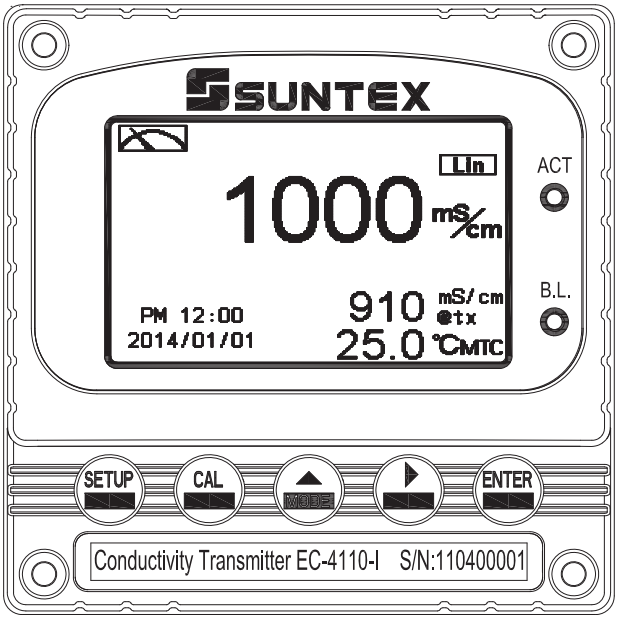
EC-4110-I
EC-4110-ICON
Intelligent Conductivity Transmitter

Operation Manual



SUNTEX

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7. Settings

8. Calibration

Thank you for purchasing Suntex products. In order to continually improve and enhance the transmitter's function, Suntex reserves the right to modify the content and icon display of the product. The actual situation is subject to the instrument without notice. The operation manual is only provided for function and installation description, Suntex Instruments Co., Ltd. is not liable for any person or entity for any direct or indirect loss or damage due to improper usage of this product. If you have any questions or find omission, negligence or mistakes of the operation manual, please contact with our staff, thank you.

Precautions for installation

Wrong wiring will lead to breakdown or electrical shock of the instrument, please read this operation manual clearly before installation.

- Make sure to remove AC power from the transmitter before wiring input, output connections, and remove it before opening the transmitter's housing.
- The installation site of the transmitter should be good in ventilation and avoid direct sunshine.
- The material of signal cable should be special coaxial cable. Strongly recommend using our coaxial cable. Do not use normal wires instead.
- Avoid electrical surge when using power. Especially when using three-phase power, use ground wire correctly. If the power surges interference occurs, separate the power supply of transmitter from the control device, such as: dosing machines, mixers, etc. to make individual power supply for the transmitter; or set surge absorber to reduce the power surges at all electromagnetic switches and power control device coils.
- The internal relay contact of the instruments is for alarm or control function. Due to safety, **please must connect to external relays which can stand enough ampere to make sure the safety operation of the instrument.**（Please refer to chapter 3.6 "Illustration of electrical connection"）
- There a manufacturer logo usually shows in the display of transmitter, and the illustration of each function in the manual is no longer expressed.

Brief Instruction

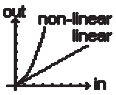
Description of set-up settings (see chapter 7 for details)

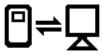
Press SETUP and MODE simultaneously to see the overview of the set-up settings now. Then press ENTER if you would like to modify set-up settings. Press keypad according to index of keypad on the screen.

Index of keypad

keypad	Accordingly item	Description
SETUP	SET:Back	Back to upper layer
MODE	▲:◢	Choose leftward of change to left page
	▲: +	Increase digit
▶	▶:◢	Choose rightward of change to right page
	▶: −	Decrease digit
ENTER	ENT: Enter	Confirm settings after modifications and then go through next step

Selection of set-up items

keypad	Accordingly item	Description
Mode		Measurement mode, to choose Conductivity with temp. compensation (Cond.@tref), Concentration, TDS, Salinity or Absolute Conductivity (Cond.@tx) and measurement mode can be displayed in Text Mode, Real-time Mode, or Trace Mode.
Product Adj.		Sample reading adjustment—for resistivity mode only.
Temperature		Temperature measurement and compensation, including MTC, PTC1000, PTC100, or NTC (4 types in total). MTC---Manual Temperature Compensation, PTC1000/PTC100/NTC--- Auto Temperature Compensation
Compensation		Temperature compensation setting, selection from linear(Lin.), non-linear(Non-Lin.), no compensation(Lin., 0.0%), 3 types
Relay 1		First relay setting, to choose action off or Hi/Lo alarm

Relay 2		Second relay setting, to choose action off or Hi/Lo alarm
Clean		Automatic wash time setting, to choose electrode clean equipment's ON and OFF duration
Current Output		Current output according to Cond.@tref, Concentration, TDS, Salinity, or Cond.@tx setting range
RS-485		RS485 serial interface (Modbus protocol)
Clock		Clock setting **(When out of power and reboot it, the instrument's time setting can maintain to the real time. If not, please replace the inner 3V CR2025 battery.)**
Digital Filter		Take every serial 1~60 measurements, average them continuously, and make it as the readings
Back Light		Backlight setting, to set Auto/ON/OFF backlight, brightness, and sensitivity
Contrast		Contrast of screen setting
Logbook		Event recorder logbook (50 data)
Return		Setting of returning to the measurement mode
Code		Security code of set-up mode. The set-up code is precedential to calibration code, thus it can pass a different security code of calibration.
Language		Available for English, Traditional Chinese, Simplified Chinese

Description of calibration settings (see chapter 8 for details)

Press CAL and MODE simultaneously to see the last calibration information. Then press ENTER if you would like to make a new calibration or modify setting of calibration. Press keypad according to index of keypad on the screen.

Index of keypad:

keypad	Accordingly item	Description
CAL	CAL:Back	Back to upper layer
MODE	▲: ◢	Choose leftward of change to left page
	▲: +	Increase digit
▶	▶: ◢	Choose rightward of change to right page
	▶: −	Decrease digit
ENTER	ENT: Enter	Confirm settings after modifications and then go through next step

Selection of calibration items

keypad	Accordingly item	Description
Cell Constant		To adjust the instrument cell constant setting until the value goes the same with the given cell constant of the sensor
Std. Solution		Use the appropriate standard solution to calibrate the system
Zero		Zero-point calibration
Return		Time interval setting of returning to the measurement mode
Code		Security code of calibration mode.

Note

Due to the need for continuous improvement of the transmitter function, we reserve the right to modify the content and the icon of the function. The actual icons and contents are subject to the instrument without notice.

1. Specifications

1.1 Specifications

Model		**EC-4110-I**	**EC-4110-ICON**
Measuring modes		Conductivity/TDS/Salinity/Temp./Concentration (EC-4110-ICON only)	
Ranges	Conductivity	0.000 µS/cm~2000 mS/cm, Auto or Fixed	
	Salinity	0.0 ppt~70.0ppt	
	TDS	0ppm~19999ppm; 0.00~199.9ppt	
	Temp.	PTC1000/PTC100: -30.0~200.0˚C, NTC30K: -30.0~130.0˚C	
	Concentration		NaCl_28%：0-28 % HCl_18%：0-18 % HCl_39%：22-39 % HNO3_30%：0-30 % HNO3_96%：35-96 % NaOH_24%：0-24 % NaOH_50%：15-50 % H2SO4_37%：0-37 % H2SO4_88%：28-88 % H2SO4_99%：89-99 % H3PO4_35%：0-35 % The boundary value of conc. conversion range of each solution can vary with changes of temp., if go over range, there twinkles an alarm on the display screen. Self-defined table (up to 9 temp. data, and there are 9 corresponding points for cond. v.s. conc. at each temp.)(9 x 9 matrix)
Resolutions	Concentration	0.01 %	
	Conductivity	0.1 µS/cm, 0.01 / 0.1 / 1 mS/cm	
	Temp.	0.1˚C	
Accuracy	Conductivity	±1% (± 1Digit)	
	Temp.	±0.2°C (± 1 Digit), Equipped with temperature error correction function	
Temperature Compensation		Automatic with NTC30K/ PTC1000/PTC100	
		Manual Temperature Compensation	
Calibration mode		(1)Manual cell constant adjustment (2)Conductivity standard solution calibration (3)Zero-point calibration	
Product Adjustment		0.7000~1.3000	
Ambient Temp.		0~50 ˚C	
Storage Temp.		-20~70 ˚C	
Cell Constant		freely selectable 0.008~9.9999 cm-1	

Temperature Coefficient		Linear temperature compensation from (0.00%~ 40.00%), Non-Linear compensation, or No compensation
Compensation Temperature		Freely set reference temperature 0~200 ˚C
Display Screen		Large LCM with sensitization sensor for auto/manual illumination function and contract function
Languages		English / Traditional Chinese / Simplified Chinese
Display		Text mode: Numerical display
		Chart mode: 3 mins real-time dynamic graph (conc. and cond. only)
		Trace mode: Set up from 3 mins to four weeks duration of the measured value trend graph (conc. and cond. only)
Analog output		Isolated DC 0/4~20mA corresponding to main measurement, max. load 500Ω
Logbook		50 event records
RS-485 interface		Isolated (MODBUS RTU or ASCII)
Modbus communication		Offer measuring value, calibration data, product adjustment, logbook, control parameter, etc or system setup
Settings	Contact	RELAY contact, 240VAC 0.5A Max.(recommended)
	Activate	Hi/Lo. Hi/Hi. Lo/Lo selectable two limited programmable, ON/OFF
Wash		RELAY contact ON 0~99min. 59sec. / OFF 0~999hr 59min.
Protection		IP65 (NEMA 4X)
Power Supply		100V~240VAC±10%, 7W max., 50/60Hz
Installation		Wall or Pipe or Panel Mounting
Dimensions		96m × 96mm × 132mm (H×W×D)
Cut off Dimensions		93 mm × 93 mm (H×W)
Weight		0.5Kg

Note: The specifications are subject to change without notice.

1.2 Product packing

1.2.1 Standard accessories

1. Transmitter
2. 8-201-PFA-10 sensor assembly(Including temperature sensor with PTC1000 and signal cable for 10 meter)

1.2.2 Optional accessories

If necessary, please order the spare parts as follows:

1. Installation（please refer to ch.11: Installation of Sensor Assembly）
   - 1.1 Flange Mounting
     1. 8-201-PFA-10 sensor assembly
     2. 5419059 Teflon gasket
     3. 5420048 FEP sealing loop
     4. 5329003 G3/4" hexagon nut
   - 1.2 Tee installation
     1. 5419061 stell tee(2"-3/4")
     2. 5329003 G3/4" hexagon nut
   - 1.3 Immersion installation
     1. 5419060 immerison nut fitting(1"-3/4")
     2. 7202-DO100 DO protection holder 1M
     3. Threading type：8-26 waterproof cap or coiling type：8-09-6 circle junction box
2. Extension cable max. up to 50M (zero-point calibration, cell constant calibration or product adjustment are required after installation)
   1. 8-09-9 square junction box 9T
   2. 5251023 signal cable, please advise specific length as ordered(M)
3. Standard calibration buffers(optional)

Note: Installation can be referred to chap. 11: Installation of Sensor Assembly

1.3 Measurement principle

1. EC-4110-I/EC-4110-ICON utililze conversion of electric field and magnetic field to measure the conductivity in a sample solution. Sensor assembly is composed of Drive Coil and Receive Coil, whose induction is not directly contact with sample solution, belonging to inductive type. It is also composed of chemical-resistant materials, for example: the 8-201-PFA-10 is made up of PFA that can be applied to acidic, alkaline, salt solutions, effluents, etc. in online monitoring industrial environments.
2. EC-4110-I/EC-4110-ICON apply alternative signals of electric field to activate drive coil to produce the magnetic field. After that, sample solution(containing ions in different conc.) turns into a conductive circuit, and then the signal can be received on receive cell, turned into magnitude of current to measure the conductivity.
3. The temperature probes have three-wiring type PTC1000 and PTC100 and two-wiring type NTC30K as reference. Users can select the spec according to sensor assembly. “Cond.@tx” which presents conductivity is being measured at actual tmeperature “tx”, is regarded as absolute conductivity. Refer to temperature compensation modes (linear, non-linear, or off)

and reference temperature, “Cond.@tref” is to present conductivity based on desired ref. temperature.

4. EC-4110-I/EC-4110-ICON both have measurement of salinity and TDS.
5. EC-4110-ICON has built-in conc. conversion table including NaCl, HCl, HNO_3, NaOH, H_2SO_4, H_3PO_4, etc. Users can select the corresponding solution types and conc. range. When the conc. range is not applicable, there twinkles error message as an alarm during measurement. The absolute conductivity “Cond.@tx” can be turned into concentration of the sample solution, and with compensation of ref. temperature it also can be treated as “Cond.@tref.”
6. EC-4110-ICON has self-defined conversion table between cond. and conc., and there are conc. units %, ppm, or ppt as reference.
7. Self-defined table(max. up to 9 temperature data, and there includes 9 corresponding cond. and conc. at each temp.) (9 x 9 matrix) can be input corresponding conductivity and concentration at the same temperature by users. The temp., cond., and conc. can be individually input in ascendant or descendant order. After that, the unit is going to check the data and correct somewhere the order goes wrong. When users only have data of cond. and conc. at one kind of temp. for conversion, it is necessary to apply linear temperature compensation to input T.C. value.
8. Due to conductivity attained by electromagnetic induction not by contact type, cell constant is to perform the geometric structure characteristic of a drive coil and a receive coil, and the signal cable of the sensor is labeled with cell constant made by lab when out of factory. The inductive signals can be influenced by the surroundings environments such as installation pipeline wall effect, metal(conductive) pipeline and plastic(insulation, non-conductive) pipeline, the distance from sensor assembly and the shell of pipeline. After installed, zero-point calibration in air and cell constant calibration are required, and there is no need to change the labeled cell constant since it can use span calibration to make product adjustment in the field directly.
9. It should restart zero-point calibration in air after each installation or maintenance, and the surface of sensor assembly needs cleaning without any attachment, making it dry, and using cell constant or product adjustment for calibration.
10. The default measuring range is 2000mS/cm, and users can select 2000mS, 999.9mS, 99.99mS, 9.99mS, 999.9μS, or AUTO, where AUTO means automatic switch unit.

2. Assembly and installation

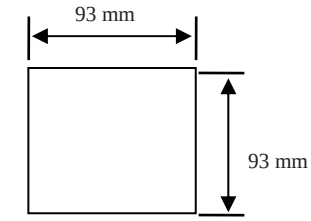
2.1 Transmitter installation:

This transmitter can be installed through panel mounting, wall mounting and 2” pipe mounting.

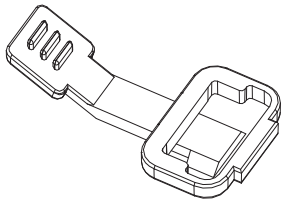
Installation of panel mounting:

First, prepare a square hole of 93 x 93mm on the panel box, and then insert the controller directly into the panel box. Insert the accessorial mounting bracket from the rear, and make it be fixed into pickup groove.

2.2 Illustration of panel mounting



Hole size



Mounting bracket

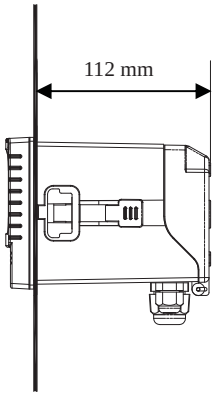
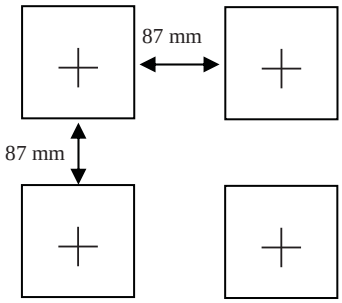
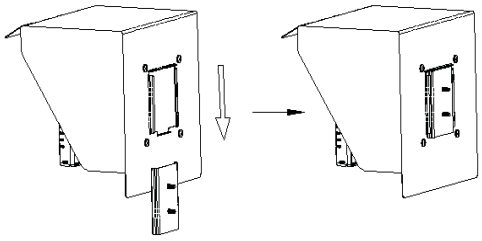


Illustration of panel mounting, fixed with mounting bracket

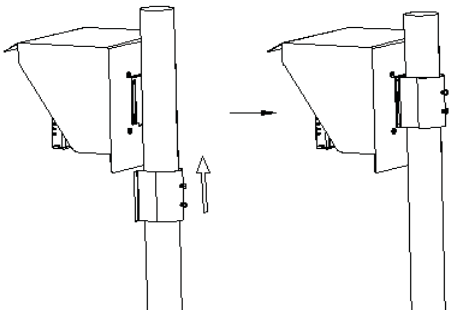


Hole distances on the panel box

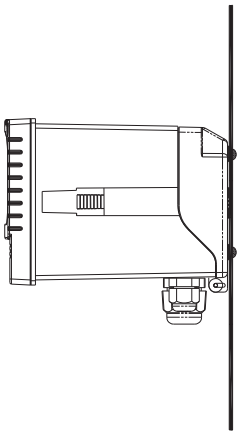
2.3 Illustration of wall mounting and pipe mounting



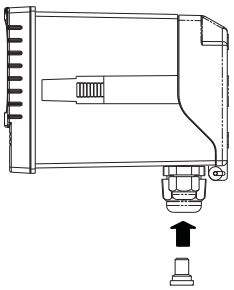
Sun Shield (Wall mounting, Optional)
(Order No.: 8-35 + 8-35-2 + 8-35-3)



Sun Shield (Pipe mounting, Optional)
(Order No.: 8-35 + 8-35-1 + 8-35-3)



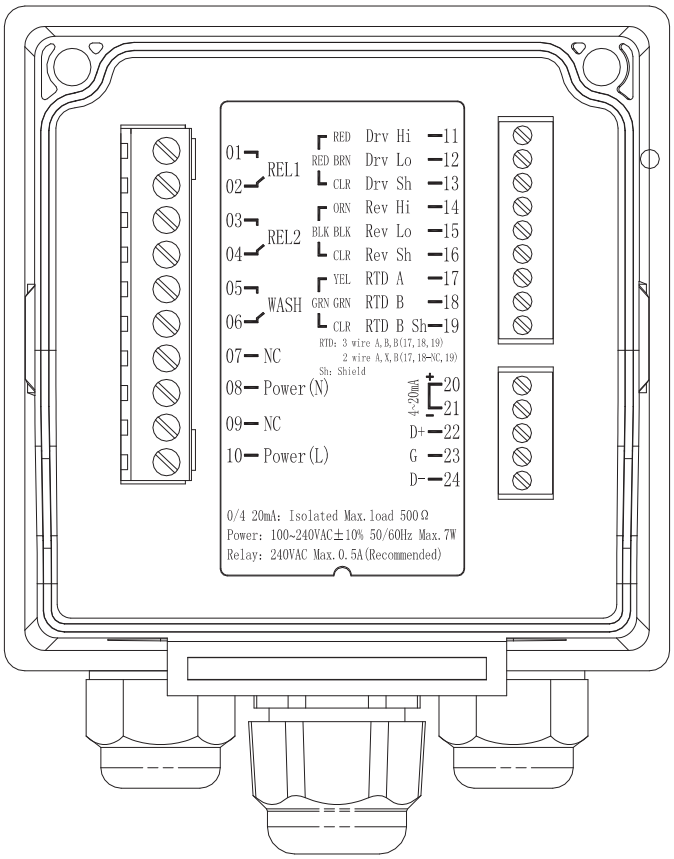
Installation of wall mounting
Fixed with 4 x M4 screws



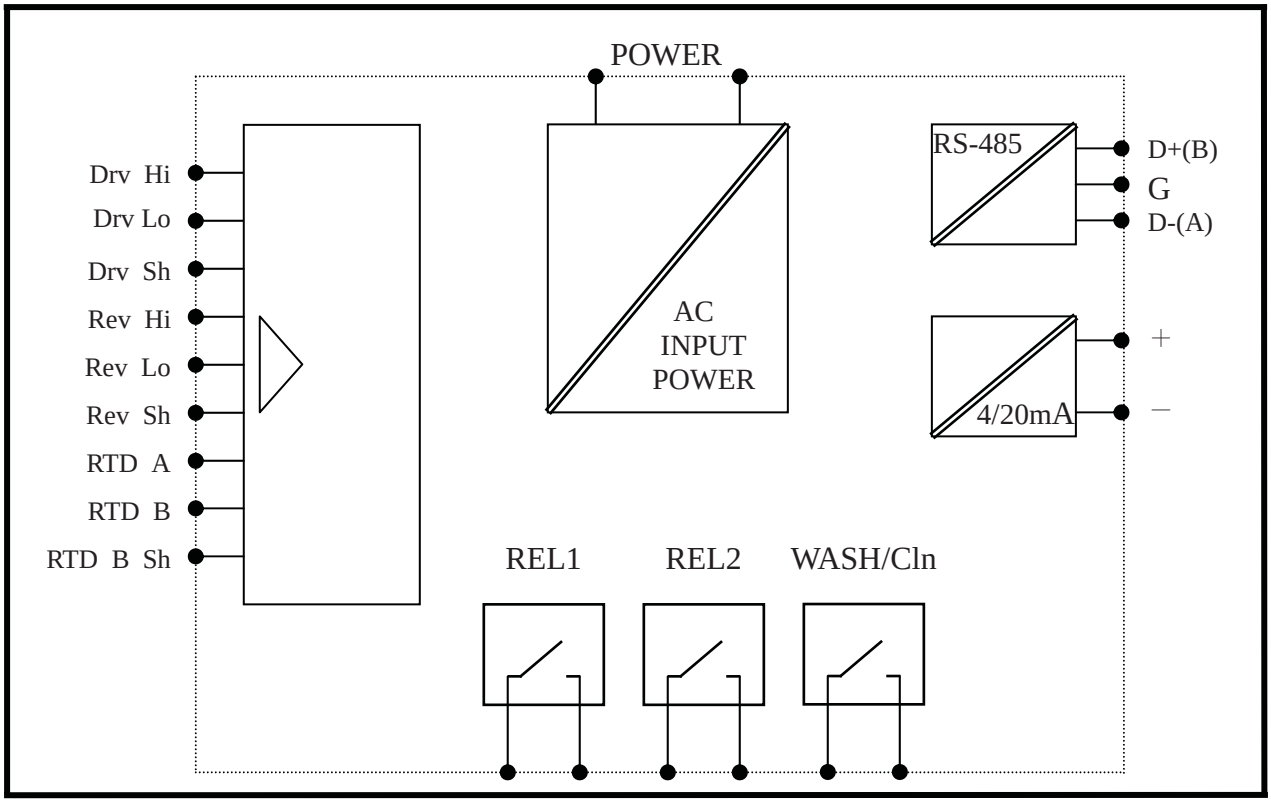
Insert the single hole rubber plug into the unused cable gland, and tighten up the cable gland to prevent from the penetration of water vapor.

3. Overview of Conductivity transmitter EC-4110-I/EC-4110-ICON

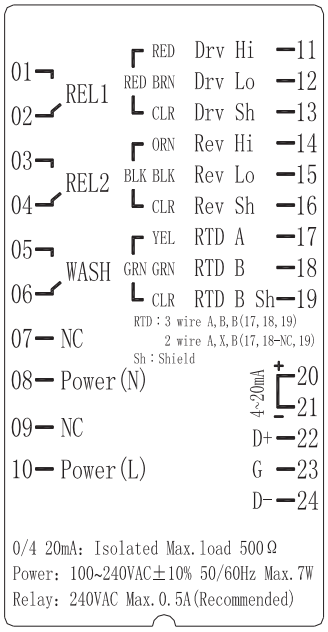
3.1 Illustration of rear panel



3.2 Illustration of terminal function



3.3 Description of terminal function



01 02 — **REL1:** First alarm control, the contact for an external relay

03 04 — **REL2**: Second alarm control, the contact for an external relay

05 06 — **WASH:** Wash relay contact for an external relay

07 — **NC:** None contact

08 — **Power(N)**: 100~240VAC Power supply terminal

09 — **NC:** None contact

10 — **Power(L)** : 100~240VAC Power supply terminal

11 — **Drv Hi**: Sensor drive coil terminal, High

12 — **Drv Lo**: Sensor drive coil terminal, Low

13 — **Drv Sh:** Shield

14 — **Drv Hi:** Sensor receive coil terminal, High

15 — **Drv Lo:** Sensor receive coil terminal, Low

16 — **Drv Sh:** Shield

17 — **RTD A:** Three-wiring temp. probe terminal A

18 — **RTD B:** Three-wiring temp. probe terminal B

19 — **RTD B Sh:** Three-wiring temp. probe terminal B Shield

20 — **4~20mA +terminal:** Master measure current output terminal +, for an external recorder or PLC control

21 — **4~20mA – terminal:** Master measure current output terminal -, for an external recorder or PLC control

22 — **D+(B):** RS-485 output D+(B)

23 — **G:** RS-485 output GND

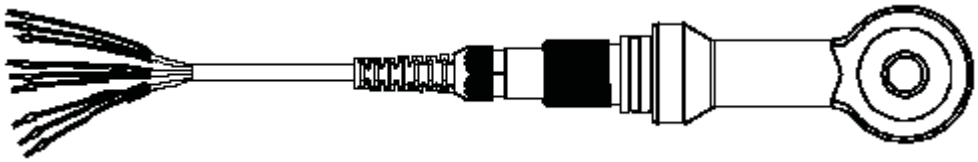
24 — **D-(A):** RS-485 output D-(A)

Temp. probe is PTC1000/PTC100(three-wiring diagram contacts 17 RTD A, 18 RTD B, and 19 RTD B Sh.)

Temp. probe is NTC30K(two-wiring diagram contacts 17 RTD A and 19 RTD B Sh.)

Temp. probe is PTC1000/PTC100(two-wiring diagram shorts with 18 RTD B and 19 RTD B Sh.)

3.4 Wiring of cable

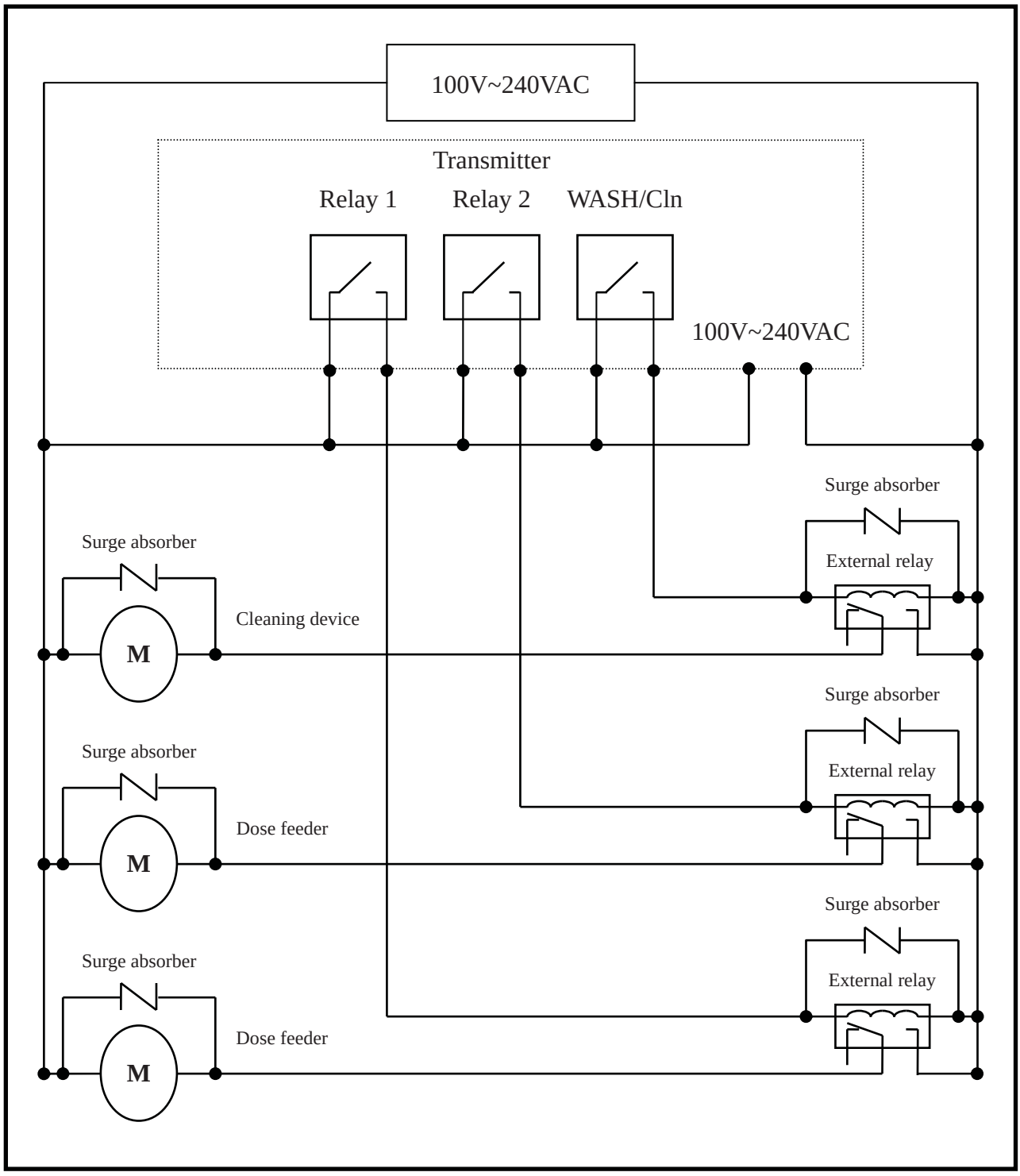


3.5 Circuit of cable

8-201-PFA-10 sensor assembly, 10M

Terminals	Color of heat shrink tube	Wire color	Wire descriptions
Drv Hi	Red	Red	Send H
Drv Lo		Brown	Send L
Drv Sh		Clear	Send SHIELD
Rev Hi	Black	Orange	Receive H
Rev Lo		Black	Receive L
Rev Sh		Clear	Receive SHIELD
RTD A	Green	Yellow	PTC1000 RTD-A
RTD B		Green	PTC1000 RTD-B
RTD B Sh		Clear	PTC1000 RTD-B

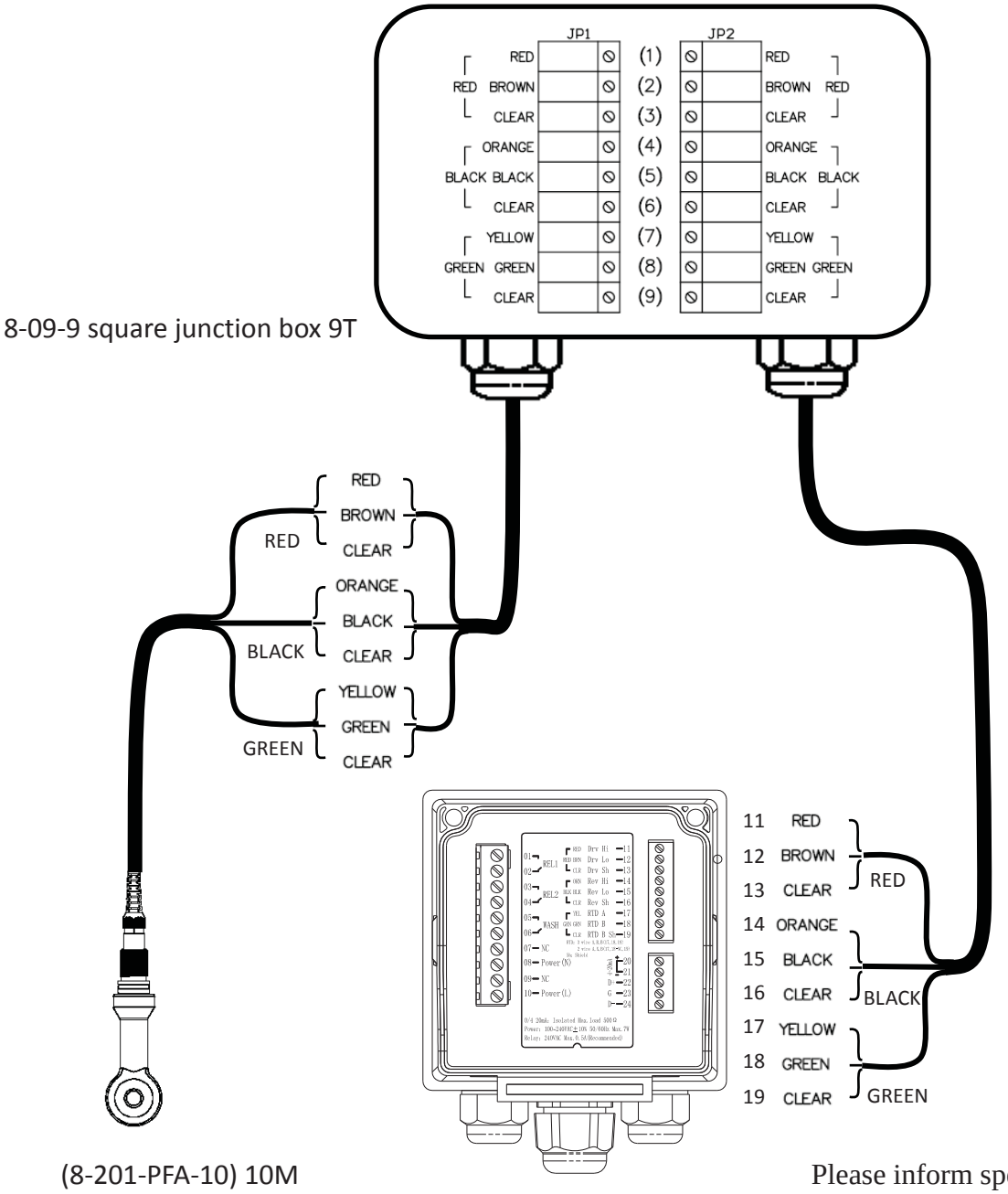
3.6 Illustration of electrical connection



Note: The transmitter built-in miniature relays is necessary to be repaired and replaced by professional technicians. It is recommended to use an external relay (Power Relay) to activate the external equipments.

