OHAUS®

ST400 Portable pH Meter and ST400M Portable Multi Parameter Meter Instruction Manual

TABLE OF CONTENTS

1 INTRODUCTION

Thank you for choosing OHAUS.

Please read the manual completely before using the ST400 portable pH and ST400M portable pH & conductivity meter to avoid incorrect operation.

ST400 series have an excellent performance and are designed with many useful features. Ohaus also offers other accessories such as electrodes for different applications as well as buffer solutions.

ST400 & ST400M have many unique designs: including IP67 waterproof and dustproof design, rechargeable lithium battery; large LCD display, data storage, and indication of electrode status.

You will find more practical features of the ST400 & ST400M in use. Some of these features include:

- pH and conductivity* measurements with 1000 sets of data storage;
- Dot matrix LCD display, showing a clear reading;
- Multiple sets of pH buffer groups and multiple conductivity standards*, adaptable to your different needs;
- Work with Ohaus IP67 pH electrode and conductivity electrode*, truly waterproof and suitable for harsh environments.

* Only applies to ST400M.

1.1 Definition of Signal Warnings and Symbols

Safety notes are marked with signal words and warning symbols. These show safety issues and warnings. Ignoring the safety notes may lead to personal injury, damage to the instrument, malfunctions and false results.

Signal Words

WARNING	For a hazardous situation with medium risk, possibly resulting in injuries or death if not avoided.
CAUTION	For a hazardous situation with low risk, resulting in damage to the device or the property or in loss of data, or injuries if not avoided.
Attention	For important information about the product.
Note	For useful information about the product

Warning Symbols


General hazard


Explosion hazard


Corrosive hazard

~ Alternating current

⎓ Direct current

1.2 Safety Precautions

CAUTION: Read all safety warnings before installing, making connections, or servicing this equipment. Failure to comply with these warnings could result in personal injury and/or property damage. Retain all instructions for future reference.

- Verify that the AC adapter's input voltage range and the plug type are compatible with the local AC mains power supply.
- Make sure that the power cord does not pose a potential obstacle or tripping hazard.
- Do not position the equipment such that it is difficult to reach the power connection.
- Operate the equipment only under ambient conditions specified in these instructions.
- Do not operate the equipment in hazardous or unstable environments.
- Disconnect the equipment from the power supply when cleaning.
- Use only approved accessories and peripherals.
- When shipping or transporting this product, follow the applicable regulations for equipment containing lithium-ion batteries.
- Service should only be performed by authorized personnel.

Intended Use

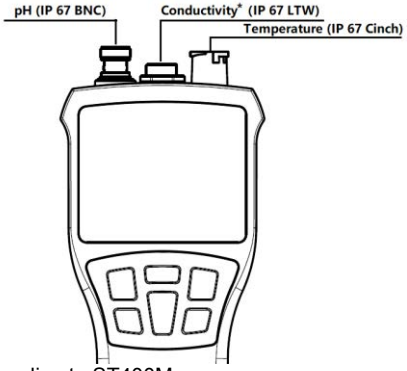
Use the equipment exclusively for measuring the parameters described in these operating instructions. Any other type of use and operation beyond the limits of technical specifications, without written consent from OHAUS, is considered as not intended.

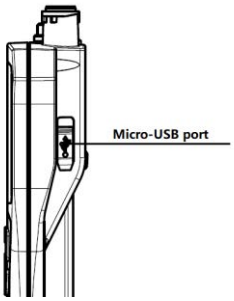
This instrument complies with current industry standards and the recognized safety regulations; however, it can constitute a hazard in use.

If the instrument is not used according to these operating instructions, the intended protection provided by the instrument may be impaired.

