MCM57-MRM57 Series Module-type Temperature Controller Instruction Manual (Detailed Version)



SHIMADEN CO., LTD.

MMCM57-E01-C Jun. 2022 Thank you very much for purchasing this Shimaden product. Make sure that the delivered product is the one that you ordered. Carefully read and fully understand this Instruction Manual before use.

Notice

Ensure that this manual is handed to the final user of the instrument.

Introduction

This Instruction Manual is intended for personnel engaged in wiring, installation, and regular maintenance of the MCM57-MRM57 Series (personnel with knowledge and experience in electrical work).

This Instruction Manual contains the specifications and the operating and wiring instructions necessary to use the MCM57-MRM57 Series. Keep this manual handy so that it can be consulted by anyone using the MCM57-MRM57 Series.

Always operate the instrument according to the instructions contained in this Instruction Manual.

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1. Important safety instructions

The following symbols appear with instructions for safety and for equipment/facility damage prevention, as well as additional explanations and notes on exceptions:

"Warning": Failure to comply may result in personal injury or death.

"Caution": Failure to comply may result in damage to equipment and/or facilities.

[Note]: Additional explanations, notes on exceptions, and other necessary information

Warning" The MCM57-MRM57 Series industrial control instruments are designed for the conversion of temperature, humidity, and other physical quantities. Therefore, avoid use for conversion purposes that may cause life-threatening risks. Otherwise, take appropriate safety measures before use. We shall not be held responsible or liable for any accident that may occur due to the failure of the user to take safety measures. • Install this instrument in a control panel, etc., to prevent any terminal from physical contact with the operator. Be sure to power this instrument off before installing or uninstalling it or before inserting a hand or any conductor into its casing. Failure to comply may result in an electrical shock that may cause serious injury or death. • Before wiring, be sure to turn the power off. Failure to comply may result in an electrical shock. • Be sure to de-energize wired terminals or any other live parts before touching them. Caution" Where the failure of this instrument may cause damage to nearby devices, equipment, products, etc., take safety measures, such as installing a fuse or an anti-overheating device, before use. We shall not be held responsible or liable for any accident that may occur due to the failure of the user to take safety measures. • Install a switch or a circuit breaker, as a power-off method, on the external power supply circuit connected to the power terminal of this instrument. The switch or circuit breaker must be installed securely in a location close to this instrument and easily accessible to the operator and must be indicated as the power-off device for this instrument. About the fuse This instrument has no built-in fuse. Fit a fuse in the external power supply circuit connected to power terminal. Standard fuse rating/characteristics: 24 V DC, 160 mA per Temp Control Module. • Before wiring, be sure to tighten the terminal connection. Insufficient tightening may cause overheating due to contact resistance, leading to a burning accident. Use within the rated supply voltage. • The user must not make any modification and/or non-standard use.

- It takes 30 minutes for this instrument to read the correct temperature after power-on. (Power on this instrument more than 30 minutes before it actually starts control.)
- To ensure safety and maintain the functions of this device, do not disassemble this device. If this device must be disassembled for replacement or repair, contact your dealer.

2. Model code check

Check that the delivered product is manufactured to the specifications.

The Module-type Temperature Controller can be configured to consist of a COM Module and a desired number of Temp Control Modules.

2-1. COM Module

ITEM	CODE		SPECIFICATIONS					
Series	MCM57-	DIN	DIN rail mountable COM Module					
Master		2	EIA F	EIA RS-422, 4-wire half-duplex multi-drop (connectable to up to 31 units per group)				
method	lion	5	EIA F	EIA RS-485, 2-wire half-duplex multi-drop (connectable to up to 31 units per group)				
Remarks			0	Without				
			9	With (Please consult before ordering)				

2-2. Temp Control Module

ITEM	CODE		SPECIFICATIONS							
Series	MRM57-	DIN	DIN rail mountable Temp Control Module with 2 event output points/CH (4 points in total)							
CH1 input	I	8	Multi	ti (B, R, S, K, E, J, T, N, PL II, C (WRe5-26), U, L, Pt100, JPt100, ±10mV, 0-10mV, 0-20mV, 0-50mV, 10-50mV, 0-100mV)						
Onninput		6	Volt (Volt (±1V, 0-1V, 0-2V, 0-5V, 1-5V, 0-10V)						
CH2 input		1	8-	Multi	(B, R, 0-10n	S, K, E, nV, 0-20	J, T, N)mV, 0-{	, PL II, 50mV,	C(WRe5-26), U, L, Pt100, JPt100, ±10mV, 10-50mV, 0-100mV)	
			6-	Volt (±1V, 0∙	-1V, 0-2	V, 0-5V	, 1-5V,	0-10V)	
				C-	Tran	sistor o	pen col	ector/2	24 V DC, 100 mA	
Control outp	out			P-	SSR	drive v	oltage/´	12 V D	C, 30 mA	
(common to	both CH1 a	Ind CH	12)	I-	I- Current/4-20 mA, max. load 500Ω					
				V-	Volta	Voltage/0-10 V, max. current 2 mA				
Program					Ν	N/A				
riogram					Р	4 patt	atterns, 32 steps			
						00	DI 3 points/CH (6 points in total), non-voltage contact input/5 V,			
						Note that 6 points are usable in the 1-input configuration.				
Option (com	mon to both	n CH1	and Cl	1 2)		Analog output 1 point/CH (2 points in total), 0-10 mV, output resistance 100				
option (con)		04 Analog output 1 point/CH (2 points in total), 4-20 mA, max, load 300Ω				
						06	Analo 0-10 V	g outpi /, max.	ut 1 point/CH (2 points in total), current 2 mA	
							0	2-inp	ut 2-output (2ch independent two-loop)	
							1 1-input 2-output (1ch heating and cooling,			
Control mode						2 hea	ating stages, 2 cooling stages)			
					2	2 2-input 1-output (1ch cascade)				
							3	2-inp	ut 2-output (1ch PV switchover control)	
Remarks						0	Without			
								9	With (Please consult before ordering)	

2-3. Checking the accessories

Instruction Manual (Basic Edition):1 copyConnectors for external connection:2 to 6 pcs (variable depending on options selected)Bus connector:1 pc.Terminal resistor for RS-422 communication (supplied with MCM57):2 pcs.Terminal resistor for RS-485 communication (supplied with MCM57):1 pc.

[Note]: In case of any defect in the product or any missing accessories, or if you have any questions, contact our distributor or our nearest sales office.

2-4. Precautions for use

Do not use thinner or any other solvent to clean the instrument. Clean it with gentle wiping, using a dry cloth.

3. About installation and wiring

3-1. Installation site (environmental conditions)

Operating environmental conditions

This instrument is manufactured assuming use under the following conditions. Use it within the following environmental conditions:

(1) Indoor use

- (2) Altitude: 2,000 m or less above sea level
- (3) Operating temperature: -10 to 50°C
- (4) Operating humidity: 90%RH or less, no condensation
- (5) Transient overvoltage category: I
- (6) Contamination level: 2 (IEC 60664)



Avoid use in any of the places listed below.

Failure to comply may cause malfunction or damage to this instrument and could result in a fire.

- Places where flammable gas, corrosive gas, oil mist, or dust that deteriorates insulation is generated or abundant.
- Places exposed to excessive vibration or impact.
- Places close to a high-voltage circuit or prone to inductive interference.
- Places exposed to water droplets or direct sunlight.
- Places exposed to air blown from a heater or an air conditioner.

3-2. Installation and uninstallation

(1) Connect a sufficient number of bus connectors for one COM Module and one or more Temp Control Modules and install them on a DIN rail.



(2) First, engage the upper side of each module (the side without the stopper) with the DIN rail and slide each module diagonally into place.

Push each module in all the way until the stopper snaps into place.

(3) Repeat the above steps to connect and install multiple modules on the DIN rail.



(4) To remove a module, turn its body upward with the stopper pulled down using a screwdriver.



*There is no particular order specified for the installation/uninstallation of the COM Module and Temp Control Module(s).



This instrument does not support hot-swapping. A module must be powered off before plugging it into a bus connector (DIN rail). Failure to comply may result in failure or malfunction of the module.

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3-3. External dimensional drawing



3-4. Terminal number arrangement (1) COM Module





* Terminal Nos. 5 to 8 are not available in the RS-485 version.

(2) Functions of the COM Module terminals

Terminal		Description		
No.	Name	RS-422	RS-485	
1		Connects transmission A (+) to master reception A (+).	Connects transmission-reception A (+) to master transmission-reception A (+).	
2	COM	Connects transmission B (-) to master reception B (-).	Connects transmission-reception B (-) to master transmission-reception B (-).	
3	COM	Connects reception A (+) to master transmission A (+).	Connects transmission-reception A (+) to next group transmission-reception A (+).	
4			Connects reception B (-) to master transmission B (-).	Connects transmission-reception B (-) to next group transmission-reception B (-).
5		Connects transmission A (+) to next group transmission A (+).		
6	COM	Connects transmission B (-) to next group transmission B (-).		
7		Connects reception A (+) to next group reception A (+).		
8		Connects reception B (-) to next group reception B (-).		
13	80	RS-422 COM GND	RS-485 COM GND	
14	36	RS-422 COM GND	RS-485 COM GND	
15	Power	24V DC +	24V DC +	
16	Power	24V DC -	24V DC -	

	Front view					
			Name	Function		
	MCM57	(1)	Power LED	This LE It blinks	D remains on in the normal mode. in the address setting mode (address initialization).	
(1)		(2)	Master transmission LED	This LE	D blinks during transmission to the master unit.	
(2)(3)	M-Txd	(3)	Master reception LED	This LE	D blinks during reception from the master unit.	
(4)	S-Txd	(4)	Slave transmission LED	This LE	D blinks during transmission to the Temp Control Module.	
(5)	S-Rxd	(5)	Slave reception LED	This LED blinks during reception from the Temp Control Module.		
(6)	-> O Address	(6)	Address switch Address	Hold down for 3 seconds to switch from the normal mode to the address setting mode. Push once in the address setting mode to get the slave address.		
	SW1 SW2 SW3			SW1	Group address setting	
				SW2	Croup address setting	
(7)	SW4			SW3	Protocol selection	
	SW6 SW7	(7)	Initialization switch	SW4	Communication and coloction	
	SW8	(')	Initialization Switch	SW5		
	SHIMADEN			SW6	Data length selection	
				SW7	Parity bit selection	
				SW8	Stop bit selection	

COM Module uses address switch operations to toggle between the basic display mode and the address setting mode.

COM Module status transition diagram



*For the connection drawing for RS-422/RS485, see 20-2 "Controller-host computer connection."



(4) Functions of the Temp Control Module terminals

Terminal No.	Name	Description
1		+ (TC, mV, V), A (RTD)
2	CH1 PV input	- (TC, mV, V), B (RTD)
3		B (RTD)
4	CH1 EV_C	CH1 event common
5		+ (TC, mV, V), A (RTD)
6	CH2 PV	- (TC, mV, V), B (RTD)
7		B (RTD)
8	CH2 EV_C	CH2 event common
9		Event output 1
10	GITEV	Event output 2
11		Event output 1
12		Event output 2
13		External control input common
14		External control input 1
15	СНТЫ	External control input 2
16		External control input 3
17		CH2 external control input common/CH1 analog output+
18		CH2 external control input 1 / CH1 analog output-
19		External control input 2 / CH2 analog output+
20		External control input 3 / CH2 analog output-
21		Control output +
22		Control output -
23		Control output +
24		Control output -

	Front view			
	MPM57	No.	Name	Function
(1) — (2) — (3) —	Power	(1)	Power LED	This LED remains on in the normal mode. It blinks in the address setting mode (address initialization). It indicates Bit 5 in the address display mode.
		(2)	CH1 RUN LED	This LED remains on during CH1 operation in the normal mode. It indicates Bit 4 in the address display mode.
(4) (5) —	• • • • • • • • • • • • • • • • • • •	(3)	CH1 Output LED	This LED indicates CH1 output in the normal mode. It indicates Bit 3 in the address display mode.
(6)	Address	(4)	CH2 RUN LED	This LED remains on during CH2 operation in the normal mode. It indicates Bit 2 in the address display mode.
		(5)	CH2 Output LED	This LED indicates CH2 output in the normal mode. It indicates Bit 1 in the address display mode.
	SHIMADEN	(6)	Address switch	Push once in the normal mode to switch to the address display mode. Push once in the address setting mode to request the slave address.

Temp Control Module uses address switch operations to toggle between the basic display mode, the address setting mode, and the address display mode.

Temp Control Module status transition diagram





Otherwise, auto-return occurs in 3 min.

4. Product profile

This product supports modular configuration, in which a series of slim multi-loop temperature controllers, each having 2 input and 2 output channels, can be installed gap-free (on a DIN rail).

4-1. Advantages

- Various system modes selectable by combinations of 2 inputs and 2 outputs (some modes are optional).
- 4-pattern, 32-step program (option)
- 2 analog output channels (option)
- 3 external control input (DI) points × 2 channels, provided as standard
- · Connectable to a bus connector, requiring no external power supply.
- Slim-bodied (22.6 mm)
- Multiple gapless installation
- Easy address setting
- RS-422 or RS-485 communication function
- DIN rail-mountable
- Low cost

4-2. Configuration of this instrument

This instrument consists of a COM Module and one or more Temp Control Modules, allowing two temperature control loops per Temp Control Module. After the initial setting is completed, the Temp Control Module can be operated independently. The COM Module is still necessary to monitor the current value, to change the parameter settings, or to perform any other related operation. The COM Module controls groups and serves as a linkage between a master unit (PLC, PC, etc.) and the Temp Control Module. The COM Module uses an RS-485 or RS-422 bus for communication with a master unit and a dedicated bus for communication with the Temp Control Module.

Each module has a bus connector. When a group of modules are connected to each other on a DIN rail, they are ready to receive power supply and their bus connectors form the dedicated bus. In a group, up to 31 Temp Control Modules can be connected to each other. It is possible to connect up to 4 groups per master unit.

Conceptual diagram of product configuration



5. Setup before power-on

OFF

ON

Use the COM Module DIP switches to set the communication conditions. The switch setting information reflects the state of the COM Module immediately after power-on. This means that any switch operation after power-on will be invalid. Hence, always set the DIP switches before power-on.

SW1-2: Group address setting							
These switches are used for the address setting operation described later for							
automatic a	ddress ass	ignment that determines the slave addre	ess range of a group.				
SW1	SW2	Slave address range					
OFF	OFF	1 to 62					

65 to 127

DIP switches Left = OFF Right = ON

OFF <-> ON



ON	OFF	129 to 191							
ON	ON	193 to 255							
SW3: Pro	tocol setting								
SW3	Protocol	Protocol							
OFF	SHIMAD	EN							
ON	MODBUS	S-RTU							
SW4-5: C	ommunicatio	on speed (baud rate) setting							
SW4	SW5	Communication speed							
OFF	OFF	4800 bps							
OFF	ON	9600 bps							
ON	OFF	19200 bps							
ON	ON	38400 bps							
SW6: Dat	a length sett	ing (not applicable when the protocol is MODBUS-RTU)							
SW6	Data leng	jth							
OFF	7 bits	7 bits							
ON	8 bits	8 bits							
SW7: Par	ity bit setting								
SW7	Parity bit	Parity bit							
OFF	N/A (Non	N/A (Non)							
ON	Even nur	Even number (Even)							
SW8: Sto	p bit setting								

SVV8: Stop	bit setting
SW8	Stop bit
OFF	1 bit
ON	2 bits

6. Wiring

After installing and connecting all modules to each other, wire them to the power supply, sensors, and peripheral devices. As illustrated below, open each wire insertion hole fully by turning a screwdriver counterclockwise to insert a wire the hole.



* Use crimp terminals (bar terminals or ferrules) for easier wiring and termination.

Typical wiring



Keep the following points in mind during wiring.

- (1) According to "Functions of the COM Module terminals" and "Functions of the Temp Control Module terminals," ensure that all the wires are connected correctly.
- (2) For thermocouple input, use a compensating conductor compatible with the selected type of thermocouple.
- (3) For RTD. input, ensure that each lead wire has a resistance of 5Ω or less and that all the three wires have the same resistance.
- (4) Do not run the input signal wiring through the same conduit or duct as a high-voltage circuit.
- (5) Use shield wiring (single point grounding), which provides effective protection against static induction noise.
- (6) Twist the input wires at short, regular intervals to provide effective protection against electromagnetic induction noise.
- (7) For power supply wiring, use a wire or cable 0.5 m² or more in cross-sectional area and Min equivalent or superior in performance to a vinyl insulated wire.
- (8) Tighten the terminal screws securely in place.
- Tightening torque: 0.5 to 0.6 N·m (5 to 6 kgf·cm)

(9) Use a noise filter to prevent the malfunction of this instrument where it is likely to be affected by power supply noise. Install the noise filter on a grounded panel and minimize the wiring distance between the noise filter output and the controller's power supply terminal.

(10) Countermeasure against lightning surge will be required for signal line over 30m.



7. Power-on

After making sure that the wiring is all correct, supply 24 V DC to COM Module terminals Nos. 15 and 16. When the power is correctly supplied, the COM Module power LED comes on first. Then, the other Temp Control Module indicator LEDs come on in the following order.

 Power 	\Box	PowerRUN1	\Box	PowerOUT1	\Box	PowerRUN2	\Box	PowerOUT2
---------------------------	--------	--------------------------------------	--------	--------------------------------------	--------	--------------------------------------	--------	--------------------------------------

blink.

8. First operations after power-on

This instrument is used in a multi-drop bus network and uses an RS-485 or RS-422 bus for host-to-COM Module communication and a dedicated bus for COM Module-to-Temp Control Module communication. Each Temp Control Module needs to be assigned an identification number called a slave address. Unlike our conventional products that were set using key or rotary switch operations, this instrument can be easily set using a push-button switch. Note that a Temp Control Module has a 2-channel, built-in temperature controller. Accordingly, both CH1 and CH2 are assigned

Note that a Temp Control Module has a 2-channel, built-in temperature controller. Accordingly, both CH1 and CH2 are assigned a slave address, respectively. The slave addresses in a module are consecutively numbered, with a smaller odd number assigned to CH1.

* The factory-default settings are: CH1 = 01 and CH2 = 02.

8-1. Address setting procedure



(1) Make sure that each module is correctly connected. Then, turn the power on. Ensure that the power LED of each module is on.

(2) Hold down the COM Module address switch for 3 seconds to select the address setting mode. When the address setting mode is selected, the power LEDs of all the modules of the group start to

Then, all the Temp Control Modules of the group have their internal addresses initialized (CH 1 = 01 and CH 2 = 02).

(3) When the address switch of a Temp Control Module is pressed, the Module's power LED stops blinking and remains on, indicating the completion of internal address assignment. Then, the Temp Control Module returns to the basic display mode.

(4) When multiple Temp Control Modules are installed in a group, repeat Step (3) in the order of address assignment. Address assignment occurs in the order of switch pressing.



- (5) After assigning addresses to all the Temp Control Modules (switch pressing), push the COM Module address switch.
 Exit the address setting mode to go back to the basic display mode.
 Make sure that the power LEDs of all the modules are back on again.
- * An address assignment operation interrupted due to power loss cannot be resumed, although the addresses already assigned are valid.
- If there is any Temp Control Module left with unassigned addresses, perform the operation all over again from the beginning.
- * The order of address assignment (that of switch pressing) need not be the same as the order of modules arranged in a group.

8-2. Address check



Press the address switch of a Temp Control Module in the basic display mode to switch to the address display mode. The 5 indicator LEDs of a Temp Control Module correspond to Bits 1 to 5, which are used in combination with the statuses of the COM Module DIP switches to determine the slave addresses.

Symbol	Name	Constant
А	SW1	128
В	SW2	64
С	Power (Bit 5)	32
D	RUN1 (Bit 4)	16
Е	OUT1 (Bit 3)	8
F	RUN2 (Bit 2)	4
G	OUT2 (Bit 1)	2

According to the above table, total the constants of switches and LEDs that are ON. Then, add 1 to determine the CH1 slave address.

Slave address calculation formula: <u>A+B+C+D+E+F+G+1</u>

Example:

Xumpr	0.		_
Α	SW1	ON	
В	SW2	OFF	
С	Power (Bit 5)	OFF	Address=
D	RUN1 (Bit 4)	OFF	CH1=133
Е	OUT1 (Bit 3)	OFF	CH2=134
F	RUN2 (Bit 2)	ON	
G	OUT2 (Bit 1)	OFF	

Address=128+0+0+0+0+4+0+1=133 CH1=133

* When the address switch is pressed again in the address display mode, the Module goes back to the basic display mode.

- * The address display mode defaults back to the basic display mode in approximately 3 minutes.
- * The CH2 address value is greater by 1 than the CH1 address value.

8-3. Operation

This instrument is shipped disabled (with the outputs turned OFF). Set the parameters listed below one by one in the top-tobottom order before operating the instrument.

The parameter setting procedures in the table below may include some items necessary only for some customers. Set such items only when necessary.

* The following table assumes that the instrument has been configured and ready for communication.

