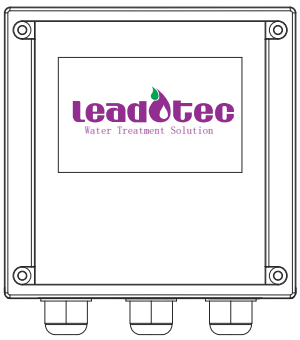
Version:2023-04

MA6000 controller



144 Series

96 Series

Content

Safety instructions

Read the manual before installing and operating the instruments.

1. Check for any damages on the content after unpacking
2. The instrument must be o perated by trained professional and technical personnel.
3. Confirm the wiring connections with the wiring figure before switching on the power to avoid damages and injuries.
4. Avoid installing in a high humidity, high temperature, corrosive and in direct with sunlight environment.
5. Separate instrument signal cables from power lines and machine that produces high noise interference.

Instrument application

1. The instrument can be connected with digital electrode or digital module.
2. The instrument can be panel mounted, wall mounted, or pipe installed.
3. Supplies 2 current outputs for a maximum load of 500Ω
4. Supplies 3 control relays with a maximum voltage and current of 5A/250VAC or 5A/30VDC

Product content

144 series: 1 meter, 1 operational manual and four sets of mounting kits(Fixed box, fixed bar and screw).
96 series: 1 meter, 1 operational manual and two sets of mounting kits.

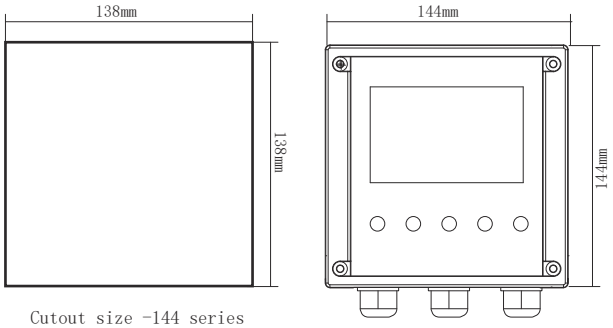
Instrument specification

Input	0-20mA/4-20mA
Range	±9.999/±99.99/±999.9/±9999
Current resolution	0.01mA
Measurement Resolution	0.001/0.01/0.1/1
Ambient temperature range	0 to +70℃
Storage temp.	-20 to +70℃
Display	Back light, dot matrix
Current output 1	Isolated, 4 to 20mA output , max.load 500 Ω
Current output accuracy	±0.05 mA
RS485	Modbus RTU protocol
Baud rate	9600/19200/38400
MAX. relay contacts capacity	5A/250VAC,5A/30VDC
Cleaning setting	ON: 1 to 1000 seconds, OFF: 0.1 to 1000.0 hours
One multi-function relay	Clean/Period alarm/Error alarm
Relay delay	0-120 seconds
Data logging capacity	500,000 records
Language selection	English/Traditional Chinese/ Simplified Chinese
IP Rating	IP65
Power supply	90 to 260VAC, power consumption < 5W
Installation	Panel/Wall/Pipe installation
Meter weight	144 series:0.85Kg/ 96 series:0.55Kg

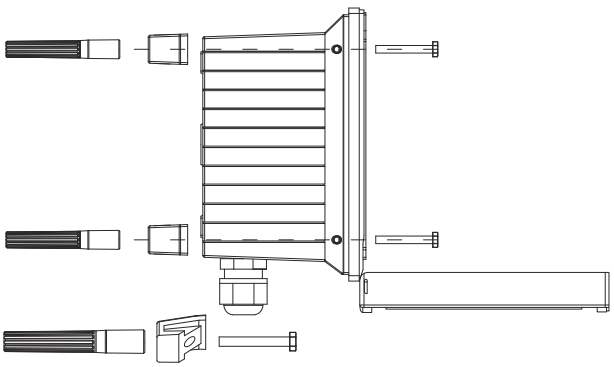
Note:Only support 32 GB or less of U disk

Instrument installation

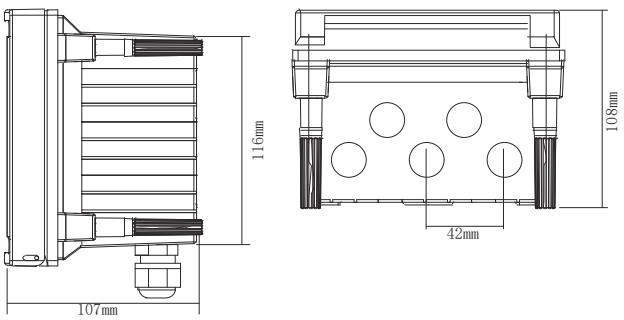
144 series: The instrument can be panel,wall or pipe mounted installation.
Panel installation: Make a 138mm square cutout and insert the instrument. Screw in the fixed block with the screws and fixed bar.