3.7 Wiring diagram of extension cable

When the length of signal cable needs extension(max. up to 50M), 8-09-9 square junction box 9T(there are 4 M4 fixed screws on the rear) and extension signal cable can be used. After installation, it needs re-calibration of zero-point of the sensor and cell constant, or product adjustments in field. Wiring diagram is as follows:



8-09-9 square junction box 9T

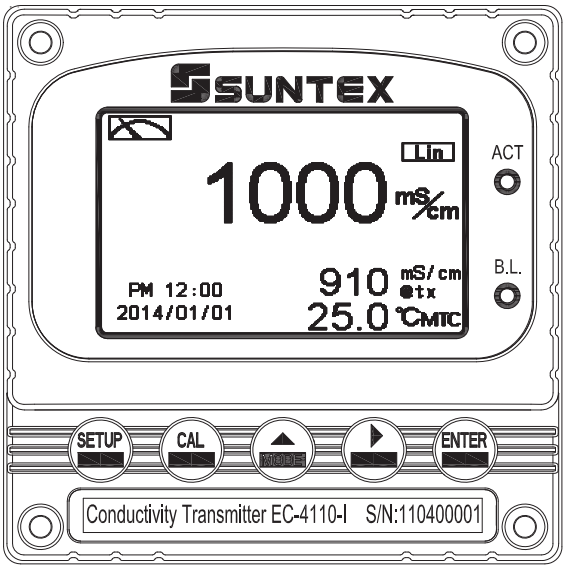
(8-201-PFA-10) 10M

(EC-4110-I/EC-4110-ICON)

Please inform specific length of extension signal cable as ordered.

4. Configuration

4.1 Illustration of front panel



4.2 Keypad

In order to prevent inappropriate operation by others, before the parameter setting and calibration, the operation applies multi-keys, and coding protection if necessary. Description of the key functions is in the following:

SETUP：In the parameter set-up mode, pressing this key allows you exit parameter set-up mode and back to Measurement mode.

CAL : In the Calibration mode, pressing this key allows you exit Calibration mode and back to Measurement mode.

MODE：1. In the parameter set-up mode and Calibration mode, pressing this key to select leftward or change to another page.

2. When adjusting value, press this key to increase the value.

：1. In the parameter set-up mode and Calibration mode, pressing this key to select rightward or change to another page.

2. When adjusting value, press this key to decrease the value.

ENTER：Key for confirmation; pressing this key is essential when modifying data value or selecting the parameter setting items in the window.

4.3 LED indicators:

ACT：Washing operation relay(Clean) and dosing operation relay (Relay 1, Relay 2) indicator

B.L. : Light sensor; in the automatic display backlit mode, the lamp will light or go out as the change of environmental brightness.

5. Operation

5.1 Measurement mode:

After all electrical connections are finished and tested, connect the instrument to the power supply and turn it on. The transmitter will automatically entering measurement mode with the factory default settings or the last settings from user.

5.2 Set-up menu:

Please refer to the set-up instructions in Chapter 7. Press SETUP and MODE simultaneously to enter into set-up menu, and press SETUP to go press to back to measurement mode.

5.3 Calibration menu:

Please refer to the calibration instructions in Chapter 8. Press CAL and MODE simultaneously to enter into calibration menu, and press CAL to go back to measurement mode.

5.4 Shortcuts:

1. In the measurement mode, if selecting MTC for temperature compensation mode, you may press MODE and ▶ to adjust MTC temperature value.
2. Under measurement mode, press SETUP continuously for 2 seconds to see the Logbook function directly. Press SETUP key to back to measurement mode.
3. Under measurement mode, press ENTER continuously for 2 seconds to switch the display mode from text mode, trace mode, and real-time chart display mode.

5.5 Default value:

5.5.1 Setting default value:

Measurement mode: Conductivity@tref
Range: 2000mS
Temperature compensation: PTC1000
Temperature Coefficient: Lin, 2.00%
Relay 1: High point alarm: AUTO, SP1= 1000mS, Hys.=10mS
Relay 2: Low point alarm: AUTO, SP2 =100 mS, Hys.= 1.0 mS
Wash time: OFF
Analog current output (Cond/Res): 4~20 mA, 0~1000mS
RS-485: RTU, 19200,EVEN, 1, ID: 1
Date & Time: 2014/1/1 00:00:00
Digital filter: 0
Backlight setting: Off
Contrast: 0
Logbook: None
Auto back: Auto, 3 minutes
Code set-up: Off

5.5.2 Calibration default value:

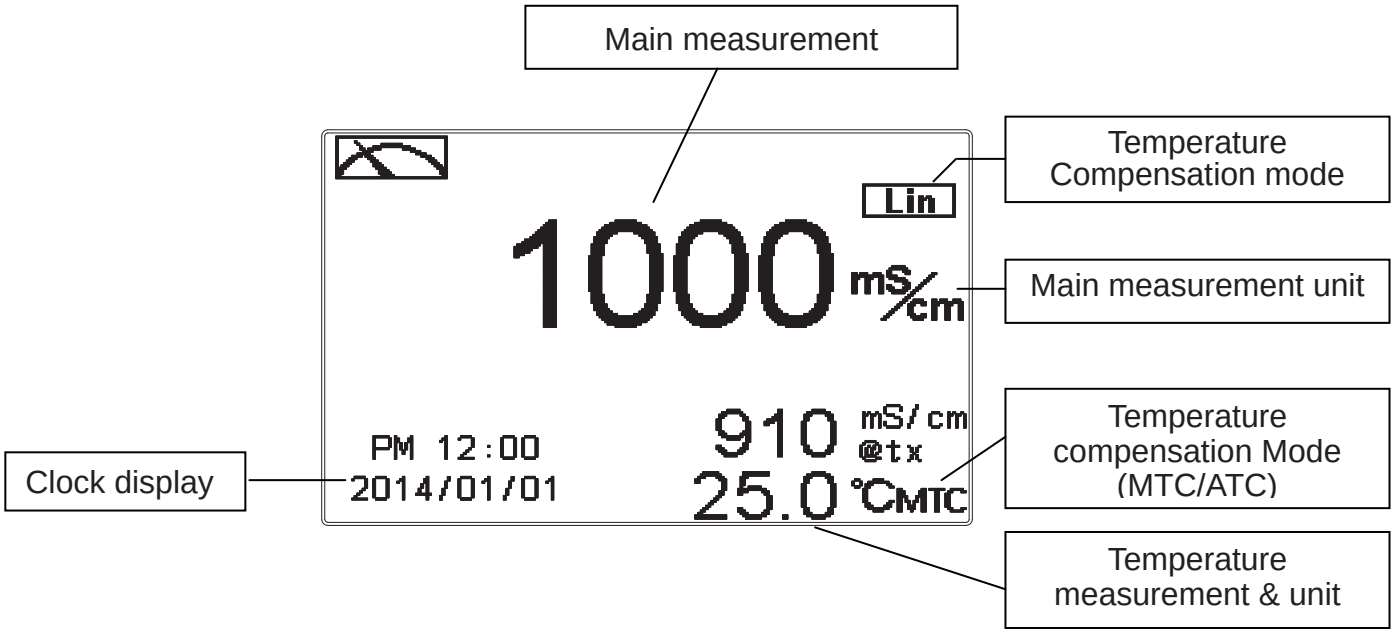
Cal Type: No Cal
Cal Temperature: None
Cell Constant: 2.700
Zero: 0.0μS
Auto back: Auto, 3 minutes
Code set-up: Off

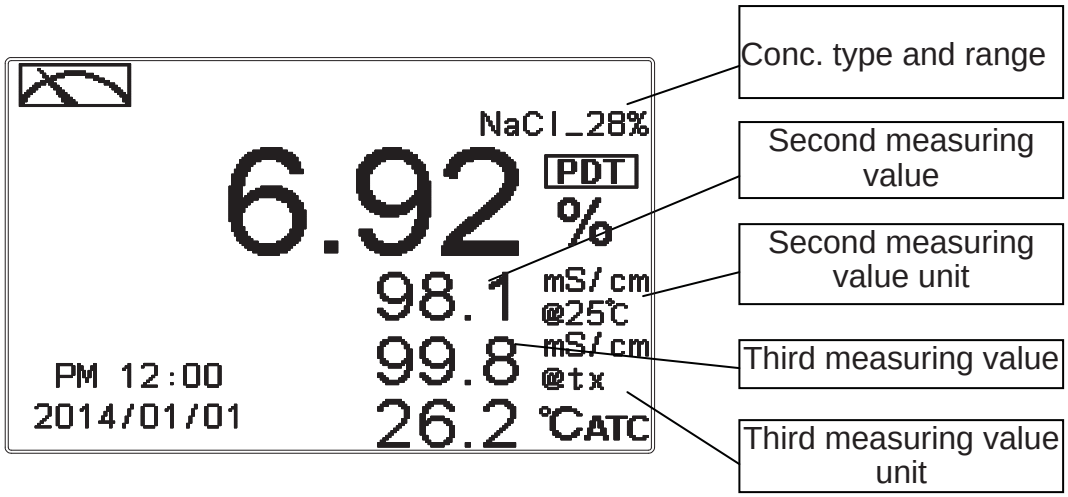
Note: The factory default of calibration presetting is “No Cal”, and the cell constant setting is “2.700”. It means that the user has not calibrated the sensor with the transmitter yet. When selecting standard solution or directly adjusting cell constant to finish calibration, the display shows cell constant of the cell. It should re-start a zero-point calibration in air after installation or maintenance, and the surface of sensor needs cleaning without attachment with cleaning solutions during calibration.

6. Measurement display mode

6.1 Text mode

The normal mode is for digit display, the content is as the following illustration. It mainly includes main measurement value and unit, temperature measurement value and unit, temperature compensation mode, and clock display.

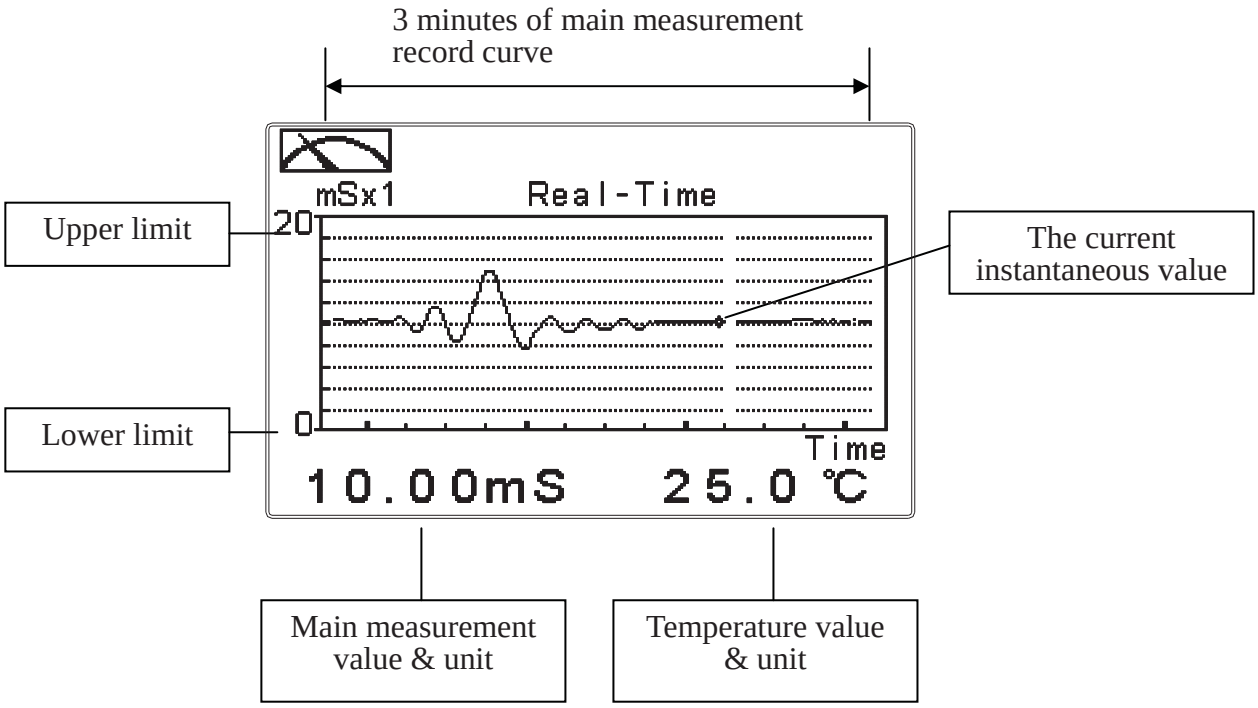




The first line is main measurement to correspond to desired parameter, and the second and the third line are auxiliary one to show related values but not necessary parameters. The fourth line is to show temperature basically.

6.2 Real-Time Chart mode

Real-time chart mode is for dynamic display of real-time graphics. The duration is about three minutes of the recent changes in measured values of the curve. Users can set the mode to its corresponding Cond./Conc. measuring range (see section 7.4). The smaller the range is set, the higher resolution of the display is. When entering setup or calibration mode and returning to measurement mode, the real-time graphic will be re-updated. When the measured value exceeds a set range of the upper and lower limit, the graphics will be presented in the upper and lower limits dotted line. Real-time chart mode display is shown as below. There are also real-time measurement value, & unit, and temperature value & unit which are displayed in the bottom of the screen. The timeline in real-time graphic is divided into 12 depict, which is describe the range of representatives of each of 1 / 4 minutes (15 seconds).

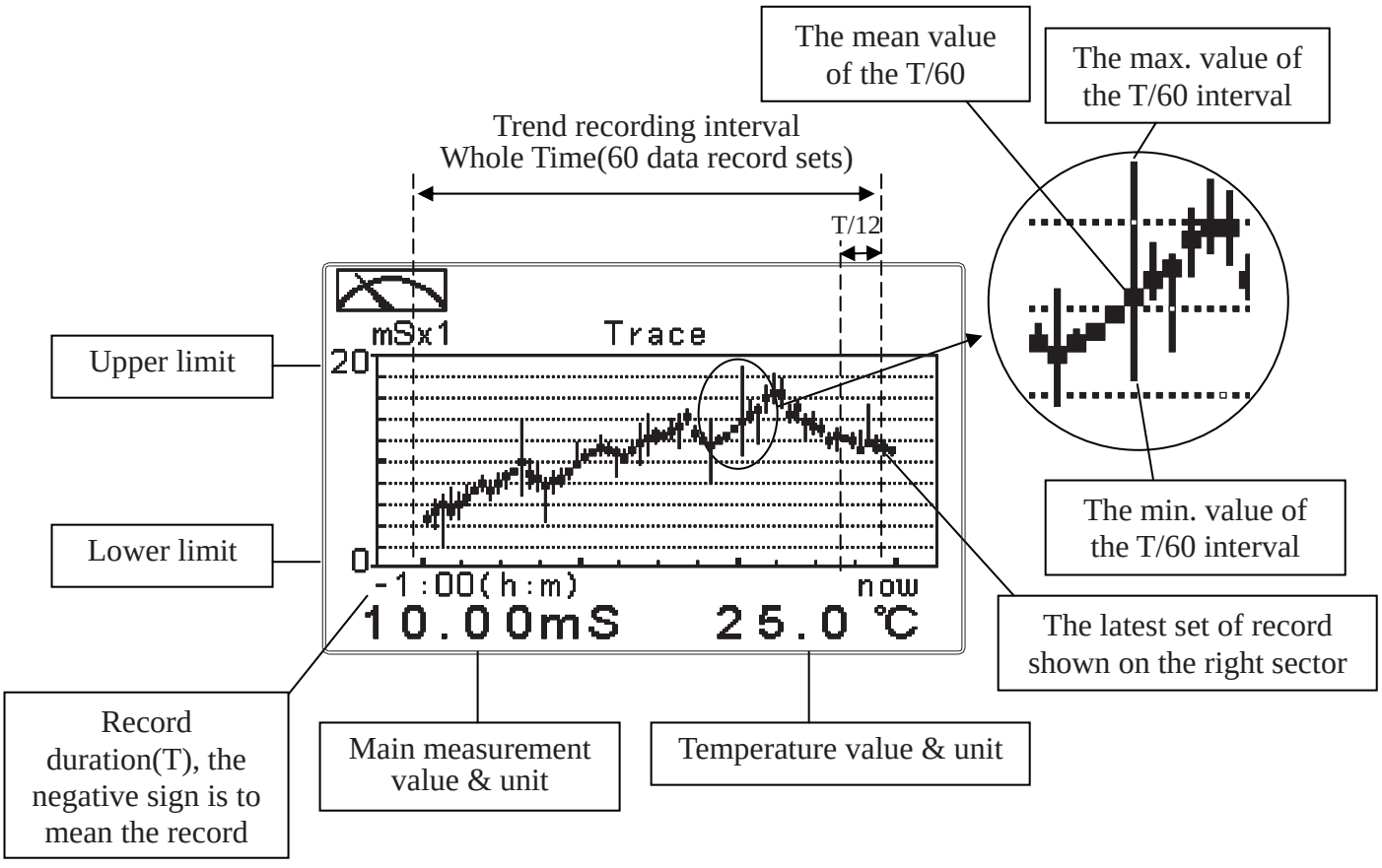


6.3 Trace mode

The feature of the trace mode is the record duration which can be set by the user (range from three minutes, up to four weeks). The trend graphic records the measurements in the past T time. The trend is recorded by the 60 group structure. Hence, each group of units is recorded in T/60 time interval. The trend line is constructed by all value data which is calculated to the average (Mean Value), maximum (Max Value) and minimum (Min Value) form. When the latest T/60 record shows in the rightmost of the trend graphic, all the previous record will be moved to the left side of the graphic. For example, T is set to 60 hours, then each set of records will be calculated to the average, the maximum, the minimum values after one hour(T/60 = 1), each time interval. Timeline of trends which is divided into 12 depictions showed on the horizontal axis of the display is on behalf of each characterization interval T/12. So, every depiction has 5 (T/60) sets of records. Users can set the corresponding Cond./Conc. measuring range in its set-up menu(see section 7.4). The smaller the range is set, the higher resolution of the display is. The trace mode is shown as below. There are also real-time measurement value, & unit, and temperature value & unit which are displayed in the bottom of the screen.

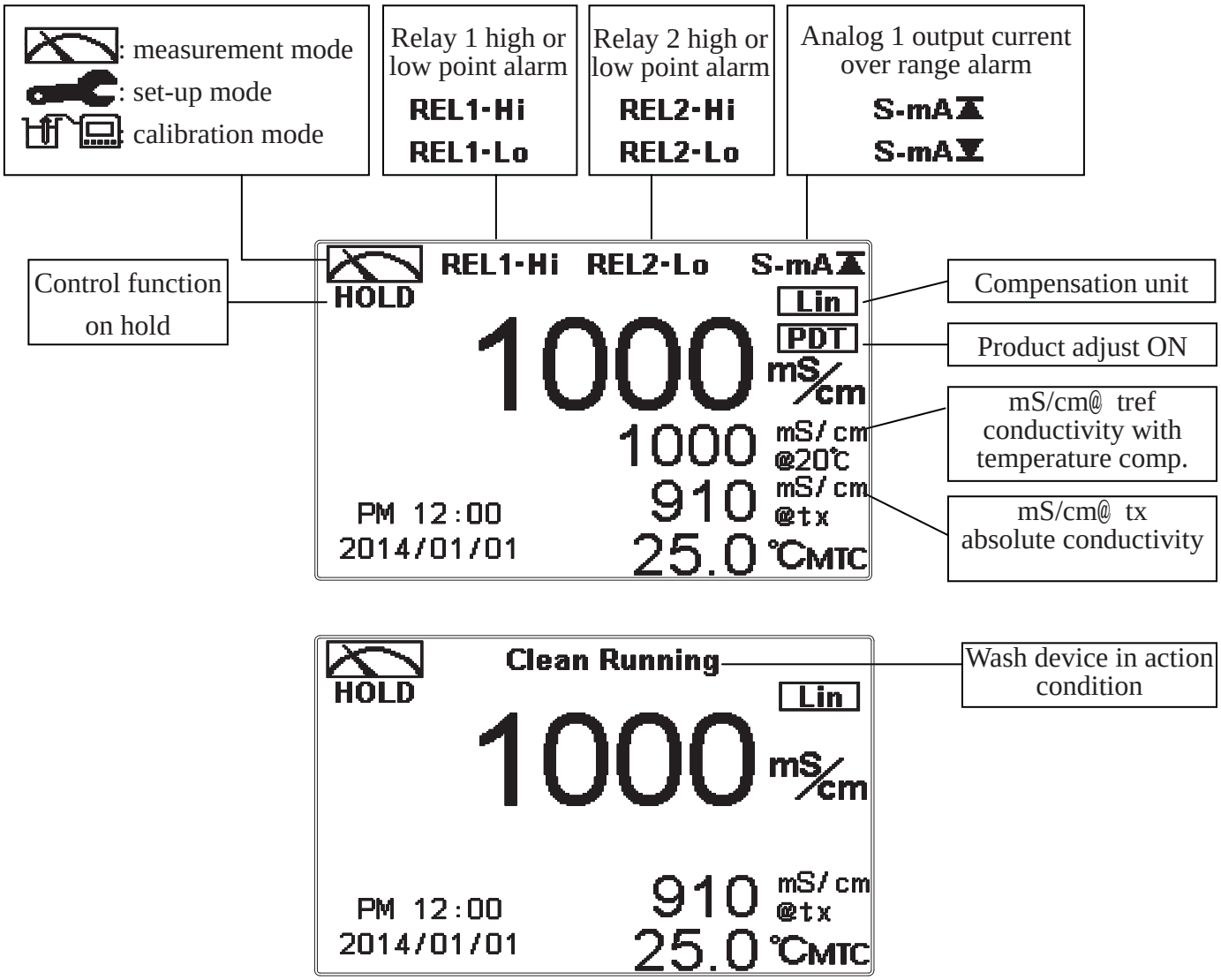
Attention: When the time interval has been reset, the trend in the data will not be retained, it will start a new trace record.

Note: The time display format (XX: XX) (hr: min), for example, appear as four weeks (672:00).



6.4 Warning symbols and text

1. When the clean function is activated, the display shows and twinkles the description, “Clean Running”. At the same time, the ACT indicator LED lights up, and the transmitter automatically turns off Relay 1 and Relay 2 function. After finishing cleaning, the Relay 1 and Relay 2 will automatically back to normal status.
2. When Relay 1/Relay 2 which is set in high setting point is in action, the display shows and twinkles the description, “REL 1-HI/REL 2-HI”, and ACT indicator LED lights up. When Relay 1/Relay 2 which is set in low setting point is in action, the display shows and twinkles the description, “REL 1-Lo/ REL 2-Lo”, and ACT indicator LED lights up.
3. When the Analog 1 current output exceeds the upper/lower limitation, the display twinkles ” S-mA ▲ / S-mA▼ ” as an alarm.

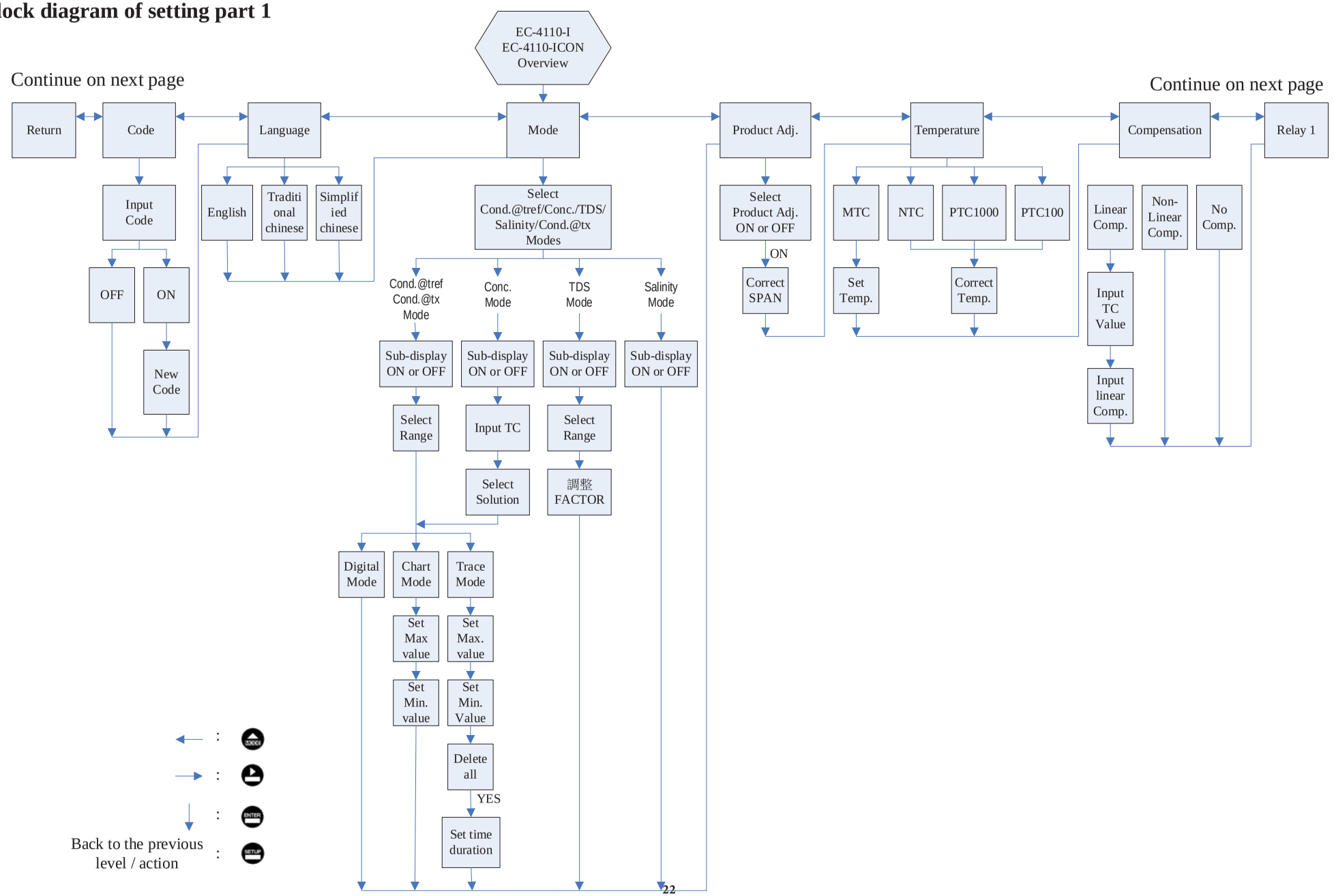


Note: The “HOLD” warning text appears when clean function is activated, or when entering setup menu, or when entering calibration menu. Under HOLD status, the corresponding display and output are as follows:

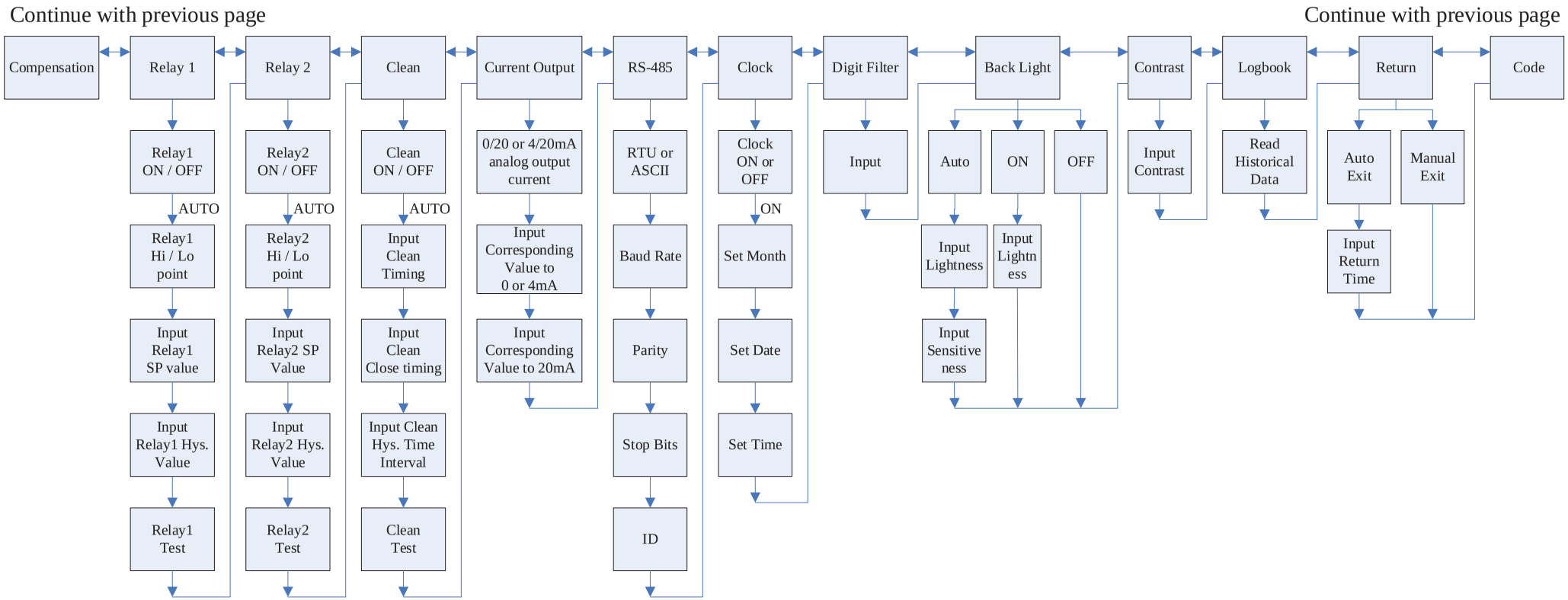
1. Both Relay 1 and Relay 2 cease from action. If enter setting menu or calibration menu under clean status, the instrument will stop clean status automatically.
2. The current output which is corresponding to measurement value remains at the last output value before HOLD status.
3. The last signal output value of RS-485 interface is kept at the last output value before HOLD status.

