SERVICE MANUAL

STARTER 2100 Bench pH Meter
STARTER 3100 Bench pH Meter
STARTER 3100C Bench pH Meter
STARTER 3100M Bench pH and Conductivity Meter

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

FIGURE NO. TITLE

1.1 INTRODUCTION

This service manual contains the information needed to perform routine maintenance and service on the Ohaus Starter Bench Series portable meters. Familiarity with the meter's Instruction Manual is assumed. The contents of this manual are contained in four chapters:

Chapter 1 Getting Started – Contains information on service facilities, tools and test equipment, specifications, and the mechanical and electronic functions of the meter.

Chapter 2 Maintenance Procedures – Contains preventive maintenance procedures and disassembly, repair and replacement procedures.

Chapter 3 Reset to factory settings – Explains procedures for resetting the meter to factory default settings.

Chapter 4 Drawings and Parts Lists – Contains exploded views of the products identifying all serviceable components.

Note: Content in this manual are subject to changes without notice.

1.2 DEFINITION OF SIGNAL WORDS 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

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

Electrostatic discharge sensitive

1.3 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.

- Service should only be performed by authorized personnel.
- Use electrostatic protection measures when handling the printed circuit board.
- Remove the AAA batteries before cleaning or servicing the equipment.
- Operate the equipment only under ambient conditions specified in the user instructions.
- Do not operate the equipment in hazardous or unstable environments.
- This equipment is intended for indoor use and should only be operated in dry locations.
- Only use original replacement parts and accessories.

1.4 SERVICE FACILITIES

To service a meter, the service area should meet the following requirements:

- Should be temperature controlled and meet meter specifications for temperature environmental requirements.
- Area must be clean and free of excessive dust.
- Work surface must be stable and level.
- Meter must not be exposed to direct sunlight or radiating heat sources.
- Use an approved Electro-Static Device.

1.5 TOOLS AND TEST EQUIPMENT REQUIRED

Service should contain the following equipment:

1. Standard hand tools.
2. Digital Voltmeter (DVM).
3. Standard Electronics tool kit.
4. Grounding mat and clip.
5. Respective electrodes.
6. Respective buffer solution.

1.6 SPECIFICATIONS

Complete specifications for the Ohaus Starter Bench meters are listed in Table 1-1. When a meter has been serviced, it must meet the specifications listed in the table. Before servicing the meter, determine what specifications are not met.

TABLE 1-1. SPECIFICATIONS

Model	Starter 2100	Starter 3100	Starter 3100C
Measuring range	0.00...14.00 pH –1999...1999 mV 0 °C...100 °C	-2.00...16.00 pH –1999...1999 mV -5 °C...110 °C	0.0 µS/cm...199.9 mS/cm 0.1 mg/l...199.9 g/l (TDS) 0.00 ... 19.99 psu (Salinity) 0 °C...100 °C
Resolution	0.01 pH 1 mV 0.1 °C	0.01 pH 1 mV 0.1 °C	Automatic range 0.1 °C
Error limits	± 0.01 pH ± 1 mV ± 0.5 °C	± 0.01 pH ± 1 mV ± 0.5 °C	± 0.5 % of the measured value ± 0.3 °C
Calibration	1 or 2 points 1 predefined buffer group (4.01, 7.00, 10.01)	3 points 3 predefined buffer group	1 point 3 predefined standards
Memory	Recall last calibration data		
Power supply	110-240V/50Hz, DC 12V		
Size/weight	Approximately 220 W x 175 D x 78 H mm / 0.75 kg		
Display	Liquid crystal		
Input	BNC, impedance > 10e+12 Ω Cinch, NTC 30 kΩ		Mini-Din
Reference input	2mm banana socket		
Temperature-compensation	ATC & MTC		Linear: 0.00 %/°C...10.00 %/°C Reference temperature: 20 & 25 °C
Housing	ABS		

