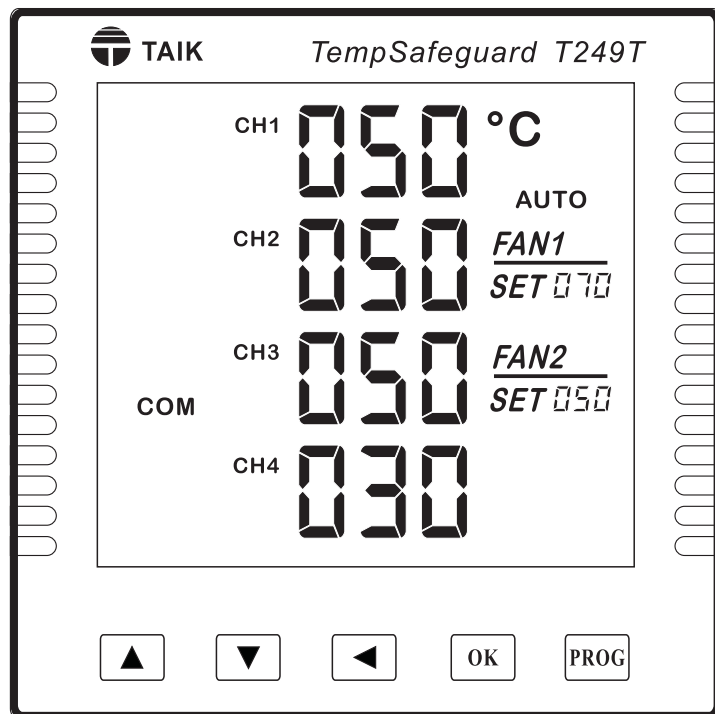


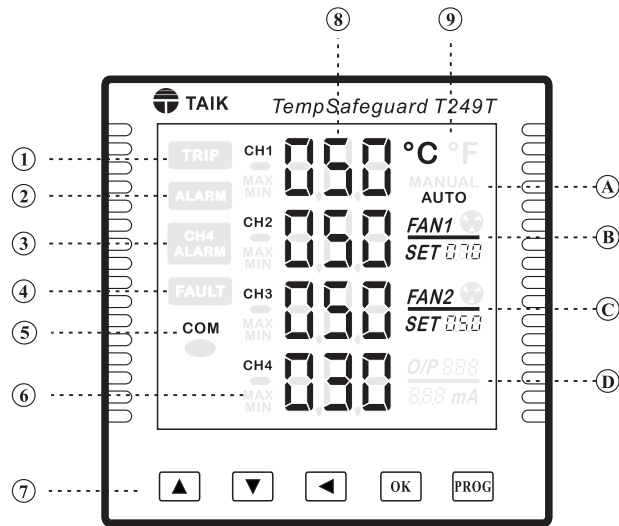
T249T

Instruction Manual



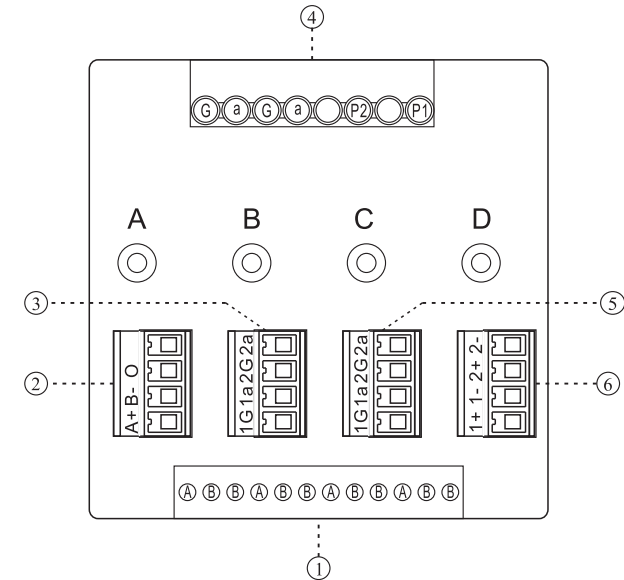
1. Exterior

1.1 Front Plate



- ① Trip energizing status
- ② Alarm energizing status
- ③ Alarm energizing on Channel 4
- ④ Faults status
- ⑤ RS 485 transmission status
(It is illuminated during a successful connection)
- ⑥ Max/Min temp measurements
- ⑦ Operation buttons
- ⑧ Temp measurements on CH1-4
- ⑨ Measurement units
- A Auto or Manual mode for FAN 1-2 On-Off
- B FAN 1 threshold value, is illuminated as FAN 1 is energized
- C FAN 2 threshold value, is illuminated as FAN 2 is energized
- D DC 4-20mA corresponds to the selected mode, and the present outputting values

