

Operation Manual

FCL5000

Free Chlorine Controller / Transmitter

Preface

This manual serves to explain the use of CLEAN FCL5000 controller / transmitter. This operation manual is written to cover as many anticipated applications of FCL5000 controller / transmitter. If you have doubts in the use of the instrument, please do not hesitate to contact CLEAN local customer service center.

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 FCL5000 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 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.

TABLE OF CONTENTS

1	PREFACE	1
	Before Use	1
	In Use	1
	Safety Measures	2
2	PRODUCT DESCRIPTION	3
2.1	Description Of Instrument Speciality :	3
2.2	Measurement And Control System	4
2.3	Appearance	5
2.3.1	Display Introduction	6
2.3.2	Key Instruction	7
2.3.3	LED Induction	7
2.3.4	Password	7
2.3.5	Function Preview	7
3	INSTALLATION AND ACCESSORY	9
	Installation	9
	FCL5000 Connetion Diagram	10
	Relay Connect	10
	Measurement Mode	12
4	CALIBRATION MODE	12
4.1	Entering Calibration Mode	12
4.2	Free Chlorine Calibration	13
5	SET UP MODE	15
	ENTERING SET UP MODE	15
5.1	P01: Temperature Set-Up Function	16
5.2	P02: Offset Set-Up Function	18
5.3	P03: Output Current (SP1/SP2) Function	19
5.4	P04: Control Mode Function	20
5.5	P05: Relay 1 Set-Up Function	21
5.6	P06: Relay 2 Set-Up Function	23
5.7	P07: Alarm Relay 3 Set-Up Function	25
5.8	P08: Measurement Range And Password Setting Funicton	27
5.9	P09: Transmitting Rate Function	28
5.10	P010: Reverting To Factory Default Settings	29
5.11	Communication Protocol	30
5.12	Maintenance Of Instrument And Electrode	31
6	TECHNICAL PARAMETERS	34
6.1	Technical Parameters Form	34
6.2	Parameter Setting And Factory Default Setting	35
7	GENERAL INFORMATION	36
	Warranty	36
	Returning the Items	36
	Guidelines for Returning the Items	36
	Appendix 3 – Hysteresis Band	37
	Appendix 4 – Proportion Control	38
	Accessory 5 – Abbreviations In Function Form	40



1 PREFACE

BEFORE USE

Thank you for selecting CLEAN FCL5000 controller / transmitter.

Although FCL5000 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 controllers / transmitters, relevant 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 this 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 center. They will be very glad to help you.



IN USE

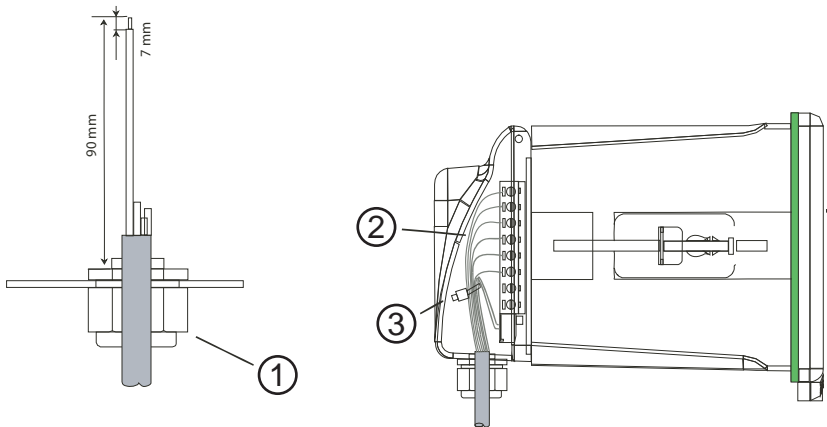
On any unmentioned use or the use that contradict with the technical parameters the operators should bear the responsibility.

Other conditions of right use include:

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

SAFETY MEASURES

	Free chlorine transmitters may only be carried out by trained experts.
	Unqualified Transmitters should not be installed and used.
	Free chlorine transmitters should be used under the required working condition.
	Free chlorine transmitters should be open and repaired by clients themselves.
	Modified Free chlorine transmitters should not be used. Manufacturers 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 cable. Also, please loose it when you open the cover. After connecting the cable, 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 FCL transmitters are used to measure free chlorine and temperature value.

The transmitters can be used as monitor in water treatment, in process of chemical industry, in food process, in cleaning water or wastewater treatment and in neutralization process.

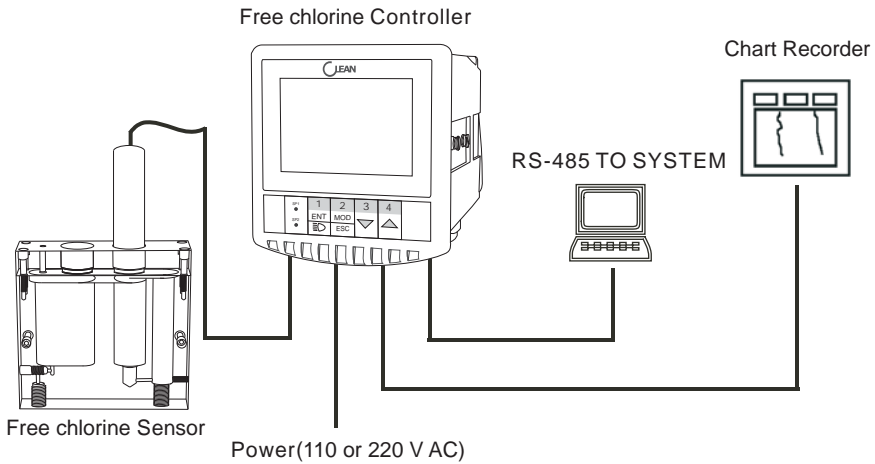
This transmitter has many user-friendly and safety features which include:

- 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 rated, waterproof and anti-gas, applicable in any extreme conditions.
- Revolutionary way to instantly get free chlorine value by using tri-electroded method measuring: faster and accurate, applicable in severe conditions.
- Adjustment of electrode offset value
- Automatic temperature compensation mode, manual set-up of process temperature and calibration temperature.
- Control mode: Limit and PLC control mode.
- 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.
- Large LCD, with high luminance LED orange backlight.
- Two switch on/off relays and one alarm relay.
- Independent alarm relay can be set up as calibration remind or washing 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.

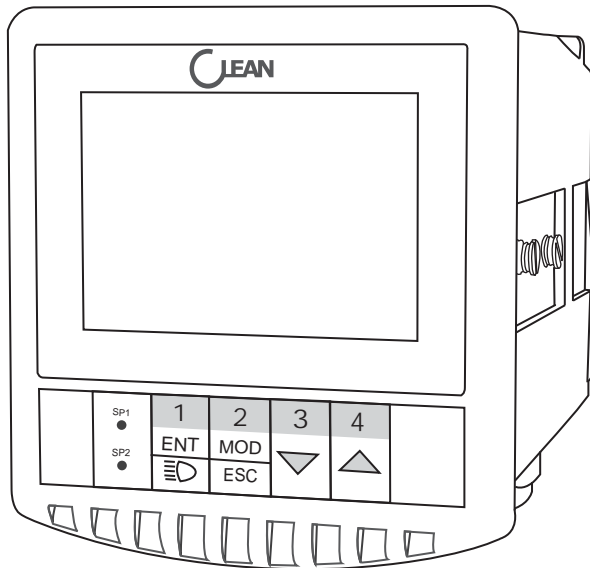
2.2 MEASUREMENT AND CONTROL SYSTEM

Typical measurement system includes:

- Free chlorine on-line transmitter.
- Free chlorine sensor with or without temperature probe NTC22K.
- Suitable Free chlorine measurement cable.
- Immersion, flow or processing parts, eg. Pump or valve.
- 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 multi control and for alarm usage.



