

The warranty period extension method 1 year→2 years

The warranty period will be extended from 1 year to 2 years when you register customer information. ATAGO Logger NFC can also be downloaded at the same time.

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QR code

Digital Hand-held "Pocket" Refractometer

PAL-S

Cat.No. 3860



Introduction

Thank you for purchasing the PAL-S Digital Hand-held "Pocket" Refractometer. Before operating, read this instruction manual carefully to understand its contents. Keep the manual with the instrument for future reference. This unit features Mode S technology, a measuring method with improved repeatability. This is ideal for fatty and/or dark samples that typically cause inconsistent readings. Also, the unit comes with MAGIC (Volatile Sample Adapter) used for hot samples to quickly cool down and to help prevent samples from evaporating. *This conclusion is based off of testing with other ATAGO units. The Mode S is not effective for all samples.

Safety Precautions

To use the PAL-S safely, the safety precautions described in this instruction manual must be observed. Failure to comply may result in injury and/or damage to property.

WARNING

- Ensure safety when handling hazardous materials. Observe precautionary measures and use protective equipment. Be aware of the hazards of such chemicals and emergency response guidelines.
- ATAGO may not be held liable for any injury or damage arising in connection with handling of hazardous materials during the use of the instrument.
- Do not drop the instrument or subject it to strong physical shock.
- Do not attempt to repair, modify, or disassemble the instrument.

CAUTION

- Carefully read this manual to have basic knowledge of the function of each component.
- ATAGO is not liable for any loss and damage caused by the measurement and use of this instrument.
- Some acids may corrode the glass prism and/or metal sample stage, which may cause erroneous measurements.
- Do not use metal tools, such as a spoon, as they may scratch the prism, resulting in erroneous measurements.
- Do not use water above 50°C to rinse the instrument.
- Only use the specified battery type. Observe proper polarities, properly aligning the anodes and cathodes.
- Store the instrument away from direct sunlight/heat sources and excessive amounts of dust/debris.
- Do not expose the instrument to a rapid change in ambient temperature.
- Do not subject the instrument to strong vibration.
- Do not subject the instrument to extreme cold temperature.
- Do not place the instrument under anything heavy.
- Loosen the battery compartment cover for air transportation.

ELI Function

<If the ELI* function indicates the [nnn] warning message when measuring a sample, shade the sample stage with your hand and repeat measurement. (Fig. A)>



If the PAL-S is subjected to intense light, such as direct sunlight or artificial lighting, when measuring a sample, the ELI function will display the [nnn] warning message immediately after the START or ZERO button is pressed. When this happens, shade the sample stage with your hand and press the START or ZERO button again.

— Note —
When intense light penetrates the prism of a digital refractometer, the light waves interfere with the sensor, which may lead to inaccurate measurements. To ensure accurate measurement results, the PAL-S is programmed with the ELI function which displays the [nnn] warning message when intense direct light is detected. Forming a habit of shading the sample stage with your hand and re-pressing the START button (when the warning message from the ELI function is displayed) will ensure accurate measurement results each time.

* External Light Interference (ELI)

Contents

- The PAL-S contains the following items:
- ◆ PAL-S 'Pocket' Refractometer 1
 - ◆ Instruction Manual (this book) 1
 - ◆ Calibration Report 1
 - ◆ AAA alkaline batteries 2
 - ◆ MAGIC™ 1

Parts



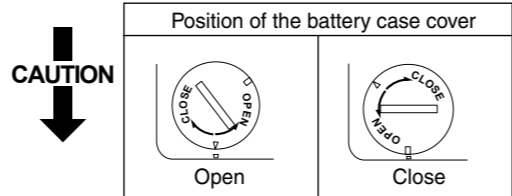
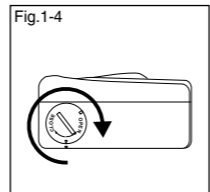
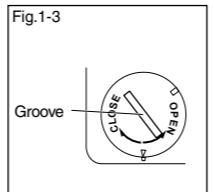
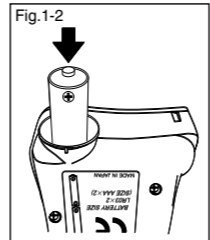
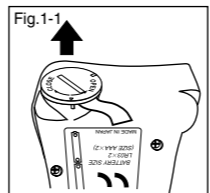
<International Protection Classification IP65>

Although the PAL-S is water resistant and may be cleaned under running water, it is not water proof. Do not submerge the instrument under water.