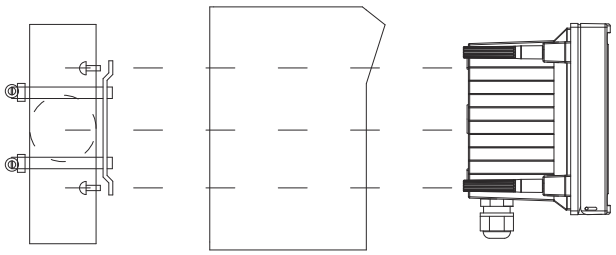
Cutout size -144 series



Installation - 144 series

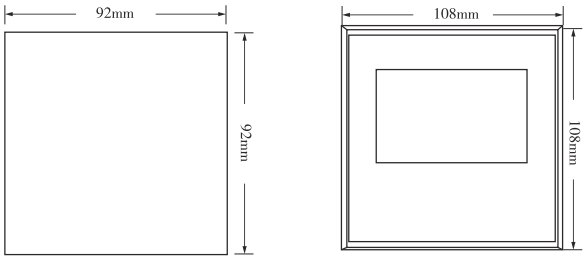


Dimension figure -144 series

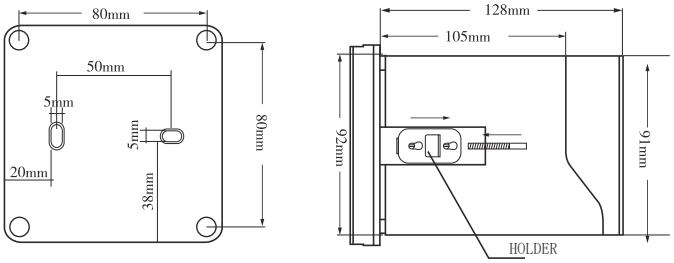


Wall and pipe installation - 144series

96 Series: The instrument can be panel,wall or pipe mounted installation. Panel installation: Make a 92x92mm square cutout and insert the instrument then screw in the fixed HOLDER.



Cutout size -96 series

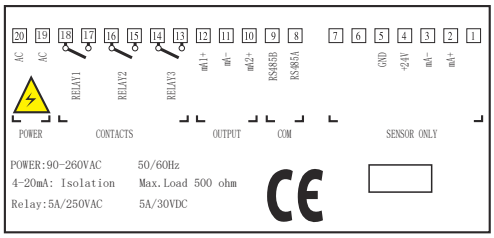


Back view - 96 series

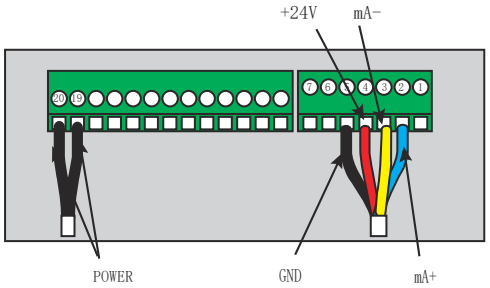
Side view -96 series

Connection label

144 Series



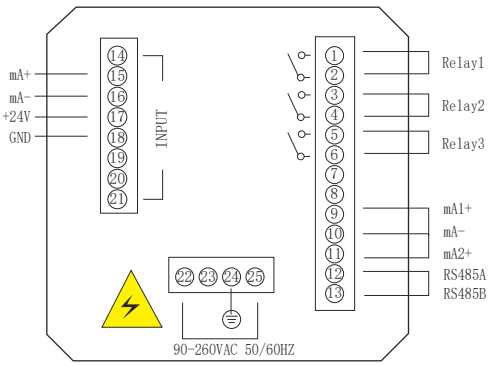
Electrode connection figure



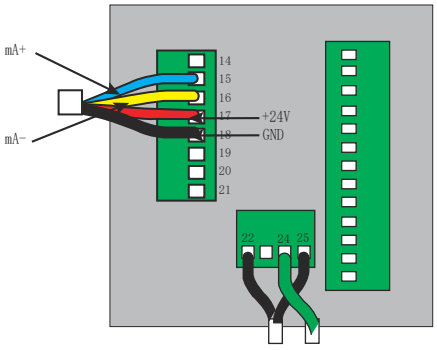
Explanation:

2/3 connnect to sensor mA output,4/5 offer sensor power.