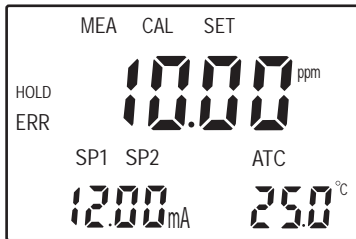
2.3 APPEARANCE



FCL5000 Free Chlorine 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.
- **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 • Starting calibrating in calibration mode • Back light switch in measurement mode
 	<ul style="list-style-type: none"> • Select function group in setting up mode to set parameter and value (Hold the key ,value changing will be quicker)

2.3.3 LED

Relay Introduction

SP1 \ SP2 LED Indicates relay's working status .

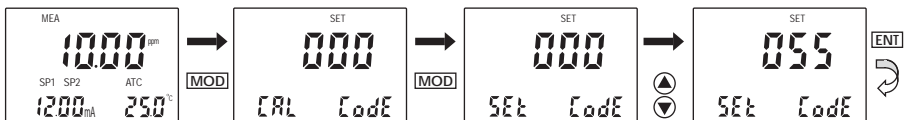
SP1 \ SP2 LED Light luminating indicates that relays are under working status.

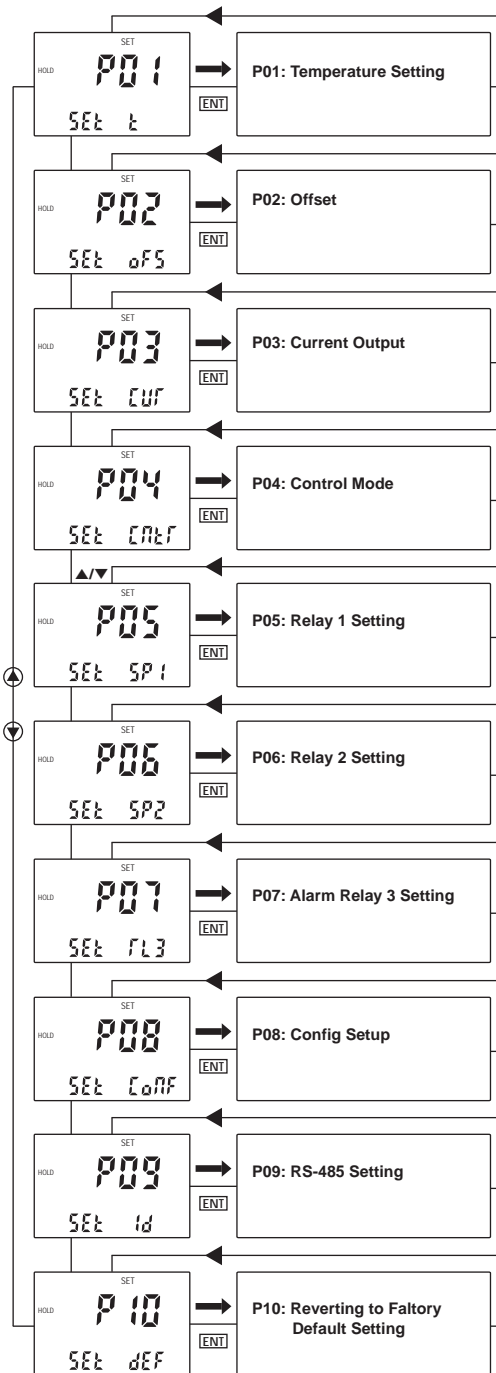
2.3.4 PASSWORD

When entering calibration mode and setting mode, there are passwords. Passwords are set by manufacturers and users can not modify them. Passwords are listed below:

Password	Mode / Instruction
028	Calibration Mode
055	Set-up mode

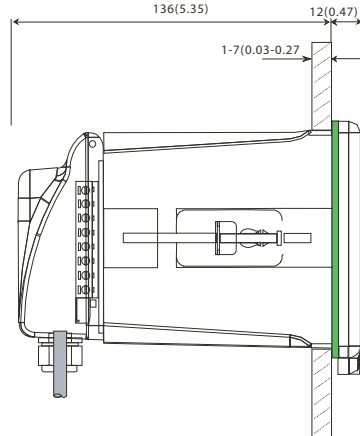
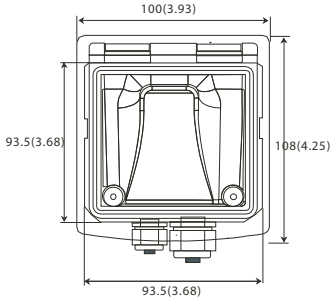
2.3.5 FUNCTION PREVIEW



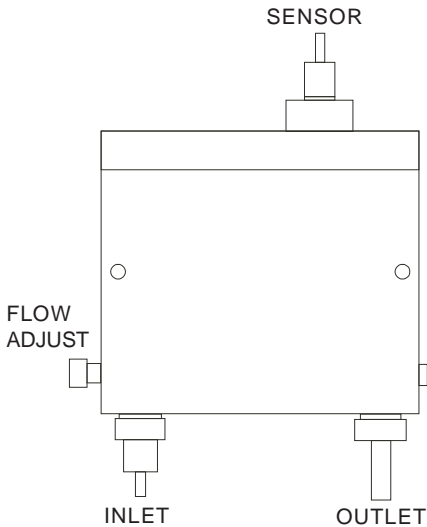


3 INSTALLATION AND ACCESSORY

INSTALLATION



Panel cutout : 93.5*93.5mm (inch)



Flow cell Parts

- 1) 4*6 inlet tube
- 2) 1/4 thread inlet connection
- 3) two fixed bolt for flow cell Φ 4 mm

Dimensions: 152*142*40 mm

Install requirement:

- 1) inlet pressure: 0.2 ~ 1 bar
- 2) inlet capacity: 10 ~ 30 litre/hour
- 3) inlet temperature: 0 ~ 50 °C

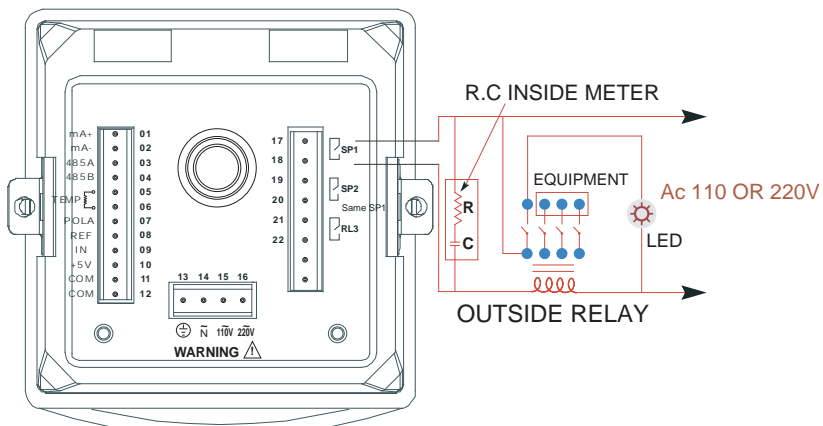
Connect in/out pipe with flow cell according to the picture, outlet pipe must be upright down Note: if there are big suspended particles in inlet pipe, please install filtrator to avoid jam.