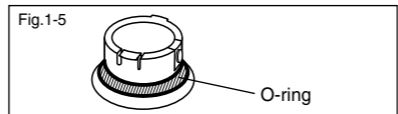
Inserting Batteries

When inserting batteries for the first time or replacing batteries, this step should be performed in an environment where there is relatively low humidity.

- Remove the battery compartment cover. Be sure to remove the protective tape located on the under side of the cover (Fig. 1-1).
- Insert batteries, observing the correct polarity (Fig. 1-2).
- Align the cover and push it down (Fig. 1-3).
- Close the battery compartment cover by pushing the cover in with a coin in the groove and turning it clockwise until it stops (Fig. 1-4).



- [CAUTION]**
- Fasten the battery compartment cover tightly to prevent water ingress or poor connection, which will cause erroneous measurements. Push the cover in firmly and turn.
 - When the O-ring on the cover is dirty or damaged, the water resistance may be compromised. (Fig. 1-5)



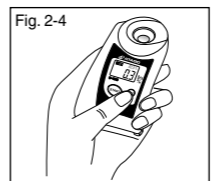
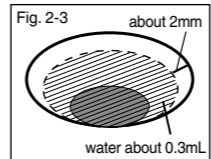
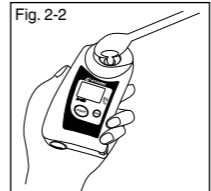
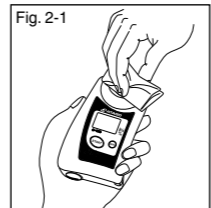
- When the battery icon indicates the low power level (), replace both batteries with a brand new set of AAA alkaline batteries (1.5V).
- Static images may occasionally appear on LCD. Such retained pixel charges do not indicate a faulty display, consume the battery power, or affect the instrument's performance in any way.
- Check the expiration dates on batteries before purchase.
- Zero-set the instrument after the batteries are replaced.

Zero Setting

[CAUTION]

- Perform Zero Setting each day prior to using the PAL-S.
- The temperature of the tap water used for zero-setting should be the same as the ambient temperature. If not, allow the water temperature to adjust to the ambient temperature before pressing the ZERO button to Zero Set.
- If the ELI* function indicates the [nnn] warning message on the LCD screen while performing zero-setting, shade the sample stage with your hand and press the ZERO button again.

- Prepare tap water. (Fig. 2-1)
- Clean the prism surface (Fig. 2-1).
- Place approx. 0.3 mL of water onto the prism surface (Fig. 2-2, Fig. 2-3).
- Press the START button. After displaying "---," it will blink "-." Temperature will be measured every second. After 5 to 15 seconds, the result will be displayed. From then on, the temperature and Brix(%) readings are measured continuously every second. (Fig. 2-2)
- Measurement : 0.0% (Fig. 2-3)



Measurement : not 0.0%
If it displays other than 0.0%, press the START button to stop continuous measuring. Press the ZERO button after placing a droplet of water onto the prism (Fig. 2-4).

After blinking, "000" will be displayed on the LCD screen (Fig 2-5). If the display reads "AAA", add more water onto the prism surface and press the ZERO button again.
When "000" is displayed, zero setting has been successfully completed. Dry the prism surface by wiping with a tissue. The PAL-S is ready to use.