96 Series



Electrode connection figure (96 series)

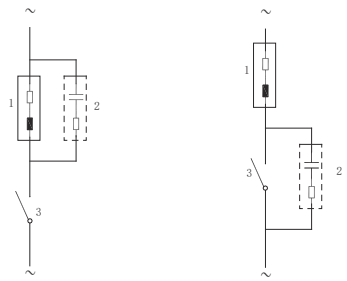


Explanation:

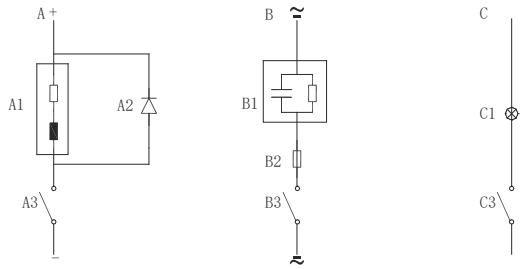
15/16 connnect to sensor mA output,17/8 offer sensor power.

Relay contact protection

Electrical spark at the relay contact may affect the life of the relay, especially in an inductive and capacitive load. In order to inhibit the spark and arc,user should use an RC circuit to extend the life of the relay.

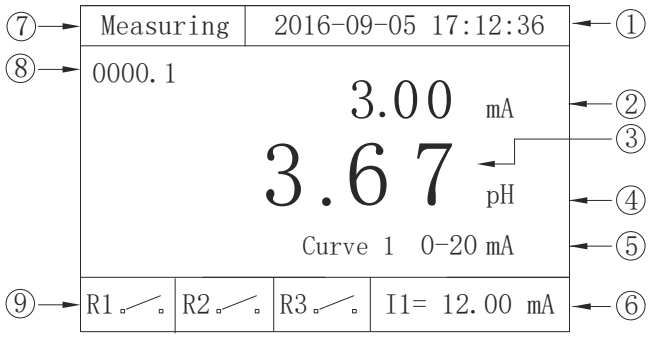


AC protection, use for inductive load
1. Load
2. RC eliminate spark, using in 220VAC, R=100 ohm/1W
3. Relay contact



DC protection: A1-Inductive load,A2-1N4007,A3-Relay contact
AC/DC protection: B1-Capacitive load,B2:0.8 ohm/1W(DC24V),B3-Relay contact
Resistive load: C1-Lamp bulb,C3-Relay contact

Display



1. Date and time
2. Display current and unit
3. Main measurement display
4. Unit
5. Operation
5. Current output 1
6. Measurement status and error indicator
7. Count down timer - Cycle time/ clean time (Displays “delay” when the delay function of relay 3 has been enabled)
8. Relays status indicator

Note: The current can be selected in two ranges: 0-20mA and 4-20mA,
Four ranges: ±9.999/±99.99/±999.9/±9999,
Units can be selected according to measurement needs (up to 5 digits)

Buttons

MODE SHIFT UP DOWN ENTER

Key name	Meas. status	Setting status	Cal. status	Record status
MODE	Enter password	Exit	Exit	Exit
SHIFT	None.	Move digit	Move digit	Move digit
UP	Enter record	Inc	Inc	Inc
DOWN	None	Dec	Dec	Dec
ENTER	ON/OFF backlight	Enter	Enter	Enter

Keeping mode

Keeping mode is a safe mode, mainly used for calibration mode, setting mode, record view mode and relay cleaning mode. In keeping mode, the relays are open (deactivated), the current is set according to the setting (fixed current / last current) and the measurement display remains fixed.

When entering the four modes above, it will enter the keeping mode
When leaving the four modes and returning to the measurement mode, it takes about 10 seconds to leave the keeping mode.
When the instrument is switched on, it enters the keeping mode and leaves the keeping mode for about 10 seconds to enter the measurement mode

Output current in keeping mode
two modes are available:

Fixed

Last

- Fixed current - The output current is fixed.
- Last current - Hold the last output before entering keeping mode.
- Relays will return to default status - All relays will be inactived.

Setting

Press MODE key to enter the password menu and then press UP/DOWN/SHIFT key to input password 1200 then press ENTER to go to the setting mode or press MODE key to exit. Controller will return to measurement mode after 10 minutes of inactivity.

PASSWORD
0 0 0 0

PASSWORD
1 2 0 0

Main display

Press UP/DOWN key to choose items then press ENTER key to enter the function.

