TRM - 006A Operation Manual

Thank you for purchasing our TRM-006A. Please thoroughly read this manual for proper operation of TRM-006A.
This product provides you not only a digital indication function but also a function of automatically holding the maximum measurement (peak value) and minimum measurement (bottom value) so as to confirm the measurements during operation. In addition, the measurements can be selected as event outputs for external contacts (option).
Furthermore, the communication function (RS-485) can be selected as an option, allowing data management on a computer to which TRM-006A is connected.

Cautions

For safety purpose, following symbols are used in this manual.

⚠ Warning	The case that a user may receive fatal damage, electric shock, or severe burn injury when the product is incorrectly used
⚠ Caution	The case that a user may receive minor damage or the equipment may get damage
⚠ Warning	Verify correct wiring before turning on electricity since incorrect wiring may cause an equipment failure or a fire. Modification of this equipment may cause malfunctioning or a fire. Do not add modification on this equipment.
⚠ Caution	Wiring: Do not use empty terminals for irrelevant purposes. Operation: Do not use a sharp-pointed tool for operating keys.

- Please hand over this manual to the person using the product and have it securely stored.
- Do not reprint or duplicate this manual without permission.
- Content of this manual may be subject to modification without prior notice.
- Please acknowledge that any fault caused after use of this product may not be responsible to us.
- It takes approx. 4 sec after its power is turned on until the product is operable. This must be taken into account if the product is used in an interlock circuit.

Verification of the product

1) Verification of the model: Refer the model name printed in the packing box to the order sheet.
2) Verification of accessories: Fixing bracket and this manual
3) Model table:

TRM−006A−□−A□□□□−□

Power supply voltage	
	Free power supply
24	24 VAC/VDC

Input	
0	Thermocouple (K, J, R, T, N, S, B)
	RTD (Pt100, JPt100)
2	0 to 5VDC, 1 to 5VDC, 4 to 20mADC
4	0 to 1VDC
5	0 to 10VDC
6	0 to 10mVDC

Input type can be switched for "0" or "2."

* The "A" in the model identifier indicates the event output 1 (relay contact output), which is incorporated as a standard

Option		
B	Event output 2	Relay contact
F	Transmission output	1 to 5VDC
G		0 to 10VDC
H		0 to 10mVDC
I		4 to 20mADC
K		0 to 1VDC
J		0 to 5VDC
M	Communication	RS-485
Q	Voltage for driving sensor	12 VDC

Environmental condition

(1) Service temperature/humidity range: 0 to 50°C, 20 to 90% RH (no dew condensation)
(2) Storage temperature/humidity range: -25 to 70°C (no freezing or dew condensation), 5 to 95% RH (no dew condensation)
(3) Equipment environment:
1) No corrosive gases, dust, and oil
2) As far away as possible from an electric noise source, and little effect from electromagnetic field
3) As few as possible with mechanical vibrations or impacts
4) No direct sunlight and water splashes
5) Indoor use
6) Altitude up to 2000m
7) Pollution Degree 2
8) Installation Category **II**

Cautions for wiring

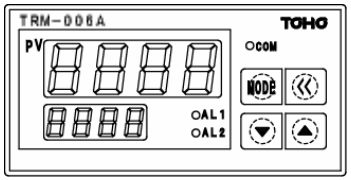
* Refer to labels on the product and this manual for correct wiring. Ensure that all wire connections, such as input terminals, power terminals and optional terminals, are correct prior to power turn-on.
* Use wire materials with wire resistance of 5Ω or less per wire for connection between a resistance thermometer and this product.
* Use a specified conductive wire or wire element for connection between a thermocouple and this product.
* Use shielded wires when this product is used adjacent to a noise generation source.
* Do not wire an input line and output line together.

