KCM-XL2 Multi-Loop Controller Instruction Manual

1. Features:

1.1. 2 channels of temperature controls up to 2 channels in a compact size.
2 kinds of combinations of temperature set value, PID constant, alarm set value, etc.

1.1.Input Sensor Types

-Thermocouple sensor: K E J T S

-Resistance thermometer (2-wire): Pt100, CU50

-Current input (analog input): 4 ~ 20 mA DC, 0 ~ 10 mA DC

Select one from the above three input types.

1.2.Control Outputs：relay contact 250 V AC, 3 A (Resistive load)

1.3.Use this controller within the following allowable range:

Allowable ambient temperature: −0 to +55 °C

Allowable ambient humidity: 5 to 85 % RH.

2. Dimensions:

M:160×80mm panel cutout :152×76mm(horizontal)

MA:96×96mm panel cutout :92×92mm

MF:96×48mm panel cutout :92×44mm(horizontal)

MG:48mm panel cutout :44×44mm

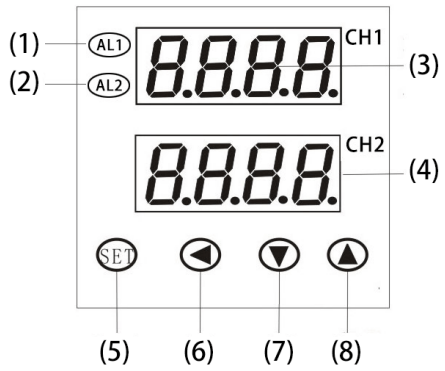
MS:80×160mm panel cutout :76×152mm(vertical)

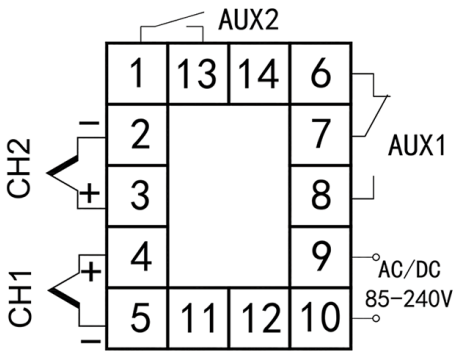
MD: 72×72mm panel cutout :68×68mm

ME:48×96mm panel cutout :44×92mm(vertical)

MR:88×72×59mm DIN 35 rail mounting socket

3. Parts Description:





1 ALM1: Lights when channel 1 has an output

2 ALM2 lamp: Lights when channel 2 has an output

3 CH1 display: Displays loop 1 Measured value (PV1) or various Parameter symbols

4 CH2 display: Displays loop 2 Measured value (PV2), or various Parameter set values.

5 Up key:

− Increase numerals.

6 Down key:

−Decrease numerals

7 Shift key: Shift digits when settings are changed.

8 Set (SET) key: Used for Parameter calling up and set value registration.

4. Parameters

ID	Code	Name	Manual	Setting range	Ex-Factory
The public parameters(Main menu)					
0	LoCY	Set data lock	LOCK=0, parameters can be set. Otherwise parameters cannot be set.	0～50	0

1	t	PID control period	Control response time	2～120	2S
2	oPb	Communication	0:no output; 1:RS232 or RS485 MODBUS-RTU;	0-1	1
3	Addr	Device Address	Device address, can be set from 0 to 255	0～255	1
4	bAud	baud rate	1200; 2400; 4800; 9600;19200	__	9600
5	C-F	Unit select	C: Celsius F: Fahrenheit	C	C
The Parameters of each channels (loops menu)					
6	SP	PID Set value	Set the temperature set value (SV) which is the target value for control	Determined by PSL PSH	100
	AL-	Alarm Set value	Refer to 4.2 Definition of output mode		
7	HY-	Differential gap	Refer to 4.2 Definition of output mode	0.1～50.0	0.1
8	SC	PV Bias	The value set in the PV bias is added to the actual input value to correct the input value.		
9	Sn	Input type	TC: K,E, J,T,S;	-	-
10	P	Proportional Band	Refer to 4.2 Definition of output mode When the parameter OP=4 or OP=5, the symbol P will not be displayed; instead, the symbol ALH will appear.	1～100.0	15
	ALH	Alarm Set value 2			
11	I	Calculus time	Eliminates offset occurring in proportional control.	0～3000	500
12	d	Differential time	Prevents overshoot and/or undershoot caused by integral action effect..	0～2000S	100S
13	Uo	Initial value	PID control Initial output value	0～3000	500
14	At	Auto tuning	1: Auto tuning (AT) with learning start 0: Auto tuning (AT) with learning stop Turns OFF automatically when the AT with learning function is completed.	0～1	0
15	oP	Control action	Refer to **7. Main output function**	0～5	0
16	dP	Decimal point position	TC/ RTD input: Only 0 or 1 can be set. Voltage (V)/Current (I) input: From 0 to 3 can be set.	0～3	1
17	PSH	Range high	Input range high	P-SL～9999	1300
18	PSL	Range high	Input range low	-1999～P-SH	0