FCL5000 CONNECTION DIAGRAM



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

FCL5000 connection diagram



1. 4~20m output, positive terminal	12. COM
2. 4~20m output, negative terminal	13.
3. 485A output A	14. AC Earth wire
4. 485B output B	15. Power input 110V AC (220V AC Prohibited)
5. Temp sensor input terminal (NTC22K)	16. Power input 110V AC (220V AC Prohibited)
6. Temp sensor input terminal (NTC22K)	17. Relay A (SP1)
7. Polarize electrode (POAL) black	18. Relay A (SP1)
8. Refer electrode terminal (REF) green	19. Relay B (SP2)
9. working electrode terminal (IN) transparent	20. Relay B (SP2)
10. 5V positive terminal	21. Clearing Relay (RL3)
11. 5V negative terminal	22. Clearing Relay (RL3)

RELAY CONNECT

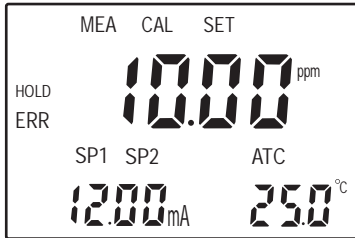
Note: Relay contactor volume of our instrument is 220V AC / 0.5A. Please do not connect with bigger current appliance. Please install bridge relay to transit according to the above diagram, or should bear the responsibility. There is RC parameter, which is 100 ohm/0.22uF on the relay contactor. Please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

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 measurement mode.

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

Icon at the left lower side of the display show the value of transmitting output current, whichas the way that users calibrate the output current.



In measurement mode, you can press  key once or twice to enter into calibration or setting password:


Then input relevant password to enter into calibration mode or set-up mode. Please refer to Item 3 (Calibration Mode) or Item 4 (set up mode).



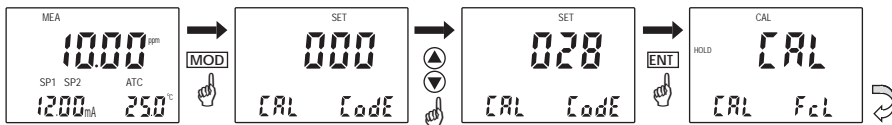
Press  key under measurement mode to open or close LCD backlight function.


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 procedures.

4.1 ENTERING CALIBRATION MODE




1. Press  once in measurement mode and enter into calibration password input menu.

2. After entering function form of calibration password input, LCD will ask you to input password.




3. Press  or  to input calibration password 28, then press  to confirm the password.



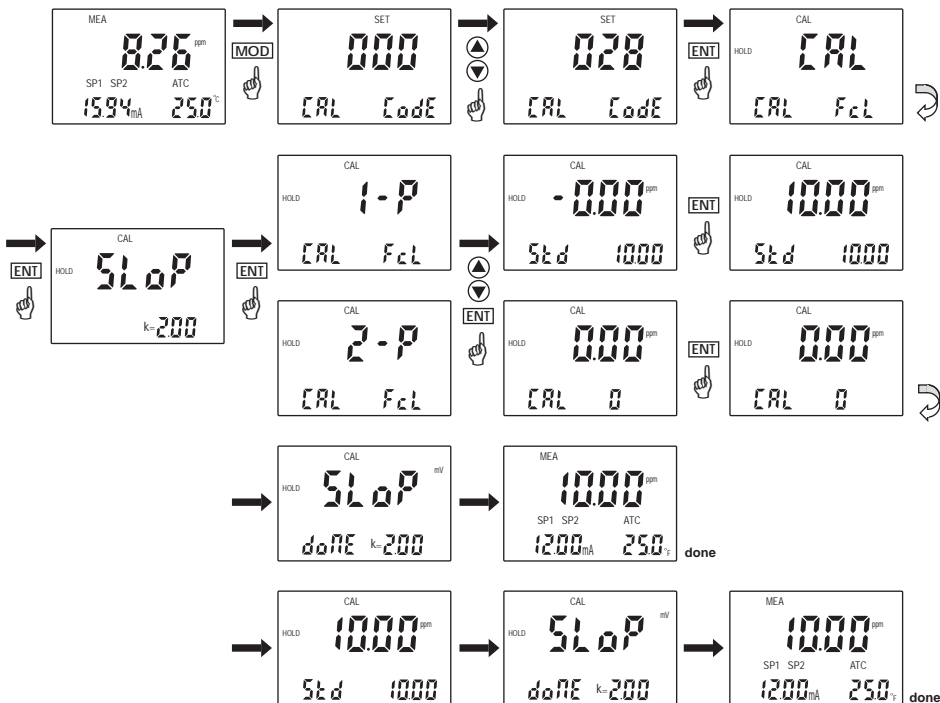
4. Press  to enter into calibration function form, lower display will show CAL FcL. If you want to calibrate, please refer to relevant items. (please refer to upper pictures)





NOTE: Anytime press  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 switch from 028 to 000 when entering calibration mode.

4.2 FREE CHLORINE CALIBRATION

This instrument can have one point or two point calibration, in MTC mode, the temperature is based on 25 °C




1. Entering calibration mode as in Item 4.1. LCD will show CAL FCL (free chlorine calibration mode).


2. Press  key to enter into calibration, LCD will show slope menu. The lower display will show ELE K=2.00, this function form shows the slope value of last calibration. The upper display will show CAL and the main display zone will show SLOP. Press  to enter into calibration process, main display zone will show 2-P, to remind you using two points calibration. Users can press ▲ or ▼ key to select 1-P (1 point calibration function). If user choose 1-P, instrument will jump over zero calibration and enter into full calibration menu. If user choose 2-P (two points calibration function), instrument will enter into zero calibration first.

3. Put electrode into air or deionized water to calibrating zero point. When calibrating slope, use standard DPD colorimeter to measure actual value of water sample, then put electrode into water sample. After data has been stabilized, use ▲ or ▼ to input the value into instrument. Put temperature electrode into the solution at the same time under auto temperature compensation mode.




4. Press  to carry out zero point calibration, the lower LCD will show CAL 0 to remind user carrying out zero point calibration. CAL will blink when calibrating. Instrument will make out signals input by electrode automatically in the process of calibrating. If the input signal is stable in the set time (20 seconds) and in the range of programmed value, instrument will recognize the calibration




as a legal calibration, will record and modify the zero point data of electrode. Press  twice to



quit one point calibration mode and return to measurement status. Press  to continue next point calibration, put electrode into known residual chlorine water sample. After data stable, the lower LCD will show STD 10.00 (in 0 ~ 2.000 measurement range, it is 1.000) to remind the second calibration point and the standard value. Users can press ▲ or ▼ to adjust the value to standard




value. Press  to confirm calibration, STD will twinkling. If the input signal is stable in the set time (20 seconds) and in the range of programmed slope, instrument will recognize the calibration as a legal calibration, will record and modify the value.

5. After calibrating, LCD main display zone will show SLOP automatically, right lower will show DONE and electrode slope K=. Parameter of zero point and slope will be refurbished after each calibration. Instrument will automatically return to measurement status if users do not press any key.


NOTE: Calibration data of instrument is only correspondant with current measurement range, for example, calibrate under the measurement range from 0 to 2.000 pm, the calibration data can only be used in the range of 0 to 2.000 ppm, but not 0 to 20.00 ppm. It is the same situation under the range of 0 to 20.00 ppm. But two calibration data will not interact. If one calibration data under its measurement range is covered, it will not influence other calibration data.



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



NOTE: Transmitter will show ERR when calibration is wrong. Under this situation,

press  to quit and calibrate again from step 1. It will show ERR again under following situations:

- (1) Use wrong standard solution or standard solution has expired.
- (2) Electrode is aging or not clean or bubble is broken.
- (3) Electrode wire is broken or electric leakage because of joint corrosion.