0x05B0H
0x0705H
0x0707H
0x030AH
0x0300H
0x0500H
0x0501H
0x0580H
0x0400H
0x0190H

9. Communication address table

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
0046H	Code selection data 1		R		CH1 / CH2 input selection	
0047H	Code selection data 2		R		Output selection	
0048H	Code selection data 3		R		Optional	
0049H	Code selection data 4		R		Program / system	
005FH	Option info		R		*2 See the bit correspondence table.	11
0100H	PV (measured value)	Within setting range	R		*1	
0101H	Execution SV value	Within set value limiter	R			
0102H	Control output 1	0 to 1000 (0.0 to 100.0%)	R			12-2 (1)
0103H	Control output 2	0 to 1000 (0.0 to 100.0%)	R		MODE2/4	12-2 (1)
040411		See the detailed description				
0104H	Action hag	below.	ĸ		"2 See the bit correspondence table.	See the table below.
0105H	Event output flag	See the detailed description	R		*2 See the bit correspondence table.	See the table below.
0106H	Execution SV No	1 to 3	R			17-2
010011	Execution PID No.	1.0.5	R		0x7EEE when not executed	11-2
010711	Execution FID No.		N.		OXTEE WHEIT NOT executed	
010BH	DI input state flag	See the detailed description below.	R		*2 See the bit correspondence table.	See the table below.
010DH	Event latch output flag	See the detailed description	R		*2 See the bit correspondence table.	See the table below.
		See the detailed description	Б		*2 See the hit correspondence table	See the table below
UTUEH	Event relay ON/OFF flag	below.	ĸ		"2 See the bit correspondence table.	See the table below.
		Cas the detailed description				
0120H	Program action flag	below	R		*2 See the bit correspondence table.	See the table below.
0121H	Execution pattern No.		R		*3 0x7FFE if not PROG. RUN	
-						
0123H	Execution pattern count	1 to 10000	R			
0124H	Execution step No.	1 to 40	R			
0125H	Execution step remaining time	00:00 to 99:59	R		*3 UX7FFE IT NOT PROG. RUN	
0126H	Execution PID No.		R			
0180H	Execution SV No.	1 to 3	R/W/B			17-2
0182H	Control output 1 manual output value	0 to 1000 (0.0 to 100.0%)	R/W/B			12-2 (1)
0183H	Control output 2 manual output value	0 to 1000 (0.0 to 100.0%)	R/W/B		MODE2/4	12-2 (1)
0184H		0: OFF 1: ON	R/W/B			17-4
0185H	AUTO <-> MAN switching	0: AUTO 1: MAN	R/W/B			17-5 (1)
01804	Communication mode	0:10C 1:COM	D/\\//B			10.3 (2)
010011			IN/W/D		*2 See the bit correspondence	19-3 (2)
018DH	Event direct output		R/W/B		table.	
0190H	RUN <-> RST switching	0: RST 1: RUN	R/W/B			16-4 / 17-1
0191H	Hold (HLD)	0: OFF 1: ON	R/W/B			18-1
0192H	Advance (ADV)	0: OFF 1: ON	R/W/B			18-2
0198H	Latching alarm release		R/W/B		*2 See the bit correspondence	
					table.	
		0: No initialization instructed				
019FH	Parameter initialization	1: Initialization instructed	W/B			
0260H	Master's internal cascade	Input unit	R		MODE3	12-4
0261H	Master's internal cascade	Input range	R		MODE3	
0262H	Master's internal cascade	Decimal point position	R		MODE3	12-5
0263H	Master's internal cascade	Measuring range lower limit value	R		MODE3	12-3 (2)
0264H	Master's internal cascade	Measuring range higher limit	R		MODE3	12-3 (2)
0280H	CH1 PV (measured value)		R			
0281H	CH2 PV (measured value)		R		MODE1/3/4	

The following table shows the details of the action flag, event output flag, and DI input state flag data (RUN_FLG, EV_FLG, DI_FLG): (When not in action: bit = 0, when in action: bit = 1)

	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
RUN_FLG	0	0	0	0	0	0	AT WAIT	COM	0	0	ESV	0	0	RST	MAN	AT
EV_FLG	0	0	0	0	0	0	0	0	0	0	0	0	EV4	EV3	EV2	EV1
DI_FLG	0	0	0	0	0	0	0	0	0	0	DI6	DI5	DI4	DI3	DI2	DI1

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
0300H	FIX SV1	Within SV limiter	R/W/B			16-3 (5)
0301H	FIX SV2	Within SV limiter	R/W/B			16-3 (5)
0302H	FIX SV3	Within SV limiter	R/W/B			16-3 (5)
030AH	SV limiter lower limit value	range higher limit value -1	R/W/B			13-1 (1)
02000	SV/ limiter higher limit volue	Measuring range lower limit value +1 to				12 1 (1)
03000		measuring range higher limit value	R/W/D			13-1 (1)
000011	O seconda manda				MODEO	40.0 (4)
0328H	Cascade mode	0: CAS1, 1: CAS2, 2: CAS3	R/W/B		MODE3	12-3 (1)
0329H	Cascade SV lower limit value		R/W/B		MODE3	12-3 (2)
032AH 032BH	Cascade SV higher limit value	30_R. C3_L+1 t0 3V2_3C_R	R/VV/D			12-3 (2)
032CH	Cascade filter	0: OFF 1 to 100 (seconds)	R/W/B		MODE3	12-3 (3)
002011			10,00,0		MODEO	12 0 (4)
022411	Switchover point	CH1 PV lower to CH2 PV higher limit				10 7 (2)
0331H	Switchover point	value	R/W/B		MODE4	12-7 (3)
0332H	Switchover hysteresis	0 to 1000 (digit)	R/W/B		MODE4	12-7 (4)
0400H	Output 1 proportional band 1	0: OFF, 1 to 10000 (0.1 to 1000.0%)	R/W/B			14-1
0401H	Output 1 Integral time 1		R/W/B			14-2
0402H	Output 1 derivative time 1	U. UFF, 1 10 3000 (Seconds)	K/W/B			14-3
0403H		-500 to 500 (-50.0 to 50.0%)				14-4
0404H 0405H	Output 1 output limiter lower limit value 1	0 to 999 (0 0 to 99 9%)	R/M/D			14-0
040311 0406H	Output 1 output limiter bigher limit value 1	1000000000000000000000000000000000000	R/W/B			14-0
0407H	Output 1 SE1	0° OFF 1 to 100 (0.01 to 1.00)	R/W/B			14-5
0408H	Output 1 proportional band 2	0: OFF 0.1 to 10000 (1 to 1000.0%)	R/W/B			14-1
0409H	Output 1 integral time 2	0: OFF, 1 to 6000 (seconds)	R/W/B			14-2
040AH	Output 1 derivative time 2	0. OFF 1 to 3600 (seconds)	R/W/B			14-3
040BH	Output 1 manual reset 2	-500 to 500 (-50 0 to 50 0%)	R/W/B			14-4
040CH	Output 1 differential gap 2	1 to 1000 (digit)	R/W/B			14-6
040DH	Output 1 output limiter lower limit value 2	0 to 999 (0.0 to 99.9%)	R/W/B			148
040EH	Output 1 output limiter higher limit value 2	Lower limit value + 1 to 1000 (to 100.0%)	R/W/B			14-8
040FH	Output 1 SF2	0: OFF, 1 to 100 (0.01 to 1.00)	R/W/B			14-5
0410H	Output 1 proportional band 3	0: OFF, 1 to 10000 (0.1 to 1000.0%)	R/W/B			14-1
0411H	Output 1 integral time 3	0: OFF. 1 to 6000 (seconds)	R/W/B			14-2
0412H	Output 1 derivative time 3	0. OFF 1 to 3600 (seconds)	R/W/B			14-3
0413H	Output 1 manual reset 3	-500 to 500 (-50 0 to 50 0%)	R/W/B			14-4
0414H	Output 1 differential gap 3	1 to 1000 (digit)	R/W/B			14-6
0415H	Output 1 output limiter lower limit value 3	0 to 999 (0.0 to 99.9%)	R/W/B			14-8
	Output 1 output limiter lower limit value 3	1 = 1000 (to 10 333 (to 10 33.376)				14-0
		$\frac{1}{10000} = \frac{1}{10000} + \frac{1}{10000} + \frac{1}{100000} + \frac{1}{10000000000000000000000000000000000$				14-0
0417日		0. OFF, 1 10 100 (0.01 10 1.00)	R/W/D	_		14-5
0460H	Output 2 proportional band 1	0: OFE 1 to 10000 (0.1 to 1000.0%)	R/W/B			14_1
040011 0461H	Output 2 integral time 1	0: OFF 1 to 6000 (seconds)	R/W/B		MODE2 / 4	14-1
0462H	Output 2 derivative time	0: OFF_1 to 3600 (seconds)	R/W/B		MODE2/4	14-3
0463H	Output 2 dead band	-2000 to 5000 (digit)	R/W/B		MODE2 / 4	14-7
0464H	Output 2 differential gap 1	1 to 1000 (digit)	R/W/B		MODE2 / 4	14-6
0465H	Output 2 output limiter lower limit value 1	0 to 999 (0.0 to 99.9%)	R/W/B		MODE2 / 4	14-8
0466H	Output 2 output limiter higher limit value 1	Lower limit value + 1 to 1000 (to 100.0%)	R/W/B		MODE2 / 4	14-8
0467H	Output 2 SF1	0: OFF, 1 to 100 (0.01 to 1.00)	R/W/B		MODE2 / 4	14-5
0468H	Output 2 proportional band 2	0: OFF, 1 to 10000 (0.1 to 1000.0%)	R/W/B		MODE2 / 4	14-1
0469H	Output 2 integral time 2	0: OFF, 1 to 6000 (seconds)	R/W/B		MODE2 / 4	14-2
046AH	Output 2 derivative time 2	0: OFF, 1 to 3600 (seconds)	R/W/B		MODE2 / 4	14-3
0468H	Output 2 dead band	-2000 to 5000 (digit)	R/W/B		MODE2/4	14-7
	Output 2 differential gap 2	1 to 1000 (algit)	R/W/B		MODE2/4	14-0
040DH 046EH	Output 2 output limiter bigher limit value 2	0.0333 (0.0033.370)	R/M/B			14-0
046FH	Output 1 SF2	0° OFF 1 to 100 (0.01 to 1.00)	R/W/R		MODE2 / 4	14-5
0470H	Output 2 proportional band 3	0: OFF. 1 to 10000 (0.1 to 1000 0%)	R/W/B		MODE2 / 4	14-1
0471H	Output 2 integral time 3	0: OFF, 1 to 6000 (seconds)	R/W/B		MODE2 / 4	14-2
0472H	Output 2 derivative time 3	0: OFF, 1 to 3600 (seconds)	R/W/B		MODE2 / 4	14-3
047 <u>3H</u>	Output 2 dead band	-2000 to 5000 (digit)	R/W/B		MODE2 / 4	14-7
0474H	Output 2 differential gap 3	1 to 1000 (digit)	R/W/B		MODE2 / 4	14-6
0475H	Output 2 output limiter lower limit value 3	0 to 999 (0.0 to 99.9%)	R/W/B		MODE2 / 4	14-8
0476H	Output 2 output limiter higher limit value 3	Lower limit value + 1 to 1000 (to 100.0%)	R/W/B		MODE2 / 4	14-8
0477H	Output 2 SF3	U: UFF, 1 to 100 (0.01 to 1.00)	R/W/B		MODE2 / 4	14-5
U4DFH	Dinerential gap mode	U. GENTER, T. SV_UFF, 2: SV_UN	K/W/B			12-9(7)

Address	Parameter name	Settir	ng range	R/W/B	OP	Remarks	Section explaining function
0500H	Event 1 code	See the event (table.	EV) assignment	R/W/B			15-1
0501H	Event 1 level	See the event le	evel value.	R/W/B			15-1 (1)
0502H	Event 1 differential gap	1 to 1000 (digit)		R/W/B			15-1 (2)
0503H	Event 1 standby action	0 to 3		R/W/B			15-1 (3)
0505H	Event 1 latching / output characteristics	0: OFF, 1: ON /	0: NO, 1: NC	R/W/B		*3	15-1(4)/(5)
0508H	Event 2 code	See the event (I table.	EV) assignment	R/W/B			15-1
0509H	Event 2 level	See the event le	evel value.	R/W/B			15-1 (1)
050AH	Event 2 differential gap	1 to 1000 (digit)		R/W/B			15-1 (2)
050BH	Event 2 standby action	0 to 3		R/W/B			15-1 (3)
050DH	Event 2 latching/output characteristics	0: OFF, 1: ON /	0: NO, 1: NC	R/W/B		*3	15-1(4)/(5)
0510H	Event 3 code	See the event (l table.	EV) assignment	R/W/B		MODE2 / 4	15-1
0511H	Event 3 level	See the event le	evel value.	R/W/B		MODE2 / 4	15-1 (1)
0512H	Event 3 differential gap	1 to 1000 (digit)		R/W/B		MODE2 / 4	15-1 (2)
0513H	Event 3 standby action	0 to 3		R/W/B		MODE2 / 4	15-1 (3)
0515H	Event 3 latching/output characteristics	0: OFF, 1: ON /	0: NO, 1: NC	R/W/B		MODE2 / 4 *3	15-1(4)/(5)
0518H	Event 4 code	See the event (l table.	EV) assignment	R/W/B		MODE2 / 4	15-1
0519H	Event 4 level	See the event le	evel value.	R/W/B		MODE2 / 4	15-1 (1)
051AH	Event 4 differential gap	1 to 1000 (digit)		R/W/B		MODE2 / 4	15-1 (2)
051BH	Event 4 standby action	0 to 3		R/W/B		MODE2 / 4	15-1 (3)
051DH	Event 4 latching/output characteristics	0: OFF, 1: ON /	0: NO, 1: NC	R/W/B		MODE2 / 4 *3	15-1(4)/(5)
0580H	DI1 Mode	0: non	7: ACt2	R/W/B	DI		19-1 (1)
0581H	DI2 Mode	1: RUN1	8: ProG	R/W/B	DI		19-1 (1)
0582H	DI3 Mode	2: RUN2	9: HLd	R/W/B	DI		19-1 (1)
0583H	DI4 Mode	3: mAn	10: AdV	R/W/B	DI	MODE2/4	19-1 (1)
0584H	DI5 Mode	4. AL 5. ES\/2	11. PU12 12: Ptn3	R/\//B	וח		19_1 (1)
050511	DIG Mode	6: ACt1	12.1 ui5 13.1 rS			MODE2 / 4	$10^{-1}(1)$
00000		0.71011	10. 2_10	R/W/D		MODEZ / 4	19-1 (1)
0540H	Analog output mode	0. PV 1. SV 2.		R/M/B			10-2 (1)
054011		D_{1} S_{1} D_{1} S_{2}			AOUT		19-2 (1)
05A1H	Analog output scaling lower limit value		to 1000	R/W/B	AOUT		19-2 (2)
05A2H	Analog output scaling higher limit value	(0.0 to	100.0%)	R/W/B	AOUT		19-2 (2)
05A4H	Analog 2 output mode	0: PV, 1: SV, 2:	OUT1, 3: OUT2	R/W/B	AOUT	MODE2 / 4	19-2 (1)
05A5H	Analog 2 output scaling lower limit value	PV, SV: Within	measuring range	R/W/B	AOUT	MODE2 / 4	19-2 (2)
05A6H	Analog 2 output scaling higher limit	OUT1, OUT2: 0	to 1000	R/W/B	AOUT	MODE2/4	19-2 (2)
	value	(0.010	100.070)				
05B0H	Communication memory mode	0: EEP, 1: rAm.	2: r E	R/W/B			19-3 (1)
05B1H	Communication mode type	0: COM1, 1: CC	DM2	R/W/B			19-3 (3)
05B4H	Analog output limiter lower limit value	0 to 999 (0.0 to	99.9%)	R/W/B	AOUT		19-2 (3)
05B5H	Analog output limiter higher limit value	Lower limit valu	e + 1 to 1000	R/\//P			19-2 (3)
00001		(to 100.0%)		1.7.07/D	1.001		10 2 (0)
05B7H	Analog 2 output limiter lower limit value	0 to 999 (0 0 to	99 9%)	R/W/B	AOUT	MODE2/4	19-2 (3)
050011	Analog 2 output limiter higher limit	Lower limit valu	e + 1 to 1000	DAVE	1.001		
05B8H	value	(to 100.0%)		K/W/B	AOUT	MODE2/4	19-2 (3)
		· · · · ·					

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
0600H	Output 1 output characteristics	0: RA, 1: DA	R/W/B			12-9 (2)
0601H	Output 1 proportional cycle	1 to 120 (seconds)	R/W/B			12-9 (3)
0604H	Output 2 proportional cycle	1 to 120 (seconds)	R/W/B		MODE2 / 4	12-9 (3)
0607H	Output 2 output characteristics	0: RA, 1: DA	R/W/B		MODE2 / 4	12-9 (2)
000411			D/M//D			40.0(4)
060AH	Output 1 soft start	0: OFF, 1 to 120 (seconds)	R/W/B			12-9 (4)
060BH		U: OFF, 1 to 120 (seconds)	R/W/B		MODE2/4	12-9 (4)
070011	D) (under a sum a time	500 to 500 (5 00 to 5 00%)	D/M//D			40.0 (4)
0700H	PV gain correction	-500 to 500 (-5.00 to 5.00%)	R/W/B			12-8 (1)
07018	PV blas	-2000 to 20000 (digit)				12-0 (1)
07020			R/W/D			12-0 (1)
0704H	Input unit	0. °C 1. °F	R/M/B			12-4 (1)
070411		See 12.6 "Measuring range	11/10/0			12-4 (1)
0705H	Input range	code table "	R/W/B			12-1 (1)
		0; (0), 1; (0,0), 2; (0,00), 3;				
0707H	Input scaling decimal point position	(0.000)	R/W/B			12-5
0708H	Input scaling lower limit value	-2000 to 9990 (digit)	R/W/B			12-1 (2)
0709H	Input scaling higher limit value	SC L+10 to 10000 (digit)	R/W/B			12-1 (2)
0730H	Switchover input 2 input unit	0: °C, 1: °F	R		MODE4	12-7 (2)
0731H	Switchover input 2 input range		R/W/B		MODE4	12-7 (2)
0733H	Switchover input 2 input scaling decimal point position	With or without decimal point	R		MODE4	12-7 (2)
0734H	Switchover input 2 input scaling lower limit value		R/W/B		MODE4	12-7 (2)
0735H	Switchover input 2 input scaling upper limit value		R/W/B		MODE4	12-7 (2)
000011						40.2 (4)
00000		U. PROG T. FIX	R/W/D			10-3 (4)
000011	Start pattern No	1 to 1 (number of nottorne)				16.2 (1)
0802H	Start pattern No.	1 to 4 (number of patterns)	R/W/B			16-3 (1)
0802H	Start pattern No.	1 to 4 (number of patterns)	R/W/B			16-3 (1)
0802H 0818H	Start pattern No. Number of patterns	1 to 4 (number of patterns) 1, 2, 4 0; HH:MM, 1; MM:SS	R/W/B			16-3 (1) 16-3 (2) 16-3 (3)
0802H 0818H 0819H	Start pattern No. Number of patterns Time unit	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS	R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3)
0802H 0818H 0819H	Start pattern No. Number of patterns Time unit	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS	R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6)
0802H 0818H 0819H 0882H 0882H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000	R/W/B R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8)
0802H 0818H 0819H 0882H 0883H 0883H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter	R/W/B R/W/B R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFE 1 to 1000 (digit)	R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit)	R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0885H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV	R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0885H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV	R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV	R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0885H 0887H 0887H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level	R/W/B			16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0885H 0887H 0889H 088AH 088BH	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value.	R/W/B		MODE2 / 4	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7)
0802H 0818H 0819H 0882H 0883H 0883H 0885H 0887H 0887H 0889H 0888H 0888H 0888H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value.	R/W/B		MODE2 / 4 MODE2 / 4	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0887H 0887H 0888H 0888H 0888H 0888H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value.	R/W/B		MODE2 / 4 MODE2 / 4	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0887H 0887H 0888H 0888H 0888H 0888H 0888H 0888H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter	R/W/B		MODE2 / 4 MODE2 / 4	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H 0887H 0889H 088AH 088BH 088AH 088BH 088CH 088AH 088AH	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59	R/W/B		MODE2 / 4 MODE2 / 4	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (8) 13-1 (1) 18-4 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0885H 0887H 0888H 0888H 0888H 0888H 0888H 0888H 0888H 0888H 0888H 0888H 0880H 0880H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step 1 me Pattern 1 step 1 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 0:000 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0887H 0887H 0888H 0888H 0888H 0888H 0888H 088AH 0888H 088AH 08	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 0:000 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0883H 0883H 0884H 0885H 0887H 0887H 0888H 0888H 0888H 0888H 0888H 0888H 0880H 088AH 0880H 0880H 0880H 0880H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step PID No. Pattern 1 step 2 step SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter	R/W/B		MODE2 / 4 MODE2 / 4 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (3) 16-5 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H 0887H 0888H 0888H 0888H 0888H 0888H 088AH 0888H 088AH 088AH 088AH 088AH 088AH 088AH 088AH 088AH	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 guarantee soak zone Pattern 1 start mode Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step ID No. Pattern 1 step 2 step SV value Pattern 1 step 2 step SV value Pattern 1 step 2 step time	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59	R/W/B		MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (3) 16-5 (1) 16-5 (1) 16-5 (2)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H 0887H 0888H 0888H 0888H 0888H 088AH 0888H 088AH 0884H 088AH 0884H 0884H 0884H 0884H 0884H 0884H 0884H 0884H 0884H 0884H 0884H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 1 step PID No. Pattern 1 step 2 step SV value Pattern 1 step 2 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H 0887H 0888H 0888H 088AH 088BH 088AH 08	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step ID No. Pattern 1 step 2 step SV value Pattern 1 step 2 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0882H 0883H 0884H 0885H 0887H 0887H 0889H 0888H 0888H 0886H 088AH 088AH 0884H 0884H 08A3H 08A4H 08A5H 08A6H 08A8H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter	R/W/B		MODE2 / 4 MODE2 / 4 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 16-5 (1)
0802H 0818H 0819H 0882H 0882H 0883H 0885H 0885H 0885H 0888H 0888H 088AH 088AH 088AH 088AH 08A0H 08A1H 08A2H 08A4H 08A5H 08A4H 08A5H 08A6H 08A8H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step SV value	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59	R/W/B		MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (3) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0883H 0883H 0885H 0885H 0885H 0885H 0888H 0888H 088CH 088AH 088CH 08A0H 08A1H 08A2H 08A4H 08A5H 08A4H 08A5H 08A6H 08A8H 08A8H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step SV value Pattern 1 step 2 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step SV value Pattern 1 step 3 step SV value Pattern 1 step 3 step ID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0819H 0819H 0882H 0883H 0883H 0885H 0885H 0887H 0887H 0884H 0884H 0884H 0884H 0884H 08A0H 08A1H 08A2H 08A4H 08A5H 08A5H 08A4H 08A5H 08A4H 08A4H 08A4H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3	R/W/B		MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (9) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3)
0802H 0818H 0819H 0882H 0883H 0883H 0885H 0885H 0885H 0885H 0885H 0886H 088AH 088AH 088AH 08A0H 08A2H 08A2H 08A4H 08A5H 08A5H 08A5H 08A6H 08A8H 08A8H 08A8H 08A8H	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step PID No. Pattern 1 step 3 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter	R/W/B		MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 9
0802H 0818H 0819H 0882H 0883H 0883H 0885H 0885H 0885H 0885H 0885H 0886H 088AH 088AH 08A0H 08A0H 08A2H 08A4H 08A2H 08A4H 08A5H 08A4H 08A5H 08A5H 08A4H 08A5H 08A5H 08A5H 08A6H 08A6H 08A0H 08A6H 08A6H 08A0H 08	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step PID No. Pattern 1 step 3 step PID No.	1 to 4 (number of patterns) 1, 2, 4 0: HH:MM, 1: MM:SS 1 to 32 1 to 10000 Within SV limiter 0: OFF, 1 to 1000 (digit) 0: SV, 1: PV See the pattern event level value. Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59 0 to 3 Within SV limiter 00:00 to 99:59	R/W/B		MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (8) 13-1 (1) 18-4 (1) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 9 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 9 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (2)
0802H 0818H 0819H 0882H 0883H 0883H 0885H 0885H 0885H 0887H 0888H 0888H 088AH 088AH 088AH 08A0H 08A2H 08A4H 08A5H 08A4H 08A5H 08A5H 08A4H 08A5H 08A5H 08A5H 08A5H 08A6H 08	Start pattern No. Number of patterns Time unit Pattern 1 number of end steps Pattern 1 repeat execution count Pattern 1 start SV value Pattern 1 start SV value Pattern 1 guarantee soak zone Pattern 1 alarm 1 level value Pattern 1 alarm 2 level value Pattern 1 alarm 3 level value Pattern 1 alarm 3 level value Pattern 1 alarm 4 level value Pattern 1 step 1 step SV value Pattern 1 step 1 step SV value Pattern 1 step 2 step PID No. Pattern 1 step 3 step SV value Pattern 1 step 3 step SV value Pattern 1 step 3 step SV value Pattern 1 step 3 step PID No. Pattern 1 step 3 step PID No. Pattern 1 step 4 step SV value Pattern 1 step 4 step SV value	1 to 4 (number of patterns) 1, 2, 4 1, 4	R/W/B R/W/B </td <td></td> <td>MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3 *3 *3</td> <td>16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (2) 16-5 (3)</td>		MODE2 / 4 MODE2 / 4 MODE2 / 4 *3 *3 *3 *3	16-3 (1) 16-3 (2) 16-3 (3) 16-3 (6) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-3 (7) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (1) 16-5 (2) 16-5 (3) 0 16-5 (2) 16-5 (3)