TOHO Webpage：http://www.toho-inc.com
E-mail：overseas@toho-inc.co.jp

Head office：1-13-21 Tanashioda, Sagamihara, Kanagawa 229-1125 Japan
TEL：+81-42-777-3316, FAX：+81-42-777-3751

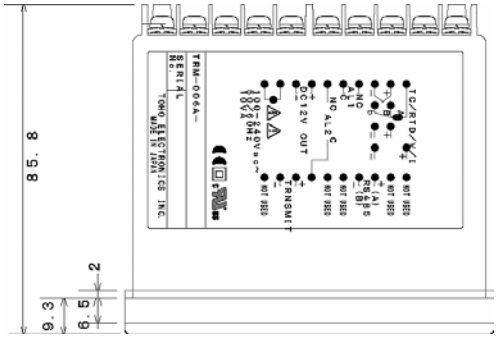
Drawing No. 20-0787

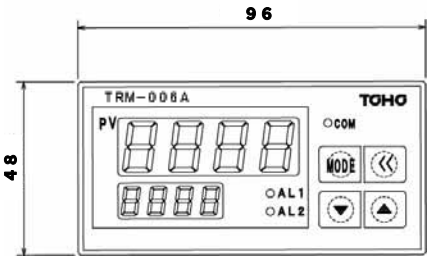
Front panel - names and tasks



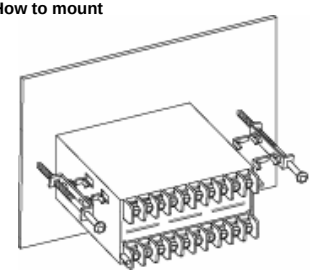
PV	Indicates measured value and character
	Indicates measured value
AL1	Lights up when the event output 1 is turned on
AL2	Lights up when the event output 2 is turned on
COM	Blinks during communication being underway
MODE	MODE key Used when screens are to be switched
<<	DIGIT MOVE key Used when digits are to be moved at setting, available by setting the digit move function setting to ON (usable)
▲	UP key Used for increasing the set value
▼	DOWN key Used for decreasing the set values

Outside dimension

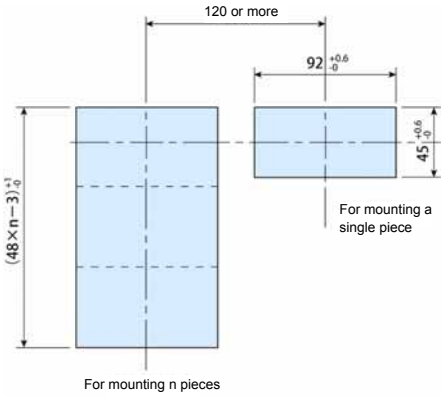




How to mount



Panel cutting diameter



Terminal arrangement

	I	TC／V	RTD				
Input	+		A	①	⑪	No use	
		+	B	②	⑫		
	−	−	b	③	⑬	A	Communi-cation
AL1 (relay contact)			NO	④	⑭	B	
			C	⑤	⑮	No use	
AL2 (relay contact)			NO	⑥	⑯		
Power supply for driving sensor 12VDC			+	⑦	⑰	C	AL2
			−	⑧	⑱	+	Transmis-sion output
Power supply voltage ⑨ is "-" and ⑩ is "+" for DC power supply.				⑨	⑲	−	
				⑩	⑳	No use	

⚠ Warning
* Use crimping terminals fitted to M3.5.
* Tightening torque: 0.5N-m (5kgf-m)
* Wire with care on polarity (+ or -), if applicable.
* For the relay contact output, "C" represents "common" and "NO" represents "normal open."

⚠ Caution * Do not touch terminals while power is supplied, due to danger of an electric shock.

Isolation

Power supply circuit		
PV input	CPU circuit	Voltage of 12VDC for driving sensor
		Transmission output
		Event output 1
		Event output 2
Communication		