1.3 Display and controls

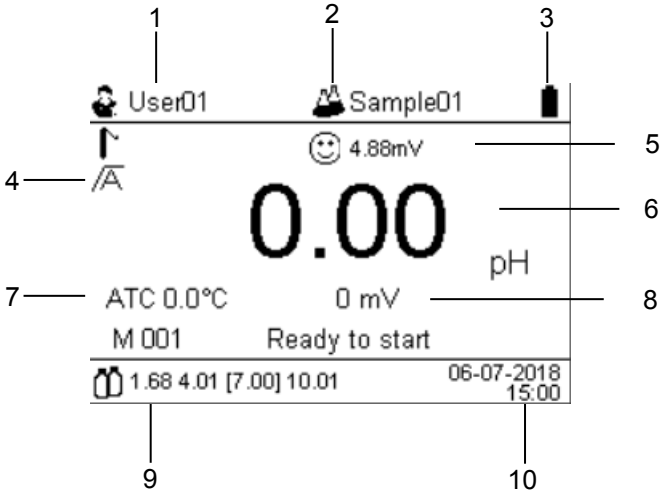
Connections





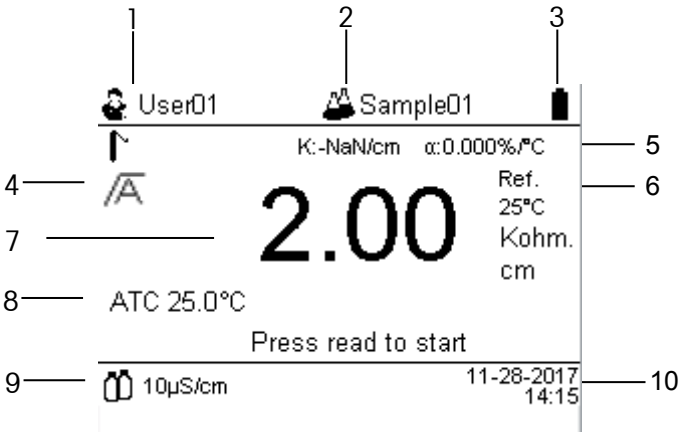
*Only applies to ST400M

pH Displays



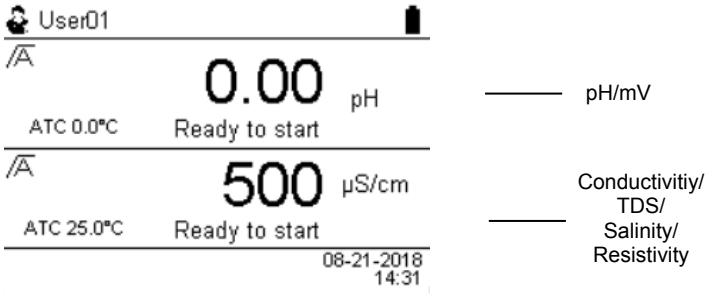
1. User ID
2. Sample ID
3. Battery status icon
4. Endpoint mode
5. Electrode slope and offset
6. pH
7. ATC or MTC, temperature
8. mV
9. Calibrated pH points
10. Date and time

Conductivity Displays*



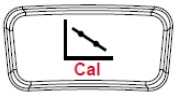
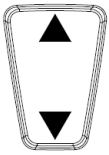
1. User ID
2. Sample ID
3. Battery status icon
4. Endpoint mode
5. Cell constant (K) and temperature correction coefficient value
6. Reference temperature
7. Conductivity / TDS / Salinity / Resistivity
8. ATC , temperature
9. Calibrated conductivity point
10. Date and time

Two-parameter Displays*



*Only applies to ST400M

Controls

button	Press & release	Press & hold for 3 seconds
	Exit and return to measurement screen	Meter turn on/turn off
	Start calibration	
	Start or stop measurement	
	- Store current reading to memory - Scroll up through the memory	
	- Switch pH and conductivity* - confirm setting	Enter setup mode
	- Increase value during setting - Decrease value during setting - switch between Conductivity, TDS, Salinity and Resistivity* - switch between pH and mV	

*Only applies to ST400M

2 INSTALLATION

Carefully remove your meter and each of its components from the box.

2.1 Package contents

ST400 is available in three different package configurations:
ST400 /B is the basic package, doesn't contain electrodes;

STARTER 400 /B	Units	Remarks
ST400	1	
Rubber cover	1	
Adapter 5V	1	
Nylon, Belt	1	
USB cable	1	

In addition to ST400/B content, ST400/F package also include the electrode and buffer powder. .

STARTER 400 /F	Units	Remarks
ST400/B	1	
IP67 ST320	1	3-in-1 plastic refillable pH Electrode, 3 m cable
Buffer powder set	1	4.01；7.00； 10.01

In addition to ST400/F content, ST400 /G also includes a portable bag.

STARTER 400 /G	Units	Remarks
ST400 /F	1	
Portable bag	1	

ST400M is available in three different package configurations:
ST400M /B is the basic package, including portable meter, doesn't contain electrodes;

STARTER 400M /B	Units	Remarks
ST400M	1	
Rubber cover	1	
Adapter 5V	1	
Nylon, Belt	1	
USB cable	1	
1413 µS/cm standard solution	1	standard solution, only use once
12.88 mS/cm standard solution	1	

In addition to ST400M/B, ST400M /F also includes IP67 ST320 electrode and STCON3 electrode.

STARTER 400M /F	Units	Remarks
ST400M /B	1	
IP67 ST320	1	3-in-1 plastic refillable pH Electrode, 3 m cable
IP67 STCON3	1	Optimal detection range:70µS/cm ~200mS/cm, 3 m cable
Buffer powder set	1	4.00; 7.01; 10.01

In addition to ST400M/F, ST400M /G also includes a portable bag.

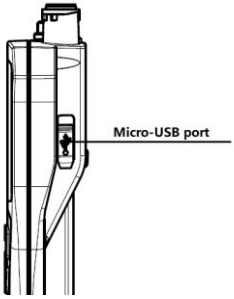
STARTER 400M /G	Units	Remarks
ST400M /F	1	
Portable bag	1	

Each pH buffer powder should be dissolved in 250ml pure water or deionized water in a volumetric flask. You can also order the bottled buffer solution from Ohaus.

Additional electrodes, solutions, accessories and spare parts are available. Please contact Ohaus for more details.

2.2 Meter charging

The ST400 and ST400M are rechargeable portable meters. The real-time power supply status will be displayed on the upper right corner of the screen. The red light on the upper left corner of the screen will be flashing to indicate low power, which reminds user to charge the meter. The charging port is located on the right side of the meter, which can be accessed by pulling out the rubber protection cover. To charge the meter, connect the Micro-USB end of the charging cable to the charging port and the USB type A end to the AC adapter, or to the USB port of a personal computer. The normal full charging time is about 8 hours, and the red light in upper left corner will turn into a blue light when the battery is full.