CONFIGURATION
■ Current 1 Settings
□ Current 2 Settings
□ Relay 1 Settings
□ Relay 2 Settings
□ Relay 3 Settings
□ Measurement Settings
□ Temperature Settings
□ RS485 Settings

Page 1

CONFIGURATION
■ Date Settings
□ Data Log Settings
□ Output Test
□ Language Settings
□ Back Light Settings
□ Reset Parameters

Page 2

Note:
1. Error on measurement page indicates that input data is not in the correct range.
2. Press ENTER on setting pages to save any changed data.
3. Press MODE to return to the previous page.
4. Meter will return to measurement mode after 10 minutes of inactivity.

Current 1 settings

Range±9.999

CURRENT 1 SETTINGS	
4.00 mA	=+ 0 .0 0 0
20.00 mA	=+ 2 .0 0 0
Offset	= + 0 .0 0 mA
Filter Time	= 0 0 0 SEC
HOLD Type	=□ Fixed
	0 4 .0 0 mA
	□ Last

Range±99.99

CURRENT 1 SETTINGS	
4.00 mA	=+ 0 0 .0 0
20.00 mA	=+ 2 0 .0 0
Offset	= + 0 .0 0 mA
Filter Time	= 0 0 0 SEC
HOLD Type	=□ Fixed
	0 4 .0 0 mA
	□ Last

Range±999.9

CURRENT 1 SETTINGS	
4.00 mA	=+ 0 0 0 .0
20.00 mA	=+ 2 0 0 .0
Offset	= + 0 .0 0 mA
Filter Time	= 0 0 0 SEC
HOLD Type	=□ Fixed
	0 4 .0 0 mA
	□ Last

Range±9999

CURRENT 1 SETTINGS	
4.00 mA	= + 1 4 3 0
20.00 mA	= + 2 0 0 0
Offset	= + 0 .0 0 mA
Filter Time	= 0 0 0 SEC
HOLD Type	=□ Fixed
	0 4 .0 0 mA
	□ Last

1. Set the corresponding value of 4.00mA output
2. Set the corresponding value of 20.00mA output, The corresponding values of 4.00mA and 20.00mA cannot be equal(difference of 0.1/1/10/100)
3. Set the offset current, with the range of ± 1.00mA.
4. Set the current filtering time 0-120 seconds, when the current changes from one point to another, after a software low-pass filter intervention, the current would be more smooth.
5. Set the current holding type, UP/DOWN key to select fixed current or last current, if fixed current is selected, press ENTER key to input fixed current.

Relay 1 settings

Range±9.999

RELAY 1 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 .1 0 0
Open S.P.	= + 0 .0 8 0
Delay Time	= 0 0 0 SEC

Range±99.99

RELAY 1 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= 0 1 .0 0
Open S.P.	= 0 0 .8 0
Delay Time	= 0 0 0 SEC

Range±9.999

RELAY 1 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 1 0 .0
Open S.P.	= + 0 0 4 .0
Delay Time	= 0 0 0 SEC

Range±9999

RELAY 1 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 1 0 0
Open S.P.	= + 0 0 8 0
Delay Time	= 0 0 0 SEC

1. Press UP/DOWN key to ON/OFF (enable/disable) relay1.
2. Close set point: Target value to activate relay.
3. Open set point: Target value to deactivate relay.
4. Delay time: Relay will only be activated when this timer time out. Timer range from 0 to 120 seconds.

Relay 2 settings

Range±9.999

RELAY 2 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 .1 0 0
Open S.P.	= + 0 .0 8 0
Delay Time	= 0 0 0 SEC

Range±99.99

RELAY 2 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= 0 1 .0 0
Open S.P.	= 0 0 .8 0
Delay Time	= 0 0 0 SEC

Range±9.999

RELAY 2 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 1 0 .0
Open S.P.	= + 0 0 4 .0
Delay Time	= 0 0 0 SEC

Range±9999

RELAY 2 SETTINGS	
ON/OFF	= ■ ON
	□ OFF
Close S.P.	= + 0 1 0 0
Open S.P.	= + 0 0 8 0
Delay Time	= 0 0 0 SEC

1. Press UP/DOWN key to ON/OFF (enable/disable) relay2.
2. Close set point: Target value to activate relay.
3. Open set point: Target value to deactivate relay.
4. Delay time: Relay will only be activated when this timer time out. Timer range from 0 to 120 seconds.

