TX 2000
Intelligent pH/ORP Transmitter
Thank you for purchasing Sensorex products. In order to continually improve and enhance the transmitter’s function, Sensorex 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. Sensorex Corporation 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 any omissions, or mistakes in this operation manual, please contact Sensorex Corporation.

### 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.
- 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 3.7 “Illustration of electrical connection” )
Precautions for installation

**Brief Instruction**

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<td>3.66”(93 mm) × 3.66”(93 mm) (H×W)</td>
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Note: The specifications are subject to change without notice.
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 3.66” (93mm) x 3.66” (93mm) on the panel box, and then insert the controller directly into the panel box. Insert the mounting bracket from the rear, and until it is fixed into the pickup groove.

2.2 Illustration of panel mounting

Panel cutout dimensions

Illustration of panel mounting, fixed with mounting bracket

Hole distances on the panel box
2.3 Illustration of wall mounting and pipe mounting

Installation of pipe mounting
Fixed with U-shaped pipe clamp.
(Optional, Order Number: 5333027)

Penetrate the two prepared holes in the rear cover and fix the U-shaped pipe clip, and then install two waterproof squeezed caps (the transmitter’s standard accessory kit) into the holes from inner rear cover to prevent from the water vapor.

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.
2.4 Assembly of electrode and housing

2.4.1 Cable set-up

a. Make sure to remove the conductive rubber or aluminum-foil layer between the electrode signal wire and the coaxial shield.

b. Extend the cable to the transmitter without any joint except specific junction box. Connect the transparent coaxial inner directly to the Glass terminal on the back of transmitter, and metal connect coaxial shield to Ref terminal.

2.4.2 Intentionally left blank

Set-up diagram of coaxial cable:

See the correct set-up method on the left:

Note: The black conductive rubber covering on the coaxial inner should be removed.

Set-up diagram:

[Diagram showing metal coaxial shield and transparent coaxial inner with note to remove conductive rubber]
3. Overview of pH transmitter TX2000

3.1 Illustration of rear panel:

3.2 Illustration of terminal function:
3.3 Description of terminal function:

- **REL1**: First alarm control, contact for an external relay
- **REL2**: Second alarm control, contact for an external relay
- **WASH**: Wash relay contact for an external relay
- **NC**: No connection
- **100~240V AC**: Power supply terminal
- **100~240VAC**: Power supply terminal
- **GLASS**: Coaxial inner wire of pH/ORP electrode signal wire
- **SG**: Solution ground wire. If no solution ground, there should be a jumper between this terminal and REF (14). A short circuit bar is attached when shipped from the factory.
- **T/P**: Connect with one of cable end of temperature probe
- **SG**: Connect with one of cable end of temperature probe
- **DC±12V**: Output terminal of direct current voltage ±12V
- **4~20mA + terminal**: Master measure current output terminal +, for external recorder or PLC control
- **4~20mA - terminal**: Master measure current output terminal -, for external recorder or PLC control
- **4~20mA + terminal/ D+(B)**: Temperature current output terminal +, for external recorder or PLC control (only applicable for TX2000); or RS-485 output D+(B) (only applicable for TX2000RS)
- **4~20mA - terminal G**: Temperature current output terminal -, for external recorder or PLC control (only applicable for TX2000); or RS-485 output GND (only applicable for TX2000RS)
- **NC / D-(A)**: NC or RS-485 output D-(A) (only applicable for TX2000RS or RS-485 output D-(A) (only applicable for TX2000RS)
3.6 Typical wirings

**Two-wire distribution**
*(No solution ground)*

- GND
- REF.
- GLAS
- Coaxial shield
- Short circuit bar
- pH/ORP

**Three-wire distribution**

- GND
- REF.
- GLAS
- Coaxial shield
- Coaxial inner
- pH/ORP

3.7 Illustration of electrical connection

- 100 ~ 240VAC
- HI
- LO
- WASH

- Surge absorber
- Cleaning device
- Dose feeder
- External relay
- Surge absorber

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.
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:

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

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

: 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 device operation indicator and controlling operation indicator (Relay 1, Relay 2)
B.L.: Light sensor; in the automatic display backlit mode, the lamp will light or go out as the change of environmental brightness.
4.4 Display:

1. When the function is activated, the display shows 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 flashes 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 flashes 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 flashes ”pH-mA ▲/ pH-mA ▼” or ”ORP-mA ▲/ ORP-mA ▼”.