1.2 Terminal Blocks

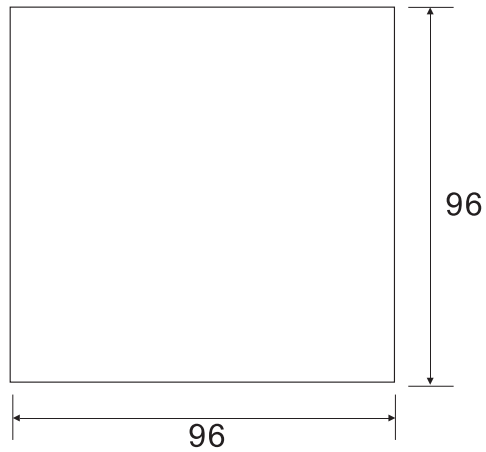


- ① Temp inputs from CH 1 ~ 4
- ② RS 485 interface
- ③ Relay contacts, Relay 1 (1G 1a): Trip ; Relay 2(2G 2a): Alarm
- ④ Aux. power supply and FAN 1-2
- ⑤ Relay contacts, Relay 1 (1G 1a): Alarm for CH4 ; Relay 2(2G 2a): Faults
- ⑥ Analog output (DC 4-20mA)

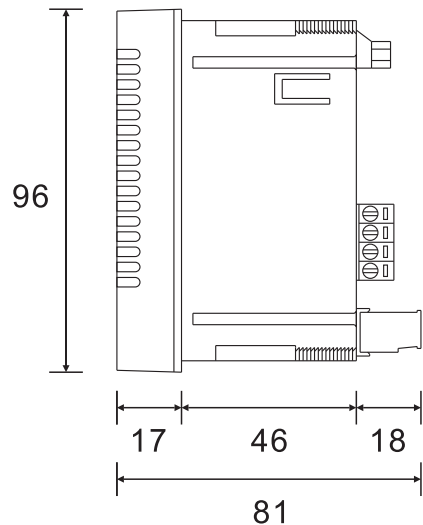
2. Installation and Wiring:

2.1 Dimension: Unit (mm)

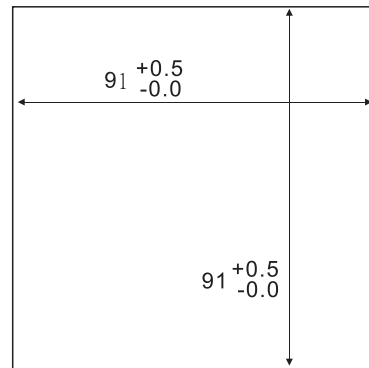
- Rear view



- Side view

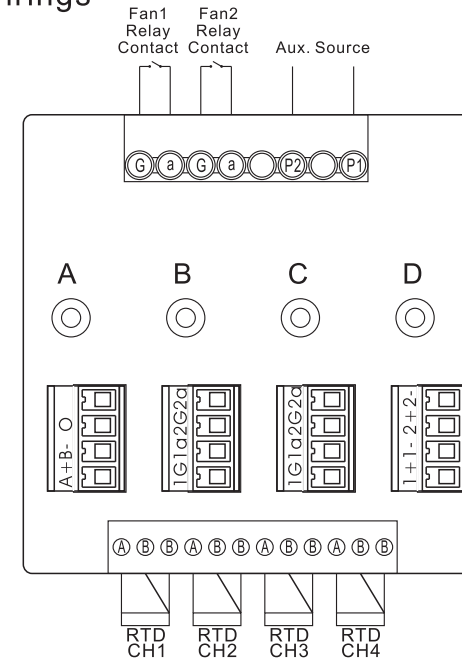


- Cut-out

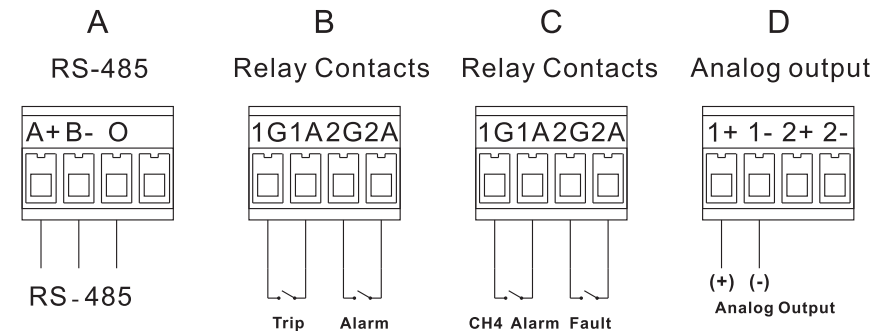


2.2 Wiring:

- Entire wirings



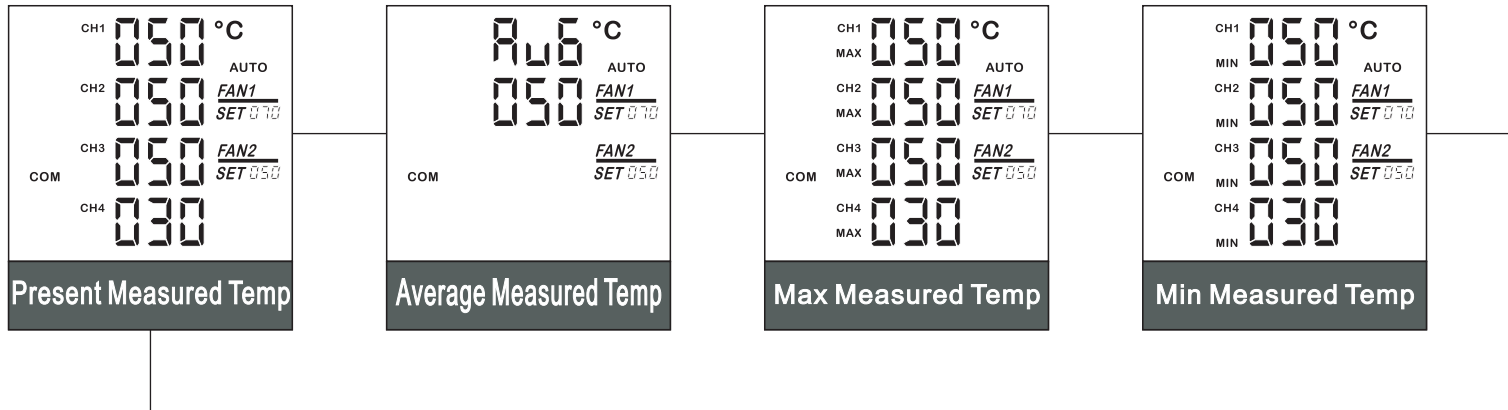
- Outputs



Relay contacts positioned under the slot B.
 Relay 1 (1G 1a): Trip ; Relay 2(2G 2a): Alarm
 Relay contacts positioned under the slot C.
 Relay 1 (1G 1a): Alarm for CH4 ; Relay 2(2G 2a): Faults

3. Main Measured Displays and Operation Buttons:

3.1 Main Measured Displays:



*This page won't be shown on display until 1-3 Au6 is set to Y

*This page won't be shown on display until HL dP is set to Y

● Functions of Buttons:

PROG Press: Shift to the next main measured display
Hold: Enter SETUP with password

OK Presence of the Max Measured Temp:
Hold for clearance of the max value
Presence of the Min Measured Temp:
Hold for clearance of the min value

◀ Hold for shift to the Manual or Auto mode during the presence of the main measured display

▼ Press for FAN 2 relay contact to be energized in manual mode, and press again to be de-energized

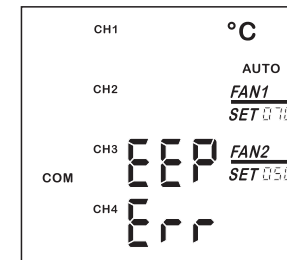
▲ Press for FAN 1 relay contact to be energized in manual mode, and press again to be de-energized

3.2 Unit Conversion:

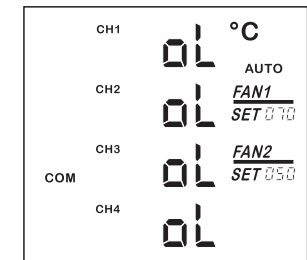
$$1^{\circ}\text{F} = 1^{\circ}\text{C} * 1.8 + 32$$

3.3 Fault Indication:

Internal Memory Error



Temp Sensor Incorrect Connection

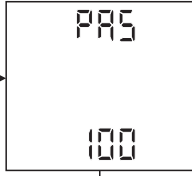


The indication of **FAULT** will be displayed as the above faults happen, and meanwhile the contact relay designated for fault will be energized.

