CONOTEC®
CONOTEC CO., LTD.

Digital Temperature Controller

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USER MANUAL

FOX-2000TR

◆ Control by temp. & time
- Open/close relay control
- 1 stage/2 stage control
◆ Alarm output : **1Relay**
- High & low limit/Alarm
◆ Door open & close for a greenhouse
◆ **RS485**

1 Cautions for Safety

Please read the cautions carefully before using the product and use it correctly.
※ The specifications, sizes and etc. described in this user manual are subject to change without advanced notice to improve the performance.

⚠ **Warning**

1. As this product is not manufactured as safety equipment, make sure to use this product after mounting double safety device when using it for the purpose of controlling a device having risk of personal injury, equipment damage or huge property loss.
2. Do not cut the wire or make check-up or maintenance when the power supply is connected.
3. Make sure to check the socket number before connecting the power.
4. Never disassemble process, improve or repair this equipment.

⚠ **Cautions**

• Be well acquainted with way of operation, safety regulations and warnings and make sure to use the product in accordance with the defined specification and within the related capacity.
• Do not connect wiring or make installation with the motors or solenoids having big inductive load.
• In extending the sensor, use the same wire, and do not make it long unnecessarily.
• Do not use the parts to generate arc in opening and closing at the same or nearby power supply.
• Power cable should be kept away from high-voltage cable, and should not be installed in the place of much water, oil or dust.
• Do not install in the place exposed to direct sunlight or rain.
• Do not install in the place exposed to strong magnetism, noise, vibration and impact.
• Keep away from the place where strong alkali or strong acid material is directly discharged.
• Do not spray water directly for cleaning when installing in the kitchen.
• Do not install in the place where the temperature and humidity exceed rated range.
• Use the product not to cut the sensor line or to get flaw on it.
• Sensor line should be kept away from the signal line, power supply, driving power and load line, and independent piping should be used for it.
• This product may not be serviced when disassembled and modified as you like.
• The mark ⚠ on the wiring diagram is the safety wording for warning or caution.
• Do not use near the devices which emit strong high frequency noise (High frequency welder, High frequency sewing machine, High frequency two-way radio, High capacity SCR controller).
• If the product is used by the way other than defined by the manufacturer, it may cause personal injury or property loss.
• As it is not a toy, keep out of the reach of the children.
• The installation should be done by an expert or a qualified person.
• Our company does not assume any responsibility for the damage and loss caused by non-complying with the above warnings and cautions or through the mistakes of the consumers.

⚠ **Danger**

■ Cautions, Danger of electric shock
• Electric shock – Do not touch AC socket while the power is connected. You may get electric shock.
• Make sure to block the input power when you check the power input.

2 Models

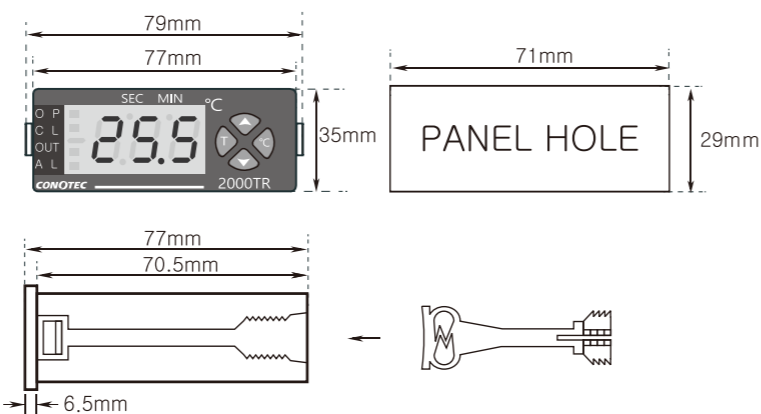| Model	Sensor	Control output	Range	Function
FOX-2000TR	FS-200N (NTC 10K)	Relay contact MAX : 250Vac 2A	-55.5 ℃ ~ 99.9℃	- Control by temp. & time - Alarm - RS-485

