CONOTEC

CONOTEC CO., LTD.
DIGITAL TEMPERATURE CONTROLLER

ISO 9001:2008

CNT-P100   Instruction Manual

◆ PID temperature controller
◆ Relay/SSR PID,Current PID control
◆ RS485(MODBUS)support
◆ NTC10K/CA(K)/PT100
sensor selectable
◆ 3 kinds of sensor mounted by
auto tuning only once

※ CNT-P100 is a controller that can perform PID function for PID, SSR PID, 4 ~ 20mA current and can select a sensor from menu among three types of NTC10K / PT100 / CA (K).

• A user manual for this product is posted on the company website.
• Please download the technical document and communications manual on the company website

01 Safety precautions

Please read the safety precautions carefully for correct operation of the product.

※ The specifications and dimensions specified in this instruction manual may be changed without any notice for performance enhancement.

⚠ Warning

1. This product was not made as a safe device. Therefore, this product should be attached with dual safety devices if it is used for the control purposes (e.g. a device vulnerable to accident and property damage, etc.).
2. Do not wire, inspect or service this product while the power is being supplied.
3. You must attach this product to a panel. Otherwise, it may cause an electric shock.
4. When connecting the power, you must check the terminal number.
5. Do not ever disassemble, process, modify or repair this product.

⚠ Caution

1. Please make yourself familiar with all the operation instructions, safety precautions and warnings before using this product. Comply with related specifications and capacity requirements
2. Do not wire or install this product to any unit with high inductive load (e.g. motor, solenoid, etc.).
3. Use a shielded cable with a proper length when extending a sensor.
4. Do not use any part that generates an arc when used in the same power or directly switched in close proximity.
5. Keep the power cable away from a high-voltage cable and do not install this product in any place that is full of water, oil and dust.
6. Do not install this product in any place that is exposed to direct sunlight or rain.
7. Do not install this product in any place that is subject to strong magnetic power, noise, vibration or shock.

8. Keep this product away from any place that generates strong alkaline or acid substances. Use a separate pipe.
9. Do not sprinkle water onto this product for cleaning when installing it in the kitchen.
10. Do not install this product in any place where the temperature/ humidity ratings are exceeded
11. The sensor cable should not be cut or cracked..
12. Keep the sensor cable away from a signal cable, a power cable or a load cable. Use a separate pipe.
13. Keep in mind that the follow-up service will not be available if this product has been arbitrarily disassembled and modified
14. ⚠ symbol on the terminal wiring diagram indicates a safety statement that alerts a warning or caution.
15. Do not use this product near any device generating strong high-frequency noise (e.g. high-frequency welding machine high-frequency sewing machine, high-frequency radio, large-capacity SCR controller, etc.).
16. Using this product in any method other than those specified by by the manufacturer may lead an injury or a property damage
17. The product is not a toy. Keep it away from children.
18. The product should be installed only by an expert or a qualified person.
19. The company will not be liable for any damage caused by the violation of the above warnings and cautions or by a consumer's fault

⚠ Danger

Caution: Risk of electric shock
• Electric shock – Do not touch the AC terminal while the current is flowing. It may cause an electric shock.
• You must disconnect the input power when servicing it.

02 Main features

* PT100, CA(K), NTC10K — 3 kinds of sensor selectable
* Control of relay PID, SSR PID, current PID * RS485 MODUB RTU available
* Function to transfer 4 ~ 20mA PV
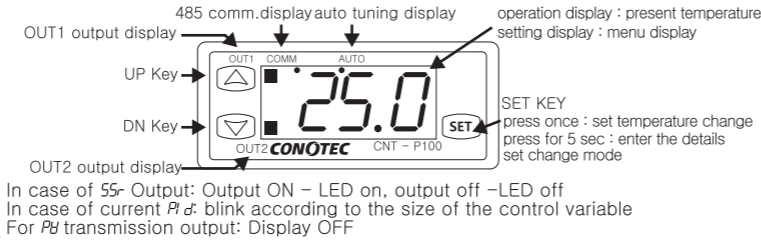* Uncomplicated entry-level PID controller

