MTC-V Series Valve Temperature Controller
Instruction Manual

Please read this manual and thoroughly understand its contents before using, keep this manual for further reference

General Notes

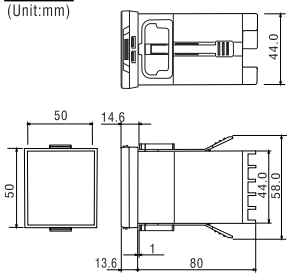
- MTC Series valve temperature controller: 4 digits with bar graphic display 0.2% accuracy, 0.1 resolution when input is TC and RTD, 0.001 resolution when input is analog signal.
- Auto/Manual bumpless transfer
- PV Re-transmission and RS-485 communication optional
- Please make sure the power code wired correctly before using Figure out if the controller need a feedback signal from valve or not before using
- Please input the travel time of the valve in the controller for no feedback valve.Travel time is the time of valve from its fully open state to fully closed state, the units is “second”, refer to the parameter“rUCY” in 6.3 Please specify the type of feedback signal for valve with feedback signals. such as: potentiometer feedback,4-20mA,0-5VDC,0-10VDC,Please conduct auto caliberation on potentiometer feedback valve. refer to user manual “9,three wires proportional valve auto caliberation”
- Input signals are selectable from panel.Please specify when order if the input signals are analog signal
- Refer to section 7 for auto manual transfer operation
- The factory default is reverse(heating) control the direct(cooling)control is field selectable, refer to parameter “OUd” in section 6.3
- PID control: Controller at PID control mode with auto-tuning function as factory default
- We recommend to use auto-tuning function to achieve best control result “refer to section 8"

1.Mounting and Dimensions

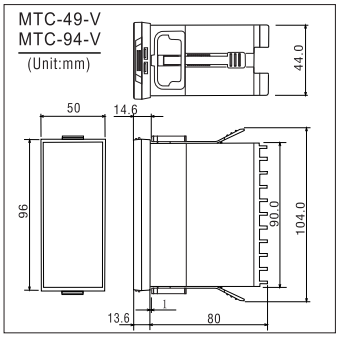
Please do not install units under below conditions

* Ambient less than 0^{0}C or higher than 50^{0}C
* Moisture less than 45%RH or higher than 85%RH
* Rapid temperature changing
* Corrosive and flammable gas
* Strong viabrate
* Water, oil, vibrat,steam contamination
* Dusty, salty,prill
* Strong electric interference
* Air condition direct blow
* Strong sunlight
* Strong radiation

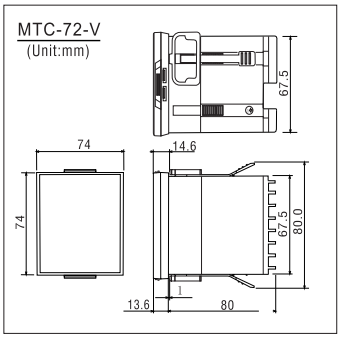
MTC-48-V
(Unit:mm)



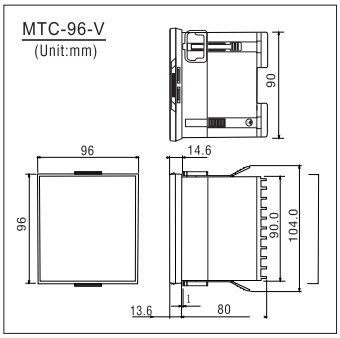
MTC-49-V
MTC-94-V
(Unit:mm)



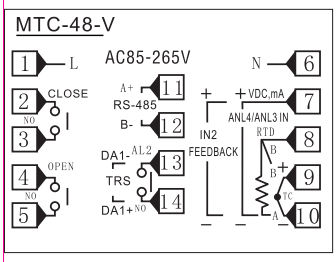
MTC-72-V
(Unit:mm)