7. Settings

Block diagram of setting part 1

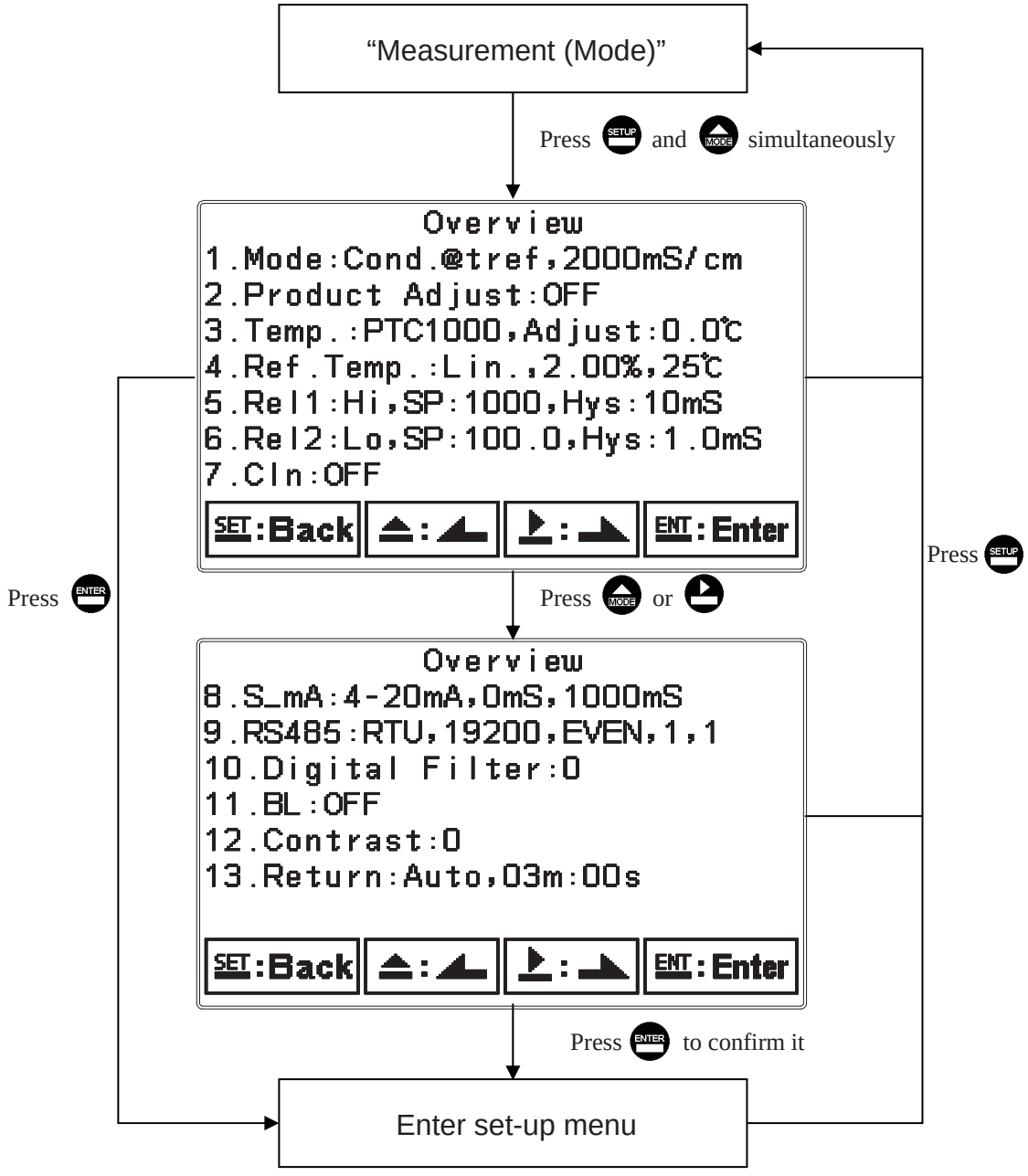


Block diagram of setting part 2



7.1 Entry of set-up menu

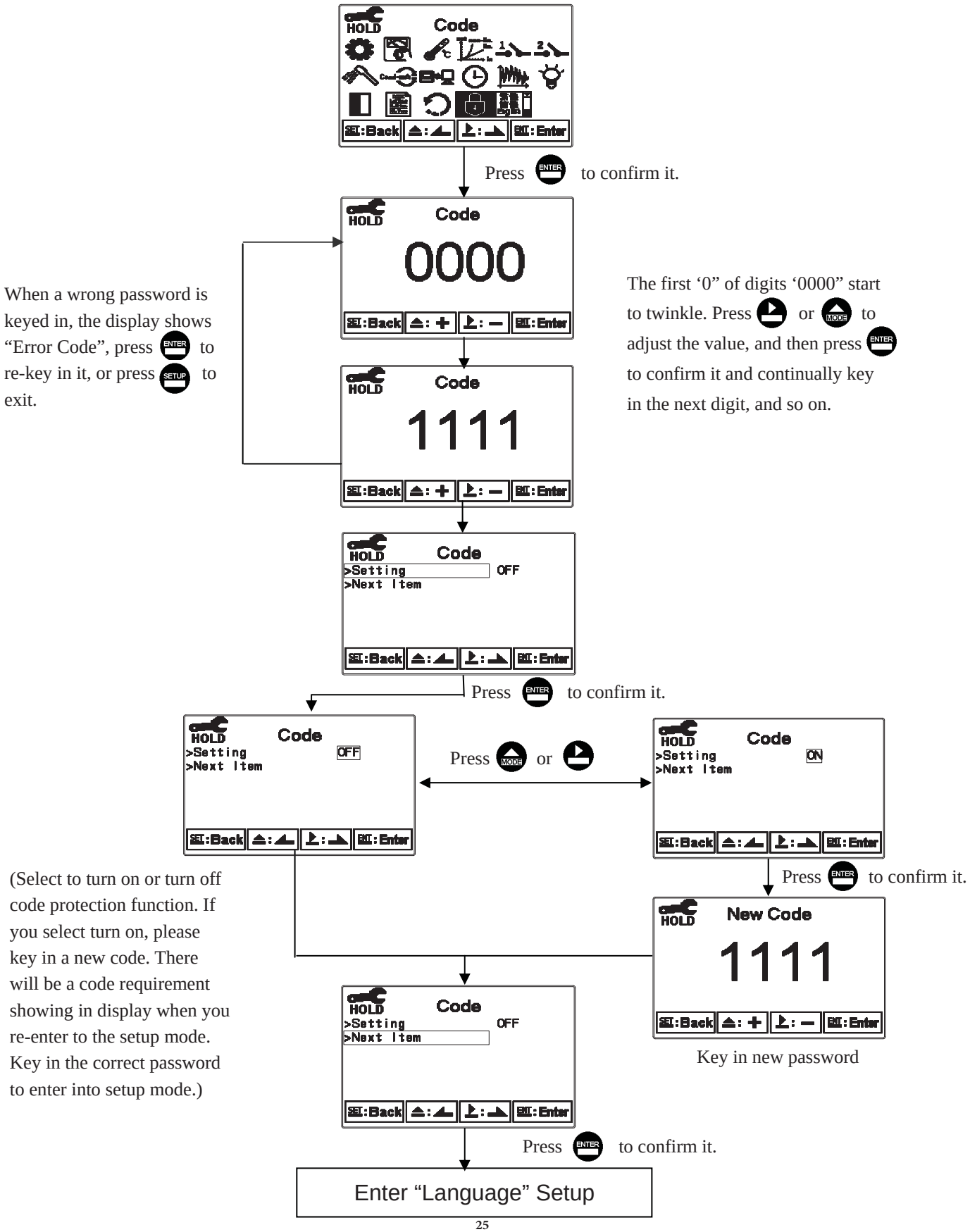
In the measurement mode, pressing the two keys SETUP and MODE simultaneously allows you enter the overview of current setting, and press ENTER to enter the set-up mode to modify the setting if necessary.



7.2 Security code of settings

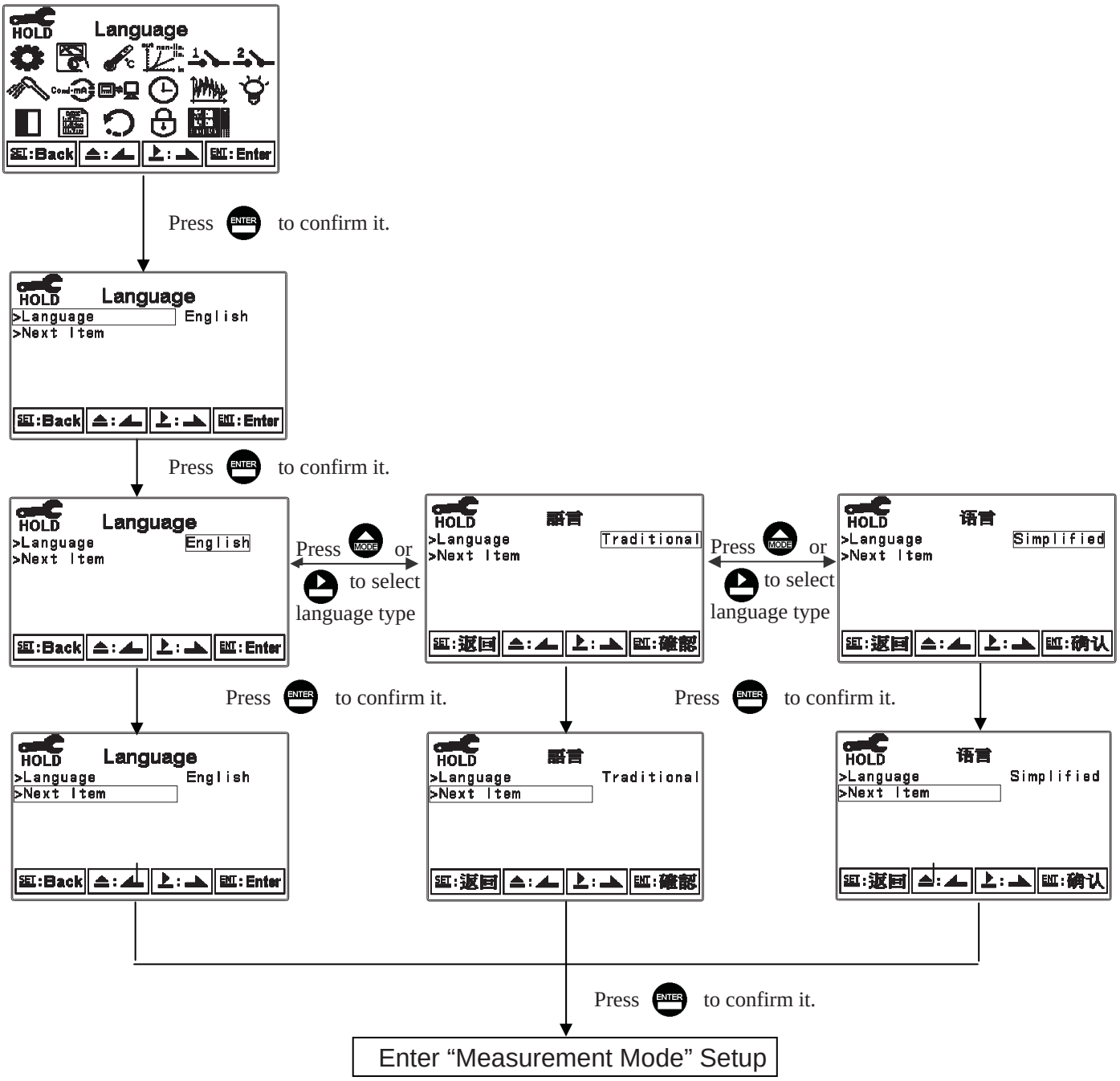
After entering set-up mode, select “code” item, press ENTER to enter into code procedure. **The code pre-setting is 1111.**

Note: The code of setting mode is prior to the code for calibration. That means that the code of setting mode can be used for the code of calibration mode.



7.3 Language

Enter Language setup menu, select the system language from English, Traditional Chinese and Simplified Chinese.



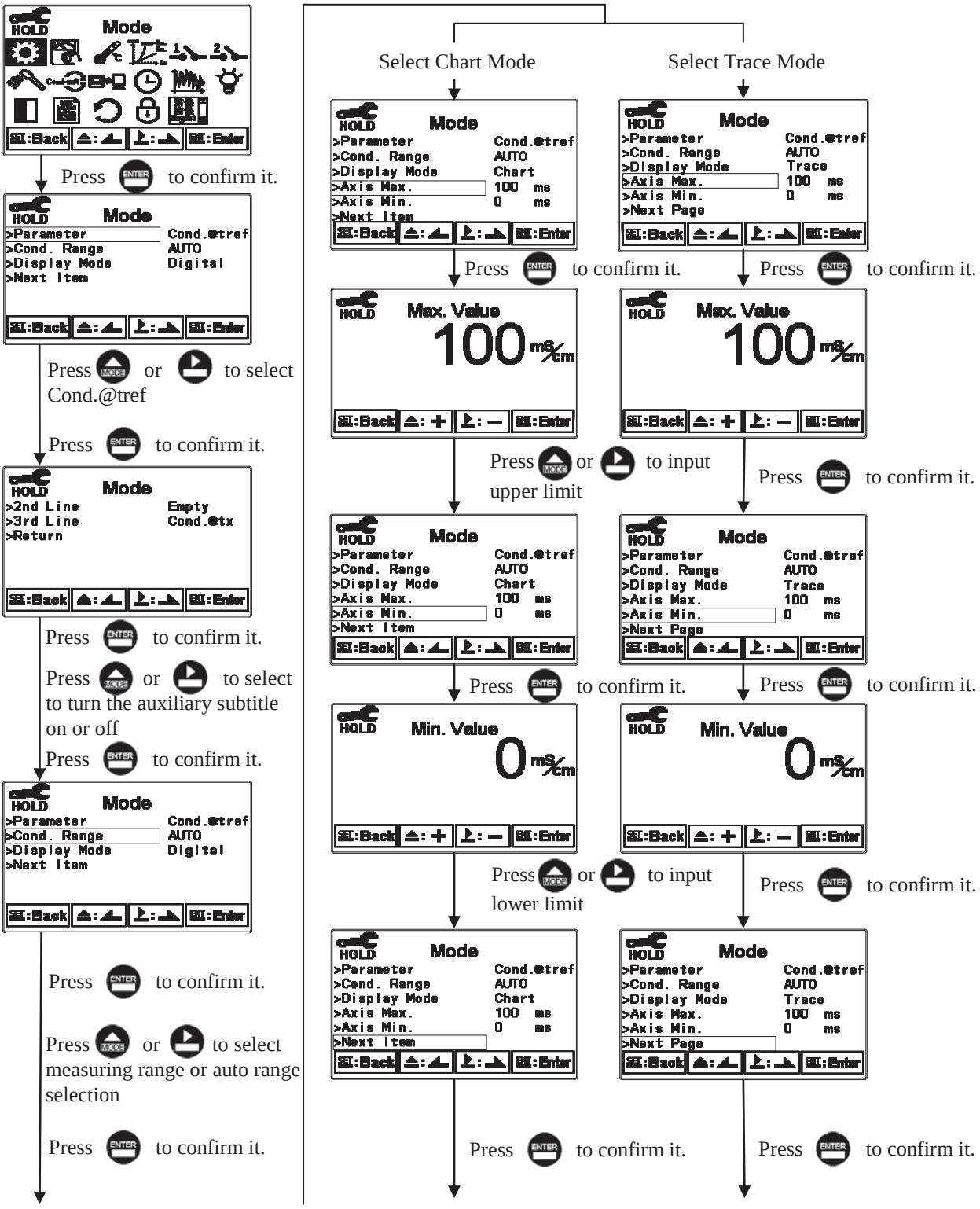
7.4 Mode

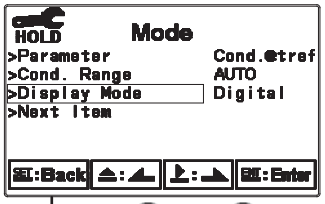
The default setting of measuring range is 2000mS/cm, and users can select the desired range according to requirements from 2000mS, 999.9mS, 99.99mS, 9.99mS, 999.9μS or AUTO range selection.

7.4.1 Conductivity with Temperature Compensation (Cond.@tref)

Conductivity with temperature compensation means that conductivity can be obtained by linear or non-linear temperature compensation setting. (“temperature compensation coefficient” and “temperature compensation reference temperature”, please refer to ch7.7 “Temperature Compensation Coefficient”.)

Enter setup of Mode, select “Cond.@tref” and measuring range from 2000mS, 999.9mS, 99.99mS, 9.99mS, 999.9μS or AUTO range selection, and then select display mode.





Press MODE or ▶ to select display mode

Press ENTER to confirm it.

Select Digital Mode

Digital Mode

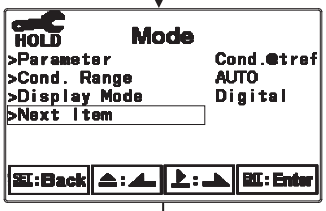
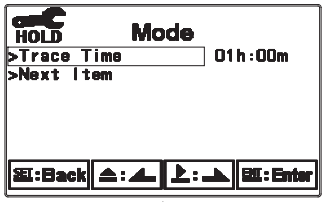


Chart Mode

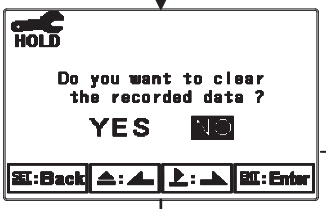
To set record duration T, press MODE or ▶ to adjust the hour value, press ENTER to confirm and move to minute adjustment part.



Press ENTER to confirm it.

Trace Mode

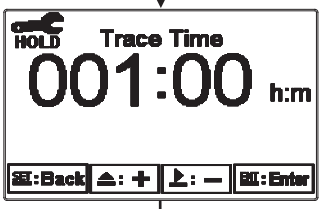
Press ENTER to confirm it.



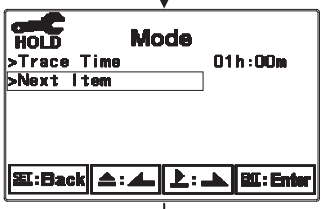
Select NO to preserve the setting and previous data

Press ENTER to confirm it.

Select YES & Press ENTER to confirm it.



Press ENTER to confirm it.



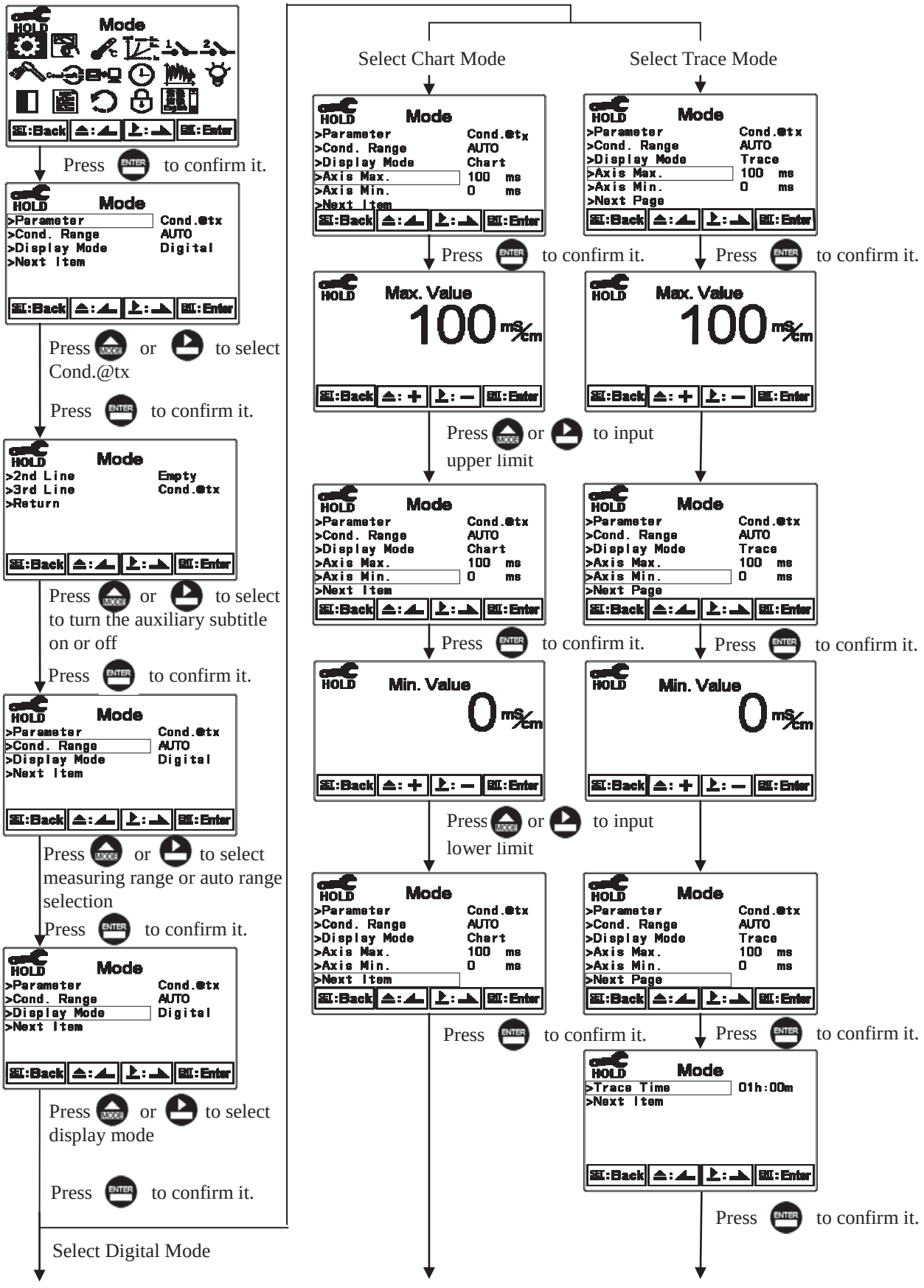
Press ENTER to confirm it.

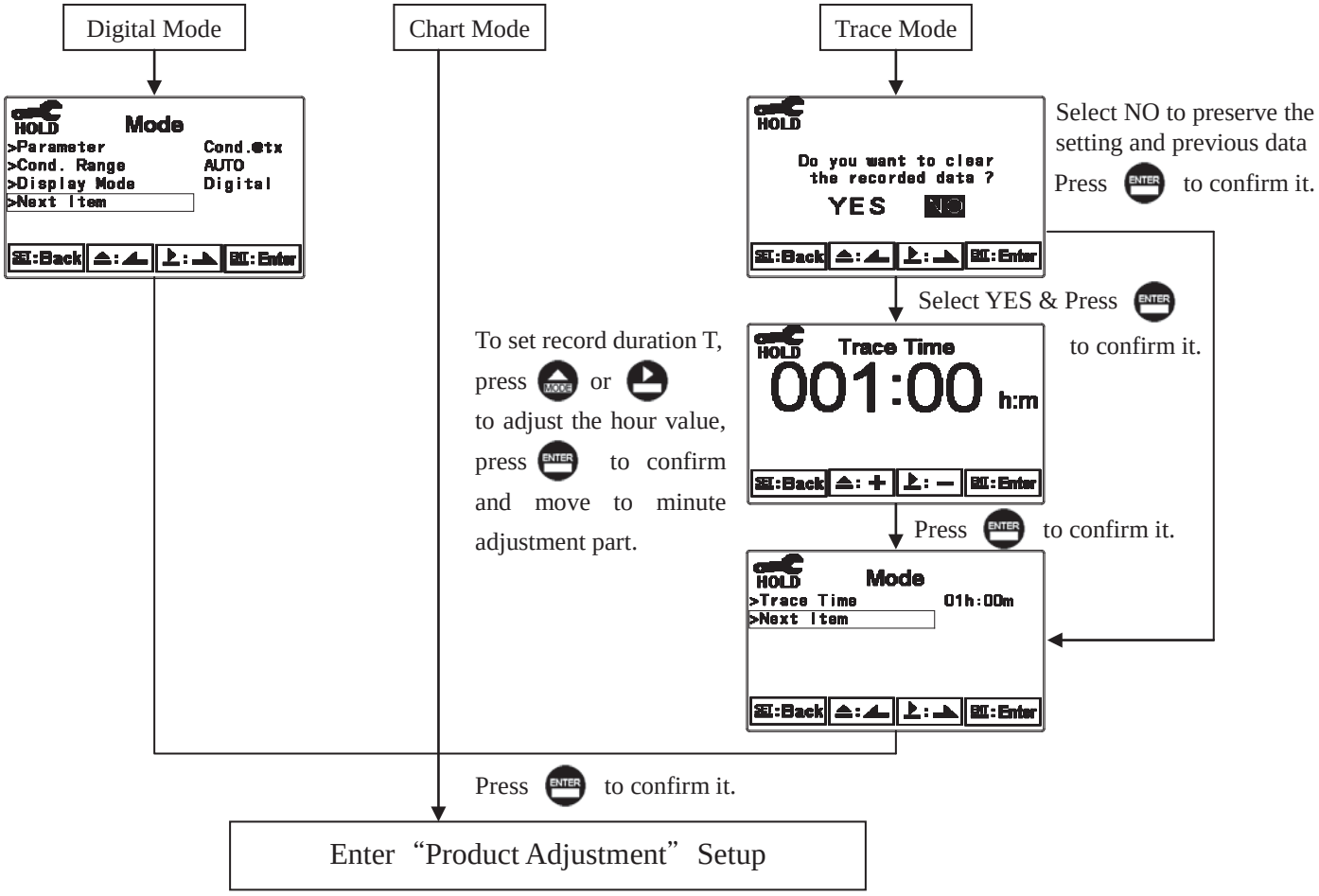
Enter "Product Adjustment." Setup

7.4.2 Absolute Conductivity(Cond.@tx)

Absolute conductivity is to present the actual conductivity without temperature compensation of a measured solution.

Enter setup of Mode and select absolute conductivity ” Cond.@tx”. Then select the measuring range from 2000mS, 999.9mS, 99.99mS, 9.99mS, 999.9μS or AUTO range selection and display mode.




