STARTER 3100
Bench pH Meter
Instruction Manual

Manual de instrucciones
del pHmetro de mesa
STARTER 3100

STARTER 3100
PH-mètre de laboratoire
Manual d’instructions

STARTER 3100
Medidor de pH de Bancada
Manual de Instruções

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1 INTRODUCTION

☺ Thank you for choosing OHAUS.
Please read the manual completely before using the STARTER 3100 bench pH meter to ensure proper setup, operation and maintenance.

STARTER 3100 has an excellent performance/price ratio and is designed with many useful features including a stand-alone electrode holder and a beeper for error alert. Other accessories such as pH electrodes and buffer solutions are also available.

STARTER 3100 offers many practical features and functions such as:

- Large backlit LCD with Quick Guide attached under the meter to assist with user operation
- Stand-alone electrode holder for maximum flexibility
- Electrode condition icon automatically showing you the health of your pH electrode
- RS232 port and memory to store up to 99 measurements

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 input voltage range printed on the data label and the plug type matches the local AC power to be used.
- Make sure that the power cord does not pose a potential obstacle or tripping hazard.
- Use the equipment only in dry locations.
- Dry off any liquid spills immediately. The instrument is not watertight.
- When using chemicals and solvents, comply with the instructions of the chemical producer and the general lab safety rules.
- Use only approved accessories and peripherals.
- Operate the equipment only under ambient conditions specified in these instructions.
- Disconnect the equipment from the power supply when cleaning.
- Do not operate the equipment in hazardous or unstable environments.
- Service should only be performed by authorized personnel.

1.3 Display and controls

Displays

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 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.

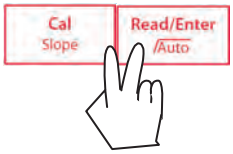
6 pH/mV reading or slope in calibration process

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

Controls

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

2 INSTALLATION

Carefully unpack the box.

2.1 Package contents

The model ST3100-B (basic package) has the following items:

ST3100-B	Units
STARTER 3100	1
Stand-alone electrode holder	1 set
In use cover	1
12V Power supply	1 set

In addition to ST3100-B content, the ST3100-F package also includes the following:

pH Buffer Powder Set (4.01, 7.00, 10.01)	1 set
ST310 3-in-1 refillable pH electrode	1

In addition to ST3100-B content, the ST3100-H package also includes the following:

pH Buffer Powder Set (4.01, 7.00, 10.01)	1 set
ST320 3-in-1 gel pH electrode	1

Each pH buffer powder should be dissolved in 250ml pure water or deionized water in a volumetric flask.

Additional electrodes available include the following:

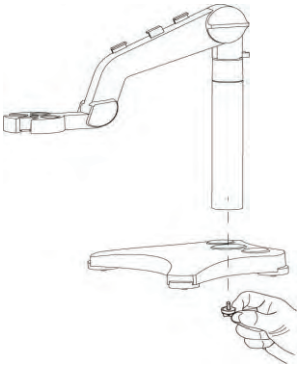
Model	Description	P/N
ST310	3-in-1 plastic refillable pH Electrode	83033965
ST210	2-in-1 plastic refillable pH Electrode	83033966
ST320	3-in-1 plastic gel pH Electrode(no need to fill)	83033967
ST230	2-in 1 glass muddy sample pH Electrode	83033968
STORP1	Gel plastic ORP electrode	30038555
STORP2	Refillable glass ORP electrode	30038553
STTEMP30	Temperature Electrode	83033970

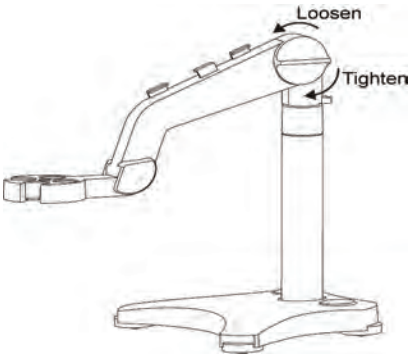
Buffers and Accessories:

Buffer powder set (4.01; 7.00; 10.00)	83033971
Buffer pH1.68 250ml	30100424
Buffer pH4.01 250ml	30100425
Buffer pH7.00 250ml	30100427
Buffer pH10.01 250ml	30100429
Buffer pH12.45 250ml	30100430
Electrode holder stand alone (3100/3100C)	30058733
In use cover	30058734

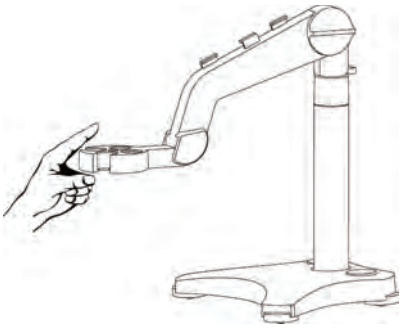
2.2 Installing the stand-alone electrode holder

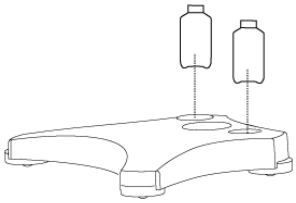
Install the electrode arm on the base,





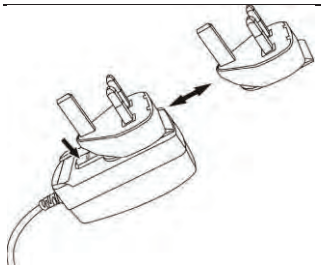
After adjusting the tension knob to some extent, you can move the upper arm up and down. When the pH electrode is installed on the arm, the storage bottle of pH electrode fits into the base hole.





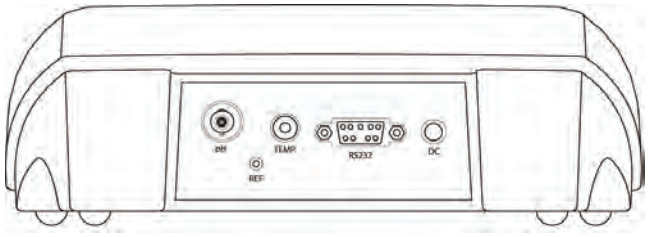
2.3 Installing the power adapter

Insert the right adapter clip into the power adapter slot. The Ohaus balance power supply is also 12V which could also be used for the pH meter.

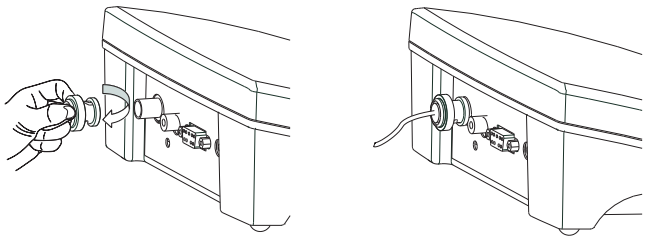


2.4 Connect the pH electrodes

There are 3 sockets for electrode. “pH” socket (BNC); “TEMP.” Socket (Cinch) and “REF” Socket (2mm banana).



For ST310 electrode connect to the BNC and Cinch socket. For 2-in-1 pH electrode (e.g. ST210) you only need to connect the BNC.



REF socket is for separate reference electrode. (e.g.STREF1)

2.5 Meter stand for adjusting view angle

One unique design of the STARTER 3100 is the meter stand, which can be used to adjust the view angle of the display in case of working on high table.

2.6 Attached quick guide

Another unique design of the STARTER 3100 is the attached quick guide, the quick guide is attached into the bottom housing of the meter.

3 SETUP

3.1 Set temperature unit and MTC value

Please note:
If a temperature electrode is used, Automatic Temperature Compensation (**ATC)** and the sample temperature are displayed on the screen. You may then choose to skip MTC setup (below).