3 Name of each parts

1 Second display
2 Open display
3 Close display
4 Relay output
5 Alarm display
6 Minute display
7 Time setting switch
8 Increasing switch
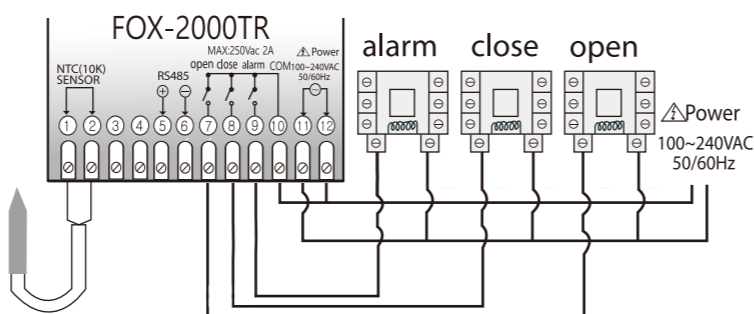9 Temp. setting switch
10 Decreasing switch

Function of Operating Key

1. : KEY for temperature setting & program change
2. T : KEY for time setting change
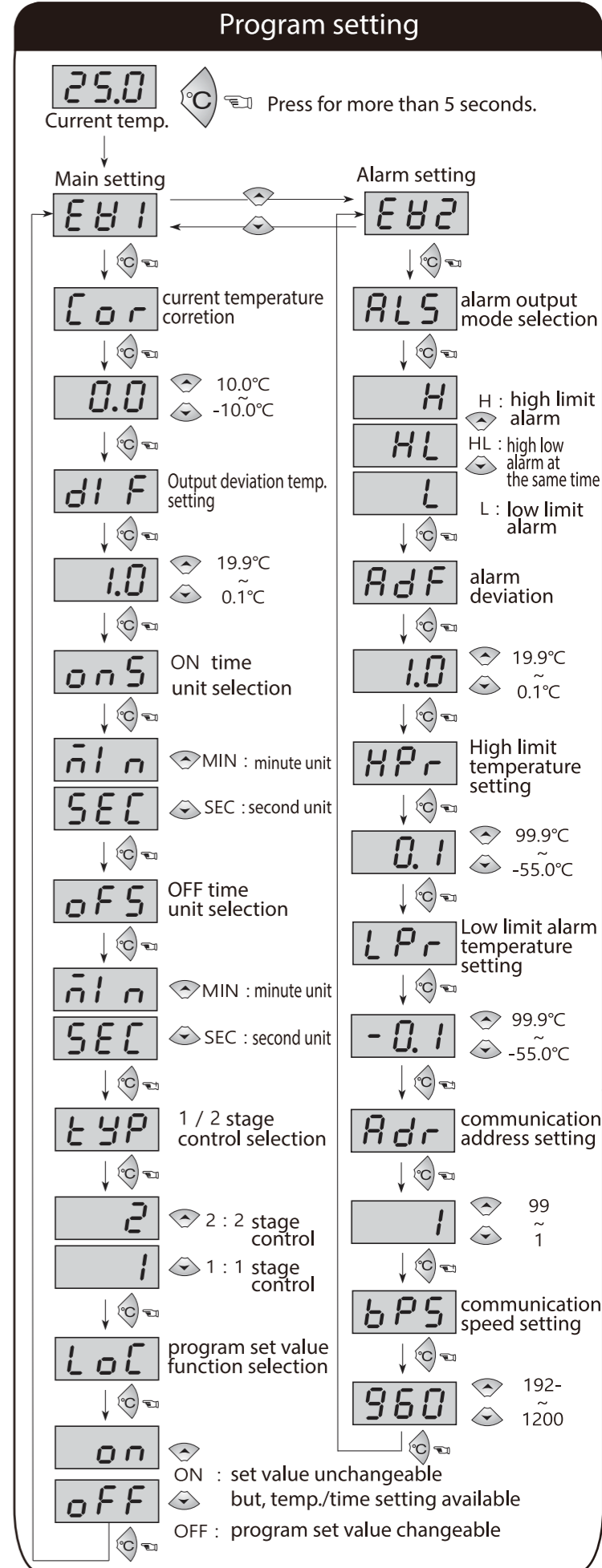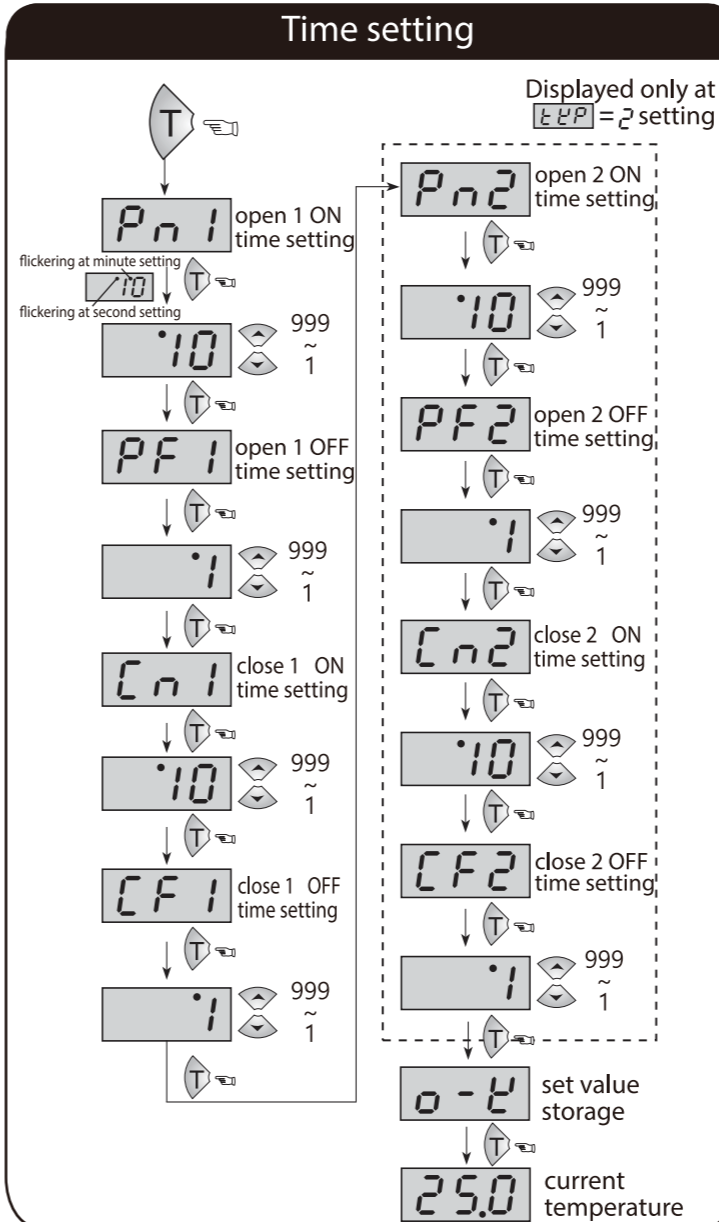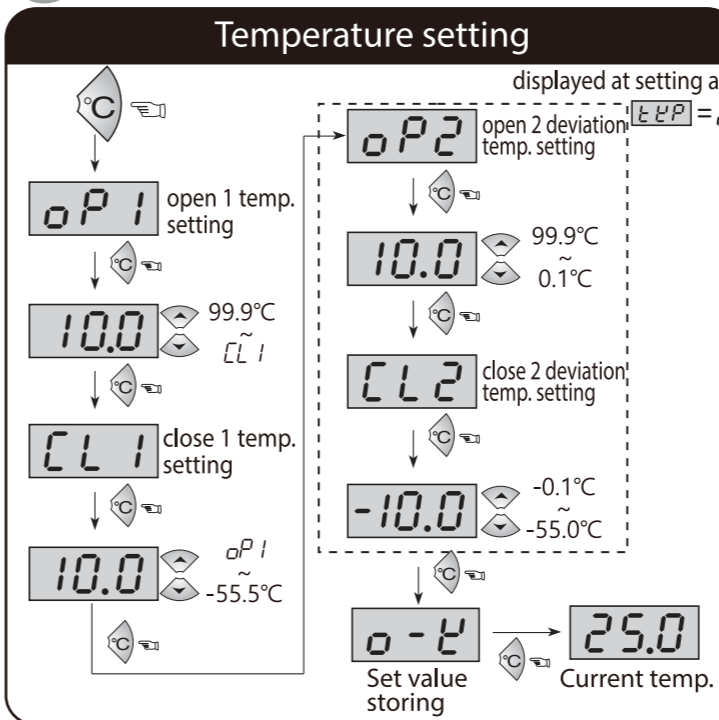3. : KEY for Data change per each setting value