03 Specifications

Input power	24~48VDC	Consumption power	
Display	7segment 3.5Digit 0.51Inch	Weight	
Sensor type	PT100, CA(K), NTC10K		
Display accuracy	PT100, NTC10K : ±1% rdg ± 1 digit		
	CA(K) : ±1% rdg ± 1 digit		
Output specifications	Out1(relay) : ON/OFF output or alarm output or PID control (250Vac 2A Max, 1a relay)		
	Out2(SSR / current) : SSR PID or current PID or PV transmit (Current:resistive load within 500ohm, SSR 11VDC±2V within 20mA)		
Communication specifications	RS485, Modbus RTU, Data 8bit / ParityNone / Stop 1		
Proportional band width(P)	PT100,NTC10K : 0~100.0℃	integral time(I)	0~1999sec
	CA(K) : 0~100℃	derivative time(D)	0~1999sec
Normal state error correction	PT100,NTC10K : -100.0~100.0℃	control cycle(T)	0~120sec
	CA(K) : -100~100℃	Memory term	about 10years(non-volatile)
Ambient	0~55℃, 35~80%Rh(no freezing or dew condensation)		

04 Model Types

Model	Sensor	Output	Communication	Input power
CNT-P100	NTC10K/PT100/CA(K)	Relay 1 SSR / Current 1	RS485 Modbus RTU	48VDC / 24~48VDC

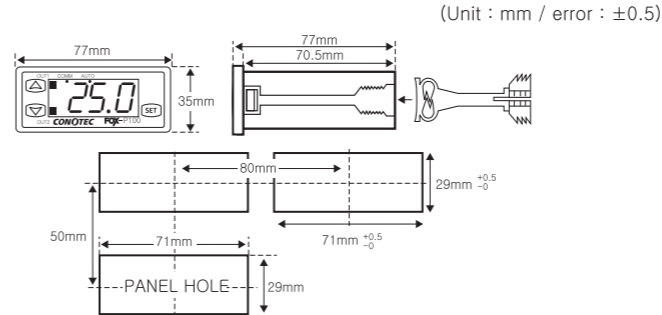NTC10K 3M is included as standard but,(PT100,CA(K)) sensor not included.

05 Components

485 comm.display auto tuning display   operation display : present temperature
                                         setting display : menu display
OUT1 output display
UP Key
DN Key   SET KEY
                                         press once : set temperature change
                                         press for 5 sec : enter the details
                                         set change mode
OUT2 output display

In case of 55- Output: Output ON – LED on, output off –LED off
In case of current Pl d: blink according to the size of the control variable
For Pd transmission output: Display OFF

06 Terminal wiring diagram

AC250V 2A   OUT1
            OUT2   POWER SUPPLY
                            ⚠ Warning
                            Please put off power when
                            working on connection or
                            replacement.

                            Current
                            DC 0/4~20mA
                            Load 500Ω Max
PT100   RS485 Relay(1a)   SSR
            + -   11VDC ±2V
               48VDC /   20mA Max
               24~48VDC

07 Diemension and panel hole sizes

(Unit : mm / error : ±0.5)

77mm   77mm
              70.5mm
         35mm
                    80mm   29mm +0.5 -0
50mm   71mm   71mm +0.5 -0
---PANEL HOLE--- 29mm

08 Setting process

How to change the set temperature

25.0   50.0   25.0   cannot be changed
present   set   present during auto-tuning
temperature temperature   temperature

Auto-tuning start/stop

at   AUTO   AUTO
present   25.0   ▲+▼   25.0   AUTO LED   Auto-tuning is
temperature no   press UP/DN key on tuning flickering   not available in
          tuning at the same time   the state of error
                                                           of sensor or
                                                           during setting.

Initialize the set value

25.0 → SYS → Int   re-booting   25.0
▲+▼+SET
If you keep pressing all the three simultaneously for 3
seconds, it will reboot after initialization.
Note: Because all the settings are initialized, check once again before use.

Program setting (The value of each item is the factory setting.)