Digital Mode
Chart Mode
Trace Mode
HOLD
Mode
>Parameter
Cond.@tx
>Cond. Range
AUTO
>Display Mode
Digital
>Next Item
SET:Back
ENT:Enter
Do you want to clear
the recorded data ?
YES
NO
Select NO to preserve the setting and previous data
Press ENTER to confirm it.
Select YES & Press ENTER to confirm it.
Trace Time
001:00 h:m
To set record duration T, press or to adjust the hour value, press ENTER to confirm and move to minute adjustment part.
Press ENTER to confirm it.
>Trace Time
01h:00m
>Next Item
Press ENTER to confirm it.
Enter "Product Adjustment" Setup

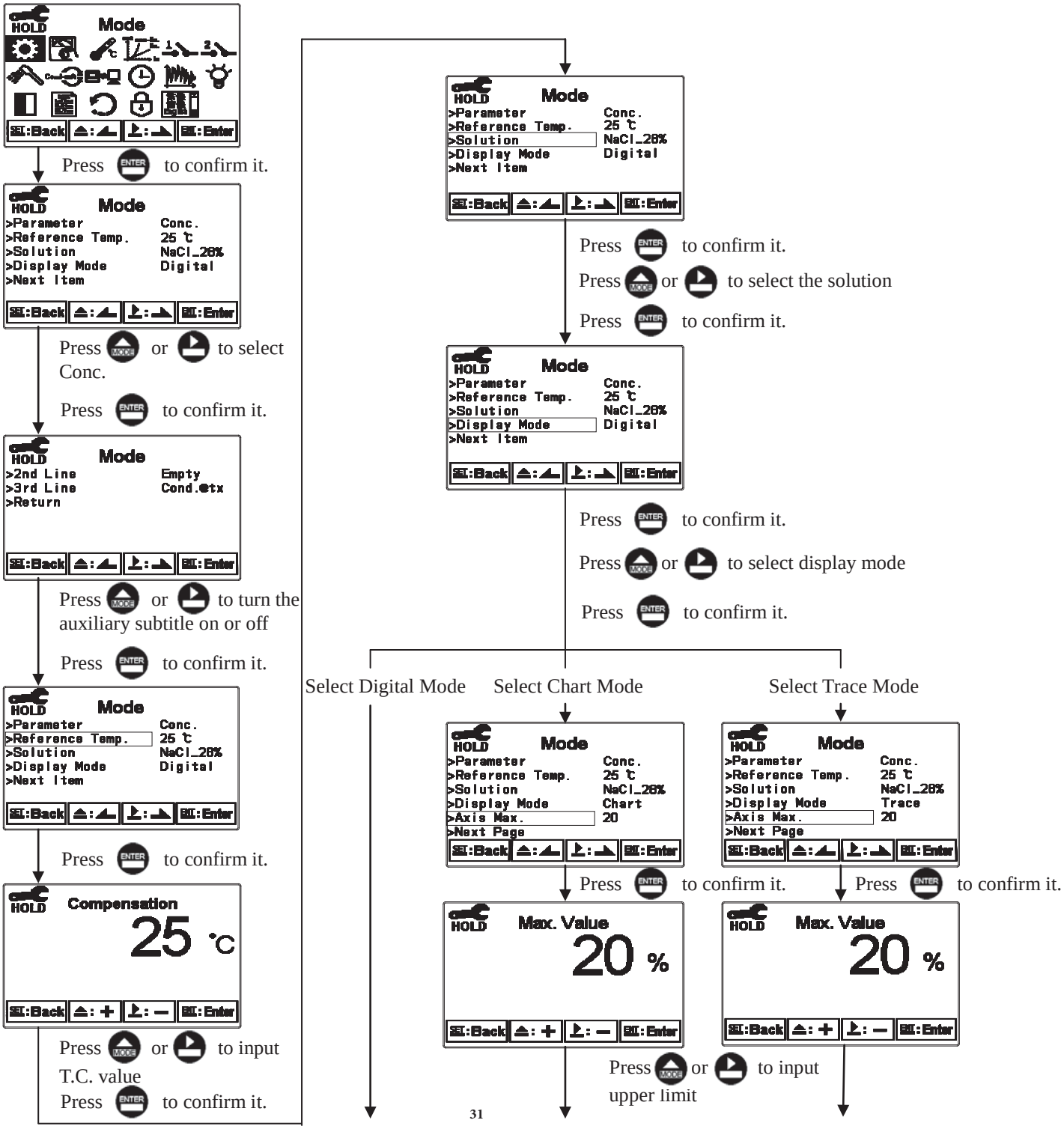
7.4.3 Concentration (EC-4110-ICON Only)

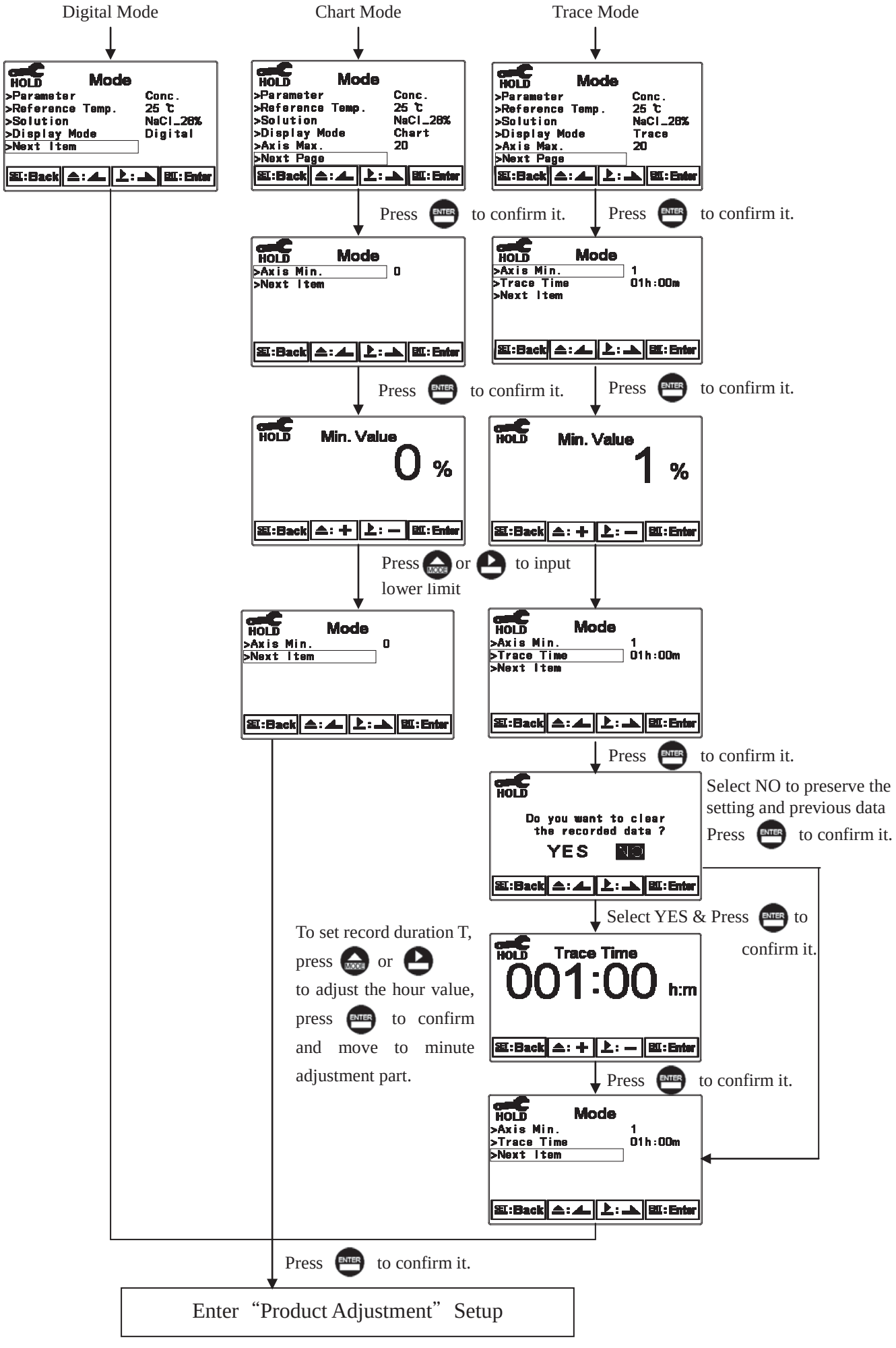
Enter setup of Mode and select “Conc.” measuring mode, optimum measuring solution, varieties and concentration.

Built-in measuring ranges are listed below: NaCl_28%(0-28%), HCl_18%(0-18%), HCl_39%(22-39%), HNO3_30%(0-30%), HNO3_96%(35-96%), NaOH_24%(0-24%), NaOH_50%(15-50%), H_2SO_4_37%(0-37%), H_2SO_4_88%(28-88%), H_2SO_4_99%(89-99%), H_3PO_4_35%(0-35%) or Defined, and then select display mode.

As conductivity or concentration exceeds boundary limits of its measuring range, the measured value twinkling will represent an error warning, however, please note that “Defined” is without measuring range limitation and an error warning.

Concentration conversion boundary values of each solution vary with the changes of temperature.




Digital Mode
Chart Mode
Trace Mode
HOLD
Mode
>Parameter Conc.
>Reference Temp. 25 ℃
>Solution NaCl_26%
>Display Mode Digital
>Next Item
>Display Mode Chart
>Next Page
>Axis Max. 20
>Display Mode Trace
SET:Back
ENT:Enter
Press ENTER to confirm it.
>Axis Min. 0
>Next Item
>Axis Min. 1
>Trace Time 01h:00m
Min. Value
0 %
1 %
Press MODE or to input lower limit
Do you want to clear the recorded data ?
YES NO
Select NO to preserve the setting and previous data
Press ENTER to confirm it.
Select YES & Press ENTER to confirm it.
To set record duration T, press MODE or to adjust the hour value, press ENTER to confirm and move to minute adjustment part.
Trace Time
001:00 h:m
Press ENTER to confirm it.
Enter “Product Adjustment” Setup

7.4.3.1 Defined concentration table

If the measured sample information is not listed in built-in table of the transmitter, users can input their defined table. Defined table can be input data with temperature of measured solution, sort ascending or sort descending, from 1~9 temperature table. At least two or up to nine conductivity and concentration conversion data are included at each temperature (more data, more approximate the solution concentration, higher conversion resolution), and each data include one concentration and its corresponding conductivity.

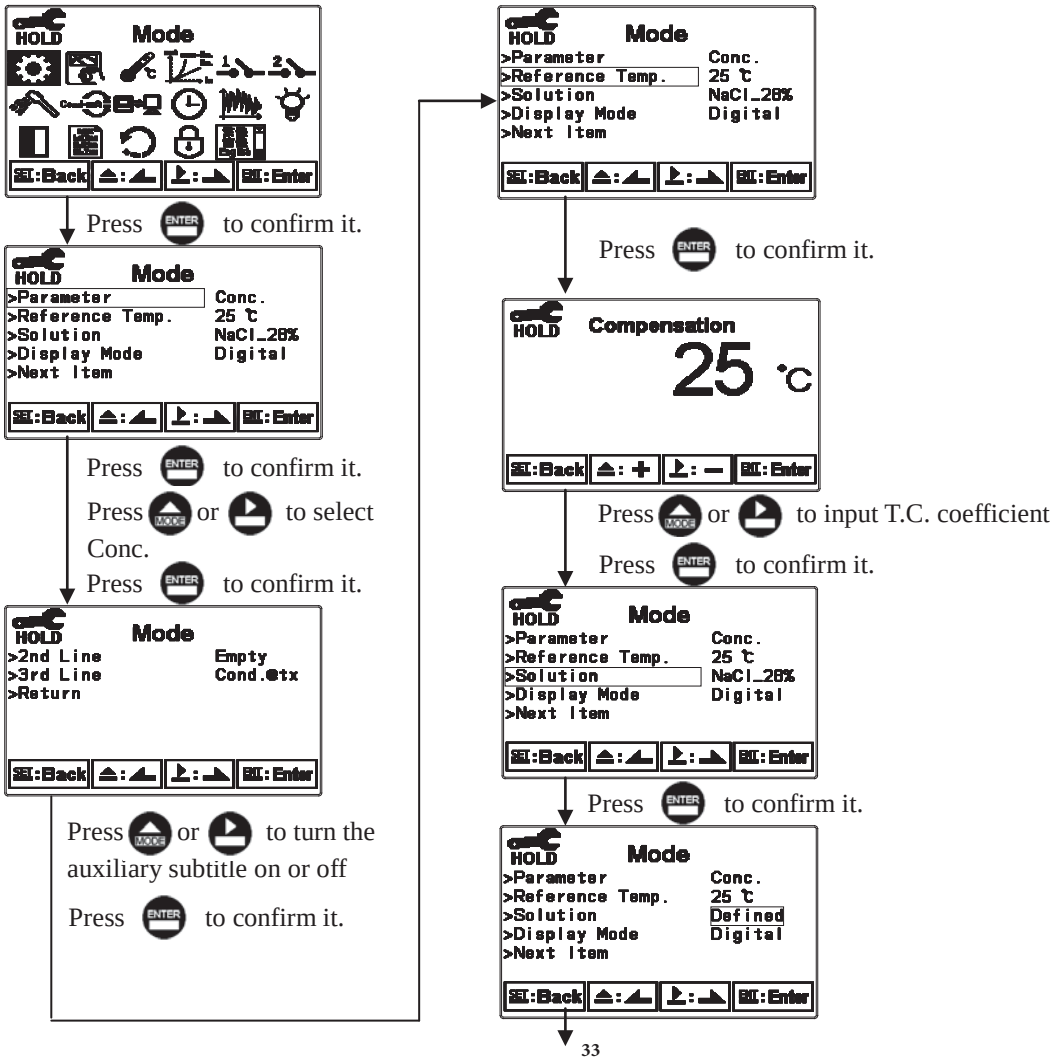
Conductivity or concentration needs to be input in ascending or descending order. If users' measured solution only has one data (one concentration and its corresponding conductivity), they need to set linear temperature compensation coefficient for that in order to make the temperature compensation.

Defined table default setting which includes 9 data is for Hydrofluoric Acid at 25℃. Users can revise the data, in addition, they need to input linear temperature compensation coefficient (refer to HF table); for users only with one data, after inputting corresponding value of conductivity and concentration, it also requires T.C. coefficient.

If the data are attained by two or more temperature points, there is no need to input T.C. coefficient because the unit can calculate the corresponding concentration value and conductivity with reference temperature based on conversion data in different temperature.

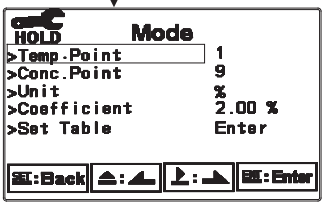
Once default conversion table for HF is being changed, it needs re-input again.

If the temperature, conductivity and concentration of test solution are approximate to measured solution, higher & more accurate conversion relation can be required.



Press MODE or ▶ to select Defined.

Press ENTER to confirm it.



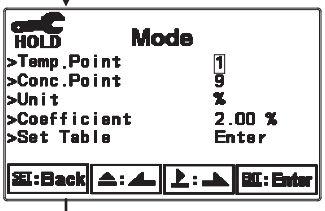
Press ENTER to confirm it.

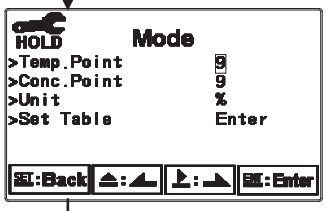
Press MODE or ▶ to set desired number of tables

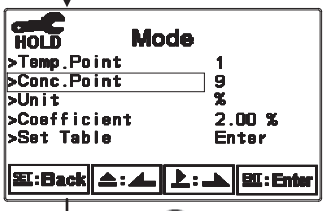
Press ENTER to confirm it.

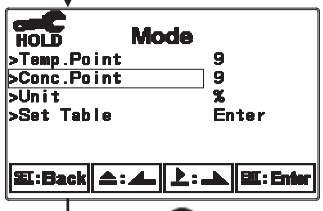
one temp. point

two or more temp. points









Press ENTER to confirm it.

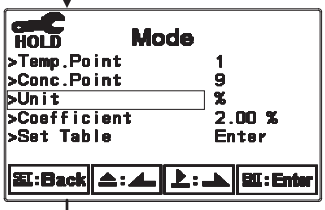
Press MODE or ▶ to set the number of Conc. points

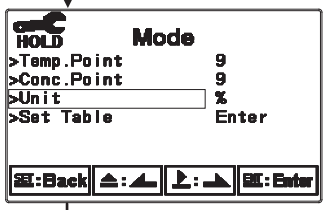
Press ENTER to confirm it.

Press ENTER to confirm it.

Press MODE or ▶ to set the number of Conc. points

Press ENTER to confirm it.





Press ENTER to confirm it.

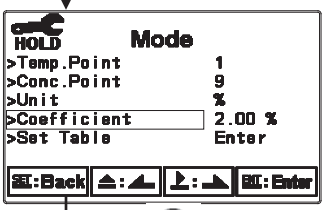
Press MODE or ▶ to set the unit of Conc.

Press ENTER to confirm it.

Press ENTER to confirm it.

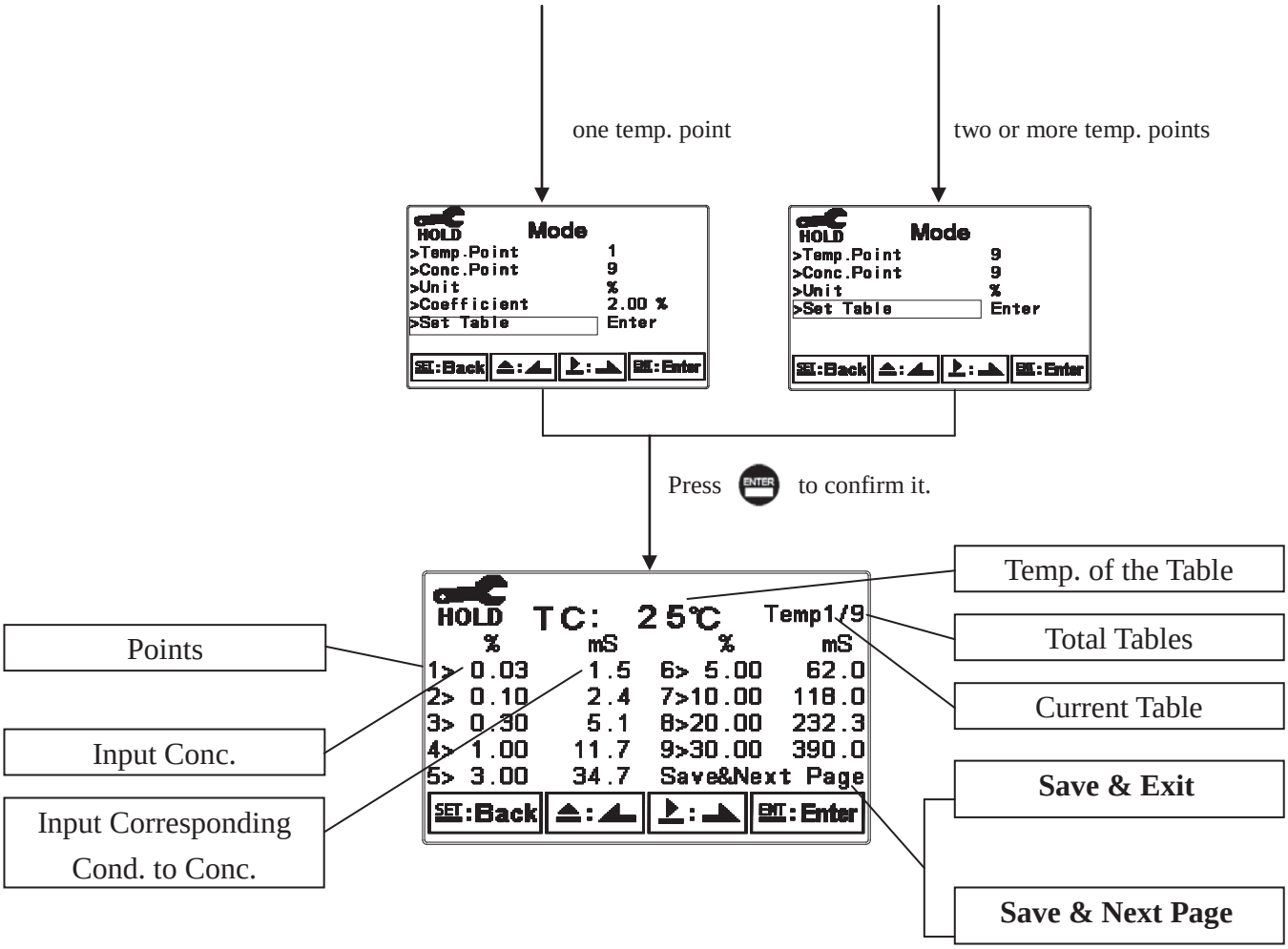
Press MODE or ▶ to set the unit of conc.

Press ENTER to confirm it.

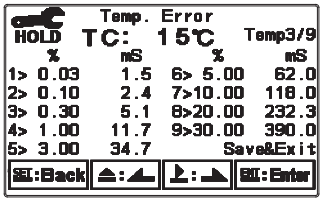


Press ENTER to confirm it.

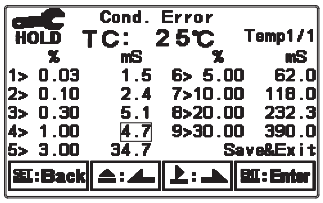
Press MODE or ▶ to set the T.C. coefficient



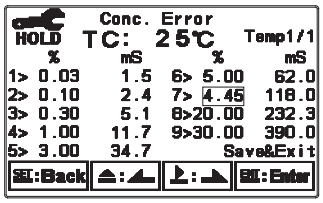
If the temperature is not input in ascending or descending order, there shows Temp. Error on the display screen.



If the conductivity is not input in ascending or descending order, there shows Cond. Error on the display screen.



If the concentration is not input in ascending or descending order, there shows Conc. Error on the display screen.



Concentration %	Hydrofluoric Acid HF Solution mS/cm at 25℃
0.0001	0.01
0.0003	0.03
0.001	0.099
0.003	0.290
0.01	0.630
0.03.	1.49
0.1	2.42
0.3	5.1
1.0	11.7
3.0	34.7
5.0	62.0
10.0	118.0
20.0	232.3
30.0	390.0

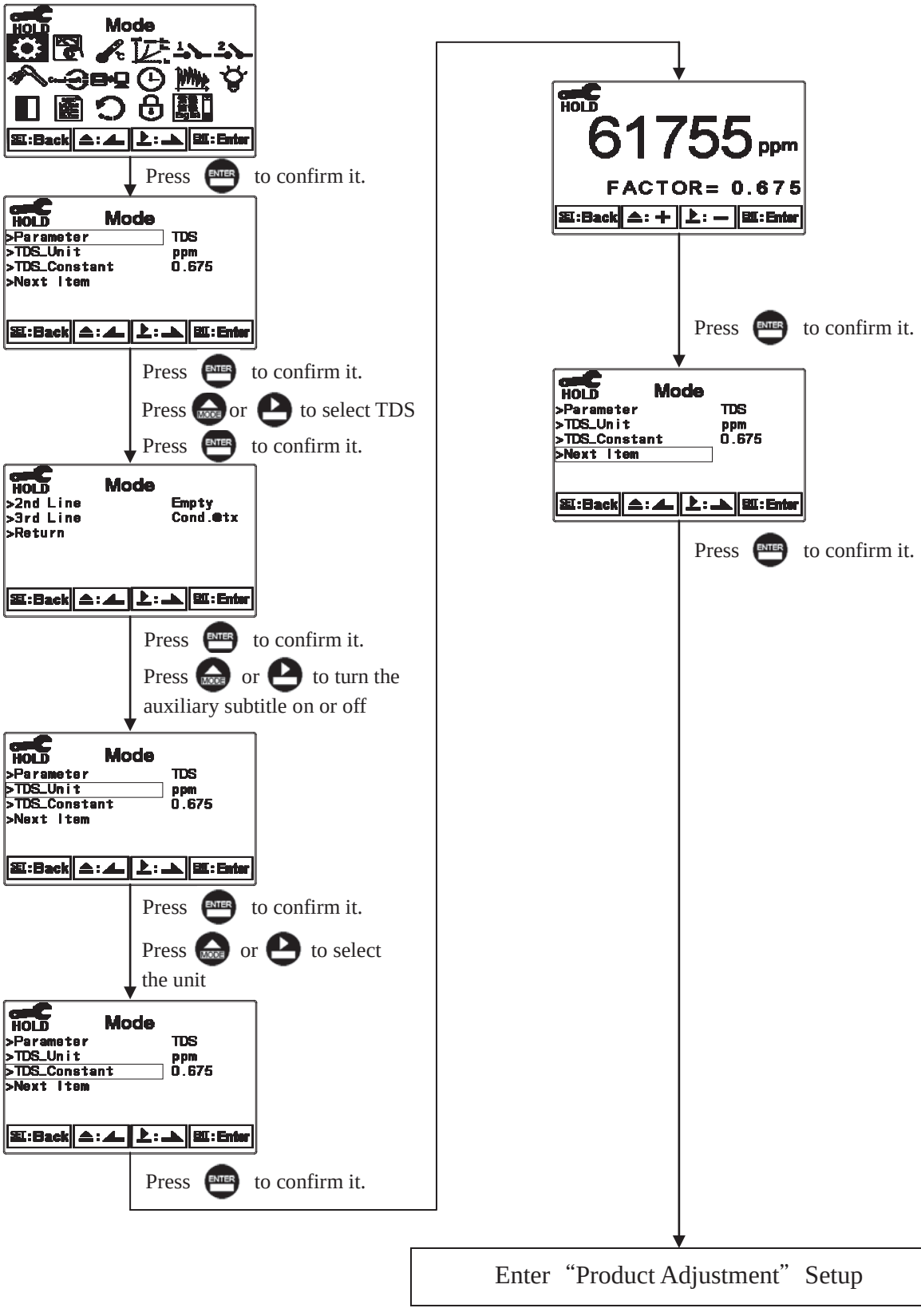
*Please refer to the concentration and conductivity conversion table of Hydrofluoric Acid (HF)
(for reference only, users need to revise it on their own)

*T.C. coefficient for common solution is within 1.8~2%, but it is 0.7% for Hydrofluoric acid (HF). Besides, according to the changes of concentration, T.C. coefficient changes and thus users need to adjust it depending on the requirements. For example, T.C. coefficient for 0.5%, 1.0%, 3.0% HF is about 0.70%, 0.73%, 0.74%. Users can attain the T.C. coefficient depending on actual situation of measured solution.

*T.C. coefficient for Hydrofluoric Acid (HF)
(for reference only, users need to revise it on their own)

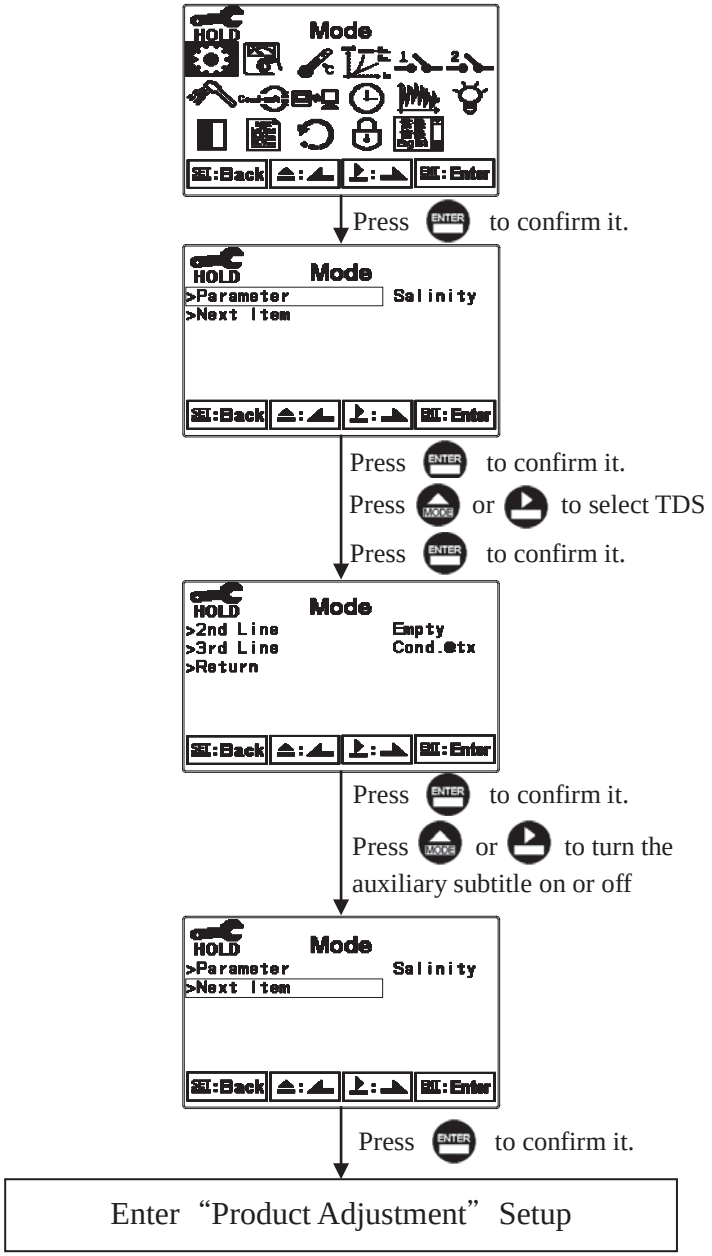
7.4.4 TDS

Enter the setup of Mode, select TDS measuring mode and units from ppm or ppt and set the TDS constant. The default TDS constant is 0.675 ppm/μS.



7.4.5 Salinity

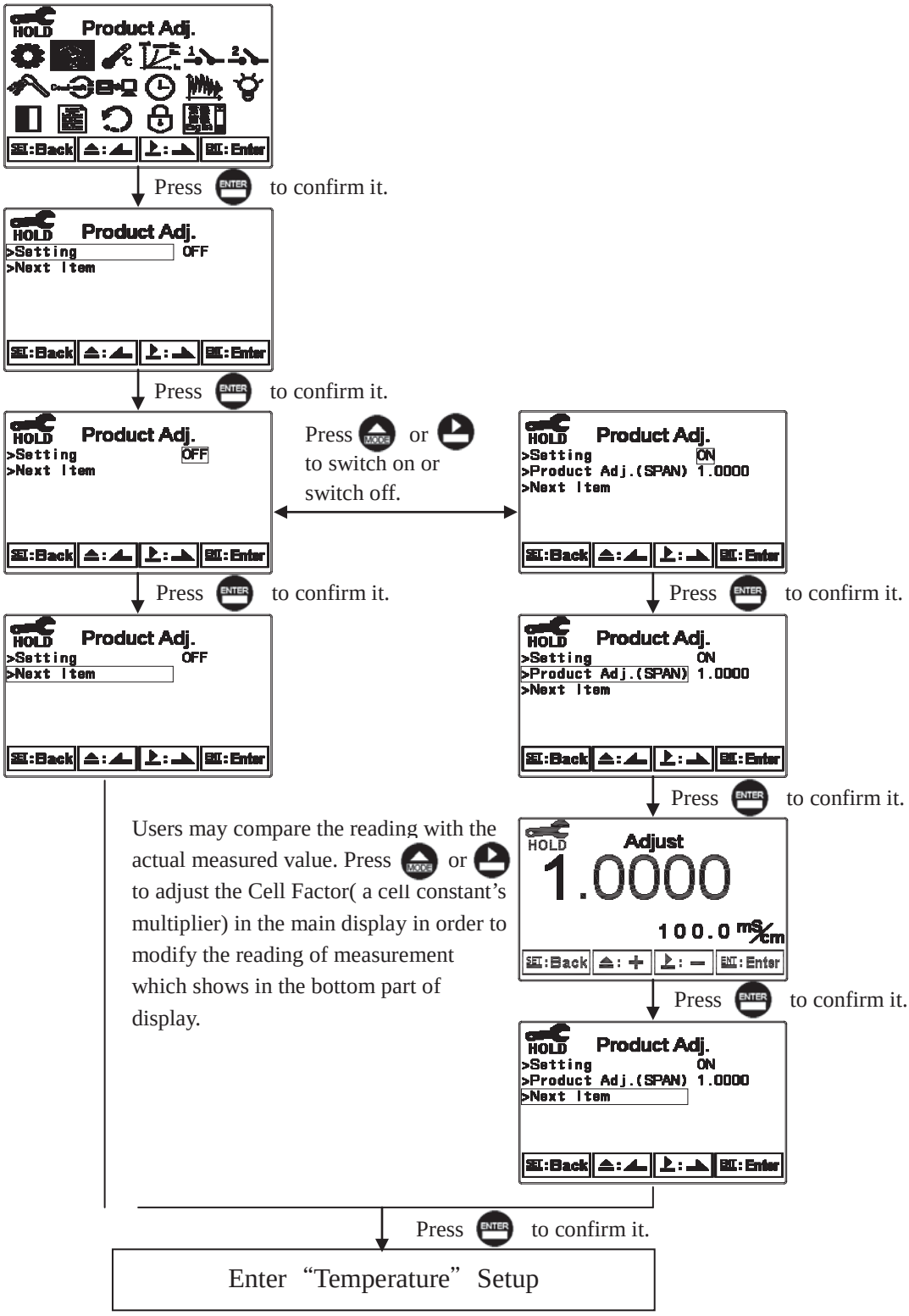
Enter setup of Mode and select Salinity measuring mode.