4.2 Definition of output mode：

-PID control mode:

PID MODE	OP	Functional Description
0: Heating Mode	OP（ oP ）=0	As the output increases, the temperature rises.
1: Cooling Mode	OP（ oP ）=1	As the output increases, the temperature decreases.

-Alarm function：

Take the alarm setting of Channel 1 as an example.			
Alarm function	OP	Alarm status[ON]	Alarm status[OFF]
2: Upper limit alarm	oP =2	PV1≥AL-1	PV1<AL-1 − HY-1
3: Lower limit alarm	oP =3	PV1≤AL-1	PV1>AL-1 + HY-1
4: Out-of-range alarm	oP =4	PV1≤AL-1 OR PV1≥ALHI	AL-1 + HY-1 < PV1<ALHI − HY-1
5: In-range alarm	oP =5	AL-1 ≤PV≤ALHI	PV1< AL-1 − HY-1 OR PV1>ALHI + HY-1
6: Upper difference alarm	oP =6	PV1 − PV2≥AL-1	PV1 − PV2<AL-1 − HY-1

7: Lower difference alarm	oP =7	PV1 − PV2≤RL-1	PV1 − PV2>RL-1 + HY-1
PV1 and PV2 represent the measured values of Channel 1 and Channel 2, respectively. For other parameters, please refer to Table 4-1. 10: RLHI 3: RL-1 7: HY-1 15: oP			

4. Operation

4.1 Menu level switching

Press and hold the “SET” key for 3 seconds to into the main Parameters (Main menu), the CH1 display shows “ Main ,” and the CH2 display shows “set”.

Press Key “▲”or”▼” to switch between main menu level and loops menu level

Press the “SET” key to into parameter setting mode of the selected menu level

Press the “◀” key to go back to the PV/SV monitor

Display returns to the PV/SV monitor if no key operation is performed within 4 seconds

4.2 Parameter setting mode:

The parameter value will be changed by using the “▲” key or the “▼” key

The flashing decimal point which digit can be set. Press ” ◀” key to go to a different digit. Every time the shift key ” ◀” is pressed, the flashing decimal point moves.

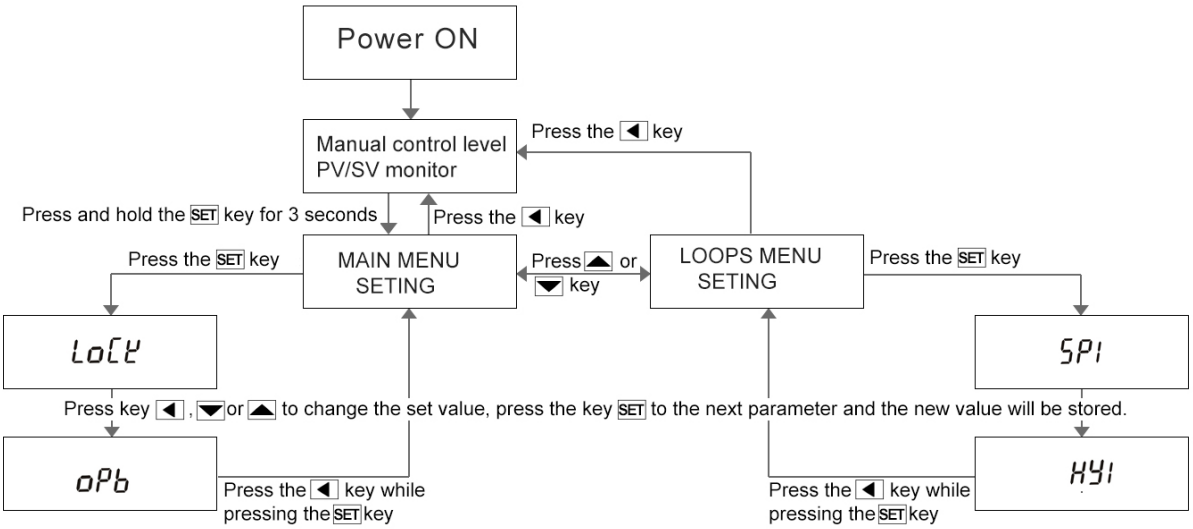
Press the “SET” key , the new value will then be saved and the display will move to the next parameter.