4. Setup and Operation Buttons:

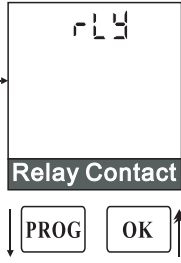
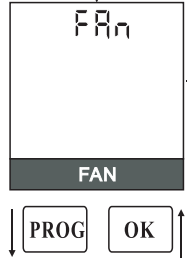
4.1 Access to Setup

Hold **PROG**



Default value is set to 1000

OK



● Functions of Buttons:

Main Configuration

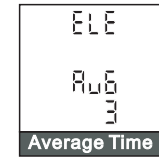
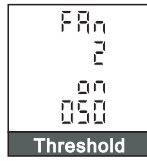
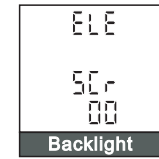
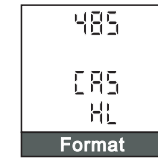
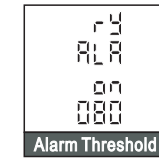
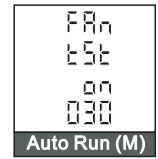
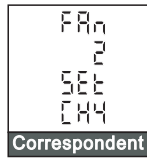
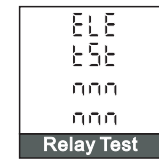
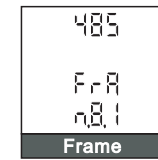
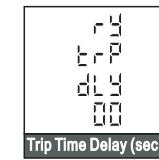
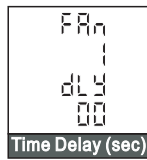
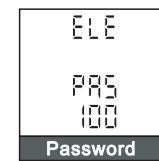
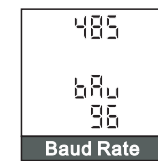
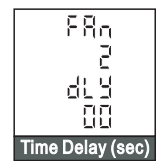
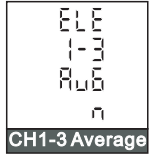
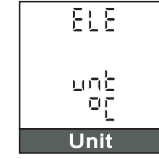
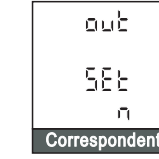
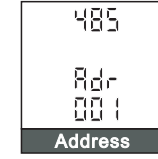
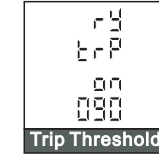
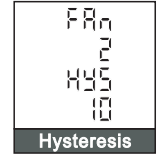
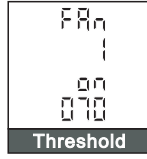
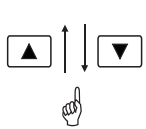
- Shift to the next configuration
- PROG** Access to the sub configuration
- OK** Return to the main measured display

Sub Configuration

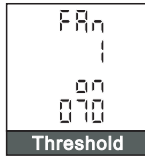
- Shift to the upper configuration
- Shift to the next configuration
- PROG** Access to the value/mode settings
- OK** Return to the main configuration

Value/Mode Settings

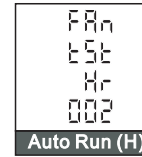
- Increase value
- Decrease value
- Shift the digit position
- OK** Confirm setting then return the sub configuration



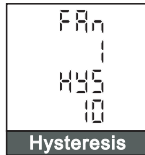
4.2 Functions of Sub Configuration



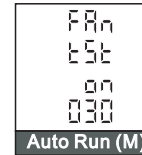
FAN 1 energized/threshold value
Set from 0-400



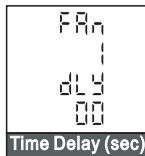
Auto-Running in interval period (Hour)
Set from 1-999



FAN 1 hysteresis, the set value is
dead band for de-actuated status
Set from 0-99



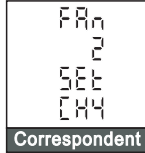
Auto-Running time (minute)
Set from 0-999



FAN 1 starts to be energized after
reaching the set time delay
Set from 0-99



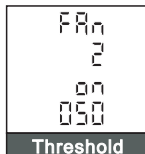
Trip energized/threshold value
Set from 0-400



FAN 2 corresponds to the selected mode
n: Disabled, 1-3: Channel 1-3 Temp,
CH4: Channel 4 Temp



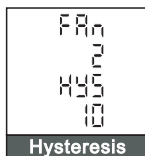
Trip Hysteresis, the set value is
dead band for de-actuated status
Set from 0-99



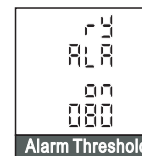
FAN 2 energized/threshold value
Set from 0-400



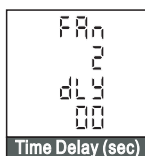
Trip Time Delay starts to be energized
after reaching the set time delay
Set from 0-99



FAN 2 hysteresis, the set value is
dead band for de-actuated status
Set from 0-99



Alarm energized/threshold value
Set from 0-400



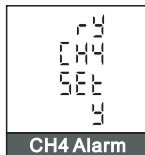
FAN 2 starts to be energized after
reaching the set time delay
Set from 0-99



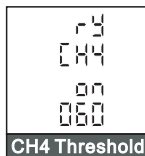
Alarm Hysteresis, the set value is dead band for
de-actuated status
Set from 0-99



Alarm Time Delay starts to be energized after reaching the set time delay
Set from 0-99