Relay 3 settings

RELAY 3 SETTINGS	
ON/OFF	= ■ ON
	= □ OFF
Period Time	= 0 0 0 1 . 0 HOUR
Clean Time	= 0 0 1 0 SEC
Delay Time	= 0 0 0 SEC
Function	= □ Rinsing
	□ Interval Alarm
	□ Error Alarm

1. ON/OFF:Press UP/DOWN key to ON/OFF (enable/disable)relay 3.
2. Period time: Rinsing or interval function only.
3. Clean time: Relay operation period.
4. Delay time: Relay will only be activated when this timer is time out.
5. Function: Press UP/DOWN key to select Rinsing /Interval/Error.

Note:

1. Rinsing: Relay will be activated when period time out. Relay will remain activated throughout cleaning time. Timer will restart when cleaning is completed.
2. Interval alarm: Relay will be activated when period time out. Relay will remain activated until user resets the alarm. Timer will restart.
3. Error alarm:Relay will be activated when an error is detected. Timer is not available for this function.

Measurement settings

0-20mA

MEASUREMENT SETTINGS	
Operation	= ■ 0-20mA
	□ 4-20mA
	□ Curve 1
	□ Curve 2

MEASUREMENT SETTINGS	
Range	= ■ ±9.999
	□ ±99.99
	□ ±999.9
	□ ±9999
Unit	= pH
0.00mA	= + 1 .2 0 0
20.00mA	= + 2 .6 0 0

MEASUREMENT SETTINGS	
Operation	= □ ±9.999
	■ ±99.99
	□ ±999.9
	□ ±9999
Unit	= pH
0.00mA	= + 0 6 .0 0
20.00mA	= + 1 0 .0 0

MEASUREMENT SETTINGS	
Range	= □ ±9.999
	□ ±99.99
	■ ±999.9
	□ ±9999
Unit	= pH
0.00mA	= + 2 2 0 .0
20.00mA	= + 4 2 0 .0

MEASUREMENT SETTINGS	
Range	= □ ±9.999
	□ ±99.99
	□ ±999.9
	■ ±9999
Unit	= pH SEC
0.00mA	= + 1 0 2 0
20.00mA	= + 2 2 5 6

1. Press the UP/DOWN key to select the operation mode, and press the ENTER key to confirm entering the range selection
2. Range: UP/DOWN key to select the range
3. Unit: UP/DOWN key to select unit, SHIFT key to move digit position

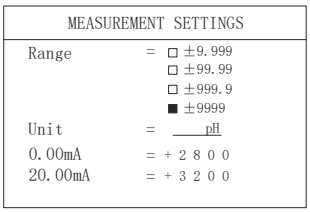
4-20mA

MEASUREMENT SETTINGS	
Operation	= □ 0-20mA
	■ 4-20mA
	□ Curve 1
	□ Curve 2

MEASUREMENT SETTINGS	
Range	= ■ ±9.999
	□ ±99.99
	□ ±999.9
	□ ±9999
Unit	= pH
4.00mA	= + 1 .0 0 0
20.00mA	= + 2 .0 0 0

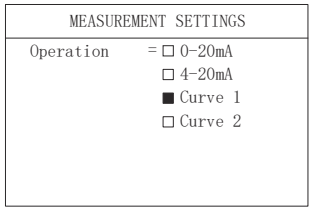
MEASUREMENT SETTINGS	
Range	= □ ±9.999
	■ ±99.99
	□ ±999.9
	□ ±9999
Unit	= pH
4.00mA	= + 1 2 .0 0
20.00mA	= + 2 0 .5 0

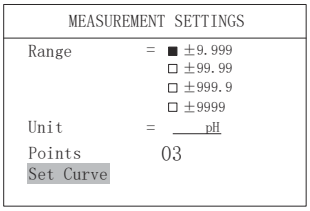
MEASUREMENT SETTINGS	
Range	= □ ±9.999
	□ ±99.99
	■ ±999.9
	□ ±9999
Unit	= pH
4.00mA	= + 1 3 6 .0
20.00mA	= + 2 7 2 .0

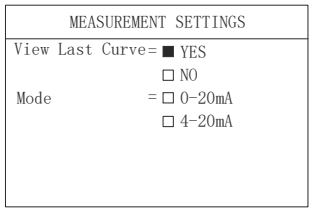


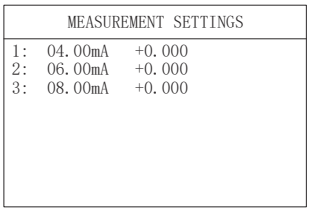
1. Press the UP/DOWN key to select the output, and press the ENTER key to confirm entering the range selection
2. Range: UP/DOWN key to select the range
3. Unit: UP/DOWN key to select unit, SHIFT key to move digit position

