

Operation Manual

CON5000

Conductivity/TDS/Resistance Controller/Transmitter

Preface

This manual serves to explain the use of CLEAN CON5000 Controller / Transmitter. This operation manual is written to cover as many anticipated applications of CON5000 controller / transmitter. If you have doubts in the use of the instrument, please do not hesitate to contact CLEAN local customer service centers.

The information presented in this manual is subject to change without notice as improvements are made, and does not represent a commitment of CLEAN brand from CLEAN Instruments.

CLEAN Instruments can not accept any responsibility for damage or malfunction of the unit due to improper use of the instrument.

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Safety Information

CLEAN CON5000 Controller / Transmitter should be installed and operated only in the manner specified in the operation manual. Only skilled, trained or authorized person should carry out installation, setup and operation of the instrument.

Before powering up the unit, make sure that power source is connected to, is as specified in the top label. Failure to do so may result in a permanent damage to the unit.



Protect level against electric shock mainly depends on relevant installation rules.

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1 PREFACE

BEFORE USE

Thank you for selecting CLEAN CON5000 Conductivity/TDS/Resistance Controller/Transmitter. Although this controller / transmitter use advanced technology and meet the requirements of current safety rules, improper use can also threaten the safety of users, and / or cause harmful influences to factory and other equipments. Therefore, before using CON5000 controller / transmitter, related person must read and understand contents of this operation manual.

Following symbols used in this operation manual are to mark safety instruction and appendix information:

	This symbol means contents and safety instructions and warning of potential dangerous. If they are neglected, person may be hunted and property may be damaged.
	This symbol indicates the useful tips that ease your meter operation.

Operation manual should be kept accessible within the person who use CON5000 controllers / transmitters.

If you have problems which are not mentioned or can not be explained in this manual, please contact with your CLEAN local customer service centers. They will be very glad to help you.

IN USE



CLEAN CON5000 controller / transmitter, as described in operation manual are intended to separate conductivity and temperature measurement.

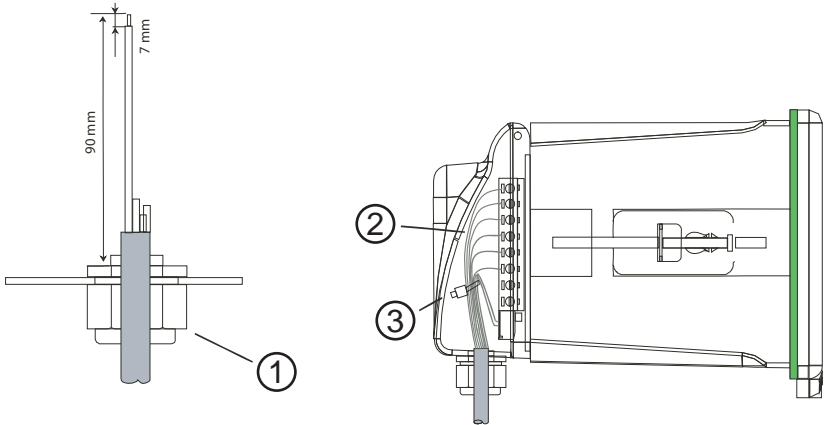
Any other uses, or other unmentioned use in operation manual, are not acceptable when they contradict the technical parameters. User must be responsible for any results of damage or abuse of use.

Other conditions of right use include:

- Remarks and requirements stated in operation manual.
- Local safety regulations about safe operation.
- Information and warning of products that are used together with the transmitters in the contract. (chassis, electrode, etc.)
- Required operating environment and working condition.

SAFETY MEASURES

	Conductivity transmitters should be installed and operated by qualified person who are familiar with the work.
	Transmitters with problems should not be installed and used.
	Conductivity transmitters should be used under the required working condition.
	Conductivity transmitters should not be opened and repaired by clients themselves.
	Mollified conductivity transmitters should not be used. Producers and suppliers do not bear responsibility for the damage and lose caused by modifying instruments without permission. Clients should bear all the risks. This instrument is IP65 rated. Please use waterproof cable glands when you connect the line. Also, please loose it when you open the cover. After connecting the line, please tighten the cable conductor according to the following instruction with cable ties, or it will cause danger such as cable conductor or interface falls off when open the cover.  Please make sure to cut the power off when you open the cover to carry on any operation.



1. Waterproof cable glands
2. Cable (recommended stripping length for cables is at least 90mm, please use 0.5 to 1 square meter's wire)
3. Cable ties

2 PRODUCT DESCRIPTION

2.1 DESCRIPTION OF INSTRUMENT SPECIALITY

CLEAN Conductivity transmitters are used to measure conductivity and temperature value.

Transmitters can be used as monitors in water treatment, in process of chemical industry, in food process, in cleaning water or wastewater treatment and in neutralization process.

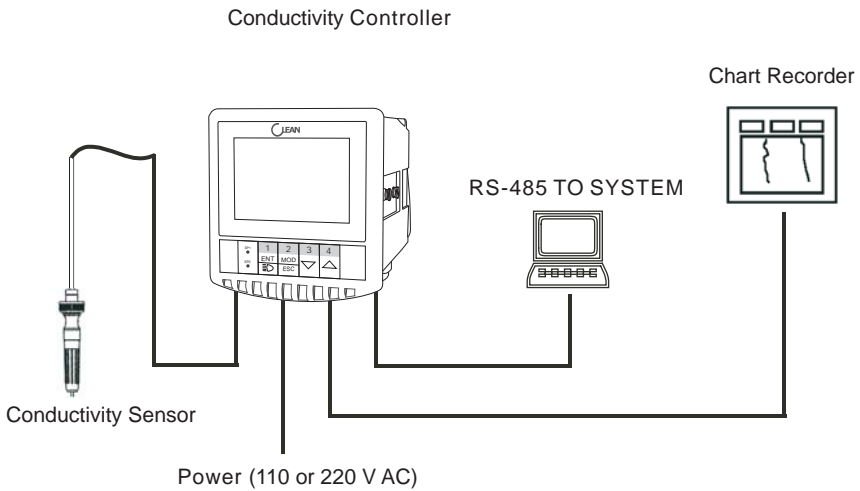
This transmitter has many user-friendly and safety features which include:

- Menu-driven program that simplifies set-up.
- Built-in memory backup to ensure that set-up parameter and calibration information are not erased if power off or power off in abnormal condition.
- Long-life micro-switch key
- IP65 all-day water and air proofing can be used in any adverse circumstances.
- Adjustment of electrode offset value
- Automatic temperature compensation mode, manual set-up of process temperature and calibration temperature.
- Separately adjustable high and low set point hysteresis (dead bands) prevents oscillating of relays around the set points.
- Large dual display LCD for easy reading with clear multiple annunciators, alarm status and operational message annunciators
- Back-light LCD can be also used in dark industrial situation.
- Two switch on/off relays and one alarm relay
- Independent alarm relay can be set up as calibration remind or clean relay, which can move with control relay under alarm mode.
- Anti-interference of electromagnetism-electric isolation of 0/4-20mA output, ensure the safety of data collection and control effect.
- RS-485 output

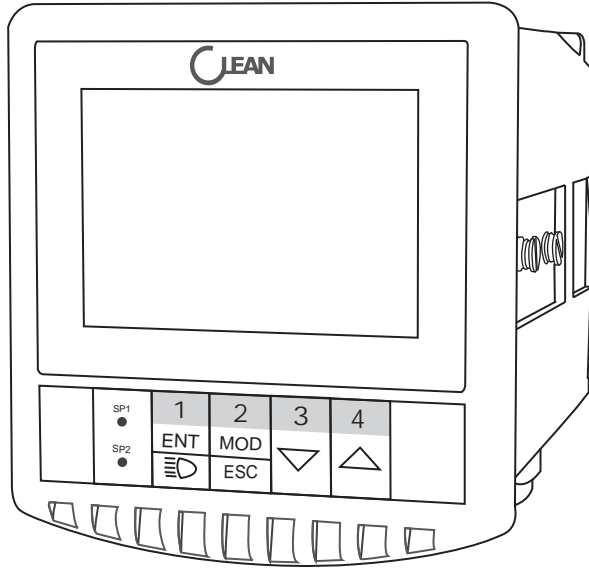
2.2 MEASUREMENT AND CONTROL SYSTEM

Typical measurement system includes:

- Conductivity on-line transmitter
- Conductivity sensor with or without Pt 1000 temperature probe
- Suitable conductivity measurement electric cable
- Immersion, flow or processing parts
- Terminating controlling parts
- 0/4~20mA can connect with recording instrument
- RS-485 can be used as multi-instrument communication
- RL3 relay can be used as alarm or washing function



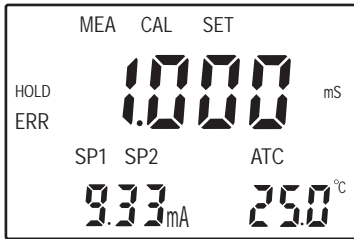
2.3 APPEARANCE



CON5000 Conductivity/TDS/Resistance Controller / Transmitter

2.3.1 DISPLAY INTRODUCTION

Two line LCD indicate measured value and various indications and parameters under different conditions.







