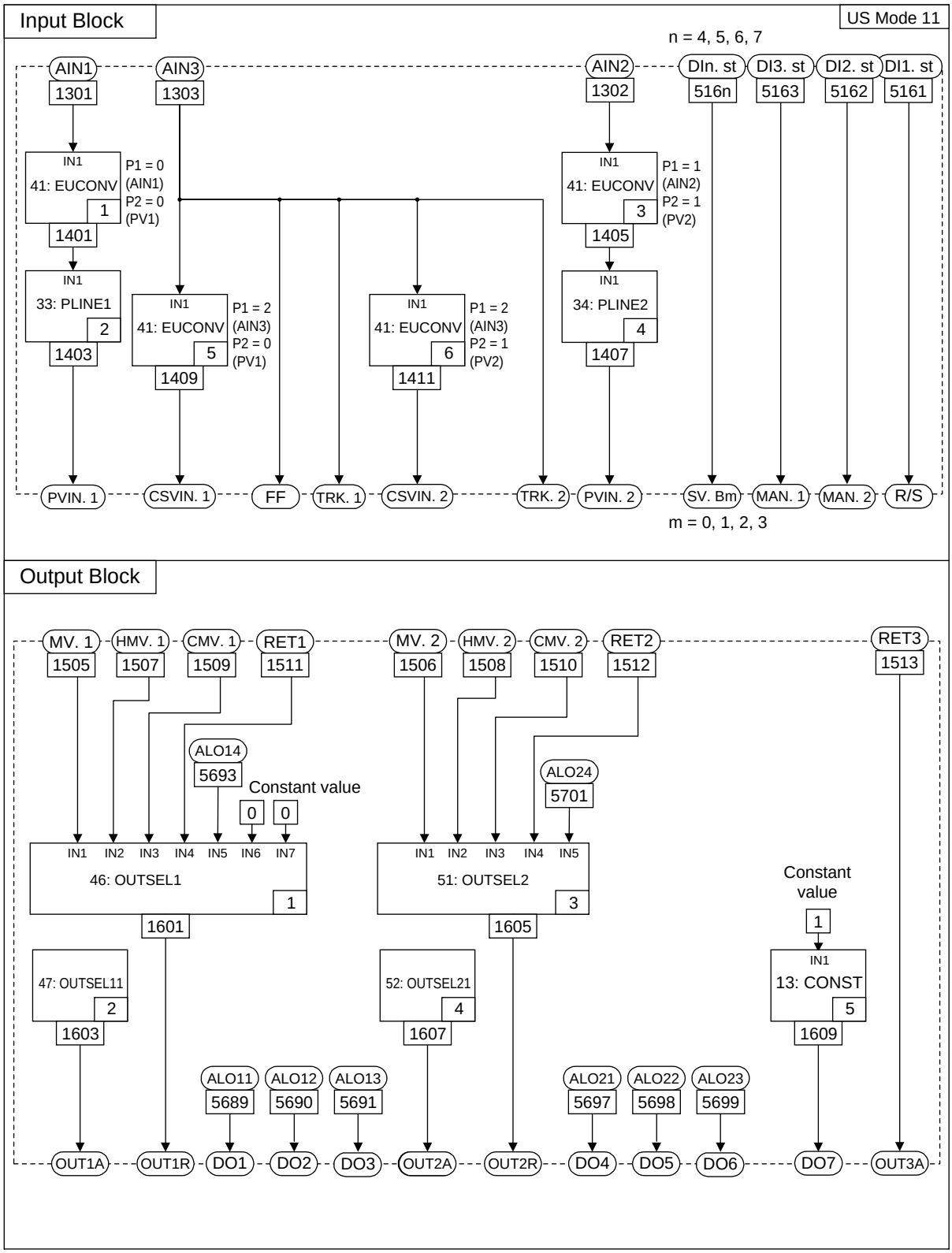


Figure 2.12 Diagram of Input and Output Block for Dual-loop Control (US Mode 11)

2.10 Diagram of Custom Computing Blocks for Temperature and Humidity Control (US Mode 12)

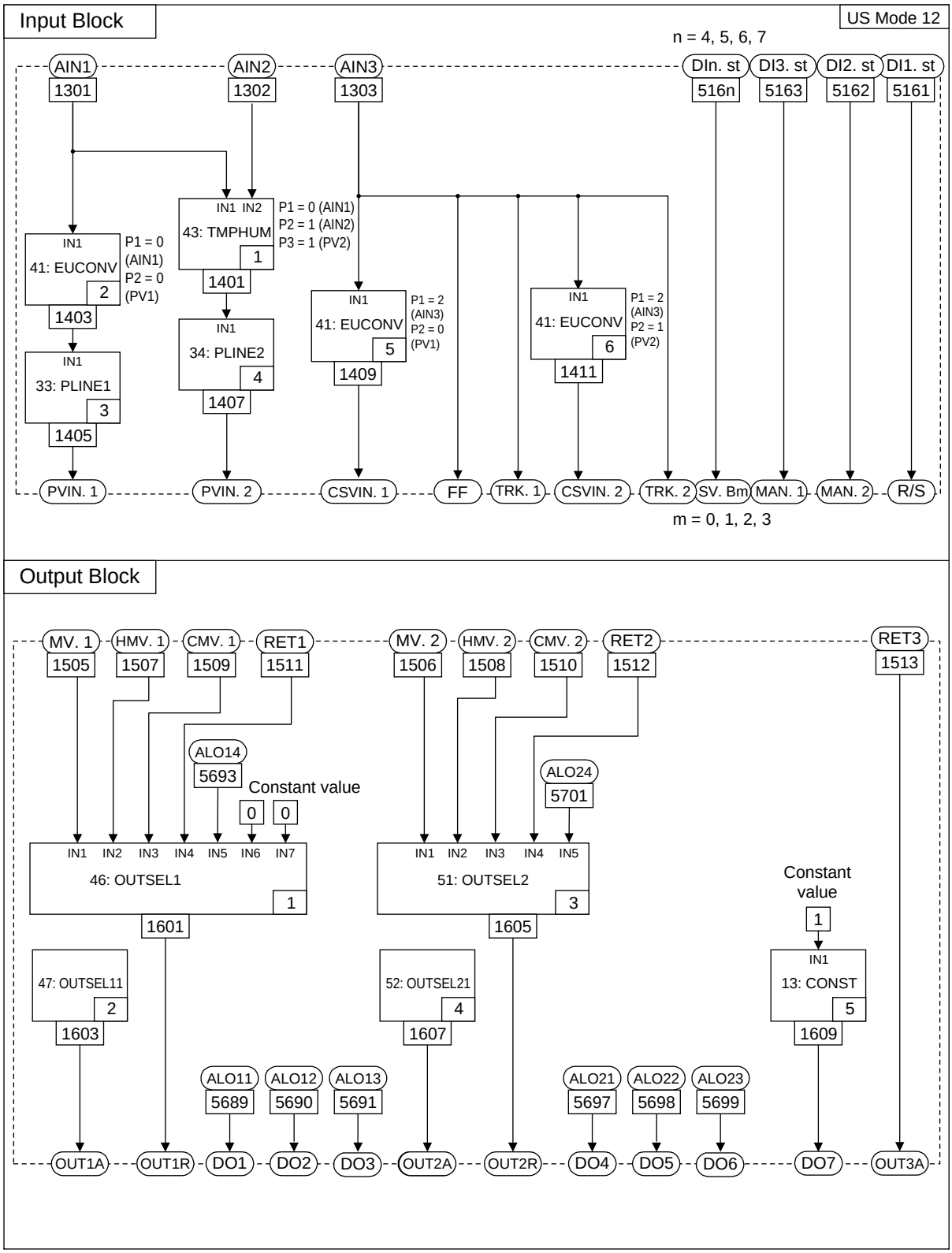


Figure 2.13 Diagram of Input and Output Block for Temperature and Humidity Control (US Mode 12)

2.11 Diagram of Custom Computing Blocks for Cascade Control with Two Universal Inputs (US Mode 13)

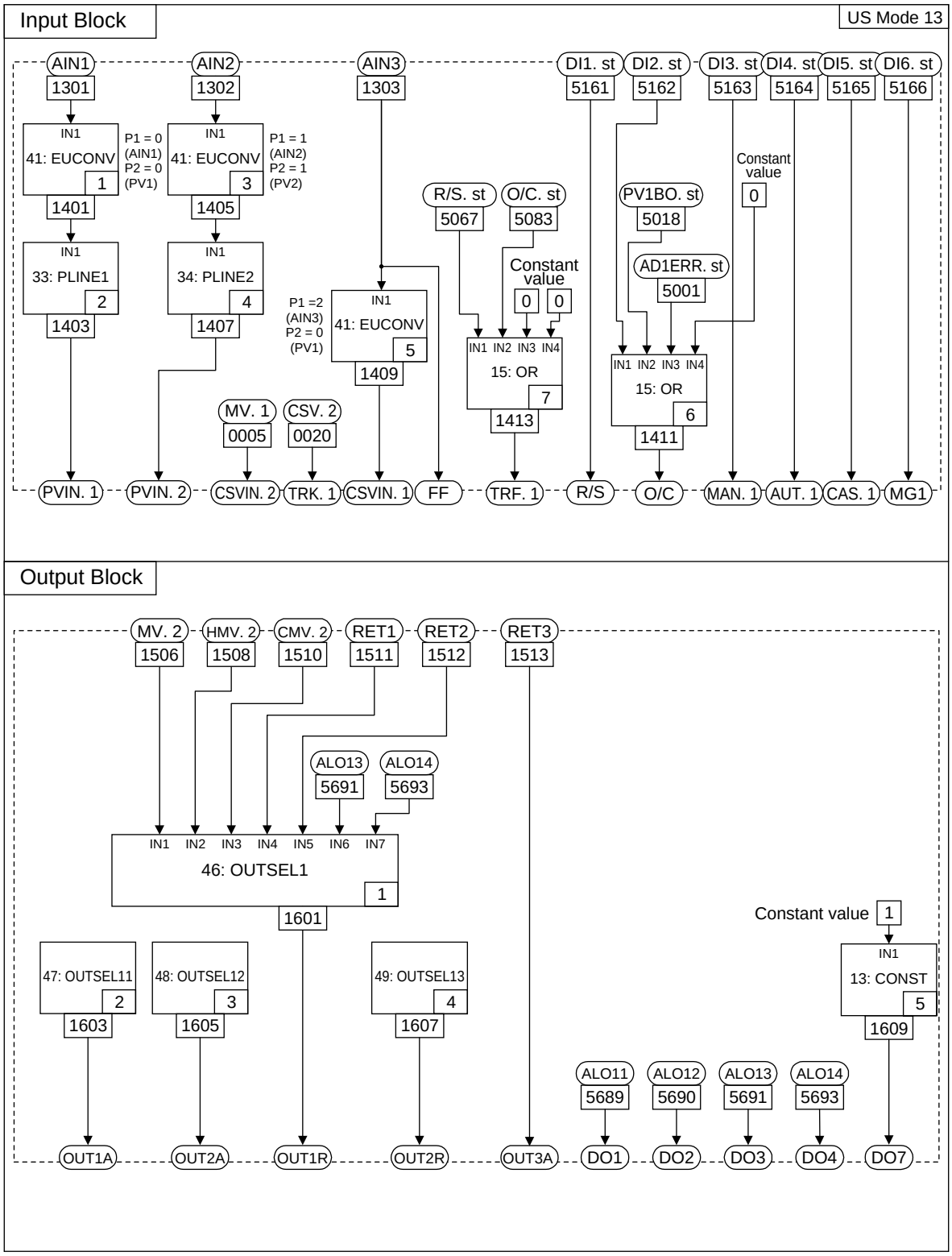


Figure 2.14 Diagram of Input and Output Block for Cascade Control with Two Universal Inputs (US Mode 13)

2.12 Diagram of Custom Computing Blocks for Loop Control with PV Switching and Two Universal Inputs (US Mode 14)

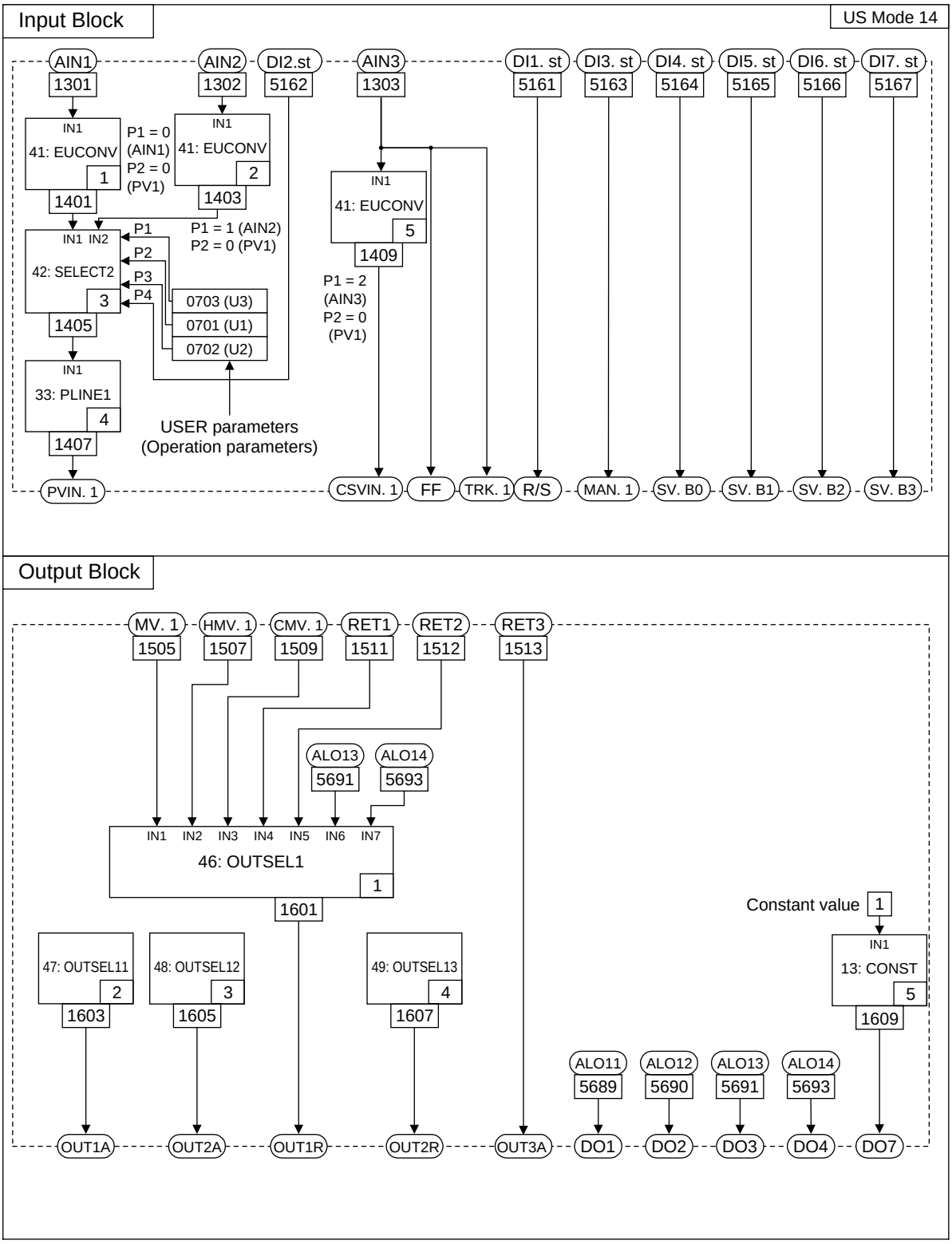


Figure 2.15 Diagram of Input and Output Block for Loop Control with PV Switching and Two Universal Inputs (US Mode 14)

2.13 Diagram of Custom Computing Blocks for Loop Control with PV Auto-selector and Two Universal Inputs (US Mode 15)

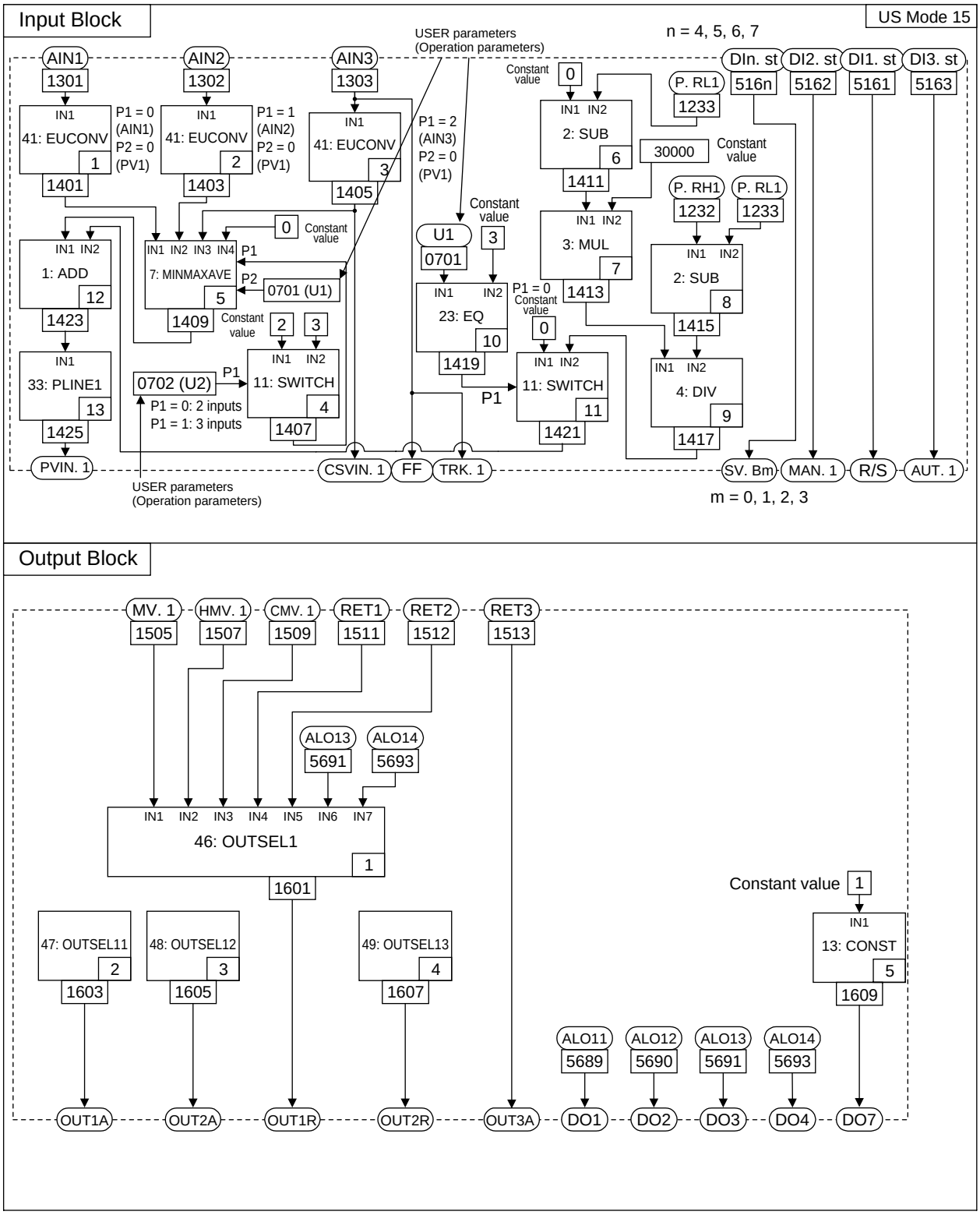


Figure 2.16 Diagram of Input and Output Block for Loop Control with PV Auto-selector and Two Universal Inputs (US Mode 15)

3. Types and Ranges of Computation Data

This chapter explains the types of computation data used in the input and output blocks, and their Ranges.
When you configure custom computations, you must make sure they comply with the specified types of computation data, such as range data, scale data and percentage-type data, which are fed to/from the input and output blocks.
This chapter also describes the ranges of “monitor data” that are read when you monitor any custom computation.

Figure 3.1 below shows an example of data flow where data taken in through analog input 1 (AIN1) is fed first to the EU Range Conversion (EUCONV) module and then the Ten-segment Linearizer 1 (PLINE1) module, for computation. The resulting data is then passed to the PVIN.1 signal of the loop-1 control and computing section.

If the AIN1 analog input is a thermocouple (TC) input or a resistance temperature detector (RTD) input, the input data has a value ranging from the minimum value of the analog input-1 range (RL) to the maximum value of the analog input-1 range (RH). The result is a value ranging from 0 to 30000 for internal computation. If AIN1 is a voltage input, the input data has a value ranging from the minimum value of the analog input-1 scale (SL) to the maximum value of the analog input-1 scale (SH). The result is a value ranging from 0 to 30000 for internal computation. The PVIN.1 signal has a value ranging from 0 to 30000, which is an internal value converted from a value ranging from the minimum value of the PV1 range (P.RL1) to the maximum value of the PV1 range (P.RH1).

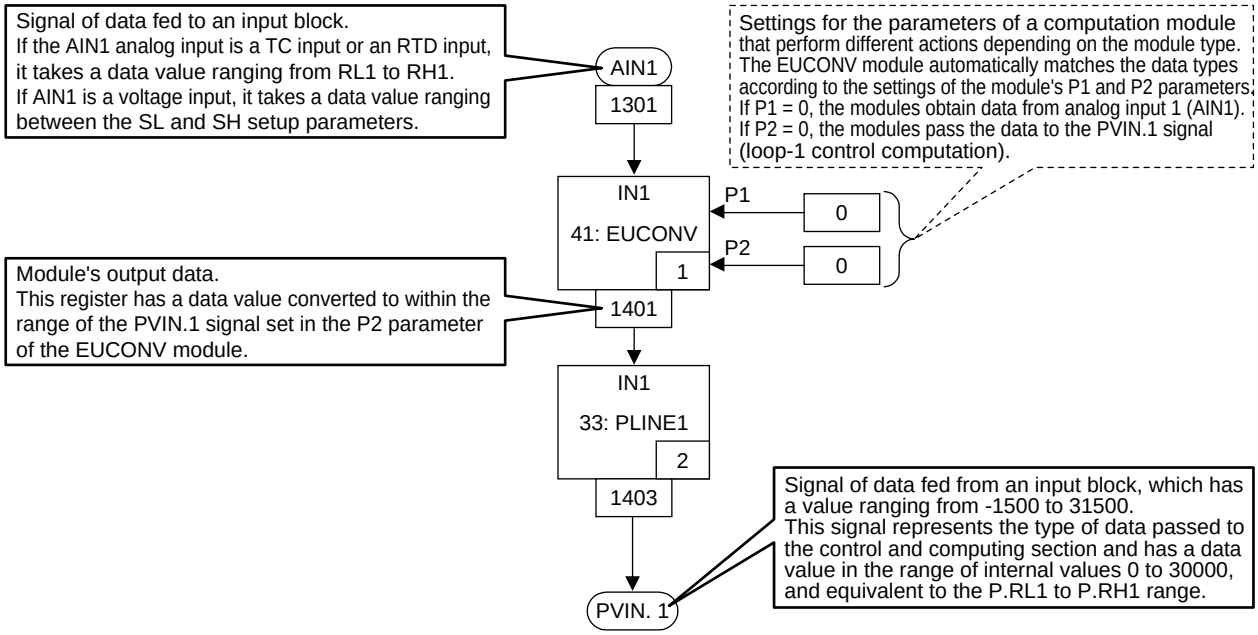


Figure 3.1 Data Flow

3.1 Types of Computation Data

The types of computation data used for custom computations are classified in the following table.

The table also summarizes the values of actual data and their corresponding computation data (data actually handled within the US1000 controller). For details on which type each item of computation data going in and out of the input and output blocks belongs, see the next section.

Data Type	Actual Range of Data	Computation Data	Data Included	Remarks
Range data	Minimum to maximum values of the range	0 to 30000 (see TIP)	TC and RTD inputs	The range is equivalent to that from the RL to RH setup parameters.
Scale data	Minimum to maximum values of the scale	0 to 30000 (see TIP)	Voltage input	The scale is equivalent to the range from the SL to SH setup parameter.
%-type data	0.0 to 100.0%	0 to 30000 (see TIP)	Tracking input, MV, etc.	The actual data value of 0.0% is equivalent to the computation data value 0; likewise, 100.0% is equivalent to 30000.
Gain data	0.001 to 10.000	1 to 10000	Gain setpoints only	The actual data value of 0.001 is equivalent to the computation data value 1; likewise, 10.000 is equivalent to 10000. When gain data is monitored, the LL1200 Tool shows the computation data value without a decimal point.
Flag data	0 or 1	0 or 1	Flags for control	0 represents off; 1 represents on.
Integer data	Arbitrary range (The readout range is -19999 to 30000.)	-30000 to 30000	Internal data without unit. All setting parameters belong to this type.	The span, outside the -30000 to 30000 range that can be shown by the US1000 controller, is -19999 to 30000. The RH value of 1500.0 is equivalent to the computation data value of 15000.

TIP

A computation data value ranging from -1500 to 31500 is used depending on the type of parameter. This range is equivalent to -5.0% to 105.0%.

Integer data is normally used to configure your own custom computations. It is signed two-byte (16-bit) data, with a value limited to the ±30000 range. You can use data of up to four bytes (32 bits) with a plus or minus sign, however, in some of the computation modules such as those for four arithmetic operations. For example, these modules can have the result of multiplying two-byte data by two-byte data as four-byte data. In that case, the result is stored in two D registers (e.g., the IMO1L register [lower-order word] and the IMO1H register [higher-order word]).

See Also

RL, RH, P.RL, P.RH, SL and SH setup parameters in the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E)

3.2 Data Fed to Input Blocks

The following table lists the data types, monitor data and computation data used with the data items from AIN1 to AIN3 and from DI1.st to DI7.st that are fed to the input blocks.
When coupling computation modules with input signals fed to an input block, check which data type and computation data apply.

Input Signal Code	D Register Number or I Relay Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
AIN1	1301	Analog input 1	Range	RL1 to RH1 (NOTE)	0 to 30000	This data item uses the RH1 and RL1 range-setting parameters. The computation data value of 0 is equivalent to RL1 and 30000 to RH1.
			Scale	SL1 to SH1 (NOTE)		This data item uses the SH1 and SL1 scale-setting parameters. The computation data value of 0 is equivalent to SL1 and 30000 to SH1.
AIN2	1302	Analog input 2	Range	RL2 to RH2 (NOTE)		This data item uses the RH2 and RL2 range-setting parameters. The computation data value of 0 is equivalent to RL2 and 30000 to RH2.
			Scale	SL2 to SH2 (NOTE)		This data item uses the SH2 and SL2 scale-setting parameters. The computation data value of 0 is equivalent to SL2 and 30000 to SH2.
AIN3	1303	Analog input 3	Scale	SL3 to SH3 (NOTE)		This data item uses the SH3 and SL3 scale-setting parameters. The computation data value of 0 is equivalent to SL3 and 30000 to SH3.
DI1.st	5161	Contact input 1	Flag	0 or 1	0 or 1	The computation data value of 0 is equivalent to "off" and 1 to "on."
DI2.st	5162	Contact input 2				
DI3.st	5163	Contact input 3				
DI4.st	5164	Contact input 4				
DI5.st	5165	Contact input 5				
DI6.st	5166	Contact input 6				
DI7.st	5167	Contact input 7				

NOTE

The range of monitor data of the AIN1 to AIN3 analog inputs is equivalent to -5.0% to 105.0% for each of the ranges RL1 to RH1, SL1 to SH1, RL2 to RH2, and SL3 to SH3.

3.3 Data Fed from Input Blocks

The following table lists the data types, monitor data and computation data used with the data items ranging from PVIN.1 to GAIN.2, from TRK.1 to MAN.2, from O/C to SV.b3, from DP1 to DP2, and from MG1 to MG4 that are fed from input blocks.
When coupling computation modules with output signals fed from an input block, check which data type and computation data apply.

NOTE

Depending on the type of input-block custom computation you configure, the data used may take a value outside the 0 to 30000 range. In order to match the data range to the range defined by the P.RL and P.RH parameters of the US1000 controller, configure custom computations using the data ranges shown in the following table.

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
PVIN.1	1331	Loop-1 PV input	Range	0 to 30000	0 to 30000	This data item uses the P.RH1 and P.RL1 range-setting parameters. The computation data value of 0 is equivalent to P.RL1 and 30000 to P.RH1.
PVIN.2	1332	Loop-2 PV input				This data item uses the P.RH2 and P.RL2 range-setting parameters. The computation data value of 0 is equivalent to P.RL2 and 30000 to P.RH2.
CSVIN.1	1333	Loop-1 cascade input				This data item uses the P.RH1 and P.RL1 range-setting parameters. The computation data value of 0 is equivalent to P.RL1 and 30000 to P.RH1.
CSVIN.2	1334	Loop-2 cascade input				This data item uses the P.RH2 and P.RL2 range-setting parameters. The computation data value of 0 is equivalent to P.RL2 and 30000 to P.RH2.
GAIN.1	1335	Loop-1 gain setting value	ABS	0 to 10000	0 to 10000	The US1000 controller carries out PID control using a proportional band divided by the gain. If the gain is 0, no gain-based action is taken. If the computation data is in the 1to10000 range, the actual data is in the range of 0.001 to 10.000 times the given proportional band.
GAIN.2	1336	Loop-2 gain setting value				

Continued from the previous table

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
TRK.1	1337	Loop-1 tracking input	%	0 to 30000	0 to 30000	This input accepts the 0.0 to 100.0% range of an input signal as data in the 0 to 30000 range. If TRF.1 is on, the input block feeds the value of TRK.1 regardless of whether loop 1 is in the AUTO mode or CAS mode. If TRF.1 changes from on to off, the US1000 controller resumes the AUTO- or CAS-mode operation based on the TRK.1 value immediately before the status change. Manual output of the value can be enabled when the loop is in the MAN mode.
TRK.2	1338	Loop-2 tracking input				This input accepts the 0.0 to 100.0% range of an input signal as data in the 0 to 30000 range. If TRF.2 is on, the input block feeds the value of TRK.2 regardless of whether loop 2 is in the AUTO mode or CAS mode. If TRF.2 changes from on to off, the US1000 controller resumes the AUTO- or CAS-mode operation based on the TRK.2 value immediately before the status change. Manual output of the value can be enabled when the loop is in the MAN mode.
FF	1339	Feedforward input				Used for feedforward control. The computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%.
CAS.1	1343	Loop-1 CAS mode	Flag	0 or 1	0 or 1	A transition in this signal from 0 to 1, switches loop 1 to cascade control. (One-shot switch)
AUT.1	1344	Loop-1 AUTO mode				A transition in this signal from 0 to 1, switches loop 1 to automatic control. (One-shot switch)
MAN.1	1345	Loop-1 MAN mode				A transition in this signal from 0 to 1, switches loop 1 to manual control. (One-shot switch)
CAS.2	1346	Loop-2 CAS mode				A transition in this signal from 0 to 1, switches loop 2 to cascade control. (One-shot switch)
AUT.2	1347	Loop-2 AUTO mode				A transition in this signal from 0 to 1, switches loop 2 to automatic control. (One-shot switch)
MAN.2	1348	Loop-2 MAN mode				A transition in this signal from 0 to 1, switches loop 2 to manual control. (One-shot switch)

Continued from the previous table

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
O/C	1349	OPEN/CLOSE mode	Flag	0 or 1	0 or 1	0: CLOSE (The secondary-loop undertakes control using the result of the PID computation in the primary-loop as the target setpoint.) 1: OPEN (The secondary-loop receives the manually set target setpoint (SV value) to be used for control.)
R/S	1350	RUN/STOP mode				0: RUN 1: STOP
TRF.1	1351	Loop-1 tracking flag				1: Tracking is on 0: Tracking is off
TRF.2	1352	Loop-2 tracking flag				1: Tracking is on 0: Tracking is off
SV.B0	1354	Bit-0 of SV number setting				A switch is made between SV numbers using on-off combinations of these four bits. 0: valid if set via key input 1 to 8: valid if set via contact input 9 or greater: valid if set via key input The bits for selecting an SV number can be configured into a binary bit string using contact input. [TIP] Bit configuration for specifying an SV number: If the contact inputs are configured as "DI4 = off; DI3 = on; DI2 = off; DI1 = on," which is represented as "0101" in the binary system and as "5" in the decimal system, then SV number 5 (5.SV) is selected.
SV.B1	1355	Bit-1 of SV number setting				
SV.B2	1356	Bit-2 of SV number setting				
SV.B3	1357	Bit-3 of SV number setting				

Continued from the previous table

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
DP1	1358	Custom display for interruption 1	Flag	0 or 1	0 or 1	A transition in this signal from 0 to 1, switches the Custom display. The Custom displays that you can view by interrupting the current display are as follows: 1) PV1 & SV1 display 2) PV1 & MV1 display 3) Cascade CLOSE1 display 4) Cascade CLOSE2 display 5) Dual-loop PV1 & SV1 display 6) Dual-loop PV1 & MV1 display 7) Dual-loop PV2 & SV2 display 8) Dual-loop PV2 & MV2 display 9) Unilluminated operation display 10) Loop-1 alarm display 11) Loop-2 alarm display 12) SV number display 13) Loop-1 PID number display 14) Loop-2 PID number display 15) Analog input-1 display 16) Analog input-2 display 17) Analog input-3 display 18) PV1 display 19) PV2 display 20) Sampling error counter display 21) DISP1 display 22) DISP2 display [See Also] Section 6.1, "List of Custom Displays and Their Explanations"
DP2	1359	Custom display for interruption 2				Define which Custom displays are to be switched to in the display conditions set in the LL1200. Turn on the contact registered with the DP1 or DP2 setup parameter. You can now, regardless of which operation display is currently active, view a custom display previously registered with the "DP1 = on" or "DP2 = on" setting of the display conditions necessary to switch between custom displays. [See Also] Section 6.3, "Conditions Necessary to Switch to Custom Displays"

Continued from the previous table

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
MG1	1360	Interruptive message display 1	Flag	0 or 1	0 or 1	This signal enables the operation display to show messages. Edit the message text using the LL1100 PC-based Parameters Setting Tool. If any of these signal flags turns on, the corresponding message (message 1, 2, 3 or 4) appears on the US1000's PV digital display. If two or more flags turn on at the same time, MG1 is highest in priority, while MG4 is lowest. The message shown disappears if you press the DISP key on the US1000 controller, and the controller returns to a normal display. [See Also] "Setting Messages" in the Model LL1100 PC-based Parameters Setting Tool instruction manual (IM 5G1A01-01E).
MG2	1361	Interruptive message display 2				
MG3	1362	Interruptive message display 3				
MG4	1363	Interruptive message display 4				

3.4 Data Fed to Output Blocks

The following table lists the data types, monitor data and computation data used with the data items from PV.1 to CMV.2 and from RET1 to RET3 that are fed to output blocks.
When coupling computation modules with output signals fed to an output block, check which data type and computation data apply.

Input Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
PV.1	1501	Loop-1 PV input	Range	0 to 30000	0 to 30000	This data item uses the P.RH1 and P.RL1 range-setting parameters. The computation data value of 0 is equivalent to P.RL1 and 30000 to P.RH1.
PV.2	1502	Loop-2 PV input				This data item uses the P.RH2 and P.RL2 range-setting parameters. The computation data value of 0 is equivalent to P.RL2 and 30000 to P.RH2.
CSV.1	1503	Loop-1 SV				This data item uses the P.RH1 and P.RL1 range-setting parameters. The computation data value of 0 is equivalent to P.RL1 and 30000 to P.RH1.
CSV.2	1504	Loop-2 SV				This data item uses the P.RH2 and P.RL2 range-setting parameters. The computation data value of 0 is equivalent to P.RL2 and 30000 to P.RH2.
MV.1	1505	Loop-1 MV	%			The computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%.
MV.2	1506	Loop-2 MV				
HMV.1	1507	Loop-1 heating-side MV				
HMV.2	1508	Loop-2 heating-side MV				
CMV.1	1509	Loop-1 cooling-side MV				
CMV.2	1510	Loop-2 cooling-side MV				

Continued from the previous table

Input Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
RET1	1511	Retransmission output 1	Range	0 to 30000	0 to 30000	This data item uses the RTH1 and RTL1 range-setting parameters. The computation data value of 0 is equivalent to RTL1 and 30000 to RTH1.
			%			This data item changes to %-type data if the RET1 setup parameter equals MV1 or MV2. The computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%.
RET2	1512	Retransmission output 2	Range			This data item uses the RTH2 and RTL2 range-setting parameters. The computation data value of 0 is equivalent to RTL2 and 30000 to RTH2.
			%			This data item changes to %-type data if the RET2 setup parameter equals MV1 or MV2. The computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%.
RET3	1513	Retransmission output 3	Range			This data item uses the RTH3 and RTL3 range-setting parameters. The computation data value of 0 is equivalent to RTL3 and 30000 to RTH3.
			%			This data item changes to %-type data if the RET3 setup parameter equals MV1 or MV2. The computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%.

3.5 Data Fed from Output Blocks

The following table lists the data types, monitor data and computation data used with the data items from OUT1A to OUT2R and from DO1 to DO7 that are fed from output blocks.
When coupling computation modules with output signals fed from an output block, check which data type and computation data apply.

Output Signal Code	D Register Number	Specifications				
		Description	Data Type	Monitor Data	Computation Data	Remarks
OUT1A	1531	Analog output 1 (current/voltage pulse)	%	0 to 1000	0 to 30000	Voltage output or current-pulse output
OUT2A	1532	Analog output 2 (current/voltage pulse)				
OUT3A	1533	Analog output 3 (voltage)				Voltage output
OUT1R	1534	MV1 relay output		0 to 30000 for time-proportional output	0 to 30000	If this data item is time-proportional output, the computation data value of 0 is equivalent to 0.0% and 30000 to 100.0%. If this data item is on-off output, the computation data value of 0 is equivalent to 0.0% (off) and 30000 to 100.0% (on).
				0 to 30000 for on-off computation	0 or 30000	
OUT2R	1535	MV2 relay output		0 to 30000 for time-proportional output	0 to 30000	
				0 or 30000 for on-off computation	0 or 30000	
DO1	1536	Contact output 1 (relay)	Flag	0 or 1	0 or 1	The computation data value of 0 is equivalent to off and 1 to on.
DO2	1537	Contact output 2 (relay)				
DO3	1538	Contact output 3 (relay)				
DO4	1539	Contact output 4 (open collector)				
DO5	1540	Contact output 5 (open collector)				
DO6	1541	Contact output 6 (open collector)				
DO7	1542	Contact output 7 (open collector)				

NOTE

Time-proportional output can be implemented only if an output selection module is used. It is recommended that the output blocks included in the US mode of the US1000 be used as they are.

4. List of Computation Modules and Their Functions

This chapter explains the function specifications of each computation module. A list of the modules is presented first, and then the functions of each module are described.

The following paragraphs explain some of the specifications that appear throughout this chapter.

■ IN1 to IN8, P1 to P4, OUT

IN1 to IN8 represent the inputs of each computation module, P1 to P4 are the module parameters, and OUT is the output. The following symbols are used to indicate the size of data supported by each of these functional assignments when used with the module in question.

◎ : Four bytes (two words)
● : Two bytes (one word)
○ : Flag (0 or 1)

NOTE

Some OUT data items are given the symbol "×" which indicates that they themselves do not output any data. In that case, the same data as that in the output register of the computation module immediately preceding the module in question, is sent to the output register of the latter module.

■ Work Area

Some computation modules require a "work area," which is assigned a number to indicate its size (i.e, the number of areas). You can use a maximum of 240 work areas; computation modules using more than 240 work areas cannot be registered.

■ Limitation on Use

Computation modules with limited usage are given a number indicating the number of times it can be used.

4.1 List of Computation Modules

No.	Name	Code	Function	IN 1	IN 2	IN 3	IN 4	IN 5	IN 6	IN 7	IN 8	P1	P2	P3	P4	OUT	Work Area	Limitation on Use
1	Addition	ADD	OUT=IN1 + IN2	◎	◎											◎		
2	Subtraction	SUB	OUT=IN1 - IN2	◎	◎											◎		
3	Multiplication	MUL	OUT=IN1×IN2	◎	◎											◎		
4	Division	DIV	OUT=IN1/IN2	◎	○											◎		
5	Absolute Value	ABS	OUT=ABS (IN1)	◎												◎		
6	Reciprocal	RECIPRO	OUT=P1/ (IN1 + P2)	◎								◎	◎			◎		
7	Auto-Selector (Min./Max./ Average/ Difference)	MINMAXAVE	OUT = either the maximum, minimum, average or difference	○	○	○	○					○	○			○		
8	Hold Maximum Value	MAXHOLD	OUT = MAX (IN1, IN2, IN3, IN4, previous OUT)	○	○	○	○	○				○	●			○	2	
9	Hold Minimum Value	MINHOLD	OUT = MIN (IN1, IN2, IN3, IN4, previous OUT)	○	○	○	○	○				○	●			○	2	
10	Hold	HOLD	OUT = previously held IN1	○								●				○	2	
11	Switch	SWITCH	OUT = IN1 or IN2	◎	◎							●				◎		
12	Limiter	LIMIT	OUT = IN1 limited to the range of P1 (upper limit) to P2 (lower limit)	◎								◎	◎			◎		
13	Constant	CONST	OUT = IN1	◎												◎		
14	AND Logic	AND	OUT = IN1∧IN2∧IN3∧IN4	●	●	●	●									●		
15	OR Logic	OR	OUT = IN1∨IN2∨IN3∨IN4	●	●	●	●									●		
16	XOR Logic	XOR	OUT = IN1∀IN2	●	●											●		
17	NOT Logic	NOT	OUT = $\overline{IN1}$	●												●		
18	Latch	LATCH	OUT = IN1 locked to on state	●								●				●	4	
19	Greater-than Logic	GT	OUT = 1 if IN1 ≧ IN2; OUT = 0 if IN1 < (IN2 - P1)	◎	◎							○				●	1	
20	Less-than Logic	LT	OUT = 1 if IN1 ≦ IN2; OUT = 0 if IN1 > (IN2 + P1)	◎	◎							○				●	1	
21	Decremental Counter	DCOUNTER	OUT = previous OUT - 1 when IN3 changes	●	●	●	○					●				○	3	
22	Counter	COUNTER	OUT = previous OUT + 1 when IN3 changes	●	●	●						●				○	3	
23	Equal-to Logic	EQ	OUT = 1 if IN1 = between IN2 and IN2 + P1	◎	◎							○				●		
24	Not-Equal-to Logic	NEQ	OUT = 1 if IN2 ≦ IN1 ≦ (IN2 + P1) is false	◎	◎							○				●		
25	Range Logic	RANGE	OUT = 1 if IN1 = between P1 and P2	◎								◎	◎			●		
26	Delay Logic	DELAY	OUT = previous IN1 (output delay of one control period)	○												○	2	
27	AND (Long Word) Logic	ANDW	OUT = IN1∧IN2	◎	◎											◎		
28	OR (Long Word) Logic	ORW	OUT = IN1∨IN2	◎	◎											◎		
29	Word Shift	SHIFT	OUT = IN1 with a shift of P1	◎								○	○			◎		
30	Sum	SUM	OUT = previous OUT + IN1	◎	◎							●				◎	4	
31	Timer	TIMER	OUT (flag) = 1 if timer count down reaches 0	●	●	●	○					●				●	4	
32	Rate-of-change Limiter	CHGLMT	OUT = IN1 whose rate of change is limited by P1 and P2	○								○	○	○	●	○	6	

No.	Name	Code	Function	IN 1	IN 2	IN 3	IN 4	IN 5	IN 6	IN 7	IN 8	P1	P2	P3	P4	OUT	Work Area	Limitation on Use
33	10-segment Linearizer 1	PLINE1	OUT = IN1 determined by linear approximation based on the table of 10-segment linearizer 1	○												○		
34	10-segment Linearizer 2	PLINE2	OUT = IN1 determined by linear approximation based on the table of 10-segment linearizer 2	○												○		
35	Inverse 10-segment Linearizer 1	ILINE1	OUT = inverse of PLINE1 output	○												○		
36	Inverse 10-segment Linearizer 2	ILINE2	OUT = inverse of PLINE2 output	○												○		
37	Curve Linearizer 1	CURVE1	OUT = IN1 determined by curvilinear approximation based on the table of 10-segment linearizer 1	○												○		
38	Curve Linearizer 2	CURVE2	OUT = IN1 determined by curvilinear approximation based on the table of 10-segment linearizer 2	○												○		
39	Ratio	RATIO	OUT = (IN1×P1/P2) + P3	○								○	○	◎		◎		
40	First Order Lag Filter	FILTER	OUT = previous OUT + IN1/(1 + P1)	○								○	●			○	4	
41	EU Range Conversion	EUCONV	OUT = IN1 with unit converted from P1's to P2's unit	○								○	○			○		
42	Switching Between 2 Inputs	SELECT2	OUT = computation obtained according to the type of switching applied for IN1 and IN2	○	○							○	○	○	●	○	2	
43	Temperature and Humidity Calculation	TMPHUM	OUT = relative humidity determined from the readings of dry- and wet-bulb temperatures	○	○							○	○	○		○		1
44	Square Root Extraction	SQR	OUT = $\sqrt{}$(IN1), where low signal cutoff based on P1 is applied	○								○				○		
45	Detection of Change	CHGDET	OUT = 1 for one control period if IN1 changes	●												●	1	
46	Loop-1Output-Selection 1	OUTSEL1	OUT = output for OUT1R (manipulated output: relay output)	○	○	○	○	○	○	○						○		1
47	Loop-1 Output-Selection 11	OUTSEL11	OUT = output for OUT1A (continuously manipulated output or RET2 output)													○		1
48	Loop-1 Output-Selection 12	OUTSEL12	OUT = output for OUT2A (continuously manipulated output on cooling side or RET1 output: OUTSEL12)													○		1
49	Loop-1 Output-Selection 13	OUTSEL13	OUT = output for OUT2R (relay manipulated output on cooling side or alarm 3: OUTSEL13)													○		1
50	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51	Loop-2 Output-Selection 2	OUTSEL2	OUT = output for OUT2R (manipulated output: relay output)	○	○	○	○	○								○		1

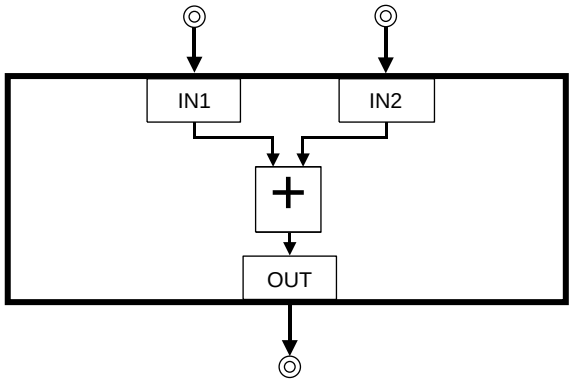
No.	Name	Code	Function	IN 1	IN 2	IN 3	IN 4	IN 5	IN 6	IN 7	IN 8	P1	P2	P3	P4	OUT	Work Area	Limitation on Use
52	Loop-2 Output-Selection 21	OUTSEL21	OUT = output for OUT2A (continuously manipulated output or RET2 output: OUTSEL21)													○		1
53	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
54	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
55	Display Data Unit Conversion	DISPCHG	OUT = absolute value without decimal point obtained by converting IN1 reading	○								○				○		
56	Parameter Setting	PARASET	Writes IN1 into register specified in P1, when P2 changes from 0 to 1	○								○	●			×	4	
57	Data Display 1	DISP1	Shows IN1 on the DISP1 customized display	○								○				×		1
58	Data Display 2	DISP2	Shows IN1 on the DISP2 customized display	○								○				×		1
59	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
60	Output-1 Terminal Configuration	OUTSET1	Selects the function of OUT1A terminal: mA output if P1 = 0, voltage pulse output if P1 = 1									●				×		1
61	Output-2 Terminal Configuration	OUTSET2	Selects the function of OUT2A terminal: mA output if P1 = 0, voltage pulse output if P1 = 1									●				×		1
62	Fluid Temperature Compensation	TCOMP	OUT = IN1 × (IN2 + P2)/ (P1 + P2)	○	○							○	○	○		○		
63	Fluid Pressure Compensation	PCOMP	OUT = IN1 × (IN2 + P2)/ (P1 + P2)	○	○							○	○	○		○		
64	10-segment Linearizer 3	PLINE3	OUT = IN1 determined by linear approximation based on table of 10-segment linearizer-3 parameters	○												○		
65	10-segment Linearizer 4	PLINE4	OUT = IN1 determined by linear approximation based on table of 10-segment linearizer-4 parameters	○												○		
66	None	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
67	Dead Time	DED	OUT = the value of IN1 given prior to the P1 time	○								○	●			○	46	
68	Moving Average	MAV	OUT = the average of IN1 given prior to the P1 time	○								○	●			○	46	
69	Multi-selector	MSELECT	OUT = a value selected from IN1 to IN8	○	○	○	○	○	○	○	○	○	○	○		◎		
70	Edge-triggered Counter	ECOUNTER	OUT = previous value of OUT + P4 when IN3 changes	●	●	●	○					○	○	○	○	○	3	
71	Edge-triggered Timer	ETIMER	OUT (flag) = 1 if the timer counts down to 0.	●	●	●	○					●	○			●	4	
72	Detection of Change at Edge	ECHGDET	OUT = 1 for one control period if IN1 changes (at the rising or falling edge)	●								●				●	1	
73	Square Root Extraction 2	SQR2	OUT = $\sqrt{\ }$(IN1), where P1 is low signal cutoff point	○								○				○		
74	Flow Sum	FLWSUM	Calculates IN3 and outputs the result	●	●	○	○					○	●	○		◎	7	

4.2 Explanation of Functions of Computation Modules

Module No.	1	Category	Arithmetic Operation
Module Name	Addition	Module Code Name	ADD

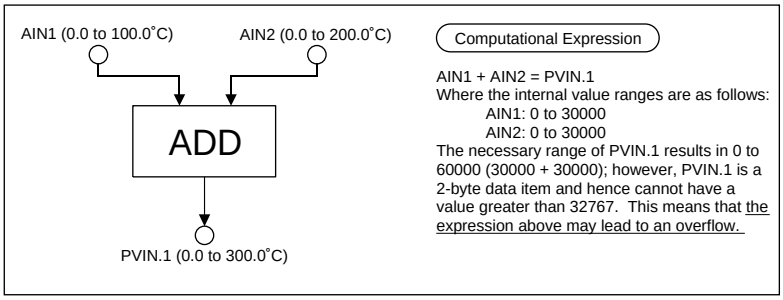
Module Input		
IN1	◎	Augend
IN2	◎	Addend
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Sum
Work Area		
Limitation on Usage		

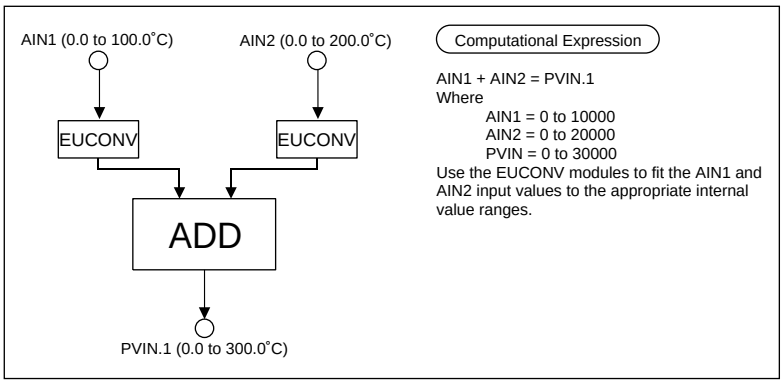
[Computational Expression]
OUT = IN1 + IN2



[Explanation]
The module outputs the value obtained by adding IN2 to IN1.
If an overflow occurs, it outputs:
- the maximum value when the addition is "(positive value) + (positive value)," or
- the minimum value when the addition is "(negative value) + (negative value)."