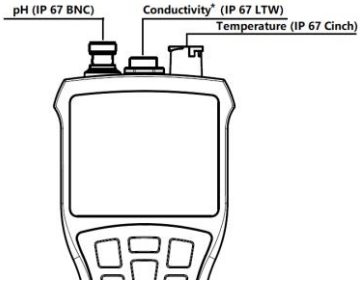
CAUTION: This product contains a lithium-ion battery.

- Only charge the battery when the ambient temperature is between 5°C and 40℃ (41° F and 104 °F)
- Stop charging the battery if charging is not completed within the specified time.
- Stop using the product if the battery becomes abnormally hot, or if there is an oder, discoloration or deformation.
- Stop using the product if abnormal conditions are detected during use, charging or storage.

2.3 Connect the electrodes

There are 3 sockets for the electrode. “pH” socket (IP67,BNC); “TEMP.” Socket (IP67, Cinch) and “IP67, LTW” Socket for conductivity electrode*.

For ST320 3-in-1 electrode, connect both the BNC and Cinch socket.



*Only applies to ST400M

3 ST400 ST400M OPERATION

Long press  button for 2 seconds to turn on the meter.

After turning on the meter, the default mode is pH mode, press ▲ button and ▼ button to switch between pH and mV, press  button to switch to conductivity mode, press ▲ button and ▼ button to switch between Conductivity, TDS, Salinity, Resistivity*.

3.1 Menu directory

The menus of first and secondary directory for STARTER 400/400M:

Setup	**System settings**	User ID
		Sample ID
		Language
		Date & Time
		Backlight
		Beep
		Auto power off
	pH Settings	Temperature compensation
		Temperature
		Temperature unit
		Buffer group
		Continuous measurement
		End point
		Sensor ID
	Conductivity Settings*	Calibration standard
		Reference temperature
		Temperature unit
		Alpha-Coefficient
		TDS factor
		End point
		Sensor ID
	Sensor management	Review
		Create
		Delete
	Data management	Review
		Delete
	Factory reset	Reset settings
		Reset all
	User help	

*Only applies to ST400M portable meter

3.2 Setup

3.2.1 System setup

In the measurement mode, long press  button (more than 3 seconds) to enter the setup mode. Press ▲ button and ▼ button to select the system settings, press  button to enter the system settings.

User ID**,** the system allows a maximum of 5 user IDs.(less than 8-Bit characters, it can be numbers or uppercase or lowercase letters), press ▲ button and ▼ button to select the desired user ID you want to set, long press  ,the cursor blinks, press ▲ button or ▼ button to select between uppercase letters, numbers and lowercase letters, press  to confirm the current selection, it will automatically jump to the next character. When the settings are completed, press the  button to confirm the settings and return to the parameter settings.

Sample ID**,** the system can set up to five sample IDs (less than 8-bit characters, which can be numbers or uppercase letters or lowercase letters). The user can change the ID according to the method mentioned above.

Language, system is built-in with six languages (English, German, French, Spanish, Italian, Chinese), press ▲ button and ▼ button to select, press  to confirm.

Date and Time, press ▲ button and ▼ button to change the time and date, date format, time format.

Backlight, press ▲ button and ▼ button to select between Low, Medium, High, Off. Press  to confirm.

Beep**,** press ▲ button and ▼ button to select on or off.

Auto power off**,** press ▲ button and ▼ button to select on or off. When auto power off is on, the meter will automatically shut down when no operation in 15 min (Not in continuous measurement mode).

3.2.2 pH Setting

In the setup mode, press ▲ button and ▼ button to select pH settings, press  to enter the pH settings. There are the following settings:

Temperature compensation (ATC automatic temperature compensation or MTC manual temperature compensation); the electrode with built-in temperature probe is recommended, If you use 2-in-1 electrode to measure pH, it is recommended to work with a temperature probe. Unnecessary measurement errors can be avoided in the ATC mode.

Temperature (MTC mode); if MTC mode is used, all buffers and sample solutions should be kept at the same setting temperature as far as possible.

In order to ensure accurate measurement of the pH value, the pH electrode should be regularly calibrated.

Temperature unit, Celsius or Fahrenheit; Note: ℃ = 5/9 (℉ - 32)

Buffer groups**,** users can choose between United States, Europe, MERCK, DIN19266, DIN19267 and other buffer groups, see the appendix.

Continuous measurement**,** users can choose switch on or off the continuous mode. If you choose to use continuous measurement, you need to set the timing value which means how long an endpoint result will be recorded, the default timing value is 15s which means the meter will record results every 15 seconds. When you return to pH measure screen, "continuous measure" will show.

Note: After the continuous measurement is completed, please export the data and empty the instrument memory. The continuously measured data cannot be displayed on the meter.

End point : automatic end-point or manual end-point mode.