Mode:

- **MEA**: measurement mode
- **SET**: set-up mode
- **CAL**: calibration mode

Status:

- **HOLD**: Freeze relay actions and current output.
- **ATC**: Automatic temperature compensation indication.
- **ERR**: Error or warning indication.

2.3.2 KEY INSTRUCTION

KEY	Description
	<ul style="list-style-type: none"> • Mode switch or exit from current mode of operation.
	<ul style="list-style-type: none"> • Confirm selection. • Enter into function group in setting up mode. • Confirm setted parameter and value. • Start calibration in calibration mode. • Back light switch in measurement mode.
 	<ul style="list-style-type: none"> • Select function group in setting up mode to set parameters and value pressing, value changing will be quicker. • Press these two at the same time under measurement mode, electrode constant and measuring range will be showed.

2.3.3 LED

Relay Introduction

SP1 \ SP2 LED shows relevant working status of relays.

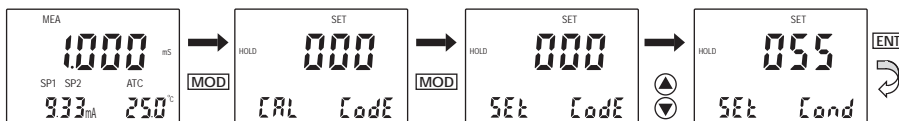
SP1 \ SP2 LED light-on shows that relays are under working status.

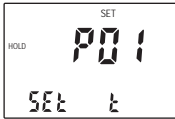
2.3.4 PASSWORD

When entering calibration mode and setting mode, there are passwords. Passwords are set by factory and users cannot modify them by themselves. Followings are those passwords:

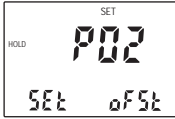
Password	Mode / Instruction
020	System set-up mode
028	Calibration Mode
055	Action set-up mode

2.3.5 FUNCTION PREVIEW





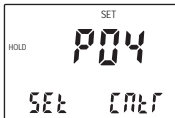
Temperature set-up function: modify relevant parameters such as auto or manual temperature compensation, set-up of manual temperature compensation.



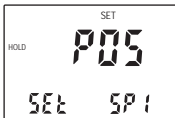
Offset set-up function: modify measuring value and cable resistance.



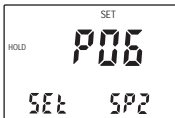
Electric current set-up function: set up output electric current.



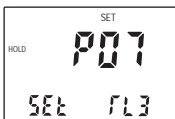
Control mode set-up function: set up working mode of relays, can set up limit control and ratio impulse control mode.



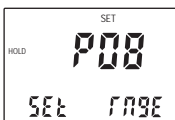
SP1 set-up function: set up action of relay 1, carry out auto control.



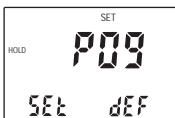
SP2 set-up function: set up action of relay 2, carry out auto control.



Relay 3 set-up function: set up action of relay 3, carry out functions of cleaning, reminding of calibration and alarm.



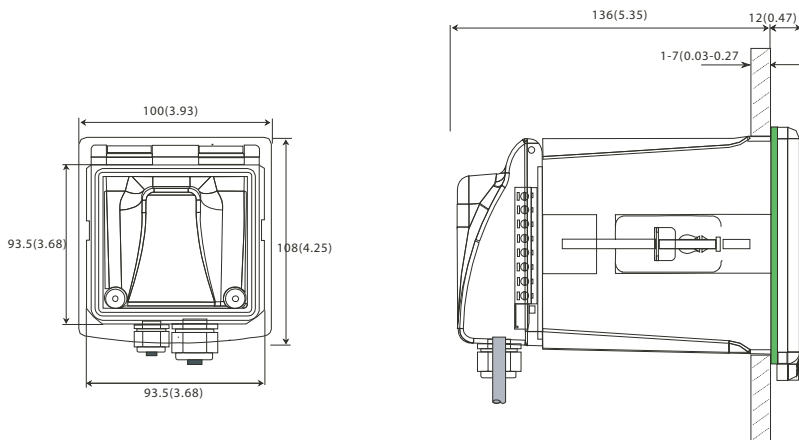
Measurement range set-up function: can set up Conductivity and TDS measuring range.



Reverting to factory default setting function: revert all setting values and calibration values to factory default setting.


3 INSTALLATION AND ACCESSORY

INSTALLATION



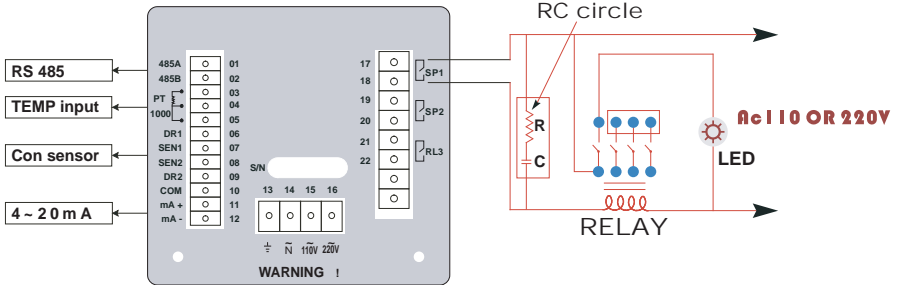
Panel cutout: 93.5 * 93.5mm (±0.5mm)
(panel mounting)

CON5000 CONNECTION DIAGRAM



Warning: Make sure to power off the meter before connecting. The rear panel consists of three connectors.

CON5000 Connection Diagram



1. 485A output A	12. 4~20mA-
2. 485B output B	13. Earth wire
3. Temperature electrode input terminal (PT1000)	14. Input of alternating current
4. Temperature electrode input terminal (PT1000)	15. Power input 110V AC (220V AC Prohibited)
5. CABL compensation terminal, use short circuit between 4	16. Power input 220V AC (110V AC Prohibited)
6. Conductivity drive 1 (2-wire system, use short circuit between 6 and 7)	17. Relay A (SP1)
7. Conductivity sense 1	18. Relay A (SP1)
8. Conductivity drive 2 (2-wire system, use short circuit between 8 and 9)	19. Relay B (SP2)
9. Conductivity sense 2	20. Relay B (SP2)
10. COM	21. Clearing Relay (RL3)
11. 4~20mA+	22. Clearing Relay (RL3)

NOTE: CON5000 can use 2 cell electrode and 4 cell electrode. Please be noted the type of electrode and connecting way in the process of connecting electrodes. When using 2 cell electrode, please connect 6 and 8, use short circuit between 6 and 7, also 8 and 9. When using 4 cell electrode, please connect with relevant pins.

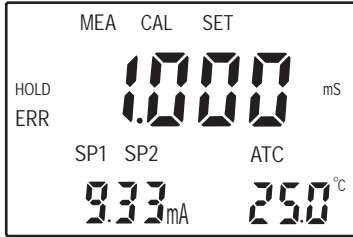
Notice: Relay contactor volume of our instrument is 220 VAC/0.5A. Please do not connect with bigger current appliance. Please install bridge relay to transit according to the above diagram. There is RC parameter, which is 100 ohm/0.22uF on the relay contactor. Please pay attention to that.

MEASUREMENT MODE

When the controller is powered on, first the large dual LCD displays all icons briefly, then the controller will automatically enter into the measurement mode.



Note: In order to get precise measurement value, users should calibrate the measurement system (Transmitter and Electrode).




MEA on top of the LCD shows that the instrument is under measuring status.

The upper display shows CON value, while the lower display shows temperature value under Conductivity measurement mode.

Annunciator at the left lower side of the display show the value of transmitting output electric circuit, which as the way that users calibrate the output electric circuit.

Such icons, as mS, at the upper right side of the display show the transmitters' different measurement modes.



In measurement mode, you can press  key once or twice to enter into the function form of calibration or set password input function form.


Then input relevant password to enter into calibration mode or set up mode. Please refer to Item 4 (Calibration Mode) or Item 5 (set up mode).



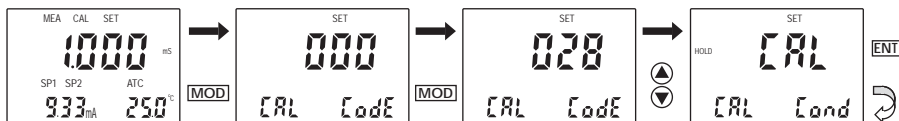
Press  key under measurement mode, you can open or close back light of LCD.