Example: Setting PV1 to the summation of AIN1 and AIN2



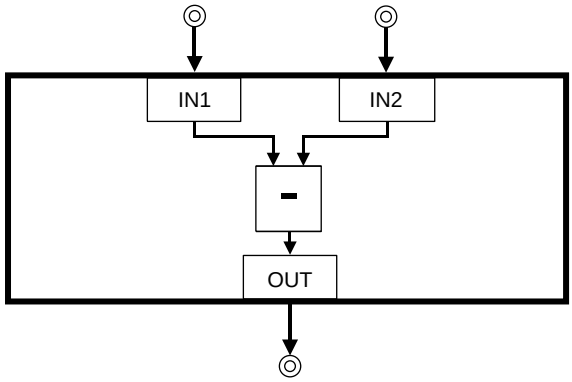


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	2	Category	Arithmetic Operation
Module Name	Subtraction	Module Code Name	SUB

Module Input		
IN1	◎	Minuend
IN2	◎	Subtrahend
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Remainder
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1 - IN2



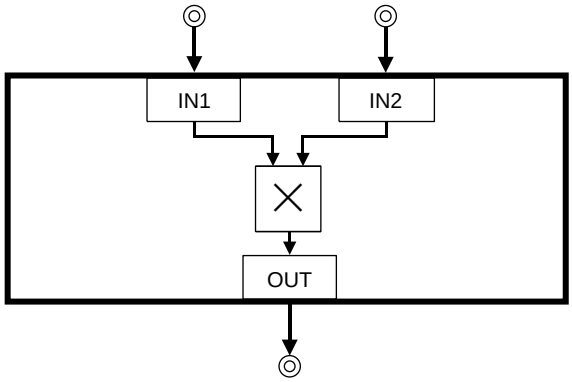
[Explanation]
The module outputs the value obtained by subtracting IN2 from IN1.
If an overflow occurs, it outputs:
- the minimum value when the subtraction is "(negative value) - (positive value)," or
- the maximum value when the subtraction is "(positive value) - (negative value)."

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	3	Category	Arithmetic Operation
Module Name	Multiplication	Module Code Name	MUL

Module Input		
IN1	◎	Multiplicand
IN2	◎	Multiplier
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Product
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1×IN2



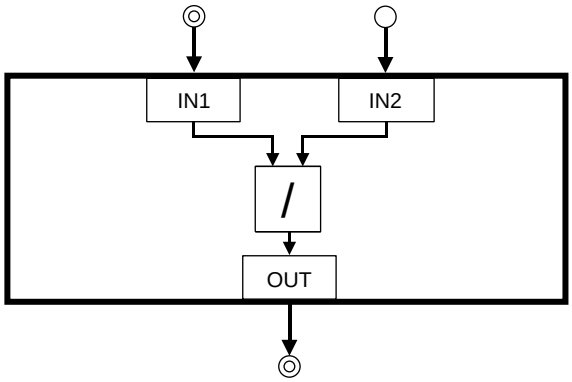
[Explanation]
The module outputs a value obtained by multiplying IN1 by IN2.
If an overflow occurs, it outputs:
- the maximum value when the signs of IN1 and IN2 are the same, or
- the minimum value when the signs of IN1 and IN2 are different.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	4	Category	Arithmetic Operation
Module Name	Division	Module Code Name	DIV

Module Input		
IN1	◎	Dividend
IN2	○	Divisor
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Quotient
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1/IN2



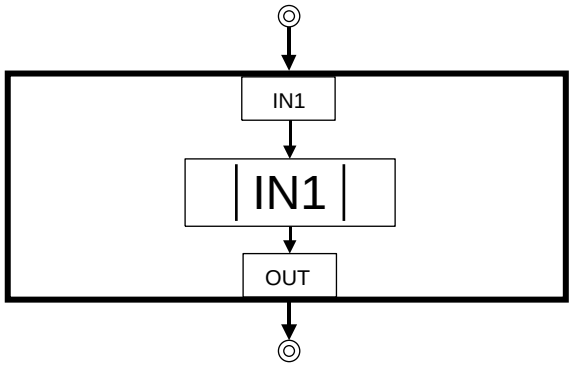
[Explanation]
The module outputs the value obtained by dividing IN1 by IN2.
Fractions are rounded off.
If IN1 = 0, the module output is 0.
If IN2 = 0, the module outputs:
- the maximum value when the sign of IN1 is positive, or
- the minimum value when the sign of IN1 is negative.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	5	Category	Arithmetic Operation
Module Name	Absolute Value	Module Code Name	ABS

Module Input		
IN1	◎	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Absolute value
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = ABS (IN1)



[Explanation]
The module outputs an absolute value of IN1.

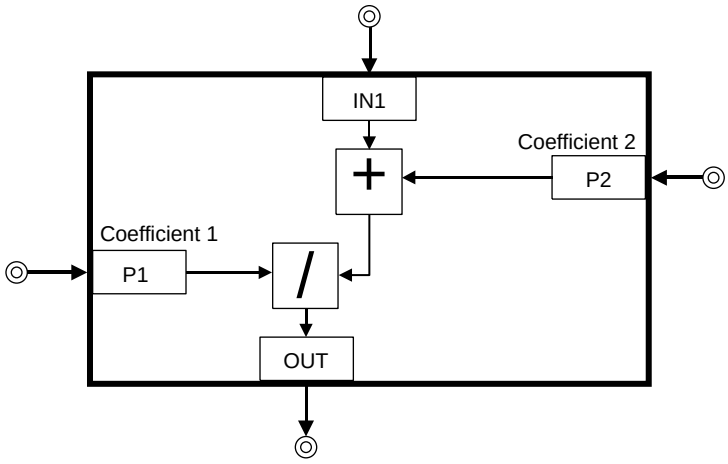
Example: 125 = |-125|

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	6	Category	Arithmetic Operation
Module Name	Reciprocal	Module Code Name	RECIPRO

Module Input		
IN1	◎	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◎	Coefficient 1
P2	◎	Coefficient 2
P3		
P4		
Module Output		
OUT	◎	Reciprocal
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = P1/(IN1 + P2)



[Explanation]
The module outputs the reciprocal of IN1.

If the result of computation is 0, the module outputs:
- 1 when the signs of the dividend and divisor are the same, or
- -1 when the signs of the dividend and divisor differ.

Additions and divisions included in the computational expression comply with the specifications of the addition and division modules.

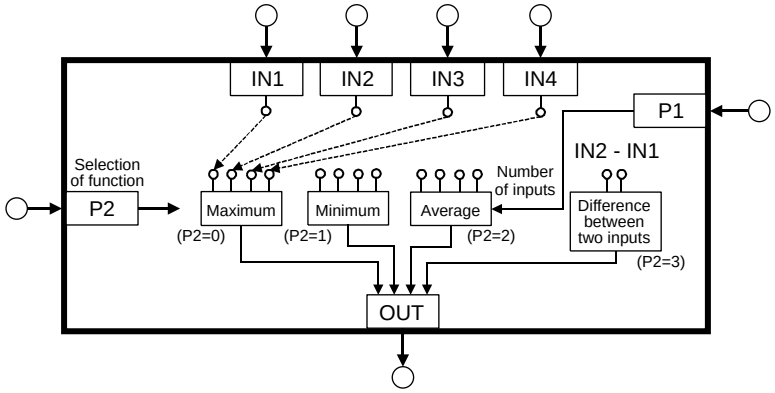
◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	7	Category	Arithmetic Operation
Module Name	Auto-Selector (Min./Max./Average/Difference)	Module Code Name	MINMAXAVE

Module Input		
IN1	○	Input 1
IN2	○	Input 2
IN3	○	Input 3
IN4	○	Input 4
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Number of inputs (1 to 4)
P2	○	Selection of function (0 to 3)
P3		
P4		
Module Output		
OUT	○	Automatically selected output
Work Area		
Limitation on Usage		

[Computational Expression]

P2 = 0: outputs the maximum; OUT = MAX (IN1, IN2, IN3, IN4)
P2 = 1: outputs the minimum; OUT = MIN (IN1, IN2, IN3, IN4)
P2 = 2: outputs the average
If P1 = 1, then OUT = IN1
If P1 = 2, then OUT = (IN1 + IN2)/2
If P1 = 3, then OUT = (IN1 + IN2 + IN3)/3
If P1 = 4, then OUT = (IN1 + IN2 + IN3 + IN4)/4
P2 = 3: outputs the remainder; OUT = (IN2 - IN1)



[Explanation]

The module outputs the maximum or minimum input from among up to four inputs (IN1 to IN4), or the difference between two inputs.

If P1 = 1, the module always outputs IN1.
If P1 ≠ 1 to 4, the module always outputs 0.
If P2 ≠ 0 to 3, the module operates assuming P2 = 0.

[TIP]

P1: Specify the number of inputs (1 to 4). (The number of inputs specified by P1, and beginning with IN1, are included in the computation.)
P2: Selection of function (P2 = 0: outputs the maximum; P2 = 1: outputs the minimum; P2 = 2: outputs the average; P2 = 3: outputs the remainder)

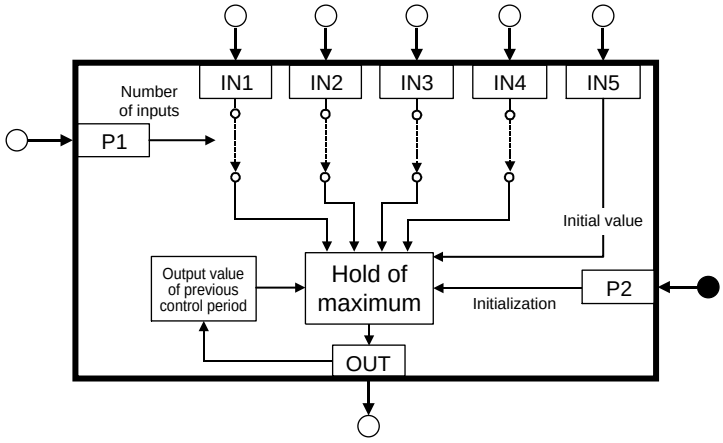
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	8	Category	Arithmetic Operation
Module Name	Hold Maximum Value	Module Code Name	MAXHOLD

Module Input		
IN1	○	Input 1
IN2	○	Input 2
IN3	○	Input 3
IN4	○	Input 4
IN5	○	Initial value
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Number of inputs (1 to 4)
P2	●	Initialization flag
P3		
P4		
Module Output		
OUT	○	Maximum value output

Work Area	2
Limitation on Usage	

[Computational Expression]
OUT = MAX (IN1, IN2, IN3, IN4, previous OUT)



[Explanation]
The module outputs whichever is greater, the maximum among IN1 to IN4 or the previous OUT.

If P1 ≠ 1 to 4, the module outputs 0.
If P2 = 1, the module outputs the initial value (IN5).

[TIP]
P1: Specify the number of inputs (1 to 4). (The number of inputs specified by P1, and beginning with IN1, are included in the computation.)
P2: Initialization flag (initializes the output if P2 = 1)

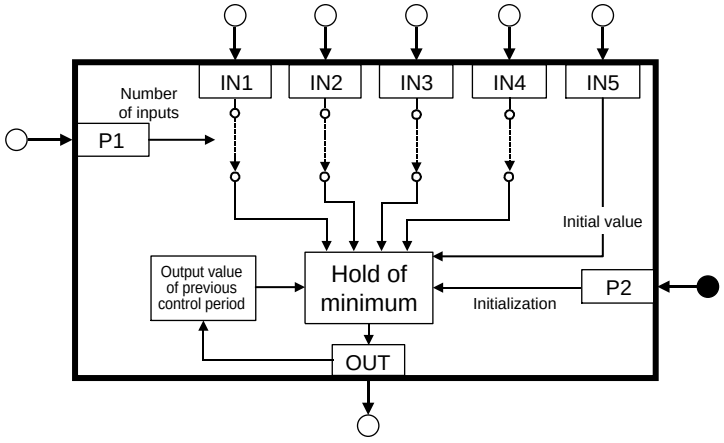
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	9	Category	Arithmetic Operation
Module Name	Hold Minimum Value	Module Code Name	MINHOLD

Module Input		
IN1	○	Input 1
IN2	○	Input 2
IN3	○	Input 3
IN4	○	Input 4
IN5	○	Initial value
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Number of inputs (1 to 4)
P2	●	Initialization flag
P3		
P4		
Module Output		
OUT	○	Maximum value output
Work Area		2
Limitation on Usage		

[Computational Expression]
OUT = MIN (IN1, IN2, IN3, IN4, previous OUT)



[Explanation]
The module outputs whichever is smaller, the minimum among IN1 to IN4 or the previous OUT.

If P1 ≠ 1 to 4, the module outputs 0.
If P2 = 1, the module outputs the initial value (IN5).

[TIP]
P1: Specify the number of inputs (1 to 4). (The number of inputs specified by P1, and beginning with IN1, are included in the computation.)
P2: Initialization flag (initializes the output if P2 = 1)

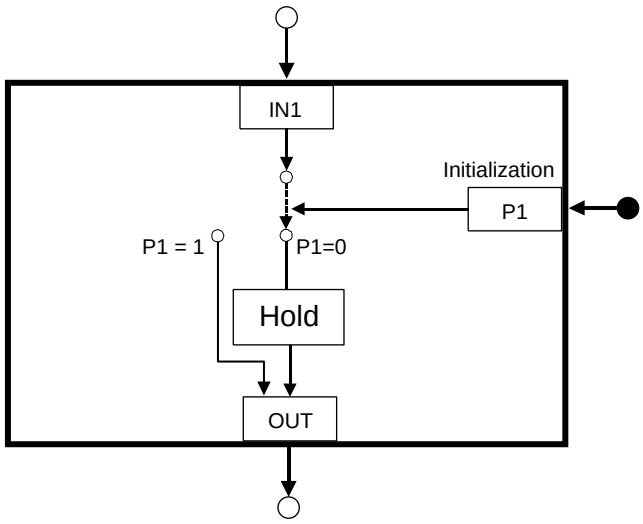
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**10**	Category	Arithmetic Operation
Module Name	Hold	Module Code Name	**HOLD**

Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Initialization flag
P2		
P3		
P4		
Module Output		
OUT	○	Held value output
Work Area		2
Limitation on Usage		

[Computational Expression]
OUT = held at previous IN1 (IN1 one control period earlier)



[Explanation]
The module retains IN1 until P1 takes a value other than 0.

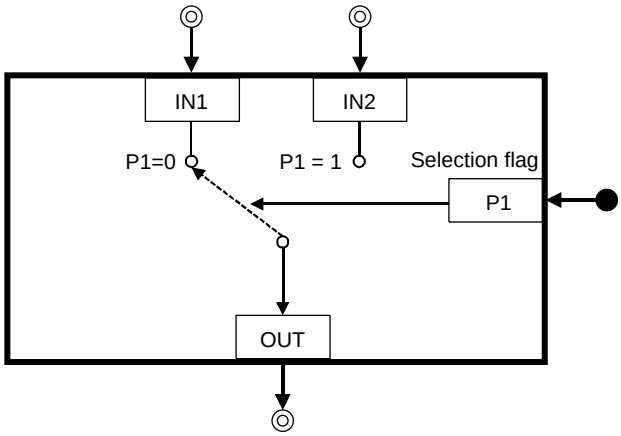
[TIP]
P1: Initialization flag
If P1 = 0, the module retains and outputs the value of IN1 obtained when P1 = 1.
If P1 = 1, the module outputs the value of IN1 as is.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**11**	Category	Arithmetic Operation
Module Name	Switch	Module Code Name	**SWITCH**

Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Selection flag
P2		
P3		
P4		
Module Output		
OUT	◎	Selected value
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1 or IN2



[Explanation]
The module outputs IN1 if P1 = 0, or IN2 if P1 = 1.

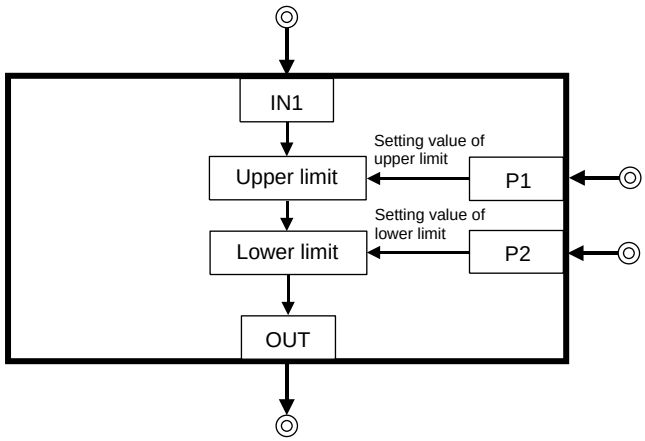
[TIP]
P1: Selection flag
If P1 = 0, the module outputs the value of IN1.
If P1 = 1, the module outputs the value of IN2.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

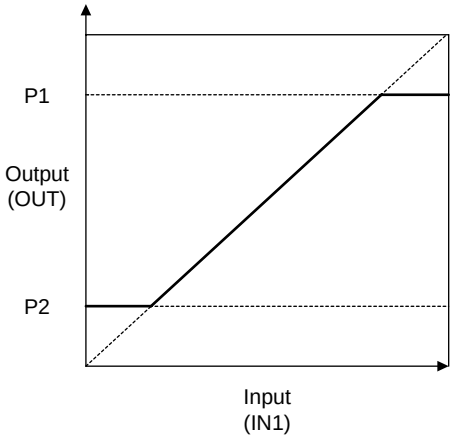
Module No.	**12**	Category	Arithmetic Operation
Module Name	Limiter	Module Code Name	**LIMIT**

Module Input		
IN1	◎	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◎	Setting value of upper limit
P2	◎	Setting value of lower limit
P3		
P4		
Module Output		
OUT	◎	Output with limiter
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = P2 ≦ IN1 ≦ P1



[Explanation]
The module outputs the value of IN1 while limiting it to within the range of P1 (setting value of upper limit) to P2 (setting value of lower limit).



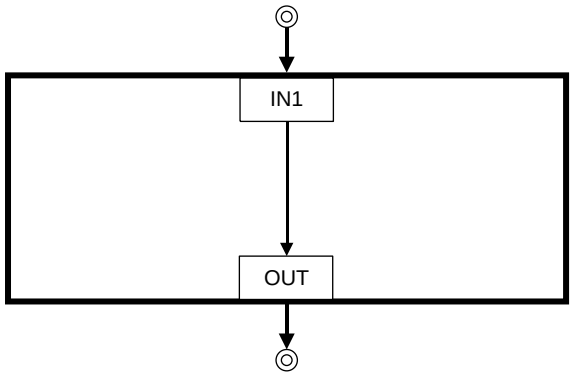
If the upper limit becomes smaller than the lower limit (P1 ≦ P2), the module outputs P1 when IN1 is greater than P1, or P2 when IN1 is smaller than P1.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**13**	Category	Arithmetic Operation
Module Name	Constant	Module Code Name	**CONST**

Module Input		
IN1	◎	Input1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	Constant
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1



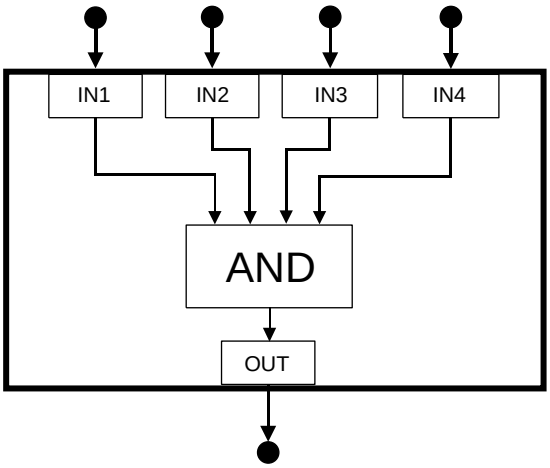
[Explanation]
The module outputs the value of IN1 as is.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	14	Category	Logical Operation
Module Name	AND Logic	Module Code Name	AND

Module Input		
IN1	●	Input 1
IN2	●	Input 2
IN3	●	Input 3
IN4	●	Input 4
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	●	AND logic result
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1∧IN2∧IN3∧IN4



[Explanation]
The module outputs the AND logic for IN1 to IN4.

Example: 1 = 1∧1∧1∧1, 0 = 1∧0∧1∧1

IN1	IN2	IN3	IN4	OUT
0	0	0	0	0
1	0	0	0	0
0	1	0	0	0
⋮	⋮	⋮	⋮	⋮
1	0	1	1	0
0	1	1	1	0
1	1	1	1	1

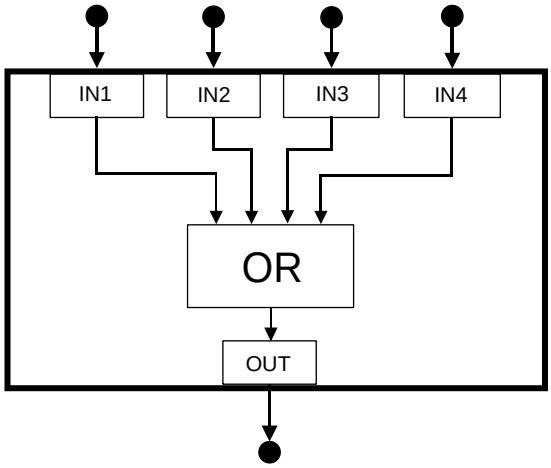
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**15**	Category	Logical Operation
Module Name	OR Logic	Module Code Name	**OR**

Module Input		
IN1	●	Input 1
IN2	●	Input 2
IN3	●	Input 3
IN4	●	Input 4
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	●	OR logic result
Work Area		
Limitation on Usage		

[Computational Expression]

OUT = IN1∨IN2∨IN3∨IN4



[Explanation]

The module outputs the OR logic for IN1 to IN4.

Example: 1 = 1∨0∨0∨1

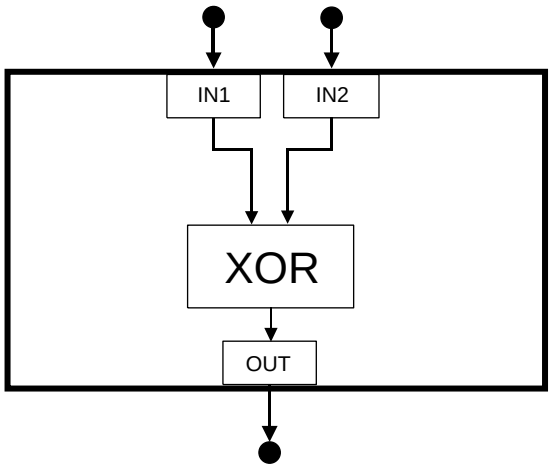
IN1	IN2	IN3	IN4	OUT
0	0	0	0	0
1	0	0	0	1
0	1	0	0	1
⋮	⋮	⋮	⋮	⋮
1	0	1	1	1
0	1	1	1	1
1	1	1	1	1

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	16	Category	Logical Operation
Module Name	XOR Logic	Module Code Name	XOR

Module Input		
IN1	●	Input 1
IN2	●	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	●	Exclusive OR logic result
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1∀IN2



[Explanation]
The module outputs the exclusive OR logic for IN1 and IN2.

Example: 1 = 1∀0, 0 = 1∀1

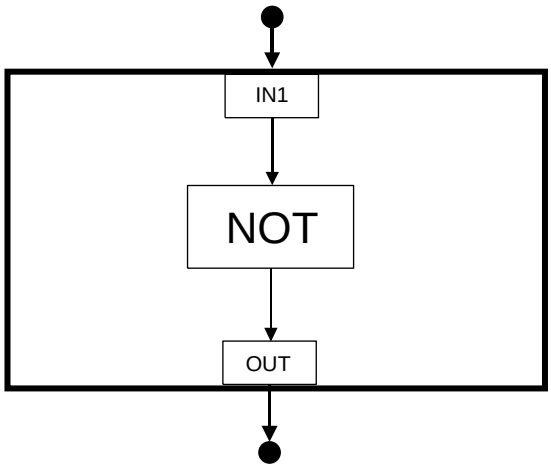
IN1	IN2	OUT
0	0	0
0	1	1
1	0	1
1	1	0

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**17**	Category	Logical Operation
Module Name	NOT Logic	Module Code Name	**NOT**

Module Input		
IN1	●	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	●	NOT logic result
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = $\overline{IN1}$



[Explanation]
The module outputs the value of IN1 after inverting it.

Example: 1 = $\overline{0}$, 0 = $\overline{1}$

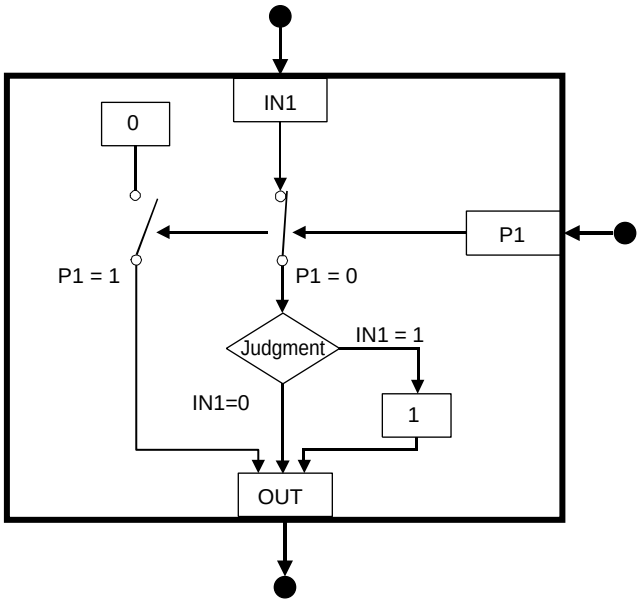
IN1	OUT
0	1
1	0

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

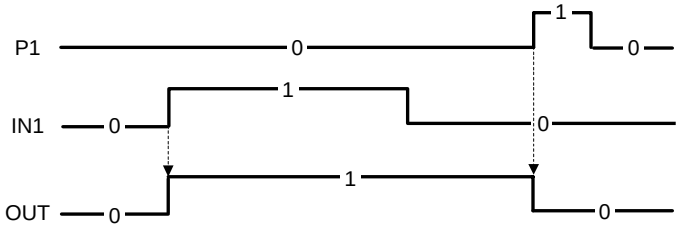
Module No.	18	Category	Logical Operation
Module Name	Latch	Module Code Name	LATCH

Module Input		
IN1	●	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Initialization flag
P2		
P3		
P4		
Module Output		
OUT	●	Latched output
Work Area	4	
Limitation on Usage		

[Computational Expression]
If P1 = 1, then OUT = 0
If P1 = 0, then: OUT = 1 for IN1 = 1
OUT = previous OUT for IN1 = 0



[Explanation]
The module locks the value of IN1 at 1 for output.



[TIP]
P1: Initialization flag (P1 = 1: initialization)

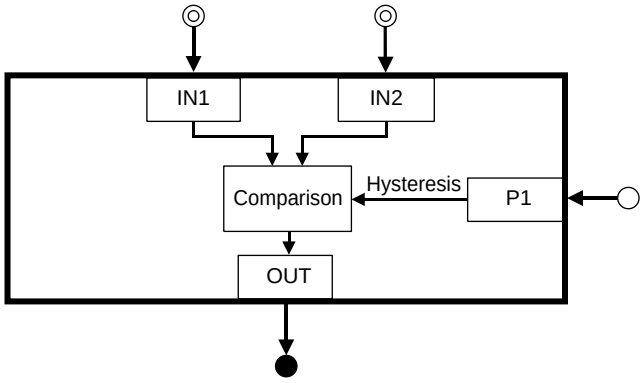
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**19**	Category	Logical Operation
Module Name	Greater-than Logic	Module Code Name	**GT**

Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Hysteresis
P2		
P3		
P4		
Module Output		
OUT	●	Result of comparison
Work Area		1
Limitation on Usage		

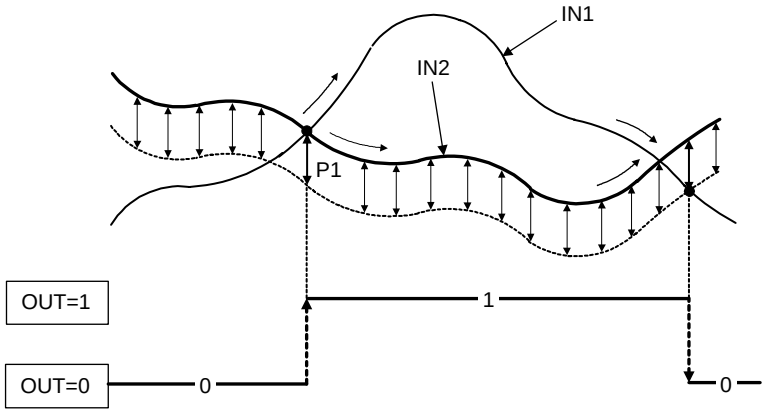
[Computational Expression]

If IN1 ≧ IN2, then OUT = 1; if IN1 < IN2 - P1, then OUT = 0;
if IN2 - P1 ≦ IN1 < IN2, the module retains the previous output.



[Explanation]

The module outputs 1 if IN1 is greater than IN2.
The module outputs 0 if IN1 is less than (IN2 - P1).



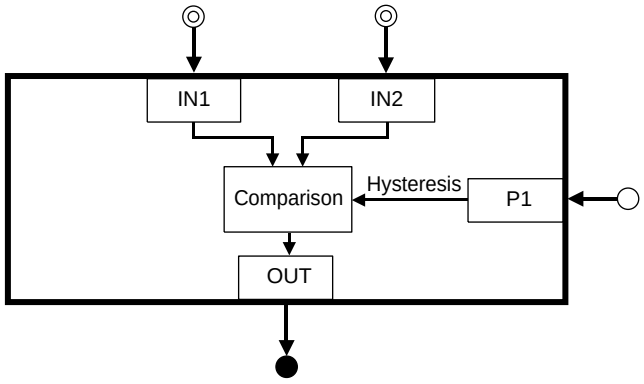
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	20	Category	Logical Operation
Module Name	Less-than Logic	Module Code Name	LT

Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Hysteresis
P2		
P3		
P4		
Module Output		
OUT	●	Result of comparison
Work Area	1	
Limitation on Usage		

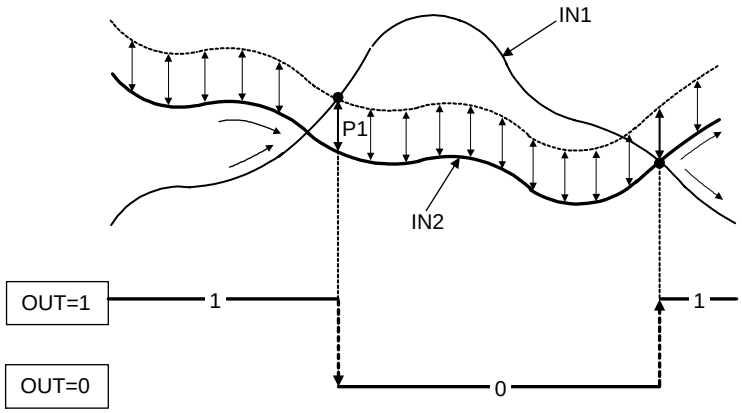
[Computational Expression]

If IN1 ≦ IN2, then OUT = 1; if IN1 > IN2 + P1, then OUT = 0;
if IN2 < IN1 ≦ IN2 + P1, the module retains the previous output



[Explanation]

The module outputs 1 if IN1 is less than IN2.
The module outputs 0 if IN1 is greater than (IN2 + P1).



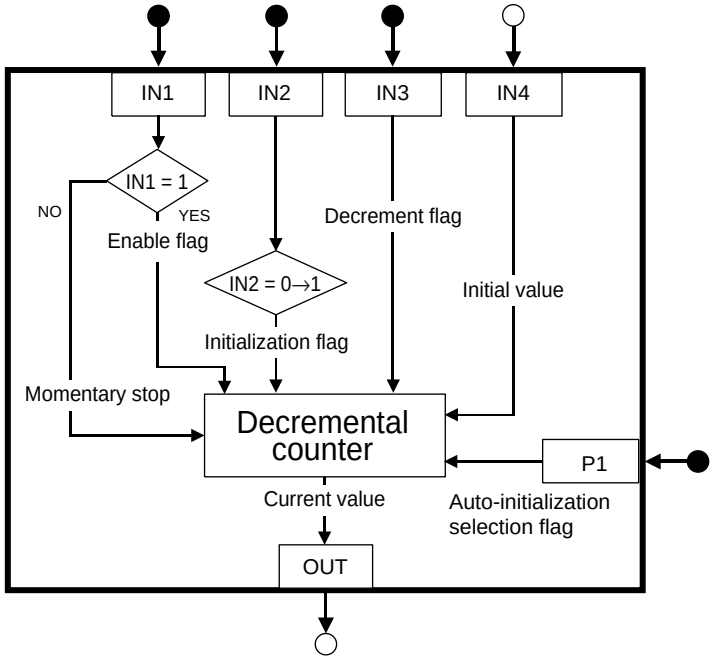
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	21	Category	Logical Operation
Module Name	Decremental Counter	Module Code Name	DCOUNTER

Module Input		
IN1	●	Enable flag
IN2	●	Initialization flag
IN3	●	Decrement flag
IN4	○	Initial value
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Auto-initialization selection flag
P2		
P3		
P4		
Module Output		
OUT	○	Current counter value

Work Area	3
Limitation on Usage	

[Computational Expression]
If IN3 changes (from 0 to 1 or from 1 to 0), then OUT = previous OUT - 1.
Otherwise, OUT = previous OUT.



[Explanation]
The module sets IN4 in the decremental counter if IN2 = 1, where OUT = initial value (irrelevant of the IN1 value).
The output is enabled if IN1 = 1, and the module counts down if IN3 changes (from 0 to 1 or from 1 to 0).
The output is disabled if IN1 = 0 and does not change for as long as IN1 = 0, even if IN3 changes.

If P1 = 0, the decremental counter stops when it reaches 0.
If P1 = 1, the initial value is set in the decremental counter when it reaches 0, resulting in a change in the initialization flag; which allows the counter to resume operation.

[TIP]
IN1: Enable flag (IN1 = 0: Stop counting momentarily; IN1 = 1: Continue counting)
IN2: Initialization flag (IN2 = 0: Do not initialize; IN2 = 1: Initialize the count)

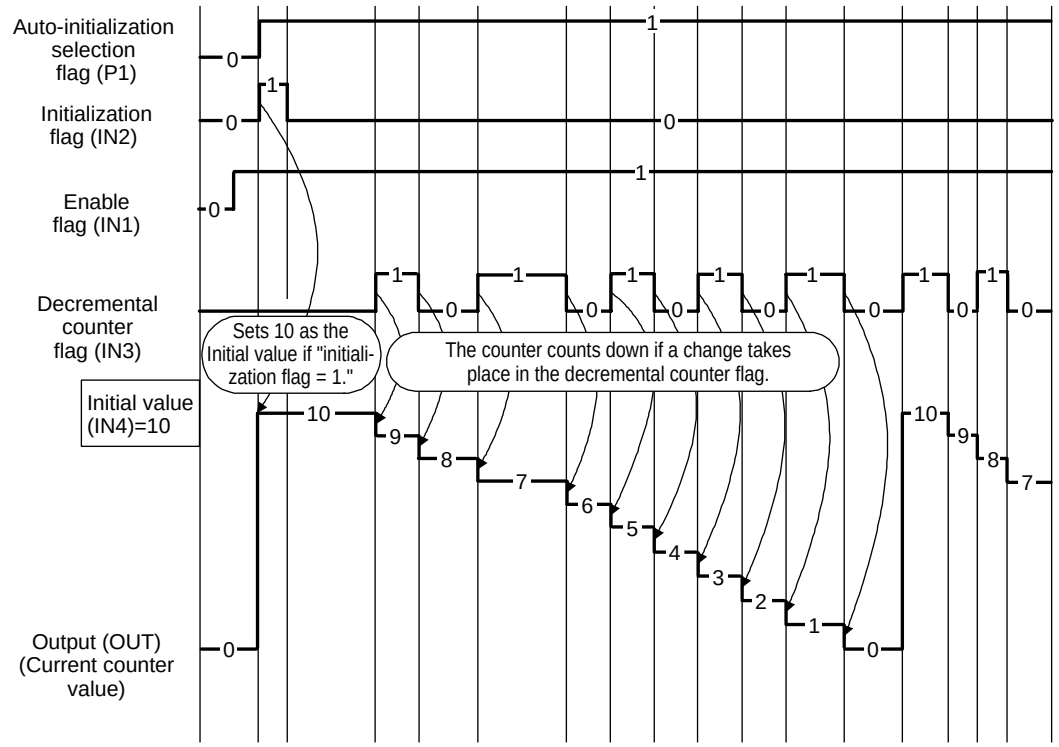
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	21	Category	Logical Operation
Module Name	Decremental Counter	Module Code Name	DCOUNTER

[Example of Use]

• Behavior of the decremental counter when automatic initialization is carried out



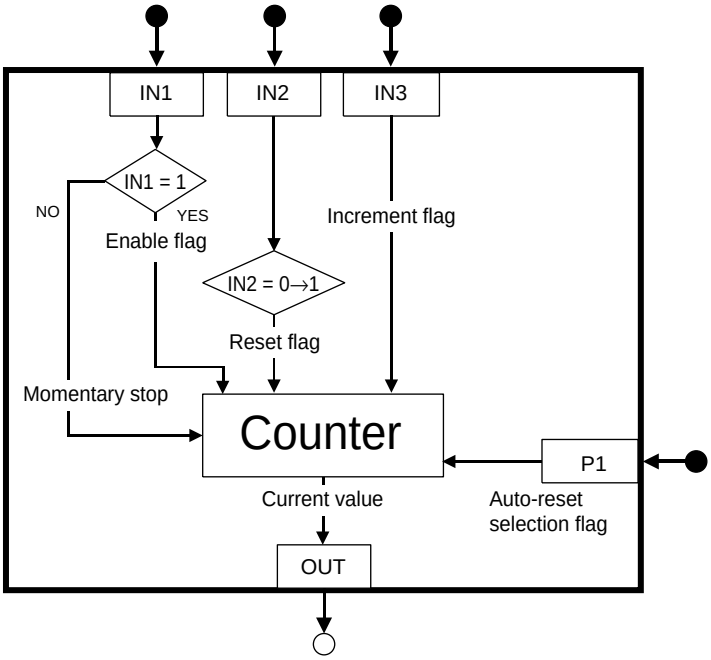
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	22	Category	Logical Operation
Module Name	Counter	Module Code Name	COUNTER

Module Input		
IN1	●	Enable flag
IN2	●	Reset flag
IN3	●	Increment flag
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Auto-reset selection flag
P2		
P3		
P4		
Module Output		
OUT	○	Current counter value

Work Area	3
Limitation on Usage	

[Computational Expression]
If IN3 changes (from 0 to 1 or from 1 to 0), then OUT = previous OUT + 1
Otherwise, OUT = previous OUT



[Explanation]
The module resets the counter if IN2 = 1, where OUT = 0 (irrelevant of the IN1 value).
The output is enabled if IN1 = 1, and the module counts up if IN3 changes.
The output is disabled if IN1 = 0 and does not change for as long as IN1 = 0, even if IN3 changes.

If P1 = 0, the counter stops when it reaches 0FFFFh (65535 in the decimal system).
If P1 = 1, the counter resets to 0 after it reaches 0FFFFh, and resumes counting.