Ch4 Alarm enabled/disabled
n: disabled y: enabled



Ch4 Threshold energized/threshold value
Set from 0-400



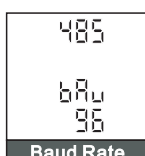
Ch4 Hysteresis, the set value is dead band for de-actuated status
Set from 0-99



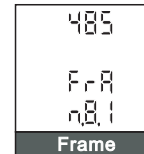
Ch4 Time Delay starts to be energized after reaching the set time delay
Set from 0-99



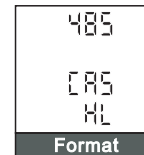
RS 485 Address
Set from 1-255



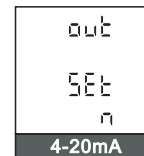
RS 485 Frame
12 : 1200 24 : 2400 48 : 4800
96 : 9600 192 : 19200 384 : 38400



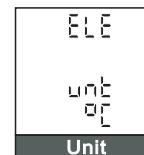
Floating Point Value
n.8.2 o.8.1 e.8.1 n.8.1



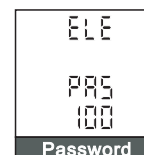
Swap High/Low Word in order
LH: Transmit Low Word first, High Word subsequently
HL: Transmit High Word first, Low Word subsequently



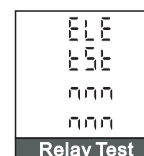
4-20mA Correspondent
n: Disabled CH1, CH2, CH3, Ch4,
Avg: Average on CH1-2-3,
Hi: Max value among CH1-2-3
* DC 4-20mA only corresponds a fixed 0-200°C



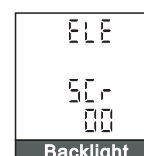
Measurement Unit
°C °F
(Max/Min measured value has to be cleared after changing the unit)



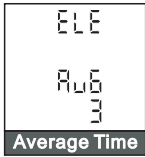
Password
0-999



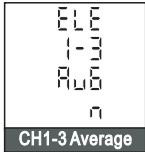
Relay Contact On/Off Test
n: Off 1:FAN 1 On 2:FAN 2 On 4:CH4 Alarm On
A:Alarm On T:Trip On F:Fault On
While your access to this setting, the shown " n " positioned in the downside and right corner is blinking, pressing up or down button to energize/de-energize the relay contact.



Backlight will be turned off after the time is set in minute without pressing any button set from 0-99 (0: Keep illuminating)



Average Sampling Times
Set from 1-99



Average on CH1-2-3
Appearing on main measured display
n: Disabled Y: Enabled



Max/Min Measured Temp
Appearing on main measured display
n: Disabled Y: Enabled



Indicate program version (non-setup)

5. General Data

- LCD graphical display:
 - Format 3" large graphical backlit LCD
 - Temp 4 rows of 3 digits represented for Channel 1 to 4
 - Icons and symbols RS 485 transmission, analog output value, temp units, temp channel, internal fault, alarm, trip, fan start-up setup
- Auxiliary power supply:
 - Operation range AC/DC85-265V
 - Frequency 45-65Hz
 - Power consumption $\leq 15VA$
(Testing during all outputs being fully energized)
- Temp. sensor input:
 - Type Platinum RTD 3-Wire,PT100,PT500,PT1000
 - Measuring range -200-600°C
available on T249T
 - Tolerance loss Class A according to EN 60751
- Communication interface:
 - Interface RS485
 - Terminal position Slot A
 - Protocol MODBUS RTU
 - Baud rate 1200 ~ 38400
 - Address range 1 ~ 255
 - Data format N,8,1/N,8,2/O,8,1/E,8,1
 - Parallel limit 32 Units
- Analog output:
 - Terminal position Slot D
 - Output signal Isolated DC 4-20mA corresponds to a fixed 0-200°C
 - Correspondent Individual from CH1 to CH4, Average on CH1-2-3, Max value among CH1-2-3
 - Output resistance $\leq 350\Omega$
 - Accuracy $\pm 0.25\%R.O.$
- Relay contact:
 - Terminal position Slot B: Relay 1- Trip、Relay 2-Alarm
Slot C: Relay 1-CH4 Alarm、Relay 2- Fault Fan1, Fan2
 - Relay contact form Form A (N.O.)
 - Correspondent FAN 1, FAN2, Trip, Alarm, CH4 Alarm、Fault
 - Setting range 0-400
 - Rated capacity Fan1, Fan2 : AC250V 10A、DC30V 7A
Others : AC250V 5A、DC30V 5A
- Environment Temperature:
 - Operating temperature 0-60°C
 - Max humidity 5-95%RH,(Non-condensing)
 - Storage temperature -10-70°C
- Electrical feature:
 - Sampling time 0.5 Sec.
 - IP enclosure IP54 front, IP20 rear
 - Dielectric strength Input/Output/Power AC2KV, 1min
Terminals/Case AC3KV, 1min
 - Insulation resistance Input/Output/Power/Case
DC500V $\geq 100M\Omega$