If the meter does not detect a temperature electrode or one is not used, the meter automatically switches to Manual Temperature Compensation (**MTC**) mode and **MTC** appears on the screen.
MTC can be set as follows:

- Power the meter on by pressing Exit.
- Press and hold pH/mV until the setup icon appears on the display and the current temperature unit blinks (°C or °F).
- Press Store or pH/mV to switch between °C and °F.
- Press Read/Enter to confirm your selection.

Then

- ❖ Continue with MTC temperature setting by using Store or pH/mV to adjust temperature compensation accordingly
- ❖ Press Read/Enter to confirm the setting
- ❖ Press Exit to return to the measurement screen.

The default MTC temperature value setting is 25°C (77°F).
Note: °C = 5/9 (°F - 32)

3.2 Selecting a predefined buffer group

After confirming the MTC compensation temperature value, make the buffer group selection. Use Store or pH/mV to select a buffer group among 3 buffer groups (4.1.1). Press Read/Enter to confirm the setting or press Exit to leave to return to the measurement screen.

The default buffer group is **b1**.

b1	1.68	4.01	7.00	10.01

4 STARTER 3100 OPERATION

Standard procedure of pH measurement is as follows:

a) pH electrode preparation
b) buffer preparation and pH electrode calibration
c) sample preparation
d) pH measurement
e) Record measurement results or print
f) Rinse the pH electrode and properly store

pH electrode preparation: pH electrode should be rinsed with pure water before and after using. Check if the electrode is physically damaged. (Be careful with the glass bulb)

The pH electrode should be stored in the storage bottle; the solution in the bottle is 3M KCl solution. After placing the pH electrode into the sample or buffer solution, user should stir several seconds then wait **30 to 60 seconds** for the signal to stabilize, and then press the button to operate (Calibration or measurement).

WARNING Do not operate the equipment in hazardous environments. The equipment is not explosion protected.

WARNING When using chemicals and solvents, comply with the instructions of the chemical producer and the general lab safety rules.

4.1 Calibration

4.1.1 Buffer group

STARTER 3100 can perform **1-, 2-** or **3- point** calibrations.

There are 3 buffer groups in the meter, you can select the buffer group you prefer (see 4.3), default buffer is **b1 US standards**; the buffer value will be automatically recognized during calibration. The 3 predefined buffer groups are (at 25°C):

b1	**1.68**	**4.01**	**7.00**	**10.01**	
b2	2.00	4.01	7.00	9.21	11.00
b3	1.68	4.00	6.86	9.18	12.46

STARTER 3100 automatically corrects for the temperature dependence of the buffer pH values given in the following table - buffer group **b1**.

This means, if the buffer solutions' temperature is 15°C, the calibration value you will get should be pH1.67 (buffer 1.68), pH4.00 (buffer 4.01), pH7.04(buffer 7.00) and pH10.12 (buffer 10.01).

5 °C	1.67	4.01	7.09	10.25
10 °C	1.67	4.00	7.06	10.18
15 °C	1.67	4.00	7.04	10.12
20 °C	1.68	4.00	7.02	10.06
25 °C	**1.68**	**4.01**	**7.00**	**10.01**
30 °C	1.68	4.01	6.99	9.97
35 °C	1.69	4.02	6.98	9.93
40 °C	1.69	4.03	6.97	9.89
45 °C	1.70	4.05	6.97	9.86
50 °C	1.71	4.06	6.96	9.83

Calibration: pH electrodes need to be calibrated with pH standard buffer solution before a proper pH measurement can be made. **Calibration** is to display the right **pH** value when meter receive the **mV** value signal from the pH electrode.