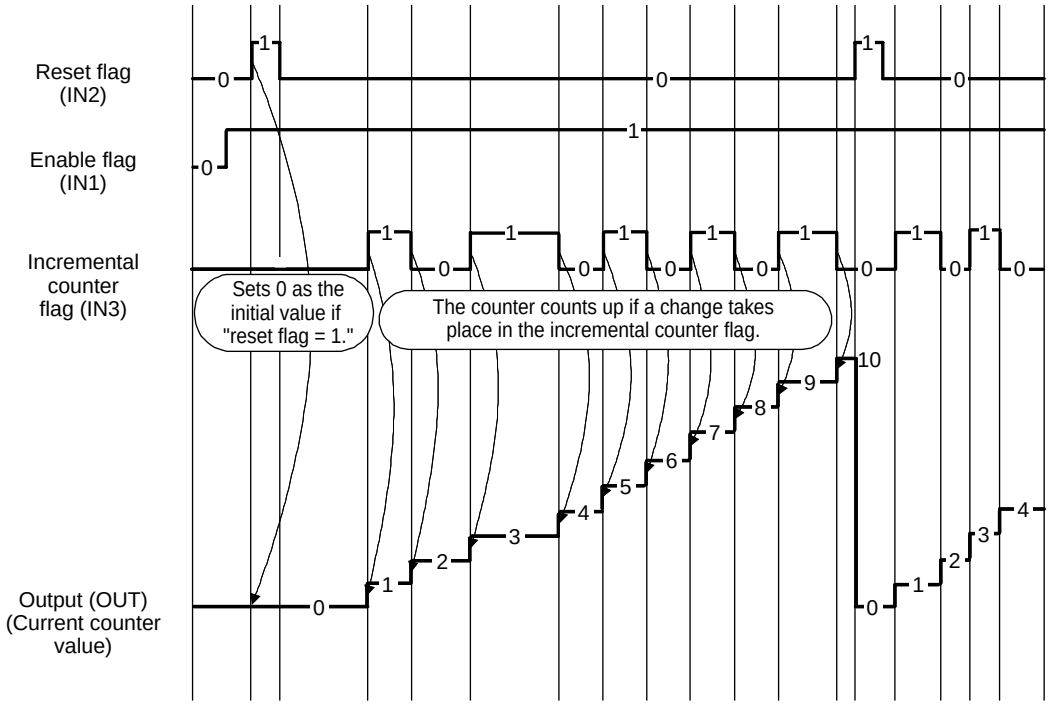
[TIP]
IN1: Enable flag (IN1 = 0: Stop counting momentarily; IN1 = 1: Continue counting)
IN2: Reset flag (IN2 = 0: Do not reset; IN2 = 1: Reset the count)

[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	22	Category	Logical Operation
Module Name	Counter	Module Code Name	COUNTER

[Example of Use]

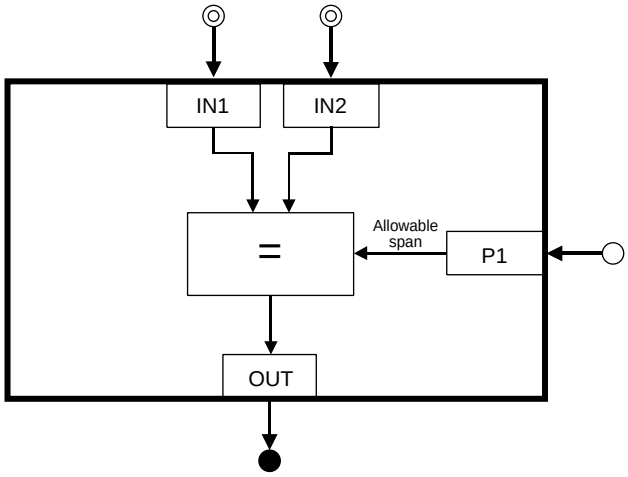


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

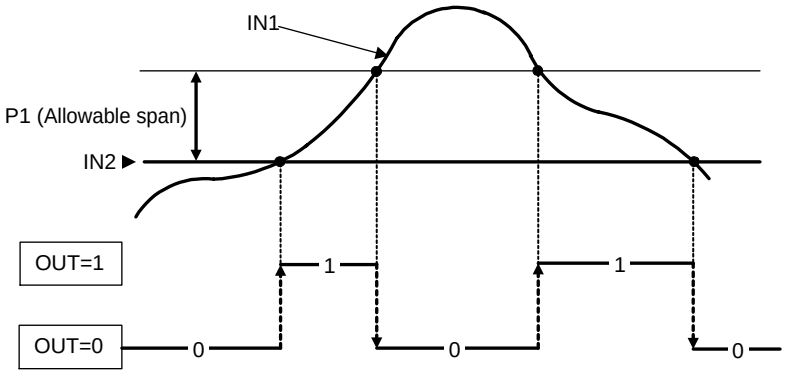
Module No.	23	Category	Logical Operation
Module Name	Equal-to Logic	Module Code Name	EQ

Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Allowable span
P2		
P3		
P4		
Module Output		
OUT	●	Result of comparison
Work Area		
Limitation on Usage		

[Computational Expression]
If IN2 ≦ IN1 ≦ (IN2 + P1), then OUT = 1
Otherwise, OUT = 0



Illustrated Explanation



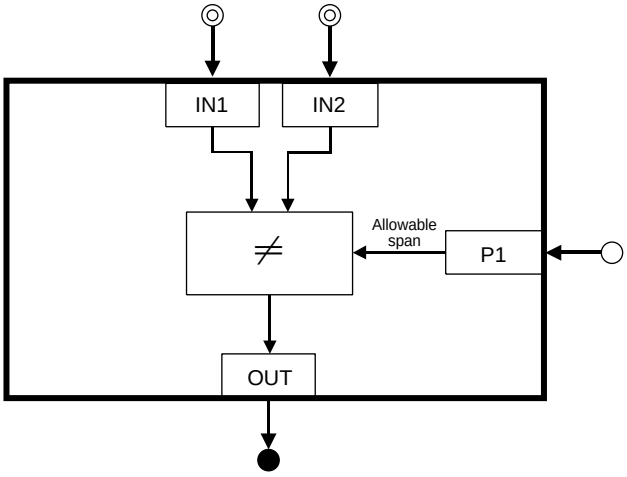
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	24	Category	Logical Operation
Module Name	Not-Equal-to Logic	Module Code Name	NEQ

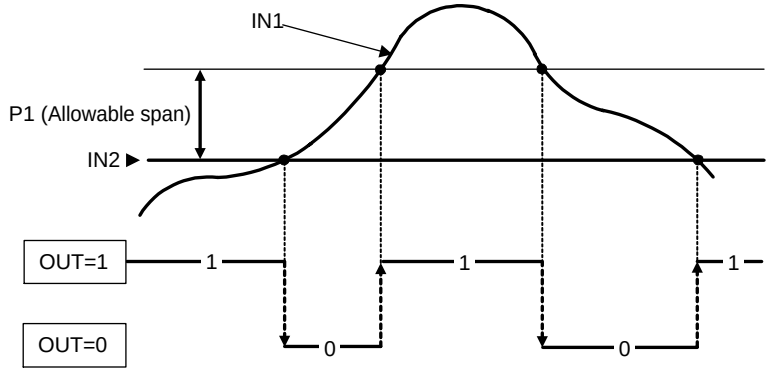
Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Allowable span
P2		
P3		
P4		
Module Output		
OUT	●	Result of comparison
Work Area		
Limitation on Usage		

[Computational Expression]

If IN1 ≦ IN2 or (IN2 + P1) ≦ IN1, then OUT = 1.
Otherwise, OUT = 0



Illustrated Explanation

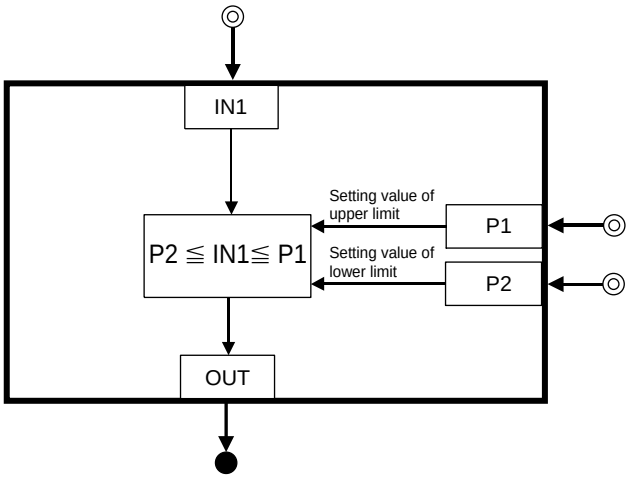


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

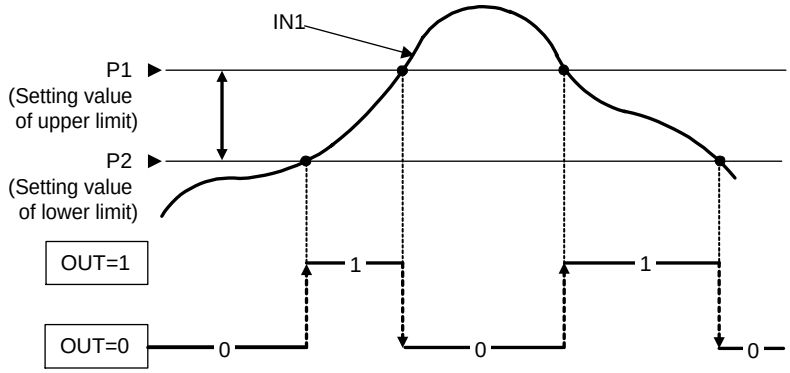
Module No.	25	Category	Logical Operation
Module Name	Range Logic	Module Code Name	RANGE

Module Input		
IN1	◎	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◎	Setting value of upper limit
P2	◎	Setting value of lower limit
P3		
P4		
Module Output		
OUT	●	Result of comparison
Work Area		
Limitation on Usage		

[Computational Expression]
If P2 ≦ IN1 ≦ P1, then OUT = 1
Otherwise, OUT = 0



Illustrated Explanation

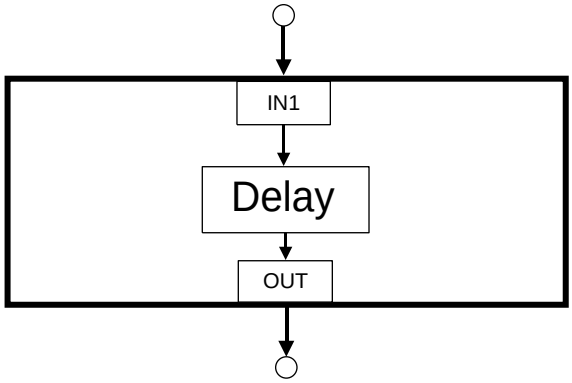


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

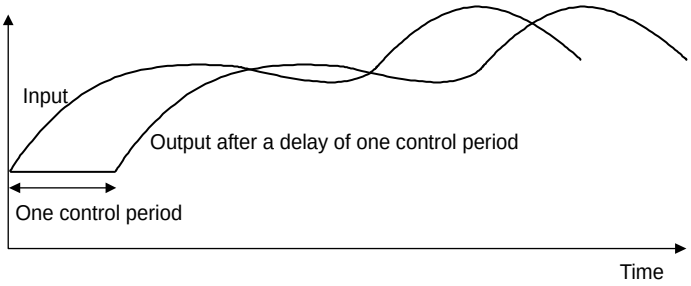
Module No.	26	Category	Logical Operation
Module Name	Delay	Module Code Name	DELAY

Module Input		
IN1	◯	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Delayed output
Work Area	2	
Limitation on Usage		

[Computational Expression]
OUT = previous IN1 (output after a delay of one control period)



[Explanation]
The module outputs the value of IN1 after a delay of one control period.
Use this module to set a delay between specific processes.



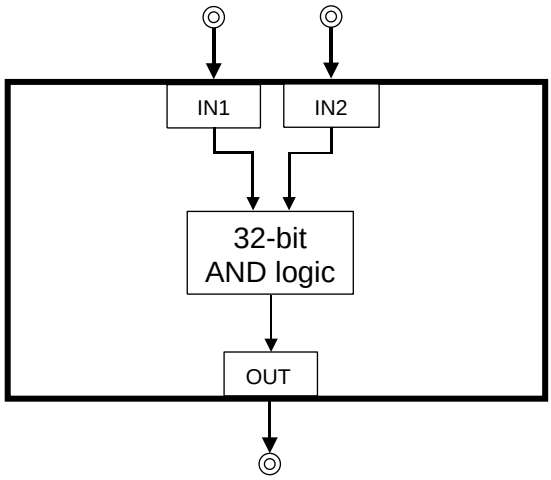
[See Also]
"Control Period" in the US1000 Digital Indicating Controller Functions Manual (IM 5D1A01-02E).

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	27	Category	Logical Operation
Module Name	AND (Long Word) Logic	Module Code Name	ANDW

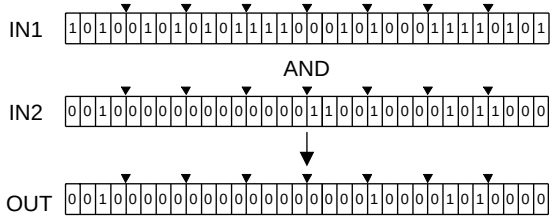
Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	AND (Long-word) logic result
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1∧IN2



[Explanation]
The module outputs the AND logic for IN1 and IN2 in long-word (32-bit) units.

Example of Operation

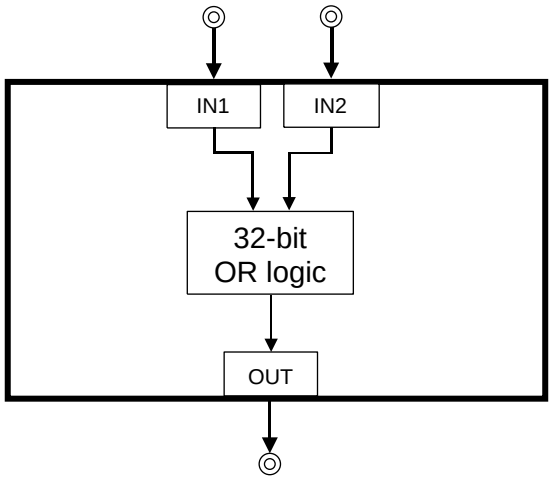


◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	28	Category	Logical Operation
Module Name	OR (Long Word) Logic	Module Code Name	ORW

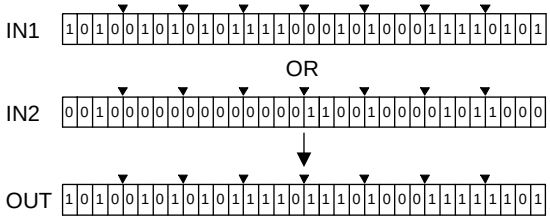
Module Input		
IN1	◎	Input 1
IN2	◎	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◎	OR (Long-word) logic result
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1⋁IN2



[Explanation]
The module outputs the OR logic of IN1 and IN2 in long-word (32-bit) units.

Example of Operation

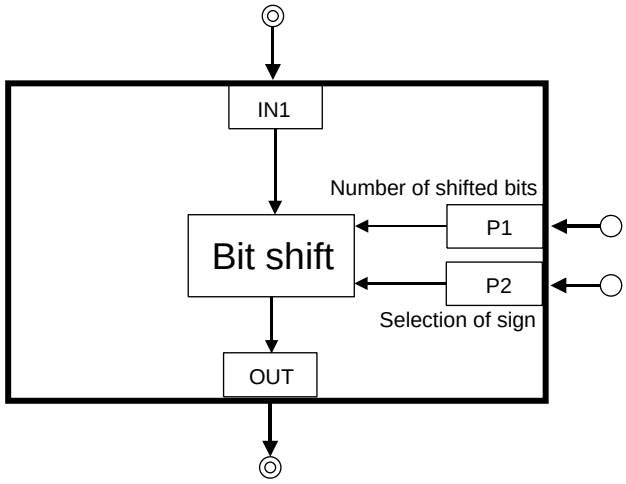


◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	29	Category	Logical Operation
Module Name	Word Shift	Module Code Name	SHIFT

Module Input		
IN1	◎	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Number of bits shifted (-32 to 32)
P2	○	Selection of sign (0, 1)
P3		
P4		
Module Output		
OUT	◎	Result of word shift
Work Area		
Limitation on Usage		

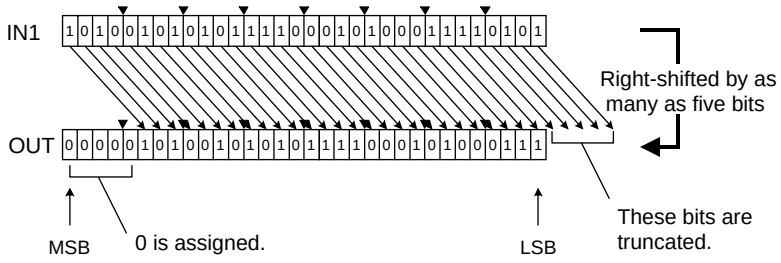
[Explanation]
The module outputs IN1 after shifting as many bits as specified in P1.



If P1 ≠ -32 to 32, no shifting is carried out.
Bits are shifted left if P1 is positive, or shifted right if P1 is negative. In the left-shifting case, 0 is assigned to LSB.
P2 = 0: Unsigned (0 is assigned to the MSB for right-shifting)
P2 ≠ 0: Signed (MSB is assigned to the MSB for right-shifting)

[TIP]
P1: Number of bits shifted (-32 to 32)
P2: Selection of sign (P2 = 0: Unsigned; P2 =1: Signed)

Example of Operation
The figure shows an unsigned IN1 that has been shifted right by as many as five bits.

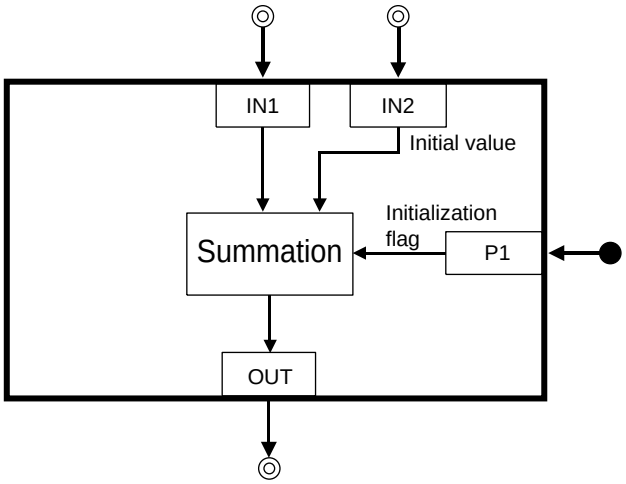


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

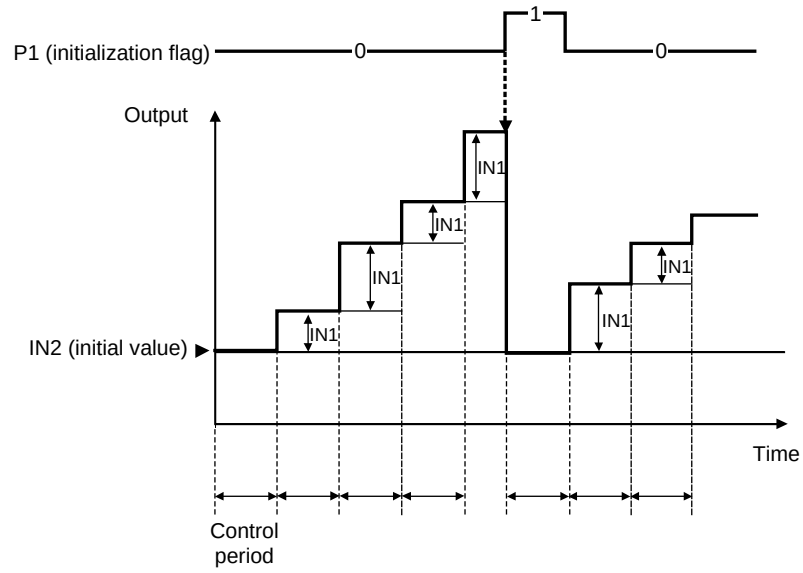
Module No.	30	Category	Special Operation
Module Name	Sum	Module Code Name	SUM

Module Input		
IN1	◎	Input 1
IN2	◎	Initial value
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Initialization flag
P2		
P3		
P4		
Module Output		
OUT	◎	Sum
Work Area	4	
Limitation on Usage		

[Computational Expression]
OUT = previous OUT + IN1



[Explanation]
The module calculates the sum of IN1.
IN1 can be either positive or negative.
If P1 = 1, then OUT = IN2.
The module limits IN1 to the maximum value if it overflows on the positive side.
The module limits IN1 to the minimum value if it overflows on the negative side.



[NOTE]
The value of OUT retains upon power failure.

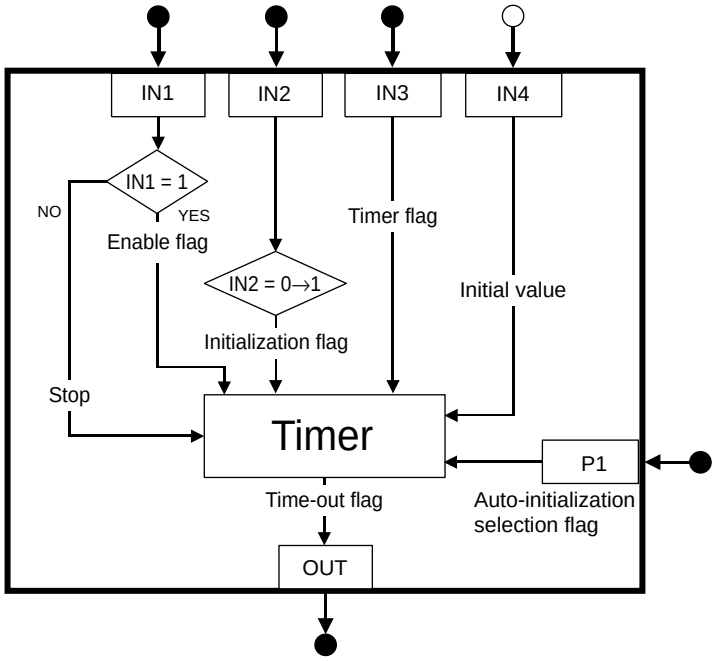
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**31**	Category	Special Operation
Module Name	Timer	Module Code Name	**TIMER**

Module Input		
IN1	●	Enable flag
IN2	●	Initialization flag
IN3	●	Timer flag
IN4	○	Initial value
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Auto-initialization selection flag
P2		
P3		
P4		
Module Output		
OUT	●	Time-out flag

Work Area	4
Limitation on Usage	

[Explanation]
The module sets OUT to 1 if the timer reaches 0. Otherwise, it sets OUT to 0.



If IN1 = 0, the timer stops.
If IN1 = 1, subtract 1 from timer value when IN3 changes (from 0 to 1 or vice versa).
If IN2 = 1, the timer value = IN4 (irrelevant of the IN1 value).

[TIP]
The timer value depends on the basic clock (timer flag) and control period.

[See Also]
"Control Period" in the US1000 Digital Indicating Controller Functions Manual (IM 5D1A01-02E).

If P1 = 0, the timer stops when it reaches the end of operation and OUT is set to 1.
If P1 = 1, the timer is set to the Initial value when the timer reaches the end of operation resulting in a change in the timer flag and OUT is set to 1; thus, the timer resumes operation.

[TIP]
IN1: Enable flag (IN1 = 0: Stop timer operation; IN1 = 1: Continue timer operation)

[NOTE]
The value of OUT retains upon power failure.

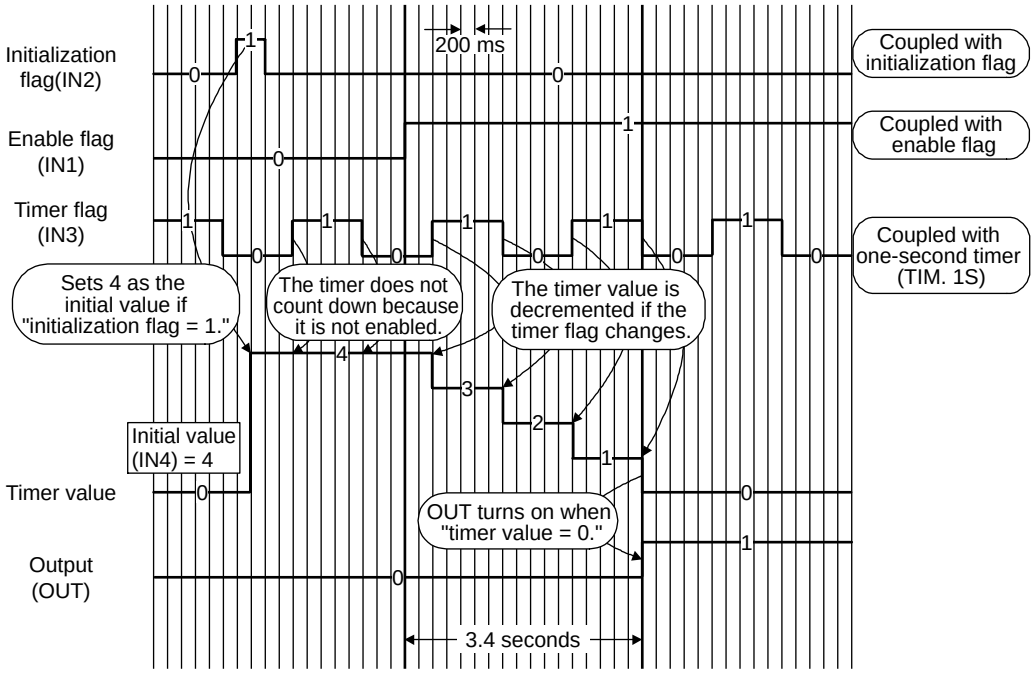
[See Also]
"Timer flag" - Subsection 5.13.2, "Timers".

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	31	Category	Special Operation
Module Name	Timer	Module Code Name	TIMER

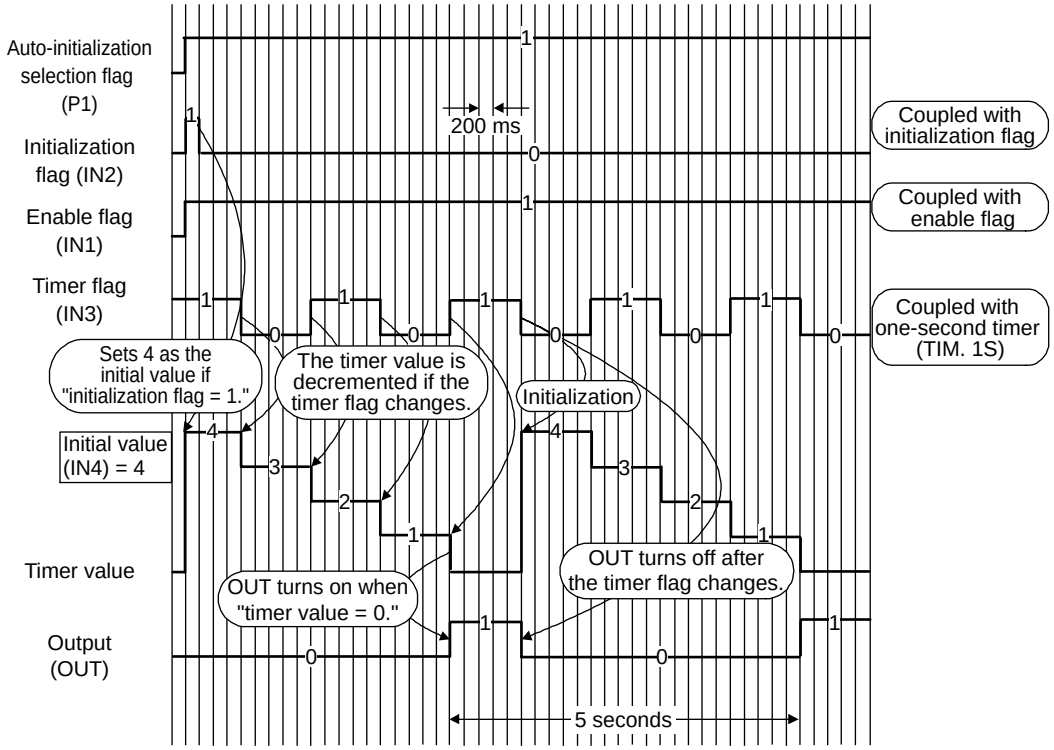
Example of Operation

The following figure shows the timing chart of a 4-second timer.
The timing chart shows an example when the control period is set to 200 ms.
In the example shown, a maximum error of no more than one second will occur since the timer value is decremented at either the rising or falling edge of each clock pulse.



Example of Operation

The following figure shows the timing chart of a fixed-interval 5-second timer that offers automatic initialization.
This timing chart shows an example of when the control period is set to 200 ms.



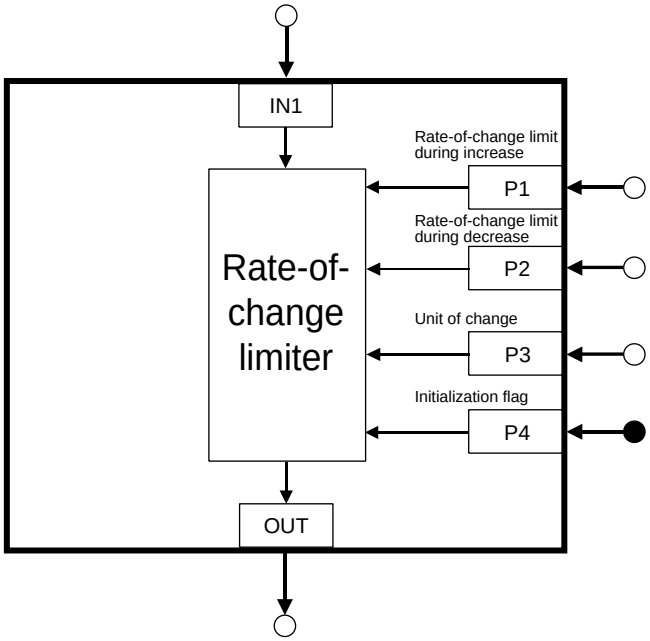
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	32	Category	Special Operation
Module Name	Rate-of-change Limiter	Module Code Name	CHGLMT

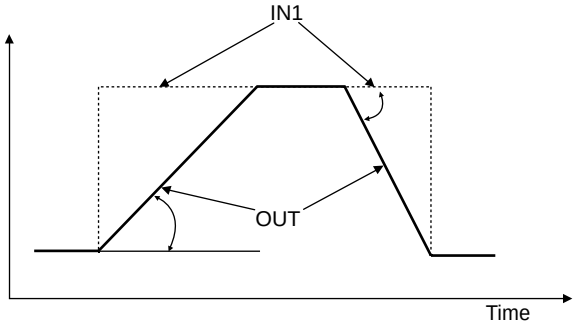
Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Rate-of-change limit during increase
P2	○	Rate-of-change limit during decrease
P3	○	Time unit of rate-of-change limitation
P4	●	Initialization flag
Module Output		
OUT	○	Output with limits

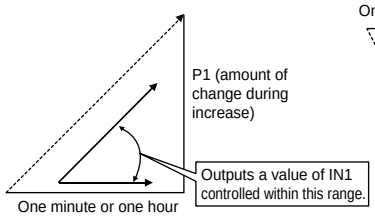
Work Area	6
Limitation on Usage	

[Explanation]
The module outputs a value of IN1 that is limited by P1 and P2 rate-of-change parameters.

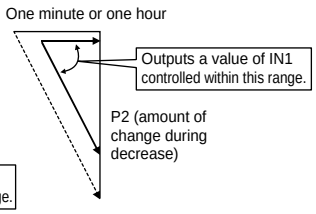


[TIP]
P1: Rate-of-change limit during increase; IN1 is controlled below this level.
P2: Rate-of-change limit during decrease; IN1 is controlled below this level.
P3: Time unit of rate-of-change limitation
P3 = 0: hours
P3 = 1: minutes
P4: Initialization flag
If P4 = 1, the module outputs the IN1 value as is.





During Increase



During Decrease

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	33	Category	Special Operation
Module Name	10-segment Linearizer 1	Module Code Name	PLINE1

Module Input		
IN1	◯	Input of 10-segment linearizer 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output of 10-segment linearizer 1
Work Area		
Limitation on Usage		

[Computational Expression]

• 10-segment linearizer-1 approximation

if IN1 < A_1 then OUT = B_1

if IN1 > A_{11} then OUT = B_{11}

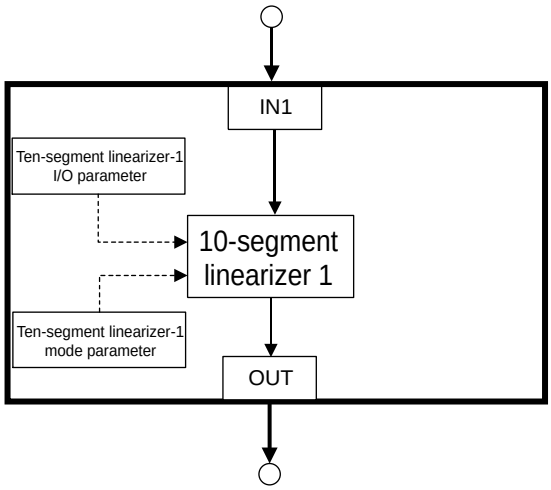
if $A_n \leqq IN1 \leqq A_{n+1}$ then $OUT = B_n + (B_{n+1} - B_n) \times (IN1 - A_n)/(A_{n+1} - A_n)$ where, n = 1 to 10

• 10-segment linearizer-1 biasing

if 1.PMD = 0 then OUT = OUT + IN1

A_n: Value of 10-segment linearizer-1 input parameter

B_n: Value of 10-segment linearizer-1 output parameter



[Explanation]

The module outputs a value of IN1 by linear approximation based on the table of 10-segment linearizer-1 parameters.

1.PMD = 0: 10-segment linearizer-1 biasing

1.PMD = 1: 10-segment linearizer-1 approximation

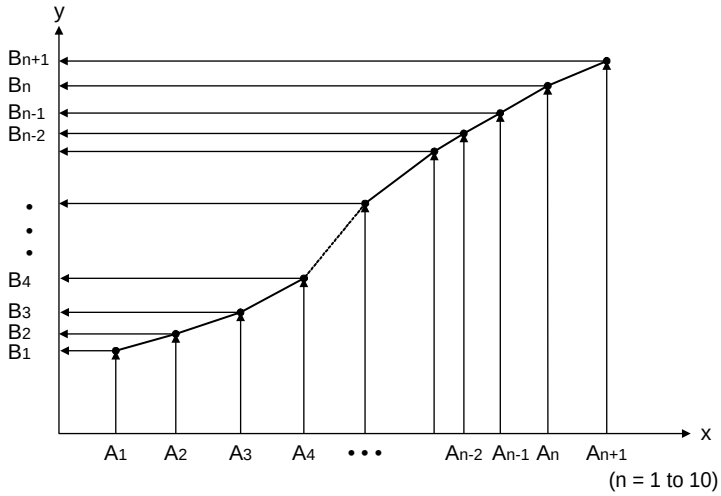
[TIP]

1.PMD refers to the operation parameter.

The following figure is an example of when linear approximation is applied.

[See Also]

"10-segment Linearizer 2—PLINE2 Module (Module No. 34)" for information on 10-segment linearizer-1 biasing



◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**34**	Category	Special Operation
Module Name	10-segment Linearizer 2	Module Code Name	**PLINE2**

Module Input		
IN1	◯	Input of 10-segment linearizer 2
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output of 10-segment linearizer 2
Work Area		
Limitation on Usage		

[Computational Expression]

• 10-segment linearizer-2 approximation

if IN1 < A_1 then OUT = B_1

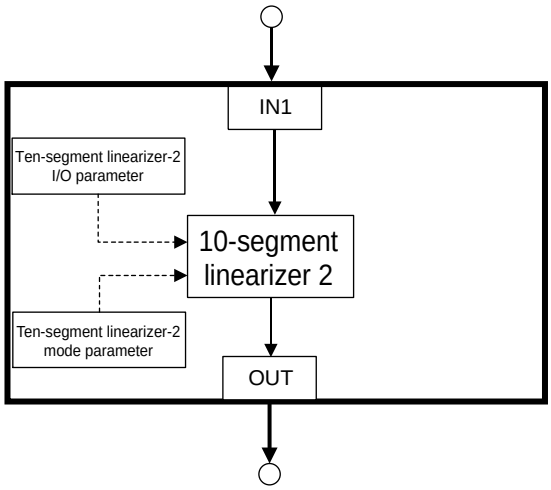
if IN1 > A_{11} then OUT = B_{11}

if $A_n \leqq IN1 \leqq A_{n+1}$ then $OUT = B_n + (B_{n+1} - B_n) \times (IN1 - A_n)/(A_{n+1} - A_n)$ where, n = 1 to 10

• 10-segment linearizer-2 biasing

if 2.PMD = 0 then OUT = OUT + IN1

A_n: Value of 10-segment linearizer-2 input parameter
B_n: Value of 10-segment linearizer-2 output parameter



[Explanation]

The module outputs a value of IN1 by linear approximation based on the table of 10-segment linearizer-2 parameters.

2.PMD = 0: 10-segment linearizer-2 biasing
2.PMD = 1: 10-segment linearizer-2 approximation

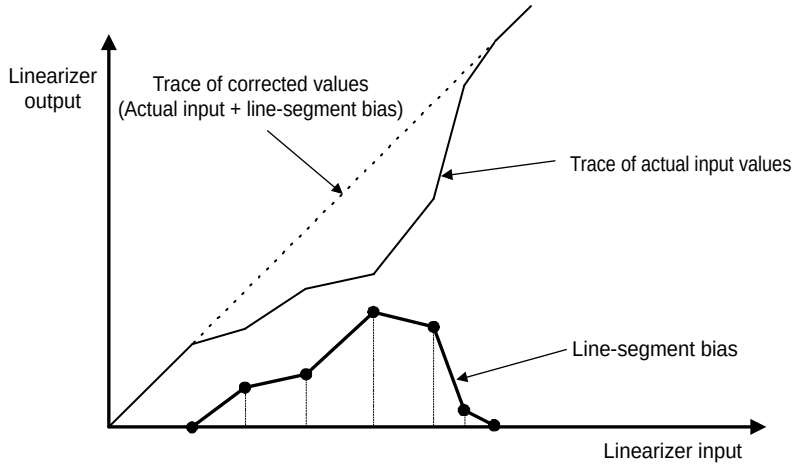
[TIP]

2.PMD refers to the operation parameter.

The following figure is an example of when line-segment biasing is applied.

[See Also]

"10-segment Linearizer 1—PLINE1 Module (Module No. 33)" for information on 10-segment linearizer 2



◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	35	Category	Special Operation
Module Name	Inverse 10-segment Linearizer 1 Approximation	Module Code Name	ILINE1

Module Input		
IN1	○	Input of inverse 10-segment linearizer 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	○	Output of inverse 10-segment linearizer 1
Work Area		
Limitation on Usage		

[Computational Expression]

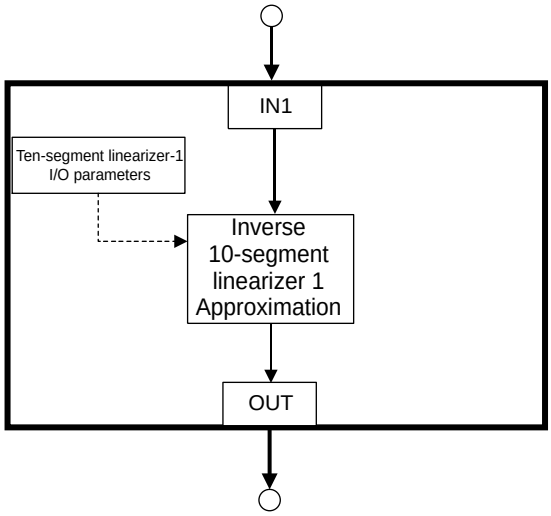
if IN1 < B_1 then OUT = A_1

if IN1 > B_{11} then OUT = A_{11}

if $B_n \leqq$ IN1 $\leqq B_{n+1}$ then OUT = $A_n + (A_{n+1} - A_n) \times (IN1 - B_n)/(B_{n+1} - B_n)$ where, n = 1 to 10

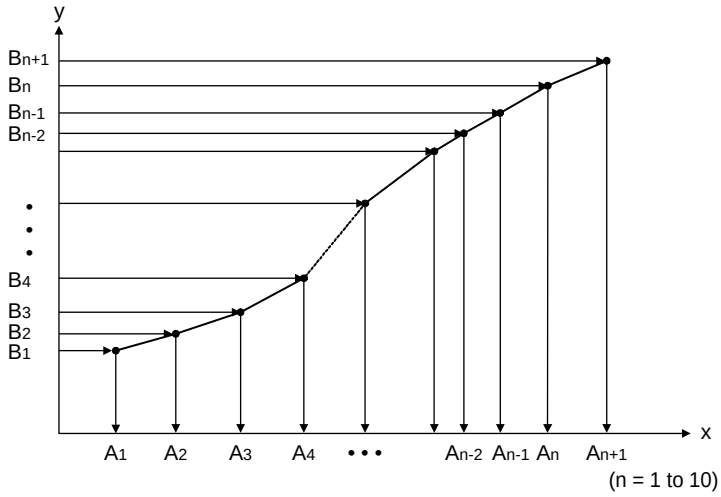
A_n: Value of 10-segment linearizer-1 input parameter

B_n: Value of 10-segment linearizer-1 output parameter



[Explanation]

The module outputs the inverse of the value of 10-segment linearizer 1 (PLINE1).



(n = 1 to 10)

[TIP]

If the line-segment does not represent a monotonically increasing function, the module takes the smaller of the two output values corresponding to the particular input level. In that case, the value may not match the input value of the PLINE1 module.

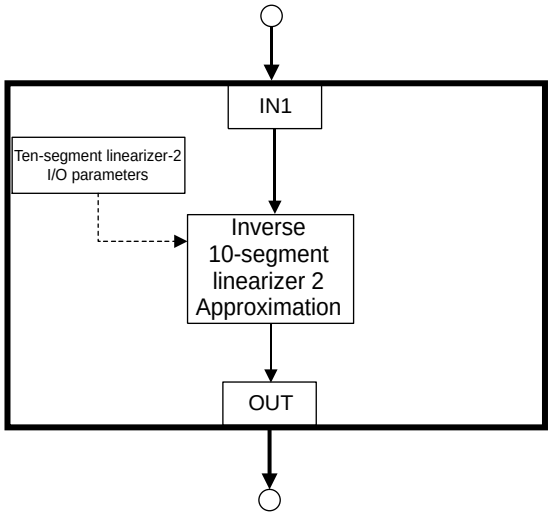
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	36	Category	Special Operation
Module Name	Inverse 10-segment Linearizer 2 Approximation	Module Code Name	ILINE2

Module Input		
IN1	◯	Input of inverse 10-segment linearizer 2
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output of inverse 10-segment linearizer 2
Work Area		
Limitation on Usage		

[Computational Expression]
if IN1 < B_1 then OUT = A_1
if IN1 > B_{11} then OUT = A_{11}
if $B_n \leqq$ IN1 $\leqq B_{n+1}$ then OUT = $A_n + (A_{n+1} - A_n) \times (IN1 - B_n)/(B_{n+1} - B_n)$ where, n = 1 to 10

A_n: Value of 10-segment linearizer-2 input parameter
B_n: Value of 10-segment linearizer-2 output parameter



[Explanation]
The module outputs the inverse of the value of 10-segment linearizer 2 (PLINE2).

[See Also]
Figure of inverse 10-segment linear approximation in "Inverse 10-segment Linearizer 1 Approximation"—ILINE1 Module (Module No. 35)

[TIP]
If the line-segment does not represent a monotonically increasing function, the module takes the smaller of the two output values corresponding to the particular input level. In that case, the value may not match the input value of the PLINE2 module.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	37	Category	Special Operation
Module Name	Curve Linearizer 1 Approximation	Module Code Name	CURVE1

Module Input		
IN1	◯	Input of curve linearizer 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output of curve linearizer 1
Work Area		
Limitation on Usage		

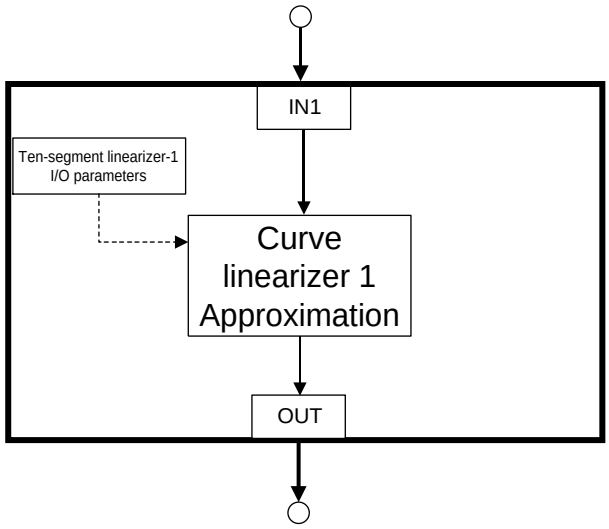
[Computational Expression]

The module approximates the interval between points P_n and P_{n+1} ($X_n < x \leqq X_{n+1}$) by plotting it with four points in all, including an additional two points—one that immediately precedes P_n and the other that immediately follows P_{n+1} (i.e., P_{n-1} to P_{n+2}).

$$y = (((d/X_{n+1} - X_n) - 1) \times ((D_{n+1} - D_{n-1}) /2) + D_n) \times d + Y_n$$

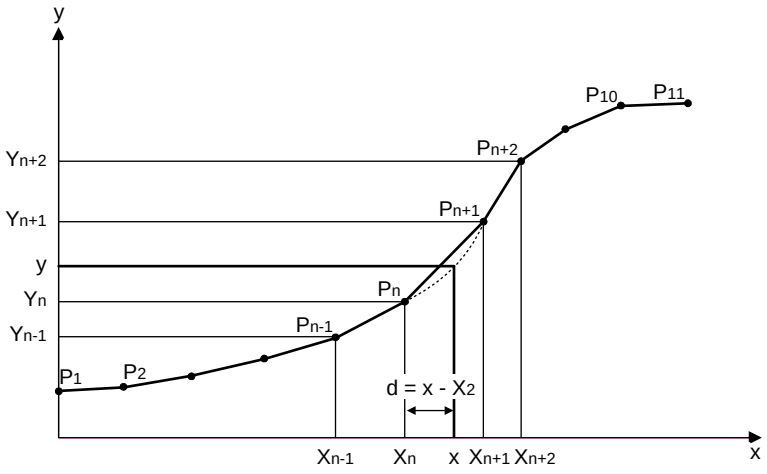
$$d = x - X_n$$
$$D_{n-1} = (Y_n - Y_{n-1})/(X_n - X_{n-1})$$
$$D_n = (Y_{n+1} - Y_n)/(X_{n+1} - X_n)$$
$$D_{n+1} = (Y_{n+2} - Y_{n+1})/(X_{n+2} - X_{n+1})$$

where,
the intervals between P_1 and P_2 and between P_{10} and P_{11} at both ends of the curve are calculated by assuming $D_{n-1} = D_n$ and $D_{n+1} = D_n$, respectively.



[Explanation]

The module outputs the value of IN1 obtained by curvilinear approximation based on the table of 10-segment linearizer-1 parameters.



◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	38	Category	Special Operation
Module Name	Curve Linearizer 2 Approximation	Module Code Name	CURVE2

Module Input		
IN1	◯	Input of curve linearizer 2
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output of curve linearizer 2
Work Area		
Limitation on Usage		

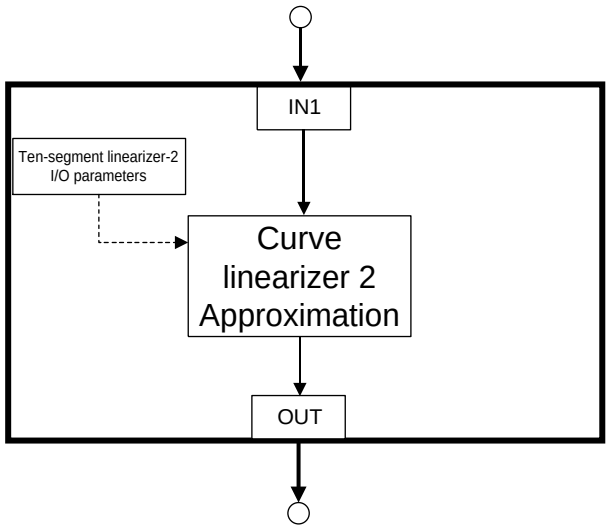
[Computational Expression]

The module approximates the interval between points P_n and P_{n+1} ($X_n < x \leqq X_{n+1}$) by plotting it with four points in all, including an additional two points—one that immediately precedes P_n and the other that immediately follows P_{n+1} (i.e., P_{n-1} to P_{n+2}).

$$y = (((d/X_{n+1} - X_n) - 1) \times ((D_{n+1} - D_{n-1}) /2) + D_n) \times d + Y_n$$

$$d = x - X_n$$
$$D_{n-1} = (Y_n - Y_{n-1})/(X_n - X_{n-1})$$
$$D_n = (Y_{n+1} - Y_n)/(X_{n+1} - X_n)$$
$$D_{n+1} = (Y_{n+2} - Y_{n+1})/(X_{n+2} - X_{n+1})$$

where,
the intervals between P_1 and P_2 and between P_{10} and P_{11} at both ends of the curve are calculated by assuming $D_{n-1} = D_n$ and $D_{n+1} = D_n$, respectively.



[Explanation]

The module outputs the value of IN1 obtained by curvilinear approximation based on the table of 10-segment linearizer-2 parameters.

[See Also]

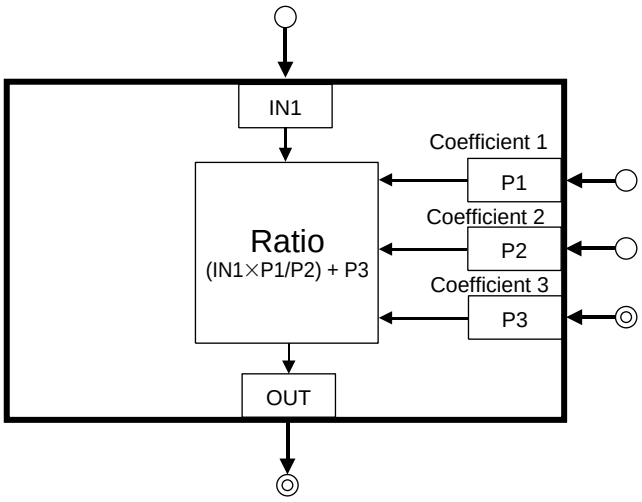
Figure of curvilinear approximation in "Curve Linearizer 1 Approximation"—CURVE1 Module (Module No. 37)

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	39	Category	Special Operation
Module Name	Ratio	Module Code Name	RATIO

Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Coefficient 1
P2	○	Coefficient 2
P3	◎	Coefficient 3
P4		
Module Output		
OUT	◎	Ratio calculation output
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = (IN1×P1/P2) + P3



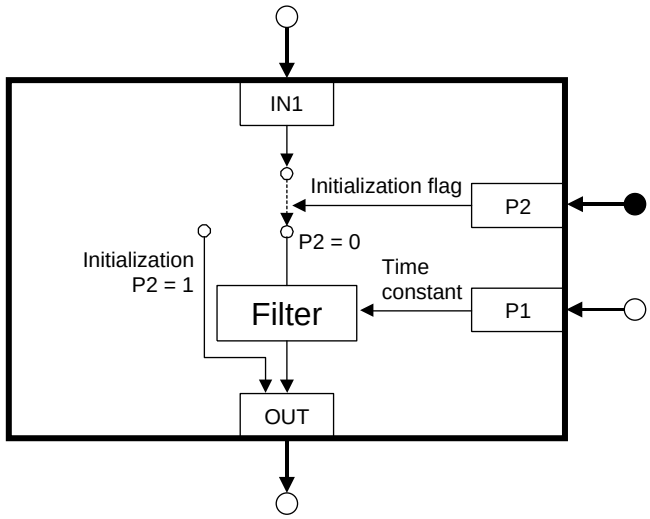
[Explanation]
Divisions, additions and multiplications included in the computational expression comply with the specifications of the division, addition and multiplication modules. (The module outputs the maximum if the result of computation overflows on the positive side, or the minimum if the result overflows on the negative side.)

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

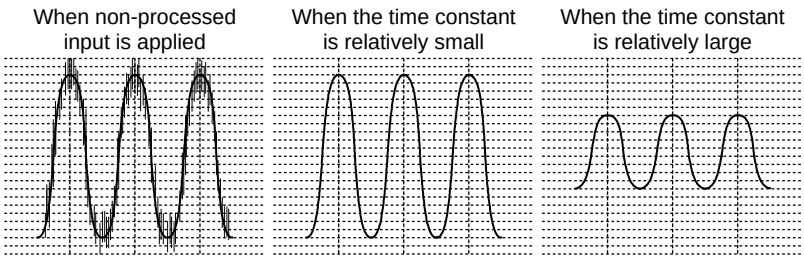
Module No.	40	Category	Special Operation
Module Name	First-order-lag Filter	Module Code Name	FILTER

Module Input		
IN1	◯	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◯	Time constant
P2	●	Initialization flag
P3		
P4		
Module Output		
OUT	◯	First-order-lag output
Work Area		4
Limitation on Usage		

[Computational Expression]
OUT = previous OUT + IN1/(1 + P1)



[Explanation]
If P1 = 0, the filter turns off and OUTn = IN1.
If P1 = 1 to 120 seconds, the module works as a first-order-lag filter.
If P1 ≠ 1 to 120 seconds, the filter turns off and OUTn = IN1.
If P2 = 1, then OUT = IN1.