NOTE: When calibrating under manual temperature compensation, transmitter will automatically switch to calibration temperature from pre-set measurement temperature. When exiting from calibration mode, transmitter will switch to measurement temperature again. (Please refer to Item 5.2 for setting measurement temperature and calibration temperature)

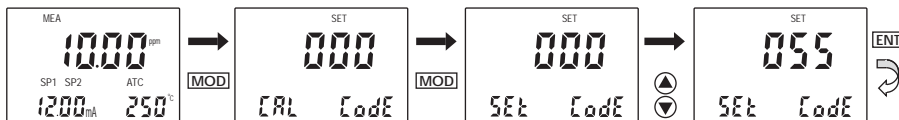






NOTE: ELE K=2.00 represents electrode conversion rate is 2.00 $\mu\text{A}/\text{ppm}$, which means 1 ppm is transferred from 2.00 μA electric current when the temperature is 25 °C. Conversion rate of this instrument is between 0.5 μA and 5 μA . When the conversion rate is lower than 0.5 μA or higher than 5 μA , instrument will show ERR to remind users to check instrument or change electrode.

5 SET UP MODE

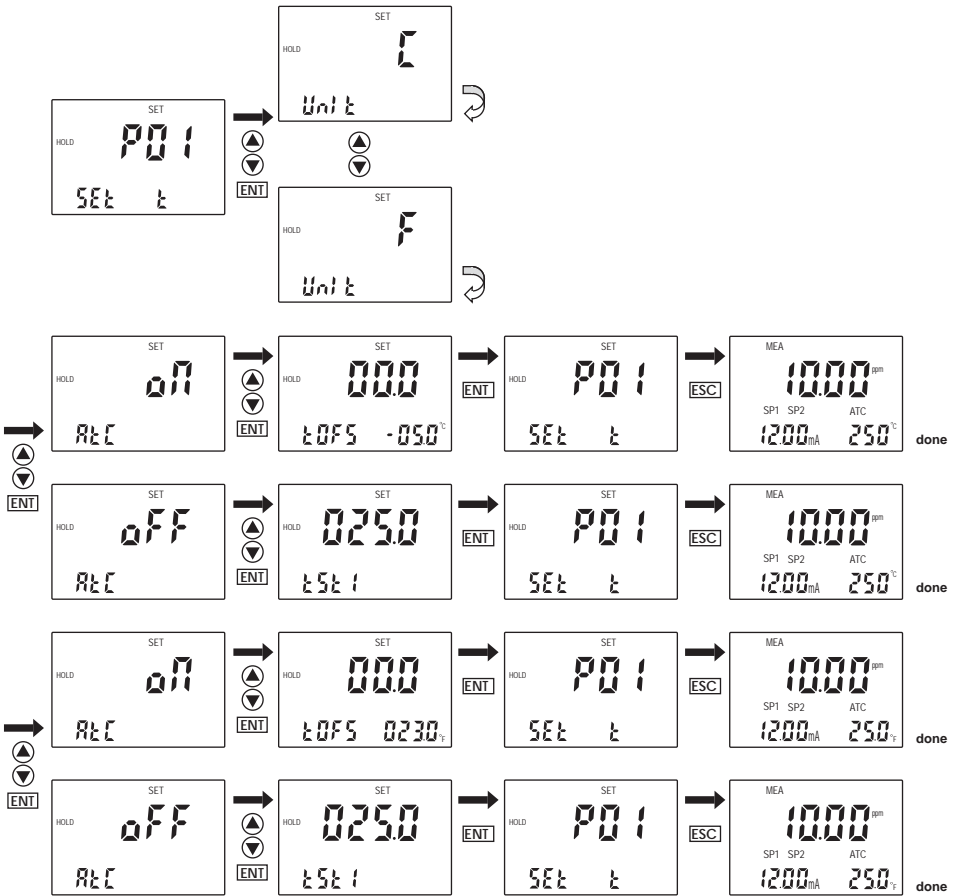
ENTERING SET UP MODE



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





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

5.1 P01: TEMPERATURE SET-UP FUNCTION





- In P01 screen, press  to enter. LCD main display zone show C, which means temperature unit is centigrade. Press ▲ or ▼ to switch to F, which means temperature unit is Fahrenheit. Press  to confirm and enter into next item.
- LCD main display zone 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 will enter 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

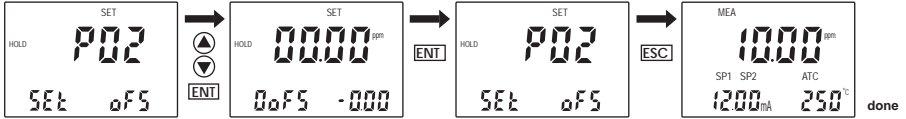
to P01 function form. Use ▲ or ▼ to select other functions or press  to return to measurement status.










3. In manual temperature compensation, press  and instrument will enter into set up status of manual temperature compensation. User can use ▲ or ▼ to set up process temperature TST1.

Press  to confirm and return to P01 function form or press ▲ or ▼ to select other functions

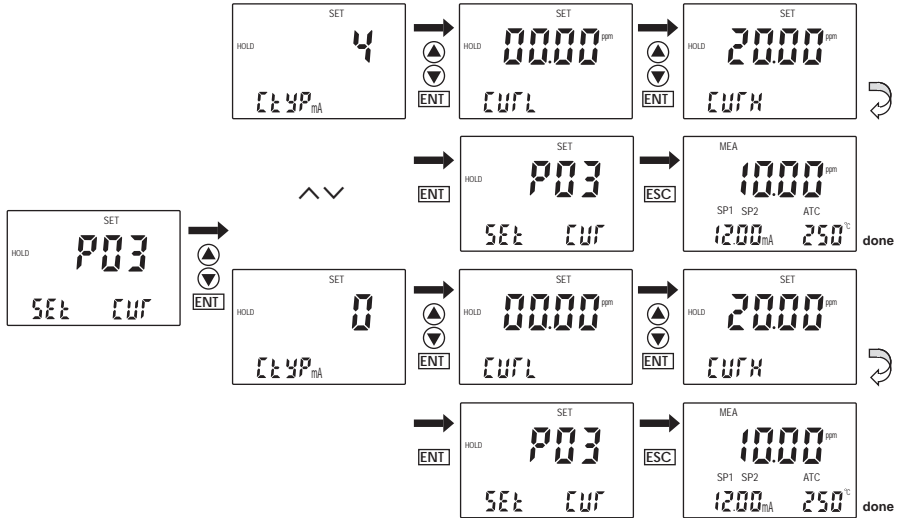
to set up or press  to return to measurement status. TST1 is the compensation temperature under normal measurement mode.

5.2 P02: OFFSET SET-UP FUNCTION



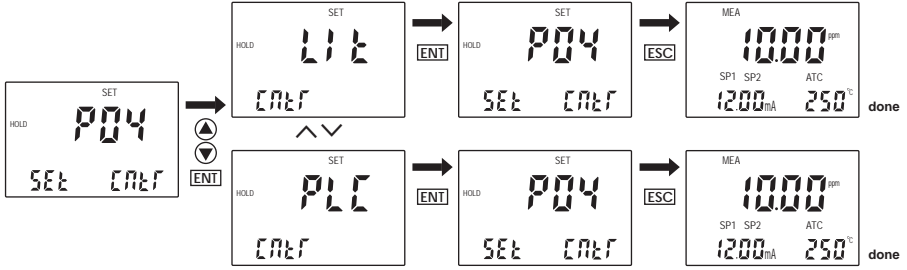
1. In P02 function form, Press . LCD main display zone shows measured FCL value in measurement mode. The lower display shows OFS. The right lower display shows offset value.
 2. User can press  or  to adjust offset to modify measurement value. Press  to confirm and return to P02 function form. Use  or  to select other function to set up.
-  **NOTE:** Press   to exit from set-up mode at anytime. Instrument will return to measurement mode automatically.