Curve 1

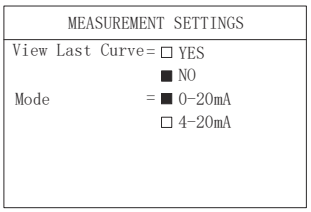


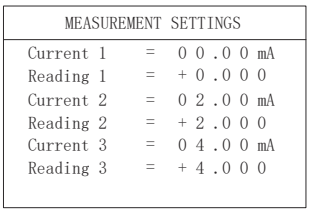






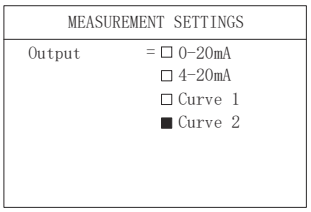
1. Press the UP/DOWN key to select the operation mode, and press the ENTER key to confirm entering the range selection
2. Range: Select the range with the UP/DOWN key and confirm with the ENTER key
3. Unit: UP/DOWN key to select unit, SHIFT key to move digit position
4. Points: Select the number of points using the UP/DOWN key, and set the curve value (2 - 10 points)
5. View Last Curve:Select "Yes" or "No" with the UP/DOWN key. If "Yes" is selected, the last value of previous curve will be displayed. Press the ENTER key to return to measurement mode.

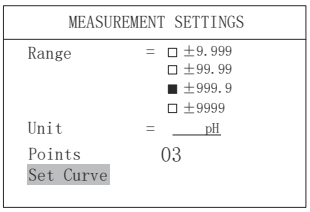


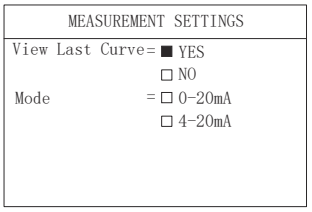


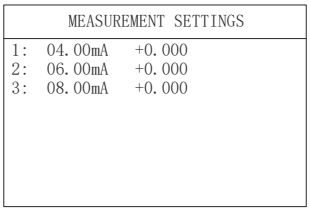
1. Select "Yes" or "No" with the UP/DOWN key. If "No" is selected, press the ENTER key to confirm entering the mode selection
2. Mode: UP/DOWN key to select the mode (0-20mA/4-20mA display is the same), and ENTER key to confirm.Read the reading value, use the slope between the two points to calculate the value between them, and the current value below should be greater than the current value above.

Curve 2

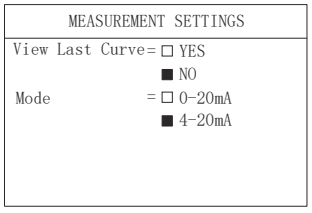


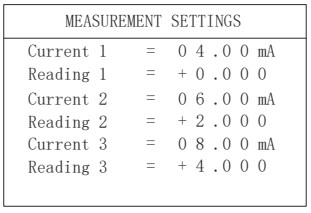






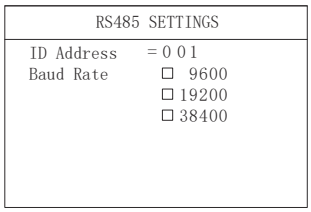
1. Press the UP/DOWN key to select the operation mode, and press the ENTER key to confirm entering the range selection
2. Range: Select the range with the UP/DOWN key and confirm with the ENTER key
3. Unit: UP/DOWN key to select unit, SHIFT key to move digit position
4. Points: Select the number of points using the UP/DOWN key, and set the curve value (2 - 10 points)
5. View Last Curve:Select "Yes" or "No" with the UP/DOWN key. If "Yes" is selected, the last value of previous curve will be displayed. Press the ENTER key to return to measurement mode.





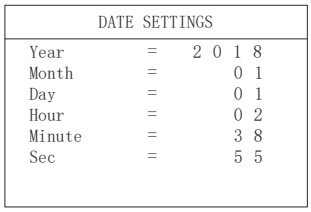
1. Select "Yes" or "No" with the UP/DOWN key. If "No" is selected, press the ENTER key to confirm entering the mode selection
2. Mode: UP/DOWN key to select the mode (0-20mA/4-20mA display is the same), and ENTER key to confirm.Read the reading value, use the slope between the two points to calculate the value between them, and the current value below should be greater than the current value above.

RS485 settings



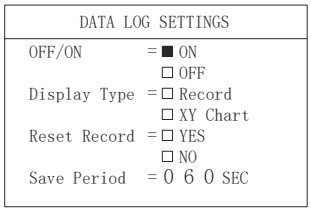
1. ID Address: 1-255
2. Baud Rate: Press UP/DOWN key to select correct baud rate.