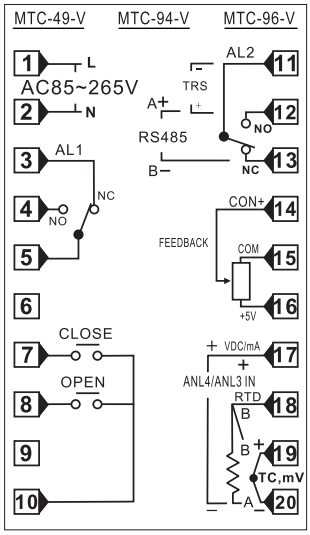


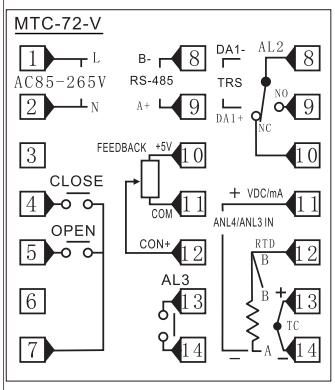
MTC-96-V
(Unit:mm)



2.Connection Diagram



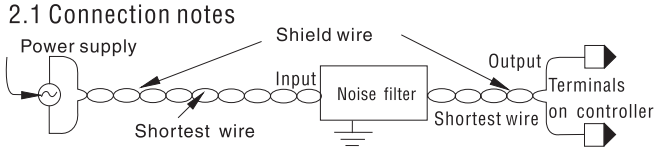




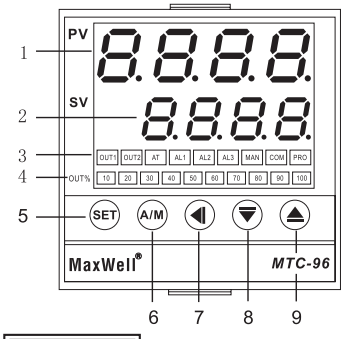
Caution

Please refer to connection diagram stickers on products as well

2.1 Connection notes



3.Panel discription



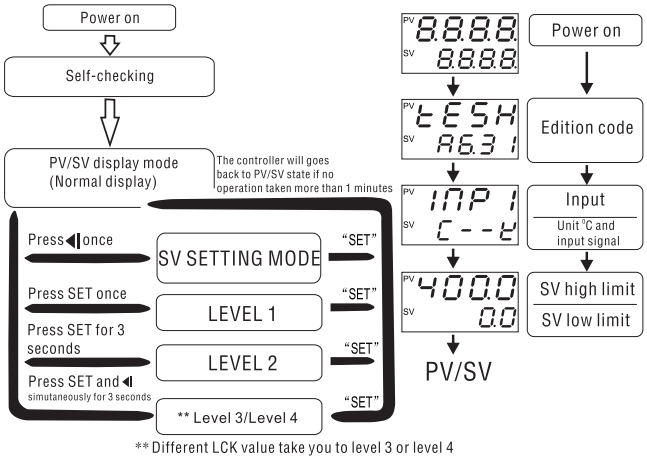
1 Process value
2 Setting value
3 Out1:Valve direct rotation indicator
Out2: Valve reverse rotation indicator
AT: Auto-tuning indicator
AI1: AI1 indicator
AI2: AI2 indicator
AI3: AI3 indicator
MAN: Manual control indicator
COM: Communication indicator
PRG: Backup indiciator
4 Bar Graph:valve position indicator
5 SET Function key
6 A/M Auto/Manual control switch key
7 ◀:Shift key/enter key
8 ▼:Decrease key
9 ▲:Increase key

Cautions

Do not press the keys with solid objects

4.Setting

4.1 Basic operation flow charts



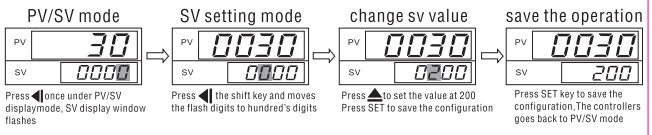
** Different LCK value take you to level 3 or level 4

Symbol	b1	b2	E1	E2	J1	J2	n	u
Input	K	K	E	E	J	J	N	Wu3_Re25
Range	400.0 °C	1300 °C	300.0°C	600°C	400.0°C	800 °C	1300°C	2000°C

Symbol	S	t	r	b	AN4	AN3	AN2	AN1	Pt1	Pt2
Input	S	T	R	B	2-10VDC 1-5VDC 4-20mA	0-10VDC 0-5VDC 0-20mA	0-50mV	0-20mV	Pt100	Pt100
Range	1600°C	400.0°C	1700°C	1800°C					-199.9~200.0°C	-200~800°C