25.0 present temperature   SET set menu move   Some of the menu cannot change the setting
                               ▲   during auto-tuning. If you try to change the
SET press for 5 sec   ▼   set value change letters tun appears briefly.

event1   event2   event3
Eu1   ◄►   Eu2   ◄►   Eu3

In sensor select   CPt control cycle   tYP output type   HEt / CoL
oU1 OUT1select   Pb proportional band   dIF output deviation temperature
oU2 OUT2select   tI integral time   dLF output delay time
Cor sensor correction td derivative time   ALS alarm output type   AL.0 / AL.1
Adr communication channel rSt normal state deviation correction AdF alarm output deviation
bPS communication speed   A.HI current control output max.value   HPr high limit alarm temp.
                            A.Lo current control ouput min.value   LPr low limit alarm temp.
                                                                     t.20 PV transmit 20mA temperature
                                                                     t.4 PV transmit 4mA temperature

Right column

1 Menu settings cannot be changed during auto-tuning
SEt In oU1 Pb tI td rSt A.HI A.Lo tYP
To change your settings, press▲+▼ keys simultaneously to turn off auto tuning before change.
When you try to change the value of the top menu during auto-tuning, tun letters appears briefly.

2 In sensor selection
Pt RTD PT100 ohm, -199 ~ 400 ℃
CA.t K thermocouple sensor, -50 ~ 1200 ℃
ntC NTC10Kohm CONOTEC model no. FS-200N), -55.0~99.9℃
Menu below is stored in a separate memory space according to the sensor type,and Pb tI. td is automatically saved to suit different sensors with one sensor tuning. In other words, changing the sensor after the completion of auto-tuning does not require re-tuning.
SEt Cor Pb tI td rSt HPr LPr t.20 t.4
However, if you want a precise auto-tuning to fit the sensor, you may do re-tuning after selecting the desired sensor.

3 oU1 OUT1 selection
⚠ Note: OUT2 output is selected automatically by selecting OUT1 output.

OUT1 : Relay output		OUT2 : SSR or 전류출력	
r.A2	Alarm output	A.Pd	4~20mA current PID control
r.A1		S.Pd	SSR PID control
r.Pd	Relay PID control	A.Pu	4~20mA current PV transment
r.nF	Relay On/OFF control		

4 Cor Sensor correction
When there is a difference between the present temperature displayed and the temperature measured by precision instruments, you may match the displayed value to the actual measured temperature.
Example 1) Display Value: 5 degrees, the actual measured temperature: 10 degrees => input Cor +5 degree
Example 2) Display Value: 5 degrees, the actual measured temperature: 2 degrees => input Cor -3 degree

5 Adr RS485 communication address
It is a menu to align an address with upper system for RS485 communication.
Example) If the F-P100 address of the PC program is set to 3, the Adr menu should meet 3.

6 bPS RS485 communicaton speed
This is a menu to align communication speed to match an upper system for RS485 communication.
Example) If the communication speed of the PC program is at 9600bPS, bPS menu should meet 960.
120 : 1200 bPS, 240 : 2400 bPS, 480 : 4800 bPS,
960 : 9600 bPS, 192 : 19200 bPS

7 CPt Control cycle
When implementing PI d control / P control / PI control, etc. using a relay or 55r output, ON and Off are repeated within a set time cycle, which is called as a control cycle.
⚠ Note: When performing PI d control by relay, if the control cycle is too short, life of the relay contact may be shorten with frequent ON/OFF.

8 Pb Proportional Band
If current temperature is within proportional band width, control by adjusting the rate of ON/OFF in CPt.

9 tI Integration time
Integration time means the time for obtaining the same manipulated variable with proportional operation with only integral action. Proportional operation alone cannot reach the target temp., and temperature deviation occurs. Integral action ensures that the current temperature reaches the target temperature adding integrated deviation.
* If the integral time is too short: regular vibrations may occur.
* If the integration time is too long: difficult to reach the target temperature or takes long time.
* If integral time is 0, integral action does not work.