4 CALIBRATION MODE




You can press  once under measurement mode and then input password 028 to get access to calibration mode. Please operate according to following squares.

4.1 ENTERING CALIBRATION MODE




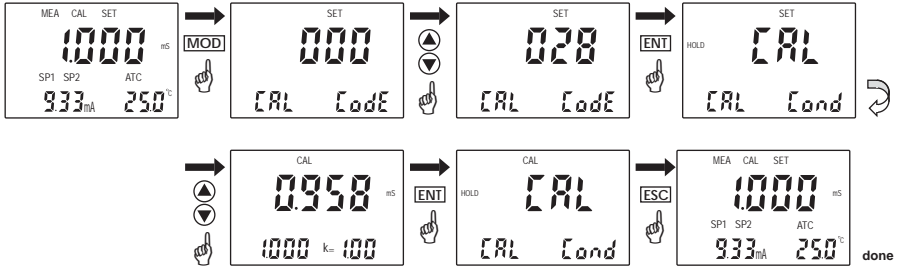
1. Press  once in measurement mode and enter into calibration form or password input form.
2. After entering function form of calibration password input, LCD will ask you to input password. Press ▲ or ▼ to input calibration password 28, then press ENTER to confirm the password.
3. Press ENTER to enter into calibration function form, lower display will show CAL conductivity. If you want to calibrate, please refer to relevant items.(please refer to upper pictures).












NOTE: At anytime, press  twice to exit from calibration mode and return to former function. If return to measurement mode, old calibration information will be kept and used. After returning to measurement mode, password will automatically set up from 28 to 000 when entering calibration mode.

4.2 CONDUCTIVITY CALIBRATION


You can press  once under measurement mode and then input password 028 to get access to calibration mode. Please operate according to following squares.



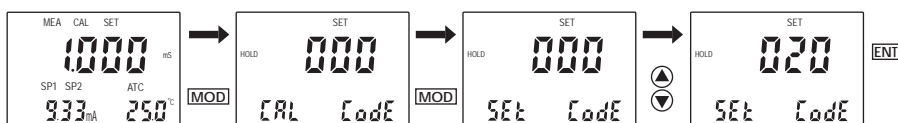
1. Entering calibration mode as Item 4.1 described. LCD will show CAL conductivity (Conductivity Calibration mode).
 2. Press  key to enter into calibration, LCD will show electrode constant and show menu. The lower display will show 1.000 K=1.00, this function form shows the electrode constant of last calibration. The upper display will show CAL and the main display area will show conductivity measuring value. Users can press ▲ or ▼ key to select electrode constant to calibrate, also, users can use standard buffer solution to select the value to calibrate.
 3. Put electrode into the prepared standard buffer solution. You should put temperature electrode into the same solution under the automatic temperature compensation mode.
 4. Press ▲ or ▼ key to select electrode constant to calibrate, also, users can use standard solution to select the value to calibrate. Press  to confirm when finished, and return to calibration mode.
 5. Press  once to return to calibration mode and finish the calibration process.
-  **NOTE:** Press  twice to exit from set up mode at any time. Instrument will return to measurement mode automatically.

	<p>NOTE: Transmitter will show ERR when calibration is error. Under this situation, press  to exit and calibrate again from step 1. It will show ERR again under following situations:</p> <ol style="list-style-type: none"> (1) Use wrong standard buffer solution or buffer solution has expired. (2) Electrode is aging, constant is over permitting range. (3) Electrode wire is broken or leakage because of joint corrosion.
	<p>NOTE: When calibrating under manual temperature compensation mode, transmitter will automatically switch to calibration temperature from pre-set measurement temperature. When leaving calibration mode, transmitter will switch to measurement temperature again. (Please refer to Item 5.2 for setting measurement temperature and calibration temperature)</p>
	<p>NOTE: ELE K=1.00 presents the electrode's standard constant is 1.0, the left 1.000 present the actual electrode constant.</p>

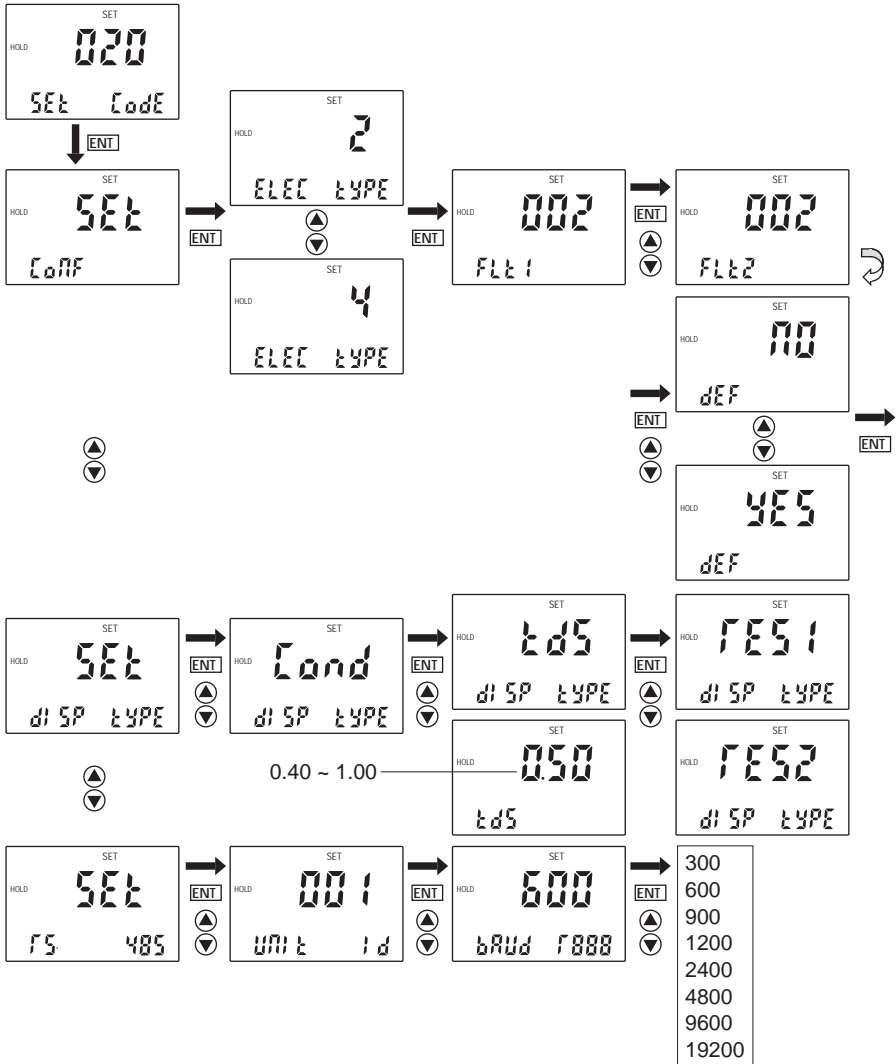
4.3 SYSTEM SET UP

You can press  twice under measurement mode and then input password 020 to get access to system set-up mode. Please operate according to following squares.

Entering System set-up mode




Entering system set-up mode according to following diagrams :



- Entering system set-up mode as Item 4.3 described. LCD display CONF (configuration function).
- | | |
|---|-----|
| 1 | ENT |
|---|-----|


2. Press to enter, LCD show to choose conductivity electrode. The lower LCD will show ELEC TYPE, upper will show 2 (2 way electrode). Users can press ▲ or ▼ to choose 4 (4



way electrode). Press  to enter into digit filtering set up menu. Press ▲ or ▼ to modify digit filtering value. Press ENT to confirm and enter into reverting to factory default setting.

3. Under measurement mode, users can choose measurement mode of conductivity, TDS, resistivity. The upper LCD will show SET, the lower LCD will show DISP TYPE. Press ENT to enter or press ▲ or ▼ to choose relevant measurement mode, press ENT to confirm. Under TDS measurement mode, users can set up the transit parameter of TDS from 0.40 to 1.00. The relationship between TDS and conductivity is: $CON * TDS \text{ parameter} = TDS$. Two measurement range, RES1 and RES2, can be chosen among resistivity. RES1 is correspondent to 3.0M ~300.0M, RES2 is correspondent to 0.3M~30.0M.

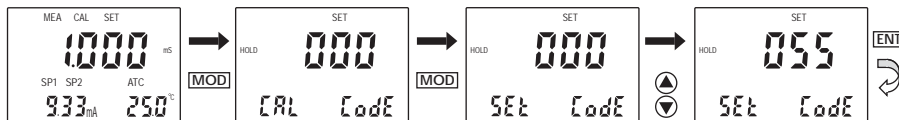






4. RS-485 set up menu, upper LCD shows SET, lower LCD shows RS-485, press  to enter instrument ID number. Press ▲ or ▼ to input number, press ENT to confirm and enter into baud rate set up menu. Press ▲ or ▼ to choose relevant value, press ENT to confirm.