Spec.		ST3100M
Measurement Range	pH	–2.00…20.00 pH
	mV	–2000…+2000mV
	Conductivity	0.0 µS/cm…199.9mS/cm
	TDS	0.1mg/l…199.9 g/l(TDS)
	Resistivity	0…20MΩ•cm
	Salinity	0-100 psu
	Temperature	-5°C…110 °C
Resolution	pH	0.01pH
	mV	1mV
	Conductivity	0.01 µS/cm Auto range
	TDS	0.01 mg/L Auto range
	Resistivity	0.01 Ω•cm Auto range
	Salinity	0.01 psu
	Temperature	0.1 °C
Error Limits/Accuracy	pH	± 0.01 pH
	mV	± 1mV
	Conductivity etc.	± 0.5 %F.S.
	Temperature	± 0.3 °C
Calibration	pH	Up to 3 point, 6 buffer groups
	Conductivity	5 predefined conductivity standard points
Memory		99 sets pH and 99 sets conductivity data, last calibration data
Power/Battery		AC Adapter Input: 100-240V ~ X.XA 50/60 Hz AC Adapter Output: 12V ⊂ X.XA
Size/weight		Approximately 220 W x 175 D x 78 H mm / 0.95 kg
Display		LCD with backlight

Spec.		ST3100M
Input	pH	BNC, impedance >10e+12 Ω
	Conductivity	Mini-Din
	Temperature	Cinch, NTC 30 kΩ
Data		RS232
Temp Compensation		ATC or MTC
Temp Compensation Range	pH	0 °C…100 °C for pH
	Conductivity	Temperature Coefficient range: 0.00 %/°C…10.00 %/°C
		Ref T: 20 or 25 °C
Housing		ABS

1.7 METER OPERATION – STARTER 2100

This section contains information on the basic operation of the Starter 2100 meter.

1.7.1 OVERVIEW OF THE CONTROLS

Displays

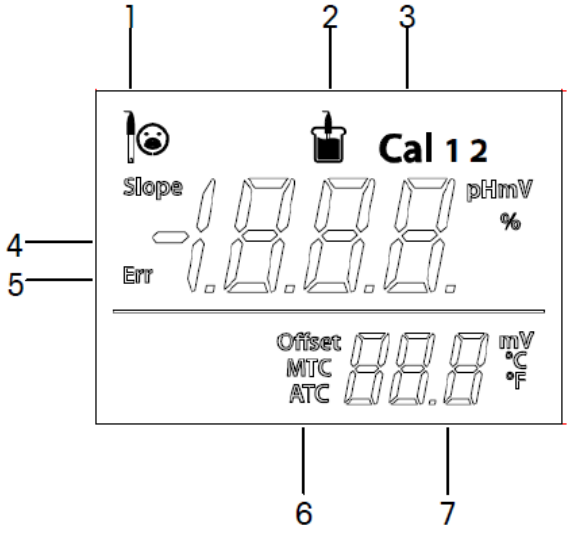


Figure 1-1. Starter 2100 display

1	Electrode condition		
	☺ Slope: more than 95% and offset: ± (0-15) mV Electrode condition is good	😐 Slope: 90-95% or offset: ± (15-35) mV Electrode condition is acceptable	☹ Slope: less than 90% or offset: ± (35-60) mV Electrode condition is not good or needs cleaning
2	Measurement icon - ; measurement or calibration is running		
3	Calibration icon - **Cal** ; 1 point or 2 point calibration in progress		
4	**pH/mV** reading or slope (%) in calibration		
5	Error message- **Err**		
6	Auto temperature compensation - **ATC** ; Manual temperature compensation - **MTC**		
7	Temperature during measurement of **Offset** (mV) in calibration		

TABLE 1-2. Control functions Starter 2100

Button	Press & release	Press & hold for 3 seconds
Read/Enter	- Start measurement or lock current reading - Confirm temp setting	
Cal Slope	- Start calibration	- Review the latest calibration data (slope, offset)
Exit	- Meter turn on - Exit, return to measurement screen	- Meter turn off
Temp	- Entered temperature setup mode - Increase temp. value when in temp. setup mode	
pH/mV	- Switch between pH and mV measuring modes - Decrease temp. value when in temp. setup mode	
Cal Slope + Read/Enter	- Start self-diagnosis	

Notes: [1] Short Press: Press less than 1 seconds.
[2] Long Press: Press and hold for more than 2 seconds.
[3] Press and hold the Off button until OFF is displayed, then release the button.