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
08B0H	Pattern 1 step 5 step SV value	Within SV limiter	R/W/B			16-5 (1)
08B1H	Pattern 1 step 5 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
08B2H	Pattern 1 step 5 step PID No.	0 to 3	R/W/B			16-5 (3)
08B4H	Pattern 1 step 6 step SV value	Within SV limiter	R/W/B			16-5 (1)
08B5H	Pattern 1 step 6 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
08B6H	Pattern 1 step 6 step PID No.	0 to 3	R/W/B			16-5 (3)
000011			DAVD			10 5 (1)
08888	Pattern 1 step 7 step SV value		R/W/B		*0	16-5 (1)
	Pattern 1 step 7 step time	00:00 to 99:59	R/W/B		- 3	16-5 (2)
UODAN	Fallenn i slep / slep Fib No.	0103	R/W/D			10-5 (5)
08BCH	Pattern 1 sten 8 sten SV value	Within SV limiter	R/W/B			16-5 (1)
08BDH	Pattern 1 step 8 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
08BEH	Pattern 1 step 8 step PID No	0 to 3	R/W/B			16-5(3)
0022.1						10 0 (0)
0902H	Pattern 2 number of end steps	1 to 16	R/W/B			16-3 (6)
0903H	Pattern 2 repeat execution count	1 to 10000	R/W/B			16-3 (8)
0904H	Pattern 2 start SV value	Within SV limiter	R/W/B			13-1
0905H	Pattern 2 guarantee soak zone	0: OFF, 1 to 1000 (digit)	R/W/B			18-4 (1)
0907H	Pattern 2 start mode	0: SV, 1: PV	R/W/B			16-3 (9)
0909H	Pattern 2 alarm 1 level value		R/W/B			16-3 (7)
090AH	Pattern 2 alarm 2 level value	See the pattern event	R/W/B			16-3 (7)
090BH	Pattern 2 alarm 3 level value	level value.	R/W/B		MODE2 / 4	16-3 (7)
090CH	Pattern 2 alarm 4 level value		R/W/B		MODE2 / 4	16-3 (7)
000011	Dettern Oster Aster Olderster	Mithin OV lineiter				40 5 (4)
0920H	Pattern 2 step 1 step 5V value		R/W/B		*0	16-5 (1)
0921H	Pattern 2 step 1 step time	00:00 10 99:59	R/W/B		- 3	10-5 (2)
09228	Pattern 2 step 1 step PID No.	0 10 3	R/W/D			10-5 (3)
0024H	Pattern 2 sten 2 sten SV value	Within SV limiter	R/W/B			$16_{-5}(1)$
092411	Pattern 2 step 2 step 5 Value	00:00 to 99:59	R/W/B		*3	16-5 (2)
0925H	Pattern 2 step 2 step IIIne	0 to 3	R/W/B		5	16-5(2)
002011		0100	T(W)D			10-3 (3)
0928H	Pattern 2 step 3 step SV value	Within SV limiter	R/W/B			16-5 (1)
0929H	Pattern 2 step 3 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
092AH	Pattern 2 step 3 step PID No.	0 to 3	R/W/B			16-5 (3)
092CH	Pattern 2 step 4 step SV value	Within SV limiter	R/W/B			16-5 (1)
092DH	Pattern 2 step 4 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
092EH	Pattern 2 step 4 step PID No.	0 to 3	R/W/B			16-5 (3)
0930H	Pattern 2 step 5 step SV value	Within SV limiter	R/W/B			16-5 (1)
0931H	Pattern 2 step 5 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0932H	Pattern 2 step 5 step PID No.	0 to 3	R/W/B			16-5 (3)
002411	Dettern 2 step 6 step SV/value	Mithin CV limitor				10 E (1)
0934日	Pattern 2 step 6 step 5V value				*2	16-5 (1)
09300	Pattern 2 step 6 step DID No	0 to 3			5	10-5 (2)
09300			T\/W/D			10-3 (3)
0938H	Pattern 2 step 7 step SV value	Within SV limiter	R/W/B			16-5 (1)
0939H	Pattern 2 step 7 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
093AH	Pattern 2 step 7 step PID No.	0 to 3	R/W/B		-	16-5 (3)
093CH	Pattern 2 step 8 step SV value	Within SV limiter	R/W/B			16-5 (1)
093DH	Pattern 2 step 8 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
093EH	Pattern 2 step 8 step PID No.	0 to 3	R/W/B			16-5 (3)
						(- <i>i</i>

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
0982H	Pattern 3 number of end steps	1 to 8	R/W/B			16-3 (6)
0983H	Pattern 3 repeat execution count	1 to 10000	R/W/B			16-3 (8)
0984H	Pattern 3 start SV value	Within SV limiter	R/W/B			13-1
0985H	Pattern 3 guarantee soak zone	0: OFF, 1 to 1000 (digit)	R/W/B			18-4 (1)
0987H	Pattern 3 start mode	0: SV, 1: PV	R/W/B			16-3 (9)
0080	Pattorn 3 alarm 1 lovel value					16.3 (7)
090911	Pattern 3 alarm 2 lovel value	See the pattern event level				16.3 (7)
	Pattern 2 alarm 2 level value	See the pattern event level				16.2 (7)
090011	Pattern 3 alarm 4 lovel value	value.	D/M//B		MODE2/4	16.3 (7)
090011			N/W/D		WODE2/4	10-3 (7)
09A0H	Pattern 3 step 1 step SV value	Within SV limiter	R/W/B			16-5 (1)
09A1H	Pattern 3 step 1 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09A2H	Pattern 3 step 1 step PID No.	0 to 3	R/W/B		-	16-5 (3)
09A4H	Pattern 3 step 2 step SV value	Within SV limiter	R/W/B			16-5 (1)
09A5H	Pattern 3 step 2 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09A6H	Pattern 3 step 2 step PID No.	0 to 3	R/W/B			16-5 (3)
09A8H	Pattern 3 step 3 step SV value	Within SV limiter	R/W/B			16-5 (1)
09A9H	Pattern 3 step 3 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09AAH	Pattern 3 step 3 step PID No.	0 to 3	R/W/B			16-5 (3)
			-			
09ACH	Pattern 3 step 4 step SV value	Within SV limiter	R/W/B			16-5 (1)
09ADH	Pattern 3 step 4 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09AEH	Pattern 3 step 4 step PID No.	0 to 3	R/W/B			16-5 (3)
09B0H	Pattern 3 sten 5 sten SV value	Within SV limiter	R/W/B			16-5 (1)
09B1H	Pattern 3 step 5 step time	00:00 to 99:59	R/W/B		*3	16-5(2)
09B2H	Pattern 3 step 5 step PID No	0 to 3	R/W/B		0	16-5(3)
0022						
09B4H	Pattern 3 step 6 step SV value	Within SV limiter	R/W/B			16-5 (1)
09B5H	Pattern 3 step 6 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09B6H	Pattern 3 step 6 step PID No.	0 to 3	R/W/B			16-5 (3)
09B8H	Pattern 3 step 7 step SV value	Within SV limiter	R/W/B			16-5 (1)
09B9H	Pattern 3 step 7 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
09BAH	Pattern 3 step 7 step PID No.	0 to 3	R/W/B			16-5 (3)
000011			D AAUD			10 5 (1)
09BCH	Pattern 3 step 8 step SV value		R/W/B		*0	16-5 (1)
09BDH	Pattern 3 step 8 step time	00:00 to 99:59	R/W/B		<u>"3</u>	16-5 (2)
U9BEH	Pattern 3 step 8 step PID No.	0 to 3	R/W/B			16-5 (3)
0A02H	Pattern 4 number of end steps	1 to 8	R/W/B			16-3 (6)
0A03H	Pattern 4 repeat execution count	1 to 10000	R/W/B			16-3 (8)
0A04H	Pattern 4 start SV value	Within SV limiter	R/W/B			13-1
0A05H	Pattern 4 guarantee soak zone	0: OFF. 1 to 1000 (digit)	R/W/B			18-4 (1)
0A07H	Pattern 4 start mode	0: SV 1: PV	R/W/B			16-3 (9)
0A09H	Pattern 4 alarm 1 level value		R/W/B			16-3 (7)
0A0AH	Pattern 4 alarm 2 level value	See the pattern event level	R/W/B			16-3 (7)
0A0BH	Pattern 4 alarm 3 level value	value.	R/W/B		MODE2 / 4	16-3 (7)
0A0CH	Pattern 4 alarm 4 level value		R/W/B		MODE2 / 4	16-3 (7)

Address	Parameter name	Setting range	R/W/B	OP	Remarks	Section explaining function
0A20H	Pattern 4 step 1 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A21H	Pattern 4 step 1 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A22H	Pattern 4 step 1 step PID No.	0 to 3	R/W/B			16-5 (3)
0A24H	Pattern 4 step 2 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A25H	Pattern 4 step 2 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A26H	Pattern 4 step 2 step PID No.	0 to 3	R/W/B			16-5 (3)
0A28H	Pattern 4 step 3 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A29H	Pattern 4 step 3 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A2AH	Pattern 4 step 3 step PID No.	0 to 3	R/W/B			16-5 (3)
0A2CH	Pattern 4 step 4 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A2DH	Pattern 4 step 4 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A2EH	Pattern 4 step 4 step PID No.	0 to 3	R/W/B			16-5 (3)
0A30H	Pattern 4 step 5 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A31H	Pattern 4 step 5 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A32H	Pattern 4 step 5 step PID No.	0 to 3	R/W/B			16-5 (3)
0A34H	Pattern 4 step 6 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A35H	Pattern 4 step 6 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A36H	Pattern 4 step 6 step PID No.	0 to 3	R/W/B			16-5 (3)
0A38H	Pattern 4 step 7 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A39H	Pattern 4 step 7 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A3AH	Pattern 4 step 7 step PID No.	0 to 3	R/W/B			16-5 (3)
0A3CH	Pattern 4 step 8 step SV value	Within SV limiter	R/W/B			16-5 (1)
0A3DH	Pattern 4 step 8 step time	00:00 to 99:59	R/W/B		*3	16-5 (2)
0A3EH	Pattern 4 step 8 step PID No.	0 to 3	R/W/B			16-5 (3)

• Direct specification of an address other than a predefined address will result in an error. If multiple data read by a read command include any address other than a defined one, the return value will always be 0.

*2 Bit correspondence table

	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Option info													PROG	OUT2	AOUT	DI
Action flag							AT / W	COM						RST	MAN	AT
Event flag													EV4	EV3	EV2	EV1
DI input status flag											DI6	DI5	DI4	DI3	DI2	DI1
Event latch output flag													EV4	EV3	EV2	EV1
EV relay ON/OFF flag													EV4	EV3	EV2	EV1
EV direct													EV4	EV3	EV2	EV1
Latching alarm													E\/4	E\/2	E\/2	E\/1
release													⊏∨4	EVS	EVZ	
Program action flag	PRG					UP	LVL	DW					ADV	GUA	HLD	RUN

*3 Special setting items

	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Remaining time for execution step	0 to 9 * 10h (S)			0 to 9 * 1h (S)			0 to 5 * 10m (S)				0 to 9 * 10m (S)					
Latching/output characteristics	ics Alarm latching, 0x00:			, 0x00:	N/A, 0>	(01: Ap	olicable			Output	charac	teristic	s, 0x00	: NO, 0x	:01: NC	

*4 Step information handling

• The step info of which pattern info is to be used may vary depending on the number of patterns.

Number of pattern		Pattern info 1	Pattern info 2	Pattern info 3	Pattern info 4
		Step info 1 to 8			
1	1	Steps 1 to 8	Steps 9 to 16	Steps 17 to 24	Steps 25 to 32
2	1	Steps 1 to 8	Steps 9 to 16		
2	2			Steps 1 to 8	Steps 9 to 16
-					
	1	Steps 1 to 8			
4	2		Steps 1 to 8		
4	3			Steps 1 to 8	
	4				Steps 1 to 8

10. Configuration

10-1. System mode

This instrument is a basic independent two-loop temperature controller with 2 inputs and 2 outputs. The following configurations are available for selection at the time of order placement. 2-channel, independent two-loop control

- Mode 1: 2-input 2-output
- Mode 2: 1-input 2-output 1-channel heating and cooling, 2 heating stages, 2 cooling stages
- Mode 3: 2-input 1-output Mode 4: 2-input 2-output
- 1-channel cascade control 1-channel PV switchover control
- In Mode 4, assign CH1 to the minimum temperature measuring range.
- In Mode 4, the standard measuring range for the proportional band is the span from the CH1 lower





Setting range: Relevant address: 0: 2in2Loop, 1: 1in1Loop, 2: 2in2LoopCas, 3: 2in1LoopSW 070DH

11. Checks to be made for the master unit at first power-on

The basic display mode is selected at power-on.

When powering on this instrument for the first time, run a communication test for the instrument to make sure that it is the one that you ordered.

Optional functions

Make sure that analog outputs, DIs (3 points × 2ch), and EVs (2 points × 2ch) are all provided.

Relevant address: 005FH

Details may vary depending on the specifications or the functional setting specifications.

12. Input and output settings

12-1. Measuring range settings

Set the control action to standby (RST) before performing this setting/editing operation. For the details of the operation of the control standby function, see "Control standby (RST)."

(1) Range setting

Refer to the measuring range code table to set the code No. for the Input range.

When the current input ranges from 4 to 20 mA or from 0 to 20 mA, select Input range No. 85 (1-5 V) or 84 (0-5 V) and fit a 250 ohm 0.1 % shunt resistor between the input terminals.

Relevant address: 0705H

(2) Range scaling

When selecting a range for the voltage input and the current input (corresponding to code Nos. 71 to 76 and 81 to 86, respectively), set the measuring range (scaling). Sc_L is the PV lower limit side scaling, while Sc_H is the PV higher limit side scaling. Set the control action to standby (RST) before performing this setting/editing operation. For the details of the control standby action, see "Control standby (RST)."

Reverse scaling is impossible.

The maximum span is (Sc H – Sc L) \leq 10000.

If the value Sc_L is set so that the span will exceed 10000, the value Sc_H will, by default, be set so that 10000 will not be exceeded.

Setting range:See the measuring range code table.Initial value:05, 86Relevant addresses:0707H, 0708H, 0709H

12-2. Manual setting of the control outputs

(1) AUTO/MAN output switching and setting of the control outputs (OUT1 and OUT2) Perform AUTO/MAN and MAN/AUTO switching as follows:

- (1) If either the OUT1 or OUT2 output action is switched to manual unless system mode 1 is selected, the other will also be switched similarly. Conversely, when either is switched to auto, the other will also be switched to AUTO.
- (2) When the output is the SSR drive voltage or open collector, with the proportional band (P) set to OFF, the output value will be 0.0% or 100.0%.
- (3) When the output is either voltage or current, with the proportional band (P) set to OFF, the output value will be the higher or lower limit value of the set output limiter.

[Note 1] During auto-tuning (AT), switching to manual output is impossible. Turn AT OFF beforehand. [Note 2] When MAN is selected, the external control input (DI) takes priority, disabling switching to manual output.

1) Output 1 (OUT1) setting

Manual output setting range:	0 to 1000 (0.0 to 100.0%)
Relevant address:	0182H

2) Output 2 (OUT2) setting

Valid unless system mode 1 is selected.

Manual output setting range:	0 to 1000 (0.0 to 100.0%)
Relevant address:	0183H

(2) Supplementary note on the use of manual control output

The relationship between the automatic and manual output modes is as follows (when SHIMADEN-COM is used):

- (1) When auto-manual switching is performed, the output will be balanceless-bumpless action. The output value will be the one immediately before the switching. When MAN/AUTO switching is performed, the output will be bumpless action. If the measured value (PV) is outside the proportional band, no bumpless action will occur.
- (2) When the power is turned off and back on, the control output action will remain AUTO or MAN, unchanged from when the power is turned off.
- (3) When the transition from RUN to RST occurs, manual output (MAN) will be released.
- MAN operation is possible only in the RUN state.

12-3. Internal cascade control settings

These settings are for system mode 3.

Usually, two controller meters are used in a pair, with the output of one (master unit) being the SV value of the other (slave unit), to perform cascade control.

When system mode 3 is specified, a single unit can perform this cascade control. This function is called the internal cascade function. SV1 is the master while SV2 is the slave. OUT2 is the final control output.

(1) Cascade mode

A desired cascade mode can be selected.

When mode 2 or 3 is selected, the value of SV2 will be that of SV1 or PV1 with the cascade deviation value added, regardless of the master control output.

Setting range:0: CAS1, 1: CAS2, 2: CAS3Initial value:0Relevant address:0328H

CAS1 : SV2 = (OUT1 / 100) × (SC_H2 - SC_L2) + SC_L2

CAS2 : SV2 = CAS DEV + SV1

CAS3 : SV2 = CAS DEV + PV1

(2) Cascade SV scaling

Set the SV scaling for the slave (SV2).

Set the SV range for the slave (SV2) within the control output range for the master (SV1). Use this when cascade 1 (CAS1) is selected.

Reverse scaling is impossible.

Setting range:	CS_L	: SV2_SC_L to CS_H-1
	CS_H	: CS_L to SV2_CS_H
Initial value:	CS_L	: SV2 measuring range lower limit value
	CS_H	: SV2 measuring range higher limit value
Relevant addresses:	0263H, 02	64H, 0329H, 032AH

CS_L : Sets the slave SV lower limit value to the master output lower limit value.

CS_H : Sets the slave SV higher limit value to the master output higher limit value.

(3) Cascade deviation

This is used when cascade 2 (CAS2) or cascade 3 (CAS3) is selected.

Setting range:	-2000 to 2000 (digit)
Initial value:	0
Relevant address:	032BH

(4) Cascade SV filter

Set a filter for using the master (SV1) control output as the slave (SV2) SV.

A control output is constantly variable. When it is directly entered into the slave and used as an SV, unstable control may result. In such a case, use a filter to stabilize the slave SV.

Setting range:	0: OFF, 1 to 100 (seconds)
Initial value:	OFF
Relevant address:	032CH

12-4. Unit setting

Select the unit to be used in the set measuring range. Set the control action to standby (RST) before performing this setting/editing operation. For the details of the control standby action, see "Control standby (RST)."

Setting range:	0:°C, 1:°F
Initial value:	0
Relevant addresses:	0260H, 0704H

* Fixed to 2:K when the measuring range code is between 15 and 18 (Kelvin units).

12-5. Decimal point setting

When the measuring range is for the voltage input and the current input (corresponding to code No. 71 to 76 and 81 to 86, respectively), set the decimal point position in the PV indication screen.

Set the control action to standby (RST) before performing this setting/editing operation. For the details of the control standby action, see "Control standby (RST)."

Setting range:	0: (0), 1: (0.0), 2: (0.00), 3: (0.000)
Initial value:	0
Relevant addresses:	0262H, 0707H

* This instrument has no digital indicator on it. In practice, remotely control the decimal point position on the host side.