5 SET UP MODE

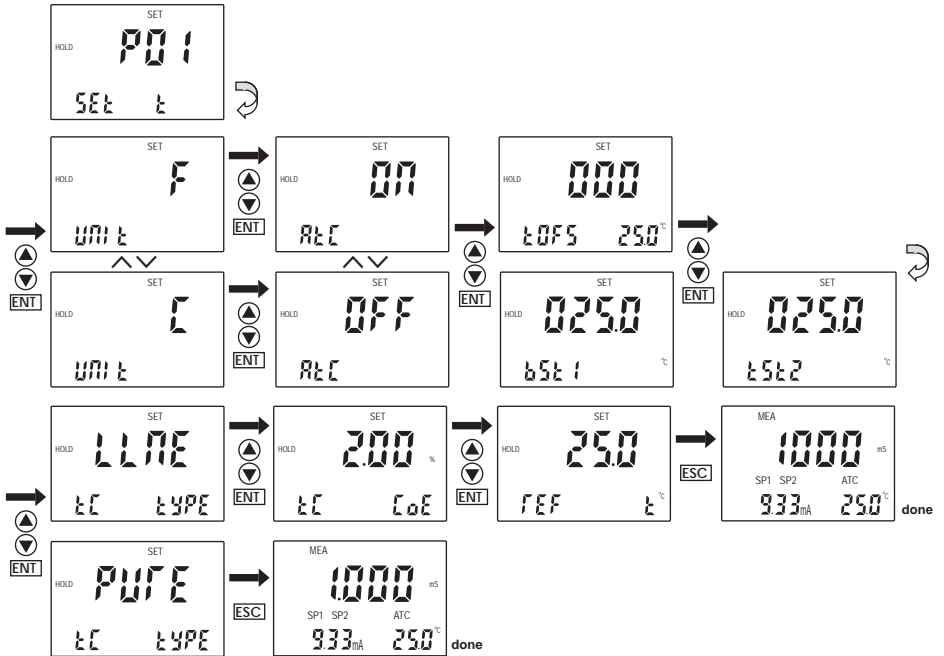
ENTERING SET UP MODE



In set up mode, transmitter can be set up according to your need.








	
1. Press MOD twice in measurement mode.	
2. LCD will ask you to input password. Use ▲ or ▼ to input the password.	
	
– Input 055 to change parameter. Press ENT to confirm.	
	 NOTE: Press MOD twice to exit from setting up mode at anytime. Instrument will return to measurement mode automatically.

5.1 P01: TEMPERATURE SET-UP FUNCTION




- Press  to enter from P01 screen. LCD main display area show °C, which means temperature unit is centigrade. You can press ▲ or ▼ to switch to °F, which means temperature unit is Fahrenheit. Press  to confirm and enter into next item.
- LCD main display area shows ON, which means automatic temperature compensation function is open. User can press ▲ or ▼ to switch to OFF and close automatic temperature compensation function to use manual temperature compensation instead.

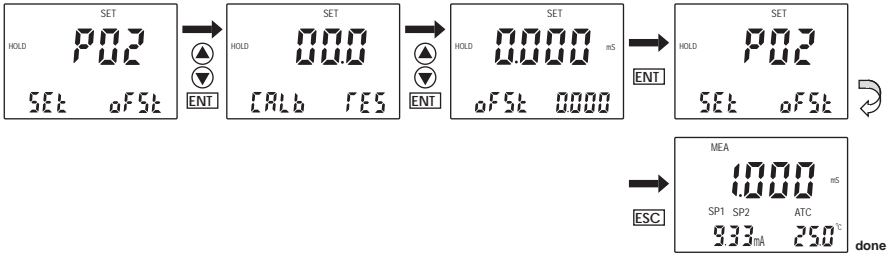
Press  to confirm item. If users choose auto temperature compensation, press , instrument enters into modifying status of temperature measurement value. LCD main display zone show current measurement value of temperature. The lower display TOFS tell users that they can use ▲ or ▼ to modify current temperature display value. Press  to confirm and return to P01 function form. Use ▲ or ▼ to select other functions or press  to return to measurement status.






3. In the status of manual temperature compensation, press  and instrument enter set up status of manual temperature compensation user can use ▲ or ▼ to set up process temperature

TST1 and calibration temperature TST2. Press  to confirm and return to P01 function form

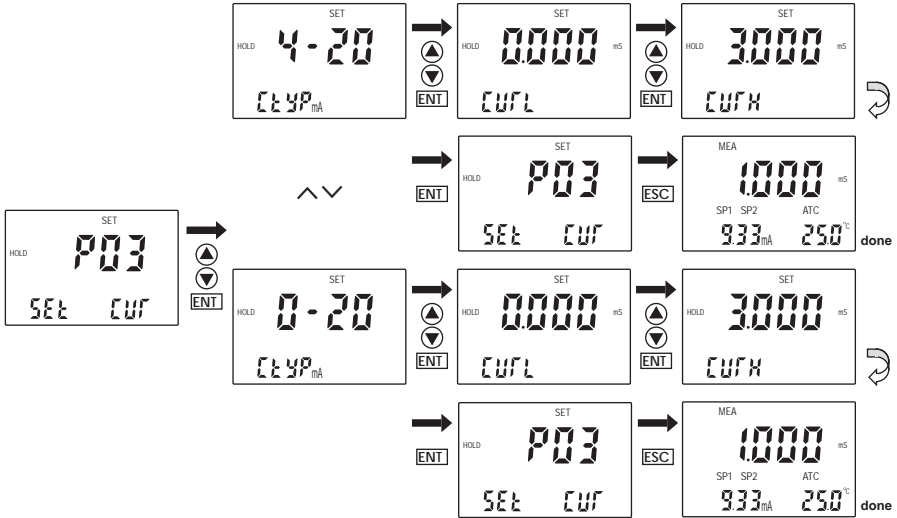
or press ▲ or ▼ to select other functions to set up or press  to return to measurement status. TST1 is the compensation temperature under normal measurement while TST2 is the compensation temperature under calibration. Since temperatures are not the same in calibration and normal measurement when instrument is used, two set up values under manual temperature compensation status are convenient. Users will not set manual temperature compensation value back and forth. For example, if user's process temperature is 50.0°C and the temperature of standard solution when calibrating is 10.0°C, user can set TST1 as 50.0°C and set TST2 as 10.0°C for convenient use afterwards. Press ENT to confirm and enter into set-up of temperature compensation parameter. LCD shows LINE (linear compensation), use ▲ or ▼ to switch to PURE (pure water compensation). Choose LINE to set up temperature compensation parameter and basic temperature.











5.2 P02: OFFSET SET-UP FUNCTION



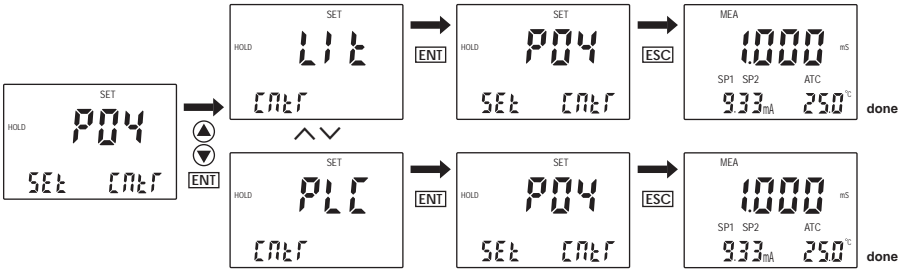
	<p>1. In P02 function form, press . LCD shows CABL RES, users can set up resistance of cable to compensate indication. Compensation of CABL RES is only valid between 0.0 to 300.0 mS. Press ENT to confirm and enter into offset set-up.</p>
	<p>2. User can press ▲ or ▼ to adjust offset to modify measurement value. Press  to confirm and return to P02 function form or press ▲ or ▼ to select other function to set up.</p>
	<p>NOTE: Press   twice to exit from set-up mode at anytime. Instrument will return to measurement mode automatically.</p>