1.8 METER OPERATION – ST3100

This section contains information on the basic operation of the ST3100 meter.

1.8.1 OVERVIEW OF THE CONTROLS

Displays

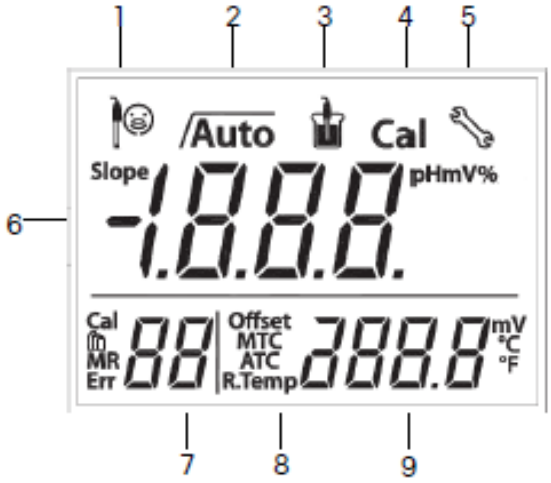


Figure 1-2. ST3100 display

1	Electrode condition		
	☺Slope: more than 95% and offset: ± (0-15) mV Electrode condition is good		☺Slope: more than 95% and offset: ± (0-15) mV Electrode condition is good
2	Endpoint stability icon ; Auto endpoint icon Auto		
3	Measurement icon - ; measurement or calibration is running		
4	Calibration icon - Cal; calibration in progress		
5	Setup icon - ; instrument is in the setup mode, can set temperature(MTC), buffer group etc.		
6	pH/mV reading or slope in calibration process		
7	Calibration point Cal / Buffer group / Memory number MR/ Error index Err		
8	Auto temperature compensation - ATC ; Manual temperature compensation - MTC		
9	Temperature during measurement or offset (mV) in calibration process		

TABLE 1-3. Control functions ST3100

Button	Press & release	Press & hold for 3 seconds
Read/Enter /Auto	- Start or finish measurement - Confirm setting, store entered value	- Turn auto endpoint on / off /Auto, /
Cal Slope	- Start calibration	- Recall the latest calibration data : slope and offset
Exit ⏻	- Meter turn on - Exit and return to measurement screen	- Meter turn off
Store Recall ^	- Store current reading to memory - Increase value during setting - Scroll up through the memory	- Recall stored data - Print current memory data
pH/mV Setup v	- Switch between pH and mV - Decrease value during setting - Scroll down through the memory	- Enter setup mode
Cal Slope + Read/Enter /Auto	- Start self-diagnosis	
Store Recall + pH/mV Setup		Turn on/turn off the backlight of the LCD

1.9 METER OPERATION – ST3100C

This section contains information on the basic operation of the Starter 3100C meter.

1.9.1 OVERVIEW OF THE CONTROLS

Displays

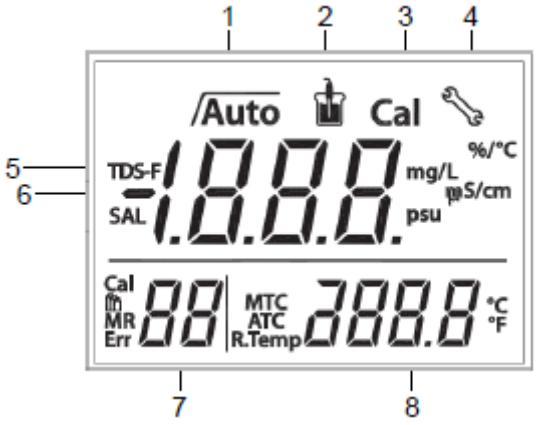


Figure 1-3. ST3100C display

1	Endpoint stability / Auto endpoint Auto
2	Measurement icon - measurement or calibration is running
3	Calibration icon Cal - calibration in progress
4	Setup icon - instrument is in the setup mode
5	TDS factor in the setup mode
6	Conductivity / TDS / Salinity / Cell Constant
7	Standard / Error index Err
8	Temperature during measurement or reference temperature in setup mode