12-6. Measuring range code table

Select the measuring range from the following table:

M D 01*1 G0 0.0 to 1800.0 *C 0.0 to 3300.0 *F S 0.3 60 0.0 to 1700.0 *C 0.0 to 3100.0 *F S 0.3 60 0.0 to 1700.0 *C 0.0 to 3100.0 *F S 0.3 60 0.0 to 1700.0 *C 0.0 to 3100.0 *F C 0.6 61 0.0 to 1700.0 *C 0.0 to 3100.0 *F E 0.7 61 0.0 to 1200.0 *C 0.0 to 1300.0 *F N 10 61 0.0 to 1300.0 *C 0.0 to 100.0 *F N 10 61 0.0 to 1300.0 *C 0.0 to 2200.0 *F V	Input type			CODE		Measu	uring r	ange (°C	Measuring range (°F)				
Multi-Input R 02 61 0.0 to 1700.0 °C 0.0 to 3100.0 °F S 03 60 0.0 to 1700.0 °C 0.0 to 3100.0 °F K 05 61 0.0 to 400.0 °C 0.00 to 3100.0 °F E 05 61 0.0 to 400.0 °C 0.0 to 3100.0 °F J 08 61 0.0 to 100.0 °C 0.0 to 1300.0 °F N 10 61 0.0 to 1300.0 °C 0.0 to 400.0 °F PLI<'' 11 61 0.0 to 1300.0 °C 0.0 to 400.0 °F L '' 14 61 0.0 to 350.0 K 100.0 To 350.0 K 100.0			В	01 *1	G0	0.0	to	1800.0	°C	0.0	to	3300.0	°F∙
Multiple S 03 60 0.0 to 1700.0 *C 0.0 to 3100.0 *F K 06 61 0.0 to 400.0 *C -300.0 to 750.0 *F C 06 61 0.0 to 1000.0 *C 0.0 to 1500.0 *F E 07 61 0.0 to 100.0 *C 0.0 to 1300.0 *F T 09 2 60 -200.0 to 200.0 *C 0.0 to 1100.0 *F PLII *3 11 G1 0.0 to 1300.0 *C 0.0 to 2300.0 *F V *4 13*2 G1 -0.0.0 to 2300.0 *C 0.0 to 2300.0 *F L *4 14 G1 0.0 to 350.0 K 10.0 350.0 <td></td> <td></td> <td>R</td> <td>02</td> <td>G1</td> <td>0.0</td> <td>to</td> <td>1700.0</td> <td>°C</td> <td>0.0</td> <td>to</td> <td>3100.0</td> <td>°F</td>			R	02	G1	0.0	to	1700.0	°C	0.0	to	3100.0	°F
Model 04 *2 00 -200.0 to 400.0 *C -300.0 to 750.0 *F Model 05 G1 0.0 to 800.0 *C 0.0 to 1500.0 *F Model 06 G1 0.0 to 800.0 *C 0.0 to 1500.0 *F Model 08 G1 0.0 to 700.0 *C 0.0 to 1300.0 *F T 09 *2 G0 -200.0 to 200.0 *C 0.0 to 2300.0 *F PLI 31 G1 0.0 to 1300.0 *C 0.0 to 2300.0 *F U *4 13 *2 G1 -200.0 to 2300.0 *C 0.0 100.0 *F L *4 13 *2 G1 -200.0 to 230.0 K 100.0 *G 0.0 100.0			S	03	G0	0.0	to	1700.0	°C	0.0	to	3100.0	°F
Multi- ingrege K 05 G1 0.0 to 800.0 *C 0.0 to 1500.0 *T 06 G1 0.0 to 1200.0 *C 0.0 to 1300.0 *T 07 G1 0.0 to 1000.0 *C 0.0 to 1300.0 *T 08 G1 0.0 to 600.0 *C 0.0 to 1300.0 *T 10 G1 0.0 to 1300.0 *C 0.0 to 2300.0 *T 12 G1 0.0 to 1300.0 *C 0.0 to 2300.0 *T 14 13<*2				04 *2	G0	-200.0	to	400.0	°C	-300.0	to	750.0	°F
Multi-input 06 G1 0.0 is 1200.0 °C 0.0 is 2200.0 °F J 08 G1 0.0 is 700.0 °C 0.0 is 1200.0 °F J 08 G1 0.0 is 700.0 °C 0.0 is 1300.0 °F T 09 °2 60 -200.0 is 2000.0 °C -300.0 is 4100.0 °F PLII 311 G1 0.0 is 1300.0 °C 0.0 is 2300.0 °F C(WRe5-26) 12 G1 0.0 is 2300.0 °C -0.0 is 2300.0 °F L *4 13 °2 G1 -200.0 is 2300.0 °C -0.0 is 2300.0 °F L *4 14 G1 0.0 is 350.0 K 10.0 is 350.0 K		_	к	05	G1	0.0	to	800.0	°C	0.0	to	1500.0	°F
Multiple Image: constraint of the second secon		he		06	G1	0.0	to	1200.0	°C	0.0	to	2200.0	°F
Multi-input 3 61 0.0 is 6000 *C 0.0 is 10000 *F T 09 2 60 -200.0 16 200.0 *C -0.0 10 10000 *F N 10 61 0.0 10 200.0 *C 0.0 to 200.0 *F C(WRe5-26) 12 G1 -0.00 to 200.0 *C 0.0 to 2300.0 *F L *4 14 G1 -0.0 to 2300.0 *C 0.0 to 2300.0 *F L *4 14 G1 -0.0 to 2300.0 *C 0.0 to 350.0 K 10.0 to 350.0		m	F	07	G1	0.0	to	700.0	0°	0.0	to	1300.0	°F
Multi-line T 09 *2 GO -2000 to 2000 *C -3000 to 4000 *F N 10 G1 0.0 to 1300.0 *C 0 to 2300.0 *F PLII *3 11 G1 0.0 to 2300.0 *C 0.0 to 2300.0 *F U *4 13*2 G1 -2000.0 to 2300.0 *C 0.0 to 2300.0 *F U *4 13*2 G1 -2000.0 to 200.0 *C 0.0 to 400.0 *F U *4 14 G1 0.0 to 350.0 K 10.0 to 350.0 K MuFe-Cr *6 18 G0 0.0 to 350.0 K 100.0 *F 13 G2 -200.0 to 500.0 C -150.0 to 350.0		8		08	G1	0.0	to	600.0	0°	0.0	to	1100.0	°F
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$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$			PLII *3	11	G1	0.0	to	1300.0	°C	0.0	to	2300.0	°F
Multi-ingreg U *4 13 *2 Git -200.0 to 200.0 °C -300.0 to 400.0 °F L *4 14 Git 0.0 to 600.0 °C 0.00 to 1100.0 °F K *5 15 Go 10.0 to 350.0 K 100.0 to 1100.0 °F 30 Git -100.0 to 100.0 °C -300.0 to 1100.0 °F 30 Git -100.0			C(WRe5-26)	12	G1	0.0	to	2300.0	°C	0.0	to	4200.0	°F
Metricity L *4 14 G1 0.0 to 600.0 *C 0.0 to 1100.0 *T K *5 15 G0 10.0 to 350.0 K 100.0 to 350.0 K MuFe-Cr *6 16 G0 0.0 to 350.0 K 10.0 to 350.0 K AuFe-Cr *6 18 G0 0.0 to 350.0 K 10.0 to 350.0 K AuFe-Cr *6 18 G0 0.0 to 350.0 K 10.0 to 350.0 K 131 G2 G1 -100.0 to 350.0 *C -150.0 to 350.0 F 333 G1 -50.0 to 200.0 *C -50.0 to 1100.0 *F 34 G1 -0.0 to 200.0 *C -50.0 to			U *4	13 *2	G1	-200.0	to	200.0	°C	-300.0	to	400.0	°F
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Multi-line Image: Second		<u>ک</u>	AuFe-Cr *6	16	G0	0.0	to	350.0	K	0.0	to	350.0	K
Multiplication Aufectr 6 18 G0 0.0 to 350.0 K 0.0 to 360.0 F Multiplication 30 G1 -100.0 to 350.0 C -150.0 to 650.0 °F Multiplication 31 G2 -200.0 to 600.0 °C -300.0 to 1100.0 °F 31 G2 -200.0 to 600.0 °C -300.0 to 1100.0 °F 32 G1 -100.0 to 100.0 °C -150.0 to 200.0 °F 34 G1 0.0 to 200.0 °C -300.0 to 1000.0 °F 36 G1 -100.0 to 50.0 °C -50.0 to 120.0 °F 38 G1 0.0 to 350.0 °C -150.0 to 650.0 °F 9 H1		elvir	K *5	17	G0	10.0	to	350.0	K	10.0	to	350.0	K
Number 30 G1 -100.0 to 350.0 °C -150.0 to 660.0 °F 31 G2 -200.0 to 600.0 °C -300.0 to 1100.0 °F 33 G1 -50.0 to 50.0 °C -50.0 to 200.0 °F 33 G1 -50.0 to 50.0 °C -50.0 to 120.0 °F 34 G1 0.0 to 200.0 °C -50.0 to 120.0 °F 35 G2 -200 to 500.0 °C -300.0 to 1000.0 °F 36 G1 -100.0 to 100.0 °C -50.0 to 200.0 °F 38 G1 -100.0 to 350.0 °C -50.0 to 650.0 °F 40 G2 -200.0 to 550.0 °C 0.0 <td< td=""><td></td><td></td><td>AuFe-Cr *6</td><td>18</td><td>G0</td><td>0.0</td><td>to</td><td>350.0</td><td>K</td><td>0.0</td><td>to</td><td>350.0</td><td>K</td></td<>			AuFe-Cr *6	18	G0	0.0	to	350.0	K	0.0	to	350.0	K
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Ξ			30	G1	-100.0	to	350.0	°C	-150.0	to	650.0	°F·
Time Pt100 32 G1 -100.0 to 100.0 °C -150.0 to 200.0 °F 33 G1 -50.0 to 50.0 °C -50.0 to 120.0 °F 34 G1 0.0 to 200.0 °C -50.0 to 120.0 °F 34 G1 0.0 to 200.0 °C -300.0 to 400.0 °F 35 G2 -200 to 500.0 °C -300.0 to 400.0 °F 38 G1 -0.0 to 100.0 °C -50.0 to 120.0 °F 39 G1 -100.0 to 350.0 °C -50.0 to 120.0 °F 40 G2 -200.0 to 550.0 °C -150.0 to 650.0 °F 41 G1 0.0 to 550.0 °C 0.0 <td>lult</td> <td></td> <td></td> <td>31</td> <td>G2</td> <td>-200.0</td> <td>to</td> <td>600.0</td> <td>°C</td> <td>-300.0</td> <td>to</td> <td>1100.0</td> <td>°F</td>	lult			31	G2	-200.0	to	600.0	°C	-300.0	to	1100.0	°F
P 1000 33 G1 -500 10 500 1000 1200 F 34 G1 -500 to 500 °C -500 to 1200 °F 34 G1 0.0 to 200.0 °C -300.0 to 1000.0 °F 36 G1 -100.0 to 500.0 °C -300.0 to 1000.0 °F 36 G1 -100.0 to 100.0 °C -100.0 to 200.0 °F 38 G1 -00.0 to 200.0 °C -50.0 to 120.0 °F 39 G1 -100.0 to 350.0 °C -150.0 to 650.0 °F 40 G2 -200.0 to 350.0 °C -300.0 to 1000.0 °F 41 G1 0.0 to 350.0 °C 0.0 to 1000.0 <td>-i-i</td> <td>고</td> <td>Pt100</td> <td>32</td> <td>G1</td> <td>-100.0</td> <td>to</td> <td>100.0</td> <td>0°</td> <td>-150.0</td> <td>to</td> <td>200.0</td> <td>°F</td>	-i-i	고	Pt100	32	G1	-100.0	to	100.0	0°	-150.0	to	200.0	°F
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	put	ise.		33	G1	- 50.0	to	50.0	°C	- 50.0	to	120.0	°F
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		sta		34	G1	0.0	to	200.0	°C	0.0	to	400.0	°F
Mitting 36 G1 -100.0 to 100.0 °C -150.0 to 200.0 °F 37 G1 -50.0 to 50.0 °C -50.0 to 120.0 °F 38 G1 0.0 to 200.0 °C -50.0 to 120.0 °F 39 G1 -100.0 to 350.0 °C -150.0 to 650.0 °F 40 G2 -200.0 to 550.0 °C -150.0 to 650.0 °F 41 G1 0.0 to 350.0 °C 0.0 to 650.0 °F 42 G2 0.0 to 550.0 °C 0.0 to 1000.0 °F 45 G2 -200.0 to 500.0 °C 0.0 to 1000.0 °F 47 G2 0.0 to 500.0 °C 0.0 to		nce	JPt100	35	G2	-200	to	500.0	°C	-300.0	to	1000.0	°F
V JPt100 37 G1 -50.0 to 50.0 to 120.0 °F 38 G1 0.0 to 200.0 °C -50.0 to 400.0 °F 39 G1 -100.0 to 350.0 °C -150.0 to 650.0 °F 40 G2 -200.0 to 550.0 °C -300.0 to 650.0 °F 40 G2 -200.0 to 550.0 °C -300.0 to 1000.0 °F 41 G1 0.0 to 350.0 °C 0.0 to 650.0 °F 42 G2 0.0 to 550.0 °C 0.0 to 1000.0 °F JPt100 45 G2 -200.0 to 500.0 °C 0.0 to 1000.0 °F JPt100 46 G1 0.0 to 350.0 °C 0.0 <td></td> <td>e t</td> <td>36</td> <td>G1</td> <td>-100.0</td> <td>to</td> <td>100.0</td> <td>°C</td> <td>-150.0</td> <td>to</td> <td>200.0</td> <td>°F</td>		e t		36	G1	-100.0	to	100.0	°C	-150.0	to	200.0	°F
Mode Mode <th< td=""><td></td><td>ler</td><td>37</td><td>G1</td><td>- 50 0</td><td>to</td><td>50.0</td><td>°C</td><td>- 50.0</td><td>to</td><td>120.0</td><td>°F</td></th<>		ler		37	G1	- 50 0	to	50.0	°C	- 50.0	to	120.0	°F
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		mo		38	G1	0.0	to	200.0	0°	0.0	to	400.0	°F
$ \frac{1}{100} = \frac{1}{100} + \frac{1}{100} + \frac{1}{100} + \frac{1}{1000} + \frac{1}{10000} + \frac{1}{10000} + \frac{1}{100000} + \frac{1}{100000} + \frac{1}{1000000} + \frac{1}{1000000} + \frac{1}{10000000} + \frac{1}{10000000000000000000000000000000000$		m∈		39	G1	-100.0	to	350.0	0°	-150.0	to	650.0	°F
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		ter		40	G2	-200.0	to	550.0	0°	-300.0	to	1000.0	°F
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		de	Pt100	41	G1	0.0	to	350.0	0°	0.0	to	650.0	°F
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		ete		42	G2	0.0	to	550.0	0°	0.0	to	1000.0	°F
$ \sqrt[4]{ V } \begin{array}{c c c c c c c c c c c c c c c c c c c $		Cto		45	G2	-200.0	to	500.0	0°	-300.0	to	1000.0	°F
$\bigvee_{\text{mV}} \begin{array}{c c c c c c c c c c c c c c c c c c c $		7	JPt100	46	G1	0.0	to	350.0	0°	0.0	to	650.0	°F
$V = V \begin{bmatrix} -10 \text{ to } 10 \text{ mV} & 71 & 60 \\ 0 \text{ to } 10 \text{ mV} & 72 & 60 \\ 0 \text{ to } 10 \text{ mV} & 72 & 60 \\ 0 \text{ to } 10 \text{ mV} & 72 & 60 \\ 0 \text{ to } 20 \text{ mV} & 73 & 61 \\ 0 \text{ to } 20 \text{ mV} & 73 & 61 \\ 0 \text{ to } 20 \text{ mV} & 73 & 61 \\ 0 \text{ to } 50 \text{ mV} & 74 & 61 \\ 10 \text{ to } 50 \text{ mV} & 74 & 61 \\ 10 \text{ to } 50 \text{ mV} & 75 & 61 \\ 0 \text{ to } 100 \text{ mV} & 76 & 62 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 \text{ to } 100 \text{ mV} & 76 & 76 \\ 10 m$			0	47	G2	0.0	to	500.0	0°	0.0	to	1000.0	°F
V 0 to 10mV 72 G0 Input scaling setting range: -2000 to 10000 digit 0 to 10mV 73 G1 Span: 10 to 10000 digit 0 to 20mV 73 G1 Decimal point position: none, 1st to 3rd decimal places 0 to 50mV 74 G1 Lower limit value < higher limit value			-10 to 10mV	71	G0	Initial value		00010	: 0.0 to	100.0			-
V 0 to 20mV 73 G1 Span: Decimal point position: Decimal point position: 10 to 50mV 10 to 10000 digit none, 1st to 3rd decimal places 0 to 50mV 74 G1 Lower limit value < higher limit value			0 to 10mV	72	G0	Input scaling settin	ig rang	e:	-2000 to	o 10000 digit			
MV 0 to 20mV 74 G1 Decirinal point position: none, ist to 3rd decirinal places 0 to 50mV 74 G1 Lower limit value < higher limit value			0 to 20mV	73	G1	Span:	4:		10 to 10	000 digit		_	
$V = \frac{10 \text{ to } 50 \text{ mV}}{0 \text{ to } 100 \text{ mV}} = \frac{10 \text{ to } 50 \text{ mV}}{75 \text{ G1}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{76 \text{ G2}} = \frac{10 \text{ to } 100 \text{ mV}}{10 \text{ to } 100 \text{ mV}} = \frac{10 \text{ to } 100 \text{ mV}}{81 \text{ G0}} = \frac{10000 \text{ digit}}{10000 \text{ digit}} = \frac{100000 \text{ digit}}{100000 \text{ digit}} = \frac{10000 \text{ digit}}{100000 \text{ digit}} = \frac{10000 \text{ digit}}{10000 \text{ digit}} = \frac{10000 \text{ digit}}{100000 \text{ digit}} = \frac{100000 \text{ digit}}{100000 \text{ digit}} = \frac{100000 \text{ digit}}{100000 \text{ digit}} = \frac{100000 \text{ digit}}{100000000000000000000000000000000000$		mV	0 to 50mV	74	G1	l ower limit value <	tion. Chiahe	r limit valu	none, i: ie	st to stu decimal	places	5	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			10 to 50mV	75	G1								
$ \sqrt[6]{0} \\ V \\ \begin{array}{c c c c c c c c c c c c c c c c c c c $			0 to 100mV	76	G2	G2 <caution></caution>							
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			-1 to 1V	81 G0 more than ±10000 digit the higher limit value will default to differ from the						ss than +1	0 digit or		
$V = \frac{0 \text{ to } 2V}{0 \text{ to } 2V} = \frac{83}{61}$ $V = \frac{0 \text{ to } 2V}{0 \text{ to } 5V} = \frac{83}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{84}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{84}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{84}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{85}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{100}{61}$ $V = \frac{0 \text{ to } 2V}{1 \text{ to } 5V} = \frac{100}{61}$ $V = \frac{100}{61$			0 to 1V	82	G0	a more than +10000 digit, the higher limit value will default to differ from the lower limit value by +10 or +10000 digit							wer innit
\vec{r}_{0} V \vec{r}_{0} lower limit value + 10000 digit. \vec{r}_{0} lower limit value + 10000 digit. \vec{r}_{0} lower limit value + 10000 digit. For current input, select a voltage input and fit the specified receiving resistor (250 Ω) to the input terminal for use as per sector 24 (0 to 20 mt) as 25 (4 to 20 mt).	< o∣	<u>,</u> ,	0 to 2V	83	G1	The higher limit va	lue ca	nnot be s	et below th	e lower limit valu	e + 10) digit or a	bove the
$\overline{\Phi}$ 1 to 5V 85 G1 For current input, select a voltage input and fit the specified receiving resistor (250 Ω) to	Itac	V	0 to 5V	84	G1	lower limit value +	10000	digit.					
a + a + a = 0 the input series a voltage input and in the specific receiving (2002) to	Je		1 to 5V	85	G1	For current input	select	a voltage i	innut and fi	t the specified re-	reivin	n resistor (2500) to
1000000000000000000000000000000000000			0 to 10V	86	G2	the input terminal f	for use	as per co	de 84 (0 to	20 mA) or 85 (4 1	to 20 i	mA).	200327 10

<Caution> When any change is made to this code, all data related to the measuring range will be initialized. Settings can only be changed while in the STANDBY state.

Thermocouple (TC) B, R, S, K, E, J, T, N: JIS/IEC

*1 TC B: accuracy not guaranteed for 400°C (752°F) or less.

*2 If TC K, T, or U reads -100°C or less, the accuracy is ± (0.7%FS + 1 digit).

*3 TC PLII: Platinel II

*4 TC U or L: DIN 43710

*5 High-accuracy temp. range of TC K (Kelvin) (Kelvin)

* 6 High-accuracy temp. range of TC gold/iron-chromel [AuFe-Cr]

JPt100

Pt100: JIS/IEC

± (0.7%FS +	 9°C+1digit)
± (0.5%FS +	+ 4.5°C+1digit)
± (0.3%FS +	+ 3.6°C+1digit)
± (0.3%FS +	- 3°C+1digit)
± (0.5%FS +	- 3°C+1digit)
	± (0.7%FS + ± (0.5%FS + ± (0.3%FS + ± (0.3%FS + ± (0.5%FS +

10.0 to 30.0 K	± (2.0%FS + 60°C+1digit)
30.0 to 70.0 K	± (1.0%FS + 21°C+1digit)
70.0 to 170.0 K	± (0.7%FS + 9°C+1digit)
170.0 to 270.0 K	± (0.5%FS + 4.5°C+1digit)
270.0 to 350.0 K	± (0.3%FS + 3°C+1digit)

[Note] Do not use the above sensors (current sensors, voltage sensors, thermocouples, RTDs) for power-line measurements.