5.3 P03: OUTPUT CURRENT (SP1/SP2) FUNCTION



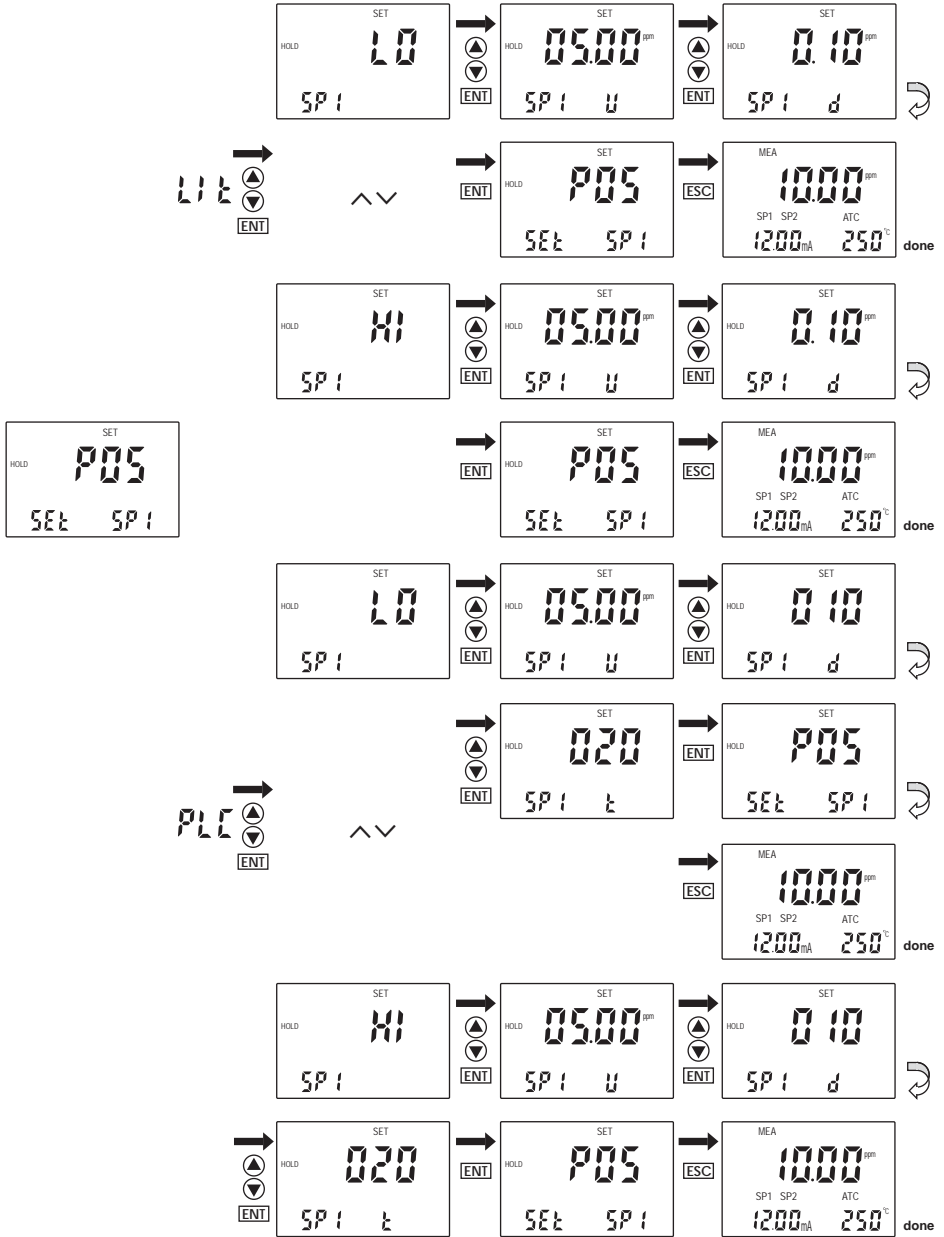
	<p>1. Press to confirm in P03 function. Entering set up mode.</p>
	<p>2. The lower display shows CTYP. The upper display shows 4 (it means current output is from 4 mA to 20 mA). User can press ▲ or ▼ to select 0 (it means current output is from 0 to 20 mA). Press to confirm and enter into set-up of transmitting 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 ppm. User can press ▲ or ▼ to adjust the actual value. Press to confirm. The lower display shows CURH while the upper display shows 10.00, which means 20.00 mA transmitting range indicates 10.00 ppm. User can press ▲ or ▼ key to adjust the actual value. Press to confirm and return to P03 function firm.</p>
	<p> NOTE: Press twice to exit from setting 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 overlap.</p>

5.4 P04: CONTROL MODE FUNCTION




	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> 1 ENT </div>	<p>1. Press  in P04 screen to enter into the setting 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 <div style="border: 1px solid black; padding: 2px; display: inline-block;"> 2 MOD ESC </div> 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





1. In P05 menu. Press  to enter into setting-up procedure.

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.


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.

4. This function sets hysteresis band under limited control mode to protect relay, which may oscillate frequently around set point and be damaged. Controlling proportion range is set up under proportion control mode (this parameter is not lower than 5 under PLC mode) to confirm and adjust time period




of adding medicine automatically. Press  to confirm and enter into next set up procedure. Under proportion control mode, this function is used to set time period of whole controlling circle.



Press  to confirm and return to P05 function menu. Use ▲ or ▼ to select other function and to set up.