10 td Time proportional integral derivative time

Derivative time is the time from when the deviation is proportional action only get the amount of operation such as differential behavior when changing constantly. D action by monitoring a variation of the disturbance takes place rapidly, when the difference between the previous deviation of the operation amount is large, added much to quickly respond to the disturbance.
* If the derivative time is too short: late response to disturbance.
* If the derivative time is too long: regular vibration may occur.
* If the differential time is 0, no derivative action.

11 rSt Correction of deviation in a steady-state

Applicable when using(P)action only. (P) action alone cannot reach target temperature ans will have a steady-state deviation. Deviation can be corrected using rSt menu.
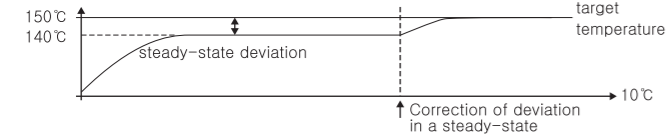
12 A.HI Maximum output of current control

Current output value of 100% operation when operating PId control with current output.
Ex) RH = 15.0mA is the curent output value at , 100% operation, current output 15.0mA

13 A.Lo Current control output minimum value

This will be the current output value if the manipulated variable is 0% and it's the case of operation such as PId control etc., as the current output
Ex) RLo = 10.0mA If the current output of 10.0mA when the manipulated variable of 0%

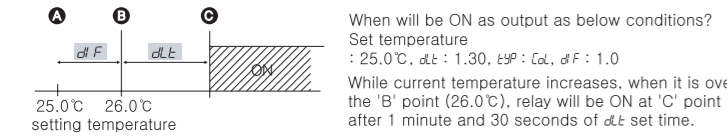## 14 tYP Output type

Heater : HEt settingCooler : CoL setting

15 dIF Output deviation temperature setting

* Direction of deviation: one direction (+ direction).   * Output OFF at setpoint
When the relay output is repeated too frequent ON / OFF, output contacts are quickly damaged or hunting by external noise (oscillation, chattering) occurs.It is a function to protect contact of the device by setting a regular intervals between ON and OFF to avoid such phenomina.
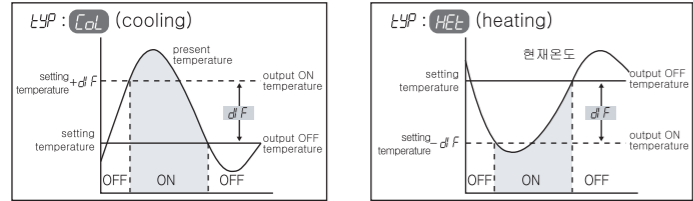
16 dLt Set Output Delay Time

If a problem occurs frequently repeating ON/OFF operation, it functions to protect the device from momentary power failure or power resumption (chillers, compressors, etc.)

When will be ON as output as below conditions?
Set temperature
: 25.0℃, dLt : 1.30, tYP : CoL, dIF : 1.0
While current temperature increases, when it is over the 'B' point (26.0℃), relay will be ON at 'C' point after 1 minute and 30 seconds of dLt set time.

17 ALS Alarm output type setting
AdF Alarm output deviation temperature
HPr Alarm output high limit temperature setting
LPr Alarm output low limit temperature setting

AL.0 : Alarm output type when out of the range
alarming when displayed temperature is out of the range

Alarm ON	AdF	Alarm OFF	AdF	Alarm ON
	LPr	LPr + AdF	HPr − AdF	HPr

AL.1 : Alarm output type when within the range
alarming when displayed temperature is within the range

Alarm OFF	AdF	Alarm ON	AdF	Alarm OFF
	LPr − AdF	LPr	HPr	HPr + AdF
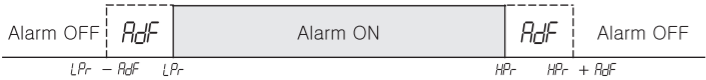
18 t.20 Temperature setting that corresponds to 20mA current output in PV transmission output.
t.4 Temperature setting that corresponds to 4mA current output in PV transmission output.