Press the “◀” key while pressing the “SET” key for 1 seconds to go back to the PV/SV monitor

Display returns to the PV/SV monitor if no key operation is performed within 4 seconds

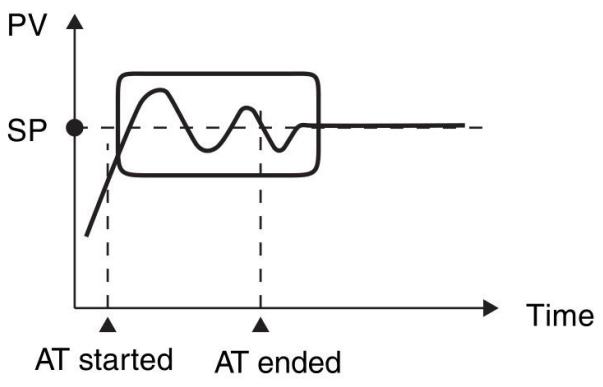
Attentions:

LOCK=0, parameters can be set. Otherwise parameters cannot be set.



5. Determining PID Constants(Auto-tuning)

To enter the secondary menu, first set the setpoint (SP). Then, set the hysteresis (Hy) to approximately 0.5–1. Finally, set the AT parameter to "on" to enable the instrument's self-tuning mode. The entire cycle is estimated to take 20–60 minutes, depending on the temperature rise and fall rate of the controlled equipment.



During the self-tuning process: The "AT" indicator and measured value on the corresponding channel will alternate display. The instrument operates in on-off control mode, requiring no manual intervention. After three automatic up-and-down oscillations, the instrument will determine and automatically save the optimal P, I, and D parameters. The "AT" indicator on the corresponding channel will disappear, the AT parameter will automatically reset to "off", and the instrument will restart in the optimal PID control mode.

Attentions：

when **Auto-tuning**, the controller should not change the set value.

When the power off during **Auto-tuning**, it will restart **Auto-tuning** next time.

When it need artificially exit during **Auto-tuning**, set the Parameter(AT) to off so that can exit， but the setting result will not be valid.

10. Host communication based on MODBUS-RTU protocol [OPTIONAL]

The master controls communication between master and slave. A typical message consists of a request (query message) sent from the master followed by an answer (response message) from the slave. When master begins data transmission, a set of data is sent to the slave in a fixed sequence. When it is received, the slave decodes it, takes the necessary action, and returns data to the master.

10.1 Communication Mode:

Data bit length	Stop bits	Parity bit	Communication time interval
8-bit (Binary)	1,2	NONE	300ms

10.2 Message length of each function (Unit: byte):

Function code (Hexadecimal)	Function	Query message		Response message	
		Min	Max	Min	Max
03H	Read holding registers	8	8	7	7
06H	Preset single register	8	8	8	8

10.3 Message format

Slave address	The slave address is a number from 1 to 255 manually set at the front key panel of the controller.
Function code	Refer to **2. Message length of each function**
Data	The data to execute the function specified by the function code is sent to the slave and corresponding data returned to the master from the slave.
CRC-16	CRC-16: Cyclic Redundancy Check)

10.4 Read holding registers [03H]

The query message specifies the starting register address and quantity of registers to be read.