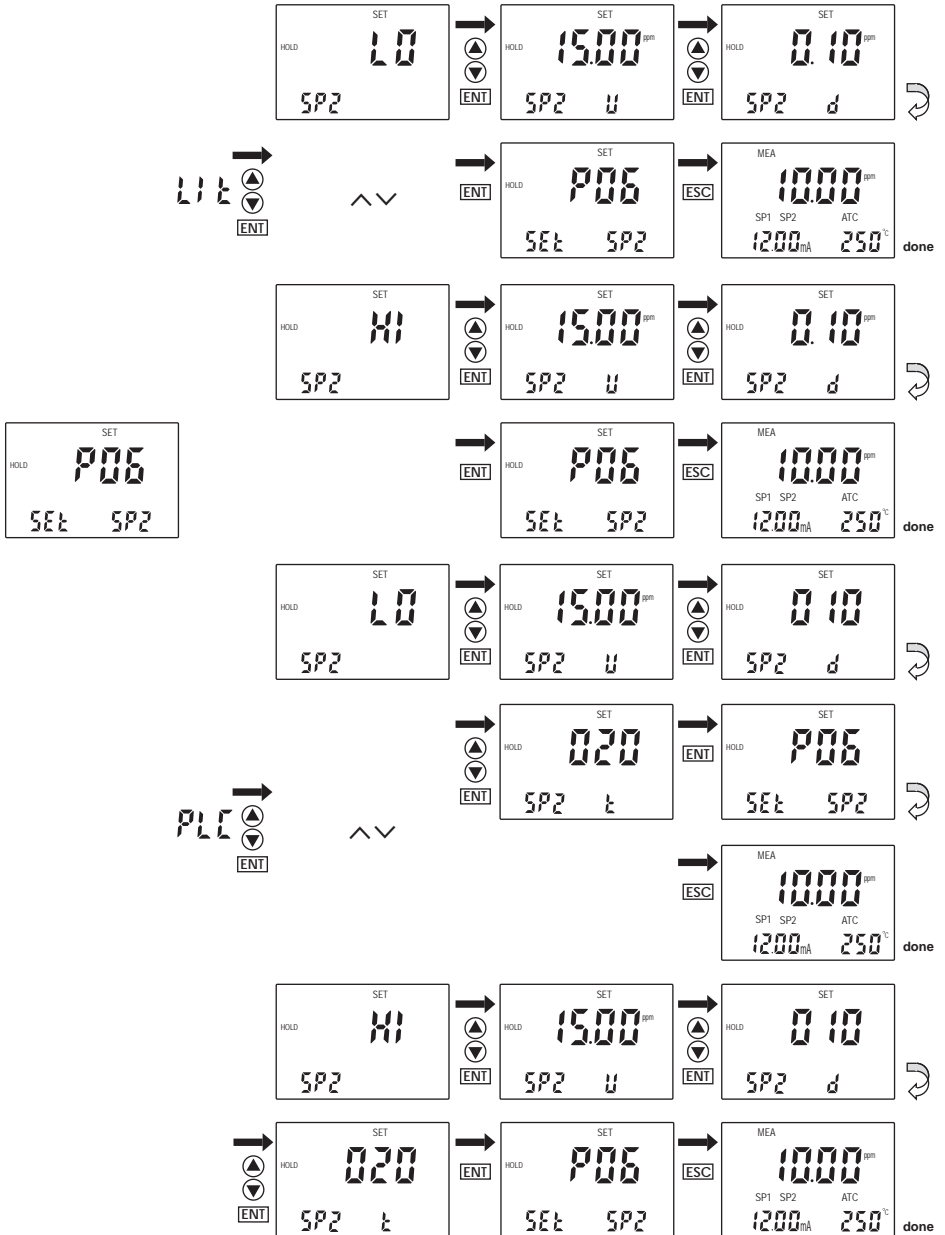


NOTE: Press  to exit from set-up mode at any time.

Instrument will return to measurement mode automatically.

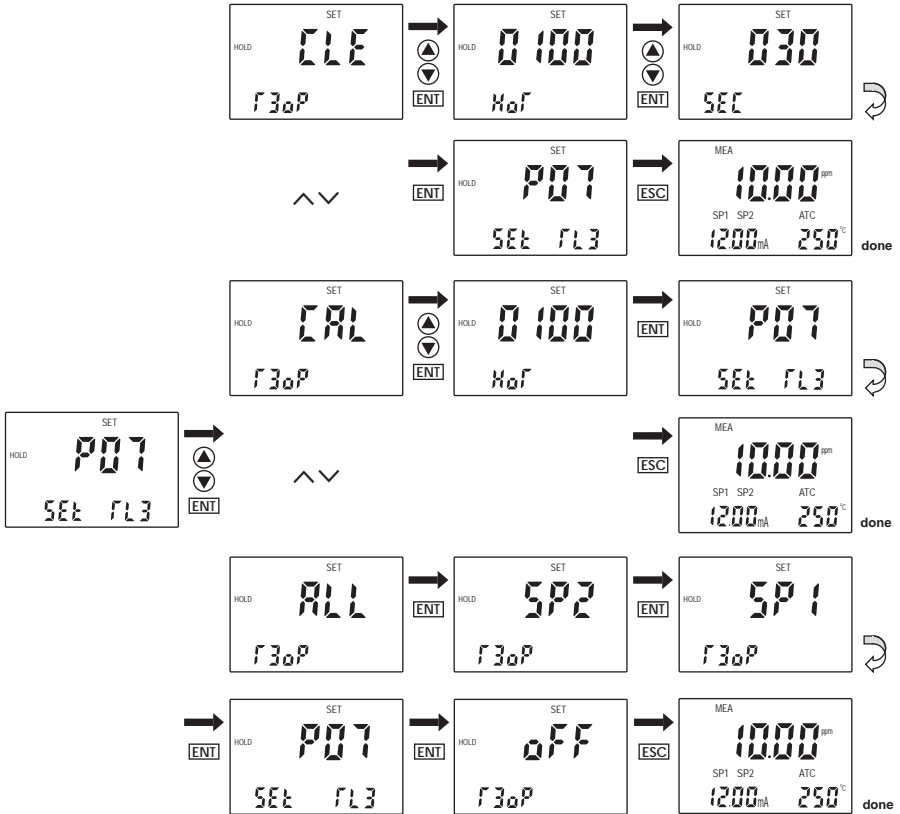
5.6 P06: RELAY 2 SET-UP FUNCTION

Working principle of this part is the same as in 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 20.00 ppm.
For example, if high point is 5.00 ppm and hysteresis band is 0.50 ppm, movement range of the relay is from 5.00 ppm to 4.50 ppm. If low point is 6.00 ppm and hysteresis band is 0.20 ppm, movement range of the relay is from 6.00 ppm to 6.20 ppm.

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.

- **CLE** = Relay 3 as cleaning control relay
- **CAL** = Relay 3 as calibration alarm relay
- **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.



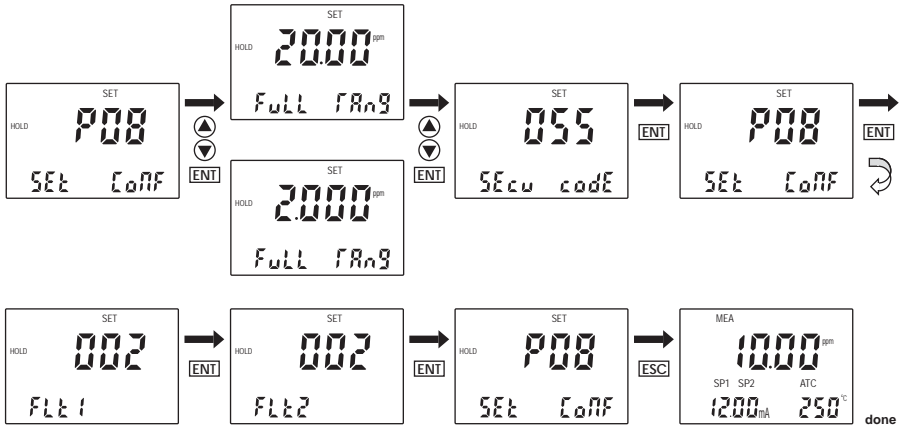
Press  to confirm and return to P07 function form. Use  or  to select other functions to set up.








NOTE: Press  to exit from set-up mode at any time.




Instrument will return to measurement mode automatically.