4.2 Change SV Value

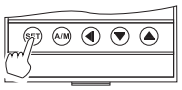
For example: change SV from 0 to 200



General notes
Press increase or decrease once will increase or decrease the by "1",The number will change faster if keep pressing the increase or decrease key,Press the A/M key can save the configuration as well

5.Parameter Level

5.1 Level 1



5.1.1 parameter setting:

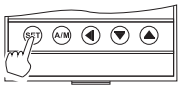
Press SET key once to enter level 1 parameters
parameters listed below will be displayed one by one
Press SET key to save the configuration and exit to PV/SV mode

1# Factory default seting

Symbol	Name	Range	1#	Description
AT	Auto-tuning	NO or YES	NO	At=YES Auto-tuning ON,At=NO Auto-tuning OFF
AL1	First alarm	-1999 to 9999	10	Alarm 1 value
AL2	Second alarm	-1999 to 9999	10	Alarm 2 value
AL3	Third alarm	-1999 to 9999	10	Alarm 3 value
UAd	Communication address		1	To display the communication address of controller

Press increase or decrease key to change the value of a parameter,press SET key to exit and save the modification

5.2 Level 2



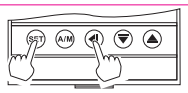
Press SET key for more than 3 seconds
Below parameters will be displayed one by one

1# Factory default setting

Symbol	Name	Range	1#	Description
P1	Proportional band	0.0~200.0	30.0	Proportional band,Unit is degree, when P1=0.0 Controller in ON/OFF control mode
i1	Integral time	0-3600 Sec	240	Integral time, When i1=0,integral action off,when i1 gets bigger, integral action gets more effective,but more likely to cause fluctuation
d1	Derivative time	0-3600 Sec	60	Derivative time,When d1=0,derivate action off,when d1 gets bigger, derivative action gets more effective,but more likely to cause fluctuation
AtCL	Hysteresis value in auto-tuning process	0-199 °C	0	SV Hysteresis value,The controller works as a ON/OFF controller during the auto-tuning process The system will likely go through a very huge overshoot, can set a hysteresis value to restrain the overshoot
CYt1	Control cycle	0-999 sec	20	PID Control cycle time Cycle time=20 sec for Relay oputput
HYS1	ON/OFF control hysteresis	0.0 to 100.0	1.0	When P1=0.0, HYS1 is the hysteresis in ON/OFF control mode
rE	Overshoot Supression	0.0 to 100.0	10.0	Overshoot supression first power up and supression,when SV reset
rSt1	Proportional reset	-30 to 30	-5.0	控制用于抑制PID控制的过冲（rst1设定大于-P/2）(数值越小加温越慢)
OPL	Output limit (low)	0.0 to 100.0%	0.0	Output lower limit
OPH	Output limit (high)	0.0 to 100.0%	100.0	Output higher limit
Pto	Initial output value for manual mode	0.0 to 100.0%	0.0	When manual control mode activated, this parameter used to define the output ratio, when controller just powered up
LCt	Data protection	0000-0255	0	LCK=0000 Be able to modify all parameters LCK=0001 Be able to modify SV LCK=0010 Be able to modify SV and parameters under level 1 LCK=0011 Not able to modify all parameters LCK=0101 Can modify all parameters, can access level 3 parameters

5.3 Level 3

5.3.1 How to access to level 3



1: Goes to level 2 and set the LCK as 0101 and press SET for 3 sec to exit and save

2:Refer to image at right side, press SET and at the same time for at least 3 secs Press SET each time, below parameter will display one by one

1# factory default

Symbol	Name	Range	1#	Description
INP1	Input signal selection			

Symbol	E1	E2	E1	E2	J1	J2	N	U
Signal type	K	K	E	E	J	J	N	Wu3_Re25
Range	400.0 °C	1300 °C	300.0°C	600°C	400.0°C	800 °C	1300°C	2000°C

Symbol	S	t	r	b	AN4	AN3	AN2	AN1	Pt1	Pt2
Signal type	S	T	R	B	2-10VDC 1-5VDC 4-20mA	0-10VDC 0-5VDC 0-20mA	0-50mV	0-20mV	Pt100	Pt100
Range	1600°C	400.0°C	1700°C	1800°C					-199.9~200.0°C	-200~800°C