- In the manual end-point mode, the meter will always show “measuring” before pressing the measure-button. If reading is no longer changed by artificial judgment, then press 

button to confirm the reading, the meter will show “measurement finished”.
- In the automatic end-point mode, performing measurement or calibration, the meter will display “measuring or calibrating”. The meter can determine the endpoint automatically, then display “measurement finished”.
- Endpoint criteria: pH measurement: (Low)-The signal may not change by more than 0.6 mv/0.6pH in 4 seconds. (medium) – The signal may not change by more than 0.15mV/0.1pH in 6 seconds. (High)-The signal may not change by more than 0.18mV/0.18 pH in 8 seconds. Conductivity measurement- input signal may not change by more than 0.4% from the average conductivity of the probe in 6 seconds.

Sensor ID, user can view the sensor ID

3.2.3 Conductivity Setting*

In the setup mode, press ▲ button, ▼button and  button to enter conductivity setting. There are the following settings:

Calibration standard: User can select calibration standard between 10, 84, 500, 1413, 12880 µs/cm, which is closest to the sample value.

Reference temperature**:** the temperature used in temperature compensation, default value is 25°C

Temperature unit, Celsius or Fahrenheit; Note: ℃ = 5/9 (℉ - 32)

Alpha-Coefficient: For different samples, the conductivity value varies with temperature. Generally, the default value of Alpha-Coefficient for ordinary water sample is 2%/℃. If you set the temperature correction coefficient value as 0 %/°C, that means NO Temperature Compensation for the conductivity measurement. The meter displays the real conductivity value at current temperature. The temperature correction coefficient of different samples is different. Please confirm the temperature of the sample.

TDS factor: The conversion coefficient that was converted from the conductivity to the TDS.

Endpoint: you can choose automatic end-point mode or manual end-point mode. The rule of automatic conductivity end-point is that the temperature change doesn't exceed 0.3 degrees and the numerical value (conductance, TDS or salinity value) change doesn't more than 5 within 12 seconds.

Sensor ID, user can view the sensor ID

*only apply to ST400M

3.2.4 Sensor management

In the setup mode, press ▲ button, ▼ button and  button to enter sensor management, to review, create or delete electrode ID.

pH electrode or conductivity electrode can set five IDs and one default ID. The calibration data is stored according to the electrode ID, and each ID can store last calibration records.

Review, press ▲ button and▼ button to choose sensor type (pH or conductivity*), select the sensor to review the calibration data.

Create, press ▲ button and▼ button to choose sensor type (pH or conductivity*),then follow the cursor press ▲ button and▼ button to name the sensor.

Delete, press ▲ button and▼ button to choose sensor type (pH or conductivity*), select and delete the sensor and its calibration data.

3.2.5 Data management

In the setup mode, press ▲ button, ▼ button and  button to enter data management, to review or delete data.

The stored measurement data records include as follow:

Date, time, user ID, sample ID, electrode ID, measurement results, measurement mode, measurement temperature, end-point mode, * reference temperature (conductivity), * temperature correction coefficient (conductivity).

The meter can restore 1000 measurement records. For ST400M, the conductivity and pH records can be added to 1000 storage records.

3.2.6 Factory reset

Reset settings: Reset user ID, backlight, pH setting, conductivity setting, etc. Please restart the instrument after confirmation.

Reset all: Reset settings and delete all the calibration and measurement data. Please restart the instrument after confirmation.

3.3 pH Calibration

3.3.1 Buffer group

Meters can perform **1-5 point** calibrations.

- The purpose of the calibration is to convert the corresponding electrical signal (mV value) of the pH electrode to a pH value. As the electrode storage time becomes longer or the electrode being constantly used, the electrical signal of the same electrode in the same sample (such as standard buffer) will be different, so regular calibrations are required.
- Calibrate the pH electrode for the first use or after a period of time.

There are 6 buffer groups built-in the meter, you can select the buffer group in the pH setting→ buffer group, default buffer group is [OH US] **(US standard)**, and the buffer value will be automatically recognized during calibration.

The 6 predefined buffer groups are (at 25°C):

1	**1.68**	**4.01**	**7.00**	**10.01**	
2	2.00	4.01	7.00	9.21	11.00
3	2.00	4.00	7.00	9.00	12.00
4	1.680	4.008	6.865	9.184	12.454
5	1.09	4.65	6.79	9.23	12.75
6	1.680	4.003	6.864	9.182	12.460

For example, after the sixth group is selected, the meter uses the data in the following table to calibrate the actual value of the buffer corresponding to the real-time temperature during calibration at 0.01 pH accuracy. E.g. a pH 9.18 buffer solution is calibrated at 20 °C. The instrument should display the calibration value of 9.23. See the Appendix for the table of other buffer changes with temperature:

5 °C	1.67	4.00	6.95	9.39	13.21
10 °C	1.67	4.00	6.92	9.33	13.01
15 °C	1.67	4.00	6.90	9.28	12.82
20 °C	1.68	4.00	6.88	**9.23**	12.64
25 °C	**1.68**	**4.00**	**6.86**	**9.18**	**12.46**
30 °C	1.68	4.01	6.85	9.14	12.29
35 °C	1.69	4.02	6.84	9.11	12.13
40 °C	1.69	4.03	6.84	9.07	11.98
45 °C	1.67	4.00	6.95	9.39	13.21
50 °C	1.67	4.00	6.92	9.33	13.01

3.3.2 Performing 1-point calibration

Place the pH electrode in the buffer, and press 

button to enter the calibration mode, and continue to press 

button to start calibration. During the calibration, the "calibrating" is displayed at the bottom of the screen, and the 

is displayed at the top of the screen. After the first calibration point complete, “press the calibration button to continue calibration” will be displayed at the bottom of the screen. The corresponding calibration buffer is displayed and stored.