RTD

[Note] If unspecified, the instrument is factory-set to the following measuring ranges:

Input	Spec/rating	Measuring range
Multi-input	K thermocouple	0.0 to 800.0°C
Voltage (V)	0 to 10 V DC	0.0 to 100.0 (unitless)

12-7. Switchover control

(1) Principle of operation

Switchover control is a control method that handles the measuring ranges assigned respectively to CH1 and CH2 as a single range to cover a wider measuring range.



(2) Limitations on switchover control

There are the following limitations on the use of switchover control:

- (1) Specify the lower measuring range for CH1 and the higher measuring range for CH2.
- (2) The decimal point position and the input unit are the same for both CH1 and CH2. (Neither the CH2 decimal point position nor the CH2 input unit can be changed.)
- (3) The CH1 and CH2 measuring ranges must share an overlapping part.
- (4) When the measuring range and the input unit for CH1 are changed, the same settings will, by default, apply to CH2.
- (5) If the decimal point is hidden in a CH1, CH2 can only be switched to either linear range (mV or V input).
- (6) If either CH exceeds the full scale range, switching between PV1 and PV2 will not occur.

Relevant addresses: 0730H, 0731H, 0733H, 0734H, 0735H

(3) Switchover point

Set the temperature at which CH1 switches over to CH2 for the PV in a temperature rising process. (Set this value within the overlapping part of the CH1 and CH2 measuring ranges.)

Setting range:	CH2 PV lower limit value to CH1 PV higher limit value
Initial value:	Midpoint of the overlap between CH1 and CH2 measuring ranges
Relevant address:	0331H

(4) Switchover hysteresis

Based on the value subtracted from the switchover point, specify the temperature at which CH1 switches over to CH2 for the PV in a temperature dropping process. (Set this value within the range of 0 to 1000 digit.)

Setting range:	0 to 1000 (digit)
Initial value:	20
Relevant address:	0332H

12-8. Auxiliary input and output settings

(1) PV compensation value settings

1) PV bias

This is used to compensate errors in sensor- or instrument-temperature readings.

Setting range:	-2000 to 2000 (digit)
Initial value:	0
Relevant address:	0701H

2) PV filter

If a PV signal contains noise, the control results may be affected by factors such as the drift of the PV signal. Use a PV filter to reduce such adverse effects and ensure stable control.

Setting range:	0 to 1000 (seconds)
Initial value:	0
Relevant address:	0702H

PV filtering is performed by first-order lag calculation.

A greater time constant will improve the noise filtering performance but may cause negative effects in rapid response control systems.

3) Gain compensation value setting

This is used to compensate input gain errors of sensors, etc.

After gain compensation, the compensated value will be used for control.

Setting range:	-500 to 500 (-5.00 to 5.00%)
Initial value:	0 (0.00%)
Relevant address:	0700H

12-9. Control output settings

(1) Control output characteristics

In system mode 2, the control output characteristics of output 1 can be set independently from those of output 2 and vice versa. Set the characteristics of heating action to RA (reverse action) and those of cooling action to DA (direct action).





(2) Output action characteristics

Select the output characteristics from reverse and direct characteristics:

Setting range:	0: RA, 1: DA
Initial value:	0
Relevant addresses:	0600H, 0607H

- RA : An action that generates a greater output as the measured value (PV) becomes smaller than the set value (SV). This is generally used for heating control.
- DA : An action that generates a greater output as the measured value (PV) becomes larger than the set value (SV). This is generally used for cooling control.

[Note] During auto-tuning (AT), output characteristics switching is impossible.

(3) Output proportional cycle

This parameter can only be set for an open collector output (C) or an SSR drive output (P). Set the output ON-OFF cycle time in seconds.

When this proportional cycle time is set short in a rapid response control system, good control results will result.

Setting range:	1 to 120 (seconds)
Initial value:	SSR: 30 / Open collector: 3
Relevant addresses:	0601H, 0604H

[Note] When a proportional cycle time is set long in a control system with a short delay time, the control results may be affected.

Proportional cycle time setting is impossible during auto-tuning (AT) and during ramp control.

The following figures show typical proportional cycle time-control output relationships. (The following figures show typical cases of heating action.)



(4) About soft start

At power-ON, standby OFF, or normal recovery from scale over, this function gradually increases a control output within a set time and can effectively prevent overcurrent to a load such as a heater.

1) Conditions for soft start to function

- (1) Power-ON, standby OFF, or normal recovery from scale over in automatic output mode.
- (2) P (proportional band) is set to a value other than OFF in "Proportional band setting."
- (3) The soft start time is not set to OFF in "Soft start time setting."

2) Conditions for soft start to be turned off

- (1) The normal soft start time has elapsed.
- (2) The soft start output value exceeds the value of the PID calculation output.
- (3) The soft start time setting is changed to OFF.
- (4) The output mode is changed to MAN.
- (5) AT (auto-tuning) is executed.
- (6) The P (proportional band) setting is changed to OFF.
- (7) One control output characteristic is changed.
- (8) A standby state has occurred.
- 3) Control output soft start time setting

Set the soft start time for a gradual change in the output. When set to OFF, the soft start function is disabled.

Setting range:	0: OFF, 1 to 120 (seconds)
Initial value:	0
Relevant addresses:	060AH, 060BH

(5) Higher and lower limiter settings

- (1) The output limiter is a function that limits the minimum or maximum value of a control output and is effective in, among other things, securing the minimum temperature or preventing control overshoot.
- (2) As for the output limiter settings, the lower limit value takes priority. When the lower limit value is set equal to or above the higher limit value, the higher limit value will default to exceed the lower limit value by +1 %. The higher limit value cannot be set to exceed the lower limit value by less than +1 %.

(6) Differential gap mode

Set the differential gap mode for an ON/OFF action selected. Note that the set mode will be reflected in all of OUT1, OUT2, and PID1 to 3.

Setting range:	0: CENTER, 1: SV_OFF
Initial value:	0
Relevant address:	04DFH

CENTER : A mode that uses the center position in the differential gap as the SV value.

SV_OFF : A mode that uses the differential-gap output OFF position as the SV value.

(7) Two-position action

When performing a two-position action, use the differential gap to prevent frequent on/off of the output.



13. SV value settings

13-1. SV value settings

(1) SV limiter

The SV limiter is used to prevent inputs of incorrect target set values.

Set the lower limit (SV L) and higher limit (SV H) for the set-value (SV value) setting range.

Setting range:	Lower limit value: Measuring range lower limit value to measuring range higher limit value - 1 Higher limit value: Measuring range lower limit value + 1 to measuring range higher limit value Note that SV Limit $L < SV$ Limit H.
Initial value:	Lower limit value: Measuring range lower limit value
Relevant addresses:	030AH, 030BH

The SV limiter set here is valid for any Execution SV.

Any Execution SV is limited by the SV limiter value.

[Note] When any change is made to the SV limiter after SV value setting, SV values falling outside the limiter range may be discarded, invalidating the settings.

To prevent such a state, always perform SV limiter setting before SV value setting.

(2) Start SV

Set the SV value that starts the program.

This value will be the same as the SV limiter value if the SV limiter range is exceeded due to any change made to the SV limiter.

Setting range:	Within SV limiter
Initial value:	0
Relevant addresses:	0884H, 0904H, 0984H, 0A04H

(3) End step

Set the number of steps for use in program patterns.

The maximum number of steps may vary depending on the number of patterns.

If the number of steps is reduced to smaller than the number of the step currently being executed, the program will end or loop back to the first step when the currently executed step ends.

		No. of patterns	Max. No. of steps
Setting range:	1 to 32	1	32
Initial value:	8	2	16
Relevant addresses:	0882H, 0902H, 0982H, 0A02H	4	8

(4) Start mode

Set the program start mode.

When the program start mode is set to SV, the program will start from the start SV value. When the mode is set to PV, the PV start function will become active and eliminate dead time, depending on the conditions.

Setting range:	0: SV, 1: PV
Initial value:	0
Relevant addresses:	0887H, 0907H

14. PID settings

14-1. Proportional band (P) setting

A proportional band is a range in which the amount of control output changes proportionally to the difference (deviation) between a measured value (PV) and a set value (SV). For the purpose here, set the rate of change (%) in control output with respect to the measuring range.

With a wide proportional band, the change in control output will be small relative to the deviation while the offset (steady-state deviation) will be large. With a narrow proportional band, the change in control output will be large while the offset will be small. Note that, with too narrow a proportional band, hunting (vibration) will occur, making the action similar to an ON-OFF control action. When P is set to OFF, the action will be an ON-OFF control action and unable to be auto-tuned.

Setting range:	0: OFF, 1 to 10000 (0.1 to 1000.0%)
Initial value:	30 (3.0)
Relevant addresses:	0400H, 0408H, 0410H, 0460H, 0468H, 0470H

14-2. Integral time (I) setting

Integral action is an operation used to correct the offset (steady-state deviation) caused by proportional action. With a long integral time, integral action will have a weak corrective effect and take a long time to correct the offset. The shorter the integral time is, the stronger corrective effect integral action has. Too short an integral time will cause hunting (vibration), making the action similar to an ON-OFF control action.

Setting range:	0: OFF, 1 to 6000 (seconds)
Initial value:	120
Relevant addresses:	0401H, 0409H, 0411H, 0461H, 0469H, 0471H

If auto-tuning is performed with I = OFF, the manual reset (MR) value will be calculated and auto-set. For MR auto-setting, see "Setting the manual reset (MR)."

14-3. Derivative time (D) setting

Derivative action is an operation that predicts the change in control output to reduce the influence of external disturbances, as well as to reduce overshoot caused by integration in order to improve control stability. The shorter/longer the derivative time is, the weaker/stronger effect derivative action has. With too long a derivative time, hunting

(vibration) will occur, making the action similar to an ON-OFF control action.

Setting range:	0: OFF, 1 to 3600 (seconds)
Initial value:	30
Relevant addresses:	0402H, 040AH, 0412H, 0462H, 046AH, 0472H

During auto-tuning with D = OFF, calculations will be performed using PI (proportional-integral) values only.

14-4. Manual reset (MR) setting

In PID action, offsets are automatically corrected by integration (I). With I set to OFF, however, offsets will not be corrected. In this case, offsets need to be manually increased or decreased for correction. This method is called manual reset. This is a manual function used to correct offsets that occur when P or P+D control action is performed with I (integral time) set to OFF. Set the value to the positive (+) or negative (-) side to shift the control result in the positive (+) or negative (-) direction. The amount of shift is proportional to the size of the numerical value.

Setting range:	-500 to 500 (-50.0 to 50.0%)
Initial value:	1 output: 0
	2 outputs: -500
Relevant addresses:	0403H, 040BH, 0413H

Auto-setting the MR

When auto-tuning is performed, a value corresponding to this manual reset (MR) value will be calculated and auto-set. In PID control, the MR value is used as the target load factor for the initial PID calculation. Accordingly, when required to reduce overshoot at power-ON or at change RST to RUN, set a small MR value to reduce the target load factor.

When auto-tuning is performed by PID control in this instrument, load factor calculation is performed to reduce the offset with no I action and to auto-set an MR-value equivalent. This function allows the user to obtain control results better than those achievable with conventional PID control.

14-5. Set value function (SF) setting

This function determines the effect of the overshoot prevention function for expert PID calculation.

Expert PID predicts the amount of change in the PV value up to the target set value (SV) (or proportional band), predicts the amount of overshoot based on the PID value, etc., and then performs calculations to cancel the predicted amount of overshoot and reduce the actual amount of overshoot.

A set point function (SF) is valid only when integral action (PI or PID action) is present.

Setting range:	0: OFF, 1 to 100 (0.01 to 1.00)
Initial value:	40 (0.40)
Relevant addresses:	0407H, 040FH, 0417H, 0467H, 046FH, 0477H

SF = OFF: Expert PID will be disabled and ordinary PID action will be performed.

SF =100 (1.00): Overshoot will be minimized in expert PID control.

SF→Low: The overshoot prevention function has a weak effect.

 $SF \rightarrow High:$ The overshoot prevention function has a strong effect.

14-6. Differential gap (DF) setting

This is an item for setting the differential gap (DF) for an ON-OFF control action with P set to OFF.

When a narrow differential gap is set, output chattering is likely to occur.

When a wide differential gap is set, a stable, chattering-free control action will result. The response time, however, may become longer.

Setting range:	1 to 1000 (digit)
Initial value:	20
Relevant addresses:	0404H, 040CH, 0414H, 0464H, 046CH, 0474H

14-7. Dead band (DB) setting

This parameter setting is required only when the instrument is configured for two outputs. Set the operating range of output 2 (OUT2), taking into account the characteristics and energy efficiency of the controlled system.

Setting range:	-2000 to 5000 (digit)
Initial value:	0
Relevant addresses:	0463H. 046BH. 0473H

The output action-DB relationship is as shown in the following figures: RA: Reverse Action DA: Direct Action DA: Direct Action

Control Output 1: RA Control Output 2: RA (RA + RA)



Low \leftarrow Measured value (PV) \rightarrow High

14-8. Output limit value settings (OUT1L and OUT2H)

Set the higher and lower limits for the control output value corresponding to the PID No. The initial values of these parameters should be used for ordinary control. Their values should be changed when the controlled system requires high accuracy control.

When the instrument is configured for use with a heating system and is slow in recovery from upward overshoot, set a lower value for the higher limit. If the controlled system is slow in temperature rise and immediately starts to decrease in temperature when its output is turned down, set a higher value for the lower limit.

Setting range:	Lower limit value: 0 to 999 (0.0 to 99.9%)
	Higher limit value: Lower limit value +1 to 1000 (Lower limit value +1 to 100.0%)
Initial value:	Lower limit value: 0 (0.0)
	Higher limit value: 1,000 (100.0)
Relevant addresses:	0405H, 0406H, 040DH, 040EH, 0415H, 0416H, 0465H, 0466H, 046DH, 046EH, 0475H, 0476H

[Note] When P is set to OFF for ON-OFF control, the output limiter will be invalid for SSR drive voltage output or for open collector output.

15. Event (EV) settings

15-1. Event (EV) action

When the type of any assigned EV is changed, the action set point (SP) and differential gap (DF) parameters will be initialized.

Setting range:	See the event (EV) assignment table.
Initial value:	1 (EV1)
	2 (EV2)
Relevant addresses:	0500H, 0508H, 0510H, 0518H

Event (EV) assignment table

CODE	Event action mode type	Remarks
0	None selected	
1	Higher limit deviation (HD)	EV1 initial value
2	Lower limit deviation (LD)	EV2 initial value
3	Outside higher/lower limit deviation (OD)	
4	Inside higher/lower limit deviation (ID)	
5	Higher limit absolute value (HA)	
6	Lower limit absolute value (LA)	
7	Scale over (SO)	
8	RUN signal (during execution)	This signal occurs during control operation.
9	Output 1 reverse output (ROT1)	Applicable only to open collector
10	COM direct (COM)	EV output is turned ON / OFF by serial communication.
11	Step signal (STPS)	This signal lasts for one second each time a step ends during program control.
12	Pattern signal (PTNS)	This signal lasts for one second each time a pattern ends during program control.
13	Program end signal (ENDS)	This signal lasts for one second when program control ends. (This signal also occurs when the program is aborted in the middle.)
14	Hold signal (HOLD)	This signal occurs when a hold (a pause of the program) occurs during program control.
15	Program signal (PROG)	This signal occurs when the instrument is set to the program mode.
16	Up-slope signal (U_SL)	This signal occurs during an upward slope step performed by program control.
17	Down-slope signal (D_SL)	This signal occurs during a downward slope step performed by program control.
18	Guarantee soak (GUA)	This signal occurs when guarantee soak is enabled.

(1) Event action point setting

The event action point setting is displayed when an alarm is assigned to an event code. This setting sets the event action point at which the program comes into action.

Setting range:	See the event level value table.
Initial value:	EV1: 2000
	EV2: -2000
Relevant addresses:	0501H, 0509H, 0511H, 0519H

The event action point setting is disabled when no alarm is assigned. Event level values

Alarm type	Setting range	Initial value	
Higher limit absolute value	Within measuring range	Measuring range higher limit value	
Lower limit absolute value	Within measuring range	Measuring range lower limit value	
Higher limit deviation	-2000 to 2000	2000	
Lower limit deviation	-2000 to 2000	-2000	
Inside higher/lower limit deviation	0 to 2000	2000	
Outside higher/lower limit deviation	0 to 2000	2000	

(2) Differential gap setting

The differential gap setting is displayed when one of types (1) through (6) is selected in the event action mode.

Set the differential gap (DF) between ON and OFF actions. When a wide differential gap is set, a stable, chattering-free control action will result.

Setting range:	1 to 1000 (digit)
Initial value:	20
Relevant addresses:	0502H, 050AH, 0512H, 051AH

(3) Event standby action selection

Standby action is an item displayed only when one of types (1) to (6) is selected in the EV action mode.

Standby action is a function that does not generate an EV output with the PV value falling in the event action range at power-on, at change RST to RUN, or at an SV change but generates an EV output when the PV value falls back in the event action range after falling outside the range.

Taking into account the standby action and the event action during scale over, select one of the following:

Setting range:	0 to 3
Initial value:	0
Relevant addresses:	0503H. 050BH. 0513H. 051BH

Standby action code table

CODE	Specifics of standby action	
0	No standby	
1	Power-ON and RST \rightarrow RUN	
2	Power-ON, RST \rightarrow RUN, and SV change	
3	Control mode (no standby)	

[Note 1] When the setting is changed to 0 during the standby action, the standby action will be immediately cancelled.

[Note 2] Standby action will be cancelled when scale over occurs.

1) Standby action

When event standby action is set to 1 (or 2), no event will be generated with the measured value falling within the alarm action range (ON range) at power-ON or at change RST to RUN(or at a change of the target set value). An event will be generated when the measured value falls back in the alarm action range after it falls outside the range (OFF range) and the standby action is cancelled.

2) Non-standby actions

An event will always be generated if the measured value falls within the alarm action range with event standby action set to 0.

(4) Latching setting

The event latching function is used to repetitively generate a type of event even when the event condition is lost after the event is activated. (Self-holding of an event)

This function is enabled when the alarm type code is one of types (1) to (6).

Setting range:	0: OFF, 1: ON
Initial value:	0
Relevant addresses:	0505H, 050DH, 0515H, 051DH

OFF : Latching function disabled

ON : Latching function enabled

(5) Output characteristics selection

Specify the output characteristics.

Select whether the transistor open collector output is in or out of conduction at the occurrence of an event action.

Whether NO or NC is selected, the event output at power-OFF will be out of conduction.

Setting range:	0: NO, 1: NC.
Initial value:	0
Relevant addresses:	0505H, 050DH, 0515H, 051DH

Normally open (NO): The transistor is turned ON when the EV is ON. Normally close (NC): The transistor is turned OFF when the EV is ON.

E.g.) PV-Low case



(6) Operational diagrams of event selection alarm

Shown below are the operational diagrams of the alarms to be selected as events (EV1 and EV2):

- \triangle : SV value
- ▲: Alarm action point set value



(7) About reversed output from OUT1

When an open collector output is built in as OUT1, select OUT1 reversed output as the event code to reverse the output from OUT1. Note, however, that both output 1 and the event output will be OFF at power-OFF. It should also be noted that the output from OUT1 is similarly inverted during standby.



16. Control mode and program

16-1. Control mode

This instrument can perform fixed value control in addition to program control, which is the main mode of control. The "program mode" is used for program control, while the "FIX mode" is used for fixed value control. The following figure shows the relationship between the two modes and their switching operations:



Set the FIX mode to ON or OFF to toggle between the two modes. Select ON to select the FIX mode (fixed value control) and OFF to select the program mode.

16-2. RESET state

During the RESET state in both the program mode and the FIX mode, no control will occur. If any of the action modes in the following table is assigned to the event, no output will occur during the RESET state:

• Events action modes with no outputs generated in reset state

CODE	Action		CODE	Action	
1	Higher limit deviation action		4	Inside higher/lower limit deviation action	
2	Lower limit deviation action		5	PV higher limit absolute value action	
3	Outside higher/lower limit deviation action		6	PV lower limit absolute value action	

16-3. Preparations for using the program function

Before using the program function, set the following parameters first:

(1) Start pattern No.

Specify the ordinal number of the pattern to be used.

Setting range:	1 to number of patterns (4 max.)
Initial value:	1
Relevant address:	0802H

In a DI-equipped configuration, the DI function is used to specify the start pattern No. If assigned to a DI, this function cannot be operated remotely.

* While the program is running, no change can be made to the settings.

(2) Number of patterns

Specify the number of patterns to be used.

Note that the total number of available steps is fixed to 32 steps. The number of steps available per pattern may vary depending on the specified number of patterns.

Setting range: Initial value: Relevant address:	1, 2, 4 4 0818H		
Number of patterns	Pattern No.	Number of steps	Total number of steps
1	1	1 to 32	32
2	1	1 to 16	30
	2	1 to 16	52
	1	1 to 8	
4	2	1 to 8	30
	3	1 to 8	32
	4	1 to 8	

* While the program is running, no change can be made to the settings.

It should be noted that if any change is made to the settings, program-related parameters will be initialized.

(3) Time unit

Use the program time unit for setting.

Setting range:	0: HM, 1: MS
Initial value:	0
Relevant address:	0819H

Set the step time unit as the time unit.

The time may be indicated differently depending on the relevant steps (up to the end step).

Time unit	Time	Setting range
HM (0)	Hr, min	00 hr 00 min to 99 hr 59 min
MS (1)	Min, sec	00 min 00 sec to 99 min 59 sec

* While the program is running, no change can be made to the settings.

(4) Switching to the program function

When required to switch to the program mode, short-circuit the DI to which the program function is assigned. Release to switch to the FIX mode.

The program signal will continue to occur as long as the program mode is selected. Note that a one-second program end signal will occur when program execution ends.

Select the desired mode by toggling ON / OFF of FIX control.