4. When the Analog 2 current output exceeds the upper/lower limitation, the display flashes “°C-mA ▲/ °C-mA ▼”.

- Measurement mode
- Set-up mode
- Calibration mode
- Control function on hold
- Measurement unit
- Temperature compensation mode (MTC/ATC)
- Temperature value

Display:

- REL 1-HI
- REL 1-Lo
- REL 2-HI
- REL 2-Lo
- pH-mA ▲
- pH-mA ▼
- ORP-mA ▲
- ORP-mA ▼
- °C-mA ▲
- °C-mA ▼
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 are not functioning. 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.
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 enter 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 6. Press \[ \text{SET} \] and \[ \text{SEL} \] simultaneously to enter into set-up menu. Press \[ \text{SEL} \] go back to measurement mode.

5.3 Calibration menu:
Please refer to the calibration instructions in Chapter 7. Press \[ \text{CAL} \] and \[ \text{SEL} \] simultaneously to enter into calibration menu. Press \[ \text{SEL} \] to go back to measurement mode.

5.4 Shortcuts:
In the measurement mode, if selecting MTC for temperature compensation mode, you may press \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] \[ \text{SEL} \] adjust MTC temperature value.

5.5 Default value:

5.5.1 Setting default value:
Measurement mode: pH
Multi-Cal : 2 points pre-setting
Temperature compensation: MTC 25°C
Relay 1: High point alarm: AUTO, SP1= 10.00 pH, Hys= 0.10 pH
Relay 2: Low point alarm: AUTO, SP2 =04.00 pH, Hys= 0.10 pH
Wash time: OFF
Analog 1 current output (pH/ORP): 4~20 mA, 0.00~14.00pH
Analog 2 current output (Temp): 4~20 mA, 0~100.0°C
Digital filter: 5
Backlight setting: Off
Code set-up: OFF
Date & Time: 2012/1/1 00:00:00  
Contrast: 0
Auto back: Auto, 3 minutes

5.5.2 Calibration default value:
Asy: 0 mV
Slope: -59.15 mV/pH @ 25.0°C
Calibration type: TECH-No Cal
Calibration value: None data
Auto back: Auto, 3 minutes

Note: The factory default of calibration presetting is “No Cal”, and the calibration value is “None”. This means that the user has not calibrated the sensor with the transmitter yet. After finishing every calibration, the display shows the calibration type and the calibration value. If the equipment have not been calibrated yet, the measurement takes pre-set Asy and Slope into calculation. The factory default values are subject to change without notice.
6. Settings

Block diagram of setting-part 1
Block diagram of setting-part 2

CONTINUED FROM PREVIOUS PAGE

Relay 2 Setting → Clean Setting → Analog 1 pH/ORP Output 1 → Select Clean On/Off

→ Auto → Input Clean Active Time

→ Input Shut down Time → Input Clean Hys. Time → Clean Test

→ Analog 2 Temp. Output 2 → Select 0/20mA or 4/20mA

→ Select 0–20mA or 4–20mA → Value corr. to 0 or 4mA → Value corr. to 0 or 4mA

→ Value corr. to 20mA → Value corr. to 20mA

→ Clock Setting → Select Clock On/Off

→ ON → Set Year → Set Date → Set Time

→ Digit Filter Setting → Select Clock On/Off

→ Number of Signal Average → Set Year

→ Set Date → Set Time

→ Back Light Setting → Input Brightness

→ Input Brightness → Input Sensitivity

→ Contrast Setting → Auto

→ On → Off → Contrast

→ Auto → Manual Exit

→ Return Timer → Return Setting

→ Code Setting

Return to previous level/action
6.1 Entry of set-up menu

In the measurement mode, pressing the two keys and simultaneously allows you enter the overview of current setting, and press to enter the set-up mode to modify the setting if necessary.
6.2 Security code of settings

After entering set-up mode, select “code” item, press 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.

When a wrong password is keyed in, the display shows “Error Code”, press to re-key it in, or press to exit.