The 1-point calibration is finished. There are now 2 options (OHAUS recommends conducting at least a 2-point calibration);

1. When performing calibration, Ohaus recommends using **Auto End Point Mode.** Press button- 

to continue calibration.
2. Press button- 
to complete the calibration, the offset and the slope are shown on the top right corner of the screen then return to the measurement screen.

Note: With the 1-point calibration, only the **offset** is adjusted. If the sensor was previously calibrated with multi-point calibration, the stored **slope** will remain. Otherwise theoretical **100% slope** (-59.16 mV / pH) will be used.

3.4 Performing Multi-point calibration

- Perform 1-point calibration as described above.
- Rinse the pH electrode with pure water.
- Place the electrode in the next calibration buffer, stir and wait for a few seconds, then press button- 

, “*Calibrating*” displays on the bottom of the screen.

The meter reaches the calibration endpoint with the result display on the screen. The 2 point calibration is finished. Then you can continue to do the 3-point calibration, 4-point calibration and 5-point calibration, or stop the calibration.

Note: If the electrode calibration fails, "calibration error" will be displayed at the bottom of the screen, and the calibration results are not saved.

3.5 pH measurement

3.5.1 pH measurement

- Calibrate and make sure the electrode is in good condition, then start pH measurement.
- Place the electrode in the sample, stir and wait several seconds.

- Press  to start the pH measurement, “measuring” appears on the display. Auto or manual endpoint mode can be used, the pH value with the temperature will display on the screen with an asterisk on the left.

If the repeatability is poor in the automatic end point mode, or it cannot reach auto end point for a long time, it is suggested to use the manual end point mode.
Sometimes the repeatability is poor because an ordinary electrode was used to measure special sample (such as juice, milk, distilled water, tap water etc.) It is recommended to use special pH electrode, such as ST230 turbidity sample electrode, pure water electrode. For application and selection of pH electrode, please consult the relevant personnel or technical support.

The pH value of tap water is not the same everywhere, and tap water is usually a low ionic system. Typically, the pH electrode needs a long time to reach the end-point, and the repeatability is poor. It cannot be used to judge the quality of ordinary electrodes or meters.

3.5.2 mV measurement

- Press▲▼ button to switch between **pH** and **mV measurement**.
- Follow the same procedure as for pH measurement to perform a mV measurement.

For the ORP (redox potential), it is necessary to connect with the ORP electrode (such as STORP1) to measure the corresponding mV value.

3.5.3 Temperature measurement

For better accuracy, we recommend to use either a built-in or a separate temperature (STTEMP30) electrode.

- ❖ If a temperature electrode is used, the sample temperature is displayed.
- ❖ If the meter does not detect a temperature electrode, the meter will display “---“, It is necessary to set up the Temperature compensation as MTC and input the temperature.

Note: Meter is compatible with NTC 30 kΩ temperature sensor.

3.6 Conductivity calibration*

This chapter only applies to ST400M.
Before using the conductivity electrode for the first measurement, calibration must be done first. After the electrode is calibrated, it does not need to be calibrated for a long time. User should select the standard buffer solution that is closest to the conductivity value of the sample to do the calibration otherwise it will cause some error.

3.6.1 Setting the standard buffer

Long press (more than 3 seconds)  button to enter the setup mode, press▲ button and ▼ button to select conductivity settings. press  button to enter conductivity settings, press▲ button and ▼ button to enter conductivity standard buffer settings, press▲ button and ▼ button

to select between five conductivity buffers. press  button to confirm setting. Then press  button to return to the measuring mode or continue to set other parameters. The predefined standard buffers of the meter are 10 µS/cm, 84 µS/cm, 500 µS/cm, 1413 µS/cm and 12.88 mS/cm, and the actual conductivity of different temperature is built-in in the meter program.

3.6.2 Conductivity calibration

After selecting the conductivity standard buffer, you can start to calibrate.

- First, make sure that the meter and the conductivity electrode are connected, and the conductivity electrode is rinsed with pure water and dried.
- Place the conductivity electrode in the corresponding standard buffer, press 

button to start calibration.

After reaching and locking the end-point (automatic end-point or manual end-point), the meter displays the calibration value and electrode constant and temperature compensation coefficient in the upper right corner of the screen.

Note: In order to ensure accurate conductivity reading, the electrode should be calibrated regularly with standard buffer. Please use the standard buffer within the period of validity.

Wrong calibration operation in air: if the conductivity electrode is connected to the meter, press the calibration when the electrode is in the air, then the meter will always show "---", sometimes there is an error message, indicating that the value is out of range. For example, STCON3, the normal electrode constant should be between 1.50 and 2.00 /cm. If the calibration is conducted in the air, the electrode constant will be abnormal, for example, it displays 1320 /cm. In this case, the electrode can be recalibrated in the standard buffer.

3.6.3 Conductivity measuring

The section only applies to ST400M.

★Do not measure when connecting to the computer or charger.

Please confirm that the conductivity electrode is properly connected, and the conductivity electrode is rinsed with pure water and dried. Place the conductivity electrode in the sample, press 

to start measuring.