To send the present temperature to the current output, by dividing the set temperature range at t.20 and t.4 and output as 4~20mA.
Output a current corresponding to the temperature change by 0.1 degrees.

ex)

	t.4				t.20
present temperature	−200.0℃	−50.0℃	100.0℃	250.0℃	400.0℃
current output	4mA	8mA	12mA	16mA	20mA
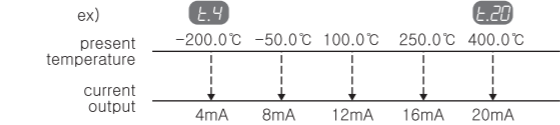
09 Control output

1 Relay ON/OFF Control

If set oU1 as r.nF, OUT1:relay on/off output
OUT2:4~20mA to be set as current output
Refer and set tYP output type, dIF output deviation, temperature dLt output delay time, etc.,

2 P control : Perform P control when both integral time (tI) and differential time (td) are zero

Output type	Setting & using terminal number
Relay P control	Set as oU1 r.Pd tI td using terminal No. 7, 8 OUT1:relay P control, OUT2:Pt transmit ouput
SS-P control	Set as oU1 r.A1 tI td using terminal No. 9, 10 OUT1:alarm output, OUT2:SS- P control
Current P control	Set as oU1 r.A2 tI td using terminal No. 9, 10 OUT1:alarm output, OUT2:Current P control
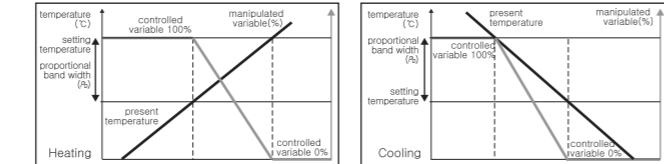
P control alone cannot have the current temperature reach the set temperature and leaves residual variance. This is called steady-state error, which can be corrected using the r-St (steady-state error compensation) menu.
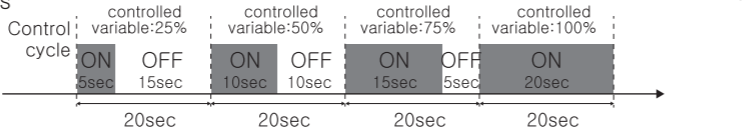
3 PId Control

Output type	Setting and using terminal number
Relay PId control	oU1 :set as r.Pd terminal using no. 7, 8 OUT1:relay PId control, OUT2:Pt transmit
SS- PId control	oU1 :set as r.A1 terminal using no. 9, 10 OUT1:alarm output, OUT2:SS- PId control
Curren PId control	oU1 :set as r.A2 terminal using no. 9, 10 OUT1:alarm output, OUT2:current PId contro

PId control calculates optimum coefficient through the auto-tuning and allows you to effectively maintain the target temperature.

-Auto tuning

After two or three times on and off in the vicinity of the set temperature, complete tuning. Even if the sensor is changed,it is not necessary to re-tune existing one.
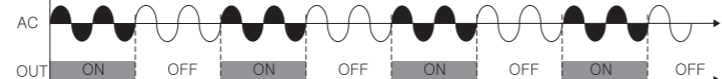
* Relay PId and SS- PId control operate in the format of dividing control cycle into on and off section as a percentage.
* Minimum on and off times in case of Relay PID control:
when CPt is less than 5 seconds: 0.3 seconds
less than10 seconds: 0.5 second
more than 10 seconds: 1 second
* Minimum on and off time at SS- PId control is 0.05 seconds unconditionally(50mS).