Standard specifications

Types of inputs	Thermocouple	K, J, R, T, N, S or B (External resistance within 0.5μV/1Ω)	Key switching available
	RTD	Pt100 or JPt100 (External resistance 10Ω or less per line)	
	Current/voltage	0 to 5VDC/1 to 5VDC (Input resistance of 500kΩ or more), 4 to 20mADC (Input resistance of 250Ω)	Key switching available
		0 to 1VDC (Input resistance of 500kΩ or more), 0 to 10mVDC/0 to 10VDC (Input resistance of 1MΩ or more)	Model designation
Indication	Indication of set value/character	4 figures, green, 14mm	
	Setting indication	4 figures, red, 8mm	
	Function indication	Red LED (AL1 and AL2), green LED (COM)	
Sampling interval		250mS	
Display precision	Thermocouple	Either ± (0.3% + 1digit) or ± 2°C of the reference value, whichever larger (ambient temperature of 23 ± 10°C)	
		Note: ± 3°C for - 100 to 0°C, ± 4°C for - 200 to - 100°C, and no specification for 400°C or lower with thermocouple B	
	RTD	Either ± (0.3% + 1 digit) or ± 0.9°C of the reference value, whichever larger (ambient temperature of 23 ± 10°C)	
	Current/voltage	Full span ± (0.3% + 1digit) (ambient temperature of 23 ± 10°C), where full span = setting range	
Memory element		EEPROM	
Power supply voltage		100 to 240VAC, 50/60Hz, and 24VAC/VDC ± 10%, 50/60Hz	
Weight		300g or less	
Power consumption		10VA (240VAC), 6VA (24VAC), and 4W (24VDC)	
Instant power-off		No effect on operation by power-off within 1 cycle	
Insulation resistance		Between measurement terminal and casing: 20MΩ at 500VDC, and between power supply terminal and casing: 20MΩ at 500VDC	
Withstand voltage		Between measurement terminal and casing: 1 min at 1000VAC, and between power supply terminal and casing: 1 min at 1500VAC	
Burnout (cut wire)		Thermocouple/resistance thermometer	Overscale
		0 to 5 /0 to 1 /0 to 10VDC	Equivalent to 0 input
		1 to 5 VDC/4 to 20mADC	Underscale
		0 to 10 mVDC	Overscale
Priority screen		Available with indication of arbitrary parameter screens in the operation mode (9 pcs)	
Lock function		4-mode selection (lock OFF, ALL, lock of the operation mode and lock other than the operation mode)	

Option specifications

Event output	Rated output	Contact	1a			
		Contact capacity	250VAC, 2.4A (resistance load)			
		Mechanical life	5 million times or more			
		Electrical life	0.2 million times or more			
Transmission output (PV transmission)	Type		Load resistance	Output response time	Output precision	Output resolution
	Voltage	0 to 10mVDC	500kΩ or more	600ms or shorter	±0.3% (23℃ ±10℃)	Equivalent to the indication resolution or higher
		0 to 1VDC				
		0 to 5VDC	1kΩ or more			
		1 to 5VDC				
		0 to 10VDC				
	Current	4 to 20mADC	600kΩ or more			
Communication	Communication standards	Conformity with RS-485 (1:31 stations)				
	Communication method	Protocol	Proprietary to TOHO Electronics/MODBUS (RTU or ASCII)			
		Information direction	Half duplex			
		Sync system	Asynchronous			
		Transmission code	Two-wire type			
		Interface	1200/2400/4800/9600/19200 BPS			
		Character	Proprietary to TOHO Electronics	Start bit	1 bit fixed	
				Stop bit	1/2 bits	
				Data length	7/8 bits	
				Parity	None/odd No./even No.	
				BCC check	With/without	
				Address	1 to 99 stations	
			MODBUS (RTU)	Start bit	1 bit fixed	
				Stop bit	1/2 bits	
				Data length	8 bits	
				Parity	None/odd No./even No.	
				Address	1 to 247 stations	
			MODBUS (ASCII)	Start bit	1 bit fixed	
				Stop bit	1/2 bits	
				Data length	7 bits	
				Parity	None/even No.	
				Address	1 to 247 stations	
		Response delay time	0 to 250ms			
Power supply for driving sensor	Output voltage	12VDC				
	Allowable current	Max. 20mA (load resistance of 600Ω or more)				
	Output precision	± 1V (0 to 50°C)				