5.3 P03: OUTPUT CURRENT FUNCTION



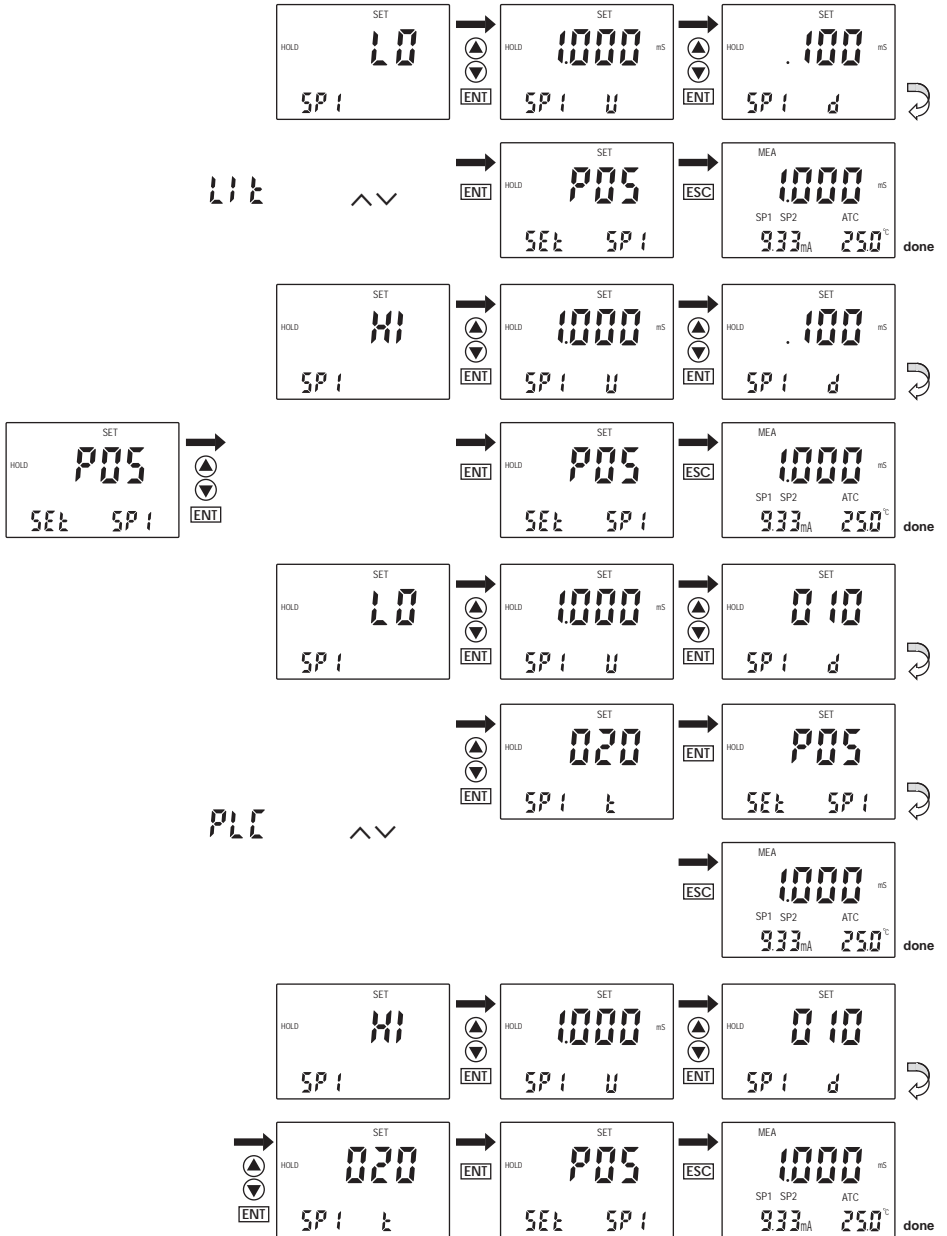
	<p>1. Press  to confirm in P03 function. Entering set up function.</p>
	<p>2. The lower display shows CTYP. The upper display shows 4-20 (it means current output from 4 mA to 20 mA). User can press ▲ or ▼ select 0-20 (it means current output from 0 to 20 mA). Press  to confirm and enter into set-up of transmitting range.</p>
	<p>3. The lower display shows CURL while the upper display shows 0.00, which means that 0.00 mA transmitting range indicates 0.00 ms. User can press ▲ or ▼ to adjust the actual value. Press  to confirm. The lower display shows CURH while the upper display shows 30.00, which means 20.00mA transmitting range indicates 10.00 ms. User can press ▲ or ▼ key to adjust the actual value. Press  to confirm and return to P03 function or press ▲ or ▼ to select other functions and to set up.</p>
<p>For example, set CTYP to 0 or 4, set CURL to 2.00 and set CURH to 10.00, which means 0 / 4 to 20 mA output mode is selected as circuit output. 0 / 4.00 mA indicates 2.00 ms, 20.00 mA indicates 10.00 ms</p>	
	<p>NOTE: Press  twice to exit from set-up mode at anytime. Instrument will return to measurement mode automatically.</p>
	<p>NOTE: This parameter allows you to set range of current output, but transmitting high point and low point can't be overlapped.</p>








5.4 P04: CONTROL MODE FUNCTION



	<p>1. Press  in P04 function form to enter into concrete set up procedure.</p>
<p>2. The lower display shows CNTR while the upper display shows LIT. This form allows users to set up limited control mode. User can press ▲ or ▼ to select PLC mode. Press  to confirm and return to P04 function form. Use ▲ or ▼ to select other functions and to set up.</p>	
<p>NOTE: Press  twice to exit from set up mode at any time. Instrument will return to measurement mode automatically.</p>	

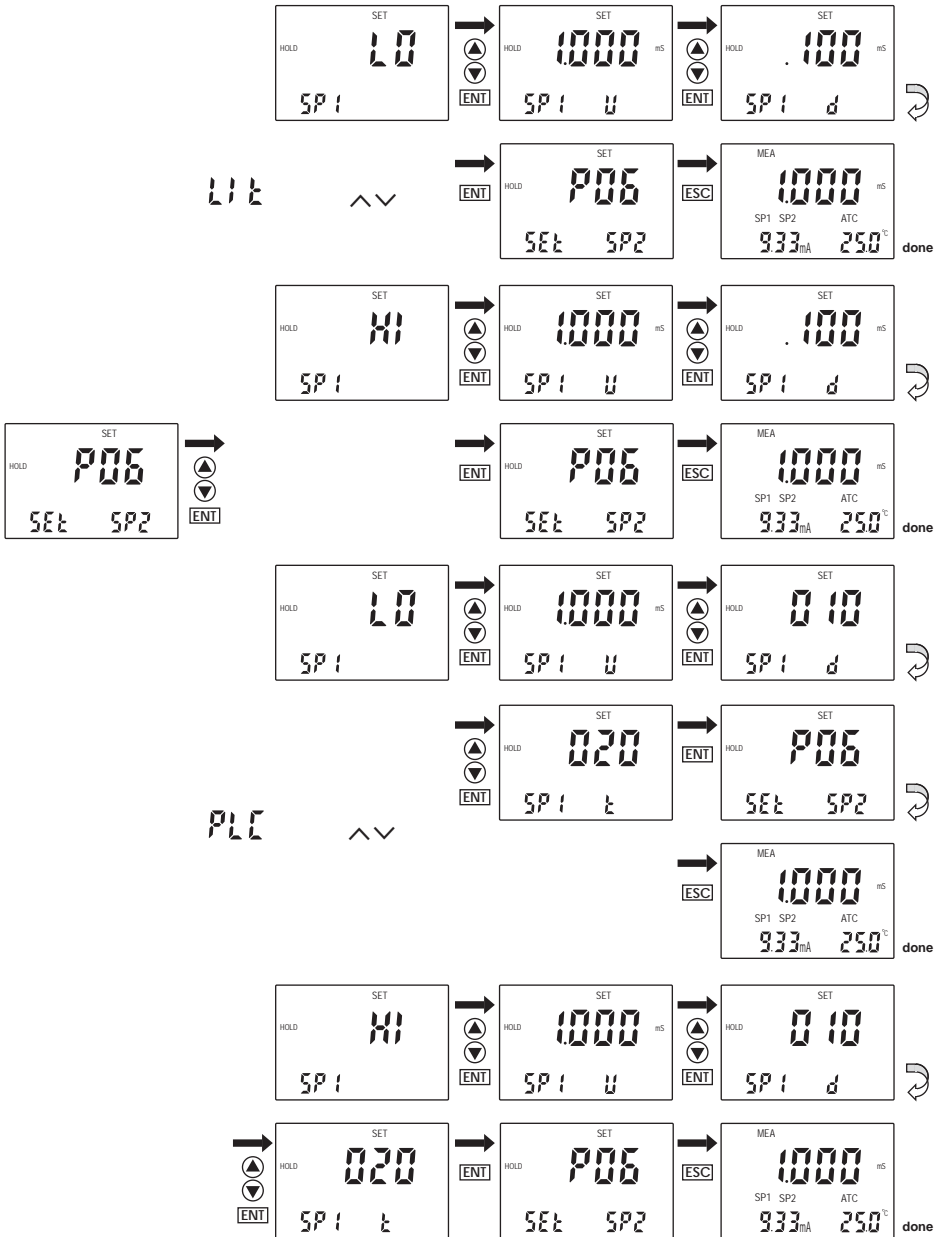
5.5 P05: RELAY 1 SET-UP FUNCTION



<p>1. In P05 function form. Press  to enter into concrete set-up procedure.</p>	
<p>2. The lower display shows SP1 while the upper display shows HI, which means set point 1 is under high-point control status, relay begins to work when the measured value up to set value. Press  to confirm and enter into next set up procedure.</p>	
<p>3. The lower display shows SP1 U while the upper display shows concrete value. User of the function form can press ▲ or ▼ to adjust the value to confirm concrete set up value. Press  to confirm and enter into next set up procedure.</p>	
<p>4. The lower display shows SP1 d, this function form sets hysteresis band under limited control mode to protect relay, which may oscillate frequently around set point and be damaged. Press  to confirm and enter into next set up procedure.</p>	
	<p>NOTE: There are two modes of relay set-up: LIT and PLC. Please refer to next page about PLC.</p> <p> NOTE: Press  twice to exit from set up mode at any time. Instrument will return to measurement mode automatically.</p>

5.6 P06: RELAY 2 SET-UP FUNCTION

Working principle of this part is the same as which of P05 relay 1 set-up function. Please operate according to P05.