Date Settings



Press UP/DOWN key to set the date.Clock will continue to run for about 2 days after power down.

Data log settings



1. ON/OFF:Enable or disable data logging function.
2. Display Type:Select data logging display mode.
3. Reset Record:Erase all recorded data.
4. Saving Period:Recording interval.

Note:
1. When Data Logging is on, data will be saved according to the time of the storage interval in measurement mode.
2. The logging method can be selected as either a log display (5 data per page) or a graphical display (150 data per page).
3. When Reset Record is selected, it will take about 10 seconds for all logs to be cleared.

Output test

OUTPUT TEST	
Current1	= 0 4 . 0 0 mA
Relay1	= ☐ CLOSE
	☐ OPEN
Relay2	= ☐ CLOSE
	☐ OPEN
Relay3	= ☐ CLOSE
	☐ OPEN

1. Current 1:Input current ranging from 4.00-20.00mA to the output. Press UP/DOWN to set.
2. Relay 1:Open or close contact. Press UP/DOWN to select.
3. Relay 2:Open or close contact. Press UP/DOWN to select.
4. Relay 3:Open or close contact. Press UP/DOWN to select.Notice:This function for testing the output only.

Language settings

LANGUAGE SETTINGS	
Language	= ■ English
	☐ 繁體中文
	☐ 简体中文

Press UP/DOWN key to select the language.

Back light settings

BACK LIGHT SETTING	
Back Light	= ■ 60 Seconds
	☐ Manual
Contrast	= 05

1. 60 seconds: The back light will turn off when no key is pressed in 60 seconds.
2. Manual: User needs to press the ENTER key to turn on/off the back light in manual.

Reset parameters

RESET PARAMETERS	
Reset Type	= ■ Current
	☐ Relay1
	☐ Relay2
	☐ Relay3
	☐ All

Press UP/DOWN key to select the targeted parameters to reset.
When the operation mode is 0-20mA or 4-20mA, the current and relay are recovered separately, and the current output and relay closing/releasing points will be consistent with the corresponding measuring values set by the user for 0-20mA/4-20mA.

Record query

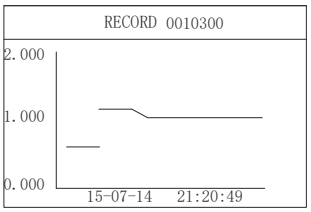
INPUT RECORD START NUMBER
010300

Press UP key at the measurement mode to enter the record query mode.
Press UP/DOWN and SHIFT key to input record number then press ENTER key to confirm record number or press MODE key to exit.

Display (pH) data in detail view

RECORD 0010300	
15-08-14 21:20:49	07.00 pH 000.0
15-08-14 21:20:59	07.00 pH 000.0
15-08-14 21:21:09	07.00 pH 000.0
15-08-14 21:21:19	07.00 pH 000.0
15-08-14 21:21:29	07.00 pH 000.0

Display data in XY chart view(±9.999)



Calibration

Press MODE key to enter the password menu. Then press UP/DOWN/SHIFT key to input password 1100. Pressing ENTER to go to calibration mode or press MODE to exit. If no key is pressed for over 10 minute, then it will go back to measurement mode.

PASSWORD
0000

PASSWORD
1100

Main display

CALIBRATION
■ Offset Calibration
□ 0-20mA Calibration
□ 4-20mA Calibration

Press UP/DOWN key to select the functions and then press ENTER key to confirm
1. Offset Calibration: Input offset
2. 0-20mA Calibration: Calibrate the current input of 0-20mA working mode.
3. 4-20mA Calibration: Calibrate the current input of 4-20mA operating mode.

Offset Calibration

PAPAMETERS SETTING	
Offset	= + 0 . 0 0 0

Set the offset for the reading value.

0-20mA Calibration

CURRENT CALIBRATION	
Input 0.00mA	= 1 0 2 3 0
Input 10.00mA	= 2 0 2 0 0
Input 20.00mA	= 3 0 1 0 0

1. Input 0.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.
2. Input 10.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.
3. Input 20.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.

4-20mA Calibration

CURRENT CALIBRATION	
Input 4.00mA	= 1 0 2 6 0
Input 12.00mA	= 2 1 0 0 0
Input 20.00mA	= 3 2 0 7 6

1. Input 4.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.
2. Input 10.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.
3. Input 20.00mA and wait for the reading value to stabilize, and then press the ENTER key to confirm.