Setting range:	0: PROG, 1: FIX
Initial value:	0
Relevant address:	0800H

Set FIX to OFF to switch to the program function.

If PROG is assigned to the DI, it is impossible to switch between PROG and FIX. When FIX is switched to PROG or vice versa, the RUN or STANDBY state will remain unchanged.

(5) Setting the start SV

Set the SV value that starts the program.

This value will be the same as the SV limiter value if the SV limiter range is exceeded due to any change made to the SV limiter.

Setting range:	Within SV limiter
Initial value:	0
Relevant addresses:	0884H, 0904H, 0984H, 0A04H

(6) End step setting

Set the number of steps for use in program patterns.

Setting range:	1 to 32
Initial value:	8
Relevant addresses:	0882H, 0902H, 0982H, 0A02H

The maximum number of steps may vary depending on the number of patterns.

Number of patterns	Max. number of steps
1	32
2	16
4	8

If the number of steps is reduced to smaller than the number of the step currently being executed, the program will end or loop back to the first step when the currently executed step ends.

(7) Pattern event action point setting

The pattern event action point setting is displayed when an alarm is assigned to an event code. This setting sets the event action point at which the program comes into action.

Setting range:	See the pattern event level value table.
Initial value:	EV1: 2000
	EV2: -2000
Relevant addresses:	0889H, 088AH, 088BH, 088CH, 0909H, 090AH, 090BH, 090CH, 0989H, 098AH, 098BH,
	098CH, 0A09H, 0A0AH, 0A0BH, 0A0CH

The pattern event action point setting is disabled when no alarm is assigned.

Pattern event level values

Alarm type	Setting range	Initial value
Higher limit absolute value	Within measuring range	Measuring range higher limit value
Lower limit absolute value	Within measuring range	Measuring range lower limit value
Higher limit deviation	-2000 to 2000	2000
Lower limit deviation	-2000 to 2000	-2000
Inside higher/lower limit deviation	0 to 2000	2000
Outside higher/lower limit deviation	0 to 2000	2000

(8) Pattern execution count setting

Specify the number of times for the execution of the relevant pattern.

If a numerical value smaller than the number of the current run is set during the execution of the program, the program will end after the execution of the end step.

Setting range:1 to 10000Initial value:1Relevant addresses:0123H, 0883H, 0903H, 0983H, 0A03H

Pattern RUN function

This function is used to repeat the execution of a desired pattern once to 10,000 times.



(9) Start mode setting

Set the program start mode.

When the program start mode is set to SV, the program will start from the start SV value. When the mode is set to PV, the PV start function will become active and eliminate dead time, depending on the conditions. (See 18-3. "About PV start.")

Setting range:	0: SV, 1: PV
Initial value:	0
Relevant addresses:	0887H, 0907H, 0987H, 0A07H

16-4. Start pattern setting and execution

Specify the number of the pattern to be executed and execute the pattern as follows. Note that similar operations can be performed for DIs. This instrument can memorize up to 8 steps × 4 patterns.

(1) RUN Start/Stop

Use this function to start or stop program execution.

If assigned to the DI function, this function cannot be operated remotely.

It should also be noted that the program will not be executed if all the step times of the pattern set on the Program Start Pattern monitor are set to "00:00."

Setting range:	0: RST, 1: RUN
Initial value:	0
Relevant address:	0190H

The RUN state and the RESET state can be switched by a DI to which this function is assigned. Select from two options: RUN1 and RUN2.

(1) When RUN1 (level) is selected

- The RUN state will continue as long as the DI is short-circuited.
- If the program ends normally, the transition to the RUN state will occur only after the DI is released once and shortcircuited again.
- If the DI is short-circuited at power-ON, the transition to the RUN state will occur immediately after power-ON.

(2) When RUN2 (edge) is selected

- Each time the DI is short-circuited, the RUN state and the RESET state will toggle each other.
- •When the program ends normally, the DI will be short-circuited again for transition to the RUN state.
- If the DI is short-circuited at power-ON, the transition to the RUN state will not occur immediately after power-ON.

16-5. Descriptions and settings of step info

(1) Setting the step SV

Set the SV value of a relevant step.

This value will be the same as the SV limiter value if the SV limiter range is exceeded due to any change made to the SV limiter.

Setting range:	Within SV limiter
Initial value:	0
Relevant addresses:	08A0H, 08A4H, 08A8H, 08ACH, 08B0H, 08B4H, 08B8H, 08BCH, 0920H, 0924H, 0928H, 092CH, 0930H, 0934H, 0938H, 093CH, 09A0H, 09A4H, 09A8H, 09ACH, 09B0H, 09B4H,
	09B8H, 09BCH, 0A20H, 0A24H, 0A28H, 0A2CH, 0A30H, 0A34H, 0A38H, 0A3CH

(2) Step time setting

Set the relevant step time. The time unit will be the one set by the user.

Setting range: Initial value:	0x0000 (00:00) to 0x9959 (99:59) 0000
Relevant addresses:	08A1H, 08A5H, 08A9H, 08ADH, 08B1H, 08B5H, 08B9H, 08BDH, 0921H, 0925H, 0929H, 092DH, 0931H, 0935H, 0939H, 093DH, 09A1H, 09A5H, 09A9H, 09ADH, 09B1H, 09B5H,
	09B9H, 09BDH, 0A21H, 0A25H, 0A29H, 0A2DH, 0A31H, 0A35H, 0A39H, 0A3DH

(3) Step PID No. setting

Set the PID No. of a relevant step. Select 0 to continue using the PID No. from the previous step. When 0 is set for Step 1, the action will occur with PID No. 1.

Setting range:	0 to 3
Initial value:	0
Relevant addresses:	08A2H, 08A6H, 08AAH, 08AEH, 08B2H, 08B6H, 08BAH, 08BEH, 0922H, 0926H, 092AH,
	092EH, 0932H, 0936H, 093AH, 093EH, 09A2H, 09A6H, 09AAH, 09AEH, 09B2H, 09B6H,
	09BAH, 09BEH, 0A22H, 0A26H, 0A2AH, 0A2EH, 0A32H, 0A36H, 0A3AH, 0A3EH

17. Operations during control

17-1. Control standby (RST)

This is a wait-and-see function used to set the control output and the event output to standby and to start control when the input, etc., are stabilized.

The analog outputs operate regardless of run/standby.

The standby control output will be 0%.

Assign "control run/standby switching" to a DI to enable run/standby switching by an external contact.

Setting range:	0: RST, 1: RUN (STBY<->RUN)
Initial value:	0
Relevant address:	0190H

RUN : The instrument stops control action and switches over to the standby output (0%).

RST : The instrument performs normal control.

[Note] This instrument turns power off when set to standby (RST) and remains on standby when powered ON again.

17-2. Execution SV No. switching

When the internal cascade function is selected, the CH2 SV value will be the CH1 output, making SV No. setting impossible. If the SV No. switching operation is set to external switching, SV No. cannot be changed remotely.

Setting range:	1 to 3
Initial value:	1
Relevant address:	0180H

17-3. External SV No. switching

When required to use more than one target set value (SV), use an external contact to perform Execution SV No. selection and switching.

[Note] If there is no input to any DI, SV No. 1 will be the Execution SV. If a device such as a decimal switch is used to perform this switching, instantaneous switching to an unexpected SV No. may occur at the timing of contact switching. Set the DIs of this instrument to be switched within the response time (250 ms).

17-4. Auto-tuning

(1) Auto-tuning ON/OFF

This function toggles ON and OFF of PID auto-tuning (AT).

During AT, optimum PID constants are determined by the limit cycle method. These values are used to perform control action automatically.

During AT, hunting occurs near the SV value due to the limit cycle.

During AT, changes can be made only to AT, HLD, and ADV.

Setting range:	0: OFF, 1: ON
Initial value:	0
Relevant address:	0184H

Set AT to ON to perform auto-tuning.

Assign "AT ON/OFF switching" to a DI to enable AT by an external contact. To perform AT, all the following conditions must be met:

- The instrument is NOT in the manual output (MAN) state.
- P is NOT set to OFF (ON-OFF control).
- · The instrument is NOT in the standby state (RST: ACTION PAUSED).
- The PV value has not exceeded the full-scale range (SO).
- [Note] Depending on the controlled system or the control loop dead time, better results may be achieved by correcting the auto-tuned PID constants.
 - If required to use the output limit function, set the higher and lower limits for the control output value before performing AT.
 - Auto-tuning action stops in any of the following cases:
 - (1) Scale over occurs.
 - (2) A power failure occurs.
 - (3) Approximately 200 minutes of ON or OFF time have elapsed.
 - (4) The instrument is set to standby (RST).

17-5. Control output (MAN) setting

Use this function to toggle the control output between AUTO and MAN.

Usually, the instrument is automatically operated. This function is used to set the control output manually for purposes such as commissioning.

During manual output, a set value will continue to be generated without feedback control.

(1) AUTO/MAN switching

Assign "control output AUTO/MAN switching" to a DI to enable AUTO/MAN switching by an external contact. In a 2-loop configuration, each channel can be toggled independently between AUTO and MAN.

Setting range:	0: AUTO, 1: MAN
Initial value:	0
Relevant address:	0185H

(2) Output value

This operation can be performed for OUT1/OUT2 set to manual output.

17-6. Tuning function

(1) Tuning function

This section explains the PID constants tuning function.

Adjustment of PID constants used for PID control (P: proportional band, I: integral time, and D: derivative time) is generally called tuning. Automatic tuning of PID constants is called auto-tuning.

(2) Auto-tuning (AT)

Auto-tuning is performed to determine optimum PID values for PID calculation control.

During the program mode, AT is not performed while a slope step is being executed. Note, however, that the above does not apply when HOLD action is ON even if a slope step is being executed.

Even if the program execution count is set to 2 or more, AT will end at the end step.

If auto-tuning of all PID Nos. completes before the end step, AT will end at that point.

E.g.) When the end step is set to Step No. 6 and the pattern execution count is set to 2 or more, the following sequence of actions will occur:



Once DI input is ON, auto-tuning will start.

If the SV No. is changed by means of DI during AT, the change will not be reflected until AT ends. AT cannot be aborted by means of DI. AT can only be aborted remotely.

Auto-tuning system operation

Auto-tuning is performed by the limit cycle method.

The limit cycle method turns ON/OFF the control output to measure the measured value (PV) amplitude or the dead time and calculate the PID constants.



- AT will fail to start if:
- The instrument is set to standby (RST).
- The instrument is in the manual output (MAN) state.
- P = OFF (ON-OFF control)
- When the PV value is scale over (SO).
- Auto-tuning will be aborted if:
- AT is set to OFF (remotely).
- More than 200 minutes have elapsed with the output value standing at 0% or 100%.
- The instrument is set to standby (RST).
- When the PV value is scale over (SO).
- A power failure occurs.

[Note] If the measured value (PV) contains noise and is unstable, AT may not be performed accurately. Perform AT after

stabilizing the measurement input or after stabilizing the measured value using a PV filter, etc.

If required to use an output limiter, set it before performing AT. It should be noted, however, that when the control output is either a transistor open collector output or an SSR drive voltage output open collector output, the control output will operate at 0 or 100% (ON/OFF) regardless of the output limiter.

Depending on the controlled system, no optimum PID constants may be obtained. In such a case, better results may be achieved by correcting the auto-tuned PID constants.

18-1. HLD (hold)

This function is used to pause program execution remotely. This is a level action.

Setting range:	0: OFF, 1: ON
Initial value:	0
Relevant address:	0191H

When DI input ON: The program step time will be stopped.

The program will be paused by turning the DI input ON. Only the program execution time will be stopped; the control action will not. This is fixed-value-controlled. In a DI-equipped configuration, the HLD function can be assigned to the DI function. If assigned to a DI, this function cannot be operated remotely. When HLD is OFF, the stopped time will start counting up again.

The HLD function can be turned on by short-circuiting a DI to which it is assigned. During short-circuiting, the time is stopped and the SV value is fixed.

- (1) If assigned to a DI, HLD cannot be operated via communication.
- (2) When RUN is executed with HLD ON, a HLD state will occur at the start SV value.
- (3) If the start SV value, the step SV value, the step time, or the step PID No. is changed during HLD, the change will not be reflected until HLD is OFF.



18-2. ADV (advance)

This is an edge action.

Setting range:	0: OFF, 1: ON
Initial value:	0
Relevant address:	0192H

Once DI input is ON during program control, the current step will be aborted to force transition to the next step.

Turn DI input ON to abort a currently executed step to go to the next step. In a DI-equipped configuration, the ADV function can be assigned to the DI function.

The ADV function can be turned ON by short-circuiting a DI to which it is assigned. One action occurs per short-circuit. ADV is impossible during HLD. If short-circuiting occurs during HLD, the ADV function will be ignored.

(1) As soon as an ADV input occurs, the next step will be executed.

(2) Each time ADV is executed, ADV input will be disabled for approximately 2 seconds.

(3) After a transition occurs from one step to the next, ADV input will be disabled for approximately one second.



18-3. About PV start

If the program operation start step is slope-controlled and the start SV value and the PV value differ significantly from each other, some of the operating time may be wasted.

To eliminate this dead time, set the PV value as the start SV value to start program operation.

This function is enabled when setting the "start mode" to PV.

1) Case where PV start fails

If the PV value does not fall between the start SV value (SSV) and the relevant step 1SV value (SV1), the PV start function will fail to work.



2) Case where PV start works and saves time

If the PV value falls between the start SV value (SSV) and the relevant step 1SV value (SV1), the PV start function will work and time-saving will occur.



T1: Saved time T2: Execution time

3) Case where PV start works and omits a step.

If the PV value exceeds the relevant step 1 SV value (SV1), the PV start function will work and step 1 will be skipped.



The transition to Step 2 will occur, skipping Step 1.

Setting range:0: SV, 1: PVInitial value:0Relevant addresses:0887H, 0907H, 0987H, 0A07H

18-4. About guarantee soak (GUA)

(1) Guarantee soak zone (GUA zone) setting Set a guarantee soak zone (GUA zone).

If set to OFF, guarantee soak will not work.

Setting range:	0: OFF, 1 to 1,000
Initial value:	0
Relevant addresses:	0885H, 0905H, 0985H, 0A05H

If the PV falls outside the specified guarantee soak zone (GUA zone) at the transition from the slope step to the flat step, no transitions to the subsequent steps will occur. This function remains disabled except during a transition from a slope step to a flat step.

(2) When OFF

Éven if the PV has not reached SV1 after the elapse of step 1 time, the transition to step 2 will occur.



(3) When a guarantee soak zone (GUA zone) is set a. When the PV delay is small relative to the SV slope

If the guarantee soak zone (GUA zone) is reached after the elapse of step 1 time, the transition to step 2 will occur.



b. When the PV delay is large relative to the SV slope

If the guarantee soak zone (GUA zone) is not reached even after the elapse of step 1 time, guarantee soak will be performed until the guarantee soak zone (GUA zone) is reached.



* Even when step 1 is flat (SSV = SV1), guarantee soak will be performed.

Even when the step time is set to 00:00, guarantee soak will be performed if the conditions are met.

During guarantee soak, the decimal point for the left two digits of the PV indicator blinks on the Basic screen, the RUN Step No. monitor screen, the Step Remaining Time monitor screen, the Pattern Execution Count monitor screen, and the Execution PID No. monitor screen.

19. DI and AO settings

19-1. About external control input (DI)

The MRM57 Series requires a minimum input hold time of 250 ms or more to load an external control input. Functions assigned to any DI cannot be operated through communication (DI input takes priority.). Note, however, that AT and unlatching allow through communication operation if assigned to a DI.

(1) DI mode setting

Setting range:	0 to 13
Initial value:	0
Relevant addresses:	0580H, 0581H, 0582H, 0583H, 0584H, 0585H

Select and set external inputs (DI) for the intended use.

DI mode assignment type code table

CODE	Symbol	External control input assignment type	Assignable DI No.	Detection
0	non	None assigned		
1	RUN1	RUN1 control ON/OFF	1, 2, 3, 4, 5, 6	Level
2	RUN2	RUN2 control ON/OFF	1, 2, 3, 4, 5, 6	Edge
3	mAn	MAN manual output	1, 2, 3, 4, 5, 6	Level
4	At	AT auto-tuning execution	1, 2, 3, 4, 5, 6	Edge
5	ESV2	ESV2 external selection-2 bit	1, 2	Level
6	ACt1	ACT1 OUT1 output characteristics (RA/DA)	1, 2, 3, 4, 5, 6	Level
7	ACt2	ACT2 OUT2 output characteristics (RA/DA)	1, 2, 3, 4, 5, 6	Level
8	ProG	PROG program	1, 2, 3, 4, 5, 6	Level
9	HLd	HOLD hold signal	1, 2, 3, 4, 5, 6	Level
10	AdV	ADV advance	1, 2, 3, 4, 5, 6	Edge
11	Ptn2	PTN2 start pattern selection-2 bit 1, 2		Level
12	Ptn3	PTN3 start pattern selection-3 bit 1		Level
13	L rS	L RS total unlatching	1, 2, 3, 4, 5, 6	Edge

When ESV2 and Ptn2 are assigned to DI1, no settings can be made to DI2. When Ptn3 is assigned to DI1, no settings can be made to DI2 and DI3.

It is impossible to assign a single type of code to more than one DI.

When ESV2 and Ptn2 are assigned to DI2, no settings can be made to DI3.

(2) Temperature controller action ON - RUN1

This is used to toggle ON and OFF of a controller meter action. This is a level action.

When DI input OFF:The transition to standby (RST) will occur, causing the MRM57 to stop its action.When DI input ON:The transition to the RUN state, namely PID calculation RUN (program control RUN) state, will occur.

[Note] If the DI is ON at power-ON, the transition to the RUN state will occur immediately after power-ON.

(3) Temperature controller action ON - RUN2

This is used to toggle between the RUN state and the stop state each time DI input is ON. (Edge action)

[Note] If the DI is ON at power-ON, the transition to the RUN state will not occur immediately after power-ON.

(4) Manual output (MAN)

This is used to switch over to manual output. This is a level action.

When DI input OFF: A normal feedback control action will occur.

When DI input ON: The control output will be a manual action. No feedback control will occur.

(5) Auto-tuning execution (AT)

Use this to execute auto-tuning remotely. This is an edge action.

(6) External SV selection (ESV2)

Use this to switch the set values SV1 to SV3 to Execution SV. Two DI points are used for a level action. External SV selection can be assigned to DI1 or DI2.

When external SV selection is assigned to DI1, the same will automatically occur to DI2, making DI2 unselectable. When external SV selection is assigned to DI2, the same will automatically occur to DI3, making DI3 unselectable.

When assigned to DI1			
DI2	DI1	Selected SV No.	
0	0	1	
0	1	1	
1	0	2	
1	1	3	

When assigned to DI2			
DI3	DI2	Selected SV No.	
0	0	1	
0	1	1	
1	0	2	
1	1	3	

An Execution SV No. and an execution PID No. correspond to each other as in SV1/PID1, SV2/PID2, and SV3/PID3.

(7) OUT1 output characteristics (ACT1)

This switches the output characteristics (RA/DA) of control output 1. When DI input OFF: RA (heating) When DI input ON: DA (cooling)

(8) OUT2 output characteristics (ACT2)

This switches the output characteristics (RA/DA) of control output 2. When DI input OFF: RA (heating) When DI input ON: DA (cooling)

(9) Program (PROG)

Toggle between the FIX (fixed value control) mode and the program mode. This is a level action. Fixed value control (FIX mode) When DI input OFF: When DI input ON:

Program (PROG mode)

(10) External start pattern selection-2 bit (PTN2)

The user can select a program start pattern. Two DI points are used for a level action. External start pattern selection can be assigned to DI1 or DI2.

When external start pattern selection is assigned to DI1, the same will automatically occur to DI2, making DI2 unselectable. When external start pattern selection is assigned to DI2, the same will automatically occur to DI3, making DI3 unselectable.

When assigned to DI1

When assigned to DI1			 When assigned to DI2		
DI2	DI1	Start pattern No.	DI3	DI2	Start pattern No.
0	0	1	0	0	1
0	1	1	0	1	1
1	0	2	1	0	2
1	1	3	1	1	3

When the number of patterns is set to 2 and start pattern No. 3 is selected, start pattern No. 2 will be executed.

(11) External start pattern selection-3 bit (PTN3)

The user can select a program start pattern. Three DI points are used for a level action. Only DI1 allows assignment. When external start pattern selection-3 bit is assigned to DI1, the same will automatically occur to DI2 and DI3, making DI2 and DI3 unselectable.

DI3	DI2	DI1	Start pattern No.
0	0	0	1
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	*	*	4

* Start pattern No. 4 will be selected whether ON or OFF.

When the number of patterns is set to 2 and either start pattern No. 3 or No. 4 is selected, start pattern No. 2 will be executed.

(12) Total unlatching (L_RS)

This function is used to unlatch events remotely. This is an edge action.

Once DI input is ON, all event outputs will be unlatched. Note, however, that event outputs meeting event output conditions cannot be unlatched.

19-2. Analog output settings (Ao1 and Ao2)

This instrument can be equipped with two optional analog output points (Ao1 and Ao2). The following settings apply only to instruments equipped with these optional analog outputs:

(1) Analog output type selection

Select the type of analog output to be assigned.

Setting range:	0: PV, 1: ŠV, 2: OUT1, 3: OUT2
Initial value:	0
Relevant addresses:	05A0H, 05A4H,

PV: Measured value (CH1)

SV:Set value (CH1)OUT1:Control output 1OUT2:Control output 2

(2) Analog output scaling

Set the minimum values (0 mV, 4 mA, and 0 V) of the analog output signal as the scaling lower limits for the desired output values.

PV, SV: within measuring range
OUT1 and OUT2: 0 (0.0%) to 1000 (100.0%)
Analog scaling lower limit: Measurement lower limit
Analog scaling higher limit: Measurement higher limit
05A1H, 05A2H, 05A5H, 05A6H

Inverse scaling $(Ao_L > Ao_H)$ is also allowed. $(H-L = \pm 1 \text{ count or more})$ The following figures show the characteristics of the analog output after inverse scaling:



(3) Analog output limiter settings

Set the higher and lower limits for the analog output.