NOTE: Set-up value range of hysteresis band under limited control mode is from 0.00 to 2.0 ms.

For example, if high point is 7.00 ms and hysteresis band is 0.50 ms, movement range of the relay is from 6.50 ms to 7.00 ms. If low point is 6.00 ms and hysteresis band is 0.20 ms, movement range of the relay is from 6.00 ms to 6.20 ms.

NOTE: In PLC control mode, movements of the relay meet following formulas:

$$C * (VM - VS) * U * T / 14$$

C is discriminate parameter for high / low point.

It is +1 when set to high point and it is -1 when set to low point.

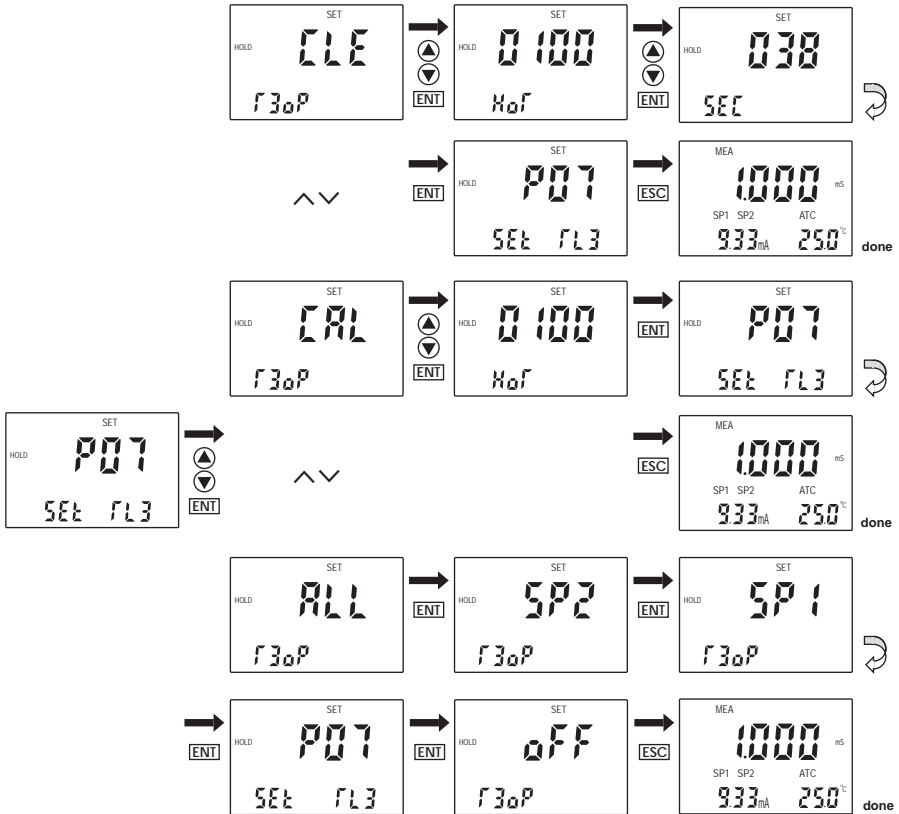
VM is measured value.

VS is set value.

U is control parameter, such as sp1 d or sp2 d, not smaller than 005

T is time constant (represent the whole movement circle of relay): SP1 t or SP2 t, not smaller than 002

5.7 P07: ALARM RELAY 3 SET-UP FUNCTION





1. Select P07 function, Press  to confirm. Enter into concrete set-up procedure.



2. Select concrete working mode. Press  or  to select suitable control mode.




- **CAL**=Relay 3 as calibrating alarm relay (time can be set between 0-999 hrs)
- **ALL**=move with two relays simultaneously
- **SP1**=relay 3 moves with SP1
- **SP2**=relay 3 moves with SP2
- **OFF**=relay 3 is off (factory default)

Press **ENTER** to confirm your set up.


If selecting CAL working mode, user can set calibration indicate intervals in the function form, use hour as the unit. In this way, instrument and electrode can keep their reliability.

If selecting CLE working mode, user can set cleaning time intervals in the function form, use hour as the unit; cleaning continuous time, use second as the unit. In this way, instrument and electrode can keep their reliability. User can install cleaning equipment to increase service life and reliability of electrode.

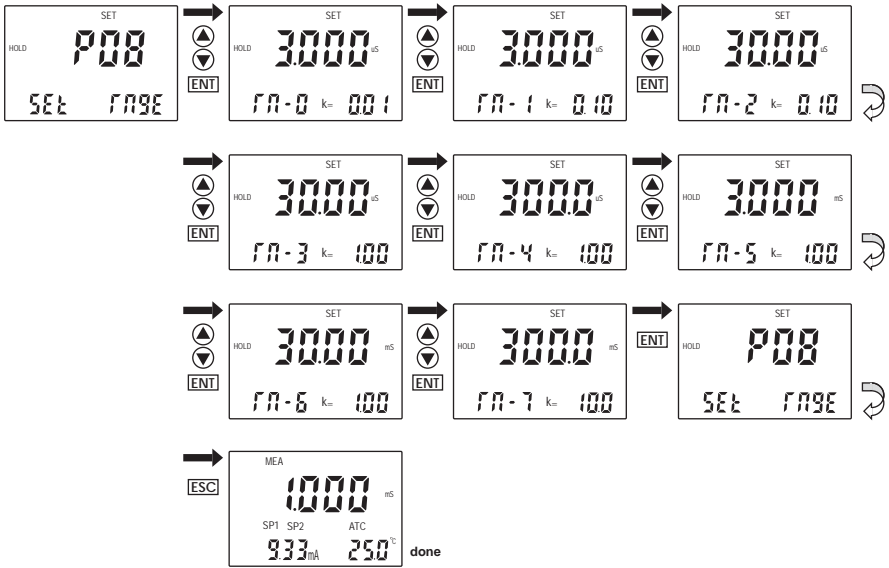


Press  to confirm and return to P07 function form. Use  or  to select other functions to set up.







NOTE: Press  twice to exit from set up mode at any time. Instrument will return to measurement mode automatically.

5.8 P08: MEASUREMENT RANGE CHOOSING FUNCTION



1. Press key to confirm in P08 and enter the concrete set-up procedures.

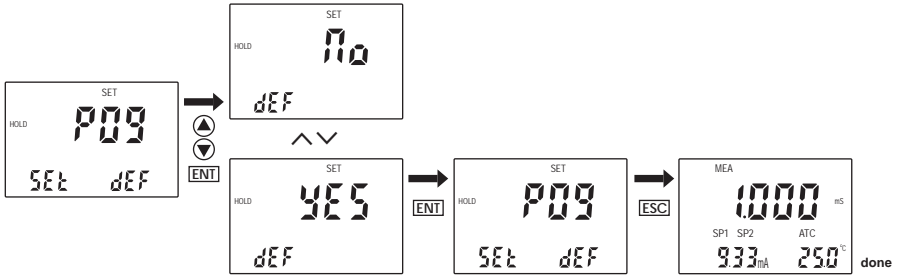
2. You can set up measurement range of conductivity and TDS in this function. Use ▲ or ▼ to select the measurement range and press  to confirm.