TABLE 1-4. Control functions ST3100C

Button	Press & release	Press & hold for 3 seconds
Read/Enter /Auto	- Start or endpoint measurement - Confirm setting, store entered value	- Turn auto endpoint on / off /Auto,
Cal Cell Constant	- Start calibration	- Review the latest calibration data (cell constant)
Exit	- Meter turn on - Return to measurement screen	- Meter turn off
Store Recall	- Store current reading to memory - Increase value during setting - Scroll up through the memory	- Recall stored data - Print current memory data
Mode Setup	- Switch between pH and mV measuring modes - Decrease value during setting - Scroll down through the memory	- Enter setup mode
Cal + Read/Enter	- Start self-diagnosis	
Store + Mode		Turn on/off the backlight of the LCD

1.10 METER OPERATION – ST3100M

This section contains information on the basic operation of the Starter 3100M meter.

1.10.1 OVERVIEW OF THE CONTROLS

Displays

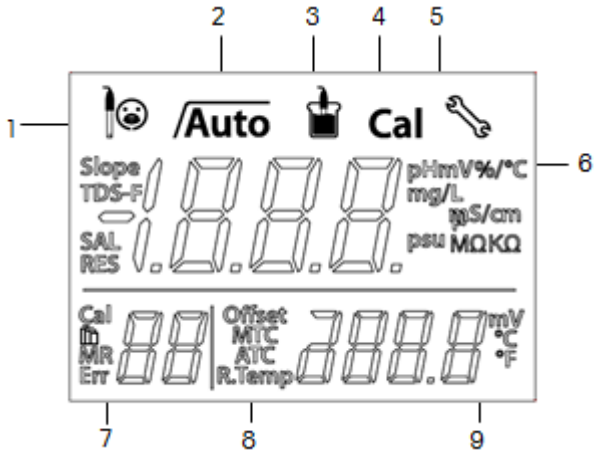


Figure 1-4. ST3100M display

1 pH Electrode condition

☺ Slope: more than 95% and offset: ± (0-15) mV Electrode condition is good	😐 Slope: 90-95% or offset: ± (15-35) mV Electrode condition is acceptable	☹ Slope: less than 90% or offset: ± (35-60) mV Electrode condition is not good or needs cleaning

2 Endpoint stability icon ; Auto endpoint icon Auto.

3 Measurement icon - ; means measurement or calibration is running when blinks.

4 Calibration icon - **Cal**; means calibration in progress when display.

5 Setup icon - ; instrument is in the setup mode, can set temperature(MTC), buffer group etc.

6 pH/mV reading, or slope of pH electrode calibration; or Conductivity/TDS/Salinity/Resistivity value, or cell constant of conductivity electrode.

7 Calibration point Cal / Buffer group /Memory number MR/ Error index Err.

8 Auto temperature compensation - **ATC** ; Manual temperature compensation – **MTC**; Conductivity reference temperature - **R.Temp**

9 Temperature value during measurement or offset (mV) value in pH calibration process.

TABLE 1-5. Control functions ST3100M

Button	Press & release	Press & hold for 3 seconds
pH/mV COND. /TDS	- Switch between pH(mV) parameter and conductivity(TDS/Salinity/Resistivity) parameter when at measurement interface	
Read/Enter /Auto	- Start or finish measurement - Confirm setting, store entered value	- Turn auto endpoint on / off /Auto, /
Cal Cal. Data	- Start calibration	- Recall the latest calibration data : slope and offset
Exit ⏻	- Meter turn on - Exit and return to measurement screen	- Meter turn off
Store Recall ^	- Store current reading to memory - Increase value during setting - Scroll up through the memory	- Recall stored data - Print current memory data
Mode Setup v	- Switch between pH and mV - Decrease value during setting - Scroll down through the memory	- Enter setup mode
Cal Cal. Data + Read/Enter /Auto	- Start self-diagnosis	
Store Recall + Mode Setup		Turn on/turn off the backlight of the LCD

2.1 PREVENTIVE MAINTENANCE

Ohaus meters are precision instruments and should be carefully handled, stored in a clean, dry, dust-free area, and cleaned periodically.