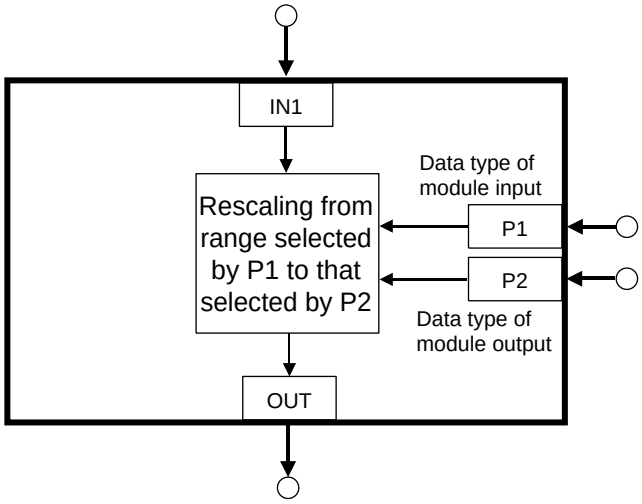
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	41	Category	Special Operation
Module Name	EU Range Conversion	Module Code Name	EUCONV

Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Data type of module input
P2	○	Data type of module output
P3		
P4		
Module Output		
OUT	○	EU range-converted output
Work Area		
Limitation on Usage		

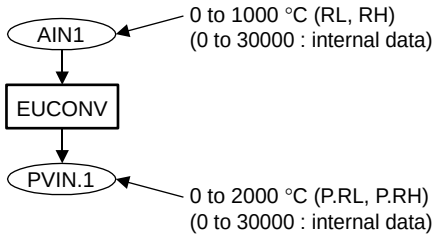
[Explanation]
The module converts the unit of IN1 from the unit of P1 to the unit of P2.



[TIP]
P1: Data type of module input
= 0: AIN1 (SH1, SL1, DP1)
= 1: AIN2 (SH2, SL2, DP2)
= 2: AIN3 (SH3, SL3, DP3)
P2: Data type of module output
= 0: PV1 (P.RH1, P.RL1, P.DP1)
= 1: PV2 (P.RH2, P.RL2, P.DP2)

[TIP]
Setup parameters include SH1 to 3, SL1 to 3, DP1 to 3, P.RH1 and 2, P.RL1 and 2, and P.DP1 and 2.

[Detailed Explanation]
In normal application, the analog input (AIN) undergoes a specific type of computational process as necessary, while coupled with the process variable input (PVIN).
Assume that AIN1 is coupled with PVIN.1, and each pair of maximum and minimum values for these inputs is set to RH1 and RL1 (or SH1 and SL1 if the input is DC voltage), and P.RH1 and P.RL1. If both of these pairs are set to the same range, the EUCONV module need not be used. If their ranges differ, the EUCONV module is placed between AIN1 and PVIN.1 so that conversion is carried out between the two different ranges in order to match the types of data.
For example, assume that RH1 = 1000 °C and RL1 = 0 °C, and P.RH1 = 2000 °C and P.RL1 = 0 °C. A signal input to AIN1 as 1000 °C is regarded as 2000 °C at PVIN.1 if the EUCONV module is absent, resulting in incorrect processing. If the EUCONV module is set in place, conversion is carried out so the signal is regarded as 1000 °C at PVIN.1. To understand this more clearly, the process is explained using specific values of internal data.
For AIN1 or PVIN.1, the module internally has a pair of upper and lower limits for the given range, and of which are set in whole numbers, e.g., (30000, 0). In the example discussed above, the data value of 1000 °C, which is the upper limit of AIN1's span, is handled as 30000 internally. In order for this value to be regarded as 1000 °C when AIN1 is coupled with PVIN.1, it must be converted to 15000. (Since the value "30000" is regarded as 2000 °C at PVIN.1, the value "15000" is equivalent to 1000 °C.) This process is carried out by the EUCONV module in actual applications.



◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	42	Category	Special Operation
Module Name	Switching Between Two Inputs	Module Code Name	SELECT2

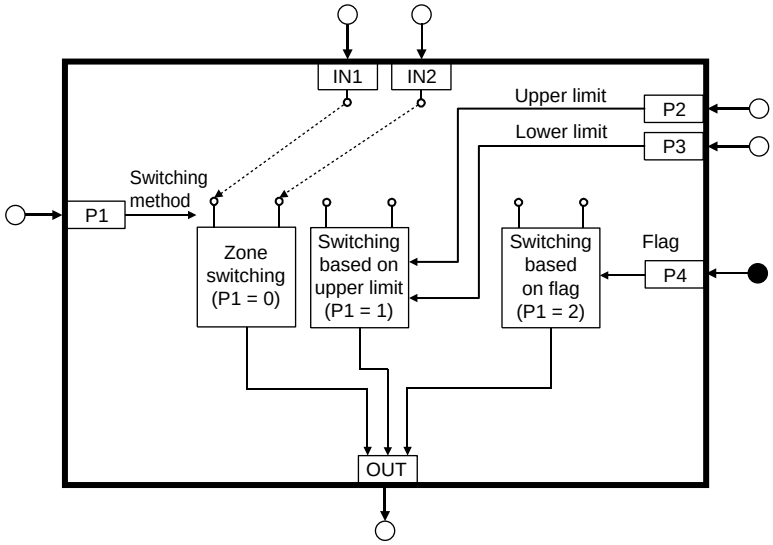
Module Input		
IN1	○	Input 1
IN2	○	Input 2
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Switching method
P2	○	Upper limit for switching
P3	○	Lower limit for switching
P4	●	Switching flag
Module Output		
OUT	○	Output based on switched inputs
Work Area		2
Limitation on Usage		

[Computational Expression and Explanation]
The module calculates equations comprising IN1 and/or IN2 according to the given switching method, and then outputs the result.

P1 = 0 (zone switching):
If IN1 ≦ P3, then OUTn = IN1,
If P2 ≦ IN1, then OUTn = IN2,
If P3 < IN1 < P2, then OUTn = (1 - x)×IN1 + (x)×IN2,
where, x = (IN1 - P3)/(P2 - OUT_{n-1}).

P1 = 1 (switching based on upper limit):
If IN1 ≧ P2, then OUTn = IN2,
If IN1 < P2 - 150, then OUT = IN1.
The module turns on the internal tracking flag when the input is switched.

P1 = 2 (switching based on flag):
If P4 = 0, then OUT = IN1,
If P4 = 1, then OUT = IN2.
The module turns on the internal tracking flag when the input is switched.



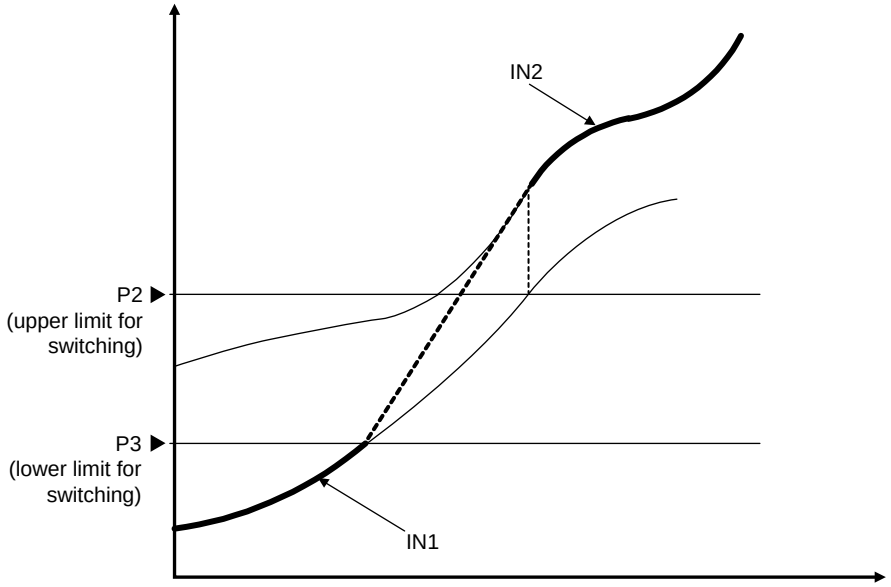
[NOTE]
The internal tracking flag is referenced by the control and computation unit so that the output does not bump during switching. If tracking is performed on PV1 however, the output bumps when a switch is made using an external contact.

[TIP]
The SELECT2 module is used when the controller mode (US mode) is loop control with PV switching (US mode 6) or loop control with PV switching and two universal inputs (US mode 14).

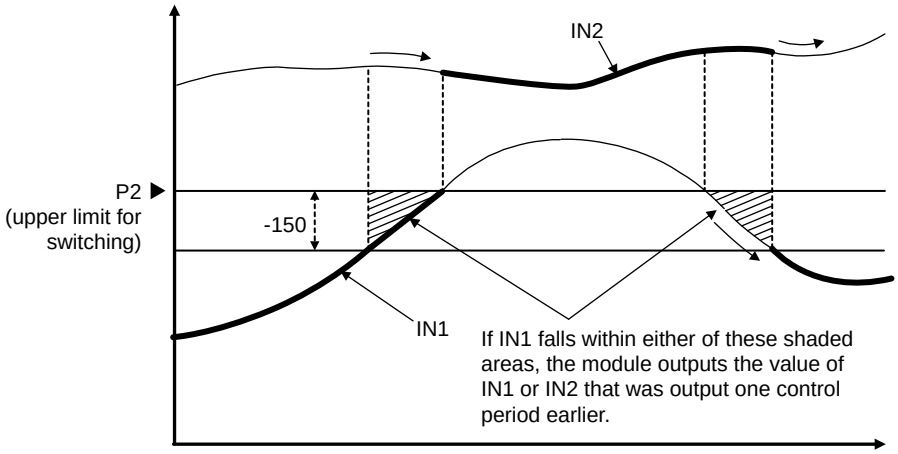
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	42	Category	Special Operation
Module Name	Switching Between Two Inputs	Module Code Name	SELECT2

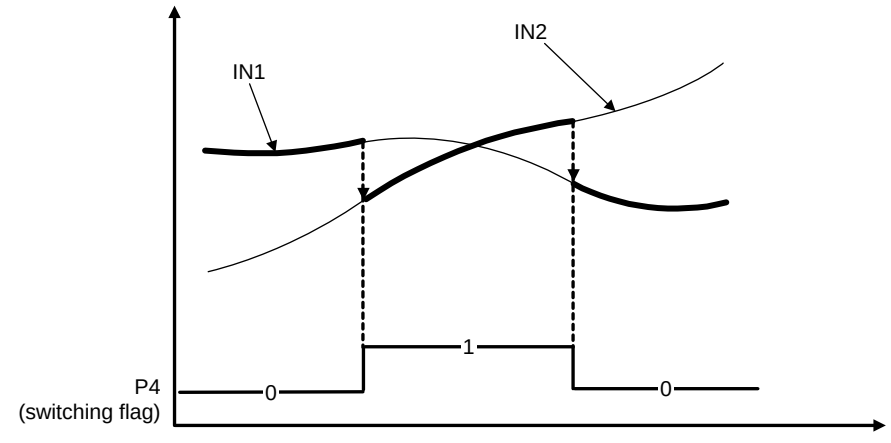
• Zone Switching



• Switching Based on Upper Limit



• Switching Based on Flag



◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	43	Category	Special Operation
Module Name	Temperature and Humidity Calculation	Module Code Name	TMPHUM

Module Input		
IN1	○	Dry-bulb temperature
IN2	○	Wet-bulb temperature
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Data type of IN1
P2	○	Data type of IN2
P3	○	Data type of OUT
P4		
Module Output		
OUT	○	Calculated relative humidity
Work Area		
Limitation on Usage		1

[Computational Expression]

Relative humidity = 1/ed×(ew - 0.5×P×(Td - Tw)/755)

where,

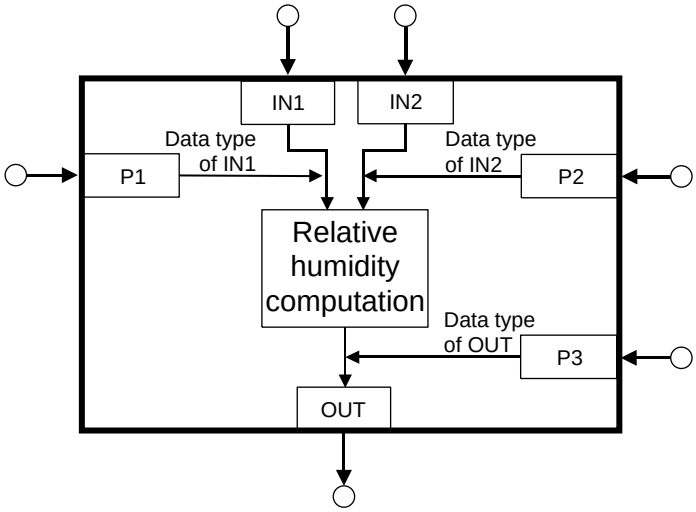
ed = saturation vapor pressure (hPa) at dry-bulb temperature, which is calculated from Td

ew = saturation vapor pressure (hPa) at wet-bulb temperature, which is calculated from Tw

Td = dry-bulb temperature (°C)

Tw = wet-bulb temperature (°C)

P = atmospheric pressure (1013.25 hPa)



[Explanation]

The module determines the relative humidity from the dry- and wet-bulb temperatures and outputs it.

Data range of OUT: 0.0 to 100.0 %RH

The modules adjust the range to that specified by the type of output data (P3).

Example: If the range specified is 0.0 to 100.0, the range remains as is.

If the range specified is 0.0 to 200.0, it is adjusted to the range from 0.0 to 100.0.

Computation accuracy: ±0.31 %RH

Computing is possible only if Td and Tw are in the range from 0 °C to 100 °C and Td > Tw.

If Td or Tw < 0 °C or if the resulting value of computation is negative, the relative humidity is 0 %RH.

If Td or Tw > 100 °C and Td < Tw, the relative humidity is 100 %RH.

The saturation vapor pressure complies with the JIS Z8806-1981 standard.

[TIP]

P1: data type of IN1
- = 0: AIN1
- = 1: AIN2
- = 2: AIN3

P2: data type of IN2
- = 0: AIN1
- = 1: AIN2
- = 2: AIN3

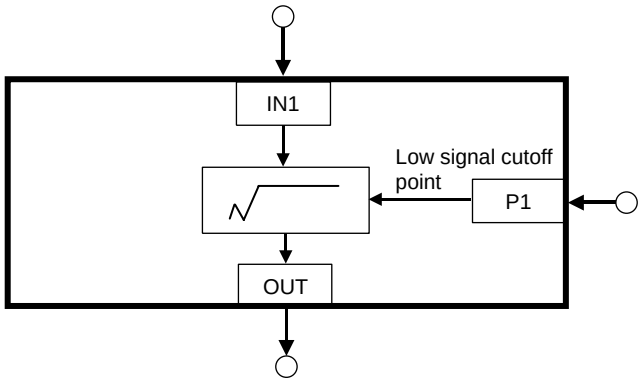
P3: data type of OUT
- = 0: PV1
- = 1: PV2

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	44	Category	Special Operation
Module Name	Square Root Extraction	Module Code Name	SQR

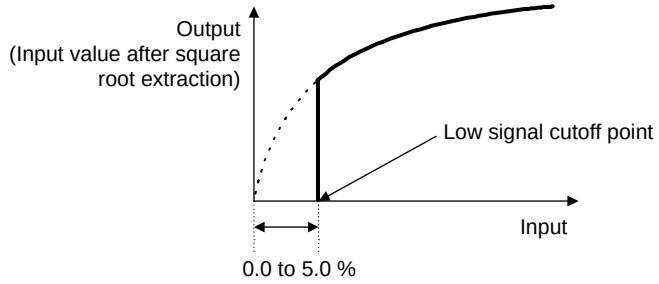
Module Input		
IN1	◯	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◯	Low signal cutoff point
P2		
P3		
P4		
Module Output		
OUT	◯	Result of square-root extraction
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = $\sqrt{}$ (IN1), where a low signal cutoff based on P1 is applied



[Explanation]
The module replaces a value on the 0 to 30000 scale with a value on the 0 to 1 scale in order to extract the square root of that value. It then converts the result back to a value on the 0 to 30000 scale for output.
Example: The square root of 30000 results in the value 30000.
The square root of 15000 results in the value 21213.

If IN1 < P1, then OUT = 0 (low signal cutoff)
If IN1 ≦ 0, then OUT = 0



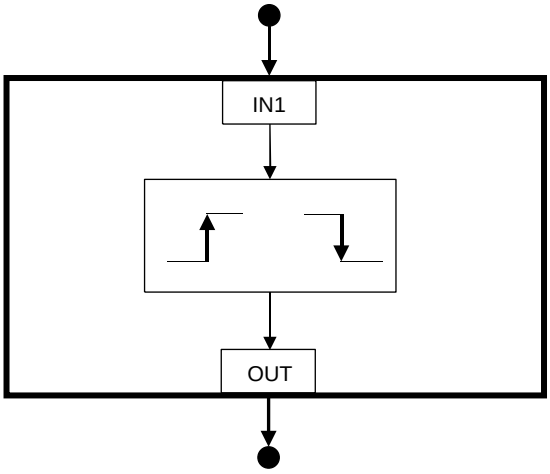
[TIP]
Use the SQR2 module (Module No. 73) when the output below the low signal cutoff point needs to be linearized.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

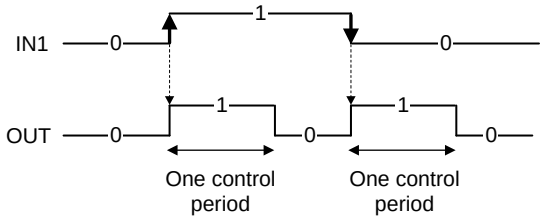
Module No.	45	Category	Special Operation
Module Name	Detection of Change	Module Code Name	CHGDET

Module Input		
IN1	●	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	●	Result of detection
Work Area		1
Limitation on Usage		

[Computational Expression and Explanation]
If IN1 changes (from 0 to 1 or vice versa), OUT = 1 for one control period.



This module is used to generate timing signals for processing.



◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	46	Category	Special Operation
Module Name	Loop-1 Output-Selection 1	Module Code Name	OUTSEL1

Module Input		
IN1	◯	Input 1 (MV.1)
IN2	◯	Input 2 (HMV.1)
IN3	◯	Input 3 (CMV.1)
IN4	◯	Input 4 (RET1)
IN5	◯	Input 5 (RET2)
IN6	◯	Input 6 (ALO13)
IN7	◯	Input 7 (ALO14)
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	OUT1R
Work Area		
Limitation on Usage	1	

NOTE

It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

[Explanation]

The module allocates the loop-1 manipulated output.

Always use this module together with the OUTSEL11, 12 and 13 modules.

The figure below shows a block diagram of the output side of single-loop control (US mode 1).

OUT : This module uses either an on-off output or a time-proportional relay contact output.

[TIP]

The module allocates the manipulated output, as shown below, according to information in the MVS1 setup parameter (MV1 selection). For cascade-based control, however, MVS2 is used.

[See Also]

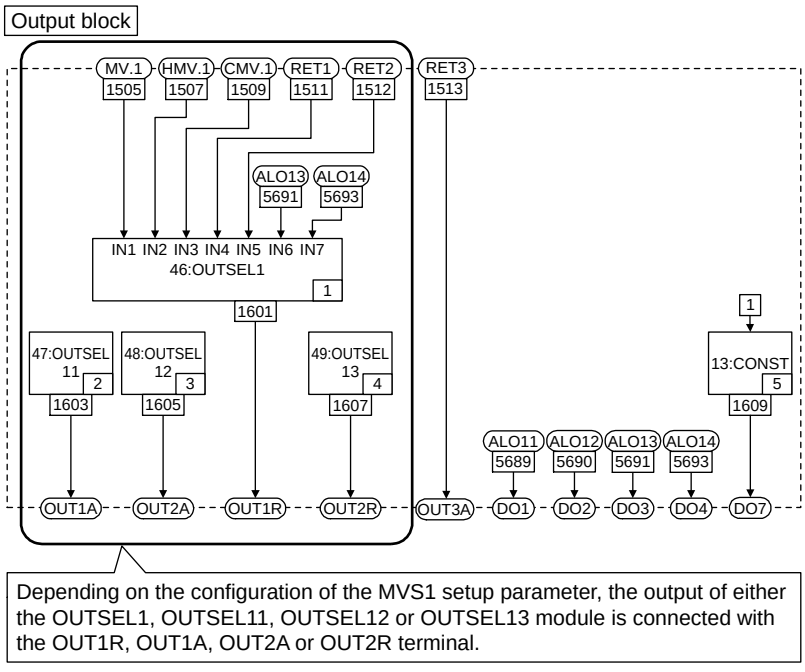
MVS1 Selection and MVS2 Selection in the US1000 Digital Indicating Controller Functions Manual (IM 5D1A01-02E).

OUT1R : Either a relay contact output, heating relay contact output, or alarm 4 output is provided by the OUTSEL1 module.
Besides the OUT1R terminal, the other terminals available for connection are OUT2R or DO1 to DO7.

OUT1A : Either a current output, voltage pulse output, heating voltage pulse output, heating current output, or retransmission output 1 (RET1) is provided by the OUTSEL11 module.
Besides the OUT1A terminal, the other terminal available for connection is OUT2A.
See Also
"Loop-1 Output-Selection 11"—OUTSEL11 Module (Module No. 47).

OUT2R : Either a cooling relay contact output or alarm 3 output is provided by the OUTSEL13 module.
Besides the OUT2R terminal, the other terminals available for connection are OUT1R or DO1 to DO7.
See Also
"Loop-1 Output-Selection 13"—OUTSEL13 Module (Module No. 49).

OUT2A : Either a cooling current output or retransmission output 2 (RET2) is provided by the OUTSEL12 module.
Besides the OUT2A terminal, the other terminal available for connection is OUT1A.
See Also
"Loop-1 Output-Selection 12"—OUTSEL12 Module (Module No. 48).



Depending on the configuration of the MVS1 setup parameter, the output of either the OUTSEL1, OUTSEL11, OUTSEL12 or OUTSEL13 module is connected with the OUT1R, OUT1A, OUT2A or OUT2R terminal.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**47**	Category	Special Operation
Module Name	Loop-1 Output-Selection 11	Module Code Name	**OUTSEL11**

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output (OUT1A)
Work Area		
Limitation on Usage	1	

[Explanation]
The module provides the output allocated by the OUTSEL1 module for the OUT1A terminal.
Always use this module together with the OUTSEL1 module.

OUT : This module uses either current output or voltage pulse output.

NOTE

It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**48**	Category	Special Operation
Module Name	Loop-1 Output-Selection 12	Module Code Name	**OUTSEL12**

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output (OUT2A)
Work Area		
Limitation on Usage	1	

[Explanation]
The module provides the output allocated by the OUTSEL1 module for the OUT2A terminal.
Always use this module together with the OUTSEL1 module.

OUT : This module uses either current output or voltage pulse output.

[NOTE]
This module cannot be used if the controller is set for dual-loop control.

NOTE

It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**49**	Category	Special Operation
Module Name	Loop-1 Output-Selection 13	Module Code Name	**OUTSEL13**

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output (OUT2R)
Work Area		
Limitation on Usage	1	

[Explanation]
The module provides the output allocated by the OUTSEL1 module for the OUT2R terminal.
Always use this module together with the OUTSEL1 module.

OUT : This module uses either an on-off output or a time-proportional relay output.

[NOTE]
This module cannot be used if the controller is set for dual-loop control.

NOTE

It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**51**	Category	Special Operation
Module Name	Loop-2 Output-Selection 2	Module Code Name	**OUTSEL2**

Module Input		
IN1	◯	Input 1 (MV.2)
IN2	◯	Input 2 (HMV.2)
IN3	◯	Input 3 (CMV.2)
IN4	◯	Input 4 (RET2)
IN5	◯	Input 5 (ALO24)
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output (OUT2R)
Work Area		
Limitation on Usage	1	

NOTE

It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

[Explanation]

The module allocates the loop-2 manipulated output.
Always use this module together with the OUTSEL21 module.

[NOTE]

This module can be used only if the controller is set for dual-loop control.

The figure below shows a block diagram of the output side of dual-loop control (US mode 11).
OUT : This module uses either an on-off output or time-proportional relay contact output.

[TIP]

The module allocates the manipulated output, as shown below, according to information in the MVS2 setup parameter (MV2 selection).
For cascade-based control, MVS2 is used.

[See Also]

MVS2 Selection in the US1000 Digital Indicating Controller Functions Manual (IM 5D1A01-02E).

OUT2R : Either a relay contact output or cooling relay contact output is provided by the OUTSEL12 module.
Besides the OUT2R terminal, the other terminals available for connection are OUT1R or DO1 to DO7.

OUT2A : Either a current output, voltage pulse output, heating current output, heating voltage pulse output or retransmission output 2 (RET2) is provided by the OUTSEL21 module.
Besides the OUT2A terminal, the other terminal available for connection is OUT1A.
See Also
"Loop-2 Output-Selection 21"—OUTSEL21 Module (Module No. 52)

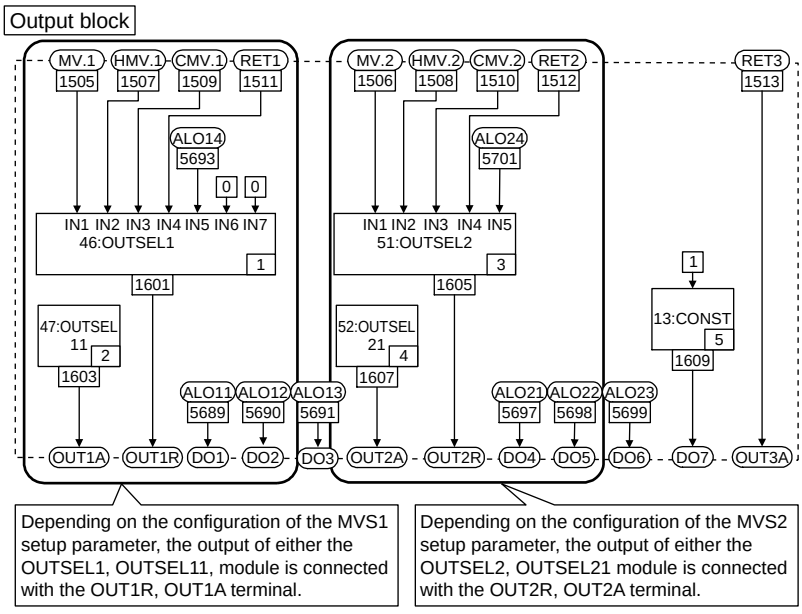
In the case of the loop-1 manipulated output, the module allocates it according to the MVS1 setup parameter (MV1 selection) , as shown below.

[See Also]

MVS1 Selection in the US1000 Digital Indicating Controller Functions Manual (IM 5D1A01-02E).

OUT1R : Either a relay contact output, cooling relay contact output, or alarm 4 output is provided by the OUTSEL1 module.
Besides the OUT1R terminal, the other terminals available for connection are OUT2R or DO1 to DO7.

OUT1A : Either a current output, voltage pulse output, heating voltage pulse output, heating current output, cooling voltage pulse output, cooling current output or retransmission output 1 (RET1) is provided by the OUTSEL11 module.
Besides the OUT1A terminal, the other terminal available for connection is OUT2A.
See Also
"Loop-1 Output-Selection 11"—OUTSEL11 Module (Module No. 47)



◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	52	Category	Special Operation
Module Name	Loop-2 Output-Selection 21	Module Code Name	OUTSEL21

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	◯	Output (OUT2A)
Work Area		
Limitation on Usage	1	

[Explanation]
The module provides the output allocated by the OUTSEL2 module for the OUT2A terminal.
Always use this module together with the OUTSEL2 module.

OUT : This module uses either current output or voltage pulse output.

[NOTE]
This module can be used if the controller is set for dual-loop control.

NOTE

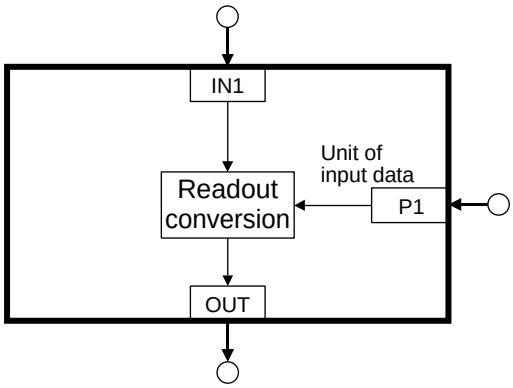
It is recommended that the US1000's built-in output blocks of the US mode be used as they are.

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	55	Category	Special Function
Module Name	Display Data Unit Conversion	Module Code Name	DISPCHG

Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Unit of input data (0 to 15)
P2		
P3		
P4		
Module Output		
OUT	○	Display data conversion output
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = an absolute value without a decimal point is obtained by converting the IN1 reading

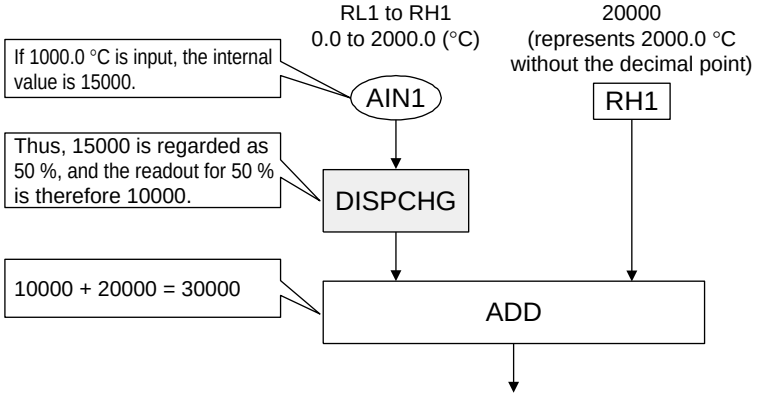


[Explanation]
The module converts the IN1 reading into the unit specified by P1 and into a non-decimal data format.

[TIP]
P1: unit of input data (0 to 15)

0 :	%	8 :	EU (AIN2)
1 :	ABS0	9 :	EUS (AIN2)
2 :	ABS1	10 :	EU (AIN3)
3 :	ABS2	11 :	EUS (AIN3)
4 :	ABS3	12 :	EU (PV1)
5 :	ABS4	13 :	EUS (PV1)
6 :	EU (AIN1)	14 :	EU (PV2)
7 :	EUS (AIN1)	15 :	EUS (PV2)

[Example of Use]
The internal value of AIN1 is converted by the DISPCHG module to a readout and then added to RH1. In this example, the module parameter is assumed to be ABS0.
RH1 : Maximum value of analog input-1 range (setup parameter)



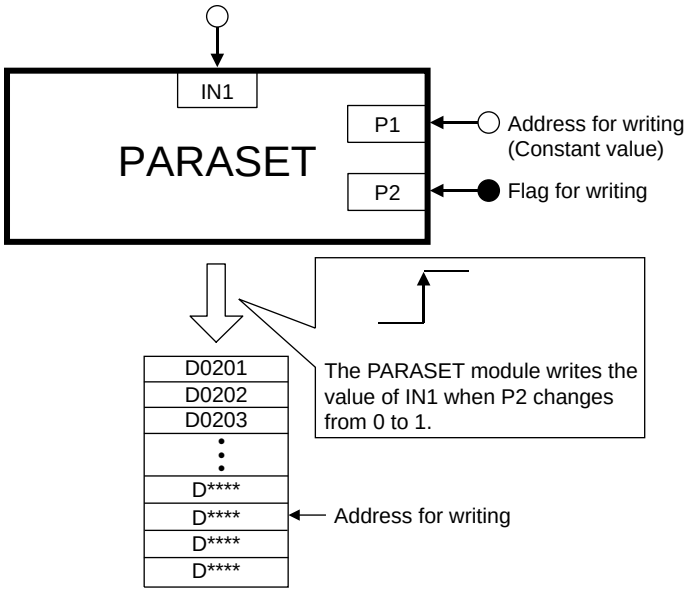
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	56	Category	Special Function
Module Name	Parameter Setting	Module Code Name	PARASET

Module Input		
IN1	○	Data to write
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Number of register to be written in
P2	●	Write flag
P3		
P4		
Module Output		
OUT	×	

Work Area	4
Limitation on Usage	

[Explanation]
If P2 changes from 0 to 1, the module writes the value of IN1 into the register specified by P1.
Data of IN1 = non-decimal reading
Writable registers: D101 to 799 (excluding those not yet mapped)



[TIP]
P1: the number of the register to which data is written (constant value: 101 to 799)
P2: write flag (data is written if P2 = 1)

[See Also]
Examples of parameter setting in the LL1200 PC-Based Custom Computation Building Tool instruction manual (IM 5G1A11-01E).

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	57	Category	Special Function
Module Name	Data Display 1	Module Code Name	DISP1

Module Input		
IN1	◯	Data to be displayed
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◯	Unit of input data (0 to 15)
P2		
P3		
P4		
Module Output		
OUT	×	
Work Area		
Limitation on Usage	1	

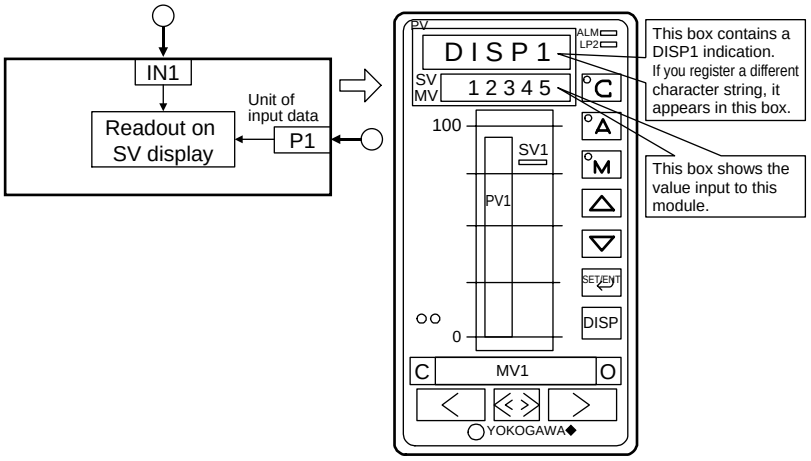
[Explanation]
The module indicates the value of IN1 on the SV digital display of the DISP1 custom display. The unit of the value indicated complies with the unit of data specified in P1.

[See Also]
The figure of "DISP1 custom display " - Section 6.1, "List of Custom Displays and Their Explanations".

[TIP]
P1: unit of input data (0 to 15)

0 :	%	8 :	EU (AIN2)
1 :	ABS0	9 :	EUS (AIN2)
2 :	ABS1	10 :	EU (AIN3)
3 :	ABS2	11 :	EUS (AIN3)
4 :	ABS3	12 :	EU (PV1)
5 :	ABS4	13 :	EUS (PV1)
6 :	EU (AIN1)	14 :	EU (PV2)
7 :	EUS (AIN1)	15 :	EUS (PV2)

The module provides the following custom display.



Example of Setup Procedure
[1] Register the DISP1 module with the block, and then configure the module inputs and parameters in the Input or Output Block dialog box of the LL1200 PC-Based Custom Computation Building Tool.
[2] Register the "DISP1 Display" option in the Custom Display Selection dialog box of the LL1200 PC-Based Custom Computation Building Tool.
As the default, "DISP1" appears in the PV digital display.

To register a character string that you want to show on the PV display, follow the instructions given below. The string should include no more than five single-byte alphanumeric characters.
For example, use the following procedure to show the text "ABCDE" on the PV display.
- In the Setting Character of DISP1, 2 Display of the Custom Display Selection dialog box of the LL1200 PC-Based Custom Computation Building Tool, type "ABCDE."

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	58	Category	Special Function
Module Name	Data Display 2	Module Code Name	DISP2

Module Input		
IN1	◯	Data to be displayed
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◯	Unit of input data (0 to 15)
P2		
P3		
P4		
Module Output		
OUT	×	

Work Area	
Limitation on Usage	1

[Explanation]
The module indicates the value of IN1 on the SV digital display of the DISP2 custom display. The unit of the value indicated complies with the unit of data specified in P1.

[See Also]
The figure of "DISP2 custom display " - Section 6.1, "List of Custom Displays and Their Explanations".

[TIP]
P1: unit of input data (0 to 15)

0 : %	8 : EU (AIN2)
1 : ABS0	9 : EUS (AIN2)
2 : ABS1	10 : EU (AIN3)
3 : ABS2	11 : EUS (AIN3)
4 : ABS3	12 : EU (PV1)
5 : ABS4	13 : EUS (PV1)
6 : EU (AIN1)	14 : EU (PV2)
7 : EUS (AIN1)	15 : EUS (PV2)

Example of Setup Procedure: See the example in "Data Display 1."

◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**60**	Category	Special Function
Module Name	Output-1 Terminal Configuration	Module Code Name	**OUTSET1**

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	OUT1A's output type specification
P2		
P3		
P4		
Module Output		
OUT	×	
Work Area		
Limitation on Usage	1	

[Explanation]
The module selects the function of the OUT1A terminal.

P1: OUT1A's output type specification
If P1 = 0, the output type is current output (mA).
If P1 = 1, the output type is voltage pulse output.

[NOTE]
This module can be used only when the OUTSEL1 module is not used (i.e., it cannot be used together with the OUTSEL1 module).

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**61**	Category	Special Function
Module Name	Output-2 Terminal Configuration	Module Code Name	**OUTSET2**

Module Input		
IN1		
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	OUT2A's output type specification
P2		
P3		
P4		
Module Output		
OUT	×	
Work Area		
Limitation on Usage	1	

[Explanation]
The module selects the function of the OUT2A terminal.

P1: OUT2A's output type specification
If P1 = 0, the output type is current output (mA).
If P1 = 1, the output type is voltage pulse output.

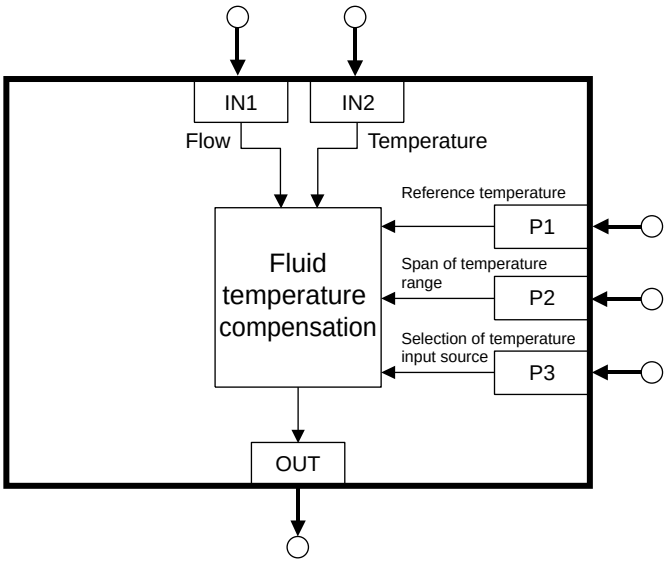
[NOTE]
This module can be used only when the OUTSEL2 module is not used (i.e., it cannot be used together with the OUTSEL2 module).

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	62	Category	Special Operation
Module Name	Fluid Temperature Compensation	Module Code Name	TCOMP

Module Input		
IN1	○	Flow
IN2	○	Temperature
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Reference temperature for compensation
P2	○	Constant (based on temperature unit)
P3	○	Specified source of measured input temperature
P4		
Module Output		
OUT	○	Fluid temperature compensation
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1×(IN2 + P2)/(P1 + P2)



[TIP]
P2 = 273 (unit: °C), 459.4 (unit: °F)
P3 = 0 : AIN1
= 1 : AIN2
= 2 : AIN3

[NOTE]
Value that are actually set are constant values without the decimal point.

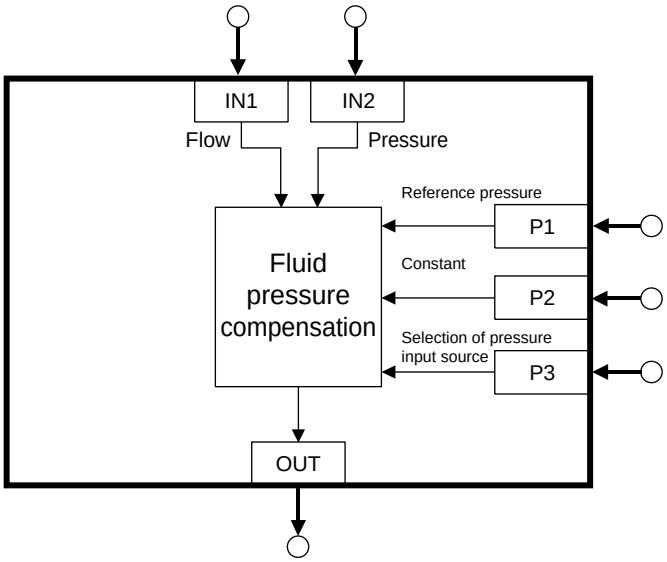
[See Also]
"Examples of Setting Fluid Temperature Compensation Coefficients" in the LL1200 PC-Based Custom Computation Building Tool instruction manual (IM 5G1A11-01E)

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	63	Category	Special Operation
Module Name	Fluid Pressure Compensation	Module Code Name	PCOMP

Module Input		
IN1	○	Flow
IN2	○	Pressure
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Reference pressure for compensation
P2	○	Constant (based on pressure unit)
P3	○	Specified source of measured input pressure
P4		
Module Output		
OUT	○	Fluid pressure compensation
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = IN1×(IN2 + P2)/(P1 + P2)



[TIP]
P2 = 1.03 (unit: kg/cm^2)
= 101.3 (unit: kPa)
[NOTE]
Values that are actually set are immediate values without the decimal point.

P3 = 0 : AIN1
= 1 : AIN2
= 2 : AIN3

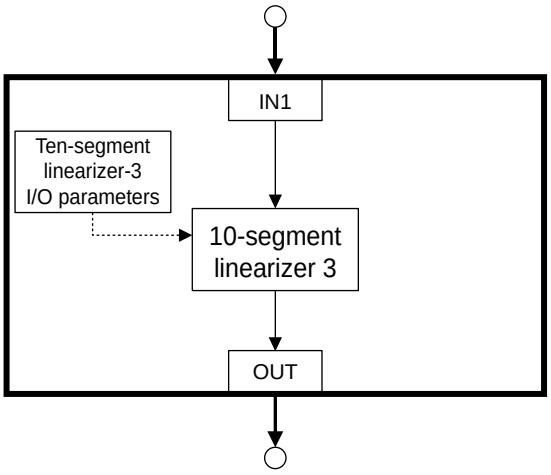
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	64	Category	Special Operation
Module Name	10-segment Linearizer 3 Approximation	Module Code Name	PLINE3

Module Input		
IN1	○	Input of 10-segment linearizer 3 approximation
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	○	Output of 10-segment linearizer 3 approximation
Work Area		
Limitation on Usage		

[Computational Expression]
if IN1 < A_1 then OUT = B_1
if IN1 > A_{11} then OUT = B_{11}
if $A_n \leqq IN1 \leqq A_{n+1}$ then $OUT = B_n + (B_{n+1} - B_n) \times (IN1 - A_n)/(A_{n+1} - A_n)$
where, n = 1 to 10

A_n: Value of 10-segment linearizer-3 input parameter
B_n: Value of 10-segment linearizer-3 output parameter



[Explanation]
The module outputs the value of IN1 obtained by linear approximation based on the table of 10-segment linearizer-3 parameters.

[NOTE]
The 10-segment linearizer-3 parameters can only be used with the LL1200 PC-Based Custom Computation Building Tool.

[See Also]
Figure of 10-segment linear approximation in "10-segment Linearizer 1"—PLINE1 Module (Module No. 33)

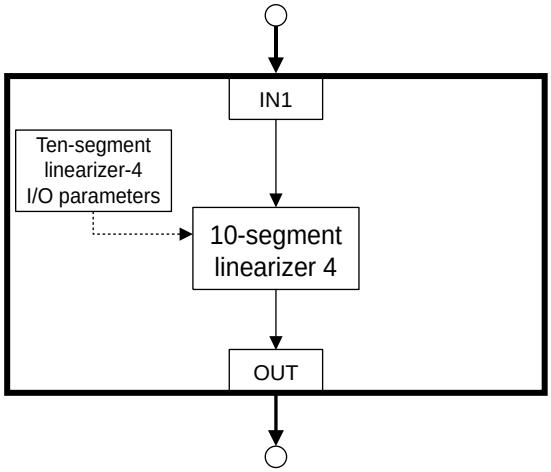
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	65	Category	Special Operation
Module Name	10-segment Linearizer 4 Approximation	Module Code Name	PLINE4

Module Input		
IN1	○	Input of 10-segment linearizer 4 approximation
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1		
P2		
P3		
P4		
Module Output		
OUT	○	Output of 10-segment linearizer 4 approximation
Work Area		
Limitation on Usage		

[Computational Expression]
if IN1 < A_1 then OUT = B_1
if IN1 > A_{11} then OUT = B_{11}
if $A_n \leqq$ IN1 $\leqq A_{n+1}$ then OUT = $B_n + (B_{n+1} - B_n) \times (IN1 - A_n)/(A_{n+1} - A_n)$
where, n = 1 to 10

A_n: Value of 10-segment linearizer-4 input parameter
B_n: Value of 10-segment linearizer-4 output parameter



[Explanation]
The module outputs the value of IN1 obtained by linear approximation based on the table of 10-segment linearizer-4 parameters.

[NOTE]
The 10-segment linearizer-4 parameters can only be used with the LL1200 PC-Based Custom Computation Building Tool.

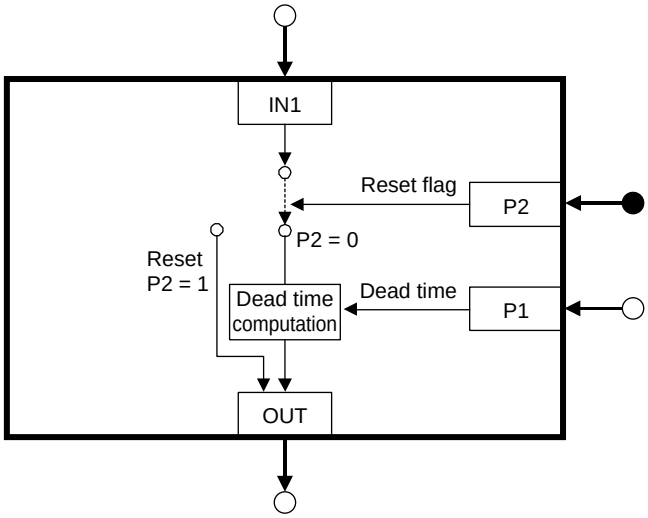
[See Also]
Figure of 10-segment linear approximation in "10-segment Linearizer 1"—PLINE1 Module (Module No. 33)

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

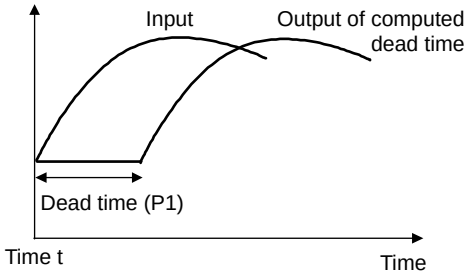
Module No.	67	Category	Special Operation
Module Name	Dead Time	Module Code Name	DED

Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Dead time
P2	●	Reset
P3		
P4		
Module Output		
OUT	○	Output of dead time computation
Work Area		46
Limitation on Usage		

[Computational Expression]
OUT = IN1 (t - P1)



[Explanation]
The module outputs the value of IN1 obtained P1 (seconds) ago.
If P2 = 1, then OUT = IN1.
The sampling time is P1/20 seconds.