 **Note:** Press   twice to exit from set-up mode at any time. Instrument will return to measurement mode automatically.

Measurement Range Form

Type of temperature compensation	Measurement Mode	Code of measurement range	Constant	Measurement range	
PURE	RES1	X	0.01	3.0~300.0 MΩ	
	RES2			0.3~30.0 MΩ	
	CON/TDS			3.000 μS / ppm	
LINE	RES1		10.0	3.0~300.0 MΩ	
	RES2			0.3~30.0 MΩ	
	CON/TDS	7	1.00	300.0 mS / ppt	
		6		30.00 mS / ppt	
		5		3.000 mS / ppt	
		4		300.0 μS / ppm	
		3		30.00 μS / ppm	
		2		0.10	30.00 μS / ppm
		1			3.000 μS / ppm
		0		0.01	3.000 μS / ppm

5.9 P09: REVERTING TO FACTORY DEFAULT SETTINGS



- | | |
|---|---|
|  | <p>1. Press  in P09 to enter into concrete set-up procedures.</p> |
| | <p>2. The lower display of the instrument shows DEF while the upper display shows NO (YES). User can press ▲ or ▼ to select necessary items. If select YES, all settings will be reset to factory default. User's settings will be lost.</p> |
| | <p>NOTE: Press  twice to exit from set up mode at any time. Instrument will return to measurement mode automatically.</p> |

5.10 COMMUNICATION PROTOCOL

1. Protocol Setting

This instrument uses RS-485 communication. It's can be connected with 1 to 64 instruments in 2 wires at the same time and communicate with PC. The distance of communication is around 1200M.

The data form is "N81" (1 start bit, 8 data bits, 1 stop bit, NO verify check code).

The baud rate is 300 to 38400 bit/s (usually is 9600 bit/s).

Users have to set the ID (NB) of the instruments and the baud rate (BT) before connecting to RS-485.

Bt	0	1	2	3	4	5	6	7
speed	300	600	1200	2400	4800	9600	19200	38400

Usually, the instrument is stand by in receiving status. Once it receives the correct ID then it will send out the data to PC. Finished sending it will enter to receive status again.

To avoid the conflict, each instrument has to use different ID (decided by NB).

All of the instruments and PC must use the same baud rate (decided by BT).

2. Data form

All one-word data is from -32767 to +32767, using the hexadecimal number system, the high bit is sign.

All one-byte is integer.

The data is ASCII code :the start sign is @ (40H), the end sign is CR (0DH).

The other data use the ASCII code to express the hexadecimal number system.

All data should be between 30H to 39H and 41H to 46H. the instructions are form 41H to 5AH.

Double-byte sending: the low byte is the first, the high byte is the second.

One-byte sending: the high nibble is the first, the low nibble is the second.

A full communication form is :40 ,ID, the sequence of the instruction,CRC,0D.

The ID is the number of the instrument (NB).

CRC (Circulation Redundant Codes) Verification is the bitwise XOR assignment of ID code and the sequence of instruction.

3. The communication instructions

1) RD: read floating data.

2) RE: read the appointment data by start address and bytes (the large byte can not over 28 bytes).

3) RR: read all of data (8-word, 12-byte), totally 28 bytes.

4. Introduce the instructions (the ID is 1)

1) RD (read the floating data): PC send: 40,30,31,52,44,CRCH,CRCL,0D (8 bytes)

40: start byte

30 31: the ID of instrument (the hexadecimal: 0~3FH, ASCII: 30 30~33 46);

52 44: instruction of R, D

CRCH, CRCL: Verification Byte, 2~5 bitwise XOR assignment

CRCH, CRCL: bitwise XOR assignment starting from Byte 2 to the byte before CRCH.

0D: the end byte

the response by instrument is "40, 30, 31, 52, 44, 30, 30, V1LH, V1LL, V1HH, V1HL, 3X, V2LH, V2LL, V2HH, V2HL, 3X, 3X, 3X, 3X, 3X, CRCH, CRCL, 0D"

40: the start byte

30 31: the ID of instrument

52 44 30 30: the fixed data

V1LH, V1LL, V1HH, V1HL: pH/ORP/DO/Dd value

3X: the position of decimal (30-33, correspondent with 0-3 decimal)

IOLH, IOLL, IOHH, IOHL (output current value)

FATC (30: OFF; 31H: ON)

V2LH, V2LL, V2HH, V2HL: temperature value
 JD1: the status of relay 1, 30: open; 31: close
 JD2: the status of relay 2, 30: open; 31: close
 JD3: the status of relay 3, 30: open; 31: close
 FKER: KERR status, 30: correct; 31: error
 FCHG: parameter modify, 30: no modify; 31: modify
 CRCH, CRCL: bitwise XOR assignment starting from Byte 2 to the byte before CRCH.
 OD: the end byte
 Total: 27 bytes

2) RE (read the appointment data)

The PC send: 40, 30, 31, 52, 45, 30, 30, adrH, adrL, lthH, lthL, CRCH, CRCL, OD (total 14 bytes)

40: the start byte

30 31: the ID of instrument (the hexadecimal: 0~3FH, ASCII: 30 30~33 46);

52 45: the instruction R, E;

30 30: reserve

adrH adrL: the address of the start parameter byte (the hexadecimal: 0~1BH; ASCII: 30 30~31 42);

1thH 1thL: the count of the parameters (the hexadecimal: 1~1CH; ASCII: 30 31~31 43);

CRCH, CRCL: Verification Byte, 2~11 bitwise XOR assignment.

OD: the end byte

The adr is the start address(00~1BH),1th is the count of the byte. The table is the relation of the adr and parameter.

adr	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D
para	TST1	TST1	TST2	TST2	SP1U	SP1U	SP2U	SP2U	CURL	CURL	CURH	CURH	POFS	POFS
adr	0E	0F	10	11	12	13	14	15	16	17	18	19	1A	1B
para	HOR	HOR	AAA	FUNC	R3OP	TOFS	SEC	SP1D	SP1T	SP2D	SP2T	NB	BT	CONF

If $\text{adr} > 1\text{BH}$ or $\text{adr} + 1\text{th} > 1\text{BH}$, the return the error code: 40, 30, 31, 52, 45, 2A, 2A, CRCH, CRCL, OD

The 2A 2A is the error sign

If the address range is correct then the instrument will send back data :

40, 30, 31, 52, 45, D1, D2, D3, Dn, CRCH, CRCL, OD

40: the start byte

30 31: the ID

52 45: the fix data

D1~Dn: parameters from instrument to PC ($n=2 \times \text{lth}$)

CRCH, CRCL: bitwise XOR assignment starting from Byte 2 to the byte before CRCH.

OD: the end byte

Total Byte = $5 + 2 \times \text{lth} + 3$

3) RR (read all of parameters) the PC send: 40, 30, 31, 52, 52, CRCH, CRCL, OD (8 bytes)

40: the start byte

30 31: the ID

52 52: the instruction of R, R

CRCH, CRCL: Verification Byte, 2~5 bitwise XOR assignment

OD: the end byte

The instrument response: 40, 30, 31, 52, 52, D1, D2, D55, D56, CRCH, CRCL, OD (64 bytes)

40: the start byte

30 31: ID

52 52: the fix data

D1~D56: the parameter of sending (8 double byte, 12 byte, total 28 bytes)

CRCH, CRCL: Verification Byte, 2~5 bitwise XOR assignment

CRCH, CRCL: bitwise XOR assignment starting from Byte 2 to the byte before CRCH.

CRC

0D: the end byte

Total Byte = 5 + 2 × n + 3

5. Notice for programming the communication program:

- 1) If the instrument receives the data with the start byte is 40 and the count of sequence data over 16 bytes and did not find the 0D then the data is invalid. The instrument will not do any response.
- 2) If the sequence data is not between 00H to 0FH, the sequence data is invalid. The instrument will not do any response. But the other errors, ex: the wrong instruction, the wrong address, the wrong parameter counts, the wrong CRC and so on, the instrument will response the wrong information.
- 3) All parameters, please see the following table, some parameters include decimal.

para	TST1	TST2	SP1U	SP2U	CURL	CURH	POFS	HOR	KUSE	SP1D
decimal	1	1	1~3	1~3	1~3	1~3	1~3	0	3	1~3
para	SP2D	TOFS	SEC	R3OP	REFT	TCOE	CABR	RNGE	SP1T	SPTT
decimal	1~3	1	0	0	1	2	1	0	0	0

The PC display the reading values should be include the decimal.