5.8 P08: MEASUREMENT RANGE AND PASSWORD SETTING FUNCTION

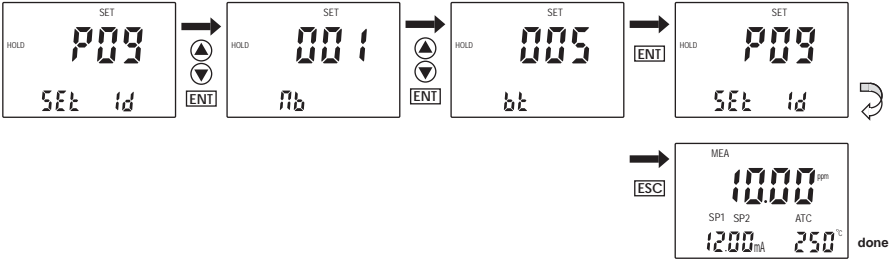





1. Press key to confirm in P08 and enter the concrete set-up procedures.

2. In this function, users can set up measurement range of free chlorine as 0~20.00 ppm or 0~2.000 ppm. Use ▲ or ▼ to choose necessary measurement range, then press  to confirm. Instrument will enter into password set-up function. The lower will display SECU CODE while the upper will display 055. Press ▲ or ▼ to select password need to be modified. Make record and press  to confirm. So, instrument will enter into set-up function with the new password. Press  to confirm and enter into figure filter set-up function. The lower will display FLT 1 (temperature display channel), the upper will display default 002. Press ▲ or ▼ to adjust the figure to change set-up value of figure filter. Press  to confirm and enter into FLT2 (residual chlorine display channel) figure filter set-up function form. Press ▲ or ▼ to adjust the figure to change set-up value of figure filter. Press  to confirm and return to P08 and finish function set-up.

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



5.9 P09: TRANSMITTING RATE FUNCTION



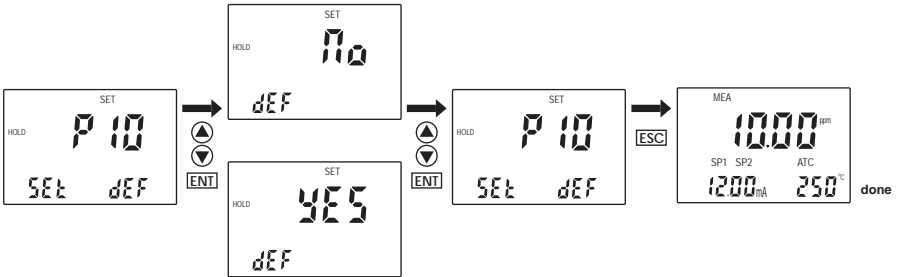
1. Press  in P09 to enter into concrete set-up procedures.
2. The lower display shows nb while the upper display shows 001, which indicates that user is setting communication address ID NO. of the instrument, from 000 to 63. Use ▲ or ▼ to select necessary ID and press  to confirm. Then enter into next set up function form.
3. The lower display of the instrument shows bt while the upper display shows 005, which indicates that user is setting communication rate function. Use ▲ or ▼ to select necessary communication rate. Press  to confirm and return to P09 function form. Use ▲ or ▼ to select other functions to set up.



4. Corresponding communication rate to codes.

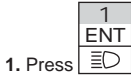
bt	000	001	002	003	004	005	006	007
baud rate	300	600	1200	2400	4800	9600	19200	38400


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

5.10 P10: REVERTING TO FACTORY DEFAULT SETTINGS




	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> 2 MOD ESC </div>
<p>NOTE: Press  to exit from set-up mode at any time. Instrument will return to measurement mode automatically.</p>	



1. Press  in P10 to enter into concrete set-up procedures.

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 setting will be lost.

NOTE: Press  to exit from set-up mode at any time.

Instrument will return to measurement mode automatically.

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.
 0D: 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, 0D (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.

0D: 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 adr>1BH or adr+1th>1BH, the return the error code: 40, 30, 31, 52, 45, 2A, 2A, CRCH, CRCL, 0D

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, 0D

40: the start byte

30 31: the ID

52 45: the fix data

D1~Dn: parameters from instrument to PC (n=2*lth)

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

0D: the end byte

Total Byte = 5 + 2 × lth + 3

3) RR (read all of parameters) the PC send: 40, 30, 31, 52, 52, CRCH, CRCL, 0D (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

0D: the end byte

The instrument response: 40, 30, 31, 52, 52, D1, D2, D55, D56, CRCH, CRCL, 0D (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

5.12 MAINTENANCE OF INSTRUMENT AND ELECTRODE:

1. If instrument displays "EEEr", it means damage of memorizer inside the instrument.
2. If instrument displays "AdEr", it means damage of input module inside the instrument.
If two above situations happen, please send back the instrument to our company to repair.
3. If instrument displays "Or", it means too high of input signal, which is beyond measurement range.
4. If instrument displays "Ur", it means too low of input signal, which is beyond measurement range.
If two above situations happen, user should check carefully whether the status of residual chlorine electrode or temperature sensor is normal or not. If residual chlorine electrode or temperature sensor is normal, please send back the instrument to our company to repair.
5. Before calibration of residual chlorine electrode, please make sure that the temperature of solution is in the range of 0.0 to 60.0°C.
When measuring residual chlorine, please make sure that the temperature of solution is in the range 0.0~60.0°C.
If the temperature is beyond the range, temperature display value will normally display in the range of -10.0~130.0°C. But it will compensate automatically according to regular temperature range 0.0~60.0°C.

System's precision and reliability depends on sensor,users must often check and calibrate the sensor.

Please maintain the sensor according to following steps if user find surface of electrode is dreggy:

- a)Take the electorde out of the flow cell, dry it off with filter paper,take care not to damage the glass bulb.
- b) Immerse the platinum circle into 5% hydrochloric acid for 30 seconds,then take it out .
- c) Rinse the electrode with deionied water or pure water, dry it off with filter paper.
- d) Install the electrode back to the flow cell.
- e) Calibrate the instrument again.

6 TECHNICAL PARAMETERS

6.1 TECHNICAL PARAMETERS FORM

FCL5000 Transmitter / Controller	
FCL Range	0.000 to 2.000 ppm 00.00 to 20.00 ppm
Resolution & Accuracy	0.01 ppm and 0.001 ppm 2% full range
Temperature	- 5.0 to 100 °C
Resolution & Accuracy	0.1 & ± 0.5 °C
Temperature electrode	NTC22K
Temperature compensation	Automatic (± 10 °C offset adjustment) / manual
Set point and control function	
Control function	Limited point / Proportion control
Cleaning circle	From 1 to 999 hours
Cleaning time	From 1 to 999 seconds
Control hysteresis band	to 2.00 ppm 0.1 to 20.0%
Relay output	3 SPST relays, 250V/1A
Communication	
RS-485	client program
Current information and connection	
Power	110 or 220 V AC
Signal output / load	0 / 4 - 20 mA isolated current output, set up by user
Signal output load	600 Ω
Connection terminal	Removable plug-in unit
Main fuse wire	250 mA, anti-surge
Alarm function	
Function (switch able)	Calibration remind / clean control / alarm
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 °C (14 to 122 °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		COdE	COdE	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		TOFS	tOFS	TEMP measurement offset	Only valid for auto	-10~10℃	0.0
05	P2 OFS	OFS	OFS	FCL measurement offset		000~1.000	0.00
06	P3 CUr	CTYP	CtyP	Current output type		0/4~20mA	4
07		CURL	CUrL	Low limit of transmitting output	ppm mode 0.01 unit	0.00~20.00	0
08		CURH	CUrH	High limit of transmitting output		0.0~2.000	2.000 20.00
09	P4 CNr	LIt	LIt	Limitation control			LIt
		PLC	PLC	pulse length control			
10	P5 SP1	SP1	SP1	Way set up of relay 1		HI /LO	LO
11		SP1U	SP1U	Setting value of relay 1	ppm mode 0.01 or 0.001	0.00~20.00 0.000~2.000	5.00 0.500
12		SP1D	SP1d	Relay 1 hysteresis / proportion		0.00~2.00 0.000~0.200	0.10 0.010
13	P6 SP2	SP2	SP2	Way set up of relay 2		HI /LO	HI
14		SP2U	SP2U	Setting value of relay 2	ppm mode 0.01 or 0.001	0.00~20.00 0.000~2.000	10.00 1.000
15		SP2D	SP2d	Relay 2 hysteresis / proportion		0~2.00 0~0.200	0.10 0.010
16	P7 rL3	R3OP	r3OP	Relay 3 working mode		OFF/SP1/SP2/ ALL/CAL/CL E	OFF
17		INT	HOr	Interval (hour)	valid for calibration and cleaning mode	0~999	100
18		DUR	SEC	Operating time (second)	valid for cleaning mode	0~200	30
19	P8 CONF	FULL RANg	FULL RANg	Measurement range		0~20.00 0~2.000	0~20.00
20		SECU codE	SECU codE	Set password		0~200	055
21		FLT1	FLT1	Digit filter 1	TEMP CHANNEL	000~200	002
22		FLT2	FLT2	Digit filter 2	FCL CHANNEL	000~200	002
23	P9 ID	NB	nb	Set ID number for 485		0~63	1
24		BT	b	Communication rate		0~7	5
25	P10 DEF	DEF	dEF	Reverting to factory default settings	Reset	YES/NO	NO

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.