[TIP]
P1: dead time (0 to 10000 s)

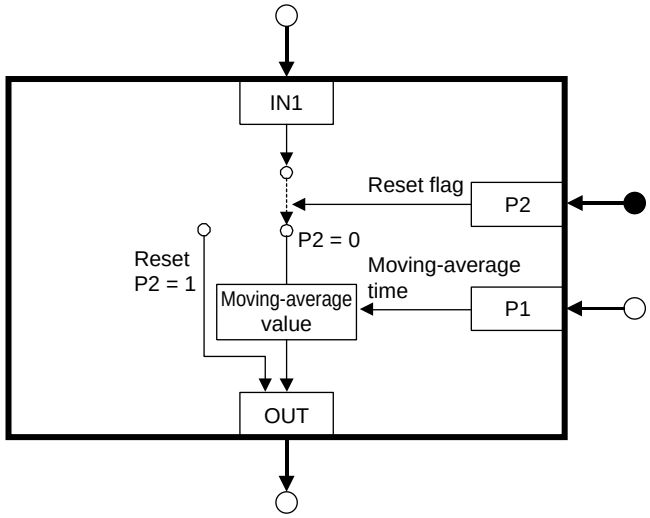
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	68	Category	Special Operation
Module Name	Moving Average	Module Code Name	MAV

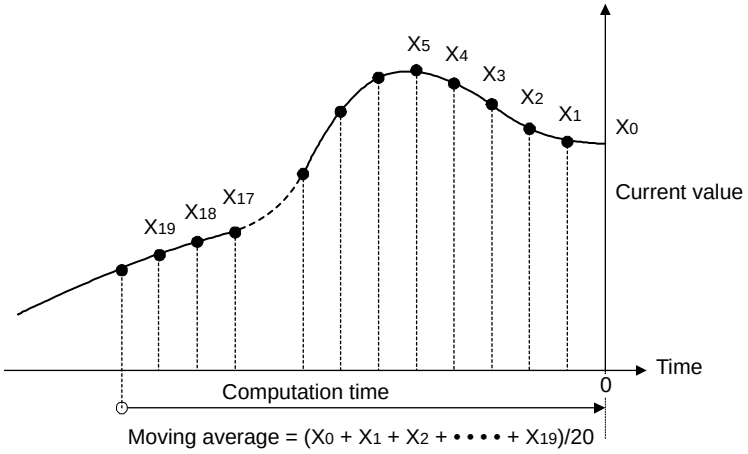
Module Input		
IN1	○	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Moving-average time
P2	●	Reset flag
P3		
P4		
Module Output		
OUT	○	Moving-average output
Work Area	46	
Limitation on Usage		

[Computational Expression]
OUT = AVE (IN1 (t - P1) + • • • + IN1 (t))



[Explanation]
The module outputs the average of IN1 over the period of P1.

If P2 = 1, then OUT = IN1.
The sampling time is P1/20 seconds.



[TIP]
P1: moving-average time (0 to 10000 s)

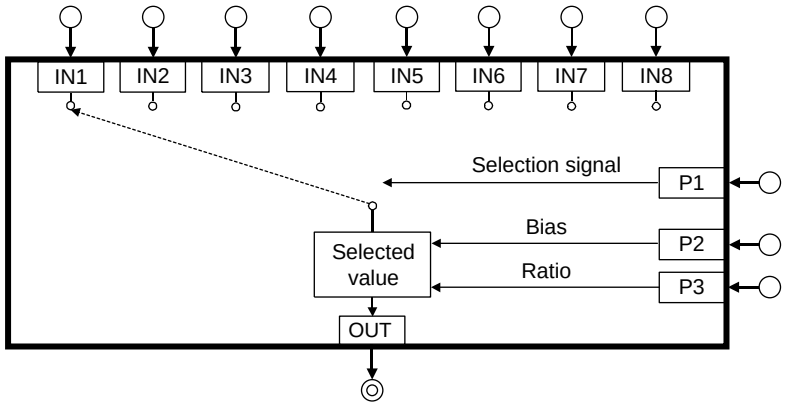
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	69	Category	Logical Operation
Module Name	Multi-selector	Module Code Name	MSELECT

Module Input		
IN1	◯	Input 1
IN2	◯	Input 2
IN3	◯	Input 3
IN4	◯	Input 4
IN5	◯	Input 5
IN6	◯	Input 6
IN7	◯	Input 7
IN8	◯	Input 8
Module Parameter		
P1	◯	Selection signal
P2	◯	Bias
P3	◯	Ratio
P4		
Module Output		
OUT	◎	Selected input value
Work Area		
Limitation on Usage		

[Computational Expression]
The module selects from inputs IN1 to IN8.



[Explanation]
According to the P1 selection signal, the module selects from inputs IN1 to IN8 and outputs the value of the selected input.

If P1 = 0, then OUT = P3×IN1 + P2.
If P1 = 1, then OUT = P3×IN2 + P2.
If P1 = 2, then OUT = P3×IN3 + P2.
If P1 = 3, then OUT = P3×IN4 + P2.
If P1 = 4, then OUT = P3×IN5 + P2.
If P1 = 5, then OUT = P3×IN6 + P2.
If P1 = 6, then OUT = P3×IN7 + P2.
If P1 = 7, then OUT = P3×IN8 + P2.
If P1 ≠ 0 to 7, then OUT = P3×IN1 + P2.

[TIP]
Bias default P2 = 0
Ratio default P3 = 1

Configurable range of ratio P3 = 1 to 9999 (where, the physical range of data is 0.001 to 9.999)

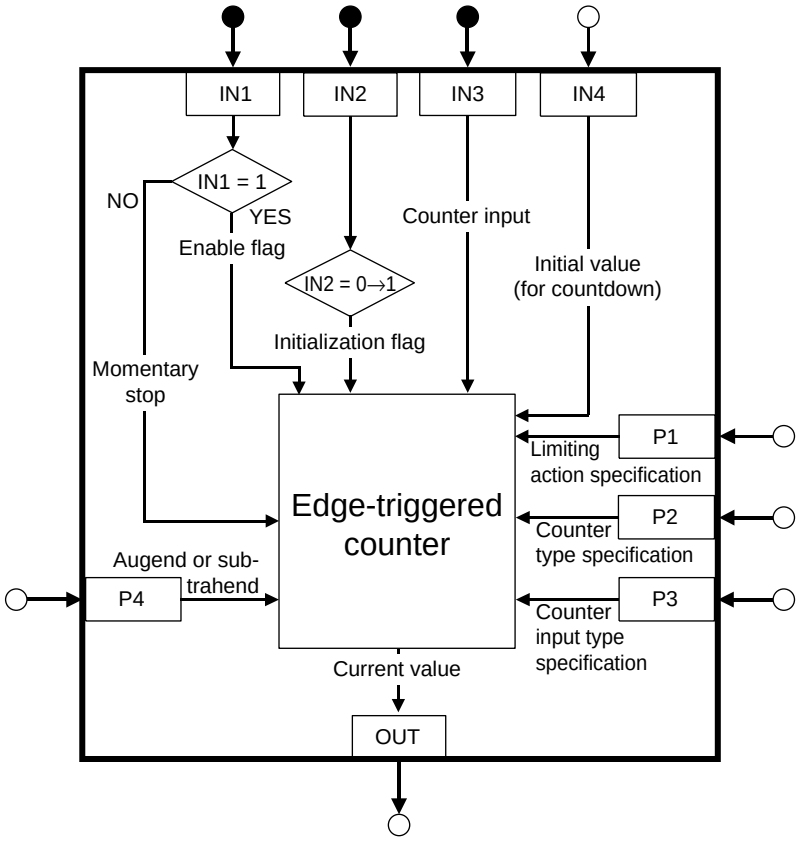
◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**70**	Category	Logical Operation
Module Name	Edge-triggered Counter	Module Code Name	**ECOUNTER**

Module Input		
IN1	●	Enable flag
IN2	●	Initialization flag
IN3	●	Counter input
IN4	○	Initial value (for decremental counting)
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Limiting action specification
P2	○	Counter type specification
P3	○	Counter input type specification
P4	○	Augend or subtrahend
Module Output		
OUT	○	Current value of edge-triggered counter

Work Area	3
Limitation on Usage	

[Computational Expression]
If IN3 changes (from 0 to 1 or from 1 to 0), then OUT = previous OUT + P4.



[TIP]
IN1: Enable flag (IN1 = 0: Stop counting momentarily; IN1 = 1: Continue counting)
IN2: Initialization flag (IN2 = 0: Do not initialize; IN2 = 1: Initialize the count)
IN4: Initial value for decremental counting (P2 = 1)
P1: Limiting action specification (P1 = 0: Do not limit; P1 = 1: Limit)
If limited, the incremental counter stops at FFFFh (65535 in the decimal system) and the decremental counter at 0h (0 in the decimal system).
If not limited, the counter continues counting.
For example, if the module operates as a decremental counter and the count is 2 and the subtrahend is 4, the next count is FFFEh (65534 in the decimal system).
P2: Counter type specification (P2 = 0: incremental counter; P2 = 1: decremental counter)
P3: Counter input type specification (P3 = 0: rising-edge counter; P3 = 1: falling-edge counter)
P4: Augend if the module is operated as an incremental counter (P2 = 0); subtrahend if the module is operated as a decremental counter (P2 = 1);

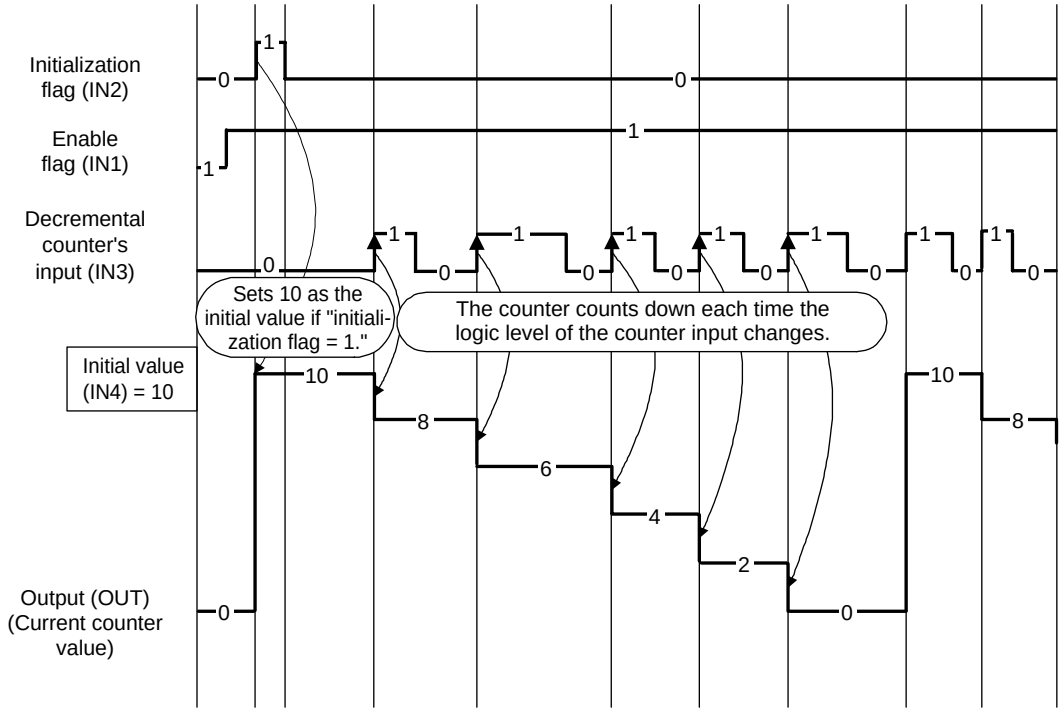
[NOTE]
Operation when no limiting action is specified
- If the incremental counter is specified, then OUT = previous OUT + P4 - 10000h (65536 in the decimal system).
- If the decremental counter is specified, then OUT = previous OUT - P4 + IN4.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	70	Category	Logical Operation
Module Name	Edge-triggered Counter	Module Code Name	ECOUNTER

[Explanation]
The basic concept of this module is the same as the concept for the COUNTER and DCOUNTER modules, except that the ECOUNTER module allows you to specify either "rising-edge" or "falling-edge" counting.
The following practical example shows a case where the initial value for decremental counting (IN4) is set and the counter is decremented by the subtrahend (IN3) each time the rising edge of the counter input (IN3) occurs. (In the example, IN4 = 10 and P4 = 2.)

Example of Operation
Decremental counter with no limiting action (where, the subtrahend is 2 and the counter input is triggered with each rising edge)



[NOTE]
The value of OUT retains upon power failure.

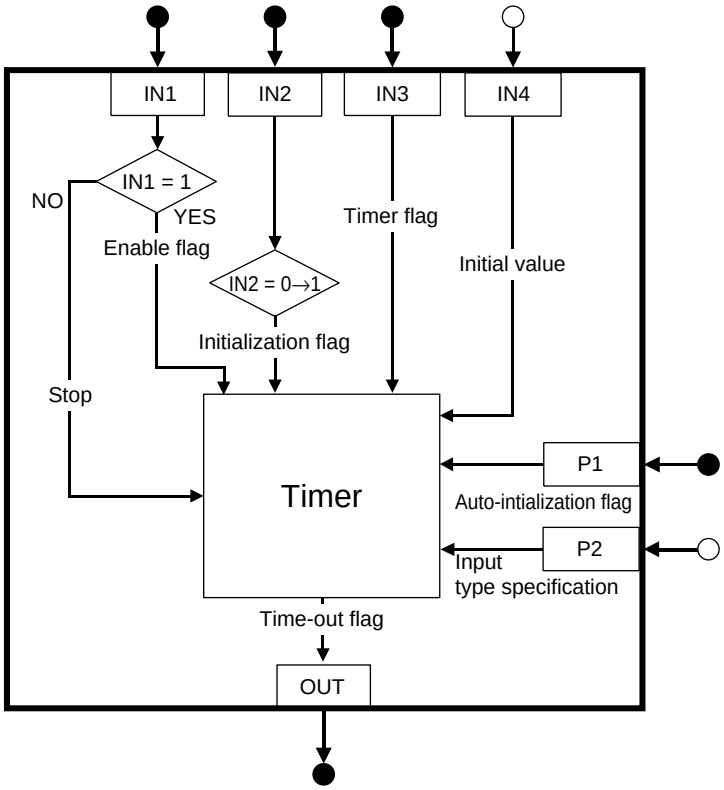
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	71	Category	Special Operation
Module Name	Edge-triggered Timer	Module Code Name	ETIMER

Module Input		
IN1	●	Enable flag
IN2	●	Initialization flag
IN3	●	Timer flag
IN4	○	Initial value
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Auto-initialization selection flag
P2	○	Timer input type specification
P3		
P4		
Module Output		
OUT	●	Time-out flag

Work Area	4
Limitation on Usage	

[Computational Expression]
If the timer reaches 0, the output is set to 1; otherwise, the output remains set to 0.



If IN1 = 0, the timer stops.
If IN1 = 1, subtract 1 from timer value when IN3 changes (from 0 to 1 or vice versa).
If IN2 = 1, the timer value equals IN4 (irrelevant of the IN1 value).

[TIP]
The timer value depends on the reference clock (timer flag) and control period.

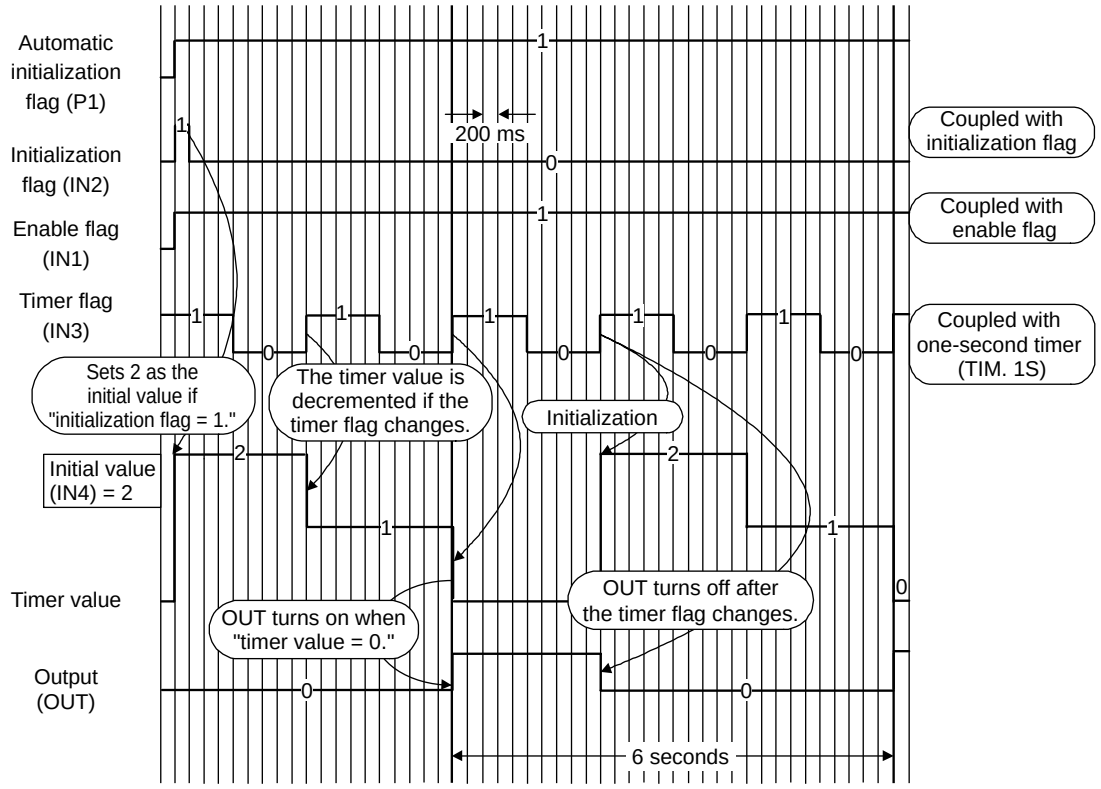
If P1 = 0, the timer stops when it reaches the end of operation and OUT is set to 1.
If P1 = 1, the timer is set to the initial value when the timer reaches the end of operation resulting in a change in the timer flag and OUT is set to 1; thus, the timer resumes operation.

[TIP]
IN1: Enable flag (IN1 = 0: Stop running; IN1 = 1: Continue to run)
P2: Timer input type selection (P2 = 0: rising edge; P2 = 1: falling edge)

[See Also]
"Timer fiag" - Subsection 5.13.2, "Timers".

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	71	Category	Special Operation
Module Name	Edge-triggered Timer	Module Code Name	ETIMER



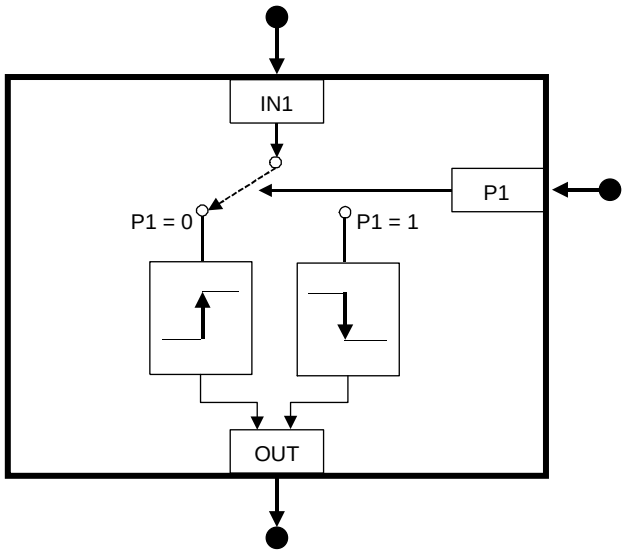
[NOTE]
The value of OUT retains upon power failure.

◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	72	Category	Special Operation
Module Name	Detection of Change at Edge	Module Code Name	ECHGDET

Module Input		
IN1	●	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	●	Input type specification
P2		
P3		
P4		
Module Output		
OUT	●	Result of change detection
Work Area	1	
Limitation on Usage		

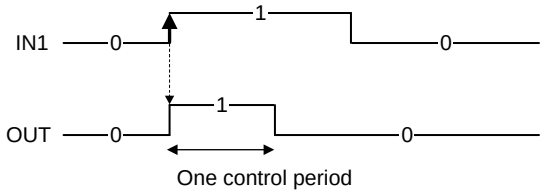
[Computational Expression and Explanation]
If IN1 changes (from 0 to 1 or vice versa), OUT = 1 for one control period.



This module is used to generate timing signals for processing.
If reset, the module retains the input and the output is set to 0.

[TIP]
P1: Input type specification (P1 = 0: rising edge; P1 = 1: falling edge)

- The following figure is an example of a timing chart where the detection of a rising edge provides an output over one control period.

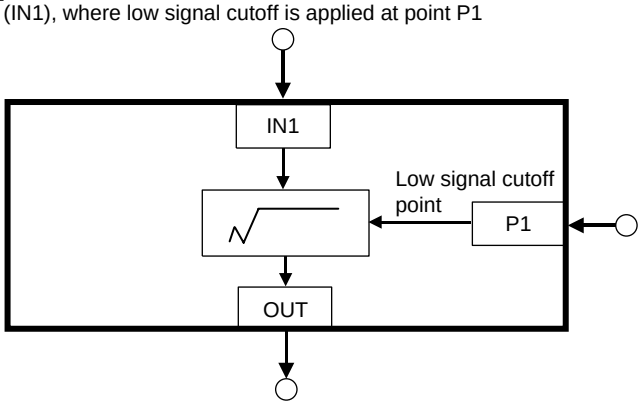


◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	73	Category	Special Operation
Module Name	Square Root Extraction 2	Module Code Name	SQR2

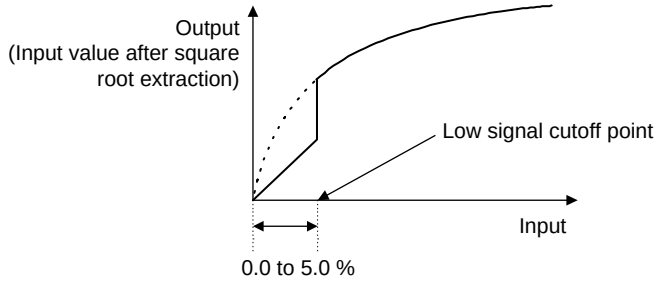
Module Input		
IN1	◯	Input 1
IN2		
IN3		
IN4		
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	◯	Low signal cutoff point
P2		
P3		
P4		
Module Output		
OUT	◯	Result of square root extraction
Work Area		
Limitation on Usage		

[Computational Expression]
OUT = $\sqrt{}$ (IN1), where low signal cutoff is applied at point P1



[Explanation]
The module replaces a value on the 0 to 30000 scale with a value on the 0 to 1 scale to extract the square root of that value; it then converts the result back to a value on the 0 to 30000 scale for output.
Example: The square root of 30000 results in the value 30000.
The square root of 15000 results in the value 21213.

If IN1 < P1, then OUT = IN1 (low signal cutoff)
If IN1 ≦ 0, then OUT = 0



[TIP]
Use the SQR module (Module No. 44) when an output below the low signal cutoff point needs to be zeroed.

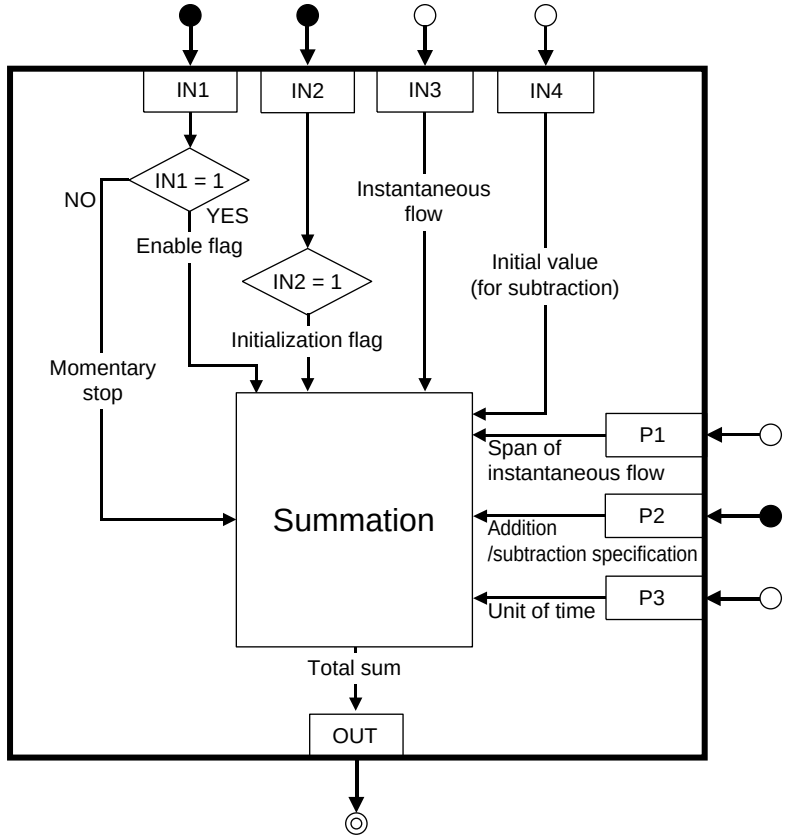
◎: Signed four-byte data; ◯: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	**74**	Category	Special Operation
Module Name	Flow Sum	Module Code Name	**FLWSUM**

Module Input		
IN1	●	Enable flag
IN2	●	Initialization flag
IN3	○	Instantaneous flow
IN4	○	Initial value for subtraction
IN5		
IN6		
IN7		
IN8		
Module Parameter		
P1	○	Span of instantaneous flow
P2	●	Addition/subtraction specification (0, 1)
P3	○	Unit of time (0 to 2)
P4		
Module Output		
OUT	◎	Sum

Work Area	7
Limitation on Usage	

[Explanation]
The module totalizes IN3 and outputs the total sum.
If IN2 = 1, the summation is initialized.



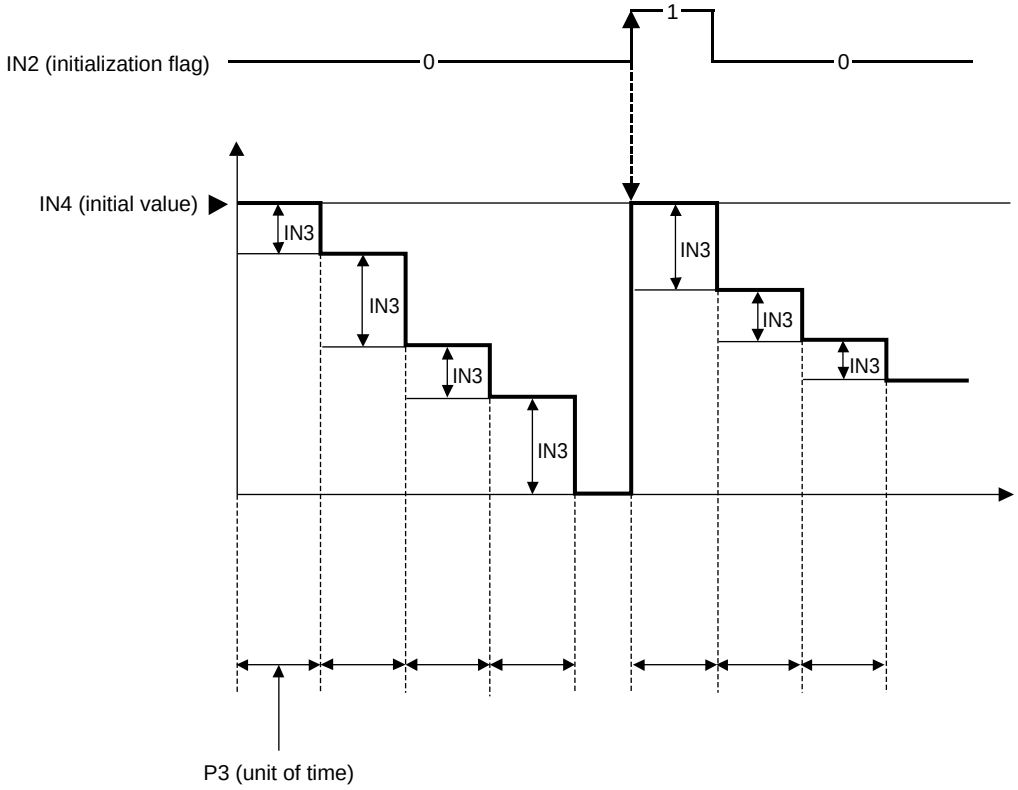
[TIP]
IN1: Enable flag (IN1 = 0: Stop totaling momentarily; IN1 = 1: Continue totaling)
IN2: Initialization flag (IN2 = 0: Don't initialize; IN2 = 1: Initialize)
P2: Addition/subtraction specification (P2 = 0: addition; P2 = 1: subtraction)
P3: Unit of time (P3 = 0: hour; P3 = 1: minute; P3 = 2: day)

[NOTE]
The value of OUT retains upon power failure.

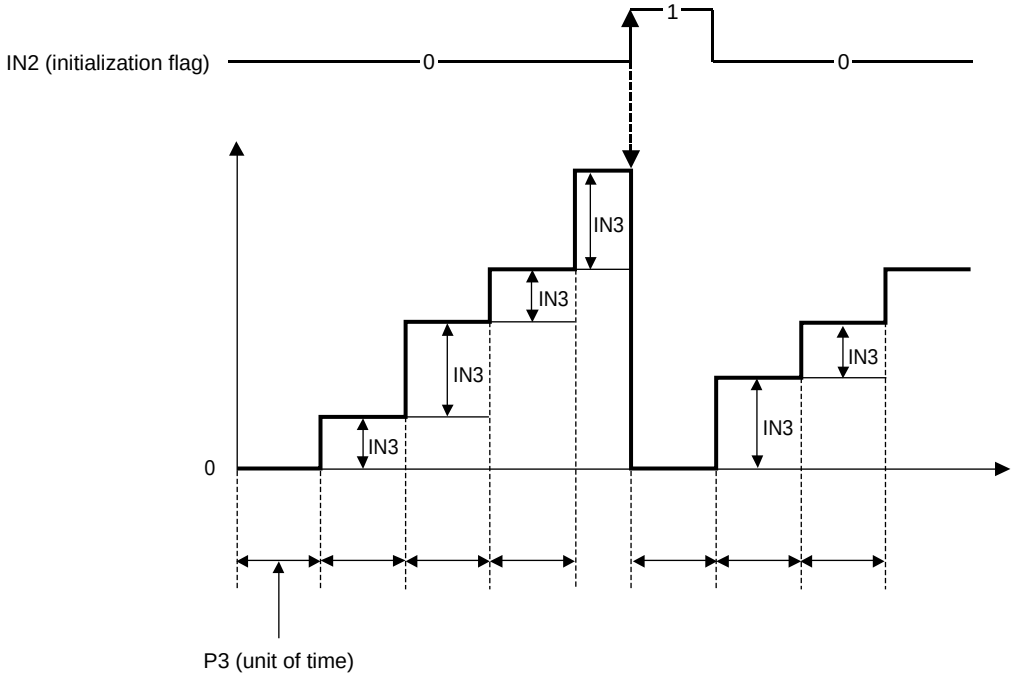
◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

Module No.	74	Category	Special Operation
Module Name	Flow Sum	Module Code Name	FLWSUM

[Explanation]
The following figure shows the timing chart of flow summation during subtraction.



The following figure shows the timing chart of flow summation during addition.



◎: Signed four-byte data; ○: Signed two-byte data; ●: Flag of 0 or 1; ×: No output

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5. US1000 Data Storage Areas (D Registers and I Relays)

This chapter explains the D registers and I relays that store process data, flag data and parameter data. The data used in custom computations are also stored in these D registers and I relays.

■ Interpretation of Lists of D Registers (D Register Map Tables)

This paragraph explains how to read the “D Register Map” tables in this chapter.
In the example shown below, the number in the leftmost column denotes a register number “1301”. Each register code name in the D register Map tables represents a specific process data item, operation parameter, setup parameter, input block data, output block data or other data item such as flag. For details on the operation and setup parameters, see the US1000 Digital Indicating Controller–Functions instruction manual (IM 5D1A01-02E).

Name of Register Map		
No.	Register name	R/W
1301	**AIN1**	R

(1) D register number

(2) Reading/Writing
(R:reading, W:writing)

■ Name of D Registers

The base names of some D registers are preceded by a combination of a number and then a period, and/or followed by a combination of a period and then a number, as shown in format Y.□□□X.

In this format, Y represents the group and X denotes the loop number.

Examples:

- The name 3.SV.1 means the SV in group 3 and for loop1.
- The name MV.2 means the MV in loop2.

NOTE

No data may be written to or read from data storage areas (D registers and I relays) with blank fields in the tables that follow. If you attempt to do so, the US1000 controller may fail to operate correctly.

■ Classification of D Registers

The table below outlines how the D registers are classified.

Register No.	Area and Data Categories		Description	Reference
1 to 49	Process data area (Note 1)	Operating data	PV, SV, MV and other values	Section 5.3
50 to 100	User area (Note 2)	----------	Used for communication with the Graphic Panel.	
101 to 200	Must not be used.			
201 to 230	Operation parameters (Note 1)	Mode parameter data area	CAM, MMV, etc.	Section 5.4
231 to 300		Loop-1 and 2 computation parameter area	AT, SC, BS, FL, etc.	
301 to 800		Loop-1 and 2 PID parameter area; USER parameter area; area for ten-segment linearizer parameters	P, I, D, etc.	Sections 5.5, 5.6 and 5.7
801 to 900	Messages	Message area	On-display messages (each comprising up to 33 alphanumeric characters)	Subsection 5.7.6
901 to 1000	Setup parameters (Note 1)	Loop-1 and 2 control parameter area	SV, ALM, CTL, etc.	Section 5.8
1001 to 1100		Loop common control function parameter area	AIN, RET, KLCK, MLCK, etc.	
1101 to 1200		I/O configuration parameter area	CSEL, DO, DI and C.PYS	
1201 to 1300		Controller mode parameter area; analog input parameter area; MV parameter area	USMD, IN, OUT, R485 and INIT	Section 5.9
1301 to 1500	Custom computation data area (Note 3)	Input-block data area	I/O blocks, module output	Sections 5.1 and 5.2
1501 to 1700		Output-block data area		

Note 1: Data for process values, operation parameters and setup parameters are stored as the types (EU, EUS, % and ABS without the decimal point) indicated in the “List of Operation Parameters” in Appendix 3 and the “List of Setup Parameters” in Appendix 4 of the *US1000 Digital Indicating Controller* instruction manual. The D registers 1 to 49 are read-only. The OFF and ON states are represented by 0 and 1, respectively.

Note 2: The user area (register numbers 50 to 100) is reserved for 16-bit device data used with the Graphic Panel or other software programs. When working with the Graphic Panel, do not write to or read from this area as usually done in user areas.

Note 3: Data in the custom computation data area (register numbers 1301 to 1700) takes the form of either a 0 to 100% value for the range of 0 to 30000 count, a flag or an absolute value.

5.1 Input-block Data Storage Area (D Registers 1301 to 1500)

Input-block Data Storage Area											
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
1301	**AIN1**	R	1351	**TRF.1**	R/W	1401	**IMO1L**	R	1451	**IMO26L**	R
1302	**AIN2**	R	1352	**TRF.2**	R/W	1402	**IMO1H**		1452	**IMO26H**	
1303	**AIN3**	R	1353			1403	**IMO2L**	R	1453	**IMO27L**	R
1304			1354	**SV.B0**	R/W	1404	**IMO2H**		1454	**IMO27H**	
1305			1355	**SV.B1**	R/W	1405	**IMO3L**	R	1455	**IMO28L**	R
1306			1356	**SV.B2**	R/W	1406	**IMO3H**		1456	**IMO28H**	
1307			1357	**SV.B3**	R/W	1407	**IMO4L**	R	1457	**IMO29L**	R
1308			1358	**DP1**	R/W	1408	**IMO4H**		1458	**IMO29H**	
1309			1359	**DP2**	R/W	1409	**IMO5L**	R	1459	**IMO30L**	R
1310			1360	**MG1**	R/W	1410	**IMO5H**		1460	**IMO30H**	
1311			1361	**MG2**	R/W	1411	**IMO6L**	R	1461		
1312			1362	**MG3**	R/W	1412	**IMO6H**		1462		
1313			1363	**MG4**	R/W	1413	**IMO7L**	R	1463		
1314			1364			1414	**IMO7H**		1464		
1315			1365			1415	**IMO8L**	R	1465		
1316			1366			1416	**IMO8H**		1466		
1317			1367			1417	**IMO9L**	R	1467		
1318			1368			1418	**IMO9H**		1468		
1319			1369			1419	**IMO10L**	R	1469		
1320			1370			1420	**IMO10H**		1470		
1321			1371			1421	**IMO11L**	R	1471		
1322			1372			1422	**IMO11H**		1472		
1323			1373			1423	**IMO12L**	R	1473		
1324			1374			1424	**IMO12H**		1474		
1325			1375			1425	**IMO13L**	R	1475		
1326			1376			1426	**IMO13H**		1476		
1327			1377			1427	**IMO14L**	R	1477		
1328			1378			1428	**IMO14H**		1478		
1329			1379			1429	**IMO15L**	R	1479		
1330			1380			1430	**IMO15H**		1480		
1331	**PVIN.1**	R/W	1381			1431	**IMO16L**	R	1481		
1332	**PVIN.2**	R/W	1382			1432	**IMO16H**		1482		
1333	**CSVIN.1**	R/W	1383			1433	**IMO17L**	R	1483		
1334	**CSVIN.2**	R/W	1384			1434	**IMO17H**		1484		
1335	**GAIN.1**	R/W	1385			1435	**IMO18L**	R	1485		
1336	**GAIN.2**	R/W	1386			1436	**IMO18H**		1486		
1337	**TRK.1**	R/W	1387			1437	**IMO19L**	R	1487		
1338	**TRK.2**	R/W	1388			1438	**IMO19H**		1488		
1339	**FF**	R/W	1389			1439	**IMO20L**	R	1489		
1340			1390			1440	**IMO20H**		1490		
1341			1391			1441	**IMO21L**	R	1491		
1342			1392			1442	**IMO21H**		1492		
1343	**CAS.1**	R/W	1393			1443	**IMO22L**	R	1493		
1344	**AUT.1**	R/W	1394			1444	**IMO22**		1494		
1345	**MAN.1**	R/W	1395			1445	**IMO23L**	R	1495		
1346	**CAS.2**	R/W	1396			1446	**IMO23H**		1496		
1347	**AUT.2**	R/W	1397			1447	**IMO24L**	R	1497		
1348	**MAN.2**	R/W	1398			1448	**IMO24H**		1498		
1349	**O/C**	R/W	1399			1449	**IMO25L**	R	1499		
1350	**R/S**	R/W	1400			1450	**IMO25H**		1500		

5.1.1 Areas for Storing Data Fed to Input Blocks

Register No.	Data Category	Description	Remarks
1301 to 1303	Analog signals	AIN1: Analog input-1 AIN2: Analog input-2 AIN3: Analog input-3	Data fed to input blocks

5.1.2 Areas for Storing Data Fed from Input Blocks

Register No.	Data Category	Description	Remarks
1331 to 1339	Analog signals	PVIN.1: Loop-1 PV input PVIN.2: Loop-2 PV input CSVIN.1: Loop-1 cascade input CSVIN.2: Loop-2 cascade input GAIN.1: Loop-1 gain setting value GAIN.2: Loop-2 gain setting value TRK.1: Loop-1 tracking input TRK.2: Loop-2 tracking input FF: Feedforward input	Data fed from input blocks
1343 to 1363	Status signals	CAS.1: Loop-1 CAS mode AUT.1: Loop-1 AUTO mode MAN.1: Loop-1 MAN mode CAS.2: Loop-2 CAS mode AUT.2: Loop-2 AUTO mode MAN.2: Loop-2 MAN mode O/C: OPEN/CLOSE mode R/S: RUN/STOP mode TRF.1: Loop-1 tracking flag TRF.2: Loop-2 tracking flag SV.B0: Bit-0 of SV number setting SV.B1: Bit-1 of SV number setting SV.B2: Bit-2 of SV number setting SV.B3: Bit-3 of SV number setting DP1: Operation display for interruption 1 DP2: Operation display for interruption 2 MG1: Interruptive message display 1 MG2: Interruptive message display 2 MG3: Interruptive message display 3 MG4: Interruptive message display 4	

5.1.3 Areas for Storing Output Data of Input-block Computation Modules

Register No.	Data Category	Description	Remarks
1401 to 1460	Computation modules' output values	These registers store the output values of computation modules that are determined when custom computations are configured. The output values are stored in the order they are registered and in units of two words. IMO1L and IMO1H: Computation modules that are 1st in the order of execution IMO2L and IMO2H: Computation modules that are 2nd in the order of execution IMO3L and IMO3H: Computation modules that are 3rd in the order of execution • • • • • IMO27L and IMO27H: Computation modules that are 27th in the order of execution IMO28L and IMO28H: Computation modules that are 28th in the order of execution IMO29L and IMO29H: Computation modules that are 29th in the order of execution IMO30L and IMO30H: Computation modules that are 30th in the order of execution Codes with the suffix L denote a lower-order word and codes with the suffix H denote a higher-order word.	When configuring a custom computation, specify the computation module's output data as connection information by selecting the lower-order word.

5.2 Output-block Data Storage Area (D Registers 1501 to 1700)

Output-block Data Storage Area											
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
1501	**PV.1**	R	1551			1601	**OMO1L**	R	1651	**OMO26L**	R
1502	**PV.2**	R	1552			1602	**OMO1H**		1652	**OMO26H**	
1503	**CSV.1**	R	1553			1603	**OMO2L**	R	1653	**OMO27L**	R
1504	**CSV.2**	R	1554			1404	**OMO2H**		1654	**OMO27H**	
1505	**MV.1**	R	1555			1605	**OMO3L**	R	1655	**OMO28L**	R
1506	**MV.2**	R	1556			1606	**OMO3H**		1656	**OMO28H**	
1507	**HMV.1**	R	1557			1607	**OMO4L**	R	1657	**OMO29L**	R
1508	**HMV.2**	R	1558			1608	**OMO4H**		1658	**OMO29H**	
1509	**CMV.1**	R	1559			1609	**OMO5L**	R	1659	**OMO30L**	R
1510	**CMV.2**	R	1560			1610	**OMO5H**		1660	**OMO30H**	
1511	**RET1**	R	1561			1611	**OMO6L**	R	1661		
1512	**RET2**	R	1562			1612	**OMO6H**		1662		
1513	**RET3**	R	1563			1615	**OMO7L**	R	1663		
1514			1564			1616	**OMO7H**		1664		
1515			1565			1615	**OMO8L**	R	1665		
1516			1566			1616	**OMO8H**		1666		
1517			1567			1617	**OMO9L**	R	1667		
1518			1568			1618	**OMO9H**		1668		
1519			1569			1619	**OMO10L**	R	1669		
1520			1570			1620	**OMO10H**		1670		
1521			1571			1621	**OMO11L**	R	1671		
1522			1572			1622	**OMO11H**		1672		
1523			1573			1623	**OMO12L**	R	1673		
1524			1574			1624	**OMO12H**		1674		
1525			1575			1625	**OMO13L**	R	1675		
1526			1576			1626	**OMO13H**		1676		
1527			1577			1627	**OMO14L**	R	1677		
1528			1578			1628	**OMO14H**		1678		
1529			1579			1629	**OMO15L**	R	1679		
1530			1580			1630	**OMO15H**		1680		
1531	**OUT1A**	R/W	1581			1631	**OMO16L**	R	1681		
1532	**OUT2A**	R/W	1582			1632	**OMO16H**		1682		
1533	**OUT3A**	R/W	1583			1633	**OMO17L**	R	1683		
1534	**OUT1R**	R/W	1584			1634	**OMO17H**		1684		
1535	**OUT2R**	R/W	1585			1635	**OMO18L**	R	1685		
1536	**DO1**	R/W	1586			1636	**OMO18H**		1686		
1537	**DO2**	R/W	1587			1637	**OMO19L**	R	1687		
1538	**DO3**	R/W	1588			1638	**OMO19H**		1688		
1539	**DO4**	R/W	1589			1639	**OMO20L**	R	1689		
1540	**DO5**	R/W	1590			1640	**OMO20H**		1690		
1541	**DO6**	R/W	1591			1641	**OMO21L**	R	1691		
1542	**DO7**	R/W	1592			1642	**OMO21H**		1692		
1543			1593			1643	**OMO22L**	R	1693		
1544			1594			1644	**OMO22H**		1694		
1545			1595			1645	**OMO23L**	R	1695		
1546			1596			1646	**OMO23H**		1696		
1547			1597			1647	**OMO24L**	R	1697		
1548			1598			1648	**OMO24H**		1698		
1549			1599			1649	**OMO25L**	R	1699		
1550			1600			1650	**OMO25H**		1700		

5.2.1 Areas for Storing Data Fed to Output Blocks

Register No.	Data Category	Description	Remarks
1501 to 1513	Computation data values	PV.1: Loop-1 PV value PV.2: Loop-2 PV value CSV.1: Loop-1 cascade setting value CSV.2: Loop-2 cascade setting value MV.1: Loop-1 MV output value MV.2: Loop-2 MV output value HMV.1: Loop-1 MV heating-side MV output value HMV.2: Loop-2 MV heating-side MV output value CMV.1: Loop-1 MV cooling-side MV output value CMV.2: Loop-2 MV cooling-side MV output value RET1: Retransmission output 1 RET2: Retransmission output 2 RET3: Retransmission output 3	Data fed to output blocks

5.2.2 Areas for Storing Data Fed from Output Blocks

Register No.	Data Category	Description	Remarks
1531 to 1535	Analog signals	OUT1A: Analog output 1 OUT2A: Analog output 2 OUT3A: Analog output 3 OUT1R: Relay output 1 OUT2R: Relay output 2	Data fed from output blocks
1536 to 1542	Status signals	DO1 to DO3: Relay outputs DO4 to DO7: Transistor outputs	

5.2.3 Areas for Storing Output Data of Output-block Computation Modules

Register No.	Data Category	Description	Remarks
1601 to 1660	Computation modules' output values	These registers store the output values of computation modules that are determined when custom computations are configured. The output values are stored in the order they are registered and in units of two words. OMO1L and OMO1H: Computation modules that are 1st in the order of execution OMO2L and OMO2H: Computation modules that are 2nd in the order of execution OMO3L and OMO3H: Computation modules that are 3rd in the order of execution • • • • • OMO27L and OMO27H: Computation modules that are 27th in the order of execution OMO28L and OMO28H: Computation modules that are 28th in the order of execution OMO29L and OMO29H: Computation modules that are 29th in the order of execution OMO30L and OMO30H: Computation modules that are 30th in the order of execution Codes with the suffix L denote a lower-order word and codes with the suffix H denote a higher-order word.	When configuring a custom computation, specify the computation module's output data as connection information by selecting the lower-order word.

5.3 Process Data Area and User Area (D Registers 1 to 200)

Process Data Area and User Area											
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
1	**ADERROR**	R	51		R/W	101			151		
2	**ERROR.1**	R	52		R/W	102			152		
3	**PV.1**	R	53		R/W	103			153		
4	**CSV.1**	R	54		R/W	104			154		
5	**MV.1**	R	55		R/W	105			155		
6	**HMV.1**	R	56		R/W	106			156		
7	**CMV.1**	R	57		R/W	107			157		
8	**MOD.1**	R	58		R/W	108			158		
9	**PIDNO.1**	R	59		R/W	109			159		
10	**CSVNO**	R	60		R/W	110			160		
11	**ALM**	R	61		R/W	111			161		
12			62		R/W	112			162		
13			63		R/W	115			163		
14			64		R/W	116			164		
15			65		R/W	115			165		
16			66		R/W	116			166		
17			67		R/W	117			167		
18	**ERROR.2**	R	68		R/W	118			168		
19	**PV.2**	R	69		R/W	119			169		
20	**CSV.2**	R	70		R/W	120			170		
21	**MV.2**	R	71		R/W	121			171		
22	**HMV.2**	R	72		R/W	122			172		
23	**CMV.2**	R	73		R/W	123			173		
24	**MOD.2**	R	74		R/W	124			174		
25	**PIDNO.2**	R	75		R/W	125			175		
26	**DEV.1**	R	76		R/W	126			176		
27			77		R/W	127			177		
28			78		R/W	128			178		
29			79		R/W	129			179		
30	**DEV.2**	R	80		R/W	130			180		
31			81		R/W	131			181		
32	**SMEC**	R	82		R/W	132			182		
33	**DISTS**	R	83		R/W	133			183		
34			84		R/W	134			184		
35	**PARAERR**	R	85		R/W	135			185		
36	**ALOSTS**	R	86		R/W	136			186		
37			87		R/W	137			187		
38			88		R/W	138			188		
39	**DISP1**	R	89		R/W	139			189		
40	**DISP2**	R	90		R/W	140			190		
41			91		R/W	141			191		
42			92		R/W	142			192		
43			93		R/W	143			193		
44			94		R/W	144			194		
45			95		R/W	145			195		
46			96		R/W	146			196		
47			97		R/W	147			197		
48			98		R/W	148			198		
49			99		R/W	149			199		
50		R/W	100		R/W	150			200		

User area (50 to 100)

5.3.1 Process Data Area (Read-only Data)

Some of registers D0001 to D0049 (read-only) are designed to indicate two or more events, such as errors and abnormal statuses, using combinations of bits within them.
If any of the events shown in the following tables occurs, the corresponding bit is set to 1. The bit remains set to 0 if the event has not occurred yet. Note that bits in blank fields are not in use.