Setting range:	Lower limit: 0 (0.0%) to 999 (99.9%)
	Higher limit: AL_L + 1 to 1000 (100.0%)
Initial value:	Lower limit: 0
	Higher limit: 1000
Relevant addresses:	05B4H, 05B5H, 05B7H, 05B8H

19-3. Communication function (COM)

(1) Communication memory mode settings screen

Set up a communication memory mode as follows.

Setting range:	0: EEP, 1: rAm, 2: r_E
Initial value:	0
Relevant address:	05B0H

When required to write data remotely, select from the table below the method of writing data to EEPROM and RAM.

CODE	Туре	Description of the write process
0	EEP	Write all to EEPROM
1	rAm	Write all to RAM
2	r_E	SV, OUT1, and OUT2 data are written to RAM, and other data are written to EEPROM.

* Precautions for using RAM as the communication memory mode

When RAM is set as the communication memory mode, all settings made using the communication function will be written to RAM.

Hence, be aware that inconsistencies may occur in the settings depending on the operating method.

(2) Communication mode selection

Select from the following to set the communication mode.

Setting range:	0: LOCAL, 1: COM
Initial value:	0
Relevant address:	018CH

CODE	Туре	Valid command		
CODL		COM1	COM2	
0	LOCAL	READ and WRITE	READ	
1	COM	READ and WRITE	READ and WRITE	

Even during local operation, the communication function allows the user to send a command from the host to this instrument to switch from LOCAL to COM.

LOCAL: During LOCAL operation, settings can be read but cannot be written or changed. COM: In this mode, settings can be read and changed remotely.

For more details of the communication function, see "Communication function."

(3) Communication mode type setting

Select the type of communication mode.

Setting range:	0: COM1, 1: COM2		
Initial value:	0		
Relevant address:	05B1H		

To enable remote operation during a remote write process performed remotely, select COM1.

Type of COM mode	co	0M1	COM2	
COM mode	COM	LOC	COM	LOC
Remote operation	Enabled	Enabled	Disabled	Enabled
COM writing	Enabled	Enabled	Enabled	Disabled

When the "communication modes" are rewritten by communication commands, the results will be as follows:

COM mode	LOC	COM	
	COM1 => COM2	COM1 => COM2	
COM writing	enabled	enabled	
	COM2 => COM1	COM2 => COM1	
	disabled	enabled	

20-1. Overview of communication

(1) Communication interface

The MCM57 Series supports the RS-422 and RS-485 communication protocols and uses RS-422 and RS-485 communication interfaces to perform the setting, reading, and writing of various data from personal computers and other external devices.

RS-422 and RS-485 are data communication standards specified by the Electronic Industries Association (EIA). These standards specify requirements applicable only to hardware and do not define any software-related parts of data transmission procedures. Even RS-422/RS-485-compliant devices with identical interfaces cannot communicate with each other without meeting additional conditions. Accordingly, the customer must have sufficient prior knowledge about data transmission specifications and transmission procedures.

The use of RS-422/RS-485 allows parallel connection of a multiple number of MCM57 Series units. Currently, few models of personal computers support RS-422/RS-485 interfaces. Use a commercially available "RS-422/RS-485 converter" for RS-422/RS-485 communication.

(2) Communication protocols and their specifications

The MCM57 Series supports the Shimaden protocol and the MODBUS protocol.

Common to both protocols

EIA RS-422/RS-485 compliant
RS-485: 2-wire half-duplex multi-drop connection
RS-422: 4-half-duplex multi-drop connection
Half-duplex, asynchronous
500 m max., total length (variable depending on connection conditions)
4800 / 9600 / 19200 / 38400 bps
Dumb-terminal procedure
Approx. 10 msec
4 groups max., 31 units per group
1 to 255
EEP / RAM / R_E
Shimaden Standard / MODBUS-RTU
Data length, 7 or 8 bits (8 bits for MODBUS-RTU)
Stop bits 1 and 2
STX (02H) / ETX (03H) / CR (ODH)
Checksum (Shimaden Standard) / CRC-16 (MODBUS)

20-2. Connection of Controller and Host computer

(1) RS-422 / RS-485

Basically, the MCM57 Series has the following input and output logic levels:

Mark state -terminal < +terminal

Space state -terminal > +terminal

Note, however, that the +/- controller terminals have a high impedance until immediately before the start of transmission and that the above levels are produced as outputs immediately before the start of transmission. (See (2) 3 "About state output control.") An "RS-422/RS-485 converter" may be necessary to use a generic personal computer as the host computer. For more details, refer to the manuals supplied with the personal computer and RS-422/RS-485 converter to be used.



(2) About 3-state output control

RS-485 is a multi-drop system. Therefore, the transmission output always has a high impedance to prevent transmission signal collision during no communication activity or during reception. The 3-state output shifts from the high-impedance state to the normal state immediately before transmission. As soon as the transmission ends, the tri-output is controlled to the high-impedance state again.

In 3-state output control, an approx. 1 msec delay occurs after the transmission of the end bit of an end character. Provide a several-msec delay time when required to start transmission immediately after the host completes reception.



20-3. Overview of the Shimaden communication protocol

The MCM57 Series uses the Shimaden communication protocol. Accordingly, when connected to Shimaden communication protocol-compliant devices of a different series, they can receive and change data in the same message format.

(1) Communication procedure

1) About master-slave relationship

- A personal computer or a PLC (host) is the master.
- An MCM57-Series unit is the slave.
- A communication session starts with a command from the master and ends with a response message from the slave. Note, however, that no response message will occur if any error such as a message format error or a BCC error is detected. Similarly, no response message will occur when a broadcast command is issued.
- 2) Communication procedure

The communication procedure is such that the master and the slave exchange tokens as they respond to each other.

3) About time-out

When failing to complete end character reception within one second after start character reception, the Controller Meter will time out and wait for another command (new start character).

Therefore, when required to set a host timeout time, set it to one second or longer.

(2) Communication formats

The MCM57 Series is multi-protocol-compatible and allows various selections of message format (control code, BCC calculation method) and message data format (data bit length, parity presence/absence, stop bit length). It is recommended, however, to use the following formats for user-friendliness and as a precaution against incorrect communication settings.

	Recommer	nded format
Control code	STX_ETX_CR	
BCC calculation method	ADD	
Communication data formats	7 data bits, even parity, 1 stop bit	8 data bits, none, 1 stop bit

1) Overview of the message formats

The command message format for transmissions from the master and the response message format for transmissions from the slave consist respectively of three blocks: basic format block I, text block, and basic format block II. The basic format blocks I and II are common in read commands (R), write commands (W), and response messages. Note, however, that the BCC data in item i ((13) and (14)) contain calculation result data that may differ each time. The text block may vary depending on, among other things, the command type, the data address, and the response message.

Command message format



Response message format



2) Details of basic format block I

- Marks where the text of a message begins.
- When a start character is received, it is determined as the first character of the text of a new message.
- A start character is selected in a pair with a text end character as follows:

STX (02H) - - - ETX (03H) "@" (40H) - - - ":" (3AH)

b: Device address [(2) and (3): 2 digits]

- Specifies the destination device.
- This address needs to be specified within the range of 1 to 255 (decimal number).
- The 8-bit binary datum (1: 0000 0001 to 255: 1111 1111) is divided into the high-order 4 bits and the low-order 4 bits for conversion into ASCII.

(2): High-order 4-bit data converted into ASCII

- (3): Low-order 4-bit data converted into ASCII
- The device address = 0 (30H, 30H) is used in broadcast commands. The MRM57 Series supports broadcast commands. Note, however, that no response occurs to a broadcast command, whether normal or not.

c: Sub-address [(4): 1 digit]

• An MRM57 Series unit is a multi-temperature controller but is handled as a single loop. Hence, its sub-address is fixed to 1(31H).

If any other sub-address is used, no response will occur due to a sub-address error.

a: Start character [(1): 1 digit / STX (02H) or "@"(40H)]

- 3) Details of basic format block II
- h: Text end character [(12): 1 digit / ETX(03H) or ":" (3AH)]
 Occurs immediately after the end of the text block of a message.

i: BCC data [(13) and (14): 2 digits]

- The block check character (BCC) data are used to check for any errors in the message data.
- If a BCC calculation results in a BCC error, no response will occur.
- The BCC calculation method is fixed to ADD.
- I) ADD

Performs the addition of all the characters, from the start character (1) to the text end character (12), handling them as single ASCII data characters (1 byte per character).

- The addition is performed in bytes (8 bits per byte), regardless of the data bit length (7 or 8 bits).
- The lower 1-byte data of the above calculation result is divided into the high-order 4 bits and the low-order 4 bits for conversion into ASCII.
 - (13): High-order 4-bit data converted into ASCII
 - (14): Low-order 4-bit data converted into ASCII

E.g.) Typical read command (R) with BCC set to Add

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(12)	(13)	(14)	(15)
STX	0	1	1	R	0	1	0	0	0,	ETX	D	А	CR

02H + 30H + 31H + 31H + 52H + 30H + 31H + 30H + 30H + 30H + 03H = 1DAH

The lower 1 byte of the addition result (1DAH) = DAH (13): "D" = 44H, (14): "A" = 41H

- j: End character (delimiter) [(15): 1 digit / CR]
 - Marks where the text of a message ends.

Note No response will occur when any errors such as the following are detected in the basic format block:

- A hardware error has occurred.
- The device address or the sub-address differs from the address of the specified device.
- Any of the characters defined in the above-mentioned message format are not in the specified position.
- The BCC calculation result differs from the BCC data.

In data conversion, binary data are converted every 4 bits into ASCII. The hexadecimal characters <A> to <F> are converted into uppercase ASCII data.

4) Overview of the text block

The text block may vary depending on the command type and the response message. For the details of text blocks, see "Details of read command (R)," "Details of write command (W)," and "Details of broadcast command (B)."

d: Command type [(5): 1 digit]

 "R" (52H / uppercase): Indicates a read command or a read command response.
 "R" is used to read various data from a master such as a personal computer or a PLC to an MCM57 Series unit.

- "W" (57H / uppercase): Indicates a write command or a write command response.
 "W" is used to write various data from a master such as a personal computer or a PLC to an MCM57 Series unit.
- "B" (42H / uppercase): Indicates a broadcast command.

"B" is used to write data from the master such as a personal computer or a PLC to all the MCM57 Series units.

• No response will occur if any abnormal character other than "R," "W," and "B" is detected.

e: Start data address [(6), (7), (8), and (9): 4 digits] (command message format)

- Specifies the read start data address of a read command (R) or the write start data address of a write command (W).
- A start data address is specified by 16-bit binary data (1 word / 0 to 65535).
- A 16-bit datum is divided every 4 bits for conversion into ASCII.

Binary number	D15, D14, D13, D12	D11, D10, D9, D8	D7, D6, D5, D4	D3, D2, D1, D0
(16 bits)	0 0 0 0	$0 \ 0 \ 0 \ 1$	1 0 0 0	$1 \ 1 \ 0 \ 0$
	\smile	\smile	\smile	\smile
Hexadecimal number (Hex) 0 H	1 H	8 H	СН
	″ O ″	<i>"</i> 1 <i>"</i>	<i>"</i> 8″	″ C ″
ASCII data	30H	31 H	38H	43H
	6	\bigcirc	8	9

· For data addresses, see "Communication Address table."

- f: Number of data [(10): 1 digit]
 - Specifies the number of data to be read per read command (R) or the number of data to be written per write command (W) or broadcast command (B).
 - · These numbers of data are specified by converting 4-bit binary data into ASCII.
 - A read command (R) can specify a number of data within the range of 1: "0" (30H) to 10: "9" (39H).
 - Note, however, that the number of data consecutively readable per MCM57/MRM57 Series unit is 10 max.: "9" (39H).
 - The number of data per write command (W) is fixed to 1: "0" (30H).
 - The number of data per broadcast command (B) is fixed to 1: "0" (30H).
 - The actual number of data is the "number of data = specified number of data + 1."

g: Data [(11): The number of digits is determined by the number of data.]

- Specifies the write data (change data) per write command (W) or broadcast command (B) or the read data per read command (R).
- The data format is parsed as follows:

_						g ((11))						
		1st d	lata			2nd c	lata		Nth dat			а	
"," 2CH	High-order 1st digit	2nd digit	3rd digit	Low-order 4th digit	High-order 1st digit	2nd digit	3rd digit	Low-order 4th digit	High-order 1st digit	2nd digit	3rd digit	Low-order 4th digit	

- A comma ("," 2CH) is always added to the beginning of a data string to mark where the data string begins. No data delimiters are used.
- The number of data is as per the number of data (f: (10)) in the command message format.
- Each datum consists of 16 binary bits (1 word), excluding the decimal-point bit. The position of the decimal point is determined for each datum.
- A 16-bit datum is divided every 4 bits, each of which is converted into ASCII.
- For the details of the data format, see "Details of read command (R)" and "Details of write command (W)."

e: Response codes [(6) and (7): 2 digits] (response message format)

• Specify the response code for a read command (R) and a write command (W).

The 8-bit binary datum (0 to 255) is divided into the high-order 4-bit datum and the low-order 4-bit datum, both of which are converted into ASCII.

(6): High-order 4-bit data converted into ASCII

- (7): Low-order 4-bit data converted into ASCII
- "0" (30H) and "0" (30H) are specified for a normal response. An error code No. converted into ASCII is specified for an error response. For the details of response codes, see "Details of response codes."

(3) Details of read command (R)

The read command (R) is used to read (load) various data from a master such as a personal computer or a PLC into an MCM57 Series unit.

1) Read command format

- The text block format for read commands is shown below.
- Note that the basic format block I and the basic format block II are common in all commands and command responses.

	1	Fext blo	ock		
d		e	e		f
(5)	(6)	(7)	(8)	(9)	(10)
R	0	4	0	0	4
52H	30H	34H	30H	30H	34H

• d ((5)):

Indicates a read command. Fixed to "R" (52H).

Specifies the start data address of the data to be read. • e ((6) to (9)):

Specifies the number of data (words) to be read. • f ((10)):

• The above command is parsed as follows:

Readout start data address = 0400H

Readout start data addres	s = 0400H	(Hexadecimal number)
	= 0000 0100 0000 0000	(Binary number)
Number of readout data	=4H	(Hexadecimal number)
	=0100	(Binary number)
	=4	(Decimal number)
(Actual number of data	() = 5(4 + 1)	, , , , , , , , , , , , , , , , , , ,

In other words, the five consecutive data from data address 0400H are designated for readout.

2) Format for normal responses to read commands

• Shown below is the format of a normal response (text block) to a read command.

Note that the basic format block I and the basic format block II are common in all commands and command responses.

d	e	e													
(5)	(6)	(7)					(11)							
					1st	data	1		2nd o	data			5th	data	
R	0	0	,	0	0	1	Е	0	0	7	8	0	0	0	3
52H	30H	30H	2CH	30H	30H	31H	45H	30H	30H	37H	38H	30H	30H	30H	33H

• d ((5)):

• e ((6) and (7)):

- g ((11)):
- <R(52H)> is inserted here to indicate a response to a read command.
- A response code <00 (30H, 30H)> is inserted to indicate a normal response to the read command.

Response data to a read command are inserted here.

- 1. <"," (2CH)> is inserted at the beginning of the data description to mark where it begins.
- 2. Then inserted consecutively are an equal number of data to the <number of readout data> from the <data of the readout start data address>.
- 3. Nothing is inserted in between the data.
- 4. Each datum consists of 16-bit binary data (1 word), excluding the decimal point. This datum is converted every 4 bits into ASCII for insertion.
- 5. The decimal point position is determined for each datum.
- 6. The number of characters per response datum is the "number of characters = 1 + 4 × number of readout data."

• More specifically, the following data are returned consecutively as the response data to the read command.

	Data Address 16 bits (1 word)	Data 16 bits (1	a word)
Readout start data address	Hexadecimal number	Hexadecimal number	Decimal number
$(400H) \longrightarrow \int 0$	0400	001E	30
1	0401	0078	120
Number of readout data 2	0402	001E	30
(4H: 5 data) 3	0403	0000	0
4	0404	0003	3

3) Format for error responses to read commands

• Shown below is the format of an error response (text block) to a read command.

Note that the basic format block I and the basic format block II are common in all commands and command responses.

Text block										
d e										
(5)	(6)	(7)								
R	0	7								
	-									
52H	30H	37H								

• d (5):

- <R(52H)> is inserted here to indicate a response to a read command.
- e ((6) and (7)): A response code is inserted to indicate an error response to a read command.
- · No response data are inserted for an error response.
- · For the details of error codes, see "Details of response codes."

(4) Details of write command (W)

The write command (W) is used to write (rewrite) various data from a master such as a personal computer or a PLC to an MCM57 Series unit.

CAUTION

It is necessary to switch the communication mode from LOC to COM to use a write command. Send the following command from the master to perform the switching.

- The above operation is required when the type of communication mode is COM2.
- The above operation is not required when the type of communication mode is COM1.
- Command format

When ADDR = 1, CTRL = STX ETX CR, and BCC = ADD

STX	0	1	1	W	0	1	8	С	0	,	0	0	0	1	ETX	Е	7	CR
02H	30H	31H	31H	57H	30H	31H	38H	43H	30H	2CH	30H	30H	30H	31H	03H	45H	37H	0DH

1) Write command format

Shown below is the text block format for write commands.

Note that the basic format block I and the basic format block II are common in all commands and command responses.

	Text block													
d		e	;		f	f g								
(5)	(6)	(7)	(8)	(9)	(10)	(11)								
								Write	data					
W	0	4	0	0	0	,	0	0	2	8				
57H	30H	34H	30H	30H	30H	2CH	30H	30H	32H	38H				

• d ((5)):

Indicates a write command.

Fixed to "W" (57H).

• e ((6) to (9)): • f ((10)):

• g ((11)):

- Specifies the start data address of write (change) data.
- Specifies the number of write (change) data.
 - The number of write data is fixed to 1: "0" (30H).
 - Specifies the write (change) data.
 - 1. <"," (2CH)> is inserted at the beginning of the data description to mark where it begins.
 - 2. Then, the write data are inserted.
 - 3. Each datum consists of 16-bit binary data (1 word), excluding the decimal point. This datum is converted every 4 bits into ASCII for insertion.
 - 4. The decimal point position is determined for each datum.

The command is parsed as follows:

Write start data address	= 0400H = 0000 0100 0000 0000	(Hexadecimal number) (Binary number)
Number of write data	= 0H = 0000 =0	(Hexadecimal number) (Binary number) (Decimal number)
(Actual number of data)	= 1 (0 + 1)	, ,
Write data	=0028H = 0000 0000 0010 1000 = 40	(Hexadecimal number) (Binary number) (Decimal number)

In other words, the data address 0400H is specified for the writing (changing) of a datum (40: decimal number).

	Data Address 16 bits (1 word)	Da 16 bits (1 wo	ata ord)
Write start data Address (400H) $\rightarrow 0$	Hexadecimal number	Hexadecim al number	Decimal number
Address (400H) $\rightarrow 0$	0400	0028	40
	0401	0078	120
1 (01)	0402		30

2) Format for normal responses to write commands

• Shown below is the format (text block) of a normal response to a write command. Note that the basic format block I and the basic format block II are common in all commands and command responses.



<W(57H)> is inserted here to indicate a write command. • d ((5)):

• e ((6) and (7)): A response code <00 (30H, 30H)> is inserted to indicate a normal response to the write command.

3) Format for error responses to write commands

· Shown below is the format (text block) of an error response to a write command. Note that the basic format block I and the basic format block II are common in all commands and command responses.

Text block				
d	е			
(5)	(6)	(7)		
w	0	9		
57H	30H	39H		

<W(57H)> is inserted here to indicate a write command. • d ((5)):

• e ((6) and (7)): A response code is inserted to indicate an error response to the write command.

· For the details of error codes, see "Details of response codes."

(5) Details of broadcast command (B)

The broadcast command (B) is used to write (rewrite) various data from a master such as a personal computer or a PLC to all devices that support broadcast commands.

Broadcast commands are not responded to.

Broadcast commands are supported by the Shimaden protocol, but not by the MODBUS protocol.

Broadcast commands can be used to write data to write (W) data addresses.

1) Broadcast command format

Shown below is the text block format for broadcast commands. Note that the device address of the basic format block I is fixed to "00."

					Text	block				
d		e	;		f			ç	3	
(5)	(6)	(7)	(8)	(9)	(10)			(1	1)	
								Write	data	
В	0	4	0	0	0	,	0	0	2	8
42H	30H	34H	30H	30H	30H	2CH	30H	30H	32H	38H

• d ((5)):

Indicates a broadcast command.

Fixed to "B" (42H).

• e ((6) to (9)): Specifies the start data address of write (change) data.

- f ((10)): Specifies the number of write (change) data.
 - The number of write data is fixed to 1: "0" (30H).
- g ((11)): Specifies the write (change) data.
 - 1. <"," (2CH)> is inserted at the beginning of the data description to mark where it begins.
 - 2. Then, the write data are inserted.
 - 3. Each datum consists of 16-bit binary data (1 word), excluding the decimal point. This datum is converted every 4 bits into ASCII for insertion.
 - 4. The decimal point position is determined for each datum.

The above command is parsed as follows for all devices that support broadcast commands:

Write start data address Number of write data (Actual number of data)	= 0400H = 0000 0100 0000 0000 = 0H = 0000 = 0 = 1 (0 + 1)	(Hexadecimal number) (Binary number) (Hexadecimal number) (Binary number) (Decimal number)
Write data	= 0028H = 0000 0000 0010 1000 = 40	(Hexadecimal number) (Binary number) (Decimal number)

In other words, the data address 0400H is specified for the writing (changing) of a datum (40: decimal number).