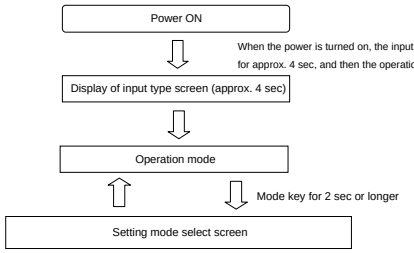
Indication ranges

		Indication range		Setting range	
		Without decimal point	With decimal point	Without decimal point	With decimal point
Thermocouple	K	−210 to 1382	−199.9 to 999.9		
	J	−210 to 860	−199.9 to 860.0		
	R	−10 to 1710			
	T	−210 to 410	−199.9 to 410.0		
	N	−210 to 1310	−199.9 to 999.9		
	S	−10 to 1710			
	B	−20 to 1802			
RTD	Pt100	−199 to 530	−199.9 to 530.0		
	JPt100	−199 to 520	−199.9 to 520.0		
Current/voltage	0 to 5VDC	Approx. - 2% of setting of the lower limit of scaling (SLL) to approx. + 12% of setting of the upper limit of scaling (SLH), within the setting range		−1999 to 9999	−199.9 to 999.9
	0 to 1VDC				−19.99 to 99.99
	0 to 10mVDC				−1.999 to 9.999
	0 to 10VDC				
	1 to 5VDC	Approx. - 12% of setting of the lower limit of scaling (SLL) to approx. + 12% of setting of the upper limit of scaling (SLH), within the setting range			
	4 to 20mVDC				

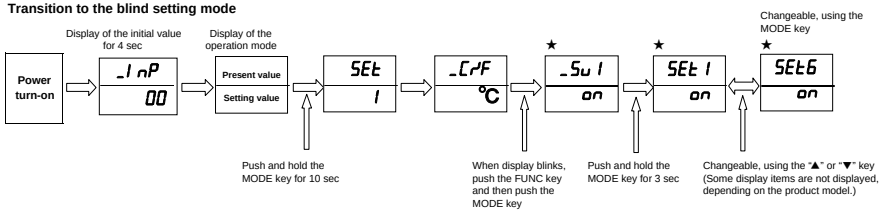
Description on operation keys

Operation key	Key name	Description
MODE	MODE key	Used for screen change (Parameter settings are saved.)
<<	DIGIT MOVE key	Used for moving the digits at each setting (Selected digits blink and are effective for all modes.)
▲	UP key	Used for increasing the set value
▼	DOWN key	Used for decreasing the set values

Outline of operation flow



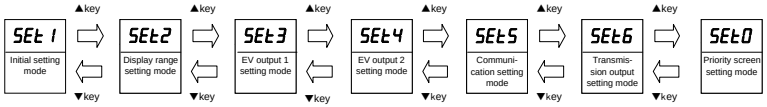
Transition to the blind setting mode



Description on the item marked "★"

1) In the blind mode, "on" or "oFF" is displayed below each character, where display is effective in "on" and display is ineffective in "oFF" (blind).
2) Setting for the blind is available by pushing the "<<" key.
3) Use the MODE key for selection when each parameter is to be individually blinded.
4) For terminating the blind setting mode, turn off the power.

Setting mode select screen



* Some mode items are not displayed, depending on the product model.