The measured results can be obtained under the automatic or manual end-point mode. If the repeatability is poor in the automatic end-point mode, it is suggested to use the manual end-point mode.

Note:

The sample measurement result is automatically compensated to the reference temperature (20 or 25 ℃) according to the measured temperature and temperature compensation coefficient (alpha value).

3.6.4 TDS, Salinity and resistivity measuring

To measure TDS (total dissolved solid) or salinity, please follow the same steps as the measurement of conductivity. Press ▲ ▼button can switch between conductivity, TDS, salinity

and resistivity.

Note: to ensure accurate measurement of ST400M, please use a conductivity electrode with a built-in temperature probe.

3.7 Two-parameter measurement*

This section only applies to ST400M.

ST400M can display pH (or mV) and conductivity (or Salinity, TDS, Resitivity) at the same time.

Press  to switch between pH, conductivity and two-parameter mode.

3.8 Using the memory

3.8.1 Storing a reading

The ST400M can store up to 1000 results (pH and conductivity add together).

- Press button-  when the measurement reaches its final reading, **M001** indicates that one result has been stored.

If you press button-  when **M1000** is displayed, **FUL** displays to indicate the memory is full. To store further data you will have to clear the memory.

3.8.2 Review from memory

Press and hold the button  to enter setup mode, press button-▲ or button-▼ to select "data management", you can review all or partial data according to instruction.

3.8.3 Clearing the memory

Press and hold the button  to enter setup mode, press button-▲ or button-▼ to select "data management", you can delete all or partial data according to instruction.

3.8.4 Export the stored data

The meter can connect the computer through the Micro-USB cable and export the storage result directly. Do not measure when connecting to the computer!

The steps are as follows:

- Connection meter and computer
- Confirm that the software (Scalemate) has been installed on the computer.

  Go to Ohaus website, Support→Software and Drivers.

- Start the program; click 'Connection' in the 'Settings' directory and select USB, then click 'OK'. Then type in the instrument model and serial number in the lower left corner and click 'Read' to read the data in the meter.
- Click 'Export' to export the stored test results to an Excel sheet.

4 MAINTENANCE

4.1 Error message

Error 0	Memory access error	Reset to factory settings
Error 2	Measured values out of range	Check if the electrode is properly connected and placed in the sample solution.
Error 3	Measured buffer temperature out of range (<5 or >40 °C)	Keep the pH buffer temperature within the range for calibration
Error 4	Offset out of range offset > 60mV or < - 60 mV	Make sure the pH buffer is correct and fresh; Clean or replace the pH electrode.
Error 5	Slope out of range	Make sure the buffer is correct and fresh; Clean or replace the pH electrode.
Error 6	Meter cannot recognize the buffer	Make sure the buffer is correct and fresh; check if the buffer has not been used more than once.
Error 9	The current data set has already been stored once	An endpoint reading can only be stored once. Perform a new measurement to store.

4.2 Meter maintenance

Do not disassemble the meter!

The ST400 series instruments do not require any maintenance other than replacement of depleted batteries. To clean, use a damp cloth.

Attention: Do not use solvents or harsh chemicals to clean the instrument.

The housing material is susceptible to damage by some organic solvents, such as toluene, xylene and methyl ethyl ketone (MEK). Any spillage should be immediately wiped off.

CAUTION: Battery is to be replaced only by an authorized Ohaus service dealer. Risk of explosion can occur if the rechargeable battery is replaced with the wrong type or if it is not properly connected. Dispose of the lithium-ion battery according to local laws and regulations.

4.3 Electrode maintenance

For pH electrode:

Make sure that the electrode is always stored in the storage solution in a protective bottle. Do not dry it out. Avoid storage in distilled water. The storage solution is 3M KCl solution. Please pay attention to whether the reference solution is leaked or crystallized. The reference solution is saturated KCl or AgCl saturated KCl solution..

The smiley face, poker face or crying face symbol on the meter represents the quality of the last calibration, not necessarily the current state of the electrode; to determine whether the current state of the electrode is good or bad, please recalibrate.

If the electrode response becomes sluggish or the slope is not acceptable, try the following:

- If the electrode dry out, soak the electrode in 0.1M HCl for 24 hours.
- For fat or oil contaminant, degrease the membrane with cotton wool soaked in either acetone or a soap solution.

After electrode treatment, a new calibration should be performed. If the electrode slope is still not acceptable, the electrode might need to be replaced.

For conductivity electrode:

Please note that always store a four-ring electrode in a **dry** environment. Make sure that the measuring fluid must reach or above the mark on the outer plastic sleeve. See the corresponding conductivity electrode manual.

5 TECHNICAL DATA

5.1 Specifications

Equipment Ratings:

- Pollution degree 2;
- Installation category II;
- Altitude 2000 m;
- Humidity: Maximum 80% for temperatures up to 30℃ decreasing linearly to 50% at 40℃ ;
- Electrical supply: 5VDC 1A (For use with CSA Certified (or equivalent approved) power source, which must have a limited-energy output);
- Indoor use;
- Ambient temperature range: 5℃ to 40℃ ;
- The main supply voltage fluctuations are not to exceed ±10% of the nominal supply voltage;
- Waterproof and dustproof grade: IP67.