7.5 Product Adjustment

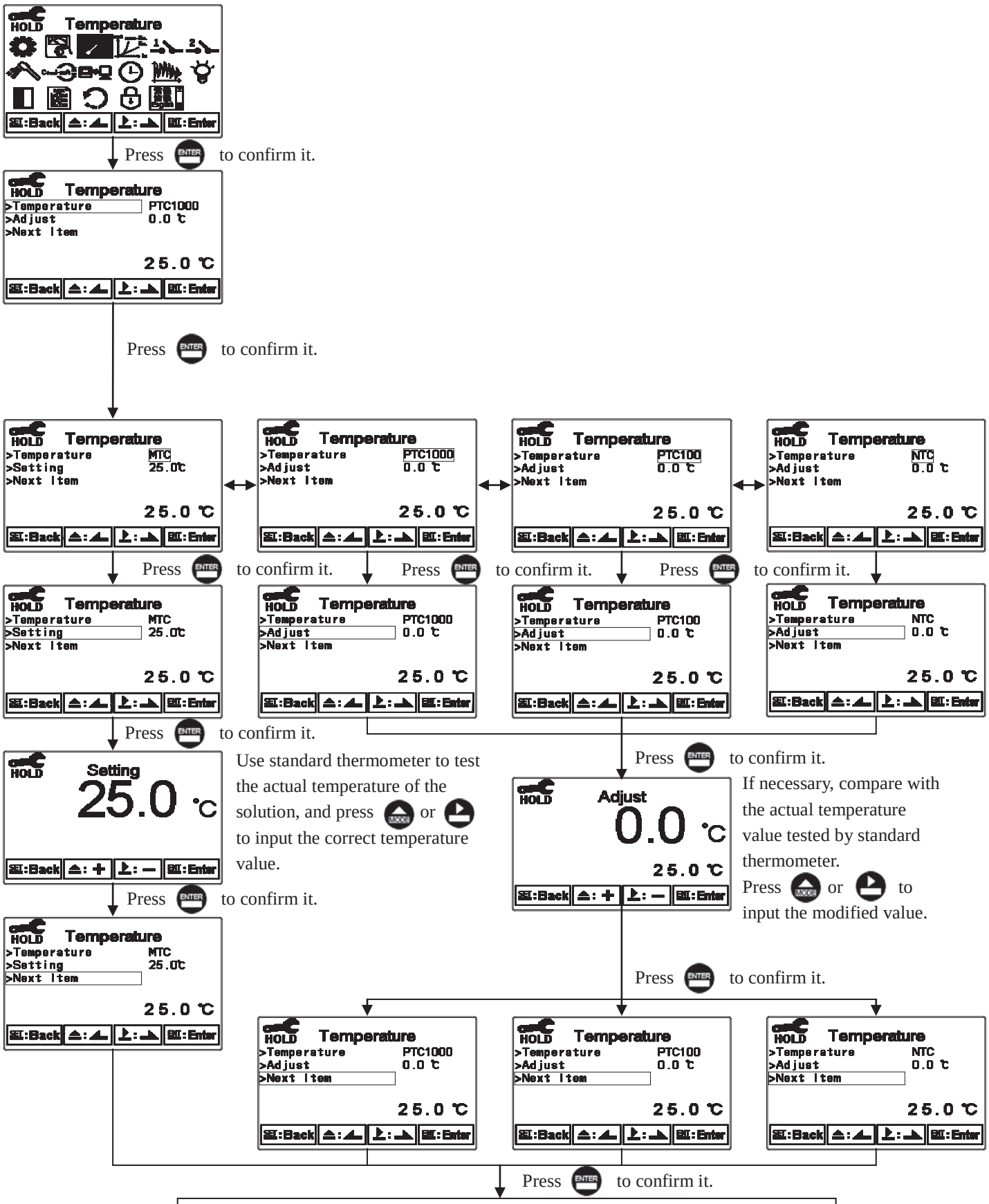
Enter setup of Product Adjustment to make the fine adjustment of the measurement reading. There is no need for users to take out the sensor from the field and calibrate it. Via this function the measuring values from the field can be compared to the result that came from the sampling and directly adjusted to the same value. If turning on this function, there shows the symbol “PDT” on the display screen.(please refer to ch6.4 “Warning symbols and text”).

The inductive sensor applies electromagnetic effects to measure the conductivity of a sample solution which can be affected by length of signal cable and the distance between a sensor and the shell of pipe, making an influence on the cell factor and measuring value. At the moment, Product Adjustment can be used to calibrate the measuring value without changing the cell factor.



7.6 Temperature

Enter setup of “Temperature” to select temperature probe types. Select from PTC1KΩ (PT-1000), PTC100Ω (PT-100), or NTC(NT30K) for Auto Temperature Compensation or MTC(Manual Adjustment).



7.7 Temperature Compensation Coefficient

The default setup of temperature compensation reference temperature is 25 ℃, and temperature compensation coefficient is 2.00%.

Enter setup of Temperature Compensation Coefficient mode and select T.C. coefficient from Linear, Non-Linear or No according to measurement requirements. Normally, select linear compensation for Conductivity measurement (Cond.).

Temperature coefficient (hereinafter referred to as TC): Conductivity of solution increases with rising temperature. The relationship is as follows:(reference temperature "t_{ref}" is 25℃, users can change depending no requirements)

How to get TC of solution:

C_{tref}	Conductivity at reference temperature	$C_t = C_{tref} \{ 1+\alpha(T-t_{ref}) \}$
C_{t1}	Conductivity at T1˚C	
T_1	Measured solution temperature	$\alpha= (C_{t2}-C_{t1}) / C_{t1} (T_2-t_{ref})-C_{t1} (T_1-t_{ref})$
C_{t2}	Conductivity at T2˚C	
T_2	Measured solution temperature	
α	Temperature compensation coefficient	

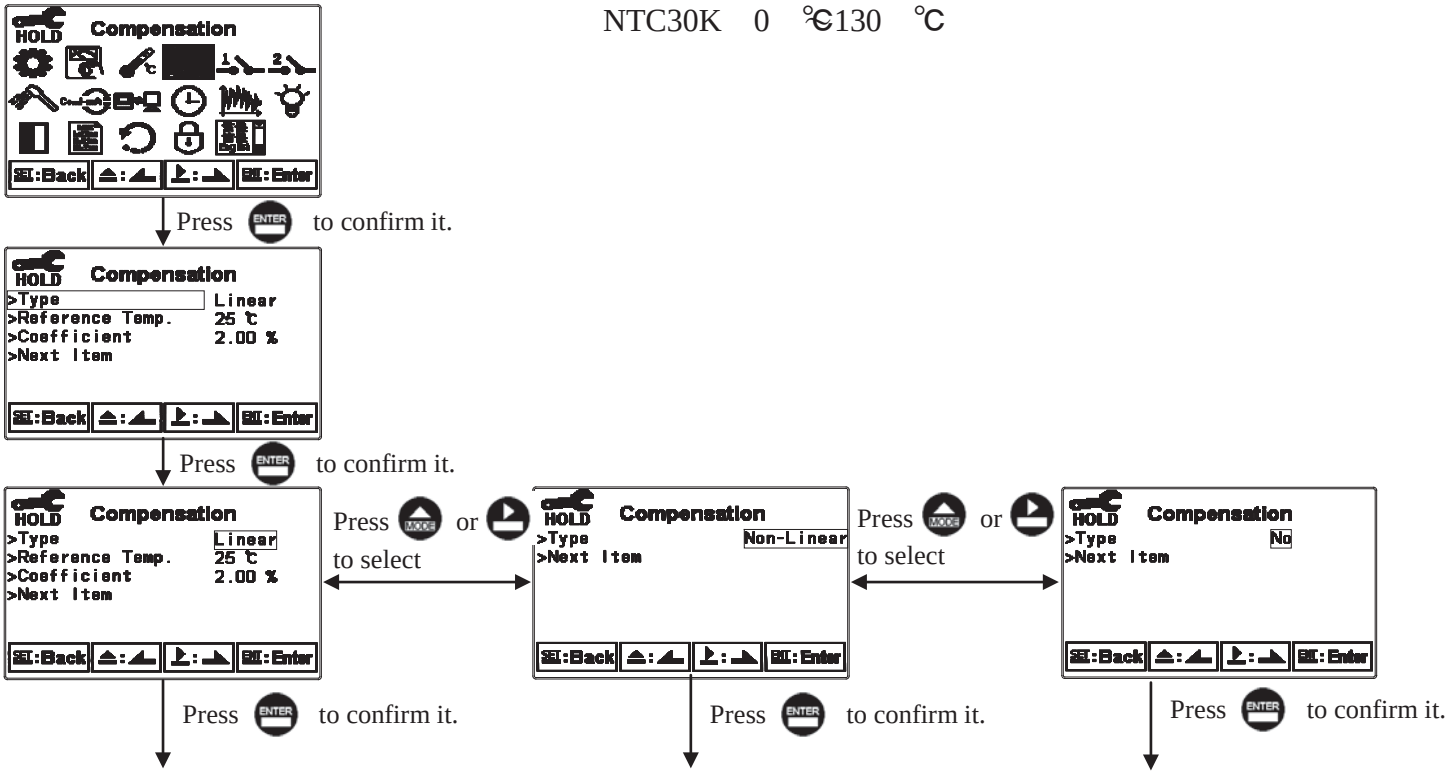
Take an example for 0.01M KCl. Set the TC of the instrument to non-compensated(Lin, 0.00%), and control the temperature at C_{t1}˚C and at C_{t2}˚C. C_{t1} means the measurement value at 20˚C (Such as C_{20} = 1278μS). C_{t2} means the measurement value at 30˚C (Such as C_{30} = 1552μS). Based on the formulas above, α＝1.94%.

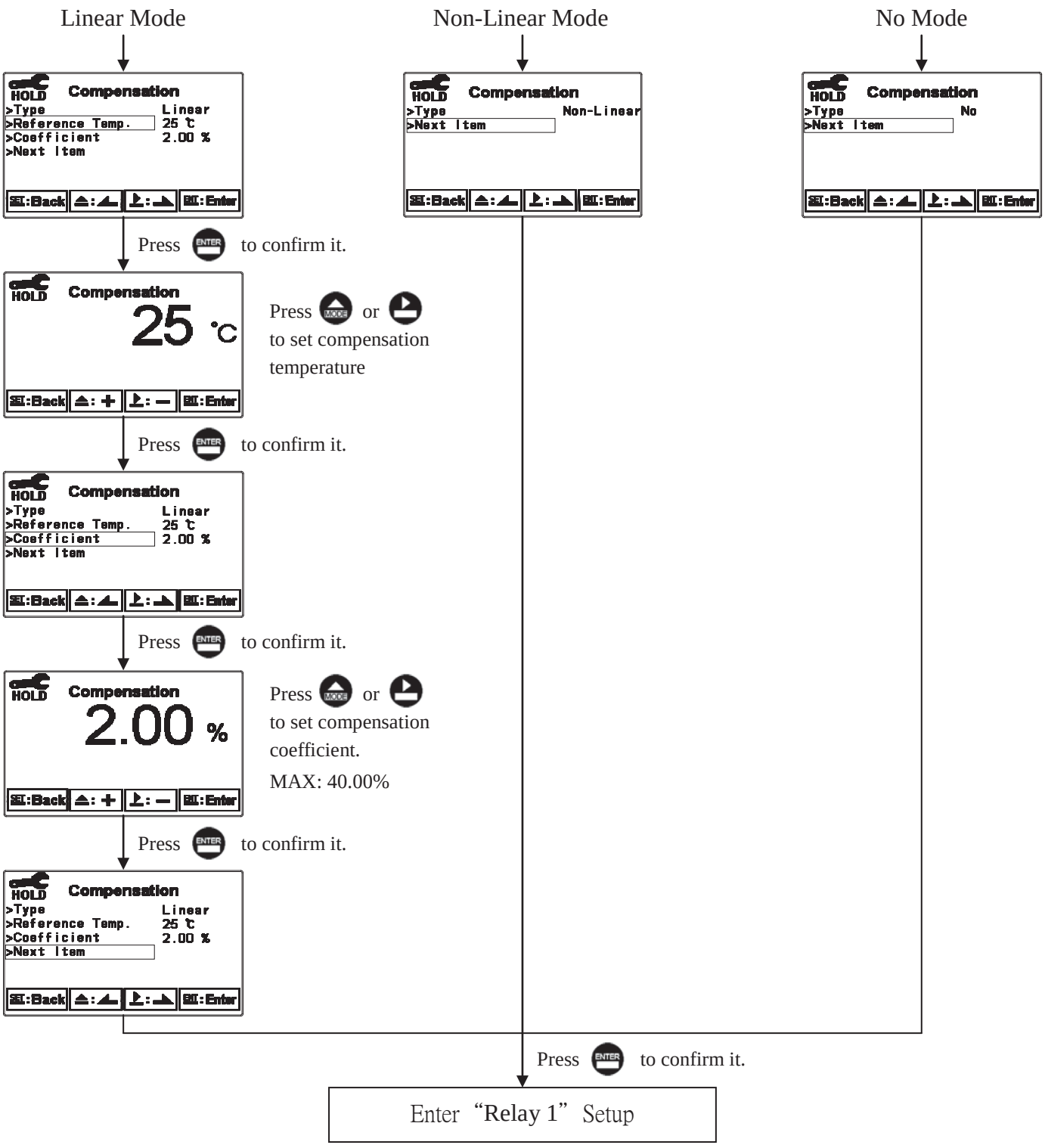
$$\alpha = \frac{1552-1278}{1278(30-25) \ -1552(20-25)} \times 100 = 1.94$$

Linear compensation range: 0.00%～40.00%

Temperature compensation range(C_{tref}): PT1000/PT100/MTC 0 ℃200 ℃

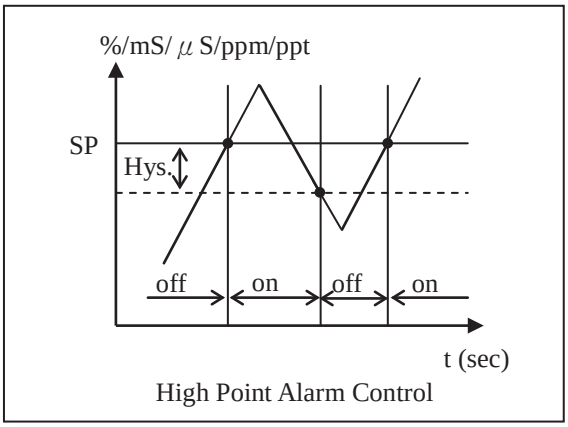
NTC30K 0 ℃130 ℃



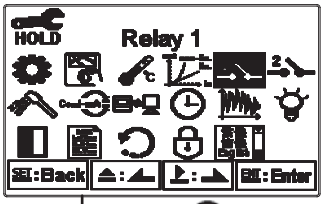

Linear Mode
Non-Linear Mode
No Mode
HOLD
Compensation
>Type Linear
>Reference Temp. 25 ℃
>Coefficient 2.00 %
>Next Item
>Type Non-Linear
>Type No
SET:Back
ENT:Enter
Press ENTER to confirm it.
25 ℃
Press MODE or to set compensation temperature
2.00 %
Press MODE or to set compensation coefficient.
MAX: 40.00%
Press ENTER to confirm it.
Enter "Relay 1" Setup

7.8 Relay 1

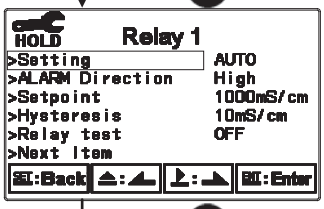
Enter setup of Relay 1. Select the item to turn on or turn of the relay 1 function. If you select to turn on the relay 1, then select for using relay 1 as “High set-point” alarm or “Low set-point” alarm. Set the value of set-point (SP) and Hysteresis (Hys.). The relationship between parameters can refer to an explanatory diagram of the box (as a high point alarm).



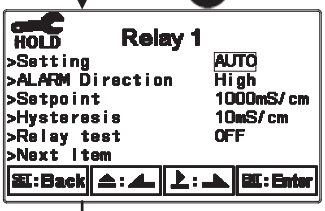
High Point Alarm Control



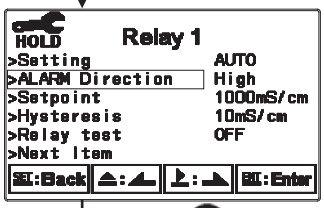
Press ENTER to confirm it.



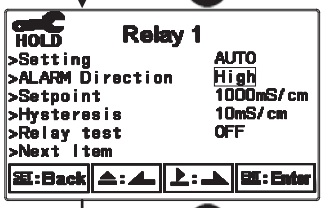
Press ENTER to confirm it.



Select AUTO. Press ENTER to confirm it.

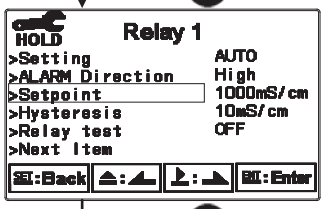


Press ENTER to confirm it.

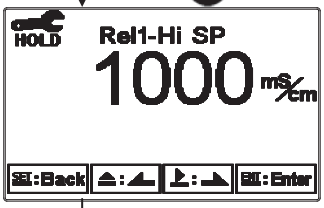


Press MODE or ▶ to select Hi point or Lo point alarm.

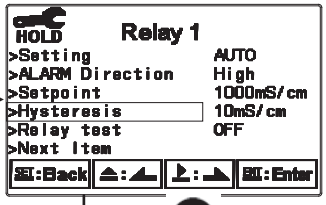
Press ENTER to confirm it.



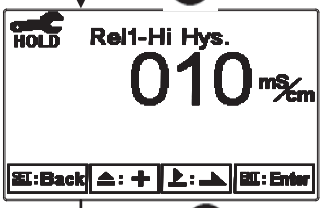
Press ENTER to confirm it.



Press MODE or ▶ to adjust set-point (SP) value.
If the measuring range of conductivity is set as AUTO, then it needs to be set unit (μS/cm or mS/cm), value, and decimal point by orders.

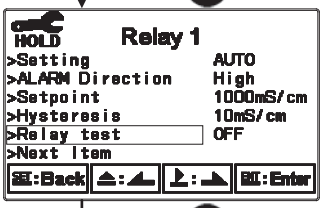


Press ENTER to confirm it.

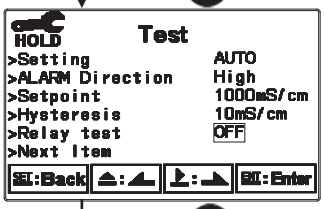


Press MODE or ▶ to adjust Hysteresis (Hys.) value

Press ENTER to confirm it.

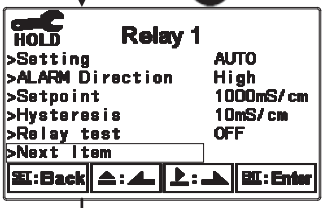


Press ENTER to confirm it.



Press MODE or ▶ to select to activate a test on REL1. If “ON”, the relay 1 is in action, and the “ACT” indication light will light up.

Press ENTER to confirm it.

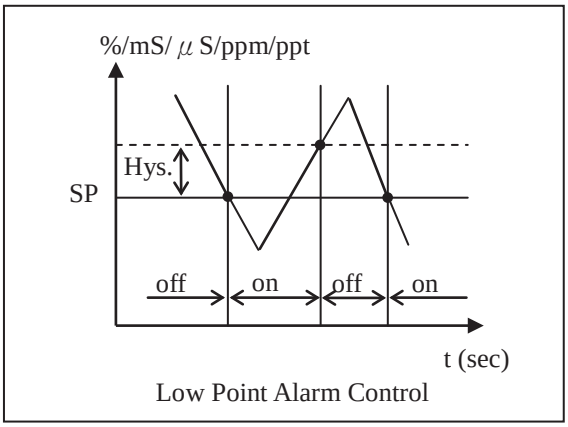


Press ENTER to confirm it.

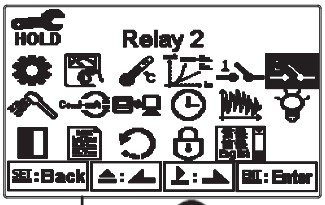
Enter “Relay 2” Setup

7.9 Relay 2

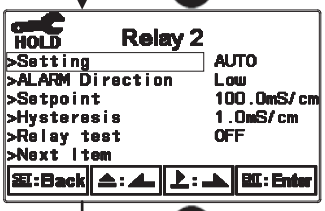
Enter setup of Relay 2. Select the item to turn on or turn of the relay 2 function. If you select to turn on the relay 2, then select for using relay 2 as “High set-point” alarm or “Low set-point” alarm. Set the value of set-point (SP) and Hysteresis (Hys.). The relationship between parameters can refer to an explanatory diagram of the box (as a high point alarm).



Low Point Alarm Control



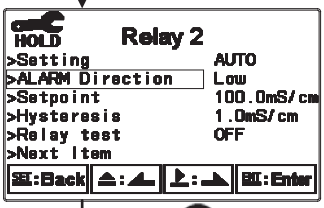
Press ENTER to confirm it.



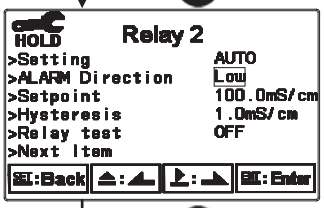
Press ENTER to confirm it.

Press MODE or ▶ to activate Relay 2

Select AUTO. Press ENTER to confirm it.

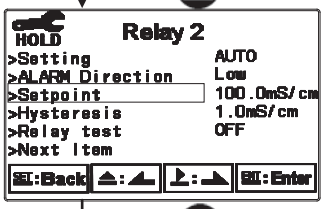


Press ENTER to confirm it.

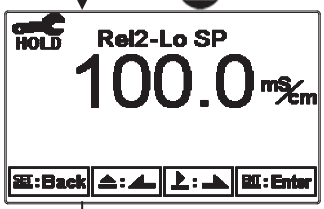


Press MODE or ▶ to select Hi point or Lo point alarm.

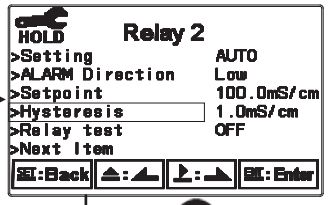
Press ENTER to confirm it.



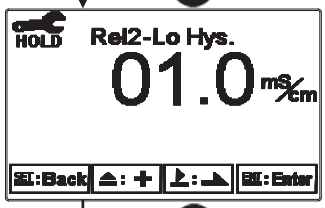
Press ENTER to confirm it.



Press ENTER to confirm it.

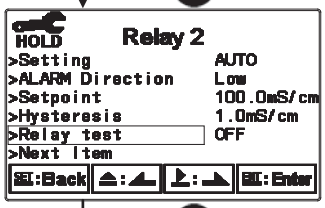


Press ENTER to confirm it.

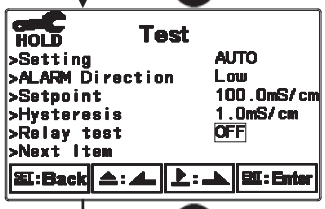


Press MODE or ▶ to adjust Hysteresis (Hys.) value

Press ENTER to confirm it.

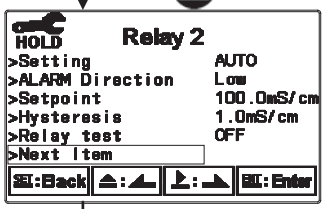


Press ENTER to confirm it.



Press MODE or ▶ to select to activate a test on REL2. If “ON”, the relay 2 is in action, and the “ACT” indication light will light up.

Press ENTER to confirm it.



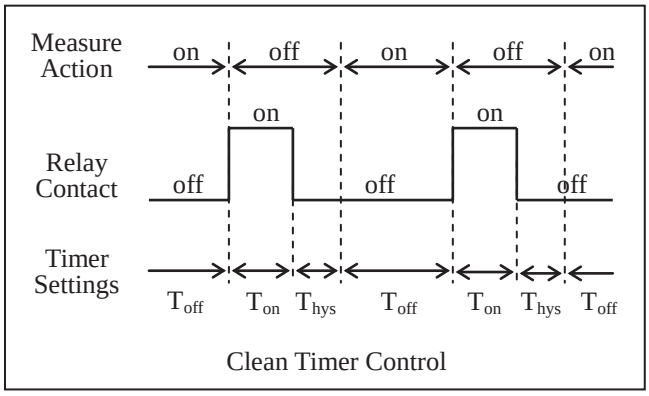
Press ENTER to confirm it.

Enter “Clean” Setup

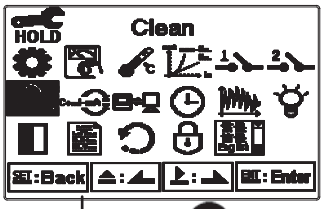
7.10 Clean

Enter setup of “Clean” function. Select the icon to turn on or turn off the clean function. If you select “Auto” turning on, then set the timer of the clean function including automatically turning on time and turning off time, and set the Hysteresis value (Hys.).

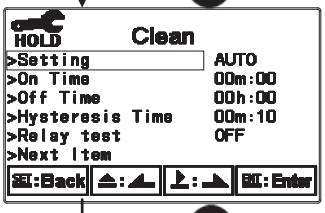
Note: When the clean function is turned on, if any value is set to be 0, the instrument will automatically turn off this function. When the clean function is activated under measurement mode, there is a “Clean Running” message showing on top of the display. The measurement value will be remained at the last measured value before cleaning. If enter setting menu or calibration menu under clean status, the instrument will stop clean status automatically.



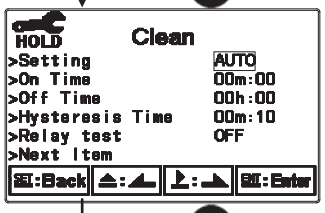
Clean Timer Control



Press ENTER to confirm it.

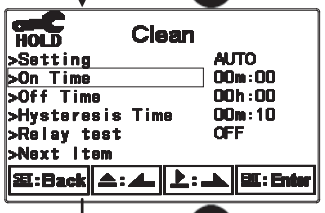


Press ENTER to confirm it.



Press MODE or ▶ to select to activate Clean or not.

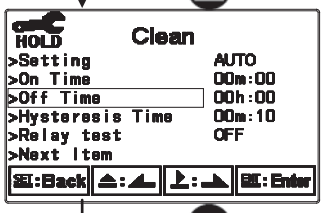
Press ENTER to confirm it.



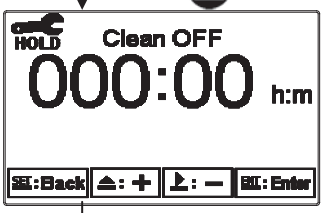
Press ENTER to confirm it.

Press MODE or ▶ to adjust the auto turning on time.
Press ENTER to confirm the minute part, and move to adjust the second part.

Press ENTER to confirm it.

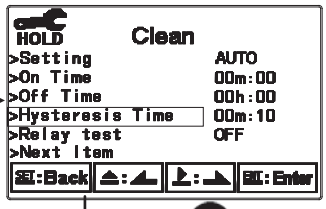


Press ENTER to confirm it.

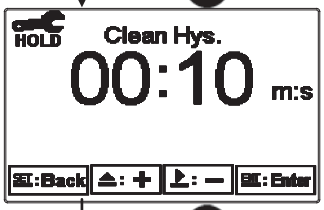


Press MODE or ▶ to adjust the auto turning off time.
Press ENTER to confirm the minute part, and move to adjust the second part.

Press ENTER to confirm it.

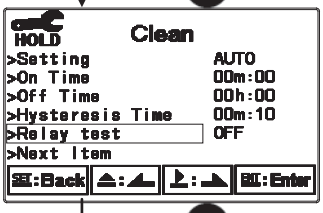


Press ENTER to confirm it.

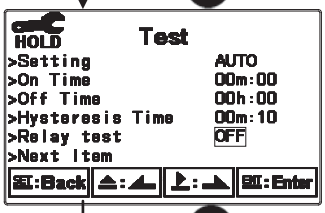


Press MODE or ▶ to adjust duration time for Hysteresis (Hys.)
Press ENTER to confirm the minute part, and move to adjust the second part.

Press ENTER to confirm it.

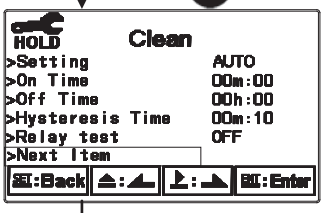


Press ENTER to confirm it.



Press MODE or ▶ to select to activate a test of Clean or not. If “ON”, the Clean function is in action, and the “ACT” indication light will light up.