Cleaning the meter housing can be done by using a cloth dampened with mild detergent if necessary.

Do not use solvents, chemicals, alcohol, ammonia or abrasives to clean the housing or control panel.

2.2 SERVICE STRATEGY

All parts of the Starter Bench Top Series are designed to be replaced rather than repaired. This includes the Main Printed Circuit Board (PCB). For an illustrated list of replaceable parts, see Chapter 4.

2.3 OPENING THE METER

Use these procedures in order to replace the Printed Circuit Board and the cables, if applicable.

CAUTION: Observe precaution for handling electrostatic sensitive deceives.

2.3.1 Separating the Top and Bottom Housings

Common hand tools are sufficient to disassemble the products. Turn the meter off and unplug the power cord before you begin.

1. Turn the meter over. Remove the four screws holding the Housing in place.

2. Separate Top Housing from Bottom Housing. Avoid straining the cables that connect the Main PCB on the bottom housing to the parts in the top Housing. (Lay the two housings close to each other, so cable is not strained.)

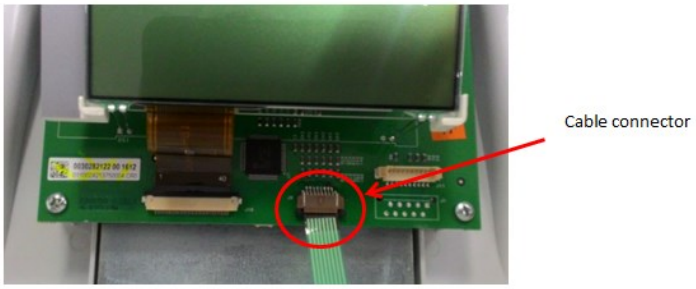
Figure 2-1. Screws (marked with white circles) that secure the housing.

2.4 Removing/Replacing the PCB

CAUTION: Observe precaution for handling electrostatic sensitive deceives.

If the PCB are suspected to be faulty, it should be replaced, as follows:

1. Disconnect the Cable connecting the PCB to the meter's control buttons.
2. For ST3100M loosen the control button cable connector in order to isolate the top housing away from the bottom housing.



3. Remove the four screws that secure the PCB to the bottom housing (Fig 2-2).
4. Lift out the PCB.
5. Position the replacement PCB.
6. Re-connect the Top housing Cable to the PCB, in the same position as originally installed.
7. Insert and tighten the screws that secure the PCB to the bottom housing.

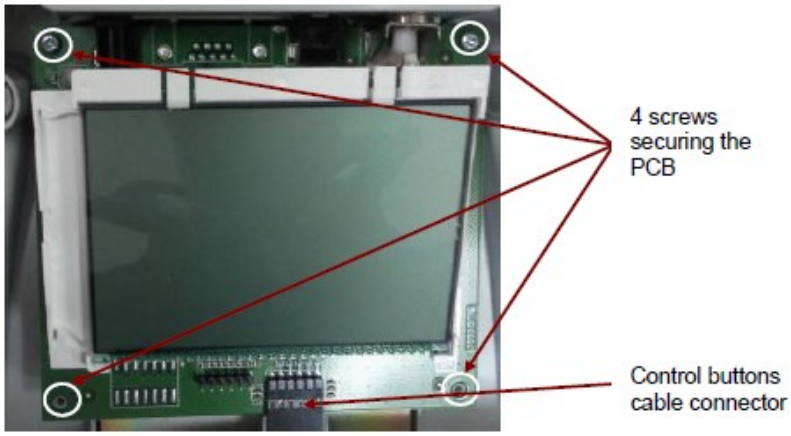


Figure 2-2. Main Printed Circuit Board with display.