4 Dimension & Panel size

79mm
77mm
35mm
71mm
PANEL HOLE
29mm
77mm
70.5mm
6.5mm

5 Wiring diagram

FOX-2000TR
NTC(10K) SENSOR
RS485
MAX:250Vac 2A
open close alarm COM100~240VAC 50/60Hz
alarm   close   open
⚠Power
100~240VAC 50/60Hz

※ The capacity of relay connection is below 250VAC 10A.
Be careful as using the load exceeding the capacity of the junction may cause bonding of the junction, contact failure, breakage of the relay and etc.

6 Set Value Change Sequence

Temperature setting

°C

oP1 open 1 temp. setting
10.0 99.9℃ ~ CL1
CL1 close 1 temp. setting
10.0 oP1 ~ -55.5℃

displayed at setting as tYP = 2

oP2 open 2 deviation temp. setting
10.0 99.9℃ ~ 0.1℃
CL2 close 2 deviation temp. setting
-10.0 -0.1℃ ~ -55.0℃

o-t Set value storing
25.0 Current temp.

Time setting

T

Pn1 open 1 ON time setting
flickering at minute setting
flickering at second setting
'10 999 ~ 1
PF1 open 1 OFF time setting
'1 999 ~ 1
Cn1 close 1 ON time setting
'10 999 ~ 1
CF1 close 1 OFF time setting
'1 999 ~ 1

Displayed only at tYP = 2 setting

Pn2 open 2 ON time setting
'10 999 ~ 1
PF2 open 2 OFF time setting
'1 999 ~ 1
Cn2 close 2 ON time setting
'10 999 ~ 1
CF2 close 2 OFF time setting
'1 999 ~ 1

o-t set value storage
25.0 current temperature

Program setting

25.0 Current temp. °C Press for more than 5 seconds.

Main setting

EH1
Cor current temperature correction
0.0 10.0℃ ~ -10.0℃
dIF Output deviation temp. setting
1.0 19.9℃ ~ 0.1℃
onS ON time unit selection
nin MIN : minute unit
SEC SEC : second unit
oFS OFF time unit selection
nin MIN : minute unit
SEC SEC : second unit
tYP 1 / 2 stage control selection
2 2 : 2 stage control
1 1 : 1 stage control
LoC program set value function selection
on ON : set value unchangeable but, temp./time setting available
oFF OFF : program set value changeable

Alarm setting

EH2
ALS alarm output mode selection
H H : high limit alarm
HL HL : high low alarm at the same time
L L : low limit alarm
AdF alarm deviation
1.0 19.9℃ ~ 0.1℃
HPr High limit temperature setting
0.1 99.9℃ ~ -55.0℃
LPr Low limit alarm temperature setting
-0.1 99.9℃ ~ -55.0℃
Adr communication address setting
1 99 ~ 1
bPS communication speed setting
960 192- ~ 1200