TIP

Each bit in the following tables is the same, in terms of the code and the type of event, as that for each I relay listed in Section 5.10, “On-Off Status Areas,” to Section 5.13, “Alarm Flag, Timer Flag, Power-on Flag Status Area.”

●Bit Configuration of D0001 Register–ADERROR (Input Error)

Bit	Code	Event	I Relay Number
0	AD1ERR.st	Error in A/D converter for input 1	1
1	AD2ERR.st	Error in A/D converter for input 2 (US1000-11 or US1000 -21 only)	2
2	AD3ERR.st	Error in A/D converter for input 3	3
3			4
4	AD1BO.st	Burn-out error in input 1	5
5	AD2BO.st	Burn-out error in input 2 (US1000-11 or US1000 -21 only)	6
6	AD3BO.st	Burn-out error in input 3	7
7			8
8	RJC1ERR.st	RJC error in input 1	9
9	RJC2ERR.st	RJC error in input 2 (US1000-11 or US1000 -21 only)	10
10			11
11	VLERR.st	Failure in automatic adjustment of valve position	12
12	VLBO.st	Burnout in valve position feedback input	13
13 to 15			14 to 16

●Bit Configuration of D0002 Register–ERROR.1 (PV1 Error)

Bit	Code	Event	I Relay Number
0	PV1ADC.st	Error in A/D converter for PV1	17
1	PV1BO.st	Burn-out error in PV1	18
2	RJC1ERR.st	RJC error in PV1	19
3			20
4	PV1+over.st	PV1 above the upper limit of scale	21
5	PV1-over.st	PV1 below the lower limit of scale	22
6, 7			23, 24
8	CSV1ADC.st	Error in A/D converter for CSV1	25
9	CSV1BO.st	Burn-out error in CSV1	26
10, 11			27, 28
12	C.CSV1ADC.st	Error in A/D converter for CSV1 when CSV1 is used for control	29
13	C.CSV1BO.st	Burn-out error when CSV1 is used for control	30
14	AT1ERR.st	Auto-tuning error	31
15			32

●D0003 Register–PV.1 (Process Variable for Loop 1)

●D0004 Register–CSV.1 (Target Setpoint Used with Loop 1)

●D0005 Register–MV.1 (Manipulated Output Value [MV] for Loop 1)

For PID computations, this register allows the result of PID computation (the readout) to be read as is. For example, the register contains an MV of 750 (without the decimal point) for a 75.0% readout.

For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).

For heating/cooling computations, the register contains a value half that of the result of PID computation. This value is obtained before it is allocated for heating/cooling and is not a readout. For example, the register contains the value 250 (without the decimal point) if the result of PID computation for heating/cooling is 50.0%.

●D0006 Register–HMV.1 (Heating-side MV for Loop-1 Heating/Cooling Computation)

This register contains the readout of the heating-side MV as is.

For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).

●D0007 Register–CMV.1 (Cooling-side MV for Loop-1 Heating/Cooling Computation)

This register contains the readout of the cooling-side MV as is.

For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).

●Bit Configuration of D0008 Register–MOD.1 (Mode of Loop 1)

Bit	Code	Event	I Relay Number
0			65
1			66
2	R/S.st	0: Run 1: Stop	67
3			68
4	CAS1.st	1: CAS mode	69
5	AUT1.st	1: AUTO mode	70
6	MAN1.st	1: MAN mode	71
7 to 13			72 to 78
14	AT1.st	0: Auto-tuning disabled; 1: Auto-tuning enabled	79
15			80

●D0009 Register–PIDNO.1 (PID Number Used with Loop 1)

This register allows the PID number, which is in use, to be read in the form of a binary bit string. The configuration of “bit3 = off; bit2 = on; bit1 = off; bit0 = on,” which is represented as “0101” in the binary system and as “5” in the decimal system, selects the PID number 5.

Bit	Code	Event	I Relay Number
0	PIDNO.0	Bit 0 for selecting PID number	593
1	PIDNO.1	Bit 1 for selecting PID number	594
2	PIDNO.2	Bit 2 for selecting PID number	595
3	PIDNO.3	Bit 3 for selecting PID number	596
4 to 15			597 to 608

●D0010 Register–CSVNO (Target-setpoint Number Currently in Use)

This register allows the CSV number, which is currently in use, to be read in the form of a binary bit string. The configuration of “bit3 = off; bit2 = on; bit1 = off; bit0 = on,” which is represented as “0101” in the binary system and as “5” in the decimal system, selects the CSV number 5.

Bit	Code	Event	I Relay Number
0	CSVNO1.0	Bit 0 for selecting CSV number	577
1	CSVNO1.1	Bit 1 for selecting CSV number	578
2	CSVNO1.2	Bit 2 for selecting CSV number	579
3	CSVNO1.3	Bit 3 for selecting CSV number	580
4 to 15			581 to 592

●Bit Configuration of D0011 Register–ALM (Alarm Status)

Bit	Code	Event	I Relay Number
0	ALM11.st	'1' if alarm 1 for loop 1 is on, or '0' if off	97
1	ALM12.st	'1' if alarm 2 for loop 1 is on, or '0' if off	98
2	ALM13.st	'1' if alarm 3 for loop 1 is on, or '0' if off	99
3			100
4	ALM14.st	'1' if alarm 4 for loop 1 is on, or '0' if off	101
5			102
6, 7			103, 104
8	ALM21.st	'1' if alarm 1 for loop 2 is on, or '0' if off	105
9	ALM22.st	'1' if alarm 2 for loop 2 is on, or '0' if off	106
10	ALM23.st	'1' if alarm 3 for loop 2 is on, or '0' if off	107
11			108
12	ALM24.st	'1' if alarm 4 for loop 2 is on, or '0' if off	109
13			110
14, 15			111, 112

ALM21 to ALM24 for loop 2 are used as alarms 5 to 8 for loop 1 if, when the controller mode (US mode) is other than “cascade control,” the 8-alarm mode is selected using the AMD alarm-related setup parameter.

See Also

The section on the eight-alarm mode in the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E)

●Bit Configuration of D0018 Register–ERROR.2 (PV2 Error)

Bit	Code	Event	I Relay Number
0	PV2ADC.st	Error in A/D converter for PV2	33
1	PV2BO.st	Burn-out error in PV2	34
2	RJC2ERR.st	RJC error in PV2 (US1000-11 or US1000 -21 only)	35
3			36
4	PV2+over.st	PV2 above the upper limit of scale	37
5	PV2-over.st	PV2 below the lower limit of scale	38
6, 7			39, 40
8	CSV2ADC.st	Error in A/D converter for CSV2 (US1000-11 or US1000 -21 only)	41
9	CSV2BO.st	Burn-out error in CSV2 (US1000-11 or US1000 -21 only)	42
10, 11			43, 44
12	C.CSV2ADC.st	Error in A/D converter for CSV2 when CSV2 is used for control (US1000-11 or US1000 -21 only)	45
13	C.CSV2BO.st	Burn-out error when CSV2 is used for control (US1000-11 or US1000 -21 only)	46
14	AT2ERR.st	Auto-tuning error	47
15			48

●D0019 Register–PV.2 (Process Variable [PV] for Loop 2)

●D0020 Register–CSV.2 (Target Setpoint [SV] Used with Loop 2)

●D0021 Register–MV.2 (Manipulated Output Value [MV] for Loop 2)
For PID computations, this register allows the result of PID computation (readout) to be read as is. For example, the register contains an MV of 750 (without the decimal point) for a 75.0% readout.
For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).
For heating/cooling computations, the register contains a value half that of the result of PID computation. This value is the one obtained before it is allocated for heating/cooling and is not a readout. For example, the register contains the value of 250 (without the decimal point) if the result of the PID computation for heating/cooling is 50.0%.

●D0022 Register–HMV.2 (Heating-side MV for Loop-2 Heating/Cooling Computation)
This register contains the readout of the heating-side MV as is.
For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).

●D0023 Register–CMV.2 (Cooling-side MV for Loop-2 Heating/Cooling Computation)
This register contains the readout of the cooling-side MV as is.
For on-off computations, the register contains a reading of 0 (0.0%) (without the decimal point) for the OFF state or 1000 (100.0%) for the ON state (without the decimal point).

●Bit Configuration of D0024 Register–MOD.2 (Mode of Loop 2)

Bit	Code	Event	I Relay Number
0			81,82
1	O/C.st	0: Close; 1: Open	83
2			84
3	CAS2.st	1: CAS mode	85
4	AUT2.st	1: AUTO mode	86
5	MAN2.st	1: MAN mode	87
6 to 13			88 to 94
14	AT2	0: Auto-tuning disabled; 1: Auto-tuning enabled	95
15			96

●D0025 Register–PIDNO.2 (PID Number Used with Loop 2)

This register allows the PID number, which is in use, to be read in the form of a binary bit string. The configuration of “bit3 = off; bit2 = on; bit1 = off; bit0 = on,” which is represented as “0101” in the binary system and as “5” in the decimal system, selects the PID number 5.

Bit	Code	Event	I Relay Number
0	PIDNO2.0	Bit 0 for selecting PID number	609
1	PIDNO2.1	Bit 1 for selecting PID number	610
2	PIDNO2.2	Bit 2 for selecting PID number	611
3	PIDNO2.3	Bit 3 for selecting PID number	612
4 to 15			613 to 624

●D0026 Register–DEV.1 (Deviation for Loop 1)

●D0030 Register–DEV.2 (Deviation for Loop 2)

●D0032 Register–SMEC (Counter for Errors in Sampling Period)

●Bit Configuration of D0033 Register–DISTS (Statuses of External Contact Inputs)

Bit	Code	Event	I Relay Number
0	DI1.st	Status of external contact input terminal 1 (the contact is on if the bit is 1, and off if 0)	161
1	DI2.st	Status of external contact input terminal 2 (the contact is on if the bit is 1, and off if 0)	162
2	DI3.st	Status of external contact input terminal 3 (the contact is on if the bit is 1, and off if 0)	163
3	DI4.st	Status of external contact input terminal 4 (the contact is on if the bit is 1, and off if 0)	164
4	DI5.st	Status of external contact input terminal 5 (the contact is on if the bit is 1, and off if 0)	165
5	DI6.st	Status of external contact input terminal 6 (the contact is on if the bit is 1, and off if 0)	166
6	DI7.st	Status of external contact input terminal 7 (the contact is on if the bit is 1, and off if 0)	167
7			168
8	DP1	Status of interruption for custom displays (the display is shown if the bit is 1, and hidden if 0) [See Also] Section 6.3, "Conditions Necessary to Switch to Custom Displays," for the interruption for custom displays.	169
9	DP2	Status of interruption for custom displays (the display is shown if the bit is 1, and hidden if 0)	170
10	MG1	Status of interruption for message 1 (the message is shown if the bit is 1, and hidden if 0)	171
11	MG2	Status of interruption for message 2 (the message is shown if the bit is 1, and hidden if 0)	172
12	MG3	Status of interruption for message 3 (the message is shown if the bit is 1, and hidden if 0)	173
13	MG4	Status of interruption for message 4 (the message is shown if the bit is 1, and hidden if 0)	174
14, 15			175, 176

Functions assigned to external contact inputs vary depending on the settings of the controller mode (US mode) and whether or not the functions of contact inputs are registered.

See Also

Chapter 2, “Controller Modes (US Modes),” in the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E), for the statuses of external contact inputs.

●Bit Configuration of D0035 Register–PARAERR (Error in Calibrated Values or Parameters)

Bit	Code	Event	I Relay Number
0	CALB.E.st	Error in calibrated values	49
1			50
2	USER.E.st	Error in data generated with the custom computation building tool	51
3			52
4	USMD.st	US-mode error	53
5	RANGE.st	Error in data for input range	54
6	SETUP.st	Error in setup parameters	55
7			56
8	PARA.E.st	Error in operation parameters	57
9	MODE.E.st	Error in backup data generated upon power failure	58
10, 11			59, 60
12	EEP.E.st	Error in EEPROM	61
13			62
14	SYSTEM.E.st	Error in system data	63
15			64

●Bit Configuration of D0036 Register–ALOSTS (Status of Alarm Output)

Bit	Code	Event	I Relay Number
0	ALO11	Output status when alarm 1 for loop 1 is assigned • 0: If alarm is off for the alarm type "active" or if alarm is on for the alarm type "passive" (i.e., the relay contact is open) • 1: If alarm is on for the alarm type "active" or if alarm is off for the alarm type "passive" (i.e., the relay contact is closed)	689
1	ALO12	Output status when alarm 2 for loop 1 is assigned Same as bit0 in regard to information on the bit status	690
2	ALO13	Output status when alarm 3 for loop 1 is assigned Same as bit0 in regard to information on the bit status	691
3			692
4	ALO14	Output status when alarm 4 for loop 1 is assigned Same as bit0 in regard to information on the bit status	693
5 to 7			694 to 696
8	ALO21	Output status when alarm 1 for loop 2 is assigned Same as bit0 in regard to information on the bit status	697
9	ALO22	Output status when alarm 2 for loop 2 is assigned Same as bit0 in regard to information on the bit status	698
10	ALO23	Output status when alarm 3 for loop 2 is assigned Same as bit0 in regard to information on the bit status	699
11			700
12	ALO24	Output status when alarm 4 for loop 2 is assigned Same as bit0 in regard to information on the bit status	701
13 to 15			702 to 704

●D0039 Register–DISP1 (Input Value for DISP1 Module Registered Using the Custom Computation Building Tool)

This register stores a value fed to input 1 (IN1) of the Data Display 1 (DISP1) module.

●D0040 Register–DISP2 (Input Value for DISP2 Module Registered Using the Custom Computation Building Tool)

This register stores a value fed to input 1 (IN1) of the Data Display 2 (DISP2) module.

5.3.2 User Area

Register No.	Data Category	Description
50 to 100	User area	Data can be written to or read from the range of D registers 50 to 100 via communication. However, the area is reserved for communication with the Graphic Panel and is not available if the Graphic Panel is used in the system. That is, you can use it freely no matter which type of control is applied, as long as you do not use the Graphic Panel.

5.4 Data Area for Modes and Computation Parameters (D Registers 201 to 300)

Data Area for Mode and Computation Parameters					
No.	Register name	R/W	No.	Register name	R/W
201	**CAM.1**	R/W	251	**FBI.1**	*R/W
202	**CAM.2**	R/W	252	**FBO.1**	*R/W
203			253	**FFL.1**	*R/W
204			254		
205	**R/S**	R/W	255		
206	**O/C**	R/W	256		
207	**SVNO**	R/W	257		
208	**C.CSV.1**	R/W	258		
209	**C.CSV.2**	R/W	259		
210	**MMV.1**	R/W	260		
211	**MMVc.1**	R/W	261	**PDATE1**	R
212	**MMV.2**	R/W	262	**PDATE2**	R
213	**MMVc.2**	R/W	263	**PDATE3**	R
214			264	**PDATE4**	R
215			265		
216			266		
217			267		
218			268		
219			269		
220			270		
221			271	**AT.2**	*R/W
222			272	**SC.2**	*R/W
223			273	**BS.2**	*R/W
224			274	**FL.2**	*R/W
225			275	**UPR.2**	*R/W
226			276	**DNR.2**	*R/W
227			277	**CRT.2**	*R/W
228			278	**CBS.2**	*R/W
229			279	**CFL.2**	*R/W
230			280		
231			281		
232			282		
233			283		
234			284		
235			285		
236			286		
237			287		
238			288		
239			289		
240			290		
241	**AT.1**	*R/W	291		
242	**SC.1**	*R/W	292		
243	**BS.1**	*R/W	293		
244	**FL.1**	*R/W	294		
245	**UPR.1**	*R/W	295		
246	**DNR.1**	*R/W	296		
247	**CRT.1**	*R/W	297		
248	**CBS.1**	*R/W	298		
249	**CFL.1**	*R/W	299		
250	**FGN.1**	*R/W	300		

*: Number of times written ≦ 100,000 times.

5.4.1 Mode Data

The mode registers listed below are designed to show, by the value contained, which mode is selected. You can change the mode by using custom computations or by writing a different mode into the register via communication.

●D0201 Register–CAM.1 (CAS, AUTO and MAN Modes for Loop 1)
If defined as D0201 = 0, the register is in the AUTO mode.
If defined as D0201 = 1, the register is in the MAN mode.
If defined as D0201 = 2, the register is in the CAS mode.

●D0202 Register–CAM.2 (CAS, AUTO and MAN Modes for Loop 2)
If defined as D0202 = 0, the register is in the AUTO mode.
If defined as D0202 = 1, the register is in the MAN mode.
If defined as D0202 = 2, the register is in the CAS mode.

●D0205 Register–R/S (RUN and STOP Modes)
If defined as D0205 = 0, the register is in the RUN mode.
If defined as D0205 = 1, the register is in the STOP mode.

●D0206 Register–O/C (OPEN and CLOSE Modes)
If defined as D0206 = 0, the register is in the CLOSE mode.
If defined as D0206 = 1, the register is in the OPEN mode.

5.4.2 Write-only Data Area

The registers listed below are write-only registers that are accessed by higher-order equipment. Values written into these registers should be the same as the display readouts.
For example, to set 150.0 ºC in the C.CSV.1 register, write 1500 in the register.
To set 50.0% in the MMV.1 register, write 500 in the register; in this case, however, you must switch to the MAN mode before writing 500 in the register.

Register No.	Code Name	Description
207	SVNO	Used to set an SV number by means of custom computation or communication. For example, if you set the SVNO to 5, the parameters 5.SV, . . ., 5.PMc are used.
208	C.CSV.1	Used to set an SV value for loop 1 by means of custom computation or communication.
209	C.CSV.2	Used to set an SV value for loop 2 by means of custom computation or communication.
210	MMV.1	Used to set an MV value or a loop-1 heating-side MV value, by means of custom computation or communication, when loop 1 is in the MAN mode.
211	MMVc.1	Used to set a cooling-side MV value, by means of custom computation or communication, when loop 1 is in the MAN mode.
212	MMV.2	Used to set an MV value or a loop-2 heating-side MV value, by means of custom computation or communication, when loop 2 is in the MAN mode.
213	MMVc.2	Used to set a cooling-side MV value, by means of custom computation or communication, when loop 2 is in the MAN mode.

5.4.3 Data Area for Computation Parameters

Register No.	Data Category	Description	Remarks
241 to 253	Loop-1 computation parameters	AT.1: Loop-1 auto-tuning selection SC.1: Loop-1 SUPER function selection BS.1: Loop-1 PV bias FL.1: Loop-1 PV filter UPR.1: Loop-1 setpoint ramp-up DNR.1: Loop-1 setpoint ramp-down CRT.1: Loop-1 cascade ratio CBS.1: Loop-1 cascade bias CFL.1: Loop-1 cascade input filter FGN.1: Loop-1 feedforward gain FBI.1: Loop-1 feedfoward input bias FBO.1: Loop-1 feedfoward output bias FFL.1: Loop-1 feedfoward input filter	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
271 to 279	Loop-2 computation parameters	The loop-2 computation parameters, i.e., AT.2, . . ., CFL.2, are functionally the same as their corresponding loop-1 computation parameters listed above, i.e., AT.1, . . ., CFL.1.	

5.4.4 Area for Storing LL1100 Parameter Setting File Names and Their Date and Time of Creation

Register No.	Data Category	Description	Remarks
881 to 888	Parameter setting file names	PNAME1 to PNAME8	These registers contain names under which you save parameters on the disk of your PC as files after setting them. The format of file names is ******.1sp. [See Also] Section 5.7, "Data Area for USER Parameters and Ten-segment Linearizer Parameters and Messages"
261 to 264	Dates and times parameters were configured	PDATE1 to PDATE8	These registers contain the date and time when you downloaded parameters to US1000 controller after setting them. The registers are allocated as shown below: PDATE1: year PDATE2: month and day PDATE3: hour and minute PDATE4: second Example: "56 seconds past 7:36 pm on November 25, 1998, " which is written as "1998 (year)/11 (month)/25 (day)/19 (hour)/36 (minute)/56 (second)," is formatted as shown below: PDATE1: hexadecimal representation of 1998 PDATE2: hexadecimal representation of 1125 PDATE3: hexadecimal representation of 1936 PDATE4: hexadecimal representation of 56

5.5 Data Area for Loop-1 PID Parameters (D Registers 301 to 500)

Data Area for Loop-1 PID Parameters												
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
301	**1.SV.1**	*R/W	351	**3.SV.1**	*R/W	401	**5.SV.1**	*R/W	451	**7.SV.1**	*R/W
302	**1.A1.1**	*R/W	352	**3.A1.1**	*R/W	402	**5.A1.1**	*R/W	452	**7.A1.1**	*R/W
303	**1.A2.1**	*R/W	353	**3.A2.1**	*R/W	403	**5.A2.1**	*R/W	453	**7.A2.1**	*R/W
304	**1.A3.1**	*R/W	354	**3.A3.1**	*R/W	404	**5.A3.1**	*R/W	454	**7.A3.1**	*R/W
305	**1.A4.1**	*R/W	355	**3.A4.1**	*R/W	405	**5.A4.1**	*R/W	455	**7.A4.1**	*R/W
306	**1.P.1**	*R/W	356	**3.P.1**	*R/W	406	**5.P.1**	*R/W	456	**7.P.1**	*R/W
307	**1.I.1**	*R/W	357	**3.I.1**	*R/W	407	**5.I.1**	*R/W	457	**7.I.1**	*R/W
308	**1.D.1**	*R/W	358	**3.D.1**	*R/W	408	**5.D.1**	*R/W	458	**7.D.1**	*R/W
309	**1.MH.1**	*R/W	359	**3.MH.1**	*R/W	409	**5.MH.1**	*R/W	459	**7.MH.1**	*R/W
310	**1.ML.1**	*R/W	360	**3.ML.1**	*R/W	410	**5.ML.1**	*R/W	460	**7.ML.1**	*R/W
311	**1.MR.1**	*R/W	361	**3.MR.1**	*R/W	411	**5.MR.1**	*R/W	461	**7.MR.1**	*R/W
312	**1.H.1**	*R/W	362	**3.H.1**	*R/W	412	**5.H.1**	*R/W	462	**7.H.1**	*R/W
313	**1.DR.1**	*R/W	363	**3.DR.1**	*R/W	413	**5.DR.1**	*R/W	463	**7.DR.1**	*R/W
314	**1.Pc.1**	*R/W	364	**3.Pc.1**	*R/W	414	**5.Pc.1**	*R/W	464	**7.Pc.1**	*R/W
315	**1.Ic.1**	*R/W	365	**3.Ic.1**	*R/W	415	**5.Ic.1**	*R/W	465	**7.Ic.1**	*R/W
316	**1.Dc.1**	*R/W	366	**3.Dc.1**	*R/W	416	**5.Dc.1**	*R/W	466	**7.Dc.1**	*R/W
317	**1.Hc.1**	*R/W	367	**3.Hc.1**	*R/W	417	**5.Hc.1**	*R/W	467	**7.Hc.1**	*R/W
318	**1.DB.1**	*R/W	368	**3.DB.1**	*R/W	418	**5.DB.1**	*R/W	468	**7.DB.1**	*R/W
319	**1.RP.1**	*R/W	369	**3.RP.1**	*R/W	419	**5.RP.1**	*R/W	469	**RHY.1**	*R/W
320	**1.PM.1**	*R/W	370	**3.PM.1**	*R/W	420	**5.PM.1**	*R/W	470	**7.PM.1**	*R/W
321	**1.PMc.1**	*R/W	371	**3.PMc.1**	*R/W	421	**5.PMc.1**	*R/W	471	**7.PMc.1**	*R/W
322			372			422			472		
323			373			423			473		
324			374			424			474		
325			375			425			475		
326	**2.SV.1**	*R/W	376	**4.SV.1**	*R/W	426	**6.SV.1**	*R/W	476	**8.SV.1**	*R/W
327	**2.A1.1**	*R/W	377	**4.A1.1**	*R/W	427	**6.A1.1**	*R/W	477	**8.A1.1**	*R/W
328	**2.A2.1**	*R/W	378	**4.A2.1**	*R/W	428	**6.A2.1**	*R/W	478	**8.A2.1**	*R/W
329	**2.A3.1**	*R/W	379	**4.A3.1**	*R/W	429	**6.A3.1**	*R/W	479	**8.A3.1**	*R/W
330	**2.A4.1**	*R/W	380	**4.A4.1**	*R/W	430	**6.A4.1**	*R/W	480	**8.A4.1**	*R/W
331	**2.P.1**	*R/W	381	**4.P.1**	*R/W	431	**6.P.1**	*R/W	481	**8.P.1**	*R/W
332	**2.I.1**	*R/W	382	**4.I.1**	*R/W	432	**6.I.1**	*R/W	482	**8.I.1**	*R/W
333	**2.D.1**	*R/W	383	**4.D.1**	*R/W	433	**6.D.1**	*R/W	483	**8.D.1**	*R/W
334	**2.MH.1**	*R/W	384	**4.MH.1**	*R/W	434	**6.MH.1**	*R/W	484	**8.MH.1**	*R/W
335	**2.ML.1**	*R/W	385	**4.ML.1**	*R/W	435	**6.ML.1**	*R/W	485	**8.ML.1**	*R/W
336	**2.MR.1**	*R/W	386	**4.MR.1**	*R/W	436	**6.MR.1**	*R/W	486	**8.MR.1**	*R/W
337	**2.H.1**	*R/W	387	**4.H.1**	*R/W	437	**6.H.1**	*R/W	487	**8.H.1**	*R/W
338	**2.DR.1**	*R/W	388	**4.DR.1**	*R/W	438	**6.DR.1**	*R/W	488	**8.DR.1**	*R/W
339	**2.Pc.1**	*R/W	389	**4.Pc.1**	*R/W	439	**6.Pc.1**	*R/W	489	**8.Pc.1**	*R/W
340	**2.Ic.1**	*R/W	390	**4.Ic.1**	*R/W	440	**6.Ic.1**	*R/W	490	**8.Ic.1**	*R/W
341	**2.Dc.1**	*R/W	391	**4.Dc.1**	*R/W	441	**6.Dc.1**	*R/W	491	**8.Dc.1**	*R/W
342	**2.Hc.1**	*R/W	392	**4.Hc.1**	*R/W	442	**6.Hc.1**	*R/W	492	**8.Hc.1**	*R/W
343	**2.DB.1**	*R/W	393	**4.DB.1**	*R/W	443	**6.DB.1**	*R/W	493	**8.DB.1**	*R/W
344	**2.RP.1**	*R/W	394	**4.RP.1**	*R/W	444	**6.RP.1**	*R/W	494	**RDV.1**	*R/W
345	**2.PM.1**	*R/W	395	**4.PM.1**	*R/W	445	**6.PM.1**	*R/W	495	**8.PM.1**	*R/W
346	**2.PMc.1**	*R/W	396	**4.PMc.1**	*R/W	446	**6.PMc.1**	*R/W	496	**8.PMc.1**	*R/W
347			397			447			497		
348			398			448			498		
349			399			449			499		
350			400			450			500		

*: Number of times written ≦ 100,000 times.

5.5.1 Data Area for Loop-1 PID Parameters

Register No.	Data Category	Description	Remarks
301 to 321	Group-1 parameters for loop 1	1.SV.1: Target setpoint 1.A1.1: Alarm 1 setpoint 1.A2.1: Alarm 2 setpoint 1.A3.1: Alarm 3 setpoint 1.A4.1: Alarm 4 setpoint 1.P.1: Proportional band 1.I.1: Integral time 1.D.1: Derivative time 1.MH.1: Upper limit of output 1.ML.1: Lower limit of output 1.MR.1: Manual reset 1.H.1: Hysteresis 1.DR.1: Direct/reverse action switchover 1.Pc.1: Cooling-side proportional band 1.Ic.1: Cooling-side integral time 1.Dc.1: Cooling-side derivative time 1.Hc.1: Cooling-side relay hysteresis 1.DB.1: Deadband 1.RP.1: Zone PID reference point 1.PM.1: Preset output value 1.PMc.1: Cooling-side preset output value	Selecting an SV number by means of the SV number selection parameter "SVNO," results in the parameters for communication, custom computation or as external contact inputs being assembled in groups and used in the group to which that SV number belongs. Thus, switches in the parameter group occur simultaneously in both loop 1 and loop 2. For example, if you set the SVNO parameter to 5, the parameters 5.SV.1, . . ., 5.PMc.1 are used. For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
326 to 346	Group-2 parameters for loop 1	The group-2 parameters for loop 1, i.e., 2.SV.1, . . ., 2.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1.	
351 to 371	Group-3 parameters for loop 1	The group-3 parameters for loop 1, i.e., 3.SV.1, . . ., 3.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1.	
376 to 396	Group-4 parameters for loop 1	The group-4 parameters for loop 1, i.e., 4.SV.1, . . ., 4.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1.	
401 to 421	Group-5 parameters for loop 1	The group-5 parameters for loop 1, i.e., 5.SV.1, . . ., 5.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1.	
426 to 446	Group-6 parameters for loop 1	The group-6 parameters for loop 1, i.e., 6.SV.1, . . ., 6.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1.	
451 to 471	Group-7 parameters for loop 1	The group-7 parameters for loop 1, i.e., 7.SV.1, . . ., 7.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1, where RHY.1 corresponding to 1.RP.1 denotes the zone PID hysteresis.	
476 to 496	Group-8 parameters for loop 1	The group-8 parameters for loop 1, i.e., 8.SV.1, . . ., 8.PMc.1, are functionally the same as their corresponding group-1 parameters for loop 1 listed above, i.e., 1.SV.1, . . ., 1.PMc.1, where RDV.1 corresponding to 1.RP.1 denotes the zone PID reference deviation.	

5.6 Data Area for Loop-2 PID Parameters (D Registers 501 to 700)

Data Area for Loop-2 PID Parameters												
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
501	**1.SV.2**	*R/W	551	**3.SV.2**	*R/W	601	**5.SV.2**	*R/W	651	**7.SV.2**	*R/W
502	**1.A1.2**	*R/W	552	**3.A1.2**	*R/W	602	**5.A1.2**	*R/W	652	**7.A1.2**	*R/W
503	**1.A2.2**	*R/W	553	**3.A2.2**	*R/W	603	**5.A2.2**	*R/W	653	**7.A2.2**	*R/W
504	**1.A3.2**	*R/W	554	**3.A3.2**	*R/W	604	**5.A3.2**	*R/W	654	**7.A3.2**	*R/W
505	**1.A4.2**	*R/W	555	**3.A4.2**	*R/W	605	**5.A4.2**	*R/W	655	**7.A4.2**	*R/W
506	**1.P.2**	*R/W	556	**3.P.2**	*R/W	606	**5.P.2**	*R/W	656	**7.P.2**	*R/W
507	**1.I.2**	*R/W	557	**3.I.2**	*R/W	607	**5.I.2**	*R/W	657	**7.I.2**	*R/W
508	**1.D.2**	*R/W	558	**3.D.2**	*R/W	608	**5.D.2**	*R/W	658	**7.D.2**	*R/W
509	**1.MH.2**	*R/W	559	**3.MH.2**	*R/W	609	**5.MH.2**	*R/W	659	**7.MH.2**	*R/W
510	**1.ML.2**	*R/W	560	**3.ML.2**	*R/W	610	**5.ML.2**	*R/W	660	**7.ML.2**	*R/W
511	**1.MR.2**	*R/W	561	**3.MR.2**	*R/W	611	**5.MR.2**	*R/W	661	**7.MR.2**	*R/W
512	**1.H.2**	*R/W	562	**3.H.2**	*R/W	612	**5.H.2**	*R/W	662	**7.H.2**	*R/W
513	**1.DR.2**	*R/W	563	**3.DR.2**	*R/W	613	**5.DR.2**	*R/W	663	**7.DR.2**	*R/W
514	**1.Pc.2**	*R/W	564	**3.Pc.2**	*R/W	614	**5.Pc.2**	*R/W	664	**7.Pc.2**	*R/W
515	**1.Ic.2**	*R/W	565	**3.Ic.2**	*R/W	615	**5.Ic.2**	*R/W	665	**7.Ic.2**	*R/W
516	**1.Dc.2**	*R/W	566	**3.Dc.2**	*R/W	616	**5.Dc.2**	*R/W	666	**7.Dc.2**	*R/W
517	**1.Hc.2**	*R/W	567	**3.Hc.2**	*R/W	617	**5.Hc.2**	*R/W	667	**7.Hc.2**	*R/W
518	**1.DB.2**	*R/W	568	**3.DB.2**	*R/W	618	**5.DB.2**	*R/W	668	**7.DB.2**	*R/W
519	**1.RP.2**	*R/W	569	**3.RP.2**	*R/W	619	**5.RP.2**	*R/W	669	**RHY.2**	*R/W
520	**1.PM.2**	*R/W	570	**3.PM.2**	*R/W	620	**5.PM.2**	*R/W	670	**7.PM.2**	*R/W
521	**1.PMc.2**	*R/W	571	**3.PMc.2**	*R/W	621	**5.PMc.2**	*R/W	671	**7.PMc.2**	*R/W
522			572			622			672		
523			573			623			673		
524			574			624			674		
525			575			625			675		
526	**2.SV.2**	*R/W	576	**4.SV.2**	*R/W	626	**6.SV.2**	*R/W	676	**8.SV.2**	*R/W
527	**2.A1.2**	*R/W	577	**4.A1.2**	*R/W	627	**6.A1.2**	*R/W	677	**8.A1.2**	*R/W
528	**2.A2.2**	*R/W	578	**4.A2.2**	*R/W	628	**6.A2.2**	*R/W	678	**8.A2.2**	*R/W
529	**2.A3.2**	*R/W	579	**4.A3.2**	*R/W	629	**6.A3.2**	*R/W	679	**8.A3.2**	*R/W
530	**2.A4.2**	*R/W	580	**4.A4.2**	*R/W	630	**6.A4.2**	*R/W	680	**8.A4.2**	*R/W
531	**2.P.2**	*R/W	581	**4.P.2**	*R/W	631	**6.P.2**	*R/W	681	**8.P.2**	*R/W
532	**2.I.2**	*R/W	582	**4.I.2**	*R/W	632	**6.I.2**	*R/W	682	**8.I.2**	*R/W
533	**2.D.2**	*R/W	583	**4.D.2**	*R/W	633	**6.D.2**	*R/W	683	**8.D.2**	*R/W
534	**2.MH.2**	*R/W	584	**4.MH.2**	*R/W	634	**6.MH.2**	*R/W	684	**8.MH.2**	*R/W
535	**2.ML.2**	*R/W	585	**4.ML.2**	*R/W	635	**6.ML.2**	*R/W	685	**8.ML.2**	*R/W
536	**2.MR.2**	*R/W	586	**4.MR.2**	*R/W	636	**6.MR.2**	*R/W	686	**8.MR.2**	*R/W
537	**2.H.2**	*R/W	587	**4.H.2**	*R/W	637	**6.H.2**	*R/W	687	**8.H.2**	*R/W
538	**2.DR.2**	*R/W	588	**4.DR.2**	*R/W	638	**6.DR.2**	*R/W	688	**8.DR.2**	*R/W
539	**2.Pc.2**	*R/W	589	**4.Pc.2**	*R/W	639	**6.Pc.2**	*R/W	689	**8.Pc.2**	*R/W
540	**2.Ic.2**	*R/W	590	**4.Ic.2**	*R/W	640	**6.Ic.2**	*R/W	690	**8.Ic.2**	*R/W
541	**2.Dc.2**	*R/W	591	**4.Dc.2**	*R/W	641	**6.Dc.2**	*R/W	691	**8.Dc.2**	*R/W
542	**2.Hc.2**	*R/W	592	**4.Hc.2**	*R/W	642	**6.Hc.2**	*R/W	692	**8.Hc.2**	*R/W
543	**2.DB.2**	*R/W	593	**4.DB.2**	*R/W	643	**6.DB.2**	*R/W	693	**8.DB.2**	*R/W
544	**2.RP.2**	*R/W	594	**4.RP.2**	*R/W	644	**6.RP.2**	*R/W	694	**RDV.2**	*R/W
545	**2.PM.2**	*R/W	595	**4.PM.2**	*R/W	645	**6.PM.2**	*R/W	695	**8.PM.2**	*R/W
546	**2.PMc.2**	*R/W	596	**4.PMc.2**	*R/W	646	**6.PMc.2**	*R/W	696	**8.PMc.2**	*R/W
547			597			647			697		
548			598			648			698		
549			599			649			699		
550			600			650			700		

*: Number of times written ≦ 100,000 times.

5.6.1 Data Area for Loop-2 PID Parameters

Register No.	Data Category	Description	Remarks
501 to 521	Group-1 parameters for loop 2	1.SV.2: Target setpoint 1.A1.2: Alarm 1 setpoint 1.A2.2: Alarm 2 setpoint 1.A3.2: Alarm 3 setpoint 1.A4.2: Alarm 4 setpoint 1.P.2: Proportional band 1.I.2: Integral time 1.D.2: Derivative time 1.MH.2: Upper limit of output 1.ML.2: Lower limit of output 1.MR.2: Manual reset 1.H.2: Hysteresis 1.DR.2: Direct/reverse action switchover 1.Pc.2: Cooling-side proportional band 1.Ic.2: Cooling-side integral time 1.Dc.2: Cooling-side derivative time 1.Hc.2: Cooling-side relay hysteresis 1.DB.2: Deadband 1.RP.2: Zone PID reference point 1.PM.2: Preset output value 1.PMc.2: Cooling-side preset output value	Selecting an SV number by means of the SV number selection parameter "SVNO," results in the parameters for communication, custom computation or as external contact inputs being assembled in groups and used in the group to which that SV number belongs. Thus, switches in the parameter group occur simultaneously in both loop 1 and loop 2. For example, if you set the SVNO parameter to 5, the parameters 5.SV.2, . . ., 5.PMc.2 are used. For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
526 to 546	Group-2 parameters for loop 2	The group-2 parameters for loop 2, i.e., 2.SV.2, . . ., 2.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2.	
551 to 571	Group-3 parameters for loop 2	The group-3 parameters for loop 2, i.e., 3.SV.2, . . ., 3.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2.	
576 to 596	Group-4 parameters for loop 2	The group-4 parameters for loop 2, i.e., 4.SV.2, . . ., 4.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2.	
601 to 621	Group-5 parameters for loop 2	The group-5 parameters for loop 2, i.e., 5.SV.2, . . ., 5.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2.	
626 to 646	Group-6 parameters for loop 2	The group-6 parameters for loop 2, i.e., 6.SV.2, . . ., 6.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2.	
651 to 671	Group-7 parameters for loop 2	The group-7 parameters for loop 2, i.e., 7.SV.2, . . ., 7.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2, where RHY.2 corresponding to 1.RP.2 denotes the zone PID hysteresis.	
676 to 696	Group-8 parameters for loop 2	The group-8 parameters for loop 2, i.e., 8.SV.2, . . ., 8.PMc.2, are functionally the same as their corresponding group-1 parameters for loop 2 listed above, i.e., 1.SV.2, . . ., 1.PMc.2, where RDV.2 corresponding to 1.RP.2 denotes the zone PID reference deviation.	

5.7 Data Area for USER Parameters and Ten-segment Linearizer Parameters and Messages (D Registers 701 to 900)

Data Area for USER Parameters and Ten-segment Linearizer Parameters						Data Area for Messages					
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
701	**U1**	*R/W	751	**2.X1**	*R/W	801	**MSG101**	*R/W	851	**MSG311**	*R/W
702	**U2**	*R/W	752	**2.Y1**	*R/W	802	**MSG102**	*R/W	852	**MSG312**	*R/W
703	**U3**	*R/W	753	**2.X2**	*R/W	803	**MSG103**	*R/W	853	**MSG313**	*R/W
704	**U4**	*R/W	754	**2.Y2**	*R/W	804	**MSG104**	*R/W	854	**MSG314**	*R/W
705	**U5**	*R/W	755	**2.X3**	*R/W	805	**MSG105**	*R/W	855	**MSG315**	*R/W
706	**U6**	*R/W	756	**2.Y3**	*R/W	806	**MSG106**	*R/W	856	**MSG316**	*R/W
707	**U7**	*R/W	757	**2.X4**	*R/W	807	**MSG107**	*R/W	857	**MSG317**	*R/W
708	**U8**	*R/W	758	**2.Y4**	*R/W	808	**MSG108**	*R/W	858	**MSG318**	*R/W
709	**UD1**	R/W	759	**2.X5**	*R/W	809	**MSG109**	*R/W	859	**MSG319**	*R/W
710	**UD2**	R/W	760	**2.Y5**	*R/W	810	**MSG110**	*R/W	860	**MSG320**	*R/W
711	**UD3**	R/W	761	**2.X6**	*R/W	811	**MSG111**	*R/W	861	**MSG401**	*R/W
712	**UD4**	R/W	762	**2.Y6**	*R/W	812	**MSG112**	*R/W	862	**MSG402**	*R/W
713	**UD5**	R/W	763	**2.X7**	*R/W	813	**MSG113**	*R/W	863	**MSG403**	*R/W
714	**UD6**	R/W	764	**2.Y7**	*R/W	814	**MSG114**	*R/W	864	**MSG404**	*R/W
715	**UD7**	R/W	765	**2.X8**	*R/W	815	**MSG115**	*R/W	865	**MSG405**	*R/W
716	**UD8**	R/W	766	**2.Y8**	*R/W	816	**MSG116**	*R/W	866	**MSG406**	*R/W
717	**UD9**	R/W	767	**2.X9**	*R/W	817	**MSG117**	*R/W	867	**MSG407**	*R/W
718	**UD10**	R/W	768	**2.Y9**	*R/W	818	**MSG118**	*R/W	868	**MSG408**	*R/W
719	**UD11**	R/W	769	**2.X10**	*R/W	819	**MSG119**	*R/W	869	**MSG409**	*R/W
720	**UD12**	R/W	770	**2.Y10**	*R/W	820	**MSG120**	*R/W	870	**MSG410**	*R/W
721	**UD13**	R/W	771	**2.X11**	*R/W	821	**MSG201**	*R/W	871	**MSG411**	*R/W
722	**UD14**	R/W	772	**2.Y11**	*R/W	822	**MSG202**	*R/W	872	**MSG412**	*R/W
723	**UD15**	R/W	773	**2.PMD**	*R/W	823	**MSG203**	*R/W	873	**MSG413**	*R/W
724	**UD16**	R/W	774			824	**MSG204**	*R/W	874	**MSG414**	*R/W
725	**UD17**	R/W	775			825	**MSG205**	*R/W	875	**MSG415**	*R/W
726	**1.X1**	*R/W	776	**DISP11**	*R/W	826	**MSG206**	*R/W	876	**MSG416**	*R/W
727	**1.Y1**	*R/W	777	**DISP12**	*R/W	827	**MSG207**	*R/W	877	**MSG417**	*R/W
728	**1.X2**	*R/W	778	**DISP13**	*R/W	828	**MSG208**	*R/W	878	**MSG418**	*R/W
729	**1.Y2**	*R/W	779	**DISP21**	*R/W	829	**MSG209**	*R/W	879	**MSG419**	*R/W
730	**1.X3**	*R/W	780	**DISP22**	*R/W	830	**MSG210**	*R/W	880	**MSG420**	*R/W
731	**1.Y3**	*R/W	781	**DISP23**	*R/W	831	**MSG211**	*R/W	881	**PNAME1**	*R/W
732	**1.X4**	*R/W	782			832	**MSG212**	*R/W	882	**PNAME2**	*R/W
733	**1.Y4**	*R/W	783			833	**MSG213**	*R/W	883	**PNAME3**	*R/W
734	**1.X5**	*R/W	784	**UNAME1**	R	834	**MSG214**	*R/W	884	**PNAME4**	*R/W
735	**1.Y5**	*R/W	785	**UNAME2**	R	835	**MSG215**	*R/W	885	**PNAME5**	*R/W
736	**1.X6**	*R/W	786	**UNAME3**	R	836	**MSG216**	*R/W	886	**PNAME6**	*R/W
737	**1.Y6**	*R/W	787	**UNAME4**	R	837	**MSG217**	*R/W	887	**PNAME7**	*R/W
738	**1.X7**	*R/W	788	**UNAME5**	R	838	**MSG218**	*R/W	888	**PNAME8**	*R/W
739	**1.Y7**	*R/W	789	**UNAME6**	R	839	**MSG219**	*R/W	889		
740	**1.X8**	*R/W	790	**UNAME7**	R	840	**MSG220**	*R/W	890		
741	**1.Y8**	*R/W	791	**UNAME8**	R	841	**MSG301**	*R/W	891		
742	**1.X9**	*R/W	792	**UDATE1**	R	842	**MSG302**	*R/W	892		
743	**1.Y9**	*R/W	793	**UDATE2**	R	843	**MSG303**	*R/W	893		
744	**1.X10**	*R/W	794	**UDATE3**	R	844	**MSG304**	*R/W	894		
745	**1.Y10**	*R/W	795	**UDATE4**	R	845	**MSG305**	*R/W	895		
746	**1.X11**	*R/W	796			846	**MSG306**	*R/W	896		
747	**1.Y11**	*R/W	797			847	**MSG307**	*R/W	897		
748	**1.PMD**	*R/W	798			848	**MSG308**	*R/W	898		
749			799			849	**MSG309**	*R/W	899		
750			800			850	**MSG310**	*R/W	900		

*: Number of times written ≦ 100,000 times.

5.7.1 Data Area for USER Parameters

Register No.	Data Category	Description	Remarks
701 to 708	USER parameters	U1 to U8	Parameters U1 to U3 are used when the controller mode (US mode) is loop control with PV switching, loop control with PV auto-selector, loop control with PV switching and two universal inputs, or loop control with PV auto-selector and two universal inputs. [See Also] US1000 Digital Indicating Controller–Functions instruction manual (IM 5D1A01-02E)

5.7.2 User Area

Register No.	Data Category	Description	Remarks
709 to 725	User area	UD1 to UD17	Data can be written to or read from the area of D registers 709 to 725 by means of custom computation.

5.7.3 Data Area for Parameters of Ten-segment Linearizers 1 and 2

Register No.	Data Category	Description	Remarks
726 to 748	Ten-segment linearizer-1 parameters	1.X1: Ten-segment linearizer-1 input 1 1.Y1: Ten-segment linearizer-1 output 1 1.X2: Ten-segment linearizer-1 input 2 1.Y2: Ten-segment linearizer-1 output 2 1.X3: Ten-segment linearizer-1 input 3 1.Y3: Ten-segment linearizer-1 output 3 1.X4: Ten-segment linearizer-1 input 4 1.Y4: Ten-segment linearizer-1 output 4 1.X5: Ten-segment linearizer-1 input 5 1.Y5: Ten-segment linearizer-1 output 5 1.X6: Ten-segment linearizer-1 input 6 1.Y6: Ten-segment linearizer-1 output 6 1.X7: Ten-segment linearizer-1 input 7 1.Y7: Ten-segment linearizer-1 output 7 1.X8: Ten-segment linearizer-1 input 8 1.Y8: Ten-segment linearizer-1 output 8 1.X9: Ten-segment linearizer-1 input 9 1.Y9: Ten-segment linearizer-1 output 9 1.X10: Ten-segment linearizer-1 input 10 1.Y10: Ten-segment linearizer-1 output 10 1.X11: Ten-segment linearizer-1 input 11 1.Y11: Ten-segment linearizer 1 output 11 1.PMD: Ten-segment linearizer 1 mode	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
751 to 773	Ten-segment linearizer-2 parameters	The parameters of ten-segment linearizer 2, i.e., 2.X1, . . ., 2.PMD, are functionally the same as the corresponding parameters of ten-segment linearizer 1 listed above, i.e., 1.X1, . . ., 1.PMD.	