Operation flow of setting mode select screen

Operation mode

1. Display of PV
* No display in the lower half

MODE key

2. PV bottom hold value (*1)

MODE key

3. PV peak hold value (*1)

MODE key

4. First priority screen (*2)

MODE key

5. Second priority screen (*2)

MODE key

6. Third priority screen (*2)

MODE key

7. Fourth priority screen (*2)

MODE key

8. Fifth priority screen (*2)

MODE key

9. Sixth priority screen (*2)

MODE key

10. Seventh priority screen (*2)

MODE key

11. Eighth priority screen (*2)

MODE key

12. Ninth priority screen (*2)

MODE key

Return to the item 1

Priority screen setting mode

1. Setting mode select screen

MODE key

2. Priority screen function setting 1

MODE key

3. Priority screen function setting 2

MODE key

4. Priority screen function setting 3

MODE key

5. Priority screen function setting 4

MODE key

6. Priority screen function setting 5

MODE key

7. Priority screen function setting 6

MODE key

8. Priority screen function setting 7

MODE key

9. Priority screen function setting 8

MODE key

10. Priority screen function setting 9

MODE key

Return to the item 1

Initial setting mode

1. Setting mode select screen

MODE key

2. Input type setting

MODE key

3. PV compensation gain setting

MODE key

4. PV compensation zero point setting

MODE key

5. Input filter setting

MODE key

6. PV hold function setting

MODE key

7. Decimal point location setting

MODE key

8. Key lock setting

MODE key

Return to the item 1

Display range setting mode

1. Setting mode select screen (*3)

MODE key

2. Scaling upper limit setting (*3)

MODE key

3. Scaling lower limit setting (*3)

MODE key

Return to the item 1

EV output 1 setting mode

1. Setting mode select screen

MODE key

2. PV event output 1 function setting

MODE key

3. Event output 1 upper limit setting (*4, *5)

MODE key

4. Event output 1 lower limit setting (*4, *5)

MODE key

5. Event output 1 sensitivity setting (*4)

MODE key

6. Event output 1 delay timer setting (*7)

MODE key

7. Special event output 1 function setting

MODE key

8. Event output 1 polarity setting

MODE key

Return to the item 1

*4: No display when the measured value event output function is not used
*5: No display when the measured value event output is not used for the upper limit alarm
*6: No display when the measured value event output is not used for the lower limit alarm
*7: No display when the function of measured value event output function/special event output is not used

EV output 2 setting mode

1. Setting mode select screen (*8)

MODE key

2. PV event output 2 function setting (*8)

MODE key

3. Event output 2 upper limit setting (*8, *9, *10)

MODE key

4. Event output 2 lower limit setting (*8, *9, *11)

MODE key

5. Event output 2 sensitivity setting (*8, *9)

MODE key

6. Event output 2 delay timer setting (*8, *12)

MODE key

7. Special event output 2 function setting (*8)

MODE key

8. Event output 2 polarity setting (*8)

MODE key

Return to the item 1

*8: No display when the event output 2 is not type-designated or when the event 2 is not assigned for output
*9: No display when the event output 2 is not type-designated or when the event 2 is not assigned for output, or when the measured value event output function is not used
*10: No display when the event output 2 is not type-designated or when the event 2 is not assigned for output, or when the measured value event output is not used for the upper limit alarm
*11: No display when the event output 2 is not type-designated or when the event 2 is not assigned for output, or when the measured value event output is not used for the lower limit alarm
*12: No display when the event output 2 is not type-designated or when the event 2 is not assigned for output, or when the measured value event output function/special event output is not used

Communication setting mode

1. Setting mode select screen (*13)

MODE key

2. Communication protocol setting (*13)

MODE key

3. Communication parameter setting (*13)

MODE key

4. Communication speed setting (*13)

MODE key

5. Communication address setting (*13)

MODE key

6. Response delay time setting (*13)

MODE key

7. Communication mode switching setting (*13)

MODE key

Return to the item 1

*13: No display when communication is not type-designated.

Transmission output setting mode

1. Setting mode select screen (*14)

MODE key

2. Transmission output function setting (*14)

MODE key

3. Transmission output normal operation/reverse operation switching setting (*14, *15)

MODE key

4. Transmission output scaling upper limit setting (*14, *15)

MODE key

5. Transmission output scaling lower limit setting (*14, *15)

MODE key

Return to the item 1

*14: No display when the transmission output is not type-designated
*15: No display when "None" is set for the transmission output function setting

Other displays

When an input exceeds the display range upper limit
When the wire for "0 to 10mVDC" of the thermocouple is broken
When either one of A, B or b of the RTD is broken

When an input exceeds the display range lower limit
When an input of "1 to 5VDC, 4 to 20mA" is broken

When memory is erroneous

When A/D conversion is erroneous

When a parameter change is attempted during key lock

*1: No display when the peak/bottom is not set in the PV hold function setting
*2: Parameters that are set in the priority screen setting mode are displayed in the first through ninth priority screens.
*3: No display on models for temperature input (thermocouple or RTD)