Electromagnetic compatibility (EMC)

Conducted emission	EN 55011
Radiated emission	EN 55011
Harmonic current emissions	EN 61000-3-2
Voltage changes, voltage fluctuations, and flicker	EN 61000-3-3
Electrostatic discharge	IEC61000-4-2
Electromagnetic field immunity	IEC61000-4-3
Electrical fast transient/burst immunity	IEC61000-4-4
Surge immunity	IEC61000-4-5
Immunity to conducted disturbances	IEC61000-4-6
Power frequency magnetic field immunity	IEC61000-4-8
Short interruptions and voltage variations immunity	IEC61000-4-11
Certificate CE	

6. Communication

6.1 Protocol:

The meters connected more than 30pcs shall use a repeater while the interface is communicated by using Modbus Protocol.

6.2 Transmission

RTU MODE

6.3 Communication:

RS 485 Half-Duplex

6.4 Modbus Frame:

6.4.1 Basic frame: Hexadecimal

Start of frame	Address Field	Function Code	Data Field	Error Check	End of Frame
----------------	---------------	---------------	------------	-------------	--------------

Start of frame : The data is not transmitted by a silent period of at least 4 characters.

Address field : The address field is valid in the range of 1-255.
The address 0 for broadcast command is only valid for Function Code → H, but it would not reply to any message.

Function code: 03H → Read Holding Registers.
06H → Write single Holding Register.

Data field : The start address of a register, and it contains the requested WORD to be read or the values to be written.

Error check : 16bit CRC.

End of frame : The data is not transmitted by a silent period of at least 4 characters.

6.4.2 Bit per byte: Access to the flowchart of 485 FrA under Sub Configuration for Setting.

Start Bit	DataBit	Parity	Stop	Frame
1	8	None	2	N,8,2
1	8	Odd	1	O,8,1
1	8	Even	1	E,8,1
1	8	None	1	N,8,1

6.5 Read Input Registers:

Query:

Start of Frame	Address Field	Function Code	Start Address Hi	Start Address Lo	Number of Word Hi	Number of Word Lo	Error Check	End of Frame
	01H ~ FFH	03H	0 ~ nnH	0 ~ nnH	0H	1 ~ nnH	CRC Lo CRC Hi	
	1 Byte	1 Byte	2 Byte		2 Byte		2 Byte	

Response : (The command shall be correct)

Start of Frame	Address Field	Function Code	Number of Data Byte Count	D0 , D1...Dn (Hi , Lo , Hi , Lo.....)	Error Check	End of Frame
	01H ~ FFH	03H			CRC Lo CRC Hi	
	1 Byte	1 Byte	1 Byte		2 Byte	

6.6 Write Input Registers : A single WORD for Writing Command

Query:

Start of Frame	Address Field	Function Code	Start Address Hi	Start Address Lo	Value Hi..	Value ..Lo	Error Check	End of Frame
	01H ~ FFH	06H	0 ~ nnH	0 ~ nnH	Setting Value		CRC Lo CRC Hi	
	1 Byte	1 Byte	2 Byte		2 or 4 Byte		2 Byte	

Response : (The command shall be correct)

Start of Frame	Address Field	Function Code	Start Address Hi	Start Address Lo	Value Hi..	Value ..Lo	Error Check	End of Frame
	01H ~ FFH	06H	0 ~ nnH	0 ~ nnH	Setting Value		CRC Lo CRC Hi	
	1 Byte	1 Byte	2 Byte		2 or 4 Byte		2 Byte	

6.7 Errors : Command Errors

Start of Frame	Address Field	Function Code	Error Code	Error Check	End of Frame
	01H ~ FFH	83H or 86H		CRC Lo CRC Hi	
	1 Byte	1 Byte	1 Byte	2 Byte	

- Function Code : Response to the received Function Code but MSB being set to 1, eg 03H → 83H.
- Error Code :
01 : Error Function.
02 : Error Data Address.
03 : Error Data Value.

6.8 CRC Calculation :

The CRC is calculated on all the bytes of a message from the address field to the last data bytes inclusively. It means a message frame in error if a packet in the final CRC check could not be valid for combination. A typical message frame is being started from the address field to the end of data field.