5.7.4 Areas for DISP1 and DISP2 Text Settings

Register No.	Data Category	Description	Remarks
776 to 778	DISP1 text setting	DISP11 to DISP13	The DISP1 and DISP2 text setting registers are enabled only when the DISP1 (Data Display 1) and DISP2 (Data Display 2) computation modules are used as the custom computations. [See Also] Chapter 4, "List of Computation Modules and Their Functions" To register a character string that you want to show on the PV digital display, follow the instructions given below. The string should include no more than five single-byte alphanumeric characters. For example, use the following procedure to show the text "ABCDE" on the PV display. • In the Setting Character of DISP1,2 Display of the Custom Display Selection Dialog box of the LL1200 PC-Based Custom Computation Building Tool, type "ABCDE." Use the same procedure to configure the DISP21 to DISP23 registers.
779 to 781	DISP2 text setting	DISP21 to DISP23	

5.7.5 Area for Storing the File Names of Created LL1200 Custom Computations and Their Date and Time of Creation

Register No.	Data Category	Description	Remarks
784 to 791	Custom computation file names	UNAME1 to UNAME8	These registers contain names under which you save Custom Computation Information on the disk of your PC as files after creating them. The format of file names is ******.1sc.
792 to 795	Dates and times custom computations were created	UDATE1 to UDATE4	These registers contain the date and time at which you downloaded the custom computations information to US1000 controller after creating them. The registers are allocated as shown below: UDATE1: year UDATE2: month and day UDATE3: hour and minute UDATE4: second Example: "56 seconds past 7:36 pm on November 25, 1998, "which is written as "1998 (year)/11 (month)/25 (day)/19 (hour)/36 (minute)/56 (second)," is formatted as shown below: UDATE1: hexadecimal representation of 1998 UDATE2: hexadecimal representation of 1125 UDATE3: hexadecimal representation of 1936 UDATE4: hexadecimal representation of 56

5.7.6 Area for Setting Message Text

Register No.	Data Category	Description	Remarks
801 to 820	Message 1 text setting	MSG101 to MSG120	These registers contain the messages you registered using the LL1100 PC-based Parameters Setting Tool. The message text should include no more than 33 single-byte alphanumeric characters. You can register a maximum of four messages.
821 to 840	Message 2 text setting	MSG201 to MSG220	
841 to 860	Message 3 text setting	MSG301 to MSG320	
861 to 880	Message 4 text setting	MSG401 to MSG420	

5.7.7 Area for Storing File Names of LL1100 Parameter Settings

Register No.	Data Category	Description	Remarks
881 to 888	Parameter setting file names	PNAME1 to PNAME8	These registers contain names under which you save parameters on the disk of your PC as files after setting them. The format of file names is ******.1sp.
261 to 264	Dates and times parameters were configured	PDATE1 to PDATE4	These registers contain the date and time when you downloaded the parameters to US1000 controller after setting them. The registers are allocated as shown below: [See Also] Section 5.4, "Data Area for Modes and Computation Parameters"

5.8 Data Area for Control Function Parameters, Loop Common Control Function Parameters, and I/O Configuration Parameters (D Registers 901 to 1200)

Data Area for Control Function Parameters						Data Area for Loop Common Control Function Parameters						Data Area for I/O Configuration Parameters					
No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W	No.	Register name	R/W
901	**CMS.1**	*R/W	951			1001	**A.BS1**	*R/W	1051	**RET1**	*R/W	1101	**C.S1**	*R/W	1151	**U.1AL**	*R/W
902			952			1002	**A.FL1**	*R/W	1052	**RTH1**	*R/W	1102	**C.S2**	*R/W	1152	**U.2AL**	*R/W
903	**PVT.1**	*R/W	953			1003	**A.SR1**	*R/W	1053	**RTL1**	*R/W	1103	**C.S3**	*R/W	1153	**U.SVN**	*R/W
904	**TMU.1**	*R/W	954			1004	**A.LC1**	*R/W	1054	**RET2**	*R/W	1104	**C.S4**	*R/W	1154	**U.1PI**	*R/W
905	**DVB.1**	*R/W	955	**AL1.2**	*R/W	1005	**A.BO1**	*R/W	1055	**RTH2**	*R/W	1105	**C.S5**	*R/W	1155	**U.2PI**	*R/W
906			956	**AL2.2**	*R/W	1006	**A.RJ1**	*R/W	1056	**RTL2**	*R/W	1106	**DO1**	*R/W	1156	**U.AI1**	*R/W
907			957	**AL3.2**	*R/W	1007			1057	**RET3**	*R/W	1107	**DO2**	*R/W	1157	**U.AI2**	*R/W
908			958	**AL4.2**	*R/W	1008			1058	**RTH3**	*R/W	1108	**DO3**	*R/W	1158	**U.AI3**	*R/W
909			959	**HY1.2**	*R/W	1009			1059	**RTL3**	*R/W	1109	**DO4**	*R/W	1159	**U.PV1**	*R/W
910			960	**HY2.2**	*R/W	1010			1060			1110	**DO5**	*R/W	1160	**U.PV2**	*R/W
911			961	**HY3.2**	*R/W	1011	**A.BS2**	*R/W	1061	**SVC**	*R/W	1111	**DO6**	*R/W	1161	**U.SMP**	*R/W
912			962	**HY4.2**	*R/W	1012	**A.FL2**	*R/W	1062	▽/△	*R/W	1112	**DO7**	*R/W	1162		
913			963	**PVR.T.2**	*R/W	1013	**A.SR2**	*R/W	1063	</>	*R/W	1113			1163		
914			964	**AMD.2**	*R/W	1014	**A.LC2**	*R/W	1064	**C**	*R/W	1114			1164		
915	**AL1.1**	*R/W	965			1015	**A.BO2**	*R/W	1065	**A**	*R/W	1115			1165		
916	**AL2.1**	*R/W	966	**MVR.2**	*R/W	1016	**A.RJ2**	*R/W	1066	**M**	*R/W	1116			1166		
917	**AL3.1**	*R/W	967	**MOD.2**	*R/W	1017			1067	**MODE**	*R/W	1117			1167		
918	**AL4.1**	*R/W	968	**AR.2**	*R/W	1018			1068	**O.LP1**	*R/W	1118			1168		
919	**HY1.1**	*R/W	969			1019			1069	**O.LP2**	*R/W	1119			1169		
920	**HY2.1**	*R/W	970			1020			1070	**PID**	*R/W	1120			1170		
921	**HY3.1**	*R/W	971			1021	**A.BS3**	*R/W	1071	**USR**	*R/W	1121			1171	**PY1X**	*R/W
922	**HY4.1**	*R/W	972			1022	**A.FL3**	*R/W	1072	**PYS1**	*R/W	1122			1172	**PY1Y**	*R/W
923	**PVR.T.1**	*R/W	973			1023	**A.SR3**	*R/W	1073	**PYS2**	*R/W	1123			1173	**PY2X**	*R/W
924	**AMD.1**	*R/W	974			1024	**A.LC3**	*R/W	1074	**PWD**	*R/W	1124			1174	**PY2Y**	*R/W
925			975			1025	**A.BO3**	*R/W	1075			1125			1175		
926	**MVR.1**	*R/W	976			1026			1076			1126			1176		
927	**MOD.1**	*R/W	977			1027			1077			1127			1177		
928	**AR.1**	*R/W	978			1028			1078			1128			1178		
929	**FFS**	*R/W	979			1029			1079			1129	**CAS.1**	*R/W	1179		
930			980			1030			1080			1130	**AUT.1**	*R/W	1180		
931			981			1031			1081	**PSL**	*R/W	1131	**MAN.1**	*R/W	1181		
932			982			1032			1082	**BPS**	*R/W	1132	**CAS.2**	*R/W	1182		
933			983			1033			1083	**PARI**	*R/W	1133	**AUT.2**	*R/W	1183		
934			984			1034			1084	**STP**	*R/W	1134	**MAN.2**	*R/W	1184		
935			985			1035			1085	**DLN**	*R/W	1135	**O/C**	*R/W	1185		
936			986			1036			1086	**ADR**	*R/W	1136	**R/S**	*R/W	1186		
937			987			1037			1087	**RSP.T**	*R/W	1137	**TRF.1**	*R/W	1187		
938			988			1038			1088			1138	**TRF.2**	*R/W	1188		
939			989			1039			1089			1139			1189		
940			990			1040			1090			1140	**SV.B0**	*R/W	1190		
941	**CMS.2**	*R/W	991			1041	**PPID**	*R/W	1091			1141	**SV.B1**	*R/W	1191		
942			992			1042	**R.MD**	*R/W	1092			1142	**SV.B2**	*R/W	1192		
943	**PVT.2**	*R/W	993			1043	**R.TM**	*R/W	1093			1143	**SV.B3**	*R/W	1193		
944	**TMU.2**	*R/W	994			1044	**CT.1**	*R/W	1094			1144	**DP1**	*R/W	1194		
945	**DVB.2**	*R/W	995			1045	**CT.2**	*R/W	1095			1145	**DP2**	*R/W	1195		
946			996			1046	**CTc.1**	*R/W	1096			1146	**MG1**	*R/W	1196		
947			997			1047	**CTc.2**	*R/W	1097			1147	**MG2**	*R/W	1197		
948			998			1048			1098			1148	**MG3**	*R/W	1198		
949			999			1049			1099			1149	**MG4**	*R/W	1199		
950			1000			1050			1100			1150			1200		

*: Number of times written ≦ 100,000 times.

5.8.1 Data Area for Control Function Parameters

Register No.	Data Category	Description	Remarks
901 to 905	Loop-1, SV-related parameters	CMS.1, . . ., DVB.1	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
915 to 924	Loop-1, alarm setting parameters	AL1.1, . . ., PMD.1	
926 to 929	Loop-1, control function setting parameter	MVR.1, . . ., FFS	
941 to 945	Loop-2, SV-related parameters	CMS.2, . . ., DVB.2	
955 to 964	Loop-2, alarm setting parameters	AL1.2, . . ., PMD.2	
966 to 968	Loop-2, control function setting parameters	MVR.2, . . ., AR.2	

5.8.2 Data Area for Loop Common Control Function Parameters

Register No.	Data Category	Description	Remarks
1001 to 1006	Input computation setting parameters	A.BS1, . . ., A.RJ1	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1011 to 1016		A.BS2, . . ., A.RJ2	
1021 to 1026		A.BS3, . . ., A.BO3	
1041 to 1047	Loop common control function setting parameters	PPID, . . ., CTc.2	
1051 to 1058	Retransmission output setting parameters	RET1, . . ., RTL3	
1061 to 1066	Keylock setting parameters	SVC, . . ., M	
1067 to 1074	Menu lock setting parameters	MODE, . . ., PWD	
1081 to 1087	RS485 setting parameters	PSL, . . ., RSP.T	

5.8.3 Data Area for I/O Configuration Parameters

Register No.	Data Category	Description	Remarks
1101 to 1105	SELECT display Configuration parameters	C.S1, . . ., C.S5	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1151 to 1161	USER display Configuration parameters	U.AL1, . . ., U.SMP	
1106 to 1112	Contact output Configuration parameters	DO1, . . ., DO7	
1129 to 1149	Contact input Configuration parameters	CAS.1, . . ., MG4	
1171 to 1174	Ten-segment linearizer unit setting parameters	PY1X, . . ., PY2Y	

5.9 Data Area for Controller-mode, Analog-input and MV Parameters (D Registers 1201 to 1300)

Data Area for Controller-mode, Analog-input and MV Parameters					
No.	Register name	R/W	No.	Register name	R/W
1201	**TYP1**	*R/W	1251		
1202	**UNI1**	*R/W	1252		
1203	**DP1**	R	1253		
1204	**RH1**	*R/W	1254		
1205	**RL1**	*R/W	1255		
1206	**SDP1**	*R/W	1256		
1207	**SH1**	*R/W	1257		
1208	**SL1**	*R/W	1258		
1209			1259		
1210			1260		
1211	**TYP2**	*R/W	1261	**V.RS**	*R/W
1212	**UNI2**	*R/W	1262	**V.L**	*R/W
1213	**DP2**	R	1263	**V.H**	*R/W
1214	**RH2**	*R/W	1264	**V.AT**	*R/W
1215	**RL2**	*R/W	1265	**INIT**	*R/W
1216	**SDP2**	*R/W	1266		
1217	**SH2**	*R/W	1267		
1218	**SL2**	*R/W	1268		
1219			1269		
1220			1270		
1221	**TYP3**	*R/W	1271		
1222			1272		
1223	**DP3**	R	1273		
1224	**RH3**	*R/W	1274		
1225	**RL3**	*R/W	1275		
1226	**SDP3**	*R/W	1276		
1227	**SH3**	*R/W	1277		
1228	**SL3**	*R/W	1278		
1229			1279		
1230			1280	**USM**	*R/W
1231	**P.DP1**	*R/W	1281	**SMP**	*R/W
1232	**P.RH1**	*R/W	1282		
1233	**P.RL1**	*R/W	1283		
1234			1284		
1235	**P.DP2**	*R/W	1285		
1236	**P.RH2**	*R/W	1286		
1237	**P.RL2**	*R/W	1287		
1238			1288		
1239			1289		
1240			1290		
1241	**MVS.1**	*R/W	1291		
1242	**MVS.2**	*R/W	1292		
1243	**AO1**	*R/W	1293		
1244	**AO2**	*R/W	1294		
1245	**AO3**	*R/W	1295		
1246	**RVOP**	*R/W	1296		
1247			1297		
1248			1298		
1249			1299		
1250			1300		

*: Number of times written.

5.9.1 Data Area for Controller-mode, Analog-input and MV Parameters

Register No.	Data Category	Description	Remarks
1201 to 1208	Analog input 1 parameters	TYP1, . . ., SL1	The DP1 register (numbered 1203) is not a parameter register but a read-only register. For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1211 to 1218	Analog input 2 parameters	TYP2, . . ., SL2	The DP2 register (numbered 1213) is not a parameter register but a read-only register. For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1221 to 1228	Analog input 3 parameters	TYP3, . . ., SL3	The DP3 register (numbered 1223) is not a parameter register but a read-only register. For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1231 to 1233	PV input 1 parameters	P.DP1, . . ., P.RL1	For details on the parameters, see the *US1000 Digital Indicating Controller–Functions* instruction manual (IM 5D1A01-02E).
1235 to 1237	PV input 2 parameters	P.DP2, . . ., P.RL2	
1241 to 1246	MV parameters	MVS.1, . . ., RVOP	
1261 to 1264	Valve calibration parameters	V.RS, . . ., V.H	
1265	Parameter initialization	INIT	
1280	US-mode parameter	USM	
1281	Control period parameter	SMP	

5.10 On-Off Status Area (I Relays 1 [5001] to 192 [5192])

The following table summarizes how the on-off status area (I relays) is configured.

I Relay No.	Data Category	Description	Remarks
1 to 16	On-off statuses	Input error (same as data in the D0001 register)	Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits.
17 to 32		PV1 error (same as data in the D0002 register)	
33 to 48		PV2 error (same as data in the D0018 register)	
49 to 64		Error in calibrated values or parameters (same as data in the D0035 register)	
65 to 80		Loop 1's mode (same as data in the D0008 register)	
81 to 96		Loop 2's mode (same as data in the D0024 register)	
97 to 112		Alarm status (same as data in the D0011 register)	
113 to 160		Do not use.	
161 to 176		Status of external contact input (same as data in the D0033 register)	
177 to 192		Do not use.	

The on-off status I relays numbered 1 to 192 store on-off status information. In normal operation, this area can be accessed to read the on-off status.

NOTE

To access this area using an I relay number, use the code number “I relay number + 5000”.
For example, use “5009,” which means “9 + 5000,” to refer to the on-off status of the RJC1ERR.st relay (I relay numbered 9).

On-Off Status Area											
No.	1 to 32	No.	33 to 64	No.	65 to 96	No.	97 to 128	No.	129 to 160	No.	161 to 192
1	**AD1ERR.st**	33	**PV2ADC.st**	65		97	**ALM11.st**	129		161	**DI1.st**
2	**AD2ERR.st**	34	**PV2BO.st**	66		98	**ALM12.st**	130		162	**DI2.st**
3	**AD3ERR.st**	35	**RJC2ERR.st**	67	**R/S.st**	99	**ALM13.st**	131		163	**DI3.st**
4		36		68		100		132		164	**DI4.st**
5	**AD1BO.st**	37	**PV2+over.st**	69	**CAS1.st**	101	**ALM14.st**	133		165	**DI5.st**
6	**AD2BO.st**	38	**PV2-over.st**	70	**AUT1.st**	102		134		166	**DI6.st**
7	**AD3BO.st**	39		71	**MAN1.st**	103		135		167	**DI7.st**
8		40		72		104		136		168	
9	**RJC1ERR.st**	41	**CSV2ADC.st**	73		105	**ALM21.st**	137		169	**DP1.st**
10	**RJC2ERR.st**	42	**CSV2BO.st**	74		106	**ALM22.st**	138		160	**DP2.st**
11		43		75		107	**ALM23.st**	139		171	**MG1.st**
12	**VLERR.st**	44		76		108		140		172	**MG2.st**
13	**VLBO.st**	45	**C.CSV2ADC.st**	77		109	**ALM24.st**	141		173	**MG3.st**
14		46	**C.CSV2BO.st**	78		110		142		174	**MG4.st**
15		47	**AT2ERR.st**	79	**AT1.st**	111		143		175	
16		48		80		112		144		176	
17	**PV1ADC.st**	49	**CALB.E.st**	81		113		145		177	
18	**PV1BO.st**	50		82		114		146		178	
19	**RJC1ERR.st**	51	**USER.E.st**	83	**O/C.st**	115		147		179	
20		52		84		116		148		180	
21	**PV1+over.st**	53	**USMD.st**	85	**CAS2.st**	117		149		181	
22	**PV1-over.st**	54	**RANGE.st**	86	**AUT2.st**	118		150		182	
23		55	**SETUP.st**	87	**MAN2.st**	119		151		183	
24		56		88		120		152		184	
25	**CSV1ADC.st**	57	**PARA.E.st**	89		121		153		185	
26	**CSV1BO.st**	58	**MODE.E.st**	90		122		154		186	
27		59		91		123		155		187	
28		60		92		124		156		188	
29	**C.CSV1ADC.st**	61	**EEP.E.st**	93		125		157		189	
30	**C.CSV1BO.st**	62		94		126		158		190	
31	**AT1ERR.st**	63	**SYSTEM.E.st**	95	**AT2.st**	127		159		191	
32		64		96		128		160		192	

5.11 On-Status Area (I Relays 193 [5193] to 384 [5384])

The following table summarizes how the on-status area (I relays) is configured.

I Relay No.	Data Category	Description	Remarks
193 to 208	On-statuses	Input error (same as data in the D0001 register)	Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits.
209 to 224		PV1 error (same as data in the D0002 register)	
225 to 240		PV2 error (same as data in the D0018 register)	
241 to 256		Error in calibrated values or parameters (same as data in the D0035 register)	
257 to 272		Loop 1's mode (same as data in the D0008 register)	
273 to 288		Loop 2's mode (same as data in the D0024 register)	
289 to 304		Alarm status (same as data in the D0011 register)	
305 to 352		Do not use.	
353 to 368		Status of external contact input	
369 to 384		Do not use.	

The on-status I relays numbered 193 to 384 remain turned on for one control period only when the status changes from “off” to “on.”

NOTE

To access this area using an I relay number, use the code number “I relay number + 5000”.
For example, use “5201,” which means “201 + 5000,” to refer to the status of the RJC1ERR.on relay (I relay numbered 201).

On Status Area											
No.	193 to 224	No.	225 to 256	No.	257 to 288	No.	289 to 320	No.	321 to 352	No.	353 to 384
193	**AD1ERR.on**	225	**PV2ADC.on**	257		289	**ALM11.on**	321		353	**DI1.on**
194	**AD2ERR.on**	226	**PV2BO.on**	258		290	**ALM12.on**	322		354	**DI2.on**
195	**AD3ERR.on**	227	**RJC2ERR.on**	259	**R/S.on**	291	**ALM13.on**	323		355	**DI3.on**
196		228		260		292		324		356	**DI4.on**
197	**AD1BO.on**	229	**PV2+over.on**	261	**CAS1.on**	293	**ALM14.on**	325		357	**DI5.on**
198	**AD2BO.on**	230	**PV2-over.on**	262	**AUT1.on**	294		326		358	**DI6.on**
199	**AD3BO.on**	231		263	**MAN1.on**	295		327		359	**DI7.on**
200		232		264		296		328		360	
201	**RJC1ERR.on**	233	**CSV2ADC.on**	265		297	**ALM21.on**	329		361	**DP1.on**
202	**RJC2ERR.on**	234	**CSV2BO.on**	266		298	**ALM22.on**	330		362	**DP2.on**
203		235		267		299	**ALM23.on**	331		363	**MG1.on**
204	**VLERR.on**	236		268		300		332		364	**MG2.on**
205	**VLBO.on**	237	**C.CSV2ADC.on**	269		301	**ALM24.on**	333		365	**MG3.on**
206		238	**C.CSV2BO.on**	270		302		334		366	**MG4.on**
207		239	**AT2ERR.on**	271	**AT1.on**	303		335		367	
208		240		272		304		336		368	
209	**PV1ADC.on**	241	**CALB.E.on**	273		305		337		369	
210	**PV1BO.on**	242		274		306		338		370	
211	**RJC1ERR.on**	243	**USER.E.on**	275	**O/C.on**	307		339		371	
212		244		276		308		340		372	
213	**PV1+over.on**	245	**USMD.on**	277	**CAS2.on**	309		341		373	
214	**PV1-over.on**	246	**RANGE.on**	278	**AUT2.on**	310		342		374	
215		247	**SETUP.on**	279	**MAN2.on**	311		343		375	
216		248		280		312		344		376	
217	**CSV1ADC.on**	249	**PARA.E.on**	281		313		345		377	
218	**CSV1BO.on**	250	**MODE.E.on**	282		314		346		378	
219		251		283		315		347		379	
220		252		284		316		348		380	
221	**C.CSV1ADC.on**	253	**EEP.E.on**	285		317		349		381	
222	**C.CSV1BO.on**	254		286		318		350		382	
223	**AT1ERR.on**	255	**SYSTEM.E.on**	287	**AT2.on**	319		351		383	
224		256		288		320		352		384	

5.12 Off-Status Area (I Relays 385 [5385] to 576 [5576])

The following table summarizes how the off-status area (I relays) is configured.

I Relay No.	Data Category	Description	Remarks
385 to 400	Off-statuses	Input error (same as data in the D0001 register)	Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits.
401 to 416		PV1 error (same as data in the D0002 register)	
417 to 432		PV2 error (same as data in the D0018 register)	
433 to 448		Error in calibrated values or parameters (same as data in the D0035 register)	
449 to 464		Loop 1's mode (same as data in the D0008 register)	
465 to 480		Loop 2's mode (same as data in the D0024 register)	
481 to 496		Alarm status (same as data in the D0011 register)	
497 to 544		Do not use.	
545 to 560		Status of external contact input	
561 to 576		Do not use.	

The off-status I relays numbered 385 to 576 remain turned on for one control period only when the status changes from “on” to “off.”

NOTE

To access this area using an I relay number, use the code number “I relay number + 5000”.
For example, use “5393,” which means “393 + 5000,” to refer to the status of the RJC1ERR.off relay (I relay numbered 393).

Off Status Area											
No.	385 to 416	No.	417 to 448	No.	449 to 480	No.	481 to 512	No.	513 to 544	No.	545 to 576
385	**AD1ERR.off**	417	**PV2ADC.off**	449		481	**ALM11.off**	513		545	**DI1.off**
386	**AD2ERR.off**	418	**PV2BO.off**	450		482	**ALM12.off**	514		546	**DI2.off**
387	**AD3ERR.off**	419	**RJC2ERR.off**	451	**R/S.off**	483	**ALM13.off**	515		547	**DI3.off**
388		420		452		484		516		548	**DI4.off**
389	**AD1BO.off**	421	**PV2+over.off**	453	**CAS1.off**	485	**ALM14.off**	517		549	**DI5.off**
390	**AD2BO.off**	422	**PV2-over.off**	454	**AUT1.off**	486		518		550	**DI6.off**
391	**AD3BO.off**	423		455	**MAN1.off**	487		519		551	**DI7.off**
392		424		456		488		520		552	
393	**RJC1ERR.off**	425	**CSV2ADC.off**	457		489	**ALM21.off**	521		553	**DP1.off**
394	**RJC2ERR.off**	426	**CSV2BO.off**	458		490	**ALM22.off**	522		554	**DP2.off**
395		427		459		491	**ALM23.off**	523		555	**MG1.off**
396	**VLERR.off**	428		460		492		524		556	**MG2.off**
397	**VLBO.off**	429	**C.CSV2ADC.off**	461		493	**ALM24.off**	525		557	**MG3.off**
398		430	**C.CSV2BO.off**	462		494		526		558	**MG4.off**
399		431	**AT2ERR.off**	463	**AT1.off**	495		527		559	
400		432		464		496		528		560	
401	**PV1ADC.off**	433	**CALB.E.off**	465		497		529		561	
402	**PV1BO.off**	434		466		498		530		562	
403	**RJC1ERR.off**	435	**USER.E.off**	467	**O/C.off**	499		531		563	
404		436		468		500		532		564	
405	**PV1+over.off**	437	**USMD.off**	469	**CAS2.off**	501		533		565	
406	**PV1-over.off**	438	**RANGE.off**	470	**AUT2.off**	502		534		566	
407		439	**SETUP.off**	471	**MAN2.off**	503		535		567	
408		440		472		504		536		568	
409	**CSV1ADC.off**	441	**PARA.E.off**	473		505		537		569	
410	**CSV1BO.off**	442	**MODE.E.off**	474		506		538		570	
411		443		475		507		539		571	
412		444		476		508		540		572	
413	**C.CSV1ADC.off**	445	**EEP.E.off**	477		509		541		573	
414	**C.CSV1BO.off**	446		478		510		542		574	
415	**AT1ERR.off**	447	**SYSTEM.E.off**	479	**AT2.off**	511		543		575	
416		448		480		512		544		576	

5.13 Alarm Flag, Timer Flag, Power-on Flag Status Area (I Relays 577 [5577] to 2048 [7048])

The following table summarizes how the status area (I relays) of flags, including alarm, timer and power-on flags, is configured.

I Relay No.	Data Category	Description
577 to 592	Statuses	Current cascade SV number (Note 1) (same as data in the D0010 register)
593 to 608		Currently selected loop-1 PID number (Note 1) (same as data in the D0009 register)
609 to 624		Currently selected loop-2 PID number (Note 1) (same as data in the D0025 register)
625 to 656		Do not use.
657 to 672		One-second, five-second, ten-second and one-minute timers (Note 2)
673 to 688		Status of PV2, LP2 and DV (deviation) lamps (Note 3)
689 to 704		Status of alarm output (same as data in the D0036 register)
705 to 720	Do not use.	Do not use.
721 to 2048	User area (Note 4)	An area where you can freely write or read status data

Note 1: Information stored in each group of these I relays is represented by the four sets of binary codes, from 0000 (0 in the decimal system) to 1000 (8 in the decimal system), which are formed by each combination of four I relays. The lowest-numbered I relay in each set signifies the LSB of the four bits.

Note 2: The one-second, five-second, ten-second and one-minute timers are the functions available with I relays only.

Note 3: Information stored in these relays represent the status of the instrument's front-panel lamps. The relay turns on (flag "1") when the lamp comes on.

Note 4: The "I Relay Map Overview" tables do not contain the range of I relays numbered from 769 to 2048 within the user area. You can write to or read from this range of I relays, however, by means of custom computation or communication.

NOTE

In the "I Relay Map Overview" tables, those I relays in the 1 to 720 range that have no code names in their fields, are not in use. Do not write to or read from these unused I relays; doing so may destroy the data in the US1000 controller.

The code name of each I relay, except the I relays listed below, is the same as that of its corresponding D register in terms of bit configuration.

I Relay No.	Code Name	Description
0577 to 0580	CSVNO.0 to CSVNO.3	SV numbers
0593 to 0596	PIDNO1.0 to PIDNO1.3	Loop-1 PID numbers
0609 to 0612	PIDNO2.0 to PIDNO2.3	Loop-2 PID numbers
0657 to 0661	TIM.1S, . . ., TIM.1M	One-second timer, . . ., one-minute timer
0672 to 0674	PON, . . ., LP2	Statuses of power-on, PV2 and LP2 lamps on the instrument's front panel
0681 to 0687	DEV1-, . . ., DEV2+	Statuses of deviations in loop 1 and loop 2

TIP

Each bit represented by any of the I relays numbered 1 to 576 and 689 to 701, is the same as that in each read-only D register in terms of the code name and assigned function.
Cross-check the assigned functions of these I relays with the information provided in subsection 5.3.1, "Process Data Area (Read-only Data)."

The status I relays numbered 577 to 2049 store SV and PID numbers, as well as the on-off statuses of flags such as timer and power-on flags.

NOTE

To access these relays using an I relay number, use the code number “I relay number + 5000”. For example, use “5657,” which means “657 + 5000,” to refer to the status of the TIM.1S relay (I relay numbered 657).

Area for SV and PID Numbers and the Statuses of Timer, Power-on and Alarm Flags, plus User Area											
No.	577 to 608	No.	609 to 640	No.	641 to 672	No.	673 to 704	No.	705 to 736	No.	737 to 768
577	**CSVNO.0**	609	**PIDNO2.0**	641		673		705		737	**UR17**
578	**CSVNO.1**	610	**PIDNO2.1**	642		674	**LP2**	706		738	**UR18**
579	**CSVNO.2**	611	**PIDNO2.2**	643		675	**MV**	707		739	**UR19**
580	**CSVNO.3**	612	**PIDNO2.3**	644		676	**ALM**	708		740	**UR20**
581		613		645		677		709		741	**UR21**
582		614		646		678		710		742	**UR22**
583		615		647		679		711		743	**UR23**
584		616		648		680		712		744	**UR24**
585		617		649		681	**DEV1-**	713		745	**UR25**
586		618		650		682	**DEV1Z**	714		746	**UR26**
587		619		651		683	**DEV1+**	715		747	**UR27**
588		620		652		684		716		748	**UR28**
589		621		653		685	**DEV2-**	717		749	**UR29**
590		622		654		686	**DEV2Z**	718		750	**UR30**
591		623		655		687	**DEV2+**	719		751	**UR31**
592		624		656		688		720		752	**UR32**
593	**PIDNO1.0**	625		657	**TIM.1S**	689	**ALO11**	721	**UR1**	753	**UR33**
594	**PIDNO1.1**	626		658	**TIM.5S**	690	**ALO12**	722	**UR2**	754	**UR34**
595	**PIDNO1.2**	627		659	**TIM.10S**	691	**ALO13**	723	**UR3**	755	**UR35**
596	**PIDNO1.3**	628		660		692		724	**UR4**	756	**UR36**
597		629		661	**TIM.1M**	693	**ALO14**	725	**UR5**	757	**UR37**
598		630		662		694		726	**UR6**	758	**UR38**
599		631		663		695		727	**UR7**	759	**UR39**
600		632		664		696		728	**UR8**	760	**UR40**
601		633		665		697	**ALO21**	729	**UR9**	761	**UR41**
602		634		666		698	**ALO22**	730	**UR10**	762	**UR42**
603		635		667		699	**ALO23**	731	**UR11**	763	**UR43**
604		636		668		700		732	**UR12**	764	**UR44**
605		637		669		701	**ALO24**	733	**UR13**	765	**UR45**
606		638		670		702		734	**UR14**	766	**UR46**
607		639		671		703		735	**UR15**	767	**UR47**
608		640		672	**PON**	704		736	**UR16**	768	**UR48**

You can freely write to or read from the range of I relays numbered 769 to 2048.

5.13.1 User Area

Register No.	Data Category	Description
721 to 2048	User area	Data can be written to or read from the range of I relays 721 to 2048 via communication. That is, you can use the area freely no matter which type of control is performed by the US1000 controller.

5.13.2 Timers

The series of I relays includes clocks having intervals of one second, five seconds, ten seconds and one minute. You can use these clocks to build timers.

The following table lists the relationships between the interval, the I relay's code name and the I relay number.

On-Off Interval (Clock)	I Relay's Code Name	I Relay Number
One second	TIM.1S	657
Five seconds	TIM.5S	658
Ten seconds	TIM.10S	659
One minute	TIM.1M	661

These timer functions are available only when you use the LL1200 PC-based Custom Computation Building Tool. You can also register these timer signals with US1000 contact outputs to feed the signals to external equipment.

See Also

Chapter 4, "List of Computation Modules and Their Functions," for information on the timer module (TIMER).

Figure 5.1 shows how the I relays work as timers.

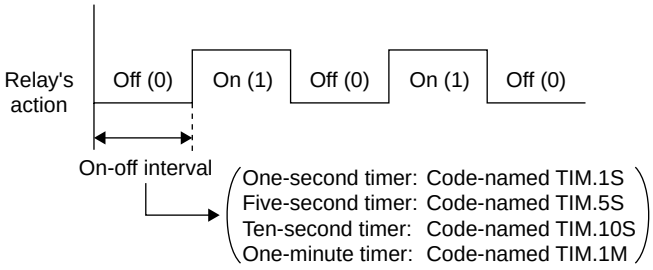


Figure 5.1 I Relay Working as a Timer

6. Specifications of Custom Display Functions

This chapter lists and explains the various types of custom displays and describes the conditions that must hold true for you to be able to switch to them, according to the mode and/or the status of the contact in question.

These functions serve the following three purposes.

[1] From the preset choices of custom displays, you can select which types you want to view in normal operation. Then, you can determine the order in which these displays should appear and the conditions that must be met before they can be retrieved.
[See Also]
Section 6.1, “List of Custom Displays and Their Explanations”

[2] You can set the conditions of display based on the OPEN/CLOSE modes. This is true only when the controller type is “cascade.”
[See Also]
Section 6.2, “Conditions Necessary to View Custom Displays”

[3] You can interrupt current operation display to forcibly show a specific custom display.
[See Also]
Section 6.3, “Conditions Necessary to Switch to Custom Displays”

6.1 List of Custom Displays and Their Explanations

The table below lists the 22 types of custom displays. Select the desired custom displays from the list and register them.
Some of these custom displays are also used by the standard controller modes (US modes). Before configuring your own custom displays using the LL1200's sample files, you must know which controller mode uses which custom display.
You can register a maximum of 20 custom displays.

Custom Display		Remarks
PV1 & SV1 display		See Figure 6.1.
PV1 & MV1 display		See Figure 6.2.
Cascade CLOSE1 display		See Figure 6.3.
Cascade CLOSE2 display		See Figure 6.4.
Dual-loop PV1 & SV1 display		See Figure 6.5.
Dual-loop PV1 & MV1 display		See Figure 6.6.

Custom Display		Remarks
Dual-loop PV2 & SV2 display		See Figure 6.7.
Dual-loop PV2 & MV2 display		See Figure 6.8.
Unilluminated operation display		All of the US1000's front-panel lamps go out. See Figure 6.9.

Custom Display		Remarks
Loop-1 alarm display		See Figure 6.10.
Loop-2 alarm display		See Figure 6.11.
SV number display		See Figure 6.12.
Loop-1 PID number display		See Figure 6.13.
Loop-2 PID number display		See Figure 6.14.
Analog input-1 display		Shows the value of the AIN1 analog signal fed to the input block. See Figure 6.15.
Analog input-2 display		Shows the value of the AIN2 analog signal fed to the input block. See Figure 6.16.

Custom Display		Remarks
Analog input-3 display		Shows the value of the AIN3 analog signal fed to the input block. See Figure 6.17.
PV1 display		See Figure 6.18.
PV2 display		See Figure 6.19.
Sampling error counter display		See Figure 6.20.
DISP1 display		See Figure 6.21. [See Also] DISP1 (Data Display 1) module in Chapter 4, "List of Custom Computation Modules and Their Functions"
DISP2 display		See Figure 6.22. [See Also] DISP2 (Data Display 2) module in Chapter 4, "List of Custom Computation Modules and Their Functions"

■ PV1 & SV1 Display

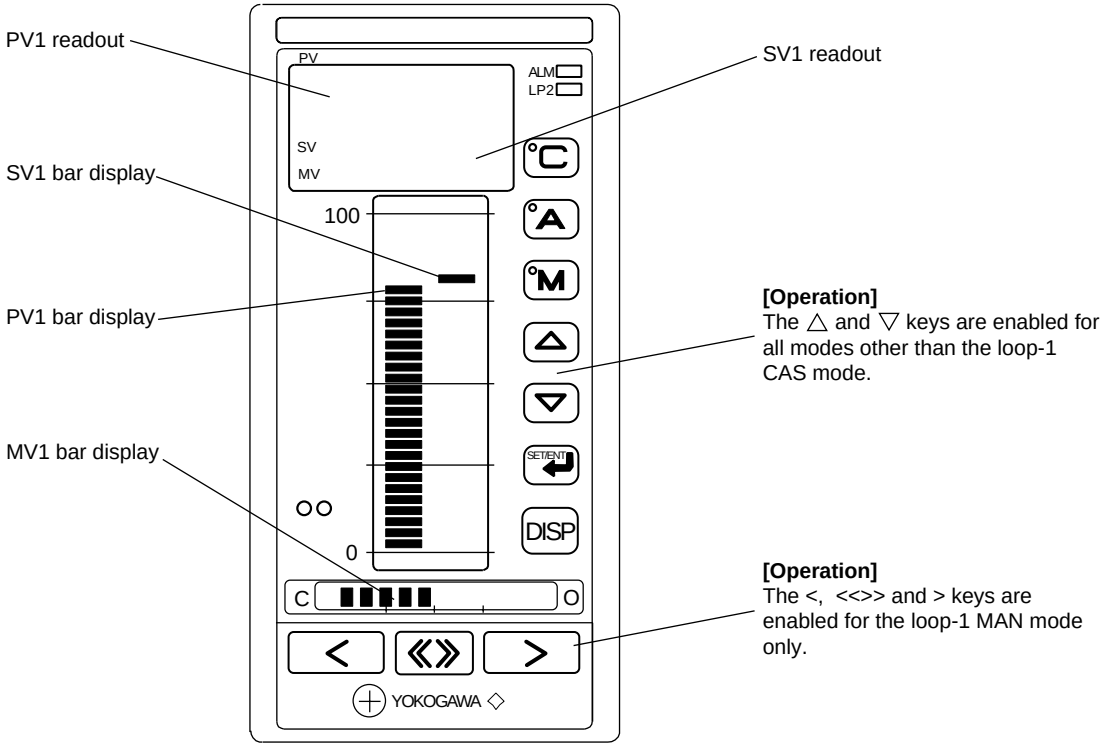


Figure 6.1 PV1 & SV1 Display

■ PV1 & MV1 Display

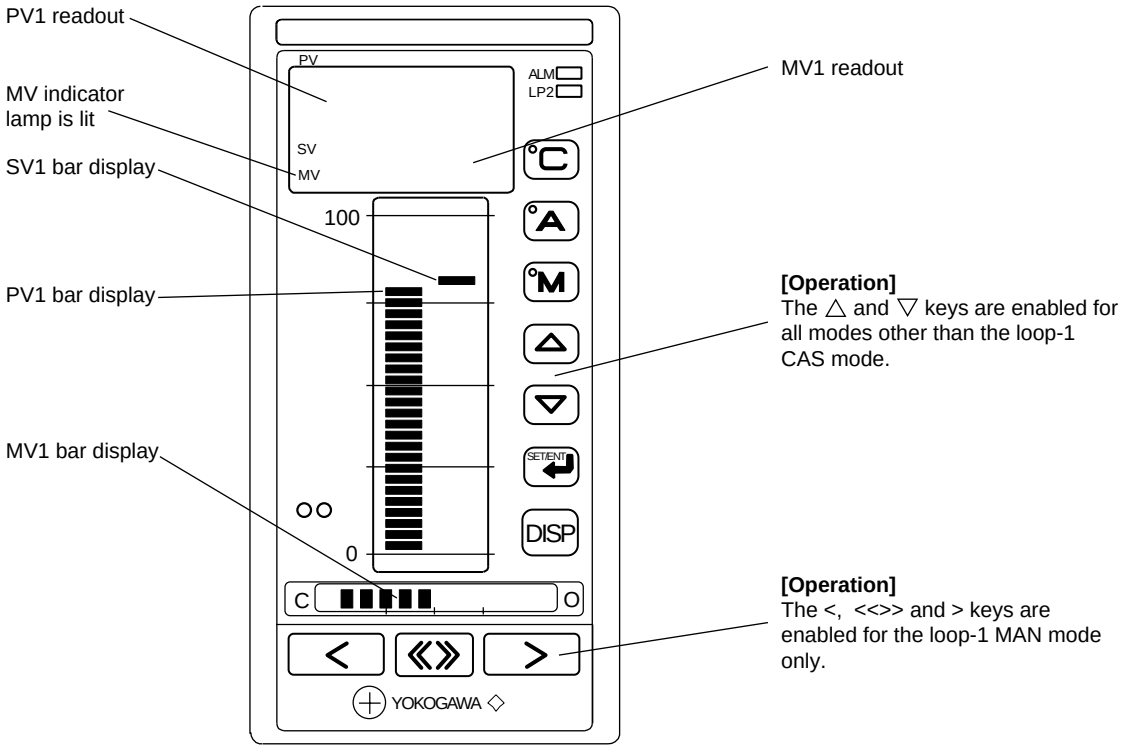
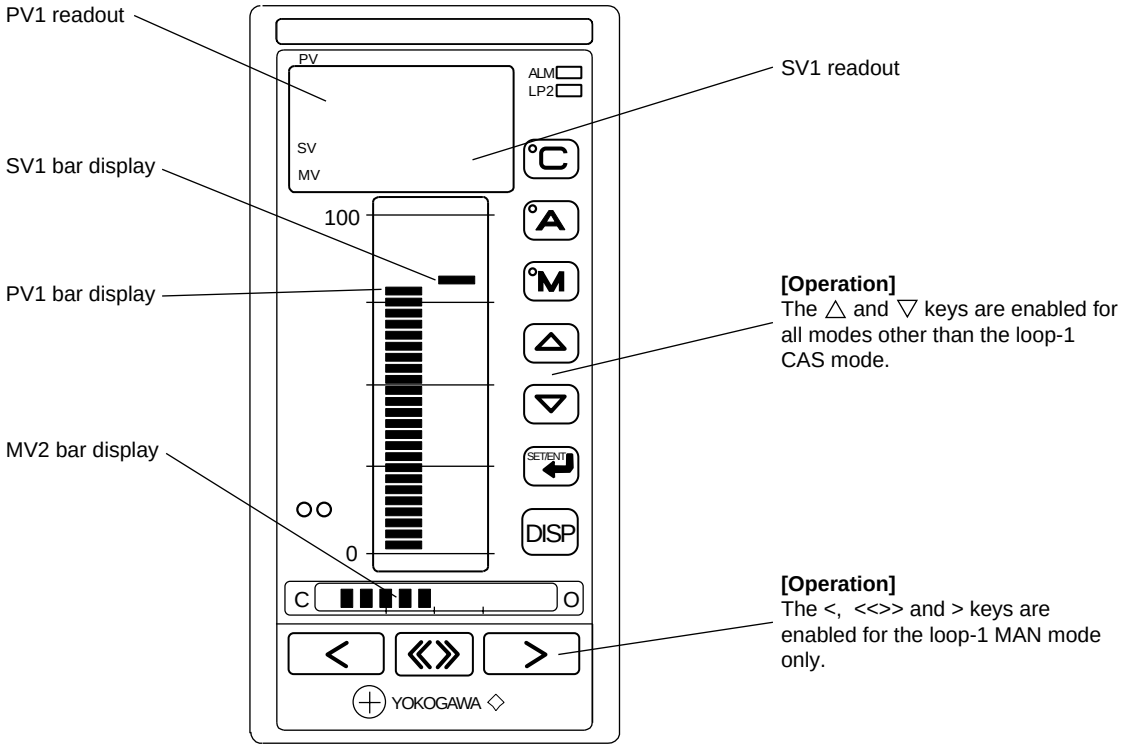


Figure 6.2 PV1 & MV1 Display

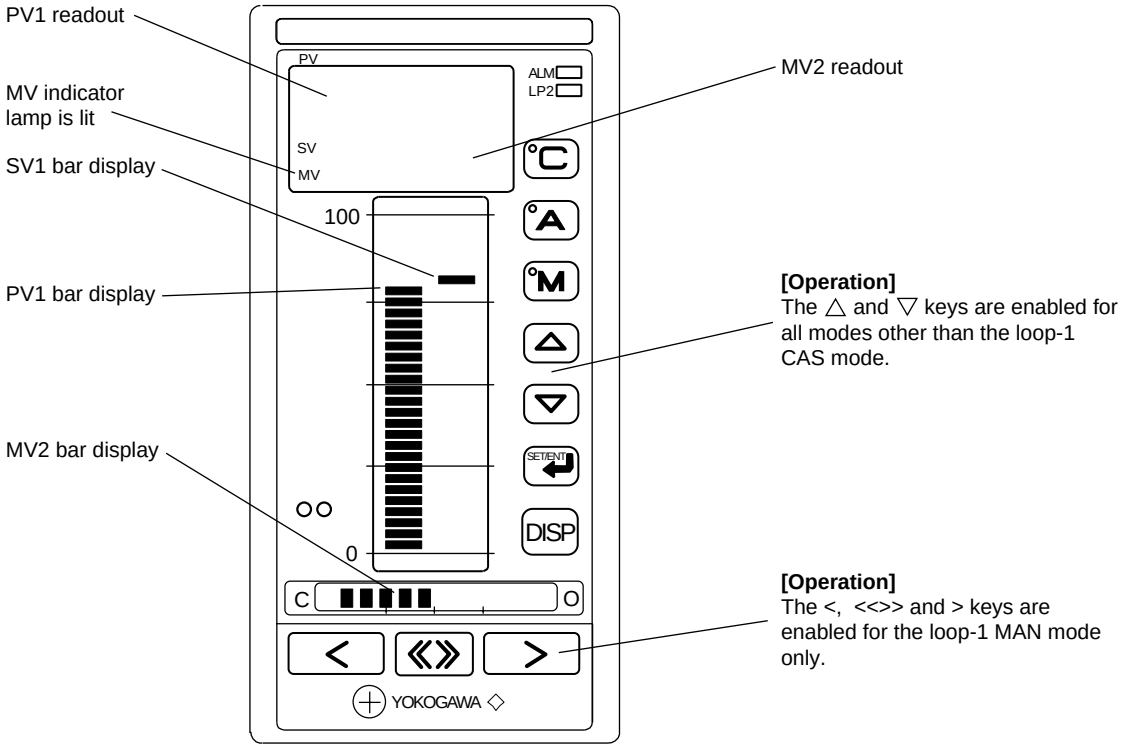
■ Cascade CLOSE1 Display



This display appears only when the setting of the OPEN/CLOSE mode is CLOSE.

Figure 6.3 Cascade CLOSE1 Display

■ Cascade CLOSE2 Display



This display appears only when the setting of the OPEN/CLOSE mode is CLOSE.