Parameter description

Operation mode

No.	Character	Name	Description	Initial value
1		PV display	Setting units: ℃ (models with inputs from thermocouple or resistance thermometer) digit (models with inputs in current/voltage) No display in the lower half of the screen	
2	bot	PV bottom hold value	Display of bottom value Bottom value to be reset by pushing and holding the " ▲" key (UP key) * Regarding a hold value Make sure to reset the bottom hold value whenever setting is changed for inputs. (Input type, PV compensation, decimal point location, scaling upper/lower limit)	PV value when power is turned on
3	PERK	PV peak hold value	Display of peak value Peak value to be reset by pushing and holding the " ▲" key (UP key) * Regarding a hold value Make sure to reset the peak hold value whenever setting is changed for inputs. (Input type, PV compensation, decimal point location, scaling upper/lower limit)	PV value when power is turned on
4 to 12		Priority screen 1 to 9	Display of a screen that is set in the priority screen setting	

Priority screen setting mode

No.	Character	Name	Description	Initial value
1	SEt 0	Setting mode select screen Priority screen setting mode	Setting regarding the priority screen	
2	Pri 1	Priority screen 1 to 9 setting	Setting parameters to be displayed on the priority screen	Screen 1 to 9 oFF
3	Pri 2			
4	Pri 3			
5	Pri 4			
6	Pri 5			
7	Pri 6			
8	Pri 7			
9	Pri 8			
10	Pri 9			

Initial setting mode

No.	Character	Name	Description			Initial value
1	SEt 1	Setting mode select screen Setup mode	Setting regarding inputs and such			
2	inP **	Input type setting	Thermocouple/RTD	**	Input type	
				00	Thermocouple K	00
				01	Thermocouple J	
				02	Thermocouple R	
				03	Thermocouple T	
				04	Thermocouple N	
				05	Thermocouple S	
				06	Thermocouple B	
				07	Pt100	
				11	JPt100	
			Current/voltage	**	Input type	
				20	0 to 5VDC	22
				21	1 to 5VDC	
				22	4 to 20mADC	
				40	0 to 1VDC	40
				50	0 to 10VDC	50
				60	0 to 10mVDC	60
3	PuG	PV compensation gain setting	Setting range	Multiplication of 0.50 to 2.00		1.00
4	PuS	PV compensation zero point setting	Thermocouple/RTD	Setting range	-199 to 999℃ -199.9 to 999.9℃	0
			Current/voltage	Setting range	-1999 to 9999 (Decimal point in a designated location)	
5	PdF	Input filter setting	Setting range	0 to 99 sec.		1
6	PuH	PV hold function setting	Function type	oFF	No hold	oFF
				PERK	Peak hold	
				bot	Bottom hold	
				PtbH	Peak/bottom hold	
7	dP	Decimal point location setting	Thermocouple/RTD	0	Without	0
				0.0	With	
			Current/voltage	0	None	
				0.0	One digit	
				0.00	Two digits	
				0.000	Three digits	
8	LoC	Key lock setting	0	OFF		0
			1	All lock		
			2	Operation mode lock		
			3	Lock other than operation mode		

* Input types of "40, 50 and 60" are not allowed to change.

Display range setting mode

No.	Character	Name	Description		Initial value
1	SEt 2	Display range setting mode	Setting regarding display scaling		
2	SLH	Scaling upper limit setting (Models of current/voltage only)	Setting range	- 1999 to 9999 (decimal point in a designated location) Variance from the lower limit to be 50 digits or more	9000
			Setting range	digit	
			* No setting allowed for the models of thermocouple/RTD		
3	SLL	Scaling lower limit setting (Models of current/voltage only)	Setting range	- 1999 to 9999 (decimal point in a designated location) Variance from the upper limit to be 50 digits or more	-1000
			Setting range	digit	
			* No setting allowed for the models of thermocouple/RTD		