※ Press the Key continuously for 5 seconds under the current temperature indicating condition to change to Program Setting Mode.
※ All the programs are to be either completed or automatically returned to current temperature after 60 seconds by continuously pressing the Key for 2 seconds after completion of setting procedure.
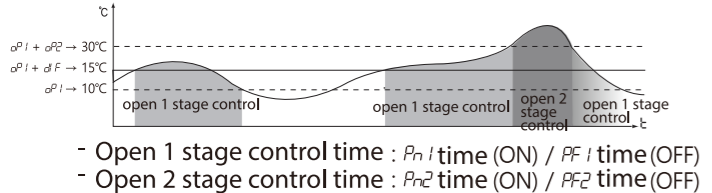
1. `oP1` : Open 1 temperature setting
   - Operates at the current temperature higher than setting value(`oP1`)
   ex) `oP1` = 30.0℃, `dIF` = 5.0℃, `tYP` = 1

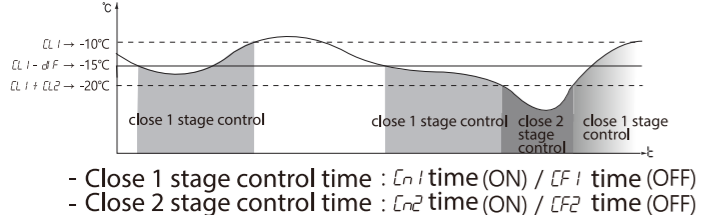   - Close 1 stage control time : `Pn1` time (ON) / `PF1` time (OFF)
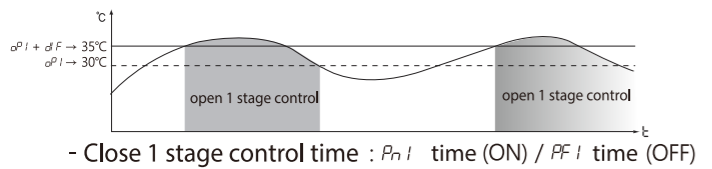
2. `CL1` : Close 1 temperature setting
   - Operates at the current temperature lower than setting value(`CL1`)
   ex) `CL1` = -10.0℃, `dIF` = 5.0℃, `tYP` = 1

   - Close 1 stage control time : `Cn1` time (ON) / `CF1` time (OFF)
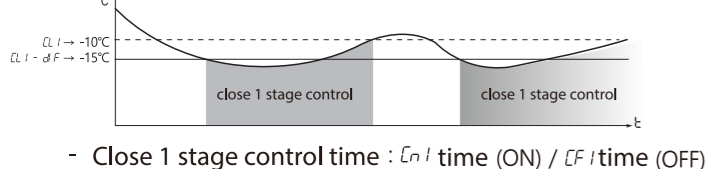
3. `oP2` : Open 2 deviation temperature setting
   - Operates at the current temperature is higher than the set value (`oP1` + `oP2`)
   ex) `oP1` = 10.0℃, `dIF` = set at 5.0℃
   If setting `oP2` as 20.0℃, the set value will be (`oP1` + 20.0℃)
   - `tYP` : Displays only at setting 2

   - Open 1 stage control time : `Pn1` time (ON) / `PF1` time (OFF)
   - Open 2 stage control time : `Pn2` time (ON) / `PF2` time (OFF)

4. `CL2` : Close 2 deviation temperature setting
   - Operates at the current temperature is lower than the set value (`CL1` + `CL2`)
   ex) `CL1` = -10.0℃, `dIF` = set at 5.0℃
   If setting `CL2` as -10.0℃, the set value will be (`CL1` - 10.0℃)
   - `tYP` : Displays only at setting 2

   - Close 1 stage control time : `Cn1` time (ON) / `CF1` time (OFF)
   - Close 2 stage control time : `Cn2` time (ON) / `CF2` time (OFF)

5. `Pn1` : Open 1 operation ON time setting
   - Output ON time when it is satisfied with the terms of No.1 `oP1`

6. `PF1` : Open 1 operation OFF time setting
   - Output OFF time after time elapsed of No. 5 `Pn1`

   [`Pn1` = 10S, `PF1` = 20S]