Figure 6.4 Cascade CLOSE2 Display

■ **Dual-loop PV1 & SV1 Display**

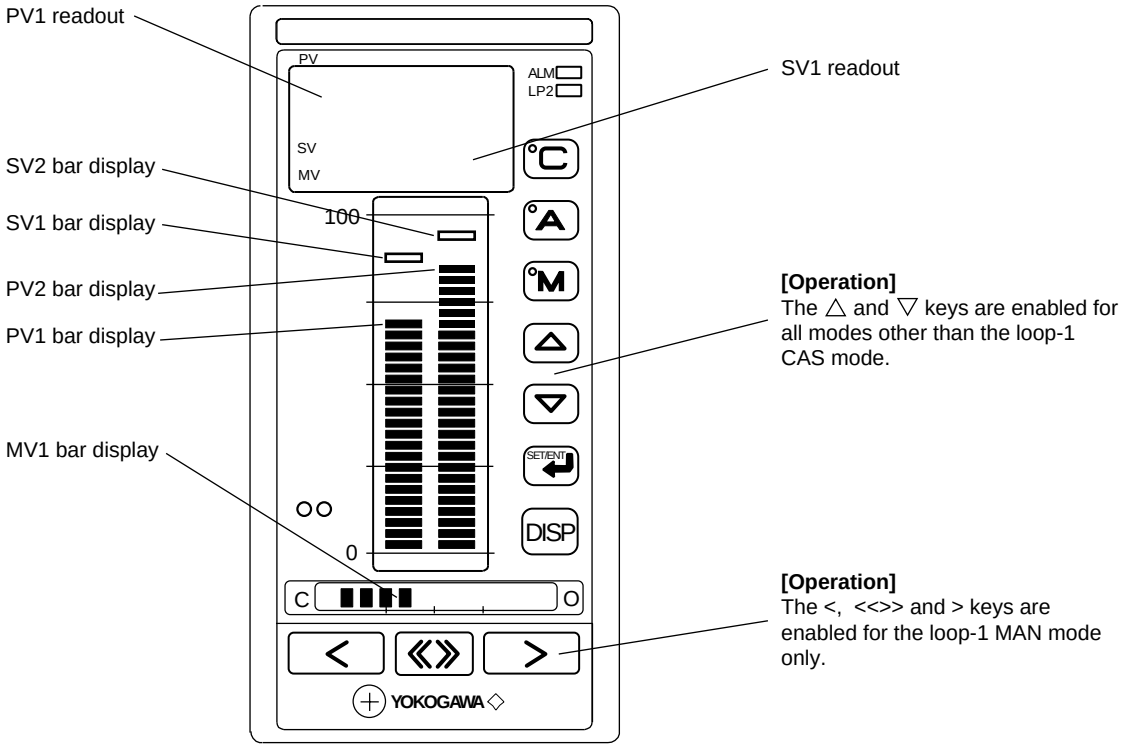


Figure 6.5 Dual-loop PV1 & SV1 Display

■ **Dual-loop PV1 & MV1 Display**

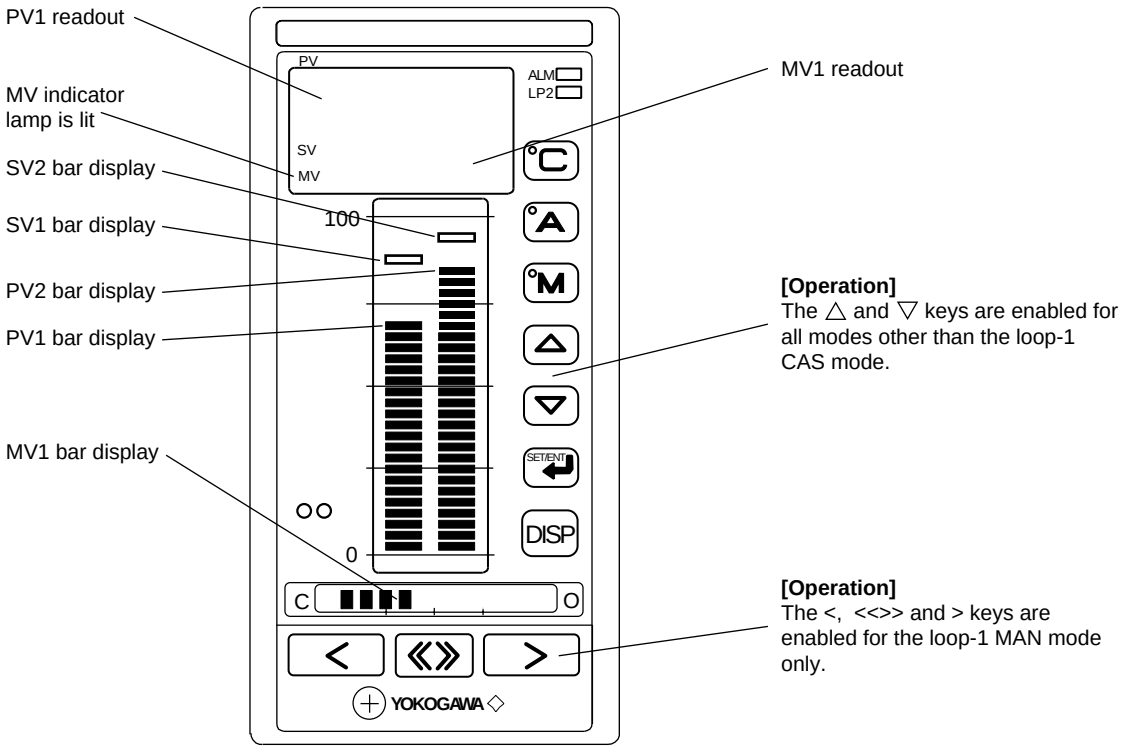


Figure 6.6 Dual-loop PV1 & MV1 Display

■ Dual-loop PV2 & SV2 Display

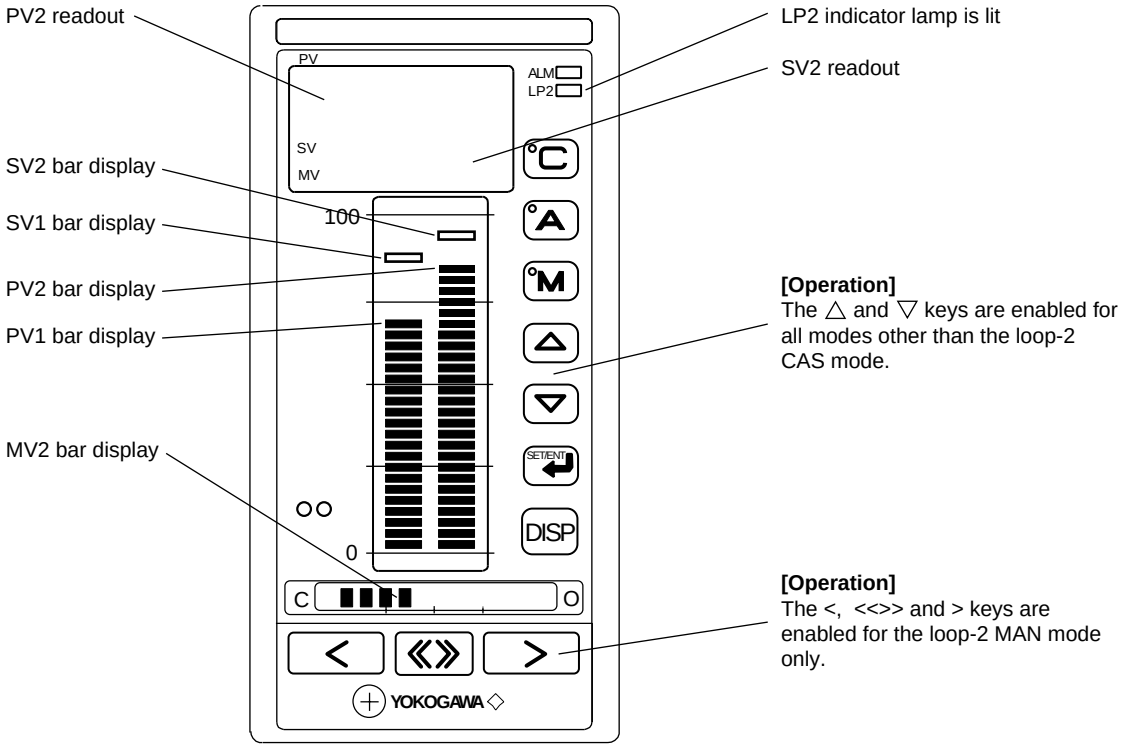


Figure 6.7 Dual-loop PV2 & SV2 Display

■ Dual-loop PV2 & MV2 Display

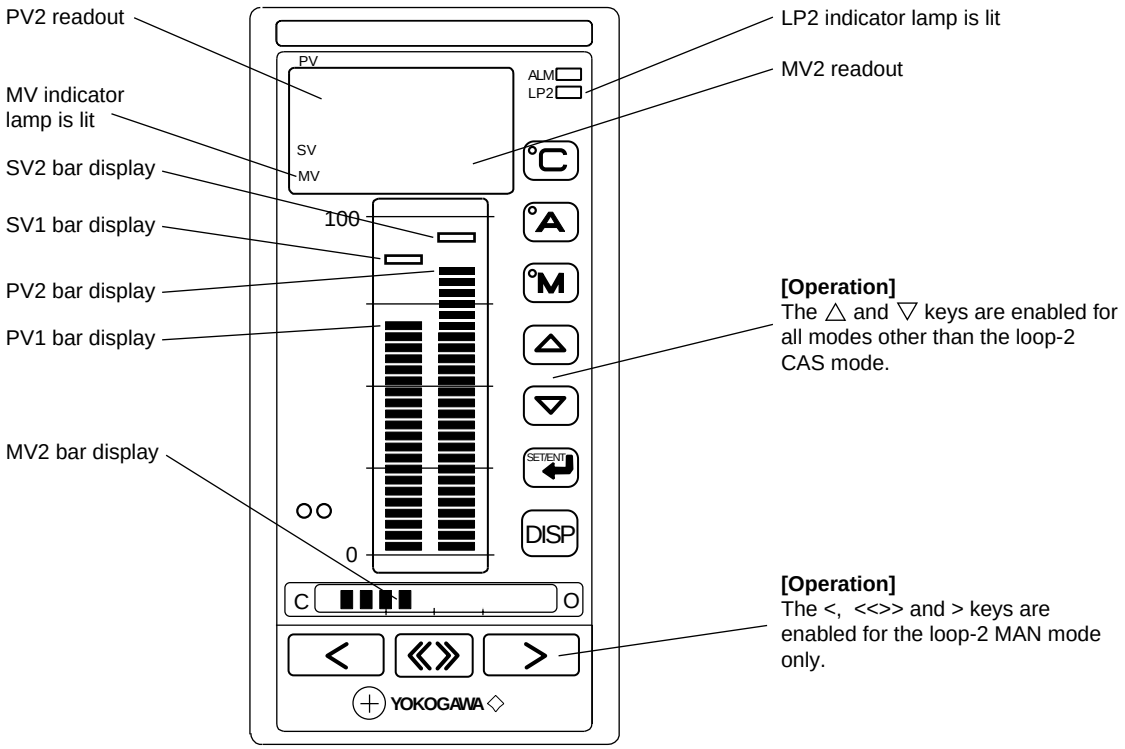
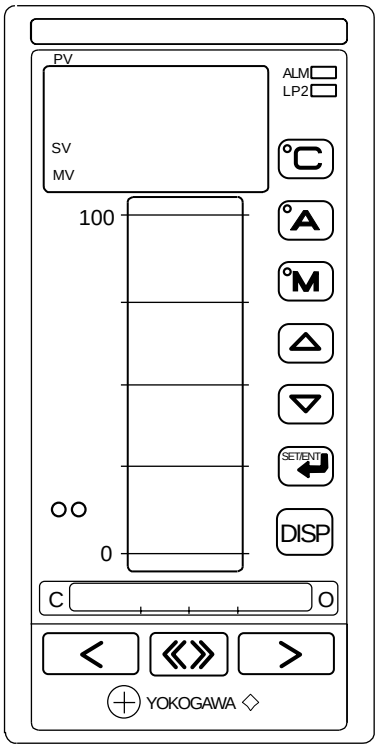


Figure 6.8 Dual-loop PV2 & MV2 Display

■ Unilluminated Operation Display



This display appears with all the lamps unlit.

Figure 6.9 Unilluminated Operation Display

■ Loop-1 Alarm Display

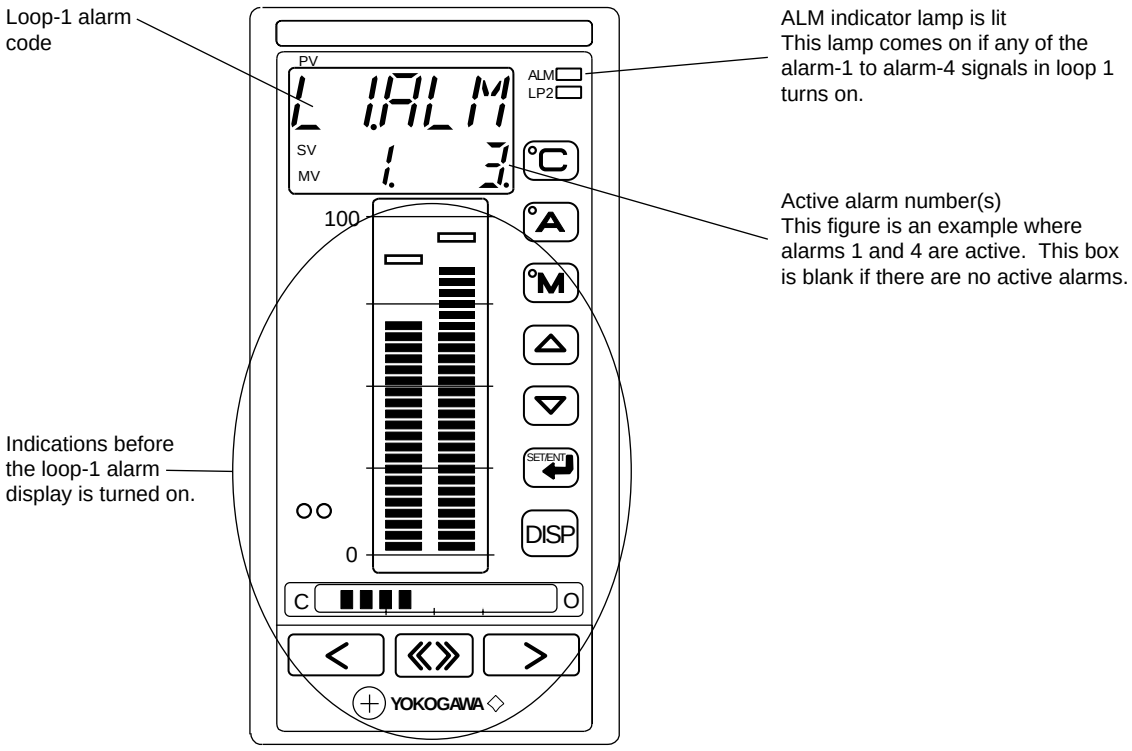


Figure 6.10 Loop-1 Alarm Display

■ Loop-2 Alarm Display

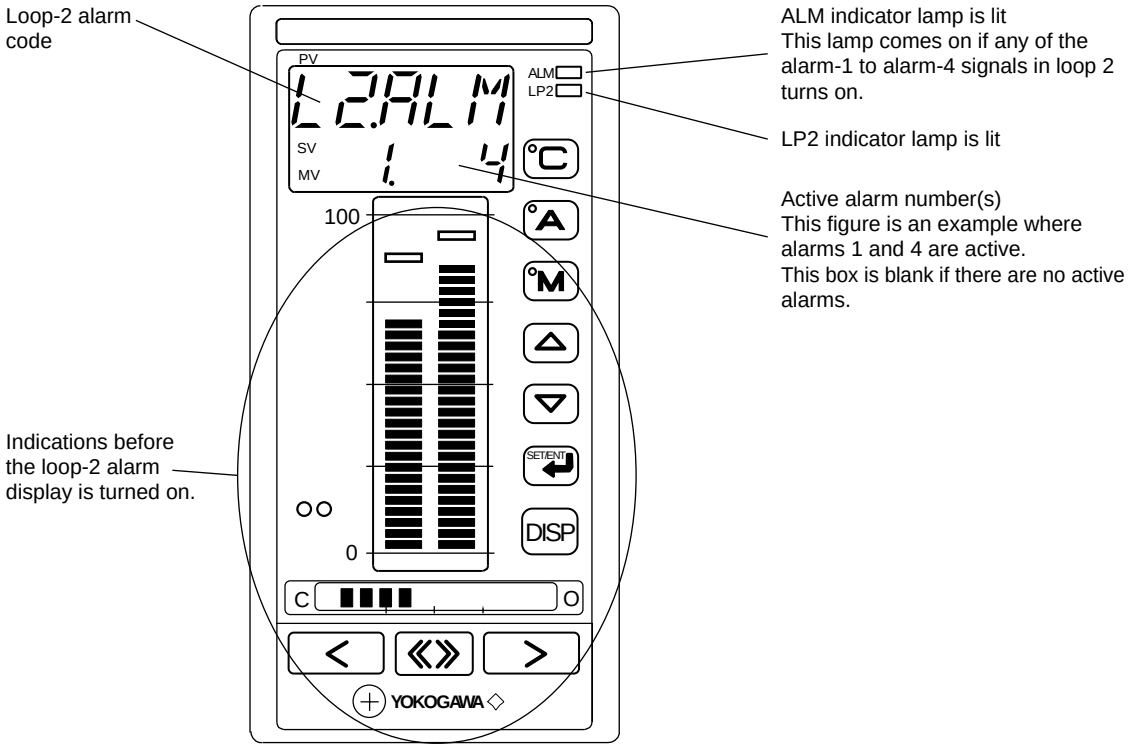


Figure 6.11 Loop-2 Alarm Display

■ SV Number Display

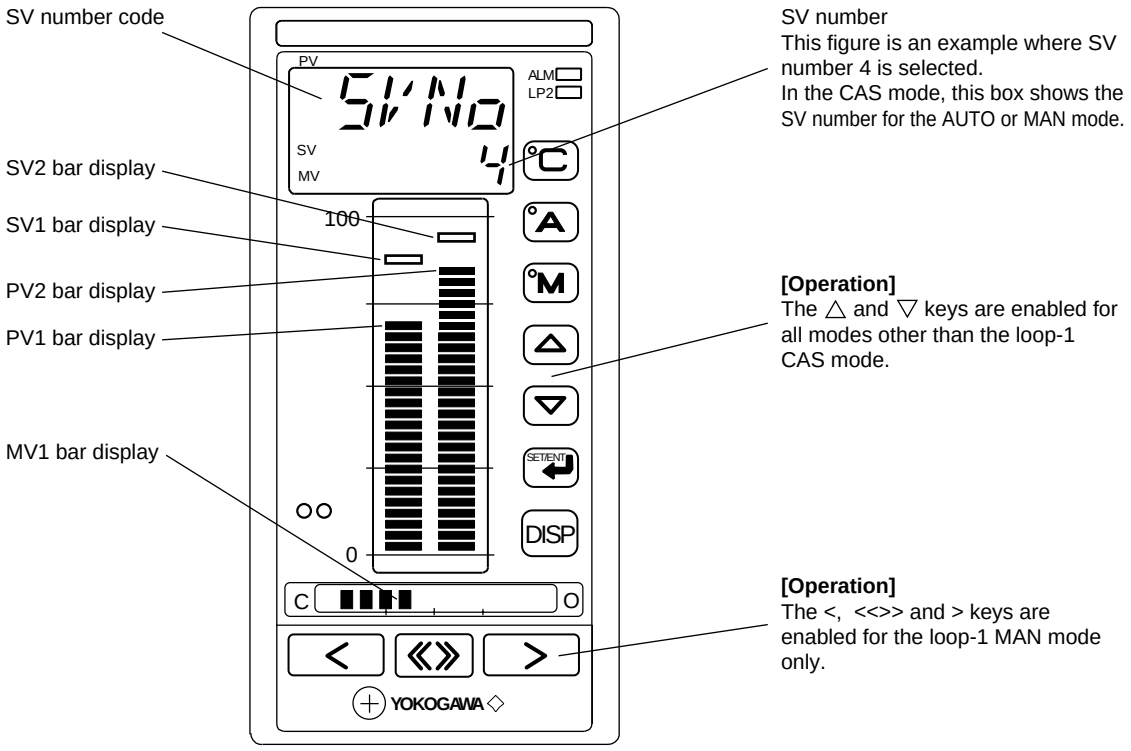


Figure 6.12 SV Number Display

■ **Loop-1 PID Number Display**

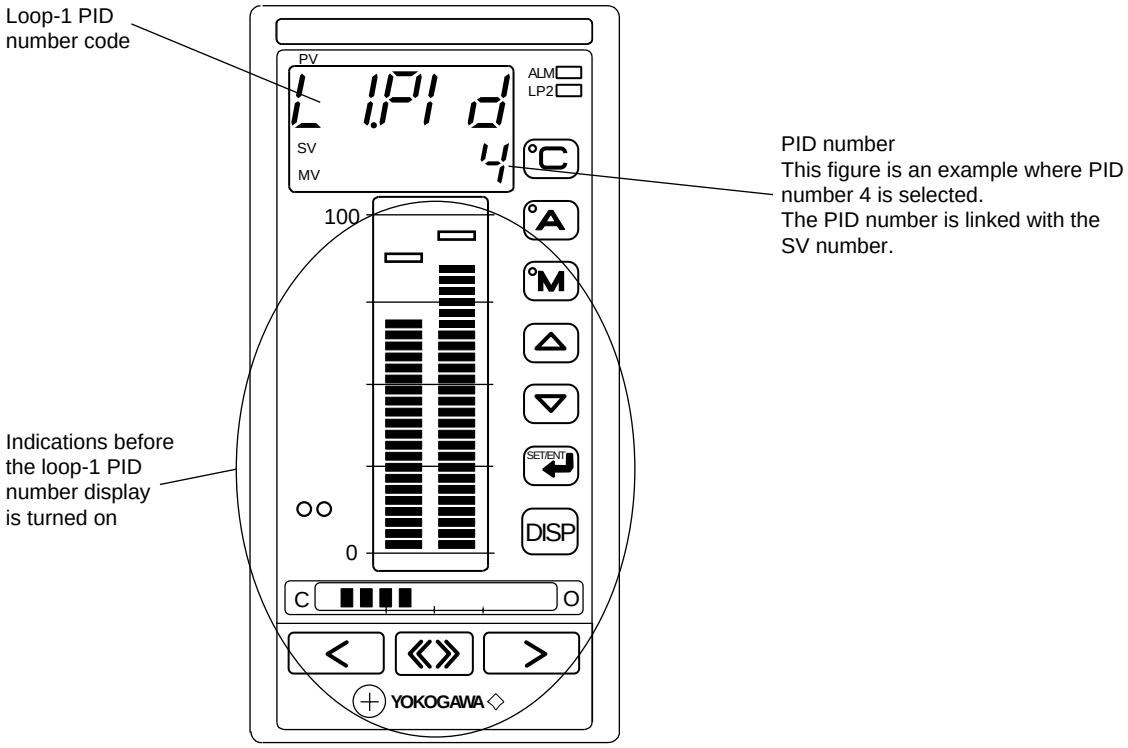


Figure 6.13 Loop-1 PID Number Display

■ **Loop-2 PID Number Display**

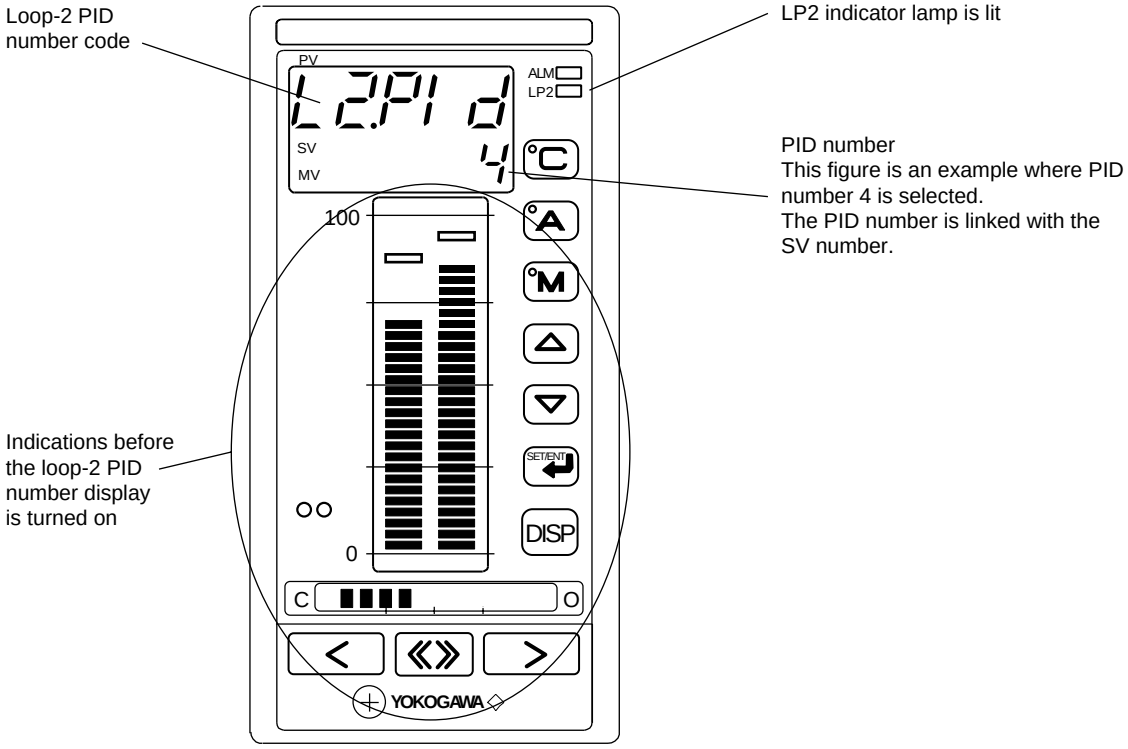


Figure 6.14 Loop-2 PID Number Display

■ Analog Input-1 Display

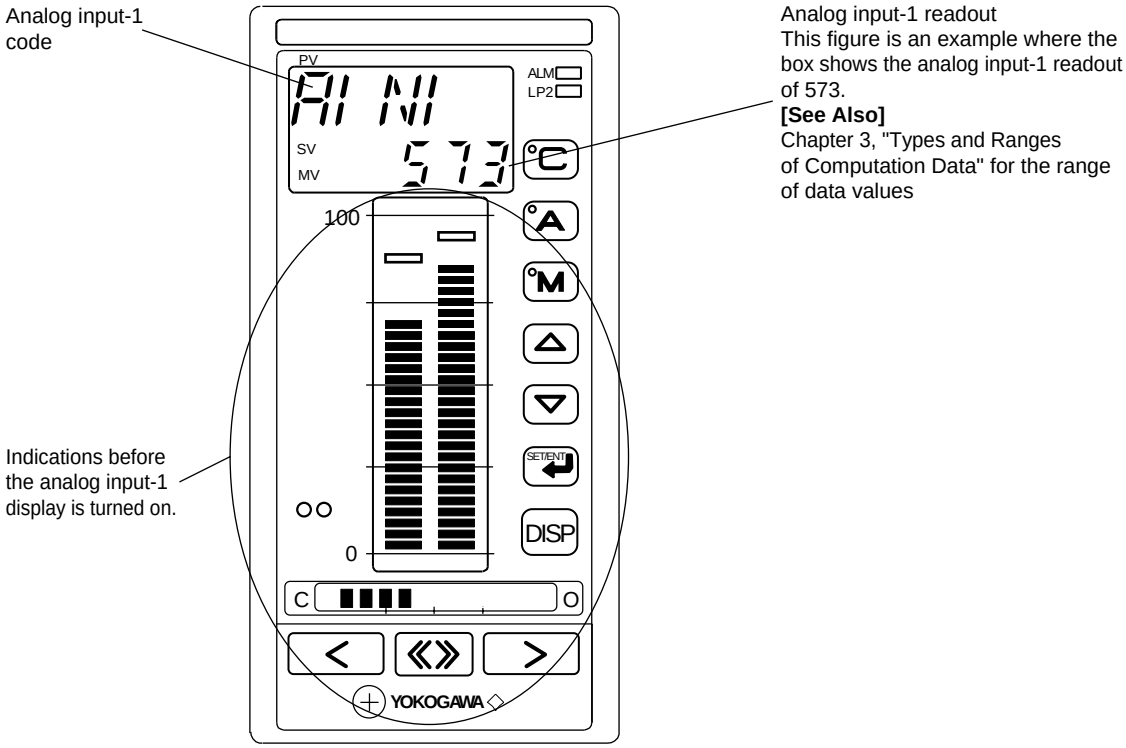


Figure 6.15 Analog Input-1 Display

■ Analog Input-2 Display

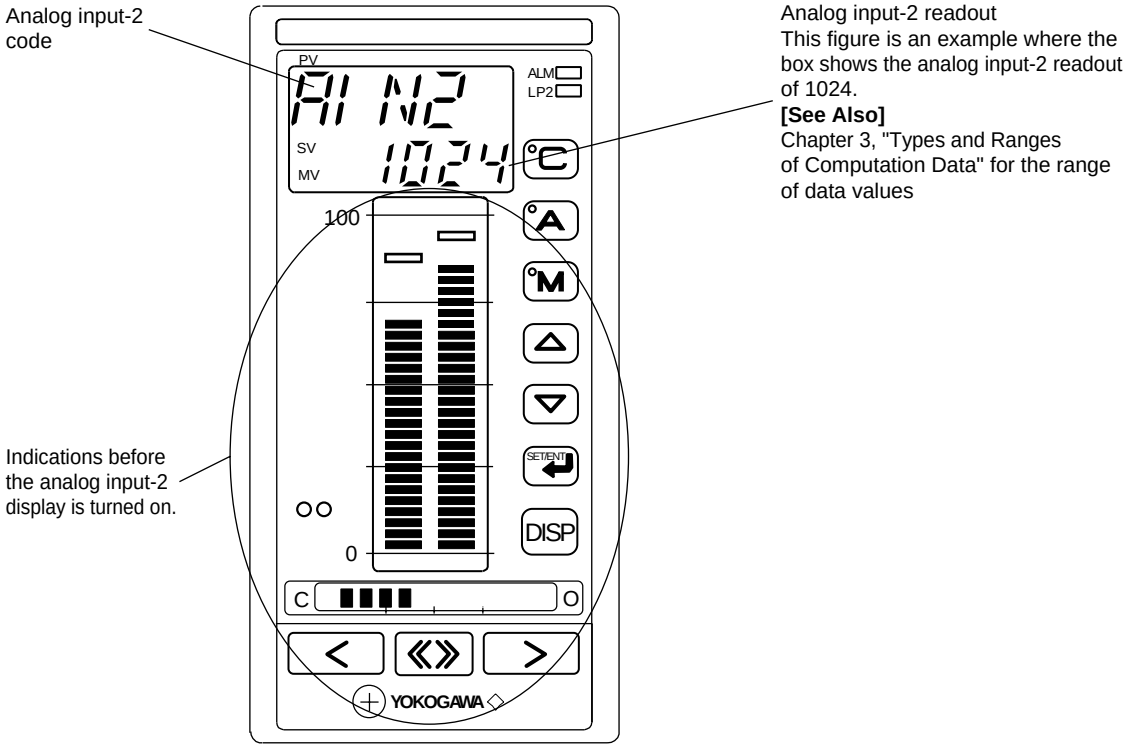
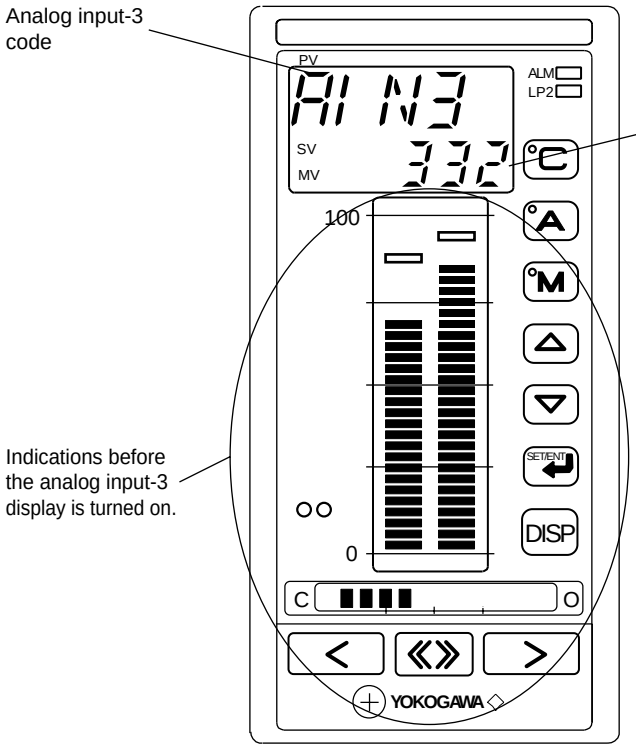


Figure 6.16 Analog Input-2 Display

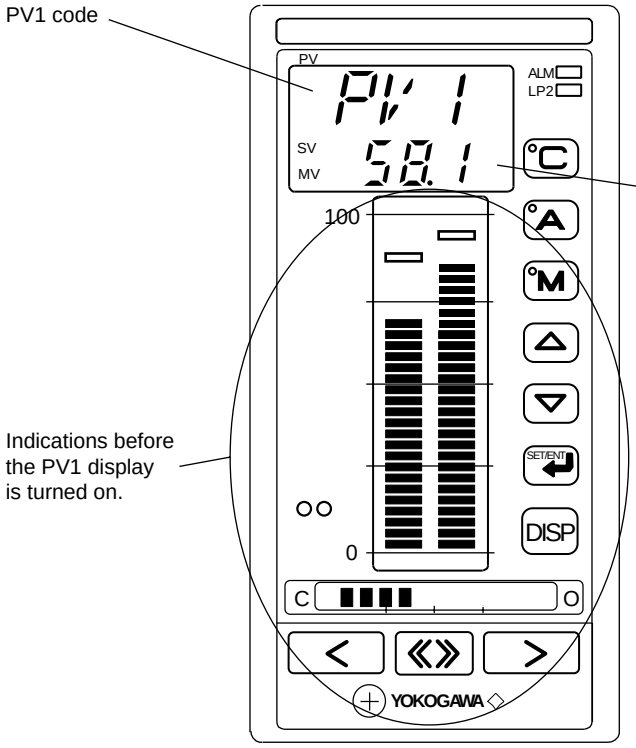
■ Analog Input-3 Display



Analog input-3 readout
This figure is an example where the box shows the analog input-3 readout of 332.
[See Also]
Chapter 3, "Types and Ranges of Computation Data" for the range of data values

Figure 6.17 Analog Input-3 Display

■ PV1 Display



Loop-1 PV input readout
This figure is an example where the box shows the PV input readout of 58.1.
[TIP]
Range of data values: Between the lower and upper limits defined by the P.RL1 and P.RH1 setup parameters. A chain line segment ("------") appears if the value is above the upper limit, while a chain line segment ("_____") is shown if the value is below the lower limit.

Figure 6.18 PV1 Display

■ PV2 Display

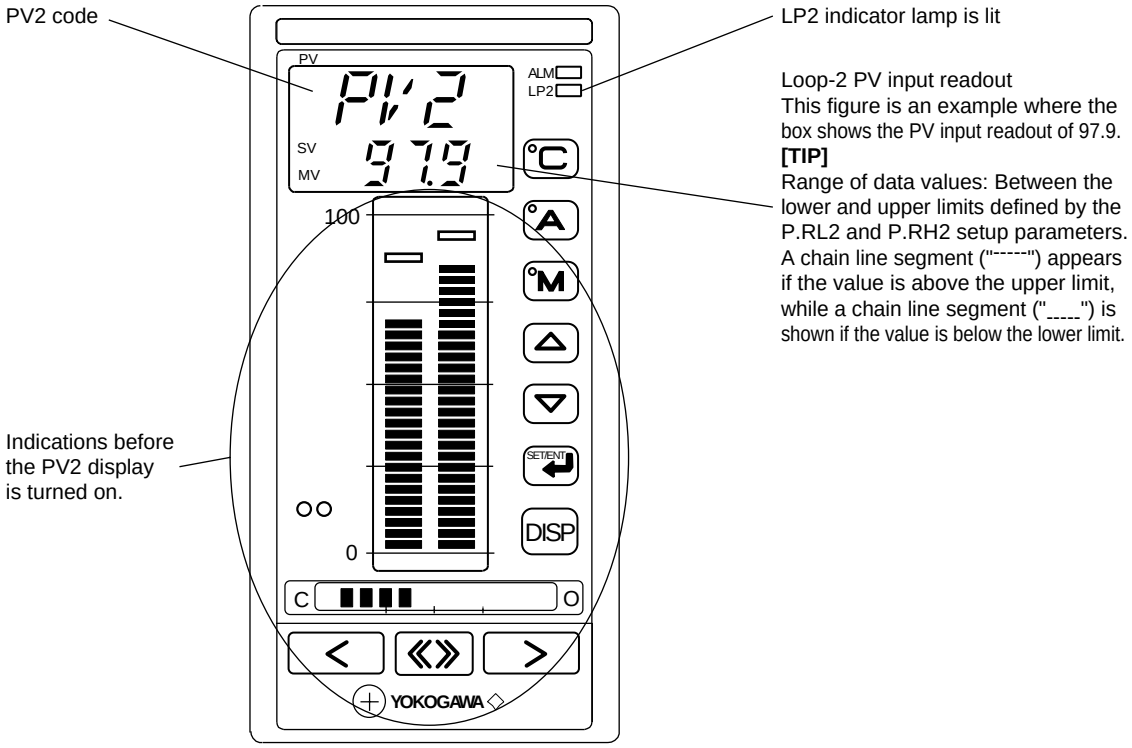


Figure 6.19 PV2 Display

■ Sampling Error Counter Display

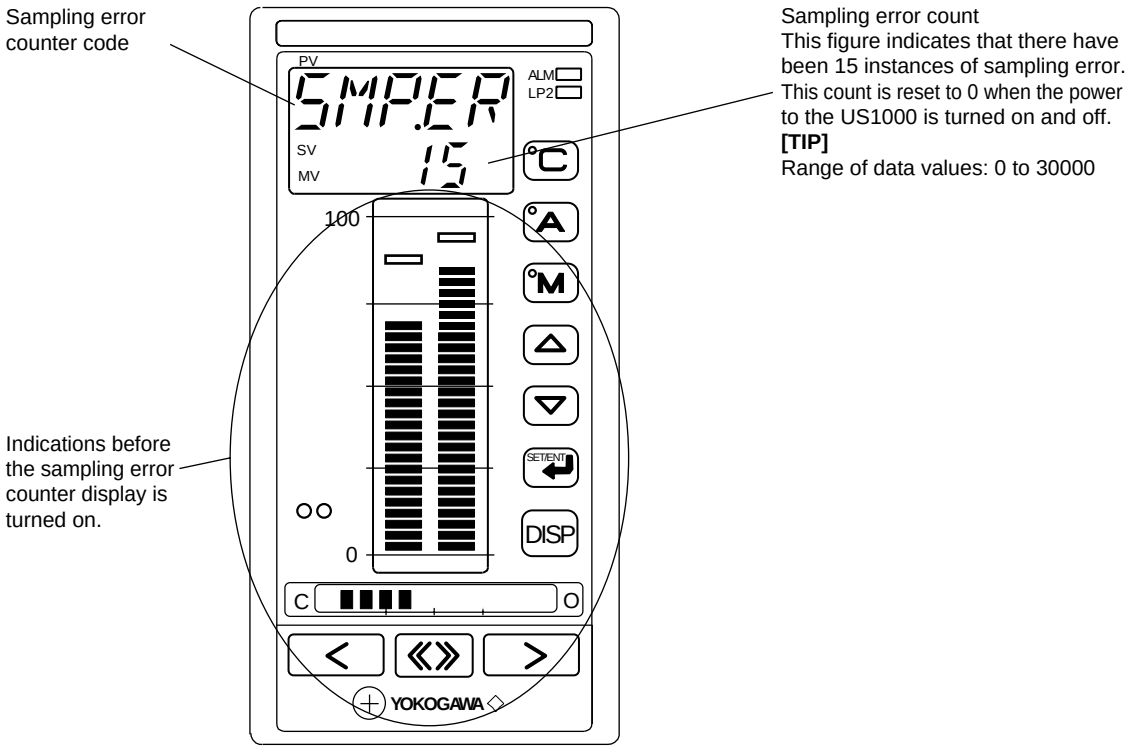


Figure 6.20 Sampling Error Counter Display

■ DISP1 Display

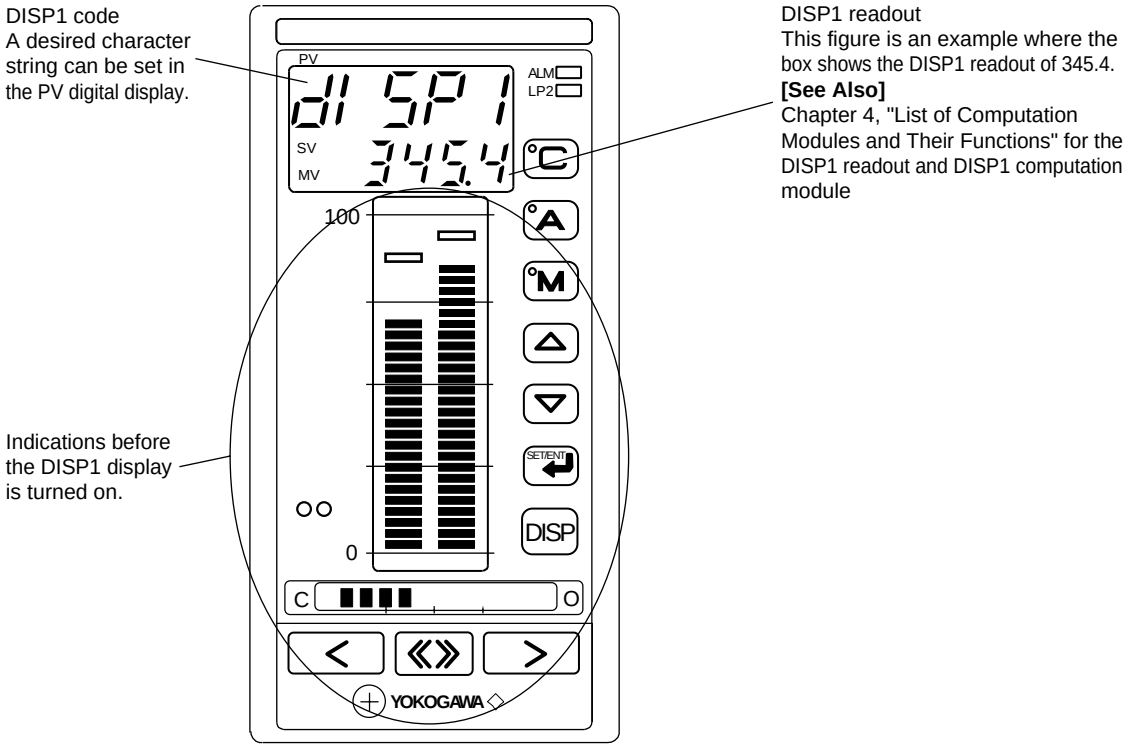


Figure 6.21 DISP1 Display

■ DISP2 Display

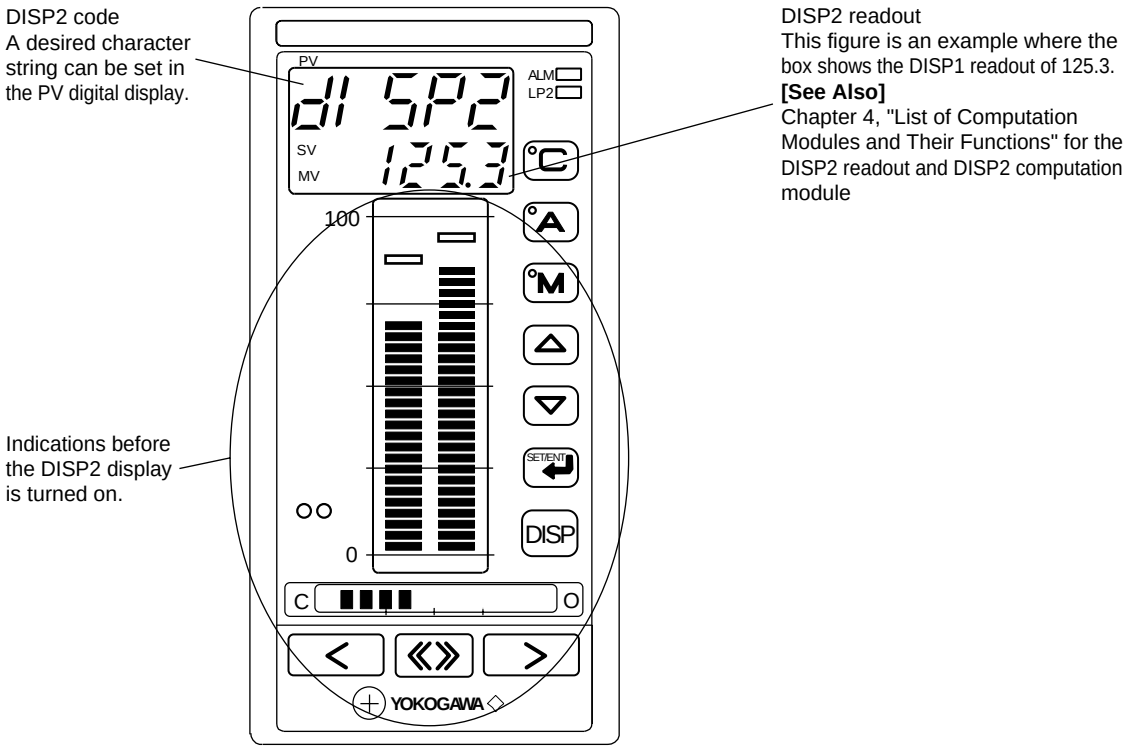


Figure 6.22 DISP2 Display

6.2 Conditions Necessary to View Custom Displays

There are three types of conditions, as shown below, which are necessary to view custom displays. You can define these display conditions only if the controller type is set to “cascade.”

Set these display conditions at the same time you select and register custom displays in the Custom Display Selection dialog box of the LL1200. Define one display condition for every custom display you select and register.

Display Condition	Description
Always display	The custom display is always visible.
Display when Close	The custom display is visible only when the CLOSE mode is selected.
Display when Open	The custom display is visible only when the OPEN mode is selected.

6.3 Conditions Necessary to Switch to Custom Displays

There are 19 types of conditions, as shown below, which are necessary to switch to custom displays. Once you have selected and registered custom displays in the Custom Display Selection dialog box of the LL1200, you can interrupt the current display to view one of these custom displays using one or more of the switching conditions listed in the following table.
You can set two or more conditions for a single custom display.
For example, if you want to view the PV1 & SV1 display upon “power-on” or upon “changing SV1 with the △ and ▽ keys when the operation display is active and the controller is in any mode other than the loop-1 CAS mode,” then you must register the PV1 & SV1 display with both of these switching conditions.

No.	Conditions to Switch to Custom Displays
1	Change in SV1 caused by manipulating the △ and ▽ keys when the operation display is active and the operation mode is other than the loop-1 CAS mode
2	Execution of loop-1 auto-tuning when the operation mode is other than the loop-1 MAN mode
3	Change in SV1 caused by manipulating the △ and ▽ keys when the operation mode is the CLOSE mode and the operation mode is other than the loop-1 CAS mode
4	Execution of loop-1 auto-tuning when the operation mode is the CLOSE mode and the operation mode is other than the loop-1 MAN mode
5	Change in SV2 caused by manipulating the △ and ▽ keys when the operation mode is the OPEN mode and the operation mode is other than the loop-1 CAS mode
6	Execution of loop-1 auto-tuning when the operation mode is the OPEN mode and the operation mode is other than the loop-1 MAN mode
7	Change in SV2 caused by manipulating the △ and ▽ keys when the operation display is active and the operation mode is other than the loop-2 CAS mode
8	Execution of loop-2 auto-tuning when the operation mode is other than the loop-2 MAN mode
9	Change in MV2 caused by manipulating the < and > keys when the mode-data register is in the CLOSE mode and the operation mode is the loop-1 MAN mode
10	Change in MV2 caused by manipulating the < and > keys when the mode-data register is in the OPEN mode and the operation mode is the loop-1 MAN mode
11	Change in MV1 caused by manipulating the < and > keys when the operation display is active and the operation mode is the loop-2 MAN mode
12	Change in MV2 caused by manipulating the < and > keys when the operation display is active and the operation mode is the loop-2 MAN mode
13	Switch to the CLOSE mode via key operation, communication or contact input
14	Switch to the OPEN mode via key operation, communication or contact input
15	Occurrence of any alarm among loop-1 alarms 1 to 4
16	Occurrence of any alarm among loop-2 alarms 1 to 4
17	Turning on of contact input or flag registered in the Operation Display for Interruption 1 parameter (DP1 setup parameter)
18	Turning on of contact input or flag registered in the Operation Display for Interruption 2 parameter (DP2 setup parameter)
19	Power-on

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