Event output setting mode

No.	Character	Name	Description			Initial value
1	SEt 3 4	Setting mode select screen Event output 1 Event output 2	Setting regarding the event output 1 function Setting regarding the event output 2 function			
2	E□F ①②	Event output □ function setting (PV event)	PV event function	②	Type	00
				0	None	
				1	Absolute value upper/lower limit	
				2	Absolute value upper limit	
				3	Absolute value lower limit	
				4	Absolute value range	
			Added function	①	Type	
				0	None	
				1	Hold	
				2	Standby sequence	
				3	Hold + standby sequence	
3,4	E□H E□L	Event output □ upper limit setting Event output □ lower limit setting	Thermocouple/RTD	Setting range	-199.9 to 999.9℃ -1999 to 9999℃	0
			Current/voltage	Setting range	- 1999 to 9999 (decimal point in a designated location)	
5	E□C	Event output □ sensitivity setting	Thermocouple/RTD	Setting range	0.0 to 999.9℃ 0 to 9999℃	0
			Current/voltage	Setting range	0 to 9999 (decimal point in a designated location)	
6	E□t	Event output □ Delay timer setting	Setting range	0 to 9999 sec.		0
7	E□b ①②	Event output □ function (Special)	②	Type		00
			0	None		
			1	PV abnormal		
			①	Type		
			0	None		
			1	Hold		
8	E□P ①	Event output □ polarity setting	①	Type		0
			0	Normal open		
			1	Normal close		

Communication setting mode

No.	Character	Name	Description			Initial value
1	SEt 5	Setting mode select screen Communication parameter mode	Setting regarding communication parameters			
2	Prt	Communication protocol setting	0	TOHO-exclusive protocol		0
			1	MODBUS(RTU)		
			2	MODBUS(ASCII)		
3	CoM ※＊☆★	Communication parameter setting	BCC check	※□□□	Type	8n2
				n□□□	Without	
				b□□□	With	
			Data length selection	□＊□□	Type	
				□7□□	7 bits	
				□8□□	8 bits	
			Parity check function	□□☆□	Type	
				□□n□	None	
				□□o□	Odd	
				□□E□	Even	
			Stop bit length function	□□□★	Type	
				□□□1	1 bit	
				□□□2	2 bits	
			Only 8N2, 8O1 or 8E1 can be selected, when MODBUS (RTU) is selected. Only 7N2, 7O1 or 7E1 can be selected, when MODBUS (ASCII) is selected. * BCC check invalid			
4	bPS	Communication speed setting	1.2	1200bps		9.6
			2.4	2400bps		
			4.8	4800bps		
			9.6	9600bps		
			19.2	19200bps		
5	Adr	Communication address	Setting range	Exclusive protocol	1 to 99 stations	1
				MODBUS	1 to 247 stations	
6	Abt	Response delay time	Setting range	0 to 250ms		0
7	Mod	Communication mode switching setting	ro	Communication R available		rW
			rW	Communication RW available		
			For MODBUS, switching setting is invalid.			

Transmission output setting mode

No.	Character	Name	Description			Initial value
1	SEt 6	Setting mode select screen Transmission output parameter mode	Setting regarding transmission parameters			
2	trF	Transmission output function setting		Type		0
			0	None		
			1	PV (measured value) output		
3	trP	Transmission output normal operation Reverse operation switching setting		Operation type		0
			0	Normal operation		
			1	Reverse operation		
4	trH	Transmission output scaling upper limit setting	Thermocouple/RTD			1200
			Setting range	Display range lower limit to display range upper limit Variance from the transmission output scaling lower limit to be 50 digits or more		
			Setting unit	℃		
			Current/voltage			9000
			Setting range	- 1999 to 9999 (decimal point in a designated location) Variance from the transmission output scaling lower limit to be 50 digits or more		
			Setting unit	digit		
5	trL	Transmission output scaling lower limit setting	Thermocouple/RTD			0
			Setting range	Display range lower limit to display range upper limit Variance from the transmission output scaling upper limit to be 50 digits or more		
			Setting unit	℃		
			Current/voltage			-1000
			Setting range	- 1999 to 9999 (decimal point in a designated location) Variance from the transmission output scaling upper limit to be 50 digits or more		
			Setting unit	digit		

Character code

1	2	3	4	5
1	2	3	4	5
6	7	8	9	0
6	7	8	9	0
A	B	C	D	E
A	b	C	d	E
F	G	H	I	K
F	G	H	I	K
L	M	N	O	P
L	M	n	o	P
R	S	T	V	W
r	S	t	u	U
Over	Under	Minus		
-	_	-		