The first ‘0’ of digits ‘0000’ start to flash. Press or adjust the value, and then press to confirm it and continually key in the next digit, and so on.

(Select to turn on or turn off code protection function. If you select turn on, please key in a new code. There will be a code requirement showing in display when you re-enter to the setup mode. Key in the correct password to enter into setup mode.)

Key in new password

Press to confirm it.
6.3 Language

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

Press \( \) to confirm it.

Press or \( \) to select language type

Press or \( \) to select language type

Press \( \) to confirm it.

Enter “Measurement Mode” Setup
6.4 Mode
Enter setup of “Mode”. Select between “pH” or “ORP” measurement.

Press to confirm it.

Press or to select between pH or ORP

Press to confirm it.

Enter "Multi-Cal" Setup
6.5 Multi-Cal

Enter setup of multi-points calibration to set the number of calibration points.

Press to confirm it.

Press or to select the number of calibration points. There are 1~3 points to choose from. The factory default is 2 points. When the calibration reaches the number of setting points, the calibration procedure will automatically finish and display the calibration result.

Press to confirm it.

Enter "Temperature" Setup

6.5.5 Product Adjustment

Allows offset adjustment to measurement. Should be set to 0.00 as default. When Product Adjustment is not 0.00 you will see "PDT" on display above the pH unit.
6.6 Temperature
Enter setup of “Temperature” to select temperature compensation mode. Select from NTC(NTC 30K), PTC(PT 1K) or MTC(Manual adjustment).

Press \(\text{[Enter]}\) to confirm it.

Press or \(\text{[Select]}\) to select

Press \(\text{[Enter]}\) to confirm it.

Use standard thermometer to test the actual temperature of the solution, and press or \(\text{[Select]}\) to input the correct temperature value.

Press \(\text{[Enter]}\) to confirm it.

If necessary, compare with the actual temperature value tested by standard thermometer. Press or \(\text{[Select]}\) to input the modified value.

Press \(\text{[Enter]}\) to confirm it.

Enter “Relay 1” Setup
6.7 Relay 1
Enter setup of Relay 1. Select the item to turn on or turn off 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).
6.8 Relay 2

Enter setup of Relay 2. Select the item to turn on or turn off 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 low point alarm).
6.9 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 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 default to the last measured value before cleaning. If entering setting menu or calibration menu during clean status, the instrument will stop clean status automatically.
6.10 Analog output 1 (pH/ORP)
Enter setup of Analog 1. Select 0~20mA or 4~20mA current output. Set the related value to the range of pH/ORP measurement. If the range of the pH/ORP 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, to ensure 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.

Enter “Analog 2” Setup(Temperature)
6.11 Analog output 2 (Temperature)
Enter setup of Analog 2. Select 0~20mA or 4~20mA current output. Set the related value to the range of temperature measurement. If the range of the temperature 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.

Enter “Date/Time(Clock)” Setup

Press to confirm it.
6.12 Date/Time(Clock)
Enter setup of Date/Time(Clock). Set the “Year”, “Month”, “Date”, “Hour”, and “Minute” time. If you select to turn off the clock function, the clock will not display in measurement mode. The calibration time of calibration record will also show ”OFF” at the calibration overview display. Note: The clock needs to be reset in the event of a power failure.

Press \[\text{ }\] to confirm it.

Press \[\text{ }\] or \[\text{ }\] to select to activate Clock function or not. If not, the guide menu goes to setup of Digital filter.

Press \[\text{ }\] to confirm it.

Press \[\text{ }\] or \[\text{ }\] to set the month part, and press \[\text{ }\] to move to adjust the date part.

Press \[\text{ }\] to confirm it.

Press \[\text{ }\] or \[\text{ }\] to set the hour part, and press \[\text{ }\] to move to adjust the minute part.

Press \[\text{ }\] to confirm it.

Enter “ Sample average of measurements (Digital Filter) ” Setup
6.13 Sample average of measurements (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.

Press \textcircled{■} to confirm it.

Press \textcircled{■} or \textcircled{□} to set the number of sample to be averaged.

Press \textcircled{ ■} to confirm it.