Note 1: End user can choose input signals freely between TC and RTD
Note 2: Please specify analog signals except 0-20mV and 0-50mV

dP	Decimal points for analoginput	0 ,1,2,3	0	0: W/O decimal points 1: 1decimal 2: 2 decimal points 3: 3 decimal points(For analog inputs only)
LSPL	SV low limit	-1999 to 9999	0	To define the low limit of the setting value or low limit for Re-transmission value
USPL	SV high limit	-1999 to 9999	400	To define the high limit of the setting value or high limit for Re-transmission value
UNIt	Display unit	0 ,1,2	0	0: Celcius 1: Fahrenheit 2: No unit
PVOS	PV Bias	-199to 199	0.0	To compenstate process value error cuased by sensors or other reasons
PVFt	PV filter	0 to 60	55	1-30: normal filter rate 31-60: enhanced filter rate
ANL1	Analog input low limit display	-199~9999	0	For example, 4-20mA input, the display is ANL1 when input is 4mA
ANH1	Analog input high limit display	-1999~9999	2000	For example, 4-20mA input, the display is ANH1 when input is 20mA
ALd1	1st alarm mode	00 to 16	11	To define the alarm mode for first stage alarm
AH1	1st alarm hysteresis	0.0 to 100.0	1.0	To define the hysteresis for first stage alarm
ALd2	2nd alarm mode	00 to 16	10	To define the alarm mode for second stage alarm
AH2	2nd alarm hysteresis	0.0 to 100.0	1.0	To define the hysteresis for second stage alarm
ALd3	3rd alarm mode	00 to 16	10	To define the alarm mode for third stage alarm
AH3	3rd alarm hysteresis	0.0 to 100.0	1.0	To define the hysteresis for third stage alarm
OUd	Direct/reverse control	0 or 1	0	0: Reverse(Heating) 1: Direct(Cooling)
rUCY	Motor Travel time	0-200S	60	To define the travel time for motor The time for a motor valve from its fully open state to fully closed state,when valve without feedback signal,the travel time is needed
IdN0	Communication address	0-127	1	To set the communication address of controller
bAUd	Baud rate setting	0,1,2,3	2	bAUd=0：2.4K, =1：4.8K, =2：9.6K, =3：19.2K

Alarm mode(ALd=00-16)
00: Without alarm output
01:Deviation high alarm with alarm standby function
02:Deviation low alarm with alarm standby function
03:Deviation high/low alarm with standby function
04:Deviation high/low reverse alarm with standby function
05:Absolute value high alarm with standby function
06:Absollute value low alarm with standby function
10: Without alarm output
11:Deviation high alarm
12:Deviation low alarm
13:Deviation high/low alarm
14:Deviation high/low reverse alarm
15:Absolute value high alarm
16:Absollute value low alarm

5.3.1 Alarm mode charts

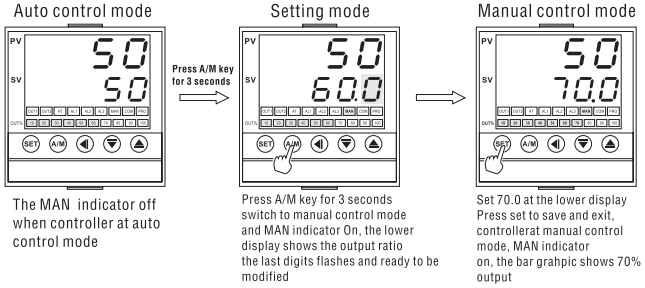
Code	Ald	Alarm mode decription(take AL1 for example)	
N	10 or 00	Without alarm	
A	11	AL1≥0	AL1 deviation high alarm, AH1, SV, SV+AL1
		AL1<0	AH1, Alarm activated, AL1 deviation high alarm, Low, SV+AL1, SV, High
B	12	AL1≥0	AL1 deviation low alarm, Alarm activated, AH1, Low, SV, SV+AL1, High
		AL1<0	Alarm activated, AH1, AL1 deviation low alarm, Low, SV+AL1, SV, High
C	13	AL1 Deviation high/low reverse alarm, Alarm activated, AH1, Alarm activated, Low, SV−AL1, SV, SV+AL1, High	