ST400 pH

Measurement technical specification:

Measurement technical specification	Measurement range of digital unit: (-2.00 -16) pH Measurement range: (0~14) pH, (-1999 ~ 1999) mV Instrument level: 0.01

ST400 pH:

Digital measuring range	-2.00 ~ 16.00 pH -1999 ~ 1999 mV -5 °C ~ 110 °C
Resolution	0.01 pH 1 mV 0.1 °C
Error limits	± 0.01 pH ± 1 mV ± 0.5 °C
Buffer groups	6
Calibration	1-5 point
Memory	1000 pH measurement results Last 5 calibration data of 6 electrodes
Power supply	Rechargeable lithium battery, 2600mAh
Size/weight	100W x 230 L x 35 H mm / 0.35 kg
Display	Dot matrix,LCD
IP protection	IP67
pH Input	IP67 BNC, impedance > 10e+12 Ω
Temperature Input	IP67 Cinch, NTC 30 kΩ
Communication output	Micro-USB
Temperature-compensation	ATC & MTC
Housing	ABS/PC

ST400M Multi-parameter meter

Measurement technical specification (pH):

Measurement technical specification	Measurement range of digital unit: (-2.00 -16) pH Measurement range: (0~14) pH, (-1999 ~ 1999) mV Instrument level: 0.5

ST400M pH:

Measuring range	-2.00～16.00 pH -1999～1999 mV -5 °C～110 °C
Resolution	0.01 pH 1 mV 0.1 °C
Error limits	± 0.01 pH ± 1 mV ± 0.5 °C
Buffer groups	6
Calibration	1-5 point
Memory	1000 pH measurement results (pH and conductivity) last 5 calibration data of 6 electrodes
Power supply	Rechargeable lithium battery, 2600mAh
Size/weight	100W x 230 L x 35 H mm / 0.35 kg
Display	Dot matrix, LCD
IP protection	IP67
pH Input	IP67 BNC, impedance > 10e+12 Ω
Temperature Input	IP67 Cinch, NTC 30 kΩ
Communication output	Micro-USB
Temperature-compensation	ATC & MTC
Housing	ABS/PC

ST400M Multi-parameter meter

Measurement technical specification (Conductivity):

Measurement technical specification	Measurement range of digital unit: 0.00 µS/cm ~ 199.9 mS/cm Measurement range: (0~14) pH, (-1999 ~ 1999) mV Instrument level: 0.5

ST400M Conductivity：

Measuring range	0.00 µS/cm ~ 199.9 mS/cm 0.1 mg/l ~ 199.9 g/l (TDS) 0.00 ~ 99.99 psu (salinity) 0.00 ~ 20 MΩ.cm (resistivity) -5 ℃ ~ 110 °C
Resolution	Auto range 0.1 °C
Error limits	± 0.5 % F.S. ± 0.3 °C
Calibration	1 point 5 predefined standard solution
Power supply	Rechargeable lithium battery, 2600mAh
IP protection	IP67
Interface	IP67 8pin-LTW
Size/weight	100W x 230 L x 35 H mm / 0.35 kg
Display	Dot matrix, LCD
Temperature-compensation	Linear: 0.00 %/°C～10.00 %/°C Reference temperature： 20 and 25 °C
Housing	ABS/PC

5.2 Compliance

Mark	Standard
CE	This product complies with the EU Directives 2011/65/EU (RoHS), 2014/30/EU (EMC) and 2014/35/EU (LVD). The EU Declaration of Conformity is available online at www.ohaus.com/ce.
	EN 61326-1
C US MC173467	CAN/CSA-C22.2 No. 61010-1 UL Std. No. 61010-1
	This product complies with the EU Directives 2012/19/EU (WEEE) and 2006/66/EC (Batteries). Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment. For disposal instructions in Europe, refer to www.ohaus.com/weee.

FCC Note
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada Note
This Class A digital apparatus complies with Canadian ICES-003.

ISO 9001 Registration
The management system governing the production of this product is ISO 9001:2015 certified.

6 Appendix

6.1 Table 1 BUFFER GROUP

ST400M automatically corrects for the temperature dependence of the buffer group pH value given in the following tables.

Buffer group 1 US standard

Temp℃	pH1.68	pH4.01	pH7.00	pH10.00
5	1.67	4.01	7.09	10.25
10	1.67	4.00	7.06	10.18
15	1.67	4.00	7.04	10.12
20	1.68	4.00	7.02	10.06
25	1.68	4.01	7.00	10.01
30	1.68	4.01	6.99	9.97
35	1.69	4.02	6.98	9.93
40	1.69	4.03	6.97	9.89
45	1.70	4.05	6.97	9.86
50	1.71	4.06	6.96	9.83

Buffer group 2 Europe standard

Temp℃	pH2.00	pH4.01	pH7.00	pH9.21	pH11.00
5	2.02	4.01	7.09	9.45	11.72
10	2.01	4.00	7.06	9.38	11.54
15	2.00	4.00	7.04	9.32	11.36
20	2.00	4.00	7.02	9.26	11.18
25	2.00	4.01	7.00	9.21	11.00
30	1.99	4.01	6.99	9.16	10.82
35	1.99	4.02	6.98	9.11	10.64
40	1.98	4.03	6.97	9.06	10.46
45	1.98	4.04	6.97	9.03	10.28
50	1.98	4.06	6.97	8.99	10.10