CRC Performing

1. Load a CRC register with xxxx.
2. Exclusive OR the first 8bit byte of the message with the low order byte of the 16 bit CRC register, subsequently putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero filling the MSB. Extract and examine the SLSB.
4. Repeat step 3 if the SLSB = 0. Exclusive OR the CRC register with the polynomial if the SLSB = 0, subsequently putting the result in the CRC register.
5. Repeat Steps 3 and 4 until 8 shifts have been performed.
6. Repeat Steps 2 through 5 for the next 8 bit byte of the message. Continue doing this until the 2 bytes have been processed.
7. When the CRC is placed into the message, its upper and lower bytes must be swapped.

CRC Checking

The returned CRC register is as unsigned short int. The start address and the data field have transmitted, and the returned CRC register with the low and high bytes has been swapped.

```
/*CRC Generation Function with 'C' language*/
/* Msg: *message to calculate CRC upon*/
/* usDatalen: number of bytes in message*/
unsigned int CRC16(char *Msg,unsigned char usDatalen)
{
    unsigned char uchCRCHi = 0xFF; /*CRC high byte*/
    unsigned char uchCRCLo = 0xFF; /*CRC low byte*/
    unsigned char uIndex;
    while (usDatalen--)/ *pass through message buffer*/
    {
        uIndex=uchCRCHi^*Msg++; /*calculate the CRC*/
        uchCRCHi=uchCRCLo^uchCRCHi [ uIndex];
        uchCRCLo=uchCRCLo [ uIndex ];
    }
}
return (uchCRCHi<<8| uchCRCLo );
```

```
static unsigned char auchCRCHi[]={
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,
0x00,0xc1,0x81,0x40,0x00,0xc1,0x81,0x40,0x01,0xc0,
0x80,0x41,0x01,0xc0,0x80,0x41,0x00,0xc1,0x81,0x40,
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x00,0xc1,
0x81,0x40,0x01,0xc0,0x80,0x41,0x01,0xc0,0x80,0x41,
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x00,0xc1,
0x81,0x40,0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40,0x00,0xc1,0x81,0x40,
0x01,0xc0,0x80,0x41,0x01,0xc0,0x80,0x41,0x00,0xc1,
0x81,0x40,0x01,0xc0,0x80,0x41,0x00,0xc1,0x81,0x40,
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,
0x00,0xc1,0x81,0x40,0x00,0xc1,0x81,0x40,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,
0x01,0xc0,0x80,0x41,0x00,0xc1,0x81,0x40,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,
0x00,0xc1,0x81,0x40,0x01,0xc0,0x80,0x41,0x01,0xc0,
0x80,0x41,0x00,0xc1,0x81,0x40};
```

6.9 Data address: Integer format

6.9.1 Setup

Address	(Hex)	Contents	Format	Word	Access	Range & Unit
0000	0000H	Fan 1 On	Integer	1	R/W	0 - 600
0001	0001H	Fan 1 Hysteresis Band	Integer	1	R/W	0 - 99
0002	0002H	Fan 1 Delay	Integer	1	R/W	0 - 99
0003	0003H	Fan 2 Select	Integer	1	R/W	0 - 2 (Note)
0004	0004H	Fan 2 On	Integer	1	R/W	0 - 600
0005	0005H	Fan 2 Hysteresis Band	Integer	1	R/W	0 - 99
0006	0006H	Fan 2 Delay	Integer	1	R/W	0 - 99
0007	0007H	Fan Test Cycle(Hour)	Integer	1	R/W	0 - 999
0008	0008H	Fan Test On(Minute)	Integer	1	R/W	0 - 999
0009	0009H	Trip On	Integer	1	R/W	0 - 600
0010	000AH	Trip Hysteresis Band	Integer	1	R/W	0 - 99
0011	000BH	Trip Delay	Integer	1	R/W	0 - 99
0012	000CH	Alarm On	Integer	1	R/W	0 - 600
0013	000DH	Alarm Hysteresis Band	Integer	1	R/W	0 - 99
0014	000EH	Alarm Delay	Integer	1	R/W	0 - 99
0015	000FH	CH4 Alarm Select	Integer	1	R/W	0 - 1 (Note)
0016	0010H	CH4 Alarm On	Integer	1	R/W	0 - 600
0017	0011H	CH4 Alarm Hysteresis Band	Integer	1	R/W	0 - 99
0018	0012H	CH4 Alarm Delay	Integer	1	R/W	0 - 99
0019	0013H	485 Address	Integer	1	R/W	1 - 255
0020	0014H	485 Baud Rate	Integer	1	R/W	0 - 5 (Note)
0021	0015H	485 Frame	Integer	1	R/W	0 - 3 (Note)
0022	0016H	485 Case (HiLo LoHi)	Integer	1	R/W	0 - 1 (Note)
0023	0017H	Output Select	Integer	1	R/W	0 - 7 (Note)
0024	0018H	Unit	Integer	1	R/W	0 - 1 (Note)
0025	0019H	Password	Integer	1	R/W	0 - 999
0026	001AH	Screen Save	Integer	1	R/W	0 - 99 (Note)
0027	001BH	Sample Average	Integer	1	R/W	0 - 99
0028	001CH	CH1-3 Average	Integer	1	R/W	0 - 1 (Note)
0029	001DH	Display Max. & Min.	Integer	1	R/W	0 - 1 (Note)
0030	001EH	Reset Maximum	Integer	1	R/W	0 - 1 (Note)
0031	001FH	Reset Minimum	Integer	1	R/W	0 - 1 (Note)