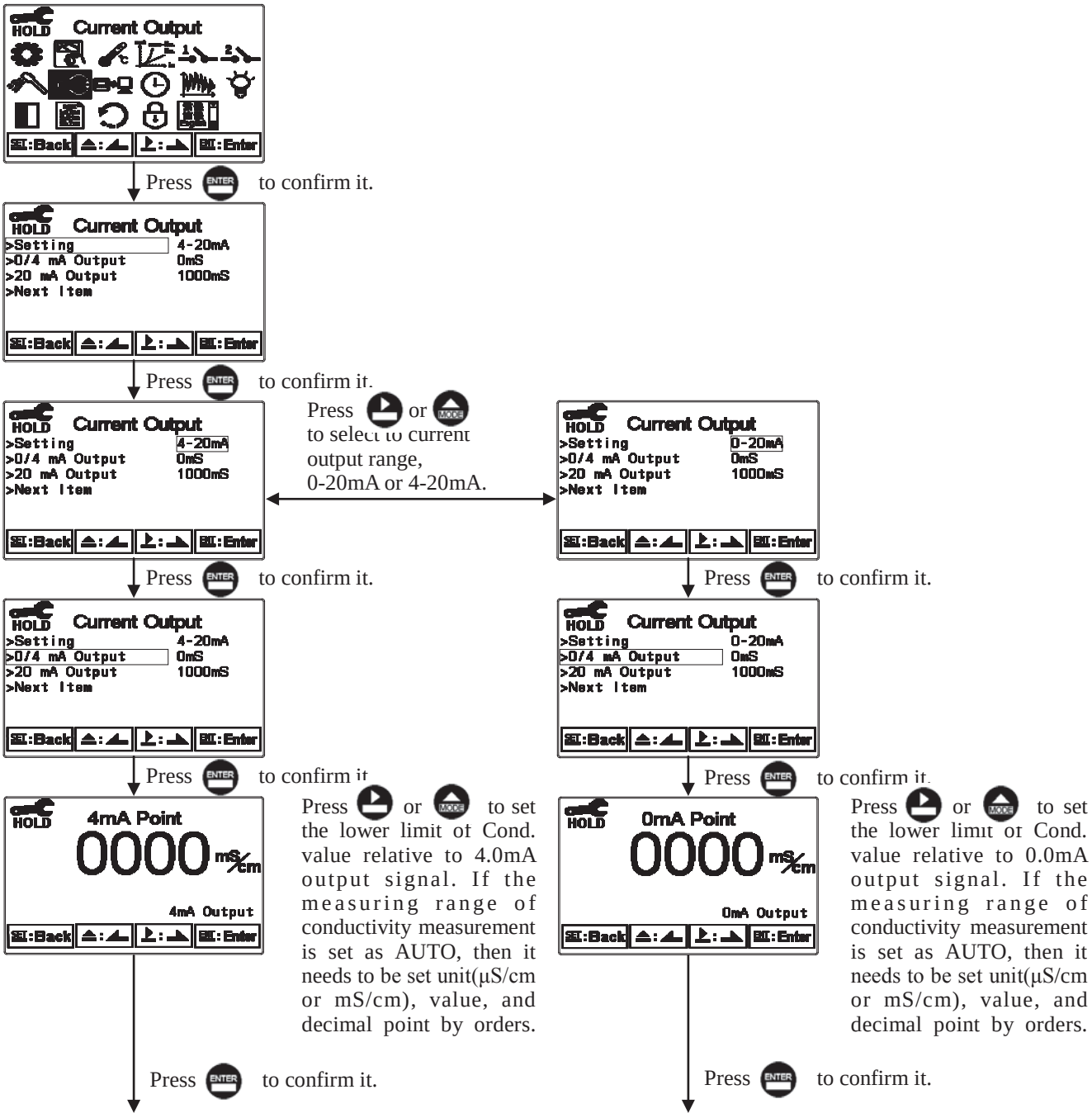
Press ENTER to confirm it.

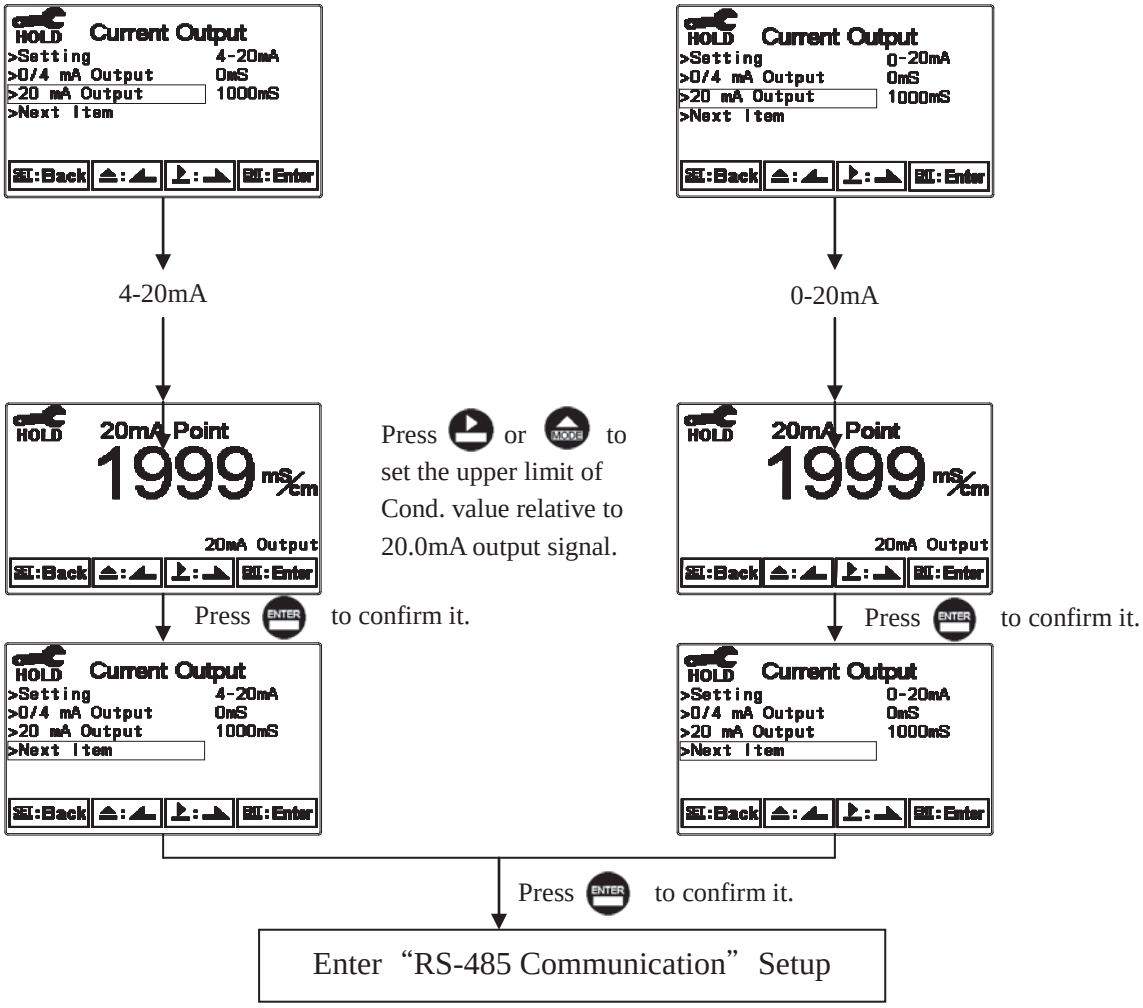


Enter “Current Output” Setup

7.11 Current Output

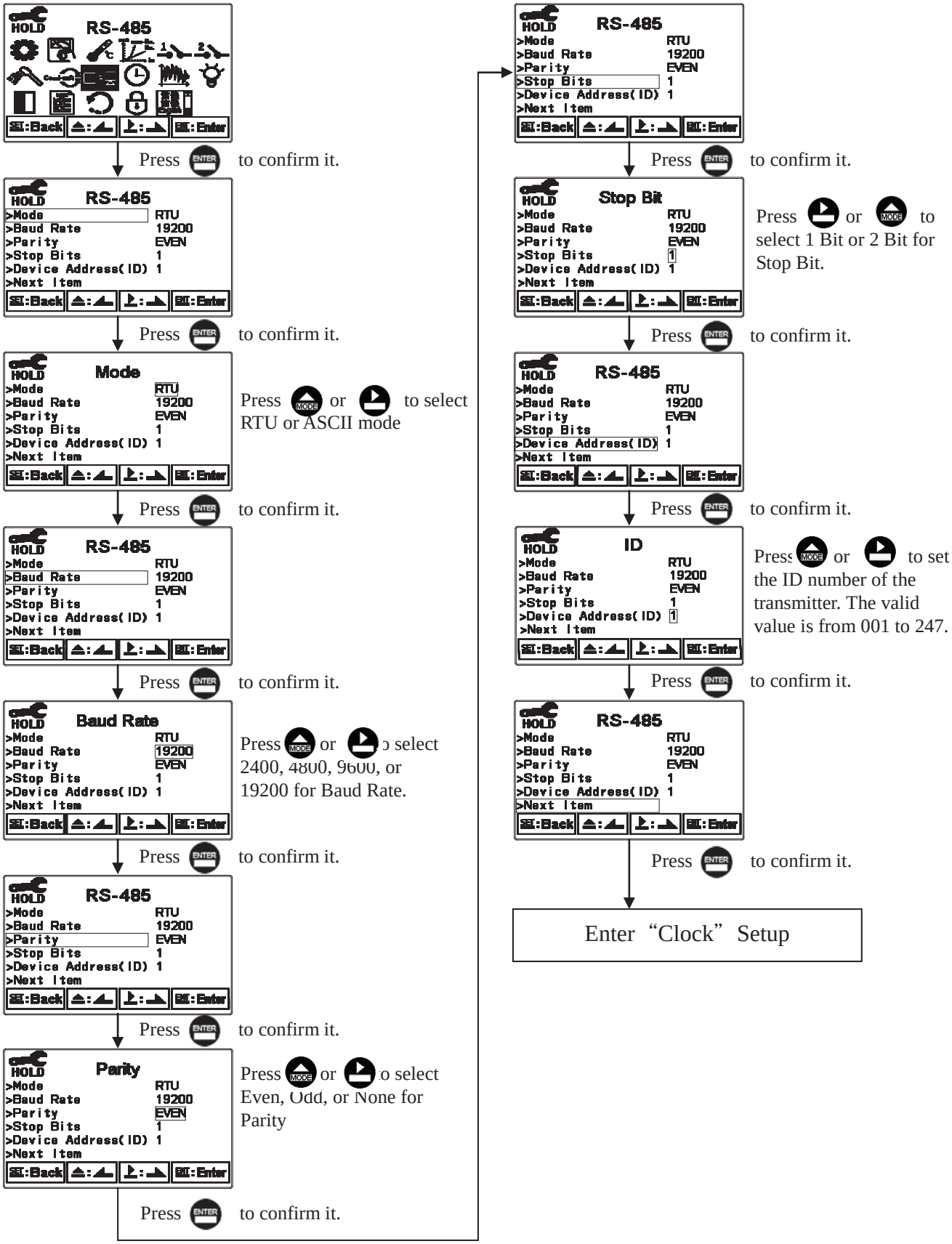
Enter setup of Current Output. Select 0~20mA or 4~20mA current output. Set the related value to the range of Cond. measurement. If the range of the Cond. measurement is to be set smaller, the resolution of current output is higher. When the measured value exceeds the higher range limit, the current will remain approximately 22mA output. When the measured value exceeds the lower range limit, under 0~20mA mode the current output will remain 0mA output; while under 4~20mA mode the current output will remain approximately 2mA output. The exceptional output value can be used as a basis for failure determination. Under HOLD(measurement) status, the current output maintain the last output value before HOLD status. However, in order for convenience of insuring the current setting of an external recorder or of a PLC controller, the current output will be 0/4mA or 20mA under the analog output setup menu.




HOLD
Current Output
>Setting 4-20mA
>0/4 mA Output 0mS
>20 mA Output 1000mS
>Next Item
SET:Back
ENT:Enter
4-20mA
0-20mA
20mA Point
1999 mS/cm
20mA Output
Press or to set the upper limit of Cond. value relative to 20.0mA output signal.
Press to confirm it.
Press to confirm it.
>Setting 0-20mA
Press to confirm it.
Enter "RS-485 Communication" Setup

7.12 RS-485 Communication

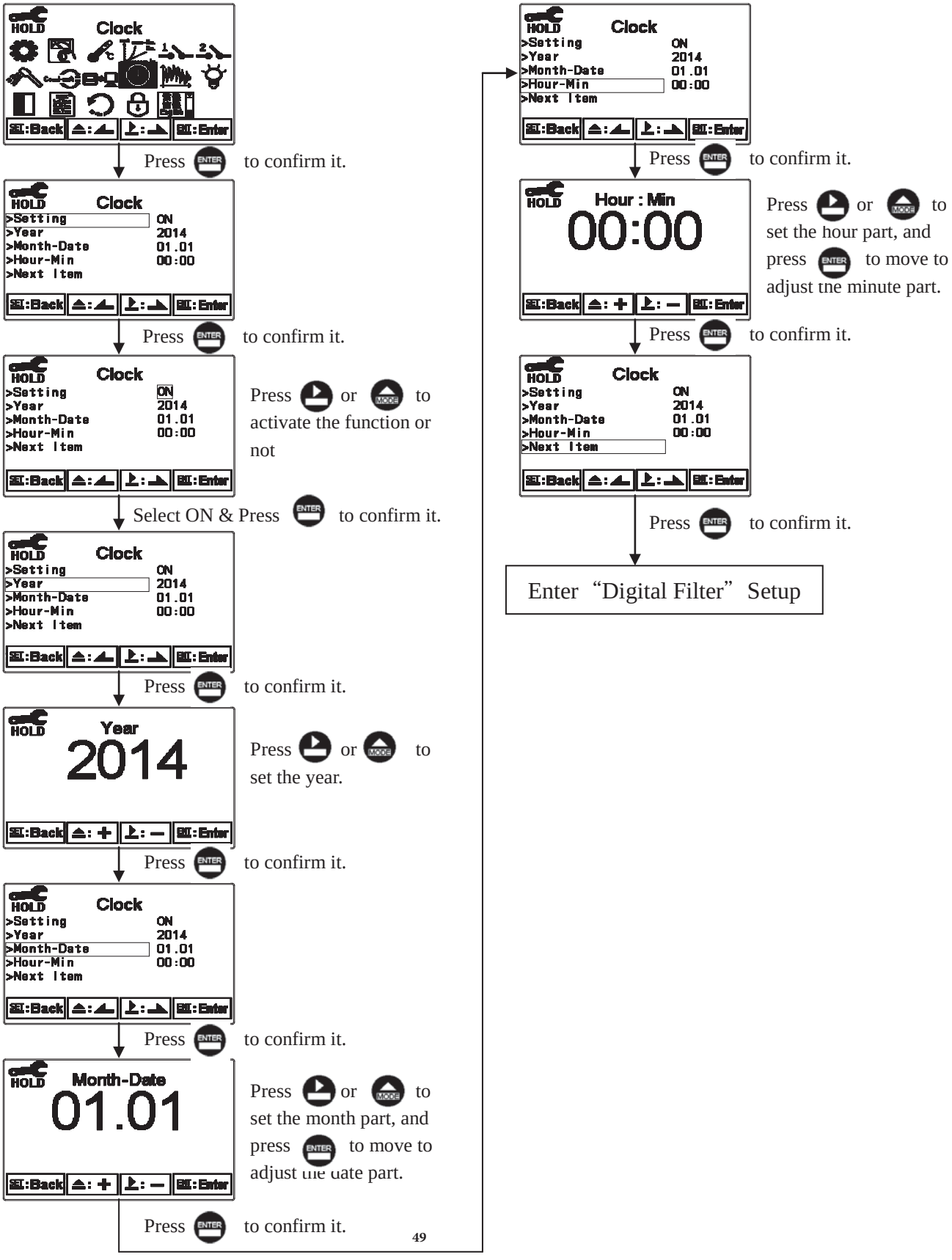
Enter setup of RS-485 communication. According to the Modbus protocol, set the Transmitting Mode, Baud Rate, Parity, Stop Bit, and ID number. About the detail of Modbus protocol, please refer to Ch9 Modbus Protocol. If under HOLD status, the measurement signal output maintains the last output value before HOLD status.



7.13 Clock

Enter setup of Date/Time(Clock). Set the “Year”, “Month”, “Date”, “Hour”, and “Minute” time. Note: If you select to turn off the clock function, there will not display clock under measurement mode. The calibration time of calibration record will also show ”OFF” under calibration overview display.

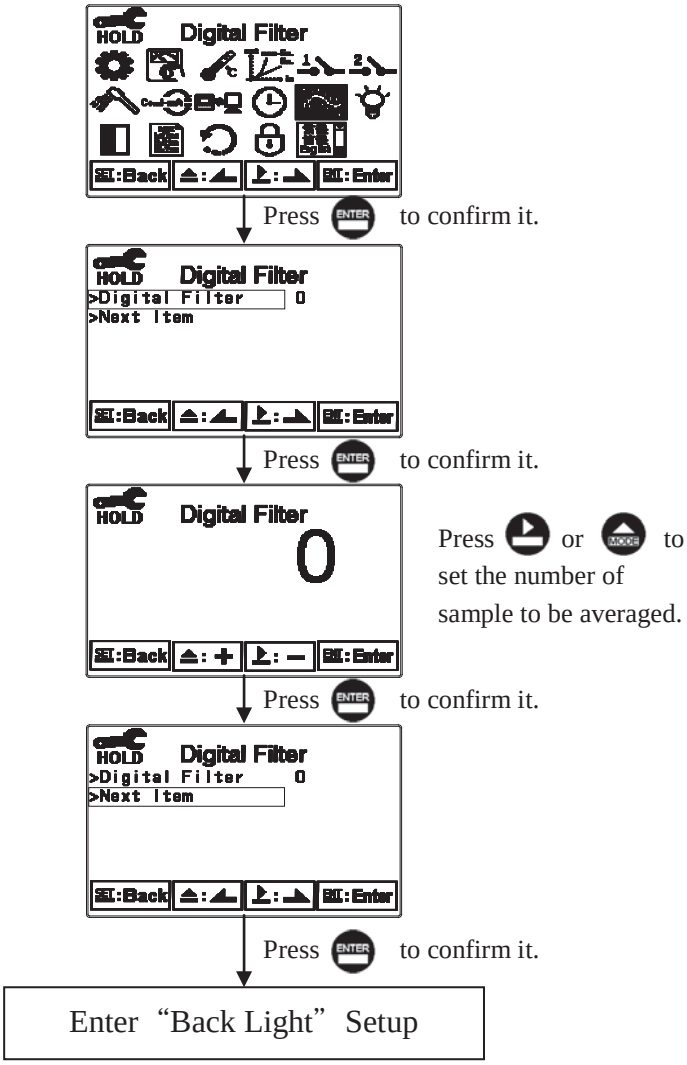
Note: With the EC-4110-ICON model, the transmitter may keep the clock in operation even when encountering power failure. Only when the inner battery is out of power, the clock may stop operation. Then, please replace the 3V CR2025 Li batter inside the transmitter.



7.14 Digital Filter

Enter the setup of Digital filter. You may select the number of sample to be averaged each time to become a reading which is gradually counted in order to increase the stability of measurement.

Note: “0” represents auto setting according to the conductivity measurement.



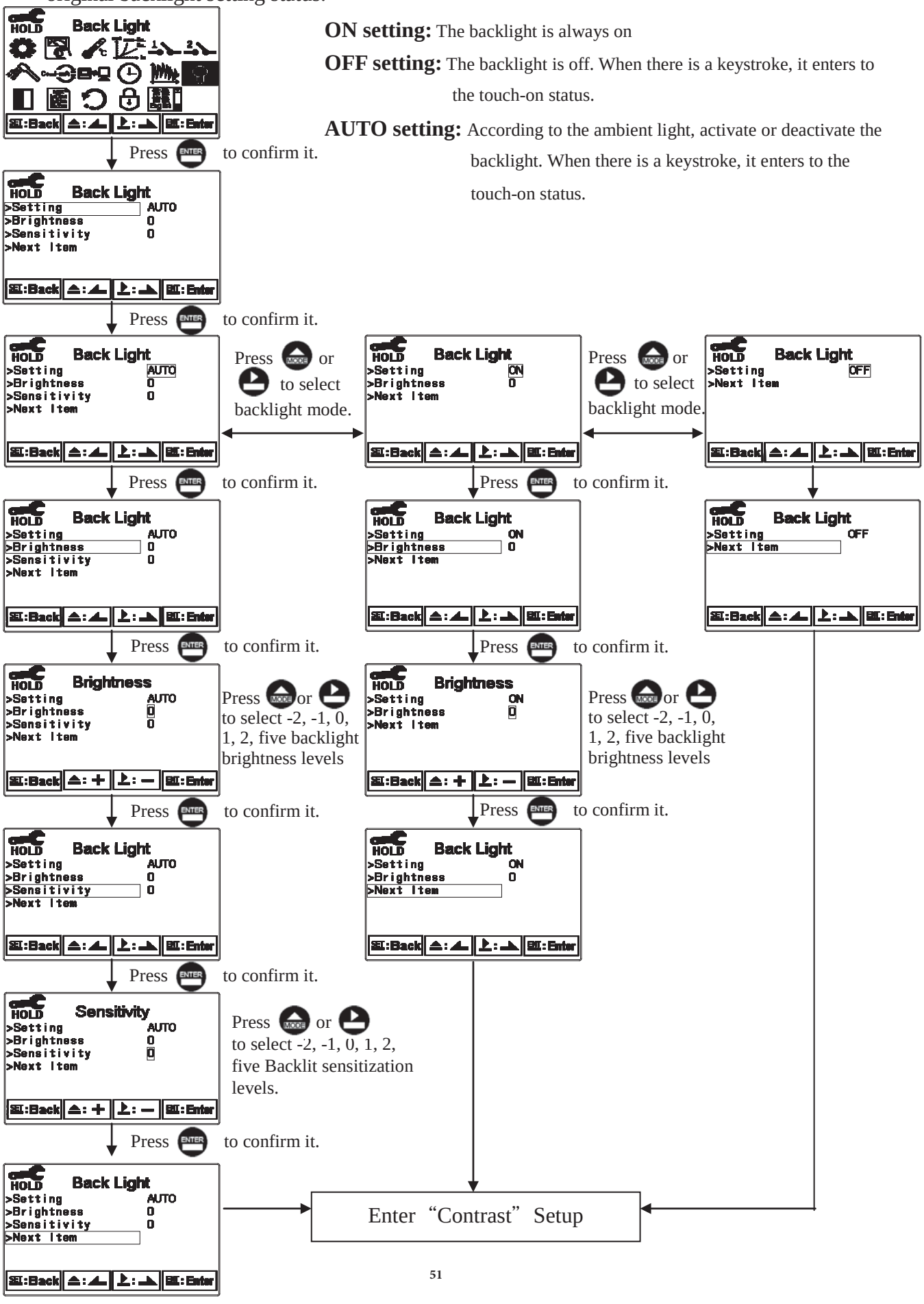
7.15 Back Light

Enter setup of backlight display. According to users' requirements, the brightness of display (-2~2, dark~bright) and sensitivity of the sensitization sensor(-2~2, insensitive~sensitive) can be set. On OFF or AUTO backlight mode, if there is a keystroke, then it activates the touch-on state, activating the backlight. If there is no keystroke for 5 seconds, the display will be back to the original backlight setting status.

ON setting: The backlight is always on

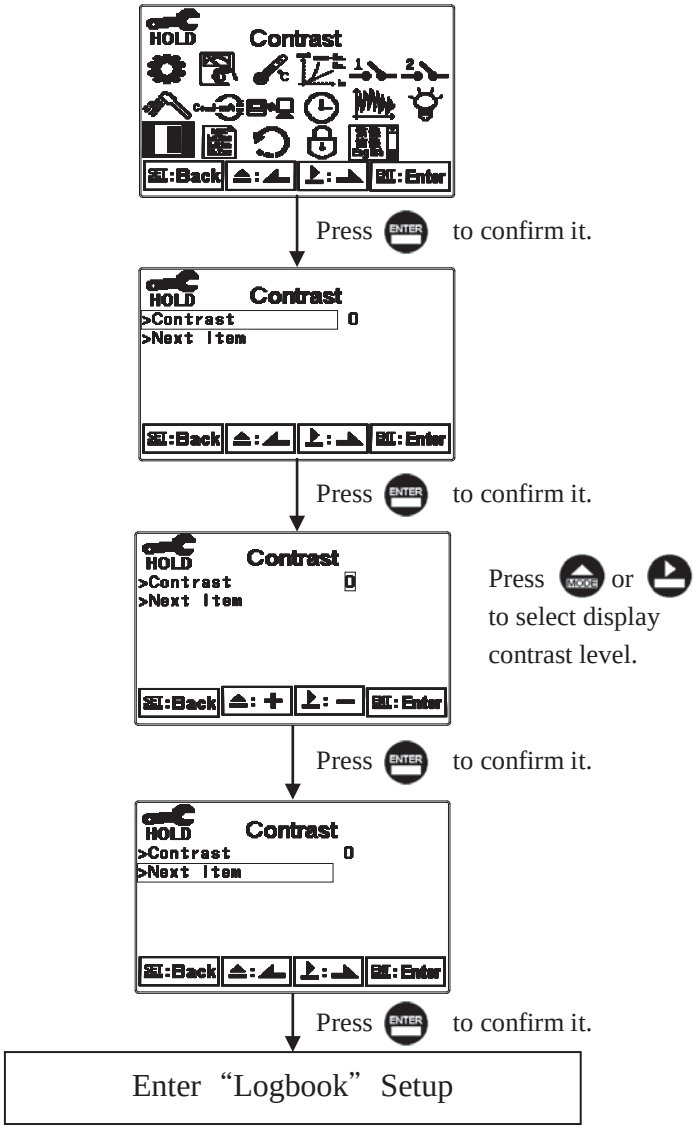
OFF setting: The backlight is off. When there is a keystroke, it enters to the touch-on status.

AUTO setting: According to the ambient light, activate or deactivate the backlight. When there is a keystroke, it enters to the touch-on status.



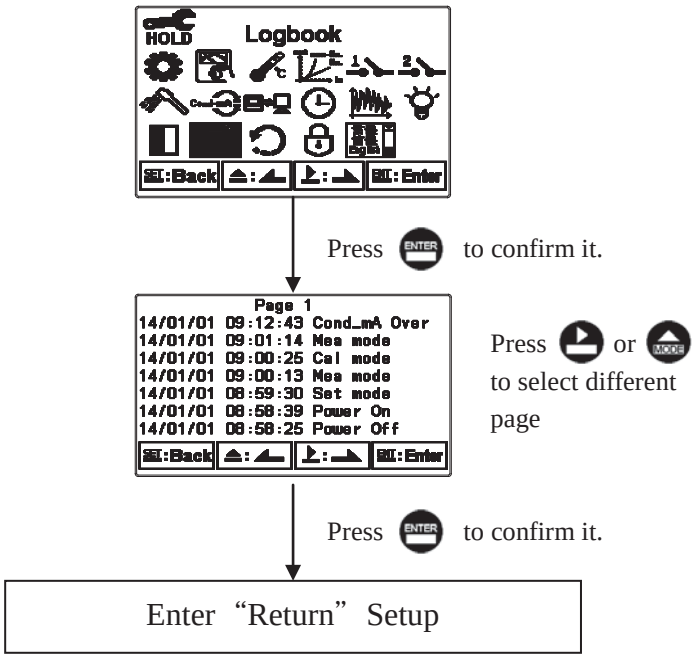
7.16 Contrast

Enter setup of Contrast. You can set the contrast of display according to your need. (-2, -1, 0, 1, 2, light to dark).



7.17 Logbook

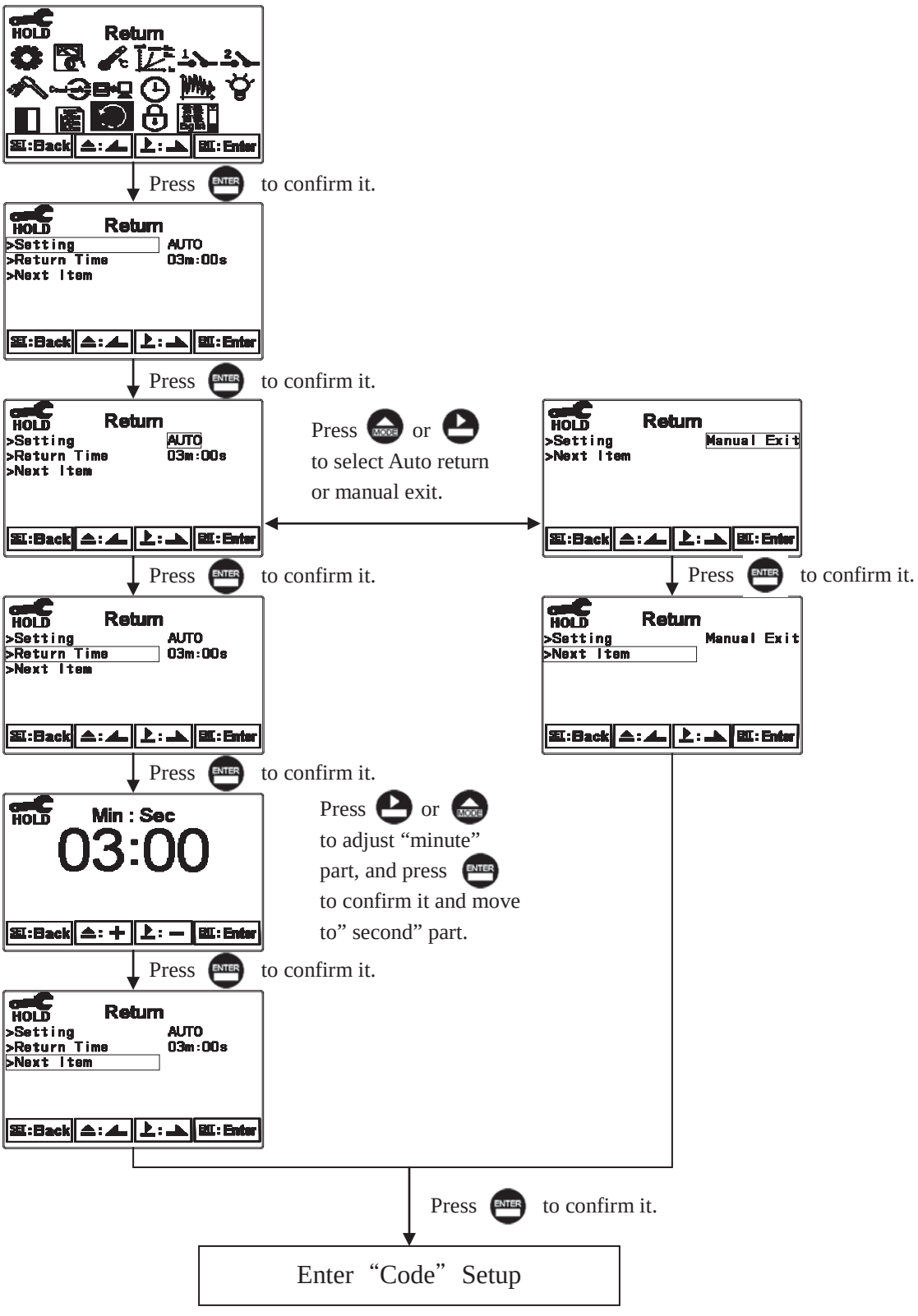
Enter setup of Logbook. Users may look up the relative 50 records of the transmitter showed on the display screen or read by Modbus. The event descriptions are as follows. If users would like to use Modbus to read the event records, they need to type the serial number 0028 first, and then they can attain the corresponding event records from 0029H~002FH. Serial number 1 means the latest event, serial number 2 means the former event, and so on.