Enter “Back Light” Setup
6.14 Backlight settings
Enter setup of backlight display. Set the brightness of display (-2~2, dark~bright) and sensitivity of the sensitization sensor (-2~2, insensitive~sensitive). When a key is pressed, the touch-on backlight function will be activated. Regardless of the type of backlight mode, the touch-on function will activate the backlight. If there is no keystroke for 5 seconds, the display will return 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.
6.15 Contrast settings

Enter setup of display contrast. Set the contrast of display according to (-2, -1, 0, 1, 2, light to dark)

- Press to confirm it.
- Press or to select display contrast level.
- Press to confirm it.

Enter “Auto return mode (Return)” Setup
6.16 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 will automatically exit the setup menu and return to measurement mode after a period of time without pressing any key.

Press \( \text{to confirm it.} \)

Press \( \text{or} \) \( \text{to select Auto return or manual exit.} \)

Press \( \text{to confirm it.} \)

Press \( \text{or} \) \( \text{to adjust “minute” part, and press} \) \( \text{to confirm it and move to” second” part.} \)

Press \( \text{to confirm it.} \)

Enter “Password (Code)”Setup
7. Calibration

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

Press  and  simultaneously

Press  or

Press  to confirm it.

Press  to go back to
measurement mode

Press  to go back to
measurement mode

Enter Calibration setup menu
7.2 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”**.

If you input a wrong code, then the display shows “Error Code” message. Press \( \text{Back} \) to input another code, or press \( \text{Enter} \) to exit the calibration menu.

The first ‘0’ of digits ‘0000’ start to twinkle. Press \( \text{▲} \) or \( \text{▼} \) to adjust the value, and then press \( \text{Enter} \) to confirm it and continually key in the next digit, and so on.

(Select to turn on or turn off code protection function. If you select turn on, please key in a new code. There will be a code requirement showing in display when you re-enter to the setup mode. Key in the correct password to enter into calibration setup menu.)

Press \( \text{Enter} \) to confirm it.

Enter “TECH, NIST, Any” Calibration
7.3 pH Calibration

The instrument provides multi-point standard buffer solution calibration. You may decide how many points to calibrate the measurement system (up to 3-point). The principle is according to “Method of Least Squares”. Apply linear regression to calibration the electrode’s slope and zero point (Any, Offset or Zero point). When calibrating a electrode, you may calibrate 1 to 3 point in any sequence to provide linear regression for mV and pH multi-calibration of a electrode, and to show the electrode’s slope and zero point (Any, Offset or Zero point) at 25°C. The electrode’s slope rate which is actual slope divided by theoretical slope and the sensitivity shows in percentage in the display. In addition, the display shows the linear regression determination coefficient, R², of the electrode and buffer solution to provide you an estimation of an electrode’s regression suitability. According to different combination of standard buffers, the TECH, NIST, Any buffer solution calibration modes are provided.

7.3.1 TECH mode

The electrode is automatically calibrated according to pH value and temperature of TECH standard buffers (pH4.01, pH7.00, pH10.00). The range of zero point and slope of the electrode is also determined. If one of them is over the range, the display shows error message of zero point and slope failure. (See appendix Table 1, pH/temperature table of TECH standard buffers)

7.3.2 NIST mode

The electrode is automatically calibrated according to pH value and temperature of NIST standard buffers (pH1.68, pH4.01, pH6.86, pH9.18, pH 12.45). The range of zero point and slope of the electrode is also determined. If one of them is over the range, the display shows error message of zero point and slope failure. (See appendix Table 2, pH/temperature table of NIST standard buffers)

7.3.3 Any mode

The electrode measures mV value of different standard solutions. According to theoretic slope and the temperature of standard solutions, the display shows an approximate pH value. Then, you can calibrate the electrode by freely adjusting the pH value to those of the standard solutions. There is not a zero point range failure determination by the instrument but only the slope range determination. If the slope is over the range, the display shows error message of slope failure.
### 7.3.4 Definition of calibration parameter

You can calibrate the electrode by one point or up to three points of standard solutions in any sequence. As different calibration point method is applied, the definition of the zero point and slope will be different.