Slave address	Function code 03H	Register address	Quantity The setting must be 1	CRC16
Example: The contents of the holding register 1001H are the read out from slave address 1. Query message: 01 03 10 01 00 01 D1 0A Response message: 01 03 02 **00 FD** 79 C5 Explain：00FD=253,is processed as 25.3				

10.5 Preset single register [06H]

Write the SP set value of 126 to the first channel of the controller.

Slave address	Function code	Register address	Write data	CRC16
Example: Data is written into the holding register 0006H of slave address 1. Query message: 01 06 00 06 04 EC 6A 86 Response message: 01 06 00 06 04 EC 6A 86				

Please note that converting 04EC to decimal equals 1260. All parameters with decimal points should be multiplied by 10; for example, a setting of 12.5 should be input as 125.

10.6 No response

The slave ignores the query message and does not respond when:

• The slave address in the query message does not coincide with any slave address settings.

• The CRC code of the master does not coincide with that of the slave.

• Transmission error such as overrun, framing, parity and etc., is found in the query message.

• Set the Response Timeout >200ms and Delay between polls>200ms.

10.7 Register address list:

Symbol	Decimal point	Real Register	Holding Register
Measured value(PV)	YES	1001H~1002H	44098~44099
Manipulated output (MV):	NO	1101H~1102H	44354~44355
Forced Shutdown Output	NO	0101H~0102H	40258~40259=1
The first public parameters *(Refer to 4. Parameters)*			
LOCK	NO	0000H	40001
T	NO	0001H	40002
OPB	NO	0002H	40003
ADDR	NO	0003H	40004
BAUD	NO	0004H	40005
C-F	NO	0005H	40006
The Parameters of channel 1 *(Refer to 4. Parameters)*			
SP1/AL-1	YES	0006H	40007
HY-1	YES	0007H	40008
SC1	YES	0008H	40009
SN1	NO	0009H	40010
P1/ALH1	YES	000AH	40011
I1	NO	000BH	40012
D1	NO	000CH	40013
UO1	NO	000DH	40014
AT1	NO	000EH	40015
OP1	NO	000FH	40016
DP1	NO	0010H	40017
PSH1	YES	0011H	40018
PSL1	YES	0012H	40019
The Parameters of channel 2*(Refer to 4. Parameters)*			
SP2~ PSL2	-	0013H~001FH	40020~40032

Refer to this link for more information on MODBUS-RTU Communication Protocol:

http://www.kcmeter.com/servicesread.asp?id=4

Or scan QR code for more information:

Model and Suffix Code:

Specifications	Model and Suffix Code						
Model	KC	□	□	□	□	□	
SIZE	160×80mm panel cutout :152×76mm (horizontal)	M					
	80×160mm panel cutout :152×76mm(vertical)	MS					
	96×96mm panel cutout :92×92mm	MA					
	96×48mm panel cutout :92×44mm(horizontal)	MF					
	48×96mm panel cutout :44×92mm(vertical)	ME					
	72×72mm panel cutout :68×68mm	MD					
	48×48mm panel cutout :44×44mm	MG					
	88×107×59mm DIN 35 rail mounting socket	MR					
Loops	2		XL2				
Input types	Thermocouple sensor: K E J T S			TC			
	Resistance thermometer (temperature input): Pt100, CU50			RD			
	Current input (analog input): 4 ~ 20 mA DC, 0 ~ 10 mA DC			A			
	NTC 10K,100K,50K,20K,KTY84130…Fix one type of NTC specification, such as 10K3950.			NTC			
Control output	Relay output				□		
	Voltage pulse(for driving SSR)				G		
Power supply	100 ~240V AC					□	
	24V DC					1	
Communications	RS-485(MODBUS-RTU)						RS
	RS-232(MODBUS-RTU)						RX
	Data Logger						LG

Character Symbols ： This manual indicates 9-segment display characters as shown below.

A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
												
N	**O**	**P**	**Q**	**R**	**S**	**T**	**U**	**Y**