Event	Description	Modbus code
Mea mode	Measurement mode	00
Set mode	Setting mode	01
Cal mode	calibration mode	02
Power On	The unit is powered up	03
Power Off	The unit is out of power	04
Cond_mA Over	Current is over range	05
Error 1	Unstable readings as calibration	06
Error 2	1. Cell factor exceeds the upper/lower limit 2. Temperature is over range	07
Error 3	Wrong password	08
Conc_mA Over	Current is over range	09
Error 9	The unit is broken	10
Modbus Write	Modbus read-in action	13

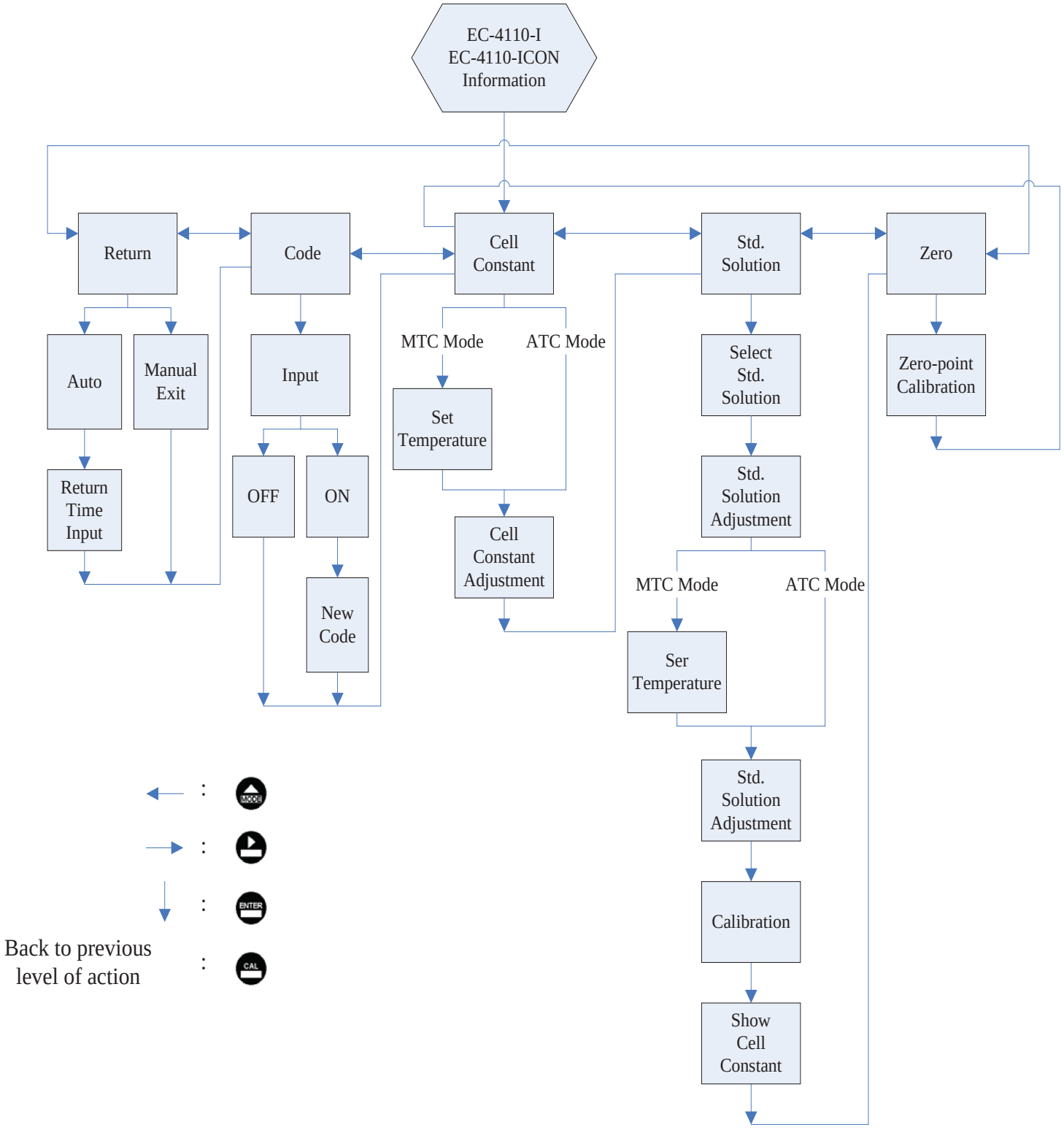
7.18 Return

Enter setup of auto return mode (Return) to set the function that the instrument automatically exit the setup menu after a period of time without pressing any key. The “Manual Exit” means that it needs to exit setup menu manually, while “Auto” means that the display automatically exit the setup menu and back to measurement mode after a period of time without pressing any key.



8. Calibration

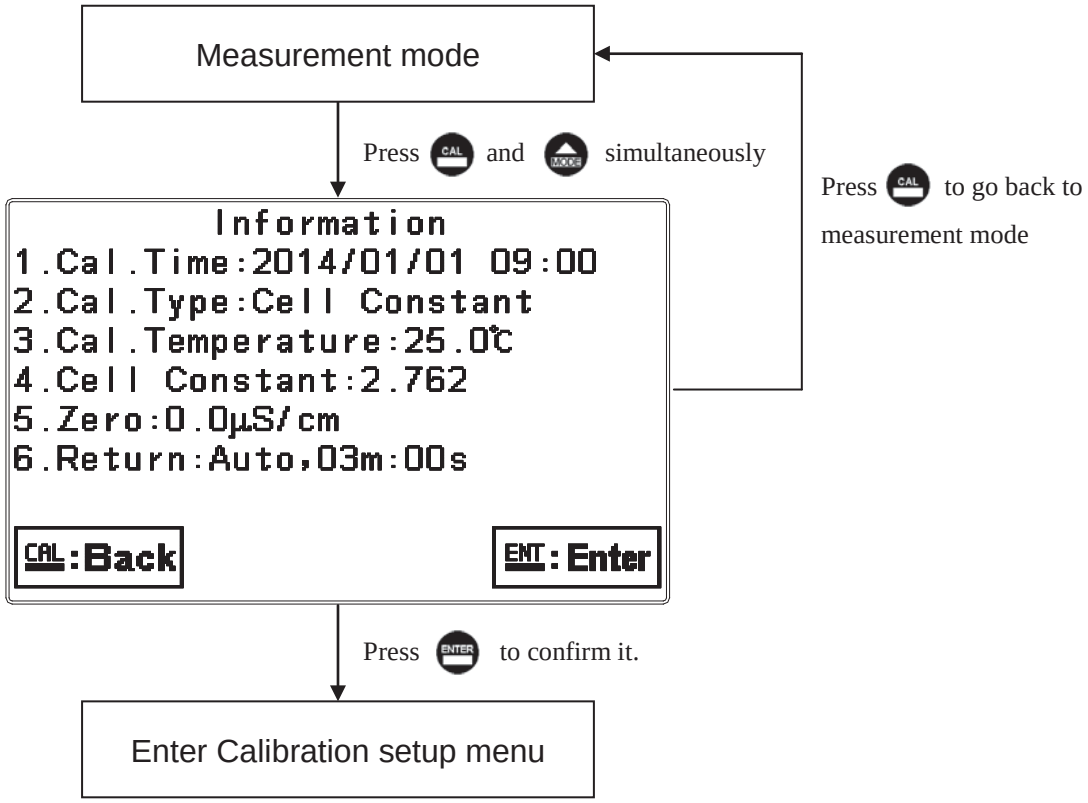
Block diagram of Calibration



1

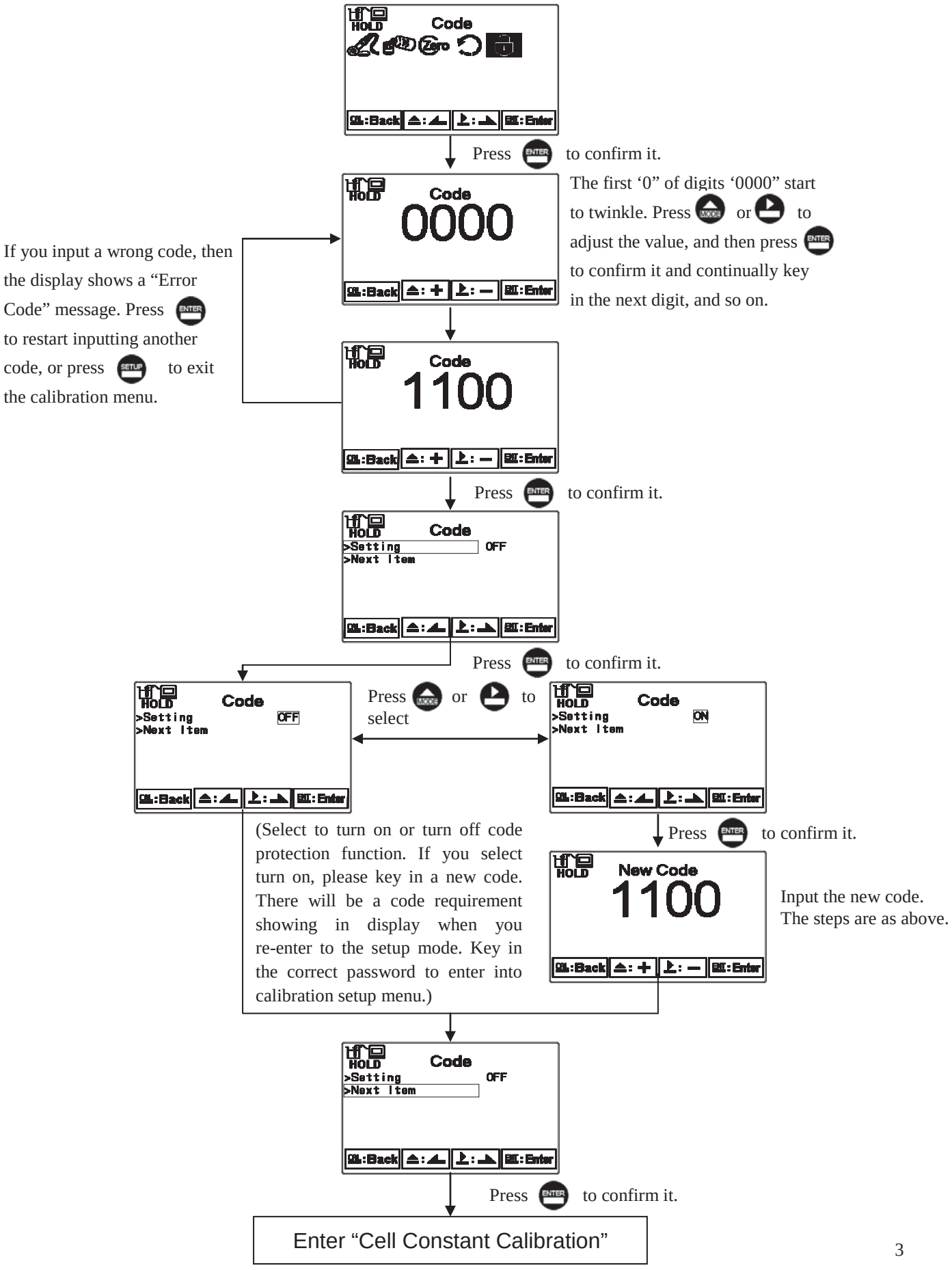
8.1 Enter calibration setup menu

In the measurement mode, pressing the two keys CAL and MODE simultaneously allows you to enter the Calibration Information. If you do not need to re-calibrate the measurement system, press CAL to go back to measurement mode. If you need to re-calibrate the system, press ENTER to enter to the calibration setup menu. (If the calibration time shows “OFF”, it represents that the clock function has been turned off.)



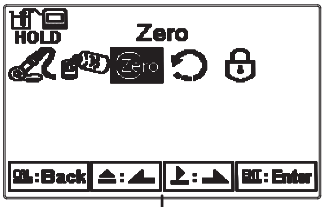
8.2 Security password of calibration (Code)

Select the Code (password) icon after entering calibration setup mode. Select to activate code function or not. **The default Calibration setting code is "1100".**

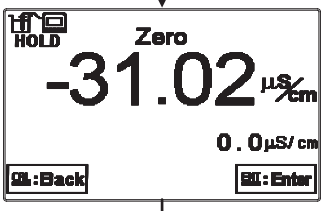


8.3 Zero-Point Calibration

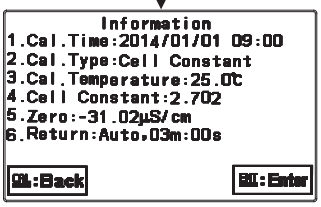
The inductive sensor connected with the transmitter needs to make a zero point calibration in the air. Before calibration, it is necessary to make sure that the surface of the inductive sensor is dry and clean and also in the air. After selecting Zero point calibration and then pressing Enter, the transmitter will directly calibrate zero point and then display the value.



Press ENTER to confirm it.



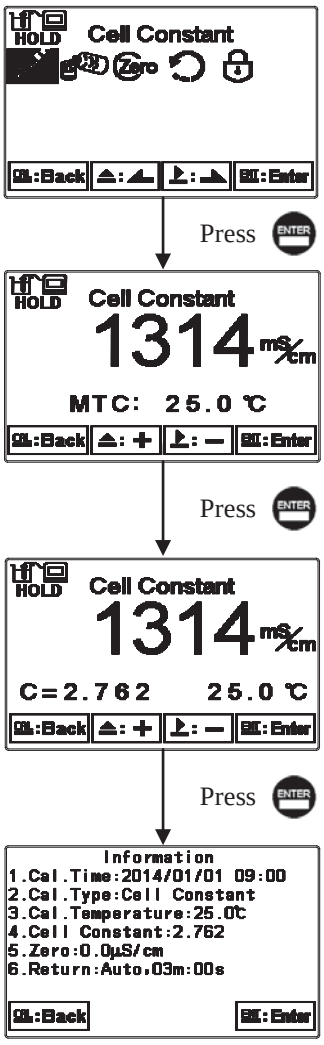
As the main value is stable and auxiliary value is 0, which means the calibration has been finished well, and then press to ENTER confirm it and see the calibration information.



8.4 Cell Constant Calibration

The inductive sensor is immersive to a tested solution, and then input the cell constant which is qualified in lab and marked on the sensor signal cable.

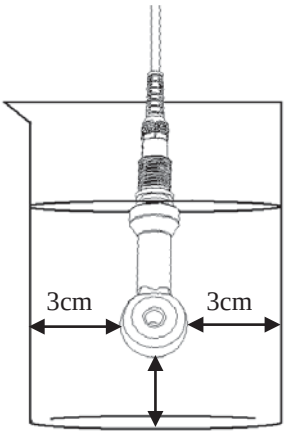
Due to the fact that the inductive sensor applies electromagnetic induction principle which belongs to non-contact technology to detect the conductivity of a sample solution. Thus, the signals may get affected by surroundings such as wall effects, metal(conductor) pipeline or plastic(insulation) pipeline, distance between the inductive sensor and shell of pipe, etc. the actual measurement value from the field may be dissimilar to that from the lab. At the moment, by adjusting the cell constant, Cell Constant Calibration can be made on the field.



Under MTC temperature mode, press MODE or to adjust temperature value; under ATC temperature mode(PTC or NTC), it reads the temp. directly.

Press MODE and to input the cell constant labeled on the sensor.

8.5 Standard solution calibration (Std. Solution)



KCl and NaCl standard solutions can be selected.

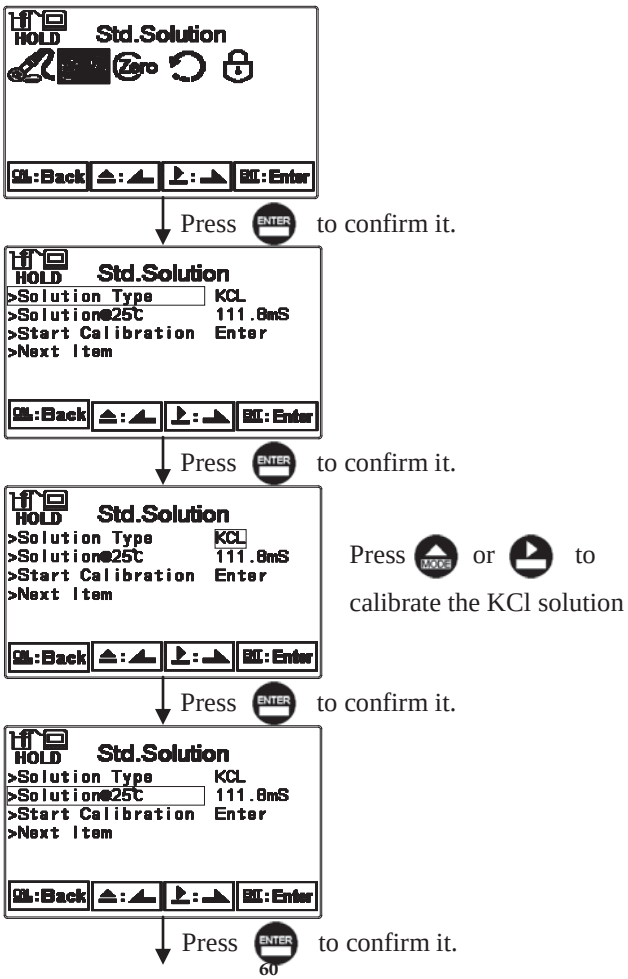
1. In the lab, place the inductive sensor into the calibration solution for 30 minutes above. Keeping it at least 3 cm distance from the wall of a container is to avoid wall effects to cell constant. Then, Cell Constant by the lab can be attained.
2. Via pipeline installation from the field the standard solution is flown to the inductive sensor, wall effects can be calibrated and thus Cell Constant from the field can be attained.
3. It is recommended to use labeled cell constant to calibrate the sensor on the field and cooperate with product adjustment function. please refer to ch7.8 Product Adjustment.
4. It is necessary to make sure that the temperature between the inductive sensor and standard solution should be the same in order to avoid temperature effects.

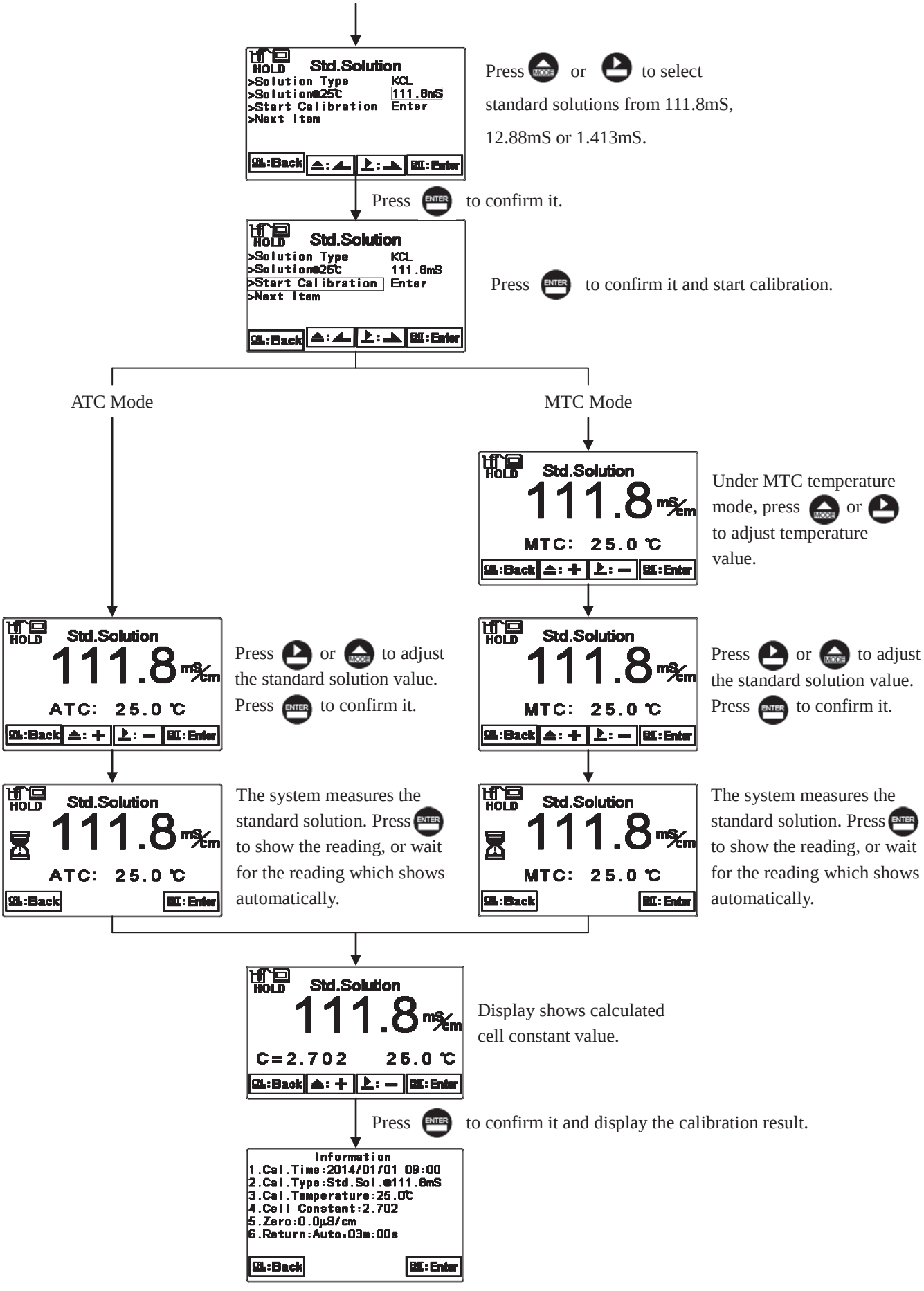
Note: it is necessary to make a zero-point calibration first before standard solution calibration when the inductive sensor runs for the first time.

8.5.1 KCl Standard Solution

Total 3 standard solutions including 111.8mS(1 mol/L), 12.88mS(0.1 mol/L) and 1.413mS(0.01 mol/L can be selected.

Please refer to “Appendix Calibration Solution: Conductivity and Temperature Table” for your reference.

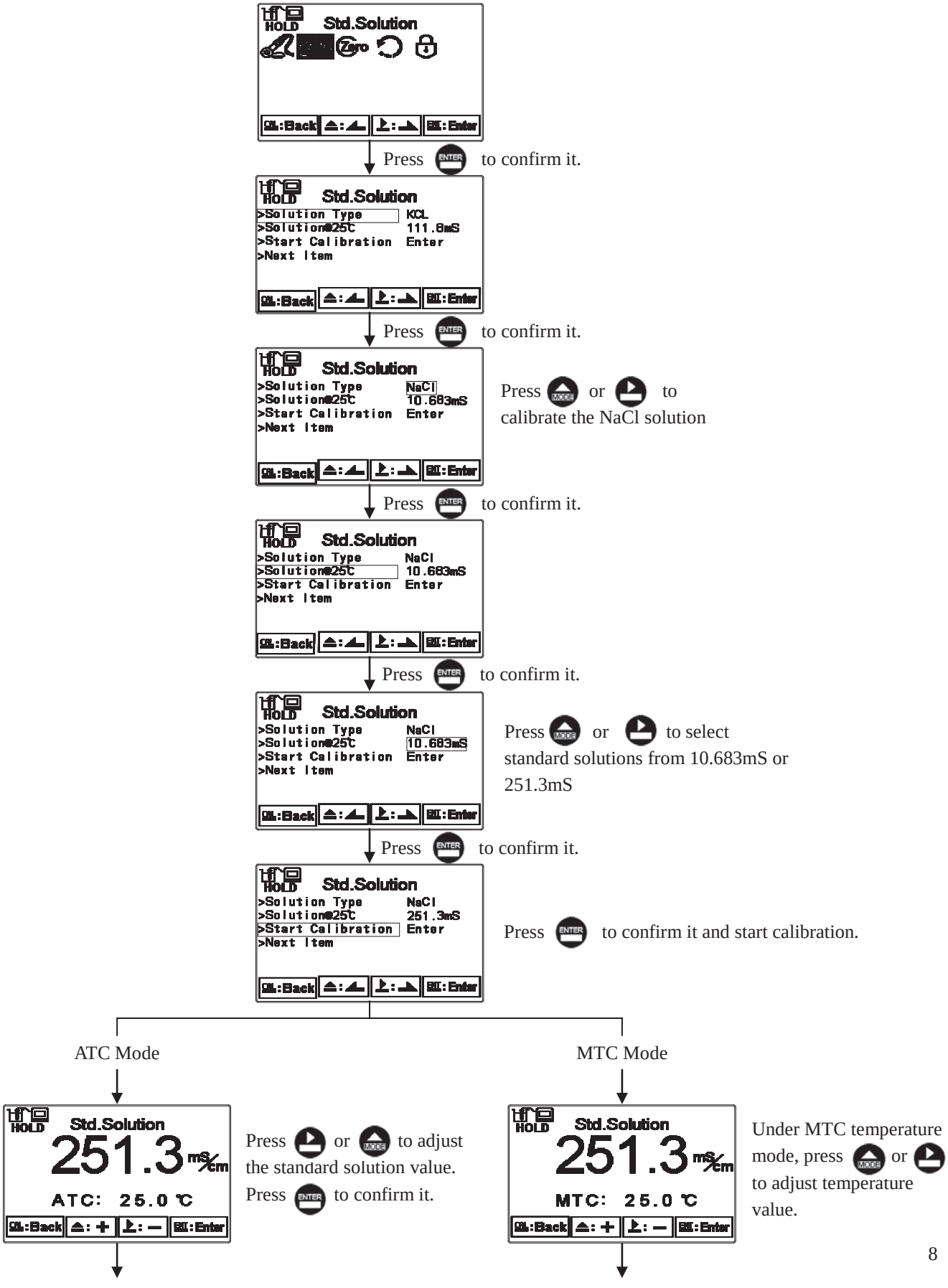


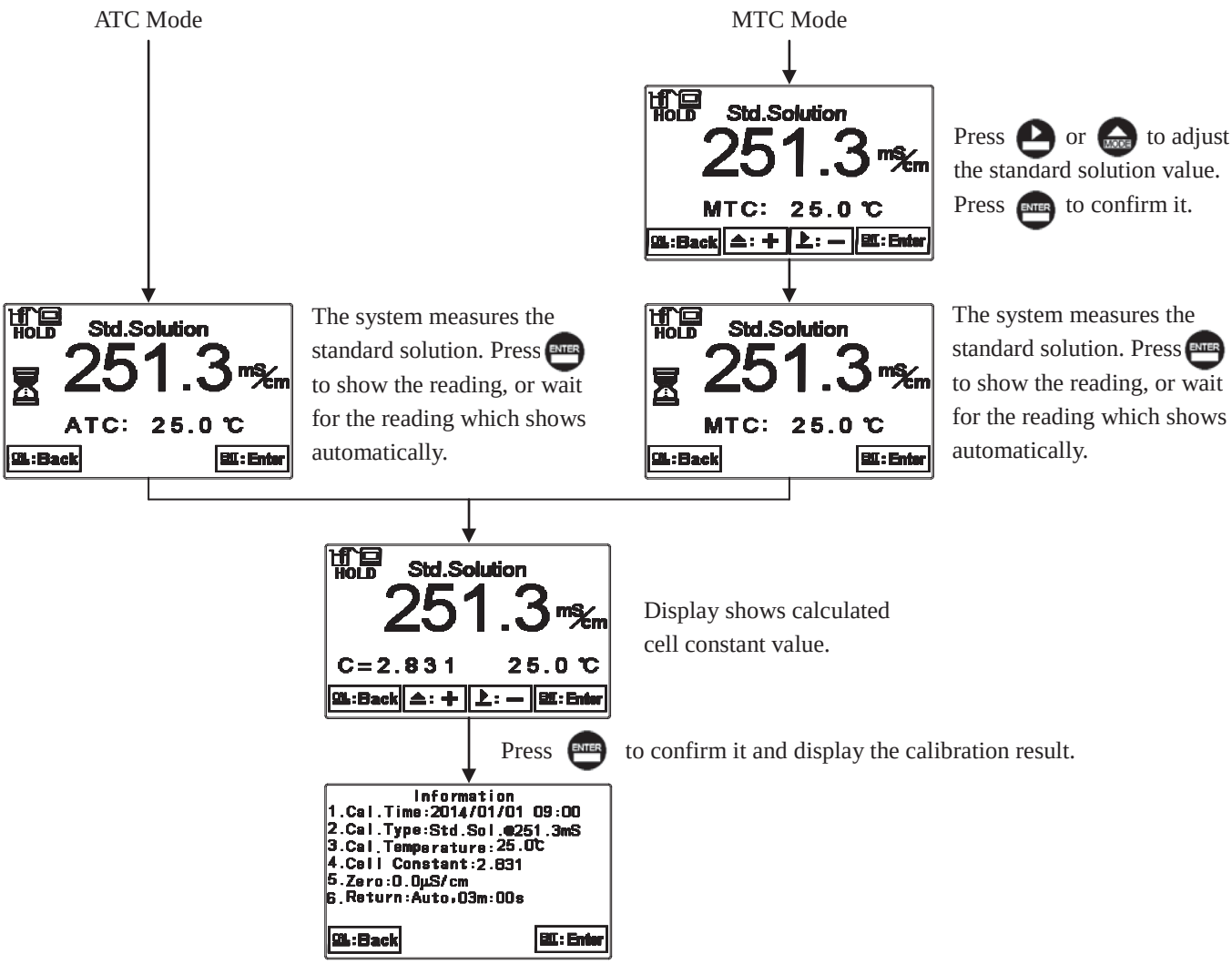

HOLD
Std.Solution
>Solution Type KCL
>Solution@25℃ 111.8mS
>Start Calibration Enter
>Next Item
Back
Enter
Press or to select standard solutions from 111.8mS, 12.88mS or 1.413mS.
Press to confirm it.
>Start Calibration Enter
Press to confirm it and start calibration.
ATC Mode
MTC Mode
111.8 mS/cm
ATC: 25.0 ℃
MTC: 25.0 ℃
Under MTC temperature mode, press or to adjust temperature value.
Press or to adjust the standard solution value.
Press to confirm it.
The system measures the standard solution. Press to show the reading, or wait for the reading which shows automatically.
C=2.702 25.0 ℃
Display shows calculated cell constant value.
Press to confirm it and display the calibration result.
Information
1.Cal.Time:2014/01/01 09:00
2.Cal.Type:Std.Sol.@111.8mS
3.Cal.Temperature:25.0℃
4.Cell Constant:2.702
5.Zero:0.0μS/cm
6.Return:Auto,03m:00s

8.5.2 NaCl Standard Solution

total 2 standard solutions including 10.683mS(0.1 mol/L) and 251.3mS(saturated) can be selected.

Please refer to “Appendix Calibration Solution: Conductivity and Temperature Table” for your reference.