	Data address 16 bits (1 word)	Da 16 bits (ata (1 word)
Write start data Address (400H) \rightarrow 0	Hexadecimal number	Hexadecimal number	Decimal number
Number of write data	0400	0028	40
1 (01)	0401	0078	120
	0402	001E	30

(6) Details of response codes

1) Types of response codes

A response message to a read command (R) or a write command (W) always contains a response code. Response codes fall into two types, i.e., normal and error response codes.

Response codes are 8-bit binary data (0 to 255), the details of which are as shown in the following table:

Response c	code	table
------------	------	-------

Response code		Codo tomo	Description	
Binary number	ASCII	Code type	of the code	
0000 0000	″0″, ″0″:30H, 30H	Normal response	Normal response code that occurs as a read command (R) or a write command (W) is received.	
0000 0001	″0″, ″1″ : 30H, 31H	Text block hardware error	A hardware error such as framing overrun error or parity error is detected in the text block data.	
0000 0111	″0″, ″7″ : 30H, 37H	Text block format error	The text block format differs from the prescribed format.	
0000 1000	″0″, ″8″ : 30H, 38H	Text block error in data format, data address, or number of data error	The text block format differs from the prescribed format. The data address or the number of data differs from the prescribed one.	
0000 1001	″0″, ″9″ : 30H, 39H	Data error	A write data exceeds the settable range for the data.	
0000 1010	″0″, ″A″ : 30H, 41H	Execution command error	An execution command (such as MAN command) is received when it cannot be.	
0000 1011	″0″, ″B″ : 30H, 42H	Write mode error	When a type of data should not be rewritten, a write command containing the data is received.	
0000 1100	"0", "C" : 30H, 43H	Specification/option error	A write command is received which contains the data of a specification or an option not added to the instrument.	

2) About the priority among response codes

A response code has a higher priority when it has a smaller value.

When more than one response code occurs, the response code with the highest priority will be returned.

20-4. Overview of the MODBUS protocol

The MODBUS protocol supports ASCII and RTU modes as its two transmission modes. The MCM57 Series supports the RTU mode only.

(1) Overview of the transmission mode

Eight-bit binary data contained in commands are transmitted as they are.

Data configuration	
Data format:	Selectable from 8E1, 8E2, 8N1, and 8N2
Error check method:	CRC-16 (cyclic redundancy check)
Data transmission interval:	3.5-character transmission time or less
Error check method: Data transmission interval:	CRC-16 (cyclic redundancy check) 3.5-character transmission time or less

(2) Message configuration

Configured to start after an idle period of 3.5-character transmission time or more and end after the elapse of an idle period of 3.5-character transmission time or more.

ldle	Slave	Function	Data	Error check	ldle	÷
3.5 characters	address	code	Data	CRC	3.5 characters	÷

(3) Slave address

A slave address is a device number assigned to each slave within the range of 1 to 247. (The MCM57 Series allows the assignment of up to 255 slave addresses.)

The master uses request messages to specify slave addresses for the identification of individual slaves.

A slave sends a response message with its own address set in it to identify itself to the master.

(4) Function codes

The function codes are used to instruct slaves of the type of action.

Function code	Details
03 (03H)	Set value and information reading by slave
06 (06H)	Writing by slave

These function codes are also used by slaves to indicate whether their response message to the master is a normal response (ACK) or indicates that an error of some kind (NAK) has occurred.

A positive acknowledgement is returned with the original function code set in it.

A negative acknowledgement is returned with the highest-order bit of the original function code set to 1. For example, when a request message with a function code set incorrectly to 10H is sent to a slave, the slave will return a

response message with the highest-order bit of 90H set to 1 because 10H is a non-existent function code. When a negative acknowledgment occurs, the response message is returned with an error code set in its data to inform the master which type of error has occurred.

Error code	Details
1 (01H)	Illegal function (non-existent function)
2 (02H)	Illegal data address (non-existent data address)
3 (03H)	Illegal data value (Scale over value)

(5) Data

Data may vary in configuration depending on the function code.

A request message from a master consists of data items, the number of data, and settings data.

A response message from a slave consists of the number of requested bytes and data, among other things, as well as an error code that may accompany a NAK.

The effective data range is from -32768 to 32767.

(6) Error check

An RTU mode error check calculates CRC-16 from the slave address to the end of the data and sets the obtained 16-bit data in low-to-high order to the end of the data.

CRC-16 calculation method

In the CRC method, the data to be transmitted are divided by a generator polynomial and transmitted with the resulting remainder added to the end of the data.

Generator polynomial: X16+X15+X2+1

- 1. CRC data (X) are initialized. (FFFFH)
- 2. The exclusive logical sum (XOR) of the first datum and X is taken and substituted into X.
- 3. X is shifted rightward by 1 bit for substitution into X.
- 4. If a carry occurs as the result of the shift, an XOR of the X resulting from Step 3 and the fixed value (A001H) is taken and substituted into X.
- If no carry occurs, the calculation proceeds to Step 5.
- 5. Steps 3 and 4 are repeated until 8 shifts are made.
- 6. An XOR of the next data and X is taken and substituted into X.
- 7. Steps 3 to 5 are repeated.
- 8. Steps 3 to 5 are repeated until the last datum is processed.
- The obtained X's are set as CRC-16 data in low-to-high order to the end of the data of the message.

(7) Typical message

Reading of device number 1 and SV

· Request message from master

		(0300H)	data (0001H)	(844EH)	3.5 characters	
1	1	2	2 2		1	1

Number of characters (8)

• Normal-state slave response message (SV=10.0°C)

	Idle 3.5 characters	Slave address	Function code	Response Number of bytes	Data	Error check CRC	Idle 3.5 characters
1		(01H)	(03H)	(02H)	(0064H)	(B9AFH)	
		1	1	1	2	2	←

Number of characters (7)

Abnormal-state slave response message (wrong data item)

			<u>, , , , , , , , , , , , , , , , , , , </u>			
ldle	Slave	Function	Error codo	Error check	Idle	1
3.5 characters	address	code	Ellor code	CRC	3.5 characters	1
	(01H)	(83H)	(02H)	(C0F1H)		1
	1	1	1	2	←	

In a response message transmitted when an error has occurred, the highest-order bit of the function code is set to 1 (83H). As a response message for an error, error code 02H (non-existent data address) is returned.

Settings of device number 1 SV = 10.0°C

· Request message from master

Idle 3.5 characters	Slave address (01H)	Function code (06H)	Data Address (0300H)	Data (0064H)	Error check CRC (8865H)	Idle 3.5 characters	
	1	1	2	2	2		Nu

lumber of characters (8)

• Normal-state slave response message (SV=10.0°C)

			· /				
ldle	Slave	Function	Data	Data	Error check	ldle	
3.5 characters	address	code	Address	Dala	CRC	3.5 characters	
	(01H)	(06H)	(0300H)	(0064H)	(8865H)		
	1	1	2	2	2	<i>←</i>	N

Number of characters (8)

• Abnormal-state slave response message (when an out of range value is set)

Idle 3.5 characters	Slave address	Function code	Error code	Error check CRC	Idle 3.5 characters
	(01H)	(86H)	(03H)	(0261H)	
	1	1	1	2	— ·

Number of characters (5)

In a response message transmitted when an error has occurred, the highest-order bit of the function code is set to 1 (86H). As a response message for an error, error code 03H (out of range value) is returned.

20-5. Communication data address

(1) Details of communication data address

[Note] Error response codes are explained above in the section on the codes used with the Shimaden protocol.

1) About data addresses and read/write

- A data address expresses every 4 bits of a binary number (16-bit data) as one number in hexadecimal.
- R/W is readable/writable data.
- R ... is read-only data.
- W ... is write-only data.
- When a write-only data address is specified by a read command (R) or when a read-only data address is specified by a write command (W) or a broadcast command (B), a data address error will occur and error response codes "0" and "8" (30H and 38H) will be returned as "text block error in data format, data address, or number of data."

2) About data addresses and numbers of data

- If any data address not listed as one for MCM57/MRM57 is specified as a start data address, a data address error will occur and error response codes "0" and "8" (30H, 38H) will be returned as "text block error in data format, data address, or number of data."
- If the start data address of a read command is within the listed one but the data address with the number of data added is outside the listed one, the read data will be "0."

F

3) About data

- Each data is a binary number without a decimal point (16-bit data) and hence needs to be checked for the data type, decimal point presence/absence, etc.
- The decimal point position for data for which the unit is digits depends on the measuring range.
- Data are handled as signed binary numbers (16-bit data: -32768 to 32767).

4) About <spare> in the parameter block

When a <spare> part is read out by a read command (R) or written by a write command (W), normal response codes "0" and "0" (30H and 30H) will be returned.

5) About option-related parameters

If a data address of a parameter not added is specified as an option by a read command (R) or a write command (W), error response codes "0" and "C" (30H and 43H) "specification/option error" will be returned.

6) About parameters hidden depending on the operating and/or setting specifications

Even parameters hidden (unused) depending on the operating and/or setting specifications can be read out/written in COM mode.

20-6. ASCII code table

	b7b6b5	000	001	010	011	100	101	110	111
b4 to b1		0	1	2	3	4	5	6	7
0000	0	NUL	TC7(DLE)	SP	0	@	Р	`	р
0001	1	TC1(SOH)	DC1	!	1	Α	Q	а	q
0010	2	TC2(STX)	DC2	"	2	В	R	b	r
0011	3	TC3(ETX)	DC3	#	3	С	S	С	S
0100	4	TC4(EOT)	DC4	\$	4	D	Т	d	t
0101	5	TC5(ENQ)	TC8(NAK)	%	5	Е	U	е	u
0110	6	TC6(ACK)	TC9(SYN)	&	6	F	V	f	v
0111	7	BEL	TC10(ETB)	,	7	G	W	g	w
1000	8	FE0(BS)	CAN	(8	Н	Х	h	х
1001	9	FE1(HT)	EM)	9	Ι	Y	i	у
1010	А	FE2(LF)	SUB	*	•••	J	Ζ	j	Z
1011	В	FE3(VT)	ESC	+	;	К	[k	{
1100	С	FE4(FF)	IS4(FS)	,	<	L	¥	Ι	
1101	D	FE5(CR)	IS3(GS)	-	=	М]	m	}
1110	E	SO	IS2(RS)		>	Ν	۸	n	to
1111	F	SI	IS1(US)	/	?	0	_	0	DEL

.g.) I) Expressing data with a decimal point						
			I	Hexadecimal			
			(data			
	20.0%	\rightarrow	$200 \rightarrow$	00C8			
	100.00° C	\rightarrow	10,000 →	2710			
	-40 00°C	\rightarrow	-4 000	F060			

E.g.) 16-bit data representation method

Signe	ed data
Decimal	Hexadecimal
number	number
0	0000
1	0001
to	to
32767	7FFF
-32768	8000
-32767	8001
to	to
-2	FFFE
-1	FFFF



21-5. Control

ol	
 Controlling method: 	Expert PID control with auto-tuning function
 Control output type/rating: 	Transistor open collector/24 VDC, 100 mA
	SSR drive voltage / 12 V ± 1.5 V DC (max. load current 30 mA)
	Current / 4 to 20 mA DC (max. load resistance 500 Ω)
	Voltage / 0 to 10 V DC (max. load current 2 mA)
 Output resolution: 	Approx. 0.008% (1/13.000)
Output accuracy:	+1.0%FS (5 to 100% output)
Control parameters	
Proportional band (P)	OFE 0.1 to 1000 0%ES (ON-OFE action when OFE)
Integral time (I):	OFE 1 to 6000 seconds (P or PD action when OFE)
Derivative time (D):	OFE 1 to 3600 seconds (P or Pl action when OFE)
Set value function (SE):	OFF 0.01 to 1.00
Differential gap mode:	Selectable from the following two modes:
Differential gap mode.	CENT mode SVOE mode SVON mode
ON-OFF differential dan:	1 to 1000 digit (enabled when $P = OEE$)
Manual reset:	$_{-50.0}$ to 50.0% (enabled when $I = OFF$)
Higher & lower output limiters:	Lower limit 0.0 to 90.0% higher limit 0.1 to 100.0% (lower limit < higher limit)
Proportional cycle:	1 to 120 seconds (for transistor open collector output and SSR drive voltage
i toportional cycle.	output)
Dood bond:	2000 to 5000 digit (with overlapping higher and lower limits if pegative)
Cascade mode:	Cascade mode selectable from 3 different calculation methods:
Mode 1:	$S_{12} = (O(1T_1/100) \times (S_{22}) O(100) + S_{22} O(100) O(100) = (O(1T_1/100) \times (S_{22}) O(100) + S_{22} O(100) O(100) = (O(100) O(100) O(10$
Mode 1.	$SV2 = (OUT 1/100) \land (Scale_1 - Scale_L) + Scale_L$
Mode 2:	$SV_2 = SV + DIdS$ $SV_2 = DV_1 + Dids$
	SVZ - FVI + DIdS
Cascade scale.	Tomporature at which DV ewitches from CH1 to CH2 in a temp, rising process
Switchover point.	$(T_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_{r_$
	Town of which DV is switched from CU4 to CU2 in a term draming ranges)
Switchover hysteresis.	nemp. at which PV is switched from the value subtracted from the switchever point
	should be specified based on the value subtracted from the switchover point.
. Manual control	(to be set within the range of 0 to 1000 digit)
• Manual control	0.0 ± 100.00 / active reactivities 0.10 /
Output setting range:	0.0 to 100.0%, setting resolution 0.1%
MAN-AUTO Switching:	Ta be act individually for CLIA and CLI2
• Solt start:	To be set individually for CHT and CH2
	OFF, 1 to 120 seconds
• AI point:	Execution SV value
Control output characteristics:	RA (inverse characteristics) / DA (direct characteristics) switchable remotely
	IO be set individually for CH1 and CH2
	RA (inverse characteristics) for neating action
	DA (direct characteristics) for cooling action
• Isolation:	Not to be isolated from other control outputs and AOs. To be isolated from other
0.11	inputs and outputs, power supply, and system.
• Other:	Do not select different output types for CH1 and CH2 in a single module.

21-6. Event output

	 Number 	er of o	utput r	points:
--	----------------------------	---------	---------	---------

Event types:

2 points per channel (EV1, EV2), 4 points in total

Selectable for each EV from the following types:

- NON (None assigned)
- HD (Higher limit deviation alarm)
- LD (Lower limit deviation alarm)
- OD (Outside higher/lower limit deviation alarm)
- ID (Inside higher/lower limit deviation alarm)
- HA (Higher limit absolute value alarm)
- LA (Lower limit absolute value alarm)
- SO (Scale over)
- RUN (RUN signal)
- ROT1 (Output 1 inverted output (during transistor open collector output only))
- COM (COM direct operation)
- STPS (Step signal)
- PTNS (Pattern signal)
- ENDS (Program end signal)
- HOLD (Hold signal)
- PROG (Program signal)
- U_SL (Up-slope signal)
- D_SL (Down-slope signal)
- GUA (Guarantee soak signal)

· Event setting ranges

Absolute value: Within measuring range (both higher and lower limits)

Deviation: -2000 to 2000 digit (both higher and lower limits)

Higher/lower limit deviation: 0 to 2000 digit (Inside/outside measuring range)

Event action: Differential gap:	ON-OFF action
Standby actions:	Selectable from the following four types:
· Standby actions.	No standby
	Standby 1 (at newer ON, and at DST , DUN)
	Standby T (at power-ON, and at RST \rightarrow RON)
	Standby 2 (at power-ON, at RST \rightarrow RUN, and at execution SV change)
	Control mode (no standby: no alarm occurrence at input error)
 Output type/rating: 	Transistor open collector/24 VDC, 100 mA
Output update cycle:	0.5 seconds
 Latching function: 	Alarm action holding function (assignable to deviation alarm/absolute value alarm)
5	Selectable from ON (enable) and OFF (disable).
	Latching can be undone via DI or remotely.
 Output characteristics: 	Selectable from NO and NC
Isolation:	To be isolated from control outputs and AOs. Not to be isolated from other inputs and outputs, power supply, and system.

4 max. (can be set to 1, 2, or 4)

 \pm (setting time \times 0.005 + 0.5 sec)

Total number of steps = 32

1 minute or one second

10000 times max.

OFF / 1 to 1000 digit

count will be reset.)

ON / OFF

3 max.

21-7. Program function

 Number of 	patterns:
-------------------------------	-----------

- Number of steps:
- Number of PID types:
- Time setting:
- Setting resolution:
- Time accuracy:
- Parameters can be set per step: SV, step time, and PID No.
- · Pattern execution count:
- PV start:
- · Guarantee soak:
- Hold:
- Advance:
- · Power failure compensation:

21-8. External control input (DI)

- Number of input points:
- DI assignment types:
- 3 points (DI1, DI2, DI3) or AO outputs Selectable for each DI from the following types: None assigned RUN1 (control execution ON/OFF) Level action RUN2 (control execution ON/OFF) Edge action MAN (manual output) Level action AT (auto-tuning) Edge action ESV2 (external SV selection 2) Level action ACT1 (output 1 output characteristics) Level action ACT2 (output 2 output characteristics) Level action PROG (program) Level action HLD (hold) Level action ADV (advance) Edge action PTN2 (start pattern selection-2 bit) Level action PTN3 (start pattern selection-3 bit) Level action L RS (unlatching) Edge action

* For a level action to function when communication contention occurs, priority is given to DI. Meanwhile, both the up-edge and down-edge will remain enabled when

To be isolated from control outputs and AOs. Not to be isolated from other inputs

8 max. (No. of patterns = 4), 16 (No. of patterns = 2), and 32 (No. of patterns = 1)

N/A (settings will be retained, while elapsed time, execution step, and execution

0 min 0 sec to 99 min 59 sec per step, or 0 hr 0 min to 99 hr 59 min per step

Operable either by external control input or communication

Operable either by external control input or communication

- Action input:
- Min. input holding time:
- Isolation:

21-9. Analog outputs (option)

- Number of output points:
 - Output type:
 - · Output specifications/rating:
 - Output scaling:
 - Output accuracy:
 - Output resolution:
 - Output update cycle:
 - Output limiter:
 - Isolation:

1 point per channel

0.5 seconds

Selectable from measured value, set value (execution SV), and control output Current 4 to 20 mADC (max. load resistance 300 Ω)

and outputs, power supply, and system.

communication contention occurs.

- Valtere 0 to 10 VDC (max. load every and)
- Voltage 0 to 10 VDC (max. load current 2 mA)
- Voltage 0 to 10 mVDC (output resistance 10 Ω)
- Within measuring range or within output range (inverse scaling possible)

Non voltage contact or open collector, approx. 5 VDC, 1 mA or less

- ±0.3%FS (relative to indicated value)
- Approx. 0.008% (1/13000)
 - 0.5 seconds
 - Higher and lower limit (0.0 to 100.0%) can be set. Lower limit< higher limit. Not to be isolated from other AOs and control outputs. To be isolated from other inputs and outputs, power and system.

Display

Status displays: LED lamps Red: Power Green: M-TXD, M-RXD, S-TXD and S-RXD

Setting

Master communication function

Indication method o from face DIP switches and push button switch					
SW1, 2	Slave address (high-order)	OFF, OFF	: 1 to 62	OFF, ON	: 65 to 127
		ON, OFF	: 129 to 191	ON, ON	: 193 to 255
SW3	Protocol	OFF	: SHIMADEN	ON	: MODBUS-RTU
SW4, 5	Baud rate	OFF, OFF	: 4800 bps	OFF, ON	: 9600 bps
		ON, OFF	: 19200 bps	ON, ON	: 38400 bps
SW6	Data length (invalid when	OFF	: 7 bits	ON	: 8 bits
	MODBUS)				
SW7	Parity bit	OFF	: Non	ON	: Even
SW8	Stop bit	OFF	:1	ON	: 2

Indication method:8 front face DIP switches and push button switch

Communication system: EIA standard RS-485 or RS-422 (specified at order placement)

Communication method: Half-duplex asynchronous

Communication delay time: Approx. 10 msec. Max. number of connectable units: 5 units including host

Communication code:	SHIMADEN: ASCII code / MODBUS-RTU: Binary code
Protocol:	Shimaden standard protocol / MODBUS-RTU
Start / end character:	STX(02h), ETX(03h), CR(0Dh) (Shimaden standard protocol)
Error detection:	CRC-16 (MODBUS-RTU), checksum (SHIMADEN)
Communication distance:	500 m max. (differs depending on conditions)
Termination:	By external 120 Ω resistor
 Temp. Control Module 	
communication function	
Communication system:	Dedicated bus
Communication method:	Half-duplex asynchronous
Max. number of connectable units:	32 units including COM Module
Communication code:	Binary code
Protocol:	Dedicated protocol
21-11. General specifications	Non veletile memory (FEDDOM)
Data memory: Operating any ironmontal	Non-volatile memory (EEPROW)
conditions	
Temperature:	-10 to 50°C
Humidity:	90%RH or less (no dew condensation)
Altitude:	2000 m or less above sea level
Overvoltage Category:	
Pollution Degree :	2 (IEC60664)
 Storage temperature: 	-20 to 65°C
 Power supply voltage: 	24V DC±10%
Insulation resistance:	500 VDC, 20 M Ω or more, for power supply-to-master communication (RS-485/RS 422)
 Withstand voltage: 	500 VAC, 1 min, for power supply-to-master communication (RS-485/RS-422)
 Applicable Standard 	EMC: EN61326-1
 Power consumption 	
COM Module:	2 W max. at 24 VDC
Temp. Control Module:	4 W max. at 24 VDC
Insulation:	Functional insulation for power supply-to-master communication (RS-485/RS-422) Dedicated bus not to be insulated from power supply and system
 Casing material: 	PA66 (66 nvlon)
External dimensions:	H108 × W22.6 × D113.6 mm
• Mass	
COM Module:	Approx. 120 g
Temp. Control Module:	Approx. 150 g

* With regard to the technical details of products, please contact your nearer Shimaden dealer.

The contents of this manual are subject to change without notice.