Slope: the linear coefficient between mV and pH according to theoretical value (e.g. -59.16mV/pH @ 25 °C which means 100% slope);

Offset: the mV value when pH value is 7.00. (Theoretical value is 0 mV);

4.1.2 Performing 1-point calibration

When performing calibration, Ohaus recommends using **Auto End Point Mode.** After powering the meter on, be sure the top of the screen shows Auto to ensure the meter is in **Auto End point Mode.**

Auto or Manual End point Mode:

- Press and hold Read/Enter /Auto to change the **End Point Mode**.
- When in Manual Mode, to manually reach a pH measurement or calibration value, you need to press button-Read/Enter /Auto when reading is stable and displays : then the sample reading or calibration value freezes, blinks 3 times and freezes on the display.
- When in Auto End Point Mode, the meter determines when the reading is stable then displays and locks the reading or calibration value automatically, the reading freezes and blinks 3 times then disappears; Auto blinks 3 times and freezes on the display.

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

When STARTER 3100 is in **pH measurement mode** (see 4.2); place the pH electrode in a calibration buffer, stir 5 seconds, wait for 30 seconds, then:

- Press Cal Slope "*Cal* 1" displays on the bottom left of the screen and "*Cal* " is blinking. **Cal** and appear on the top of the screen, is blinking during calibration.
- The meter reaches **endpoint** automatically according to the **preselected auto-endpoint mode**, the calibration point pH value (e.g. 7.00) with the temperature display on the screen.

The 1-point calibration is finished; There are now 3 options (OHAUS recommends conducting at least a 2 point calibration);

1. Press Cal Slope to do the 2-point calibration.
2. Press Read/Enter /Auto to store the 1-point calibration and exit, the **offset** and the **slope** are shown on the display for 3 seconds then return to the measurement screen.
3. Press Exit to reject the calibration, return to the measurement screen.

4.1.3 Performing 2-point calibration

- Perform 1-point calibration as described above.
- Rinse the pH electrode with pure water and wipe off with tissue.
- Place the electrode in the next calibration buffer, stir and wait, then press Cal Slope, "*Cal* 2" displays on the bottom left of the screen and "*Cal* " is blinking. On the top of the screen **Cal** and appear, is blinking during calibration.
- The meter reaches endpoint according to the endpoint mode, the calibration point pH value (e.g. 4.01) with the temperature display on the screen.

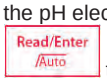
The 2-point calibration is finished. There are 3 options:

1. Press Cal Slope to do the 3-point calibration.
2. Press Read/Enter /Auto to store the 2-point calibration and exit, the **offset** and **slope** are shown on the display for 3 seconds then return to the measurement screen.
3. Press Exit to reject the calibration, return to the measurement screen.

Note: To perform a 3 point calibration, follow the instructions for performing a 2 point calibration using a third buffer.

4.2 Sample measurement

4.2.1 pH measurement

- Place the pH electrode in the sample. Stir for 5 seconds; wait for 30 seconds.
- Press 

to start the pH measurement, appears on the display. is blinking during measurement.
- When meter reaches endpoint, the pH value with the temperature display on the screen.

4.2.2 mV measurement

- Press 

to switch between **pH measurement mode** and **mV measurement mode**.
- Follow the same procedure as for pH measurement to perform mV measurement.

4.3 Temperature measurement

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

- ❖ If a temperature electrode is used, **ATC** and the sample temperature are displayed.
- ❖ If the meter does not detect a temperature electrode, it automatically switches to the manual temperature compensation mode and **MTC** appears. MTC temperature should be set.

Note: STARTER 3100 accepts **NTC 30 kΩ** temperature sensor. ATC (Auto Temperature Compensation) or MTC (Manual Temperature Compensation), the Temperature Compensation only corrects for the change in the output of the electrode, not for the change in the actual solution. This means the meter corrects the signal(mV) from the electrode to get a more accurate pH value according to the real temperature.

4.4 Using the memory

4.4.1 Storing a reading

The STARTER 3100 can store up to 99 endpoint results.

- Press button 

when the measurement reaches endpoint. **M01** indicates that one result has been stored.

If you press 

when **M99** is displayed, **FUL** displays to indicate the memory is full. To store further data you will have to clear the memory. (See 4.4.3)

4.4.2 Recalling from memory

- Press and hold 

to recall the stored values from memory when the current measurement reaches endpoint.