<table>
<thead>
<tr>
<th>Calibration point</th>
<th>Determination</th>
<th>The showed calibration value</th>
</tr>
</thead>
</table>
| One point calibration   | Asy           | Zero point (Asy, offset or Zero point)= Asy  
1. If not calibrated, Slope = Theoretical slope  
2. If calibrated, Slope = Slope of last calibration |
| Two or three point calibration | Asy | Zero point (Asy, offset or Zero point)= Asy  
Slope = Slope*  
Note: To obtain a new zero point(Asy) and Slope by applying linear regression. |
|                         | Slope         |                                                                                               |
7.3.5 TECH, NIST buffer Calibration

The procedure below is two-point calibration of TECH buffer. (The procedure is same as NIST buffer mode.) First, enter the setup of Multi-points calibration and set the number of calibration point to 2. (See chapter 6.5 Multi-Cal) Then, go to Calibration menu and select TECH mode. Follow the procedure diagram below. For three-point calibration, you will need to set 3 points in the Multi-Cal setting in advance. The calibration procedure will then be the same.

1. Clean the electrode with distilled water and then put it into the second buffer. If under MTC temperature mode, press or to adjust temperature value. Or press to decide to simply make a single point calibration.

2. Press to confirm it.

3. Obtain the pH value of second point buffer solution. The instrument measures the mV value of the buffers. Press to directly show the determination result, or wait and the result will automatically display.

4. Clean the electrode with distilled water and then put it into the first buffer. If under MTC (Manual Temp. Compensation) temperature mode, press or to adjust temperature value.

5. Press to confirm it.

6. Obtain the pH value of first point buffer solution. The instrument measures the mV value of the buffers. Press to directly show the result, or wait and the result will automatically display.

7. Press to confirm it.

Obtain the pH value of second point buffer solution.

Clean the electrode with distilled water and then put it into the second buffer.

If under MTC temperature mode, press or to adjust temperature value. Or press to decide to simply make a single point calibration.

The instrument measures the mV value of the buffers. Press to directly show the determination result, or wait and the result will automatically display.

Press or to change the page of calibration result display.
7.3.6 Any Calibration

The procedure below is two-point calibration of Any mode. First, enter the setup of Multi-points calibration and set the number of calibration point for 2. (See chapter 6.5 Multi-Cal) Then, go to Calibration menu and select “Any” mode. Follow the procedure diagram below. For three-point calibration, you will need to set 3 points in the Multi-Cal setting in advance. The calibration procedure will then be the same.

Clean the electrode by distilled water and then put it into the first buffer. If under MTC (Manual Temp. Compensation) temperature mode, press or to adjust temperature value. If under MTC temperature mode, press or to adjust temperature value.

The instrument measures the mV value of the buffers. Press or to adjust pH value.

Obtain the pH value of the first point buffer solution. Press or to adjust pH value.

Press to confirm it.

Obtain the pH value of the second point buffer solution. Press or to adjust pH value.

Press to confirm it.

Press or to change the page of calibration result display.
7.4 ORP Calibration

Under ORP measurement mode, enter calibration setup menu. Select Calibration icon, and adjust mV value. The adjustable range is from -300mV to 300mV.

1. Put the ORP electrode into ORP standard solution. Press \( \frac{O}{R} \) to adjust the main display value until it is equal to the desired mV value.

2. Press \( \frac{O}{R} \) to confirm it.

3. Calibration Info:
   1. Cal.Time: 2018/01/01 00:00
   2. Mode: ORP Calibration
   3. ORP relative: 0mV
   4. Return: Auto: 3.00

Press \( \frac{O}{R} \) to confirm it.
7.5 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 calibration setup menu manually, while “Auto” means that the display automatically exit the calibration setup menu and back to measurement mode after a period of time without pressing any key.

Note: The return function of setup menu and calibration setup menu are independent settings.
## 8. Error messages (Error code)