⚠ Note: When performing PId control by relay, if the control cycle is too short, life of the relay contact may be shorten with frequent ON/OFF
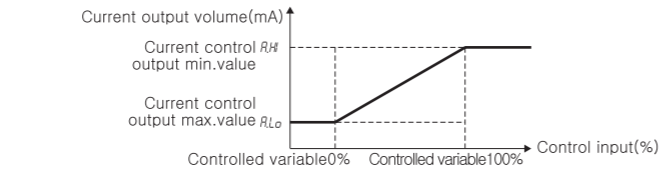
-SS- output
* SS- output is OnOff type output same as relay output and the ratio of On and Off varies depending on the controlled variable.
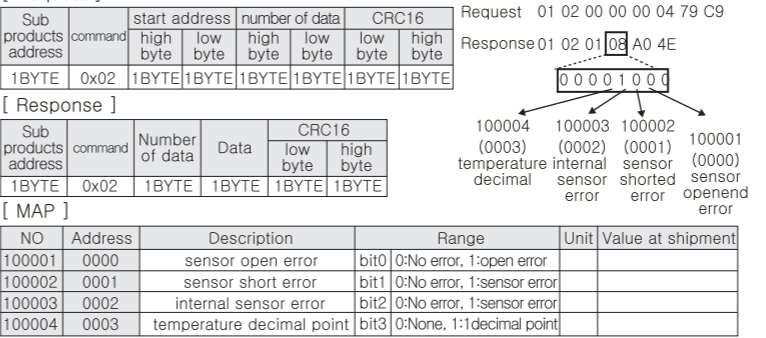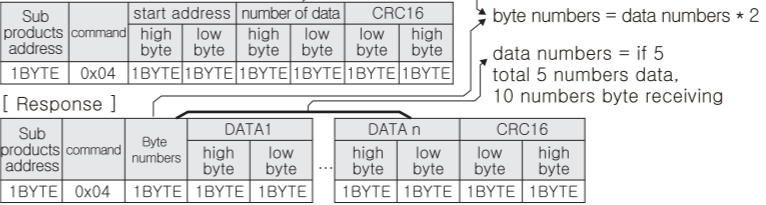* SS- output may use No. 9 & 10 current output terminal.

10 Communication output

* RS485 MODBUS RTU type of protocol is built-in.
* 2-wire half-duplex asynchronous communication system * Working distance: within 1.2Km
* Communication speed : 1200 / 2400 / 4800 / 9600 / 19200BPS
* Start bit: 1bit, stop bit : 1bit, parity bit : None, data bit : 8bit

1 Modbus Mapping Table

[Func 0x02 : Read Discrete Inputs]
— You can receive a brief information in the for of bits, such as a sensor status and a decimal.

[Request]

Sub products address	command	start address		number of data		CRC16	
		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x02	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

Request 01 02 00 00 00 04 79 C9
Response 01 02 01 08 A0 4E

[Response]

Sub products address	command	Number of data	Data	CRC16	
				low byte	high byte
1BYTE	0x02	1BYTE	1BYTE	1BYTE	1BYTE

[MAP]

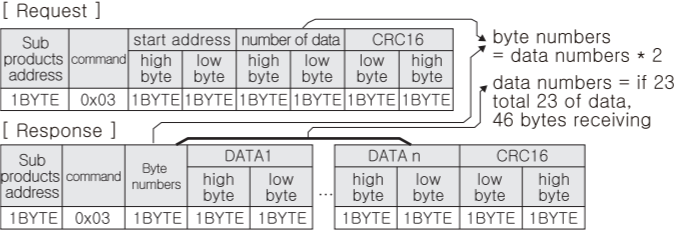| NO	Address	Description	Range	Unit	Value at shipment
100001	0000	sensor open error	bit0	0:No error, 1:open error	
100002	0001	sensor short error	bit1	0:No error, 1:sensor error	
100003	0002	internal sensor error	bit2	0:No error, 1:sensor error	
100004	0003	temperature decimal point	bit3	0:None, 1:1decimal point	

[Func 0x04 : Read Input Registers]
You can receive brief information such as Commands, Start address, Number of data, Temperature, Decimal, Current temperature, status of the sensor and decimal.
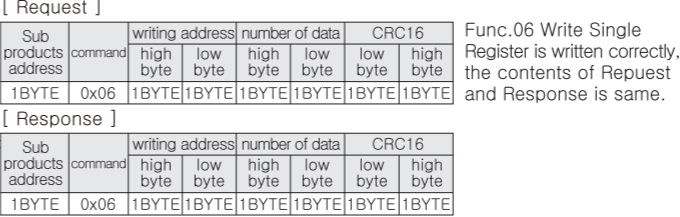
[Request]

Sub products address	command	start address		number of data		CRC16	
		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x04	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

byte numbers = data numbers * 2
data numbers = if 5 total 5 numbers data, 10 numbers byte receiving