- Press button Store Recall or pH/mV Setup to scroll through the stored results. **R01** to **R99** indicates which result is being displayed.
- Press Exit to exit.

4.4.3 Clearing the memory

- Pressing Store Recall or pH/mV Setup to scroll through the stored results until "MRCL" appears.
- Press Read/Enter /Auto, **CLr** blinks;

There are now 2 options:

- ❖ Press Read/Enter /Auto to confirm the deletion of all the stored data.
- ❖ Press Exit to return to the measurement mode without deleting the memory.

4.5 Printing

If the printer is connected to the STARTER 3100(e.g. SF-F40A, green light means connection success; printer baud rate 9600bps; 8 data bit; none parity bit; 1 stop bit), a print-out is automatically generated after each end pointed measurement or calibration.
The format for the print-out following a pH measurement is:
End Point, Value, Temp., ATC/MTC
Auto EP, 4.01pH, 25.0 °C, MTC

The details for the second line are:
Auto EP, 4.01pH, 25.0 °C , MTC
| | | |---- Manual Temperature Compensation
| | |---------- Temperature value and unit ºC
| |---------- pH value
|---------- Auto End Point

The format for the print-out following a mV measurement is:
End Point, Value, Temp., ATC/MTC
Manual EP, 182mV, 23.2 °C, ATC

The print-out in case of an error message is:
End Point, Value, Temp., ATC/MTC
Error3

The print-out for a 2-point calibration is:
Buffer1: 4.01pH
mV1: 178mV
Temp.1: 25.0 °C
Buffer2: 7.00pH
mV2: 3mV
Temp.2: 25.0 °C

Slope: 99%
Offset: 5mV
ATC/MTC: MTC

The print-out for a 3-point calibration is:
Buffer1: 4.01pH
mV1: 178mV
Temp.1: 25.0 °C
Buffer2: 7.00pH
mV2: 0mV
Temp.2: 25.0 °C
Buffer3: 9.21pH
mV3: -130mV
Temp.3: 25.0 °C
Slope: 100%
Offset: 0mV
ATC/MTC: ATC

Printing from memory: When scrolling through the memory you can print the entry that is currently viewed by pressing and holding (3 seconds) the 

. The printout format is as follows:
Recall 01:
End Point, Value, Temp., ATC/MTC
Manual EP, 4.01pH, 35.6 °C, ATC

5 MAINTENANCE

5.1 Error message

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.

If an error happens, the meter will also **beep 3 times** to alert.
For further technical support please contact Ohaus. (US please contact 1-800-672-7722).

5.2 Meter maintenance

Never unscrew the two halves of the housing!
The STARTER 3100 series instruments do not require any maintenance other than occasional wipe with a damp cloth and the replacement of depleted batteries.
The housing is made of acrylonitrile butadiene styrene (ABS). This material is attacked by some organic solvents, such as toluene, xylene and methyl ethyl ketone (MEK). Any spillage should be immediately wiped off.

5.3 Electrode maintenance

Make sure the electrode is filled with electrolyte solution. Always store the electrode according to the electrode instruction manuals and do not allow it to dry out.

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

- Soak the electrode in 0.1M HCl for at least 8 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.

5.4 Self-diagnosis

- When the meter is on, press and hold Read/Enter /Auto and Cal Cell Constant simultaneously until the meter displays the full screen. Each icon blinks one after the other.

This way you may check whether all icons are correctly shown. The next step is to check that the keys are functioning correctly. This requires user interaction.

When b blinks, five icons are displayed.

- Press the five keys in any order. Each time you press a key an icon disappears from the screen, continue to press the other keys until all the icons have disappeared.

When the self-diagnosis has been completed successfully, **PAS** appears. If self-diagnosis fails, error message **Err 1** appears.

Note: You have to finish pressing all five keys within **2 minutes**, otherwise **Err 1** appears and you will have to repeat the procedure.