RETURNING THE ITEMS

Authorisation 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.

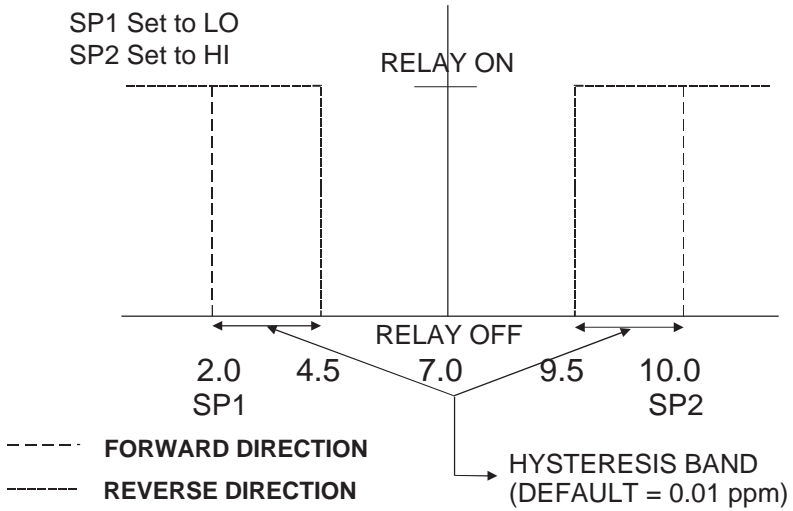
Warning: Damage as a result of inadequate packaging is the user / distributor's responsibility. Please follow the guidelines below before transporting.

GUIDELINES FOR RETURNING THE ITEMS

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.

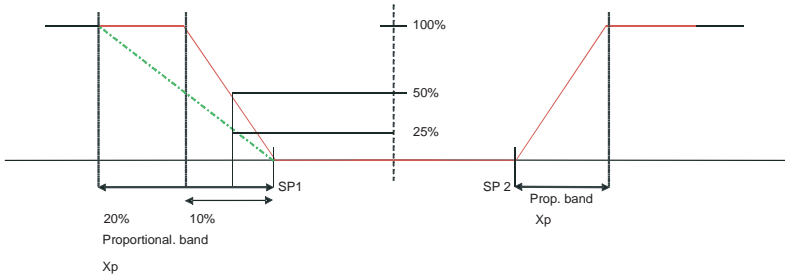
APPENDIX 3 – HYSTERESIS BAND

Brief Introduction on the Function of Hysteresis Band

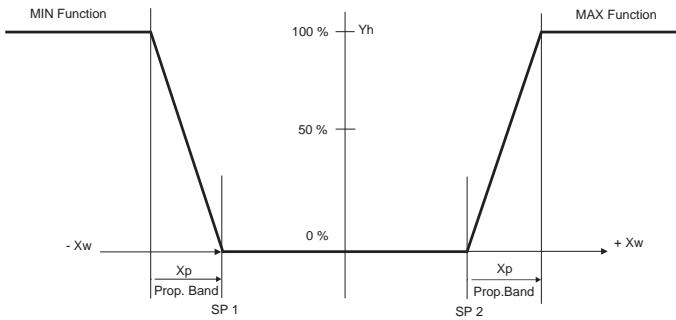


The controller relay activates when the set-point is reached. In the reverse direction, it closes. Relay continues to be active till the value reaches the amount set by hysteresis band.

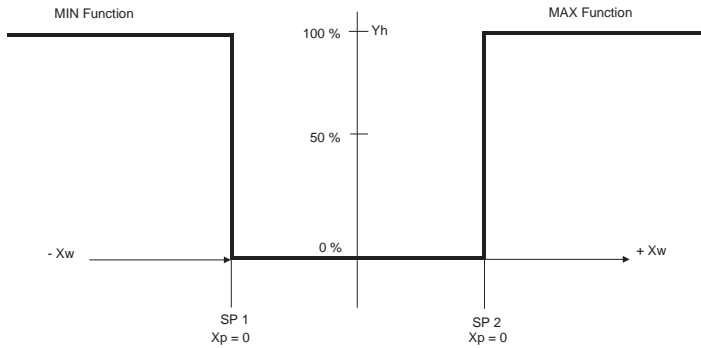
APPENDIX 4 – PROPORTION CONTROL



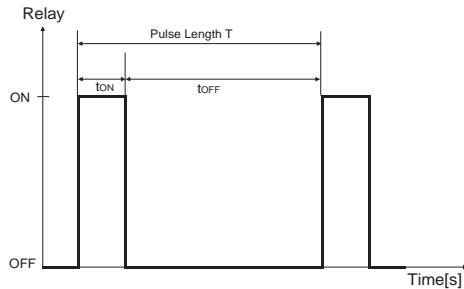
Control characteristic of PI-Controller as proportional integral controller



Control characteristic of P-Controller as proportional controller



Control characteristic of P-Controllers as limit value switch



Control signal and pulse length control

Output of relay controlled by hysteresis band is time. Pulse length T for open or close is constant. Different values come from limited value, increase or decrease of open time is in accordance with proportion range X_P .

Following applications:

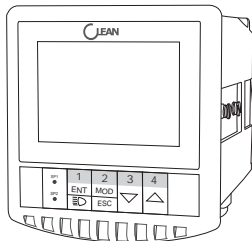
$$t_{ON} + t_{OFF} = T \text{ (Const.)}$$

greater divergence \rightarrow greater t_{ON}

X_p exceeded $\rightarrow t_{ON} = T$ (relay remains picked up)

ACCESSORY 5 - ABBREVIATIONS IN FUNTION FORM

Character	Meaning	Character	Meaning
MEA	Measurement mode	C	Centigrade
CAL	Calibration mode	F	Fahrenheit
ENT	Confirm	ppm	Unit
OFS	Zero point offset	FCL	Free chlorine
SET	Set up	SENS	Sensor
ATC	Automatic temperature compensation	DONE	Done
SP1	Set point 1	RANG	Range
SP2	Set point 2	SECU	Password
LO	Low limit	ID	ID number
HI	High limit	FULL	Full range
CNtr	Control	No	No
Llt	Limited point control	PLC	Pulse length control
RL3	Relay 3		
OUT	Output signal		
CONF	Configuration		
CLE	Cleaning		
DEF	Default		
CUR	Output current		
FLT1	Digit filter 1		
FLT2	Digit filter 2		



www.cleaninst.com

Manufacturer:

CLEAN Instruments - CISC

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