- 4) TOFS is the correct value of temperature, the setting range is 0~200, the display range is -100~100, so the PC should be subtract 100 and display with sign.
- 5) FUNC is the display mode of instrument: 0=mV; 1=ORP; 2=pH/;
0=CON; 1=TDS; 2=RES / 0=DO / 0=FCL.
- 6) R3OP is the mode of relay 3: 0=NOR; 1=SP1; 2=SP2; 3=ALL; 4=CAL; 5=CLE.
- 7) AAA is the reserve parameters.
- 8) CONF is a byte parameter, the define is following,
 - Bit 7: temperature compensation: 1=°F 0=°C
 - Bit 6: current output, 1=4~20mA; 0=0~20mA;
 - Bit 5: SP1, 1=HI; 0=LO;
 - Bit 4: SP2, 1=HI; 0=LO;
 - Bit 3: control mode, 1=PLC; 0=Lit;
 - Bit 2: electrode selection, 1=ANTI; 0=GLAS;
 - Bit 1: buffer, 1=NST; 0=USA;
 - Bit 0: reserve

6 TECHNICAL PARAMETERS

6.1 TECHNICAL PARAMETERS FORM

CON5000 Transmitter / Controller	
Range	0.000 to 3.000 $\mu\text{S/cm}$ 0.000 to 3.000 ppm 0.00 to 30.00 $\mu\text{S/cm}$ 0.00 to 30.00 ppm 0.0 to 300.0 $\mu\text{S/cm}$ 0.0 to 300.0 ppm 0 to 3.000 mS/cm 0 to 3.000 ppt 0 to 30.00 mS/cm 0 to 30.00 ppt 0 to 300.0 mS/cm 0 to 300.0 ppt 0.3 to 30.0 $\text{M}\Omega \cdot \text{cm}$ 3 to 300.0 $\text{M}\Omega \cdot \text{cm}$
Resolution & Accuracy	0.001 $\mu\text{S/cm}$, 0.1 $\text{M}\Omega \cdot \text{cm}$ / $\pm 1\%$ full range
Temperature	- 5.0 to 130 $^{\circ}\text{C}$
Resolution & Accuracy	0.1 & ± 0.5 $^{\circ}\text{C}$
Temperature electrode	Pt-1000
Temperature compensation	Automatic (± 10 $^{\circ}\text{C}$ offset adjustment) / manual
Set point and control function	
Control function	Limited point
Cleaning circle	From 1 to 999 hours
Cleaning time	From 1 to 999 seconds
Control hysteresis band	10%
Relay	3 SPST Relays, 250V/1A
RS-485	client program
Electric current information and connection	
Power	110 or 220 V AC
Signal output / load	0 / 4 - 20 mA isolated current output, can be set up freely
Signal output load	600 Ω
Connection terminal	Connection terminal
Main fuse wire	Main fuse wire
Alarm function	
Function (switchable)	Alarm, calibration remind, clean control
Display	
LCD (liquid crystal display)	Big-size screen of crystal display, orange back light
EMC Specification	
Electromagnetic emission	EN 50081-1
Electromagnetic induction	EN 50082-1
Environmental conditions	
Working temperature	- 10 to 50 $^{\circ}\text{C}$ (14 to 122 $^{\circ}\text{F}$)
Humidity	10 to 95% (no frozen dew)
Protection grade	NEMA 4X, IP 65

6.2 PARAMETER SETTING AND FACTORY DEFAULT SETTING

NO.	Indication	Parameter	Symbol	Contents	Remark	Valid range	Factory value
01		LOCK	LOC	Password function		0~200	0
02	P1 TC	ATC	AtC	Auto/Manual TEMP compensation		ON/OFF	OFF
03		TSET1	tSt1	TEMP set up of manual	Only valid for manual	-10~100℃	25.0
04		TSET2	tSt2	Calibration TEMP set		0.0~60.0℃	25.0
05		TOFS	tOFS	TEMP measurement offset	Only valid for auto	-10~10℃	0.0
06		LINE	LINE	TEMP line compensation		LINE	LINE
07		PURE	PURE	Pure temperature compensation			
08	P2 OFS	POFS	POFS	measurement value offset		000~20.00	0.00
09		CABL	CABL	CABL	Constant K=10.0 is valid	0.0~20.0 ohm	0.0
10	P3 C _{Ur}	CTYP	C _t yP	Type of current output		0/4~20mA	4
11		CURL	C _U rL	Low limit of transmitting output	ppm mode 0.01 unit % mode is 0.1 unit	0.00~40.00	0
12		CURH	C _U rH	High limit of transmitting output		0.0~400.0	1000
13	P4 SAL	LIT	LIT	Limitation control			LIT
		PLC	PLC	pulse length contro			
14	P5 SP1	SP1	SP1	Way set up of relay 1		HI/LO	LO
15		SP1U	SP1U	Setting value of relay 1	ppm mode 0.01 unit % mode is 0.1 unit	0.00~40.00	2.00
16		SP1D	SP1d	Relay 1 hysteresis / proportion		0.00~2.00	0.10
17	P6 SP2	SP2	SP2	Way set up of relay 2		HI/LO	HI
18		SP2U	SP2U	Setting value of relay 2	ppm mode 0.01 unit % mode is 0.1 unit	0.00~40.00	6.00
19		SP2D	SP2d	Relay 2 hysteresis / proportion		0~2.00	0.10
20	P7 rL3	R3OP	R3OP	Working mode of relay 3		OFF/SP1/SP2/ ALL/CAL/CL E	OFF
21		IN	HO _r	Interval (hour)	valid for calibration and cleaning mode	0-999	100
22		DUR	SEC	Operating time (second)	valid for cleaning mode	0-200	30
23	P8 CONF	RNGE	RNGE	measurement range	1,2,3,4,5,6,7		5
24	P9 DEF	NB	nb	Set ID number for 485		0-63	1
25		BT	b	Communication rate		0-7	5
26		NB	nb	Set ID number for 485		0-63	1
27		BT	bt	Communication rate		0-7	5

7 GENERAL INFORMATION

WARRANTY

CLEAN Instruments warrants this product to be free from significant deviations in material and workmanship for a period of one year from the date of purchase. If repair is necessary and has not been the result of abuse or misuse within the warranty period, please return to CLEAN Instruments and amendment will be made without any charge.

CLEAN Instruments Customer Service Center will determine if product problem is due to deviations or customer abuse. Out of warranty products will be repaired on a charge basis.

RETURN OF MALFUNCTION INSTRUMENTS

Authorization must be obtained from CLEAN Instruments Customer Service Center to issue a RIR number before returning items for any reason. When applying for authorisation, please include date requiring the reason of return. Instruments must be carefully packed to prevent damage in shipment and insured against possible damage or loss. CLEAN Instruments will not be responsible for any damage resulting from careless or insufficient packing.

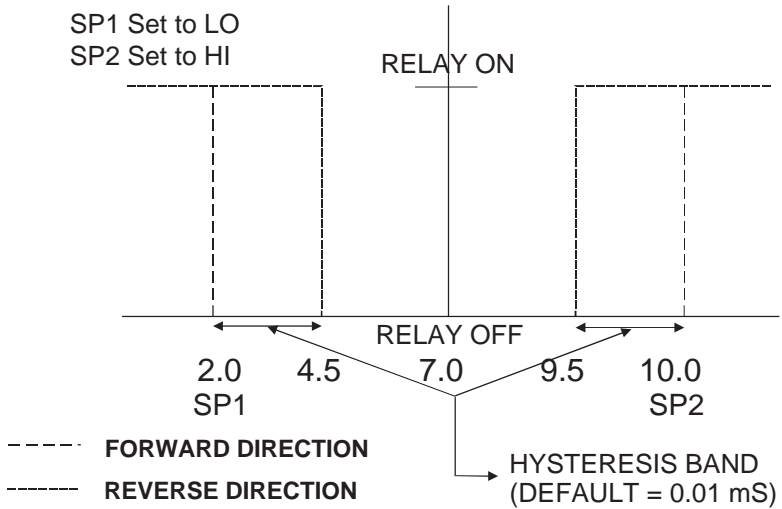
Warning: Damage as a result of inadequate packaging is the User / distributor's responsibility. Please follow the guidelines below before transporting.

GUIDELINES OR RETURNING UNIT FOR REPAIR

Use the original packaging material, if possible when transporting back the unit for repair. Otherwise wrap it with bubble pack and use a corrugated box for better protection. Include a brief description of any faults suspected for the convenience of Customer Service Center, if possible. If there are any questions, feel free to contact our Customer Service Center or distributors.

APPENDIX 3 – HYSTERESIS BAND

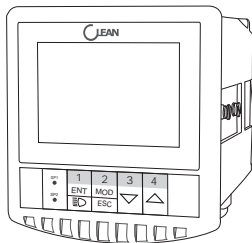
Brief Introduction on the Function of Hysteresis Band



The controller relay activates when the set-point is reached. In the reverse direction, it closes. Relay continues to be active till the value reaches the amount set by hysteresis band.

ACCESSORY 5 - ABBREVIATIONS IN FUNTION FORM

Character	Meaning	Character	Meaning
MEA	Measurement mode	C	Centigrade
CAL	Calibration mode	F	Fahrenheit
ENT	Confirm	UNIT	Unit
OFS	Zero point offset		
SET	Set up	PPt	Salty Unit
ATC	Automatic temperature compensation	LINE	Temperature line compensation
SP1	Set point 1	PURE	Pure temperature compensation
SP2	Set point 2	RNGE	Measurement range
LO	Low limit	CABL	CABL
HI	High limit	COND	Conductivity
CNtr	Control	TDS	TDS
LIt	Output signal	RES	Resistivity
PLC	Configuration	FLT1	Number filter 1
RL3	Clean	FLT2	Number filter 2
OUT	Glass electrode		
CONF	Antimony electrode		
CLE	USA standard buffer		



www.cleaninst.com

Manufacturer:

CLEAN Instruments - CISC

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