[Response]

Sub products address	command	Byte numbers	DATA1		DATA n		CRC16	
			high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x04	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

[MAP]

NO	Address	Description		Range	Unit	Value at shipment
300001	0000	present temperature		at a sensor error : −5000	℃	
300002	0001	Sensor information		0:PT100, 1:CA(K), 2:NTC10K		
300003	0002	sensor open error	bit0	0:no error, 1:open error		
		sensor short error	bit1	0:no error, 1:short error		
		internal sensor error	bit2	0:no error, 1:sensor error		
		temperature decimal point	bit3	0:no error, 1:1decimal point		
300004	0003	output setting status	bit0 bit1	00 - Out1 : On/Off Output, Out2 : Pt Transmission Output 01 - Out1 : RelayPId Output, Out2 : Pt Transmission Output 10 - Out1 : Alarm Output, Out2 : SS- Pt Output 11 - Out1 : Alarm output, Out2 : Current PId output		
		OUT1output state display	bit2	0:OFF, 1:ON		
		auto tuning check	bit3	0:tuningX, 1:on tuning		
300005	0004	PV transmit output current amount		4.0mA ~ 20.0mA		
300006	0005	PIDcontrol input		0.0 ~ 100.0%	%	
300007	0006	model no.(P100)		'P' '1'		0x5031
300008	0007	model no.(P100)		'0' '0'		0x3030
300009	0008	model no.(P100)		'0' '0'		0x0000

[Func 0x03 : Read Input Registers]– Able to read the set value

[Request]

Sub products address	command	start address		number of data		CRC16	
		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x03	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

byte numbers = data numbers * 2
data numbers = if 23 total 23 of data, 46 bytes receiving

[Response]

Sub products address	command	Byte numbers	DATA1		DATA n		CRC16	
			high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x03	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

[Func 0x06 : Write Single Register]– You can change the setting one by one.

[Request]

Sub products address	command	writing address		number of data		CRC16	
		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x06	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

Func.06 Write Single Register is written correctly, the contents of Repuest and Response is same.

[Response]

Sub products address	command	writing address		number of data		CRC16	
		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x06	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

[Func 0x10 : Write Multiple Registers]
Several items of the setting values can be changed at a time.
When writing multiple registers, if any of the data has errors, all of them will not be written. Use Func 0x06, as the Func 0x10 command is not available during autotuning.

[Request]

Sub products address	command	writing address		number of data		Byte numbers	DATA1		DATA n		CRC16	
		high byte	low byte	high byte	low byte		high byte	low byte	high byte	low byte	low byte	high byte
1BYTE	0x10	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

[Response]

Sub products address	command	writing address		number of data		Byte numbers	CRC16	
		high byte	low byte	high byte	low byte		low byte	high byte
1BYTE	0x10	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE	1BYTE