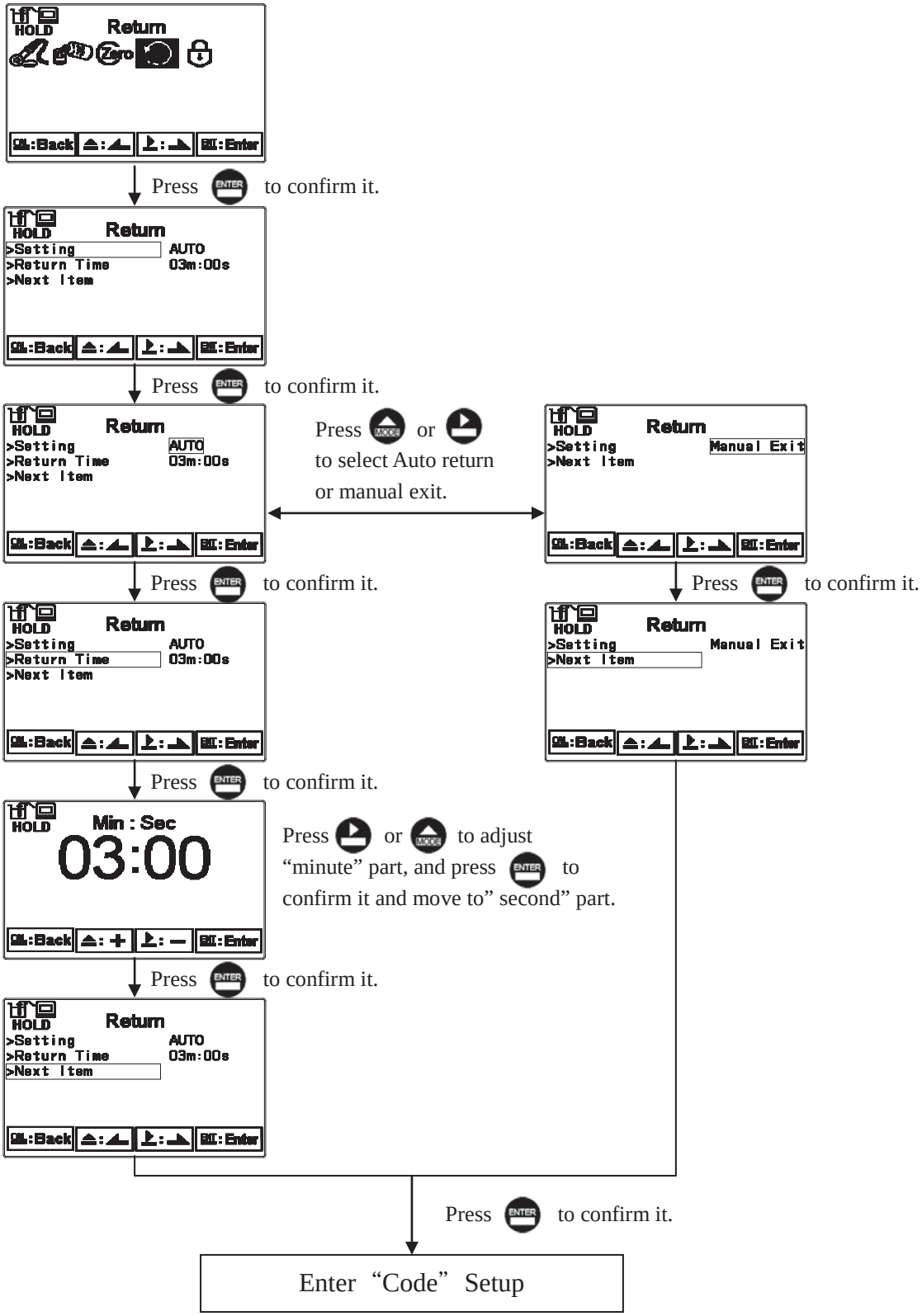



ATC Mode
MTC Mode
HOLD
Std.Solution
251.3 mS/cm
MTC: 25.0 ℃
:Back
: +
: −
:Enter
Press or to adjust the standard solution value.
Press to confirm it.
ATC: 25.0 ℃
The system measures the standard solution. Press to show the reading, or wait for the reading which shows automatically.
The system measures the standard solution. Press to show the reading, or wait for the reading which shows automatically.
C=2.831 25.0 ℃
Display shows calculated cell constant value.
Press to confirm it and display the calibration result.
Information
1.Cal.Time:2014/01/01 09:00
2.Cal.Type:Std.Sol.@251.3mS
3.Cal.Temperature:25.0℃
4.Cell Constant:2.831
5.Zero:0.0μS/cm
6.Return:Auto,03m:00s

8.6 Return

Enter setup of auto return mode (Return) to set the function that the instrument automatically exits the setup menu after a period of time without pressing any key. The “Manual Exit” means that it needs to exit calibration setup menu manually, while “Auto” means that the display automatically exits the calibration setup menu and goes back to measurement mode after a period of time without pressing any key.

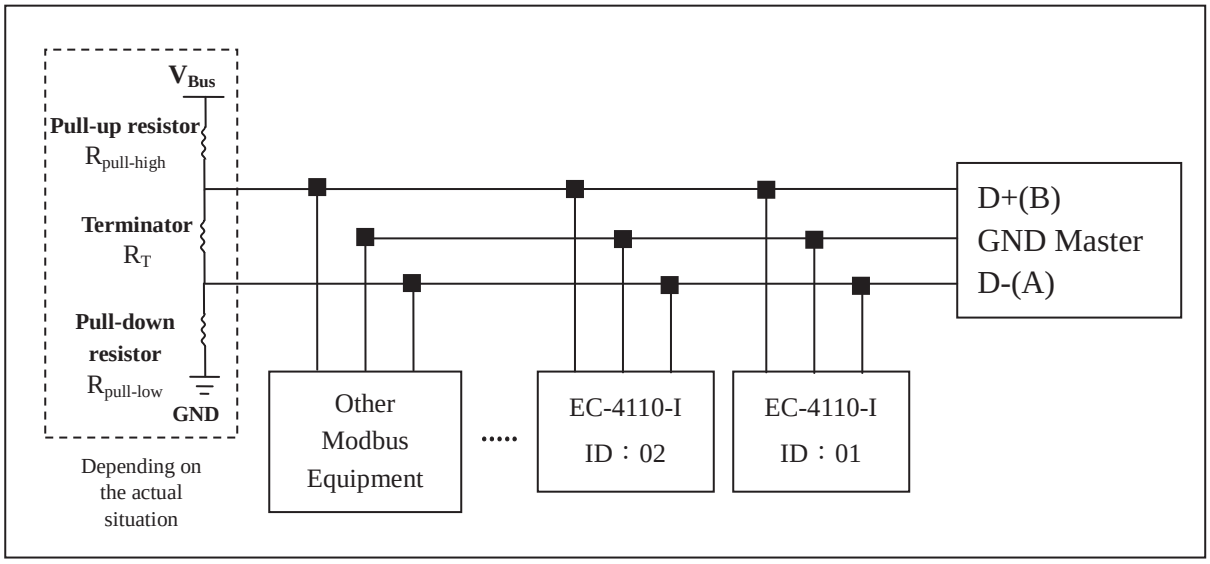
Note: The return functions of setup menu and calibration setup menu are independent settings.



9. Modbus Protocol and Instructions

9.1 Communication connection

The RS-485 communication port of the transmitter EC-4110-I and EC-4110-ICON features electronic isolation protection, lightning protection, and provides internal independent ground solution. It is allowed to use normal twisted-pair (segregation double-stranded twisted pair cable) cable connections. All devices are in contact with a double-stranded, and then all together, and another line will be connected with all the negative contacts, and the isolated shield wire must be connected to GND. When talking about communication in the laboratory, the stand-alone master-slave communication is relatively simple. Hence, it is allowed to consider using the normal cable instead. However, there should be strictly in accordance with the requirements of industrial engineering construction. Wiring diagram is as follows:



Note:

1. The RS-485 interface of transmitter EC-4110-I/EC-4110-ICON has a protective earth terminal. When it communicates with the RS-485, there should use with solution ground to eliminate risk of safety.

2. It is allowed to use an 120 ohm impedance matching resistors at terminal equipment across both ends of transmission lines (D +(B), D-(A)) to effectively reduce or eliminate signal reflection.

   Note: there are three possible situations resulting in failure connection:
   a. Open circuits: the signal cable has open circuits.
   b. Short circuits: the insulation that is insufficient between signal cables causes short circuits.
   c. Idle-bus: there is no data transmission in the Controlbus.

   Based on the previous three situations resulting in unknown state of Controlbus's voltage, the receiver accepts the unexpected signals. Therefore, in some harsh environment like multi-transmitter connection, the Controlbus needs the terminator to avoid reflection of baud rate, and it needs pull-high resistor, pull-low resistor, and biasing circuits made up of V_{Bus} as the block diagrams showing above. Besides, it makes sure that the free voltage between transmission line D+(B) and D-(A) is available for maintaining the completeness of the signals. Due to not each environment being suitable for fixed resistor and V_{Bus}, as a result, users must pay attention to the settings. Some parts of connecting instruments (as parts of RS-485 or modules) provide the terminator, pull-high resistor, pull-low resistor, and settings of V_{Bus}. Please refer to the operation

manuals for the connecting instruments.

3. Without repeaters, the RS-485 network cannot exceed a maximum of 32 nodes. The maximum communication transmission distance of RS-485 is up to 1200 meters. For long distance transmission, it is recommended to apply cables which are dedicatedly design for RS-485.

4. When communication, all the equipments of the network should be maintained in the same transfer mode, baud rate, parity consistent. And each of the device address cannot be the same, so as not to conflict resulted in the normal network communications.

5. The Modbus command of the transmitter EC-4110-I/EC-4110-ICON can only access 50 registers. If it exceeds the upper limit, then it returns abnormal message.

6. The waiting time which a slave instrument responses to a master machine is different according to each model. Generally, it shall be longer than 0.5 second. (Some models may require a longer waiting-responding time, please note whether it is specified in the operation manual.)

9.2 Modbus Address Table

Modebus response table is as follows. As users communicate with transmitters by PLC or Man-machine Interface, be noted that whether there is a minus 1 situation in actual transmission of address. If so, please be necessary to add 1 in address so that it can match with the table. Example: for the temperature logic address 0037H (16-bit) or 55 (10-bit), if there is a minus 1 output signal proceeded by PLC or Man-machine Interface, then users need to input 0038H(16-bit) or 56(10-bit) first so that it can match with accurate temperature logic address 0037H (16-bit) or 55 (10-bit).

Function Code：03H, 06, 10H Modbus Response (Setup Parameter)

Logic address	R/W	Item	Number of Byte	Information Type	Description of data transmission	Default Value	Note
0000H	None						
0001H	R	Equipment's ID	2	USHORT	1-247	1	
0002H	R	Transmitter Model	6	USHORT	ASCII Code	EC4110	
0005H	R	Communication Protocol	2	USHORT	0：RTU 1：ASCII	0	
0006H	R	Serial Transmission Speed (Baud rate)	2	USHORT	0：2400 1：4800 2：9600 3：19200	3	
0007H	R	Parity	2	USHORT	0: None 1: Even 2: Odd	1	
0008H	R/W	Real-time Clock*	12	USHORT	Second	2014-01-01 00：00：00	
0009H	R/W			USHORT	Minute		
000AH	R/W			USHORT	Hour		
000BH	R/W			USHORT	Day		
000CH	R/W			USHORT	Month		
000DH	R/W			USHORT	Year		
000EH	R/W	Code Setting*	2	USHORT	Code setting	1111	
000FH	R/W	Temperature Mode*	2	USHORT	0：MTC 1：PTC1000 2：NTC 3：PTC100	1	
0010H	R/W	Clean Relay*	2	USHORT	0：OFF 1：AUTO	0	
0011H	R/W		2	USHORT	ON.S：0-5999	0	Second
0012H	R/W		2	USHORT	OFF.H：0-999	0	Hour

0013H	R/W		2	USHORT	OFF.M：0-59	0	Minute
0014H	R/W		2	USHORT	Hys.S：0-5999	0	Second
0015H	R/W	Relay 1*	2	USHORT	0：OFF 1：AUTO	1	
0016H	R/W		2	USHORT	0：Hi 1：Lo	0	
0017H	R/W		4	FLOAT	SP1	1000mS	Data affected by sign
0019H	R/W		4	FLOAT	Hys1	10mS	
001BH	R/W	Relay2*	2	USHORT	0：OFF 1：AUTO	1	
001CH	R/W		2	USHORT	0：Hi 1：Lo	1	
001DH	R/W		4	FLOAT	SP2	100.0mS	Data affected by sign
001FH	R/W		4	FLOAT	Hys2	1.0mS	
0021H	R/W	Backlight Brightness*	2	USHORT	0：AUTO 1：ON 2：OFF	2	
0022H	R/W		2	SHORT	2: Highest brightness 1: high brightness 0: Standard -1: Low brightness -2: Lowest brightness	0	
0023H	R/W	Backlight Sensitivity*	2	SHORT	2: Highest Sensitivity 1: High Sensitivity 0: Standard -1: Low Sensitivity -2: Lowest Sensitivity	0	
0024H	R/W	Sample Average of Measurements (Digital Filter) *	2	USHORT	0-60	0	
0025H	R/W	Product Adjustment*	2	USHORT	0：OFF 1：ON	0	
0026H			4	FLOAT	0.7000~1.3000	1.0000	
0028H	R/W	Event Serial Number	2	USHORT	1~50	1	
0029H	R	Event Time	12	USHORT	Second	2014-01-01 00：00：00	
002AH	R			USHORT	Minute		
002BH	R			USHORT	Hour		

002CH	R			USHORT	Day		
002DH	R			USHORT	Month		
002EH	R			USHORT	Year		
002FH	R	Event Code	2	USHORT	0~13	0	
0030H	Factory reserved						

Note 1: The actions without * sign only support for function code 03H. The actions with * sign support function code 03H, 06H, 10H.

Note 2: EC-4110-I's FLOAT is a 32-bit IEEE 754 format. The above table, for an example, is divided into two 16-bit register data transmission. The back 16-bit register(CC CD) will be transferred first, and then the first 16-bit register (41 C8) will be transferred later. Every 16-bit format is high-bit in the front and low-bit in the post. For example, the temperature now is 25.1^{o}C. The 16-bit of FLOAT data(Hexadecimal) will show 41 C8 CC CD. The transmission order is CC CD 41 C8. For detail descriptions, please refer to ch9.3 Modbus Example Description.

Note 3 : USHORT represents unsigned short integer.

Function Code: 03H Modbus Response (Measurement Parameter)

Logic address	R/W	Item	**Number of Byte**	Information type	Description of data transmission	Default value	Note
0031H	R	Measurement Status	2	USHORT	0：Hold 1：Measurement	1	
0032H	R	Sign	6	CHAR	μS/cm mS/cm % ppm ppt	Cond.@tref 2000mS	ASCII Code
0035H	R	Cond./Conc./ TDS/Salinity Measurement	4	FLOAT	Cond./Conc./ TDS/Salinity Measurement		
0037H	R	Temperature Measurement	4	FLOAT	Temperature Measurement		
0039H-003FH	Factory reserved						
0040H	R	Cell Constant	4	FLOAT	Cell Constant	2.700	
0042H	R	Calibration Time	2	USHORT	Minute	2014-01-01 00：00	
0043H	R		2	USHORT	Hour		
0044H	R		2	USHORT	Day		
0045H	R		2	USHORT	Month		
0046H	R		2	USHORT	Year		
0047H-0050H	Factory reserved						

Function Code: 01H & 05H Modbus Response (Dispersion Parameter)

Logic address	R/W	Item	BIT	Description	Default value	Note
0070H	R	LO Alarm	1	Contact on	0 (Contact off)	
0071H	R	Hi Alarm	1	Contact on	0 (Contact off)	
0072H	R	MA Too High	1	Contact on	0 (Contact off)	
0073H	R	MATtoo Low	1	Contact on	0 (Contact off)	
0074H	R	Exceed Temp. Range	1	Contact on	0 (Contact off)	
0075H	R	Exceed Measuring Range	1	Contact on	0 (Contact off)	
0076H	R	RLY1 Action	1	Contact on	0 (Contact off)	
0077H	R	RLY2 Action	1	Contact on	0 (Contact off)	
0078H	R	Clean Action	1	Contact on	0 (Contact off)	
0079H-008FH	Factory reserved					

9.3 Modbus Example Descriptions(ex: function code 03H)

he following description takes the temperature reading(0037H) as an example. Set the temperature at the transmitter at MTC 25.1^{o}C, and confirm that host and sub-machine communication format settings are correct. The host according to the following left table to send commands, and then to get the response from sub-machine according to following right table. This example shows the message transmission function code 03H data format. If under other function code, the logic mode can be analogized.

ASCII Mode:

Request		Response	
Message Framing	Hex	Message Framing	Hex
ID, Address	01	ID, Address	01
Function code	03	Function code	03
Starting Address Hi	00	Byte Count	04
Starting Address Lo	37	Register value Hi	CC
No. of Registers Hi	00	Register value Lo	CD
No. of Registers Lo	02	Register value Hi	41
LRC	C3	Register value Lo	C8
		LRC	56

RTU Mode:

Request		Response	
Message Framing	Hex	Message Framing	Hex
ID, Address	01	ID, Address	01
Function code	03	Function code	03
Starting Address Hi	00	Byte Count	04
Starting Address Lo	37	Register value Hi	CC
No. of Registers Hi	00	Register value Lo	CD
No. of Registers Lo	02	Register value Hi	41
CRC Check Lo	75	Register value Lo	C8
CRC Check Hi)	C5	CRC Check Lo	65
		CRC Check Hi	5A

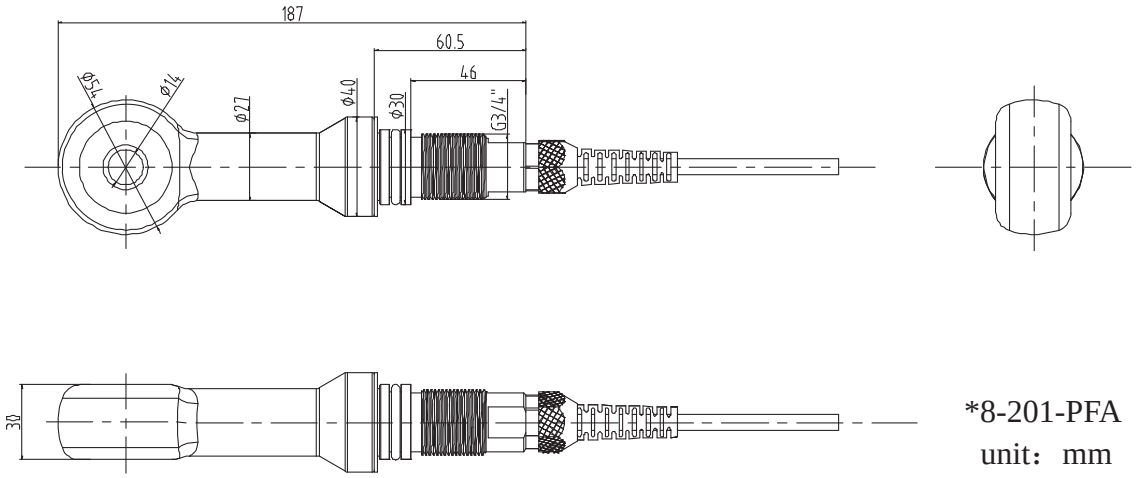
Note: FLOAT is a 32-bit IEEE 754 format. The above table, for an example, is divided into two 16-bit register data transmission. The back 16-bit register(CC CD) will be transferred first, and then the first 16-bit register (41 C8) will be transferred later. Every 16-bit format is high-bit in the front and low-bit in the post. For example, the temperature now is 25.1^{o}C. The 16-bit of FLOAT data(Hexadecimal) will show 41 C8 CC CD. The transmission order is CC CD 41 C8.

10. Error Messages (Error Code)

Messages	Reason	Dispositions
Error1	The readout is unstable when calibration	1. Replace with new standard solution 2. Maintain the electrode or replace a new electrode, and make another calibration
Error2	1. Cell constant of the electrode exceeds the upper or lower limit 2. Exceeds temperature range	1. Replace with new standard solution 1. Maintain the electrode or replace a new electrode, and make another calibration
Error3	Wrong password **ERROR CODE**	Re-enter a password
Error5	Serious error that does not permit any further measuring	Please call service engineer.

11. Installation of Cells

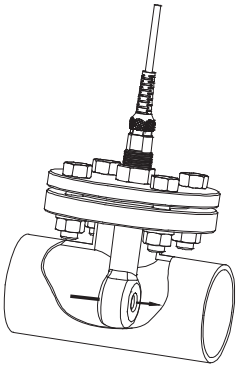
11.1 Appearance of cells

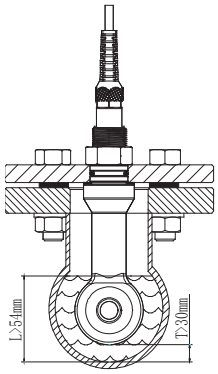


*8-201-PFA
unit：mm

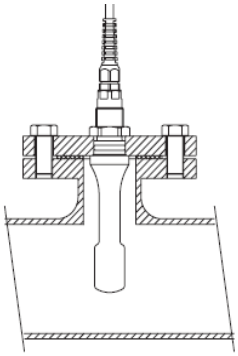
11.2 Installation Approach

11.2.1 Flange Installation

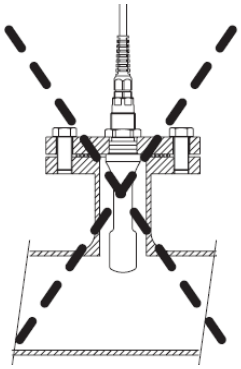




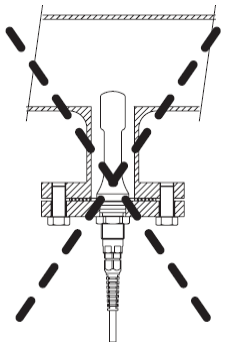
1. Keep the centric hole of the sensor in parallel with the direction of water flow, and then water flows through the hole. It suits for pipeline installation(See left diagram).
2. The sensor should be immersed as least the depth of 54mm, and the distance T to the shell of pipe should be over 30mm. （pipe diameter should be 114mm above）(see left diagram 2).
3. Flange spec: DN50 above（customer-made spec according to actual situation in the field）.



Correct Installation

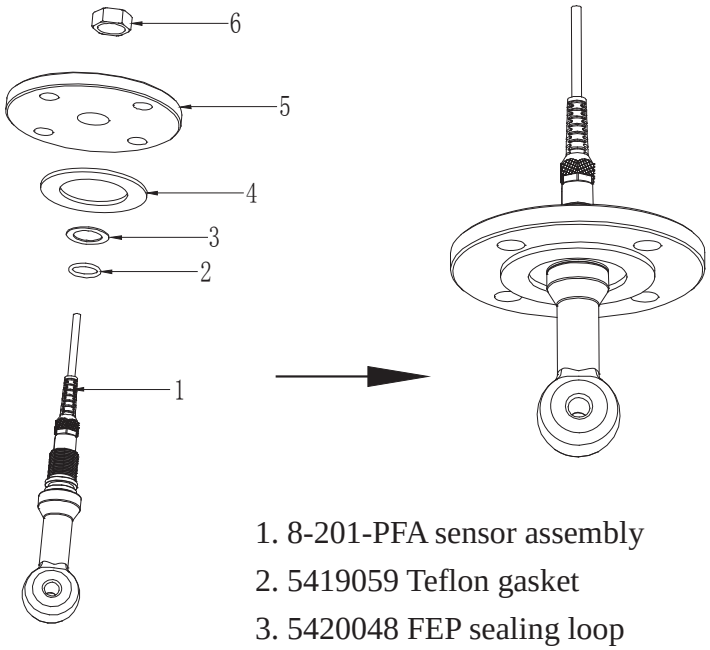


Incorrect Installation: insufficient immersion



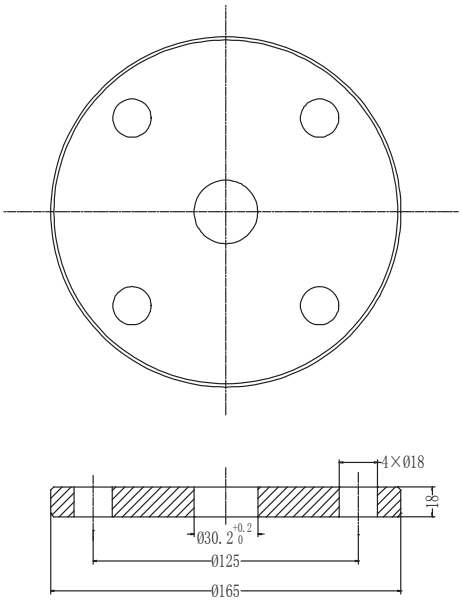
Incorrect Installation: solid impurities sediments influence measuring

Flange Installation Steps

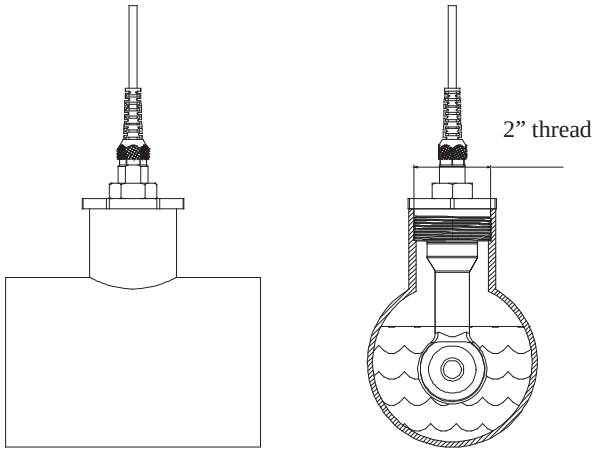


1. 8-201-PFA sensor assembly
2. 5419059 Teflon gasket
3. 5420048 FEP sealing loop
4. Falnge gasket(customer-made)
5. DN50Flange(custemer-made)
6. 5329003 G3/4" hexagon nut

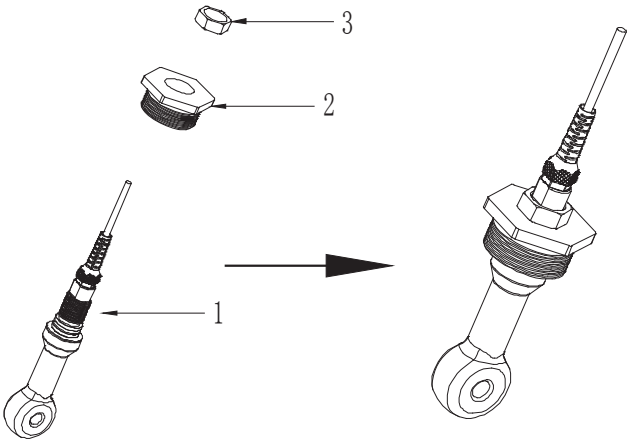
Flange Spec DN50 PL16



11.2.2 Tee Installation



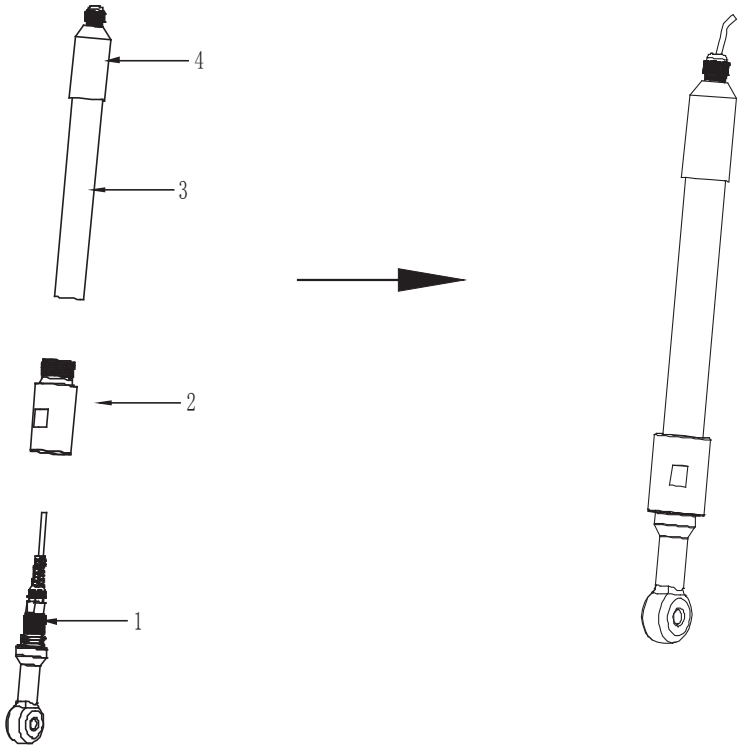
Directly install the sensor to Tee with fixed thread(at least 2” thread)



Installation accessories:

1. 8-201-PFA sensor assembly
2. 5419061 Tee adaptor(2"-3/4")
3. 5329003 G3/4" hexagon nut

11.2.3 Immersion Installation



Installation accessories:

1. 8-201-PFA sensor assembly
2. 5419060 immersion adaptor(1"-3/4")
3. 7202-DO100 DO protective holder 1M
4. Stringing method: 8-26 waterproof cap or
   Coiling method: 8-09-6 circle junction box

Appendix: Calibration Solution

Potassium chloride solution

Conductivity in mS/cm

℃	Conductivity	1.413mS@25 ℃ 0.01mol/l	12.88mS@25 ℃ 0.1mol/l	111.8mS@25 ℃ 1mol/l
0		0.776	7.15	65.41
5		0.896	8.22	74.14
10		1.020	9.33	83.19
15		1.147	10.48	95.52
16		1.173	10.72	94.41
17		1.199	10.95	96.31
18		1.225	11.19	98.22
19		1.251	11.43	100.14
20		1.278	11.67	102.07
21		1.305	11.91	104
22		1.332	12.15	105.94
23		1.359	12.39	107.89
24		1.386	12.64	109.84
25		1.413	12.88	111.8
26		1.441	13.13	113.77
27		1.468	13.37	115.74
28		1.496	13.62	
29		1.524	13.87	
30		1.552	14.12	
31		1.581	14.37	
32		1.609	14.62	
33		1.638	14.88	
34		1.667	15.13	
35		1.696	15.39	
36			15.64	

Sodium chloride solution

Conductivity in mS/cm

℃	Conductivity	10.683mS@25℃ 0.1mol/l	251.3mS@25℃ saturated
0		5.786	134.5
1		5.965	138.6
2		6.145	142.7
3		6.327	146.9
4		6.510	151.2
5		6.695	155.5
6		6.881	159.9
7		7.068	164.3
8		7.257	168.8
9		7.447	173.4
10		7.638	177.9
11		7.831	182.6
12		8.025	187.2
13		8.221	191.9
14		8.418	196.7
15		8.617	201.5
16		8.816	206.3
17		9.018	211.2
18		9.221	216.1
19		9.425	221.0
20		9.631	226.0
21		9.838	231.0
22		10.047	236.1
23		10.258	241.1
24		10.469	246.2
25		10.683	251.3
26		10.898	256.5
27		11.114	261.6
28		11.332	266.9
29		11.552	272.1
30		11.773	277.4

31	11.995	282.7
32	12.220	288
33	12.445	293.3
34	12.673	298.7
35	12.902	304.1
36	13.132	309.5

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