Buffer group 3 MERCK (Ref. 20°C)

Temp °C	pH 2.00	pH4.00	pH7.00	pH9.00	pH12.00
5	2.01	4.04	7.07	9.16	12.41
10	2.01	4.02	7.05	9.11	12.26
15	2.00	4.01	7.02	9.05	12.10
20	2.00	4.00	7.00	9.00	12.00
25	2.00	4.01	6.98	8.95	11.88
30	2.00	4.01	6.98	8.91	11.72
35	2.00	4.01	6.96	8.88	11.67
40	2.00	4.01	6.95	8.85	11.54
45	2.00	4.01	6.95	8.82	11.44
50	2.00	4.00	6.95	8.79	11.33

Buffer group 4 JJG199 (Ref. 25°C)

Temp °C	1.680	4.003	6.864	9.182	12460
5	1.669	3.999	6.949	9.391	13.210
10	1.671	3.996	6.921	9.330	13.011
15	1.673	3.996	6.898	9.276	12.820
20	1.676	3.998	6.879	9.226	12.637
25	1.680	4.003	6.864	9.182	12.460
30	1.684	4.010	6.852	9.142	12.292
35	1.688	4.019	6.844	9.105	12.130
40	1.694	4.029	6.838	9.072	11.975
45	1.700	4.042	6.834	9.042	11.828
50	1.706	4.055	6.833	9.015	11.697

Buffer group 5 DIN (19266) (Ref. 25°C)

Temp °C	pH1.09	pH4.65	pH6.79	pH9.23	pH12.75
5	1.668	4.004	6.950	9.392	13.207
10	1.670	4.001	6.922	9.331	13.003
15	1.672	4.001	6.900	9.277	12.810
20	1.676	4.003	6.880	9.228	12.627
25	1.680	4.008	6.865	9.184	12.454
30	1.685	4.015	6.853	9.144	12.289
35	1.691	4.026	6.845	9.110	12.133
40	1.697	4.036	6.837	9.076	11.984
45	1.704	4.049	6.834	9.046	11.841
50	1.712	4.064	6.833	9.018	11.705

Buffer group 6 DIN (19267) (Ref. 25°C)

Temp °C	pH1.09	pH4.65	pH6.79	pH9.23	pH12.75
5	1.08	4.67	6.87	9.43	13.63
10	1.09	4.66	6.84	9.37	13.37
15	1.09	4.66	6.82	9.32	13.16
20	1.09	4.65	6.80	9.27	12.96
25	1.09	4.65	6.79	9.23	12.75
30	1.10	4.65	6.78	9.18	12.61
35	1.10	4.65	6.77	9.13	12.45
40	1.10	4.66	6.76	9.09	12.29
45	1.10	4.67	6.76	9.04	12.09
50	1.11	4.68	6.76	9.00	11.98

6.2 Table 2 Examples of temperature coefficients (α-value)

Substance at 25 °C	Concentration [%]	Temperature coefficient α [%/°C]
HCl	10	1.56
KCl	10	1.88
CH3COOH	10	1.69
NaCl	10	2.14
H2SO4	10	1.28
HF	1.5	7.20

α-coefficients of conductivity standards for a calculation to a reference temperature of 25°C

Standard	Measurement temp.: 15°C	Measurement temp.: 20°C	Measurement temp.: 25°C	Measurement temp.: 30°C
84 µS/cm	1.95	1.95	1.95	2.01
1413 µS/cm	1.94	1.94	1.94	1.99
12.88 mS/cm	1.90	1.89	1.91	1.95

6.3 Table 3 Conductivity standards

T(°C)	10 µS/cm	84 µS/cm	500µS/cm	1413µS/cm	12.88 mS/cm
5	6.1 µS/cm	53 µS/cm	315.3µS/cm	896 µS/cm	8.22 mS/cm
10	7.1 µS/cm	60 µS/cm	359.63µS/cm	1020 µS/cm	9.33 mS/cm
15	8.0 µS/cm	68 µS/cm	402.93µS/cm	1147 µS/cm	10.48 mS/cm
20	9.0 µS/cm	76 µS/cm	451.53µS/cm	1278 µS/cm	11.67 mS/cm
25	10.0 µS/cm	84 µS/cm	500.03µS/cm	1413 µS/cm	12.88 mS/cm
30	11.0 µS/cm	92 µS/cm	548.5µS/cm	1552 µS/cm	14.12 mS/cm
35	12.1 µS/cm	101 µS/cm	602.53µS/cm	1667 µS/cm	15.39mS/cm

Conductivity	**TDS KCl**		**TDS NaCl**	
At 25℃	ppm value	Factor	ppm value	Factor
84 µS	40.38	0.5048	38.04	0.4755
447 µS	225.6	0.5047	215.5	0.4822
1413 µS	744.7	0.527	702.1	0.4969
1500 µS	757.1	0.5047	737.1	0.4914
8974 µS	5101	0.5685	4487	0.5000
12.88 µS	7447	0.5782	7230	0.5613
15 µS	8759	0.5839	8532	0.5688
80 mS	52.168	0.6521	48.384	0.6048

Ohaus Corporation