7. `Cn1` : Close 1 operation ON time setting
   - Output ON time when it is satisfied with the terms of No.2 `CL1`

8. `CF1` : Open 1 operation OFF time setting
   - Output OFF time after time elapsed of No. 7 `Pn1`
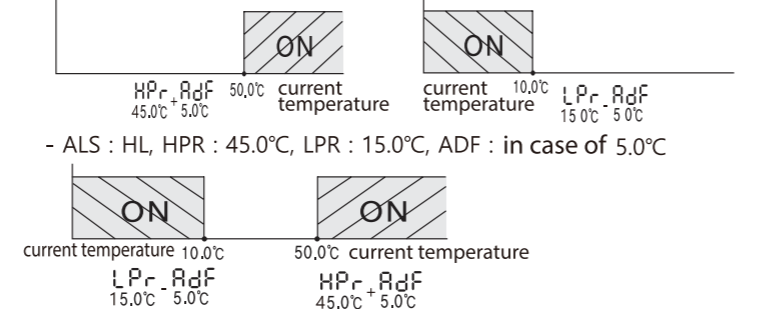

   [`Cn1` = 10S, `Cn2` = 20S]

9. `Pn2` : Open 2 operation ON time setting
   - Output ON time when it is satisfied with the terms of No.3 `oP2`

10. `PF2` : Close 1 operation ON time setting
    - Output OFF time after time elapsed of No. 9 `Pn2`

    [`Pn1` = 20S, `PF1` = 30S]
    [`Pn2` = 10S, `PF2` = 10S]

When the current temperature is more than the value 1 stage and 2 stage, 2 stage control takes priority.

11. `Cn2` : Close 2 operation ON time setting
    - Output ON time when it is satisfied with the terms of No. 4 `CL2`

12. `CF2` : Close 2 operation OFF time setting
    - Output OFF time after time elapsed No. 11 `Cn2`

    When the current temperature is lower than 1 and 2 stage set values, 2 stage control takes priority.

    [`Cn1` = 20S, `CF1` = 30S]
    [`Cn2` = 10S, `CF2` = 10S]

13. `dIF` : Output deviation temperature setting
    - By operating the ON/OFF frequently, the relay or its output contact can be damaged quickly. So it needs a deviation temperature setting to protect hunting from the external noise, etc.,

14. `Cor` : Current temperature correction
    - Correction errors in the sensor put in from the outside and different with the base temperature.
    e.g) actual value : 10.0℃
    displayed value : 12.0℃ → `Cor` : 0.0 → correct to -2.0 : displays to 10.0℃

15. `onS` : Output ON time unit selection 16. `oFS` : Output OFF time unit selection

    `SEC` : second unit   `nln` : minute unit

17. `tYP` : Control method selection
    - 1 : 1 stage setting & 1 stage control only
    - 2 : 1 stage setting / 2 stage setting & 1 stage control / 2 stage control
    When the current temperature is higher than 1 and 2 stage set values, 2 stage control takes priority.

18. `Loc` : Program set value lock function
    - As a safety menu, in order not to change the set values except for the main user.

19. `ALS` : Alarm output selection
    - Menu for selection the high, low limit output mode when using an alarm
    `H` : High limit alarm (in case of selection this mode, low limit alarm is not applied)
    `HL` : High /low limit alarm output(High or low limit alarm both applied)
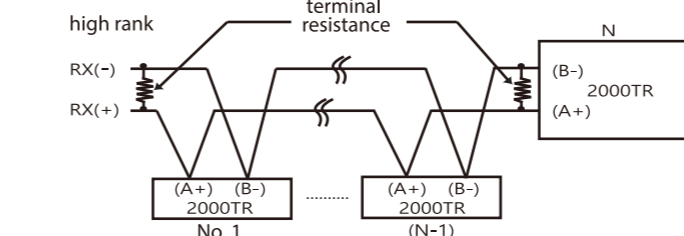   `L` : Low limit alarm output(If selects this mode, high limit alarm is not applied)

    - ALS : H, HPR : 45.0℃, ADF : in case of 5.0℃   - ALS : L, LPR : 15.0℃, ADF : in case of 5.0℃

    - ALS : HL, HPR : 45.0℃, LPR : 15.0℃, ADF : in case of 5.0℃

20. `AdF` : Alarm deviation setting
    Menu for protection the devices' contact and etc., through the regular interval ON/OFF of an alarm relay like deviation temperature setting.