Code	Ald	Alarm mode decription(take AL1 for example)	
D	14	AL1 high/low reverse alarm, SV-AL1, SV, SV+AL1	
H	15	AH1, alarm activated, AL1 absolute high alarm, Low, AL1 value, High	
J	16	alarm activated, AH1, AL1 absolute low alarm, Low, AL1 value, High	
E	01	AL1≥0	AI1 deviation high alarm with standby function, AH1, Alarm activated, Low, SV, SV+AL1, High
		AL1<0	AH1, Alarm activated, AL1 deviation high alarm with standby function, Low, SV+AL1, SV, High
F	02	AL1≥0	AL1 deviation low alarm with standby function, Alarm activated, AH1, Low, SV, SV+AL1, High
		AL1<0	Alarm activated, AH1, Low, SV+AL1, SV, High
G	03	Alarm activated, AH1, Low, SV-AL1, SV, AH1, Alarm activated, SV+AL1, High	
M	04	AL1 deviation high/low reverse alarm with standby function, Alarm activated, Low, SV-AL1, SV, SV+AL1, High	
K	05	AH1, Alarm activated, AL1 absolute value high alarm with standby function, Low, AL1 Value, High	
L	06	Alarm activated, AH1, AL1 absolute value low alarm with standby function, Low, AL1 Value, High	

Alarm standby function:Alarm will be suspended during the first round power up even if the temperature is at the scope where the alarm should be on.
The alarm mode is applicable to for AL 1 AL 2 AI3

6. Auto/manual Control Switch

All of sizes available with auto/manual control switch function except 48mm*48mm
Press (A/M) key can change between manual and auto control mode
Below example changes from auto mode to manual mode with 70% output ratio



The MAN indicator off when controller at auto control mode

Press A/M key for 3 seconds switch to manual control mode and MAN indicator On, the lower display shows the output ratio the last digits flashes and ready to be modified

Set 70.0 at the lower display Press set to save and exit, controllerat manual control mode, MAN indicator on, the bar grahpic shows 70% output

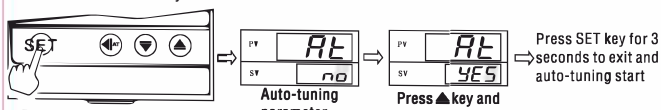
** Press A/M for 3 seconds change from manual mode to auto mode.

** Power up manual mode can be configured based on specific application, and the initial output ratio can be set on parameter Pk0"(refer to level 2 parameters)

** A/M key can be used to save a configuration made to controller

7:Auto-Tuning(Recommended to use this function)

To get better auto-tuning results, Start the auto-tuning process when unit just powered on and PV value still far away from SV value



Press SET key for 1 second to enter level 1 parameter list

Auto-tuning parameter

Press ▲key and change No to Yes

General Notes:

1:The AT indicator is flashing after auto-tuning activated,change the YES under AT parameter to NO can terminate the auto-tuning

2:During the auto-tuning process, the controller became a ON/OFF Controller, can expect a huge temperature up and down during the process, and depends on the system itself , the auto-tuning will last long or short period time

3:The AT indicator stop flashing after auto-tunin g finished, the parameters value for P1, I1, d1, rE, rSt1 will be saved automatically, controller goes back to PV /SV state and works with new P1 I1, d1, rE, rSt1 parameter value.

4:For some of specific application, the auto-tuning is not appropriate to be excecuted, or auto-tuning doesn't help to acheive a better control result, can manual adjust the parameter value.

5:P1 is the proportional band of PID control, the value of P1is in the range of SV±P1/2, shall set the P1 as 10% to 15% of SV.

6:I1 is the intergral time for PID control process, the factory default is 200, I1 gets small, the integral action gets more effective and the controller react faster to temperature changing. The tepmerature will likely to goes back and forth around the setting value.

(1):If the heating process is slow and the output does not increase, decrease the I1 will make the heating more effective

(2): If PV at somewhere higher than SV, and did not goes down, Controller outputs does not decrease. Can decrease the I1 to change the state

(3): If temperature keep goes up and down around the setting value, can decrease the I1 value to change the state.