data numbers = byte number * 2

[MAP]Func 0x03, 0x06, 0x10

NO	Address	Menu	Description	Range	Unit	Value at shipment
400001	0000	In	Sensor selection	0:PT100, 1:CA(K), 2:NTC10K		2:NTC10K
400002	0001	oUt	Output type	0 - Out1 : on/off, Out2 : PV transmit 1 - Out1 : RelayPId, Out2 : PV transmit 2 - Out1 : Alarm, Out2 : SSR PID出力 3 - Out1 : Alarm, Out2 : 전류 PID		- Out1 : On/Off output - Out2 : PV trasfer output
400003	0002	SEt	setting temperature	PT100 : −200 ~ 400℃ CA(K) : −50 ~ 1200℃ NTC10K : −55.0 ~ 99.9℃	℃	PT100 : 30.0℃ CA(K) : 30℃ NTC10K : 30.0℃
400004	0003	Cor	sensor correction of temp	PT100 / NTC10K : −19.9 ~ 19.9℃ CA(K) : −19 ~ 19℃	℃	PT100 /NTC10K : 0.0℃ CA(K) : 0℃
400005	0004	Adr	RS485address	1 ~ 99		1
400006	0005	bPS	RS485speed	1200/2400/4800/9600/19200	BPS	9600
400007	0006	CPt	control cycle	1 ~ 120	sec	20
400008	0007	Pb	proportional	PT100 / NTC10K : 0 ~ 100.0℃ CA(K) : 0 ~ 100℃	℃	PT100 / NTC10K :10.0 CA(K) : 10
400009	0008	tI	integral time	0 ~ 1999	sec	0
400010	000A	td	derivative time	0 ~ 1999	sec	0
400011	000A	rSt	steady-state error correction	PT100 / NTC10K : −100.0 ~ 100.0℃ CA(K) : −100 ~ 100℃	℃	PT100 / NTC10K :0.0℃ CA(K) : 0℃
400012	000B	RH	controlled current max. value	A.LO ~ 20mA	mA	20.0
400013	000C	RLo	controlled current min. value	0.0mA ~ A.HI	mA	4.0
400014	000D	tYP	forward/backward output	0: heater control(forward) / 1 : cooling control(backward)		0: heater control (forward)
400015	000E	dIF	output deviation temperature	PT100 / NTC10K : 0.1 ~ 19.9℃ CA(K) : 1 ~ 19℃	℃	PT100 / NTC10K : 0.1 CA(K) : 1
400016	000F	dLt	output delay time	0 ~ 1999	sec	0
400017	0010	ALS	alalrm output type	0 : AL0 / 1 : AL1		0 : AL0
400018	0011	AdF	alarm output deviation	PT100 / NTC10K : 0.1 ~ 19.9℃ CA(K) : 1 ~ 19℃	℃	PT100 / NTC10K : 0.1 CA(K) : 1
400019	0012	HPr	alarm output high limit	PT100 : LPR ~ 400℃ CA(K) : LPR ~ 1200℃ NTC10K : LPR ~ 99.9℃	℃	PT100 : 400℃ CA(K) : 1200℃ NTC10K : 99.9℃
400020	0013	LPr	alarm output low limit	PT100 : −200℃ ~ LPR CA(K) : −50℃ ~ LPR NTC10K : −55.0℃ ~ LPR	℃	PT100 : −200℃ CA(K) : −50℃ NTC10K : −55.0℃
400021	0014	t.20	PV trasmit 20mA temperature	PT100 : T.4 ~ 400℃ CA(K) : T.4 ~ 1200℃ NTC10K : T.4 ~ 99.9℃	℃	PT100 : 400℃ CA(K) : 1200℃ NTC10K : 99.9℃
400022	0015	t.4	PV trasmit 4mA temperature	PT100 : −200℃ ~ T.20 CA(K) : −50℃ ~ T.20 NTC10K : −55.0℃ ~ T.20	℃	PT100 : −200℃ CA(K) : −50℃ NTC10K : −55.0℃
400023	0016		auto-tuning control	0 : tuning completed, 1 : tuning start		0

[Exception Response] In the product whose sensor error is compensated, a command that is not supported, or when there are other errors, it returns the error information.

[Response]

Sub products address	command	Error code	CRC16	
			low byte	high byte
1BYTE	receiving command + 0x80	1BYTE	1BYTE	1BYTE

Error Code
0x01 : Command that does not support
0x02 : Start address error
0x03 : Error of the number of Data
0x04 : Abnormal processing of requested command

11 Others

* Sensor extension
 - PT100 ohm Sensor: All 3 lines should have the same material and thickness.
 - CA(K) : CA(K) : should be extended to the sensor wire or compensating cable only.
 - NTC10K : should extend using 2P shielded cable.
 => Soldering is recommended for the extended area. Poor extension areas may cause a malfunction of the sensor due to inflow of moisture, etc. Be cautious.

* Sensor error display
 o-E : If the sensor cable has been either cut in the middle, loosen the terminal connection.
 S-E : When the sensor wires make short each other.
 I -E : When the temperature sensor for compensation of the cold junction inside the product is in malfunction.

* Memory error display
 Er1 : in case an abnormal data is recorded in the non-volatile memory inside the product or damaged due to severe external noise. These settings will be changed to the factory default if you press the Set key when this mark ER1 appears.