21. `HPr` : High limit alarm temp. setting 22. `LPr` : Low limit alarm temp. setting
    - Menu for setting the high limit alarm   - Menu for setting the low limit alarm

23. `Adr` : Communication code setting
    - Menu for setting the communication code(1~99)

24. `bPS` : Communication speed setting
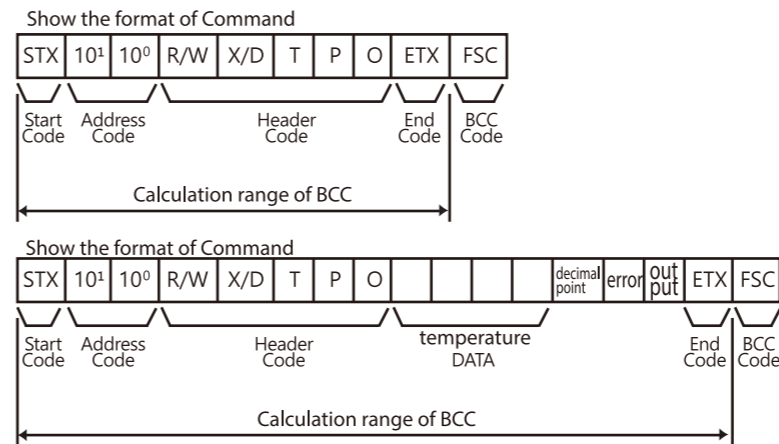   - Menu for setting the communication speed (1200, 2400, 4800, 9600, 19200 optional)

8 RS-485 communication output

Interface

Applied standard	EIA RS485
Max.number of occupations	32 units(but, Address setting : 01~99)
Communication method	2-wire half duplex
Synchronized system	Asynchronous system
Communication distance	Within 1.2 Km
Communication speed	1200/2400/4800/9600/19200bps(optional)
Start Bit	Fixed as 1bit
Stop Bit	Fixed as 1bit
Parity Bit	None
Data Bit	Fixed as 8bit
Protocol	BCC

System Composition

Definition of communication Command and Block

Show the format of Command

Calculation range of BCC

Show the format of Command

Calculation range of BCC

① Start Code : Show the lead(head) of the Block
   STX → [02H], ACK will be added in case of Response.
② Address Code : Channel Code for high rank to identify 2000TR ,
   1~99(BCD ASCⅡ) Setting available within the range
③ Header Code : Displays the name of Command as a character
   RX(reading demand) → R[52H], X[58H]
   RD(reading response) → R[52H], D[44H]
   WX(writing demand) → W[57H], X[58H]
   WD(writing response) → W[57H], D[44H]
   TPO(temperature measured value) → T[54H], P[50H], O[30H]
④ Data composition : temperature data : 16 decimal number data character string

   ASCII character string receives '0' '4' 'D' '2'→Convert to 10 decimal number from 0x04D2 : 1234
   ASCII character string receives 'F' 'B' '2' 'B'→ Convert to 10 decimal number from 0xFB2B : -1234
   (Negative number : calculation of complement on 2)

⑤ Decimal point → 0[30H] No decimal point , 1[31H] Has decimal point
⑥ Error → 0[30H] no error, 1[31H] open error, 2[32H] short error
⑦ Output

	OP(open)	CL(close)	OUT(output)	AL(alarm)
0[30H]	X	X	X	X
1[31H]	X	X	X	O
2[34H]	X	O	X	X
3[35H]	X	O	X	O
4[36H]	X	O	O	X
5[37H]	X	O	O	O
6[38H]	O	X	X	X
7[39H]	O	X	X	O
8[3AH]	O	X	O	X
9[3BH]	O	X	O	O