7:d1 is derivative time ofthe PID control process, normally the value is 20%-30% of I1 value, when d1 gets bigger, the derivative action gets more effective.

(1)Ifthe temperature goes up too fast and overshoot, can increase the d1 value to balance it. If temperature drops too fast and undershoot, increase the d1 value to balance it as wel.

(2)In some of application where the system is very sensitive, a small changes on the output can results in hugh changes on the PV, shall decrease the d1 value even set the d1=0 to have a best control outcome. For example, in a pressure control application

8:The parameter rE is used to supress the overshoot occurs in the very first time after controller just power up. Or overshoot occurs when setting value changes after system became stable, Larger rE value will have a bettereffective on supressing the overshoot, but the heating will became slower

9:rSt1 proportional reset, help to acheive the stability of the system in PID control process.

(1)In a heating system where overshoot can easily happen,can set rSt1=0, the rSt1 can not be set too small value when manually set it.(RSt1 shall be largerthan -P/2, for example, if P1=30,then rSt1≥-15),normally set rSt1≥-30%P1, when rSt1 gets smaller, the heating gets slower

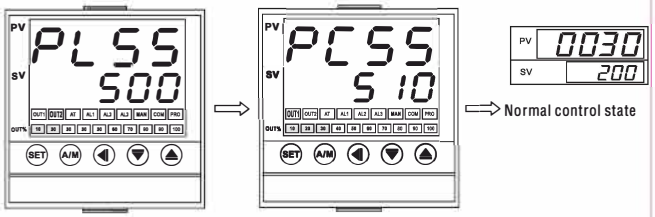
(2)Normally set rSt1 as positive value, when rSt1 gets bigger, cooling gets slower.

8.2 Auto caliberate for valve with feedback

(1) Wire correctly

(2)Press ▲and ▼at the same time for 3 seconds the upper display shows PASS, and set the password as 0111, press SET to start the auto caliberation

Display



The upper display shows PLSS, out2 indicator flashes, valve reverse rotation starts, lower Display decrease as valve rotation goes,valve zero point caliberation finished after some while. And the Display shift to images as right.

Note: The lower display gets bigger if the wiring is not correct.For potentiometer feedbac valve, switch the wires between+5V terminal and COM terminal

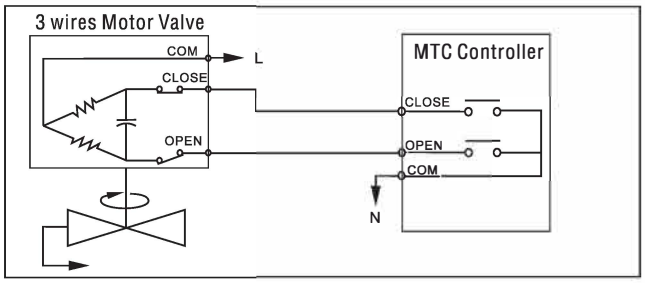
The upper display shows PCSS, out1 indicator flashes, valve direct rotation starts, lower Display increase as valve rotation goes,valve MAX point caliberation finished after some while. And the controller starts the control.

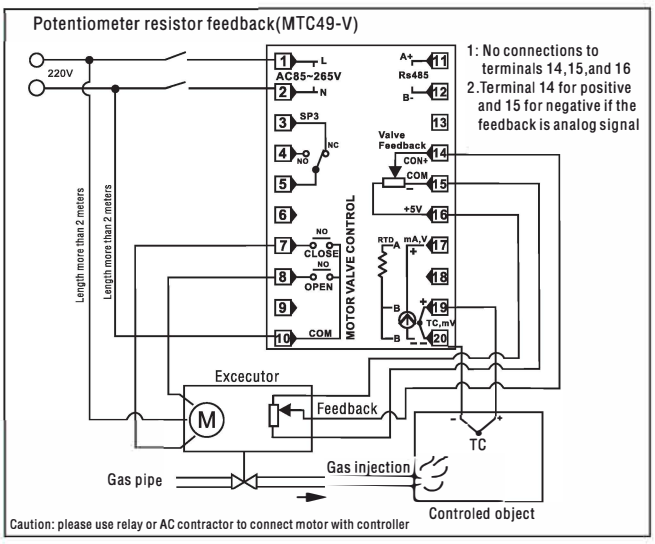
Note: The lower display gets smaller if the wiring is not correct.For potentiometer feedbac valve, switch the wires between+5V terminal and COM terminal