5.5 Recover factory settings

- When the meter is off, press and hold Read/Enter /Auto & Cal Cell Constant & Exit together for 3 seconds, the screen displays RST and blinks, this means “Reset”. There are 2 options:
  - ❖ Press Read/Enter /Auto to reset factory settings (MTC, slope and offset, etc.), display YES then restart the meter.
  - ❖ Or press Exit to quit the setting, display NO then turn off the meter.

6 TECHNICAL DATA

6.1 Specifications

Ambient conditions

- Indoor use only
- Altitude: Up to 2000 m
- Specified Temperature range: 5 °C to 40 °C
- Humidity: maximum relative humidity 80 % for temperatures up to 30 °C decreasing linearly to 50% relative humidity at 40 °C
- Mains supply voltage fluctuations: up to ±10% of the nominal voltage
- Installation category II
- Pollution degree: 2
- Operability is assured at ambient temperatures between 5 °C to 40 °C

Model	ST3100
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
Calibration	3 points 3 predefined buffer groups
Memory	99 measurements The last calibration data
Power supply	AC Adapter Input: 100-240V ~ X.XA 50/60 Hz AC Adapter Output: 12V ⊂ X.XA
Size/weight	220 W x 175 D x 78 H mm / 0.75 kg
Display	Liquid crystal with backlight
Input	BNC, impedance > 10e+12 Ω Cinch, NTC 30 kΩ
Reference input	2mm banana socket
Temperature-compensation	ATC & MTC
Housing	ABS

6.2 Compliance

This product conforms to the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.

In conformance with the European Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) this device may not be disposed of in domestic waste. This also applies to countries outside the EU, per their specific requirements. Please dispose of this product in accordance with local regulations at the collecting point specified for electrical and electronic equipment. If you have any questions, please contact the responsible authority or the distributor from which you purchased this device. Should this device be passed on to other parties (for private or professional use), the content of this regulation must also be related. Thank you for your contribution to environmental protection.

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.

ISO 9001 Registration
In 1994, OHAUS Corporation, USA, was awarded a certificate of registration to ISO 9001 by Bureau Veritus Quality International (BVQI), confirming that the OHAUS quality management system is compliant with the ISO 9001 standards requirements. On June 21, 2012, OHAUS Corporation, USA, was re-registered to the ISO 9001:2008 standard.

7 BUFFER GROUP

STARTER 3100 automatically correct for the temperature dependence of the buffer group pH value given in the following tables (**b2, b3**), you can find **b1**. (see 3.1.1)

Buffer group **b2** **Europe standard**

Temp °C	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 **b3** **JJG119**

Temp °C	pH1.68	pH4.00	pH6.86	pH9.18	pH12.46
5	1.67	4.00	6.95	9.39	13.21
10	1.67	4.00	6.92	9.33	13.01
15	1.67	4.00	6.90	9.28	12.82
20	1.68	4.00	6.88	9.23	12.64
25	**1.68**	**4.00**	**6.86**	**9.18**	**12.46**
30	1.68	4.01	6.85	9.14	12.29
35	1.69	4.02	6.84	9.11	12.13
40	1.69	4.03	6.84	9.07	11.98
45	1.70	4.04	6.83	9.04	11.83
50	1.71	4.06	6.83	9.02	11.70

LIMITED WARRANTY

Ohaus products are warranted against defects in materials and workmanship from the date of delivery through the duration of the warranty period. During the warranty period Ohaus will repair, or, at its option, replace any component(s) that proves to be defective at no charge, provided that the product is returned, freight prepaid, to Ohaus.

This warranty does not apply if the product has been damaged by accident or misuse, exposed to radioactive or corrosive materials, has foreign material penetrating to the inside of the product, or as a result of service or modification by other than Ohaus. In lieu of a properly returned warranty registration card, the warranty period shall begin on the date of shipment to the authorized dealer. No other express or implied warranty is given by Ohaus Corporation. Ohaus Corporation shall not be liable for any consequential damages.