3.1 Recover factory settings

▪ When the meter is off, press and hold button-**Read** & button-**Cal** & button-**Exit** together for 3 seconds, the screen displays and blinks, means “Reset”. Then we have 2 choice:

❖ Press button-**Read** to reset factory settings (MTC, slope and offset, etc.), display then restart the meter.
Or press button-**Exit** to quit the setting, display then turn off the meter.

3.2 Error message

3.2.1 Error message ST2100

Err	Self-diagnosis failure	Repeat the self-diagnosis. (See 5.4)
	Or Calibration failure	Calibration failure (slope < 85%, offset > 60mV); you need to use fresh buffer to do calibration again properly; if still not good, need to replace the pH electrode.

TABLE 3-1. ST2100 Error Message.

3.2.2 Error message ST3100

Error 0	Memory access error	Reset to factory settings
Error 1	Self-diagnosis failed	Repeat the self-diagnosis procedure and make sure that you finish pressing all five keys within two minutes.
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.
Error 10	The sample temperature out of range	Check the sample temperature, the temperature sensor.

TABLE 3-2. ST3100 Error Message.

3.2.3 Error message ST3100C

Error 0	Memory access error	Reset to factory settings
Error 1	Self-diagnosis failed	Repeat the self-diagnosis procedure and make sure that you finish pressing all five keys within two minutes.
Error 2	Measured values out of range C: > 199.9 mS/cm TDS: < 0.1 mg/L or > 199.9 g/L SAL: > 100.0 psu	Make if the electrode is properly connected and placed in the sample solution
Error 3	Measured standard temperature out of range (5 ... 35 °C)	Keep the standard temperature within the range for calibration
Error 4	Measuring temperature out of range (0 ... 100 °C)	Check if the electrode is properly connected and keep the sample temperature within the range
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.

If there is an error, the meter will beep 3 times to alert.

TABLE 3-3. ST3100C Error Message.

3.2.4 Error message ST3100M

When ST3100M as pH meter:

Error 0	Memory access	Reset to factory settings
Error 1	Self-diagnosis failed	Repeat the self-diagnosis procedure and make sure that you finish pressing all five keys within two minutes
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.
Error 10	The sample temperature out of range	Check the sample temperature, the temperature sensor.

TABLE 3-4. ST3100M Error Message as pH Meter.

3.2.4 Error message ST3100M (Continue)

When ST3100M as conductivity meter:

Error 0	Memory access error	Reset to factory settings
Error 1	Self-diagnosis failed	Repeat the self-diagnosis procedure and make sure that you finish pressing all five keys within two minutes.
Error 2	Measured values out of range C: > 199.9 mS/cm TDS: < 0.1 mg/L or > 199.9 g/L SAL: > 100.0 psu	Make if the electrode is properly connected and placed in the sample solution
Error 3	Measured standard temperature out of range (5 ... 35 °C)	Keep the standard temperature within the range for calibration
Error 4	Measuring temperature out of range (0 ... 100 °C)	Check if the electrode is properly connected and keep the sample temperature within the range
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.

If an error happens, the meter will **beep 3 times** as alert.

For further technical support please kindly contact Ohaus regional technical support center. Information can be obtained in http://www.Ohaus.com.

This section of the manual contains exploded views of the products. The exploded view drawings are designed to identify the parts which can be serviced.

NOTE:

Attention: After any hardware replacement, the product must be thoroughly checked. The product **MUST** meet the parameters of all applicable specifications in this manual.

Step to confirm the meter operates within specification:

1. Obtain a known good working condition electrode and buffer solution in hand.

2. Link the electrode to the portable meter, perform a calibration after completed the calibration do a measurement and compare with the meter specification.

If further technical information is needed, please contact your local Ohaus distributor, or:

www.ohaus.com

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In the United States call toll free, 800-526-0659 between 8:00 a.m. and 6:00 p.m. EST.