Note:The caliberation will be conducted automatically, only thing the user need to do the observe the display on the lower window

8:Three wires proportional valve feedback auto caliberate

8.1 Connection diagram





9: COMMUNICATION

(1) Communication comply with Modbus-RTU protocol,support 03 read command, 06 and 10 write command

(2) Connection method: 2 wire system,half-duplex multidrop connection

(3) Connection distance: 1.2KM,the maximum connection distance various slightly with the surroundings such as cables etc

(4) Communication speed: 2400bps,4800bps,9600bps,19200bps(9600 default)

(5) Data type: Start bit: 1 data bit: 8, Parity bit: None, Stop bit: 1

(6)The maximum data input support is 36 bits, when the address exceed 0048H then data will be write to 0048H.

(7)The maximum date read support is 37 bits, when the address exceed 0048H then the value pick up is "0"

10: INPUT SIGNAL RANGE

Input Type			Code	
K1	0.0 to 100.0	℃	2	D1
	0.0 to 200.0	℃	2	D2
	0.0 to 300.0	℃	2	D3
	0.0 to 400.0	℃	2	D4
K2	0 to 200	℃	K	A2
	0 to 400	℃	K	A4
	0 to 600	℃	K	A6
	0 to 1300	℃	K	B3
E1	0.0 to 100.0	℃	3	D1
	0.0 to 200.0	℃	3	D2
	0.0 to 300.0	℃	3	D3
E2	0 to 200	℃	E	A2
	0 to 400	℃	E	A4
	0 to 600	℃	E	A6
J1	0.0 to 100.0	℃	1	D1
	0.0 to 200.0	℃	1	D2
	0.0 to 300.0	℃	1	D3
	0.0 to 400.0	℃	1	D4
J2	0 to 200	℃	J	A2
	0 to 300	℃	J	A3
	0 to 400	℃	J	A4
	0 to 800	℃	J	A8
T	0.0 to 100.0	℃	T	D1
	0.0 to 200.0	℃	T	D2
	0.0 to 300.0	℃	T	D3
	0.0 to 400.0	℃	T	D4
S	0 to 1000	℃	S	B0
	0 to 1600	℃	S	B6
R	0 to 1000	℃	R	B0
	0 to 1700	℃	R	B7
B	200 to 1000	℃	B	B0
	200 to 1800	℃	B	B8
N	0 to 1000	℃	N	B0
	0 to 1300	℃	N	B3
Wu3_Re25	600 to 2000	℃	W	B0

Input Type			Code	
Pt1 (Pt1 00)	0.0 to 50.0	℃	P	06
	0.0 to 100.0	℃	P	07
	0.0 to 150.0	℃	P	11
	0.0 to 200.0	℃	P	08
	-500 to 500	℃	P	12
	-500 to 1000	℃	P	13
	-1000 to +1000	℃	P	04
	-1000 to +2000	℃	P	05
	-1999 to +2000	℃	P	02
Pt2 (Pt1 00)	0 to 100	℃	D	A1
	0 to 200	℃	D	A2
	0 to 400	℃	D	A4
	0 to 600	℃	D	A6
	0 to 800	℃	D	A8
	-50 to 100	℃	D	C1
	-100 to 200	℃	D	C2
	-100 to 300	℃	D	C3
	-200 to 400	℃	D	C4
	-200 to 500	℃	D	C5
	-200 to 600	℃	D	C6
	-200 to 700	℃	D	C7
	-200 to 800	℃	D	C8

Input Type			Code	
AN1	0 to 20mV	-1999 to 9999	V	01
AN2	0 to 50mV		V	02
AN3	0 to 5VDC	-199.9 to 999.9	V	03
AN3	0 to 10VDC		V	04
AN4	1 to 5VDC	-19.99 to 99.99	V	08
AN4	2 to 10VDC	-1.999 to 9.999	V	09
AN4	4 to 20mA		A	03
AN3	0 to 20mA		A	02
AN3	0 to 10mA		A	01

Note 1:End user can select TC and RTD on panel

Note 2: Specify the analog signals before order except 0-20mV and 0-50mV