<table>
<thead>
<tr>
<th>Messages</th>
<th>Reason</th>
<th>Dispositions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Error1</strong></td>
<td>Asy (Zero-point) exceeds upper/lower limitation</td>
<td>1. Please use new buffers.&lt;br&gt;2. Clean the electrode or change to a new electrode, and make another calibration.</td>
</tr>
<tr>
<td><strong>Error2</strong></td>
<td>Slope exceeds upper/lower limitation</td>
<td>1. Please use new buffers.&lt;br&gt;2. Clean the electrode or change to a new electrode, and make another calibration.</td>
</tr>
<tr>
<td><strong>Error3</strong></td>
<td>The readout is unstable</td>
<td>1. Check whether there is bubble or air in the glass end of the electrode&lt;br&gt;2. Clean the electrode or change to a new electrode, and make another calibration.</td>
</tr>
<tr>
<td><strong>Error4</strong></td>
<td>1. The temperature is over the range 0~50°C during calibration.&lt;br&gt;2. Buffer cannot be recognized</td>
<td>1. Please adjust the standard solution to the proper temperature range.&lt;br&gt;2. Please check whether there is bubble or air in the glass end of the electrode, or maintain the electrode or change a new electrode, and make another calibration.</td>
</tr>
<tr>
<td><strong>Error5</strong></td>
<td>Wrong password</td>
<td>Re-enter a password</td>
</tr>
<tr>
<td><strong>Error9</strong></td>
<td>Serious error that does not permit any further measuring</td>
<td>Please contact Sensorex Technical Support.</td>
</tr>
</tbody>
</table>
9. Maintenance

Generally speaking, under normal operation, the transmitter needs no maintenance except regular cleaning and calibration of the electrode to ensure accurate and stable measurement and system operation.

The cleaning cycle for the electrode depends on the pollution degree of the measurement sample. Normally, it is recommended to make weekly cleaning. Consult your electrode instruction manual for detailed cleaning and care directions.
## Appendix

Table 1  TECH Buffers

<table>
<thead>
<tr>
<th>TEMP°C</th>
<th>Buffer 4.01</th>
<th>Buffer 7.00</th>
<th>Buffer 10.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>3.999</td>
<td>7.087</td>
<td>10.241</td>
</tr>
<tr>
<td>10</td>
<td>3.998</td>
<td>7.053</td>
<td>10.155</td>
</tr>
<tr>
<td>15</td>
<td>3.999</td>
<td>7.031</td>
<td>10.116</td>
</tr>
<tr>
<td>20</td>
<td>4.002</td>
<td>7.011</td>
<td>10.047</td>
</tr>
<tr>
<td>25</td>
<td>4.006</td>
<td>6.996</td>
<td>9.998</td>
</tr>
<tr>
<td>30</td>
<td>4.011</td>
<td>6.985</td>
<td>9.952</td>
</tr>
<tr>
<td>35</td>
<td>4.018</td>
<td>6.976</td>
<td>9.925</td>
</tr>
<tr>
<td>40</td>
<td>4.031</td>
<td>6.971</td>
<td>9.874</td>
</tr>
<tr>
<td>45</td>
<td>4.047</td>
<td>6.969</td>
<td>9.843</td>
</tr>
<tr>
<td>50</td>
<td>4.055</td>
<td>6.969</td>
<td>9.810</td>
</tr>
</tbody>
</table>

Table 2  NIST Standard buffers

<table>
<thead>
<tr>
<th>TEMP°C</th>
<th>Buffer 1.68</th>
<th>Buffer 4.01</th>
<th>Buffer 6.86</th>
<th>Buffer 9.18</th>
<th>Buffer 12.45</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>1.670</td>
<td>4.000</td>
<td>6.923</td>
<td>9.332</td>
<td>13.003</td>
</tr>
<tr>
<td>15</td>
<td>1.672</td>
<td>3.999</td>
<td>6.900</td>
<td>9.276</td>
<td>12.810</td>
</tr>
<tr>
<td>20</td>
<td>1.675</td>
<td>4.001</td>
<td>6.881</td>
<td>9.225</td>
<td>12.627</td>
</tr>
<tr>
<td>30</td>
<td>1.683</td>
<td>4.012</td>
<td>6.853</td>
<td>9.139</td>
<td>12.289</td>
</tr>
<tr>
<td>35</td>
<td>1.688</td>
<td>4.021</td>
<td>6.844</td>
<td>9.102</td>
<td>12.133</td>
</tr>
<tr>
<td>40</td>
<td>1.694</td>
<td>4.031</td>
<td>6.838</td>
<td>9.068</td>
<td>11.984</td>
</tr>
<tr>
<td>45</td>
<td>1.700</td>
<td>4.043</td>
<td>6.834</td>
<td>9.038</td>
<td>11.410</td>
</tr>
</tbody>
</table>