⑧ END Code : It shows the end of BLOCK content. ETX → [03H]
⑨ BCC : It is an abbreviation of Block Check Character, and it shows XOR calculation value from the start of protocol(STX) to end of protocol(ETX).
• Others : When there's no ACK response.
  ① When the code is not correct after receipt of STX.
  ② When Receive Buffer Overflow occurs.
  ③ When Baud rate or other communication set values are not correct.
• Treatment when no ACK response.
  ① Check the line situation
  ② Check communication condition(set value)
  ③ If communication problem is caused by noise, execute communication around 3 times until it is recovered.
  ④ If frequent communication problem occurs, adjust communication speed.

9 Setting range & set value at factory

Function	Display	Range	Value at factory	Remark
Temp. setting	`oP1`	`CL1` ~ 99.9℃	10.0℃	open 1 temperature
	`CL1`	-55.0℃ ~ `oP1`	10.0℃	close 1 temperature
	`oP2`	0.1℃ ~ 99.9℃	10.0℃	open 2 deviation temperature
	`CL2`	-55.0℃ ~ -0.1℃	-10.0℃	close 2 deviation temperature
Time setting	`Pn1`	1 ~ 999	10	open 1 operation ON time
	`PF1`	1 ~ 999	1	open 1 operation OFF time
	`Cn1`	1 ~ 999	10	close 1 operation ON time
	`CF1`	1 ~ 999	1	close 1 operation OFF time
	`Pn2`	1 ~ 999	10	open 2 operation ON time
	`PF2`	1 ~ 999	1	close 2 operation OFF time
	`Cn2`	1 ~ 999	10	close 2 operation ON time
	`CF2`	1 ~ 999	1	close 2 operation OFF time
Program setting [E V 1]	`Cor`	-10.0℃ ~ 10.0℃	0.0℃	correction difference from display and actual value
	`dIF`	0.1℃ ~ 19.9℃	1.0℃	output deviation temp. setting `tYP` = 2 deviation not applied
	`onS`	SEC , `nln`	SEC	time unit setting `SEC` : sec / `nln` : min
	`oFS`	SEC , `nln`	`nln`	time unit setting `SEC` : sec / `nln` : min
	`tYP`	1 / 2	1	1 stage/2 stage control selection
	`LoC`	on / oFF	oFF	`on` : function setting `oFF` : function OFF but, except for temp. /time setting
Program setting [E V 2]	`ALS`	L , HL , H	HL	`H` : high limit alarm `HL` : high, low limit alarm `L` : low limit alarm
	`AdF`	0.1℃ ~ 19.9℃	1.0℃	alarm temperature deivation
	`HPr`	-55.0℃ ~ 99.9℃	99.9℃	high limit alarm temp.
	`LPr`	-55.0℃ ~ 99.9℃	-55.0℃	low limit alarm temp.
	`Adr`	1 ~ 99	1	communication address setting
	`bPS`	1200 / 2400 / 4800 / 9600 / 192-	9600	communication speed setting

10 Simple Fault Diagnosis method

In case ERROR is displayed during product operation

- `Erl` is displayed when inside memory cell of various data is damaged by strong noise from outside during the product operation.
  Please ask for A/S to our company in this case.
- This controller is prepared for the external noise, but cannot endure the noise without limit.
- In case the noise of 2KV or more flows in, the inside of the product may be damaged.
- In case `o-E` (open error) or `S-E` (short error) is displayed, the sensor has problem. Check the sensor.

※ The above product specifications are subject to change without advanced notice to improve the performance.
Please be well-acquainted with and keep the above-mentioned cautions.

※ This device works proper operation with :
  Ambient Temp : 0 ~ 60℃
  Ambient Humi. : below 80%RH
  Regular power : 220VAC ±10% 50/60Hz

  ■ Main product and development
  -Digital temp./humi. controller
  -Digital timer,Current/Voltage meter
  -Development of other products.