Contents	Description
Fan 2 Select	FAN 2 Select, 0:Disabled 1: Channel 1-3 Temp, 2: Channel 4 Temp
CH4 Select	CH4 Enabled, 0:Disabled 1:Enabled
485 Baud Rate	0:1200,1:2400,2:4800,3:9600,4:19200,5:38400
485 Frame	0:n,8,2,1:o,8,1,2:e,8,1,3:n,8,1
485 Case (HiLo LoHi)	Swap H/L Word in order like Float, Long 0:Lo_Hi,1:Hi_Lo
Output Select	DC 4-20mA Correspondent 0:Disabled 1:CH1, 2:CH2, 3:CH3, 4:CH4 5: Average on CH1-2-3 6: Max value among CH1-2-3
Unit	Temp. unit 0:°C, 1:°F
Screen Save	LCD backlight energy saving 00: Keep illuminating 01-99:It is turned off after the time is set in minute without pressing any push button
CH1-3 Average	Display CH1-3 Average. Appearing on main measured display 0: Disabled 1: Enabled
Display Max. & Min.	Max/Min Measured Temp. Appearing on main measured display 0: Disabled 1: Enabled
Reset Maximum	Clear the max. value 1: Clear
Reset Minimum	Clear the max. value 1: Clear

6.9.2 Values: Integer format

Address	(Hex)	Contents	Format	Word	Access	Range & Unit
512	200H	Relay Status	Integer	1	R	Note 6. 9. 4
513	201H	CH1	Integer	1	R	°C or °F
514	202H	CH2	Integer	1	R	°C or °F
515	203H	CH3	Integer	1	R	°C or °F
516	204H	CH4	Integer	1	R	°C or °F
517	205H	CH1 Maximum	Integer	1	R	°C or °F
518	206H	CH2 Maximum	Integer	1	R	°C or °F
519	207H	CH3 Maximum	Integer	1	R	°C or °F
520	208H	CH4 Maximum	Integer	1	R	°C or °F
521	209H	CH1 Minimum	Integer	1	R	°C or °F
522	20AH	CH2 Minimum	Integer	1	R	°C or °F
523	20BH	CH3 Minimum	Integer	1	R	°C or °F
524	20CH	CH4 Minimum	Integer	1	R	°C or °F
525	20DH	CH1-3 Average	Integer	1	R	°C or °F

6.9.3 Values: Floating point format (WORD swapping refers to 485 Case)

Address	(Hex)	Contents	Format	Word	Access	Range & Unit
4096	1000H	Relay Status	Float	2	R	Note 6. 9. 4
4098	1002H	CH1	Float	2	R	°C or °F
4100	1004H	CH2	Float	2	R	°C or °F
4102	1006H	CH3	Float	2	R	°C or °F
4104	1008H	CH4	Float	2	R	°C or °F
4106	100AH	CH1 Maximum	Float	2	R	°C or °F
4108	100CH	CH2 Maximum	Float	2	R	°C or °F
4110	100EH	CH3 Maximum	Float	2	R	°C or °F
4112	1010H	CH4 Maximum	Float	2	R	°C or °F
4114	1012H	CH1 Minimum	Float	2	R	°C or °F
4116	1014H	CH2 Minimum	Float	2	R	°C or °F
4118	1016H	CH3 Minimum	Float	2	R	°C or °F
4120	1018H	CH4 Minimum	Float	2	R	°C or °F
4122	101AH	CH1-3 Average	Float	2	R	°C or °F

6.9.4 Relay contact energizing status:

Integer format: Bit0 : Fan1 、 Bit1 : Fan2 、 Bit2 : Ch4 Alarm 、
Bit3 : Alarm 、 Bit4 : Trip 、 Bit5 : Fault

Floating point format: $2^0+2^1+2^2+2^3+2^4+2^5$

2^0 : Fan1 、 2^1 : Fan2 、 2^2 : Ch4 Alarm 、
 2^3 : Alarm 、 2^4 : Trip 、 2^5 : Fault

6.9.5 Temp sensor wire disconnection: Transmit a value of -10000