USB Function (144 Series)

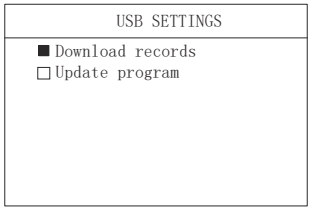
Press MODE key to enter the password menu. Press UP/DOWN/SHIFT key to input password 1300. Press ENTER to go to USB setting or press MODE key to exit. If no key is pressed for over 10 minutes, it will go back to measurement mode.

PASSWORD
0000

PASSWORD
1300

USB Settings

Press UP/DOWN key to select the functions and then press ENTER key to proceed.



1. To download records, plug in a USB flash disk into the USB port and then download all of the records. It takes around 10 minutes to download 500,000 records or 1 minute to download 50,000 records.
2. To update program, save the correct file to the USB flash disk. Plug it to the USB port. Enter the update program function to update it.

Default settings

20.00mA corresponding (±9999)	2000		
4.00mA corresponding (±9999)	0.0		
20.00mA corresponding (±999.9)	200.0		
4.00mA corresponding (±999.9)	0.0		
20.00mA corresponding (±99.99)	20.00		
4.00mA corresponding (±99.99)	0.0		
20.00mA corresponding (±9.999)	2.00		
4.00mA corresponding (±9.999)	0.0		
Current 1 output offset	0.00	mA	range: +/- 1.00
Current 1 filter	0	SEC	range: 0 - 120
Current 1 fixed output	4.00	mA	range: 4-20mA
Relay1 close S.P (±9999)	1000		
Relay1 open S.P. (±9999)	500		
Relay1 close S.P (±999.9)	100		
Relay1 open S.P. (±999.9)	50		
Relay1 close S.P (±99.99)	10		
Relay1 open S.P. (±99.99)	5		
Relay1 close S.P (±9.999)	1		
Relay1 open S.P. (±9.999)	0.5		
Relay1 delay time	0	SEC	range: 0 - 120
Relay2 close S.P (±9999)	1000		
Relay1 open S.P. (±9999)	500		
Relay2 close S.P (±999.9)	100.0		
Relay1 open S.P. (±999.9)	50.0		
Relay2 close S.P (±99.99)	10		
Relay1 open S.P. (±99.99)	5		
Relay2 close S.P (±9.999)	1		
Relay1 open S.P. (±9.999)	0.5		
Relay2 delay time	0	SEC	range: 0 - 120

Relay 3 period time	1.0	HOUR	range: 0.1 - 1000.0
Relay 3 clean time	10	SEC	range: 1 - 1000
Relay 3 delay time	0	SEC	range: 0 - 120
Relay 3 function	error alarm		range: clean/period alarm /error alarm
Record period	60	SEC	range: 5 - 120
ID address	1		range: 1 - 255
Baud rate	9600		range: 9600,19200,38400
Language	English		range: English/ traditional Chinese/ Simplified Chinese
Filter	1		range: 0 - 10
Measurement Interval	5	SEC	range: 5 - 60

Password

Press MODE key
1100: Calibration mode
1200: Setting mode
1300: USB mode
If no key is pressed within 10 minutes, it will return to measurement mode.

Error code

Error 01 Memory error
Error 02 Reading is over maximum
Error 03 Reading is under minimum
Error 04 Temperature is over maximum
Error 05 Temperature is under minimum
Error 06 Current 1 output is over 20.5 mA. The maximum is 22.00mA
Error 07 Current 1 output is under 3.8 mA. The minimum is 3.5mA
Error 08 Current 2 output is over 20.5 mA. The maximum is 22.00mA
Error 09 Current 2 output is under 3.8 mA. The minimum is 3.5mA
Error 10 Record error
Error 11 ADC damage
Error 99 Default parameters lost

RS485 command

The instrument comes in standard with Modbus-RTU protocol. All of the data are word type (2 bytes) or floating type (4 bytes), the word type range is -32767～32767.

PC command:

	ID address	command	Start address	Data number	CRC16
length	1 byte	1 byte	2 byte	2 byte	2 byte
Ex.	0x01	0x03	0x0001	0x0001	0xD5CA

Instrument response

	ID address	command	Start address	Data number	CRC16
length	1 byte	1 byte	1 byte	N byte	2 byte
Ex.	0x01	0x03	0x02	0x02 0xBC	0xB895

If response is 01, the command is wrong.
If response is 02, the address is not correct.
If response is 03, data number is not correct.
Command 03: read the settings
Command 04: read the readings

04: definition
address

(00)	0x00	Measurement value	reading: float
(01)	0x02	Current	reading: float
(02)	0x09	Model	reading: X 1