4.1 Starter Series Bench Meter: PARTS

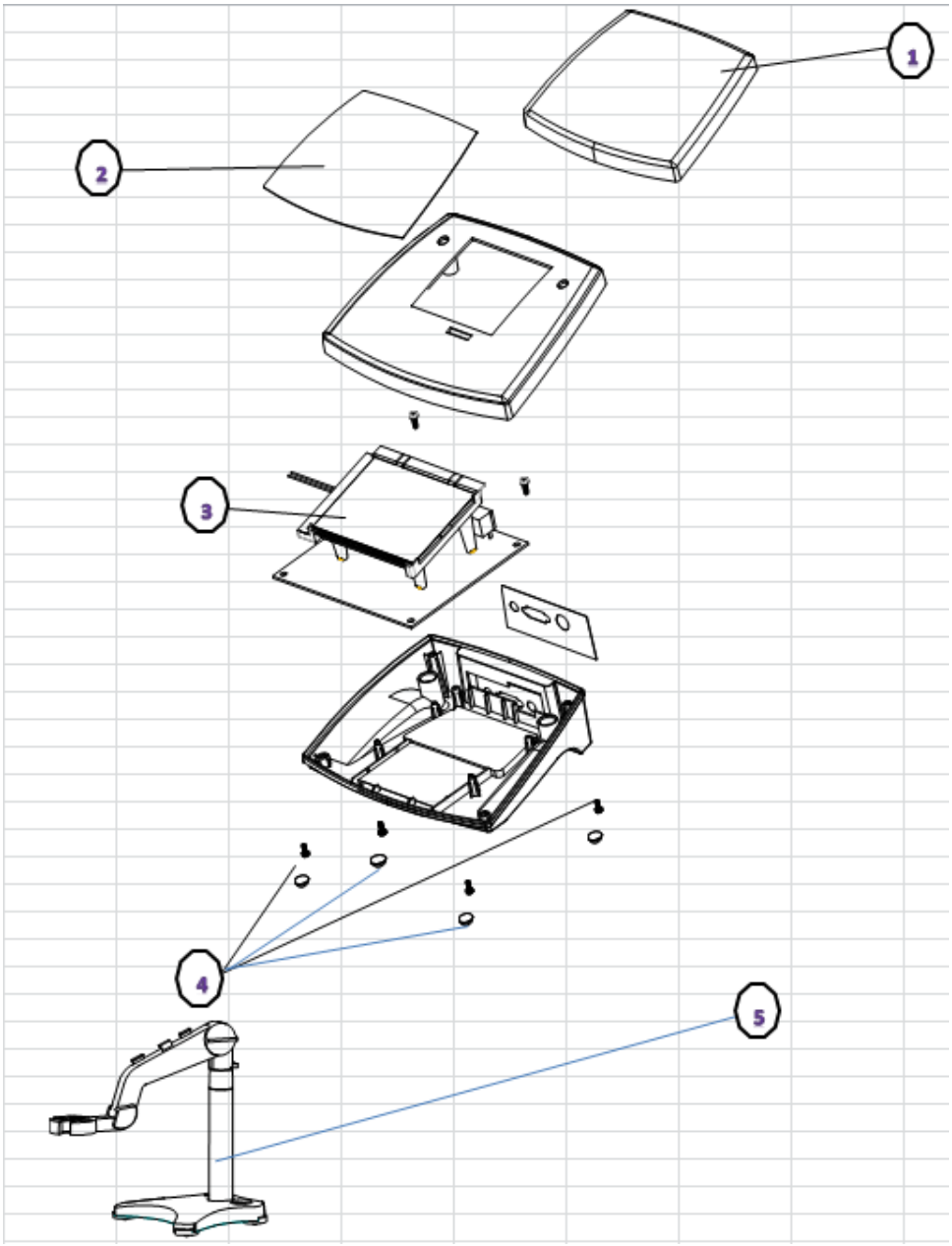

Figure 4-1. Starter Series Bench Meter: Parts.

TABLE 4-1 Starter Series Bench Meter: PARTS

Drawing Item	Description
1	Acc, In use cover
2	SP Overlay EN, ZH
3	SP PCBA
4	SP Screw and feet set for Starter Bench
5	Acc Electrode holder stand alone

Note: **For parts numbers, see your local Ohaus distributor, or visit www.ohaus.com.**

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