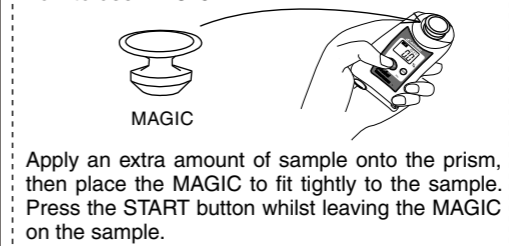
Measuring Method

[CAUTION]

- Do not use metal tools to apply samples on the prism as they may scratch the prism.
- Initial measurements may fluctuate with hot or cold samples. Wait for the instrument to acclimate to the sample temperature, approx. 20 seconds, to press the START button. Alternatively, press the START button multiple times until measurements become stable.
- Do not splash water above 50°C. The plastic may warp, which may compromise the water resistance.
- When measuring hot samples, place only the necessary amount and do not let it overflow from the sample stage well.
- When hot water is necessary to clean off hardened samples, use water-soaked gauze around the prism area and keep hot water away from the body case.

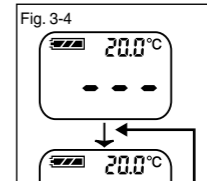
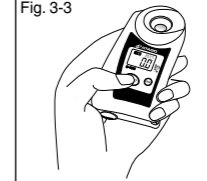
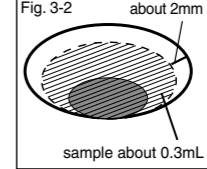
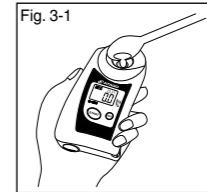
- The displayed temperature is that of the prism and may not necessarily match the temperature of the sample.
- When using the MAGIC, please refer to the instructions below.

How to use MAGIC



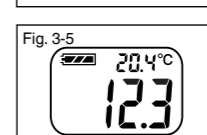
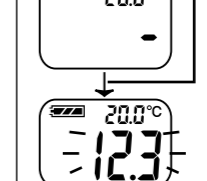
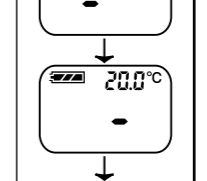
Apply an extra amount of sample onto the prism, then place the MAGIC to fit tightly to the sample. Press the START button whilst leaving the MAGIC on the sample.

- Clean the prism surface. (Fig. 3-1)
- Place approx. 0.3 mL of sample onto the prism surface (Fig. 3-1, Fig. 3-2).
- Press the START button (Fig. 3-3).
- After displaying "---," "-" will blink until the results stabilize. The temperature will be measured approx. every second. After 5 to 15 seconds, the result will be displayed. From then on, the temperature and Brix(%) readings are measured continuously every second. (Fig. 3-4). The duration for which the blinking of "-" lasts will differ, based on the sample type.



* After a minute of continuous measuring, the unit will turn itself off automatically.
* The measurement value just before the continuous measurement is completed is saved as a data history.

<To stop continuous measurement.>
Press the START button. Continuous measurement is finished and the readings are retained (Fig. 3-5). The instrument will turn itself off after approx. 2 minutes of inactivity.
* To manually turn it off, hold down the START button for more than 4 seconds.



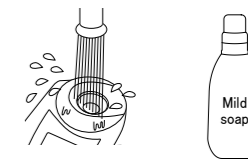
<For oily/fatty samples>
Try stirring the sample on the sensor while measuring to improve the repeatability of oily/fatty samples.

Cleaning

[Caution]

- Do not scratch the prism.
- The instrument is water-resistant, not waterproof, and should not be submerged.

- Wipe off the sample.
- Clean the prism and sample stage using a mild soap and thoroughly rinse with water.
- Dry the area with tissues thoroughly.

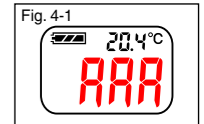


Error Messages

Improper operation of the PAL-S will result in one of the following error messages:

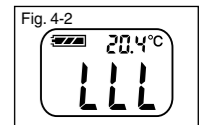
"AAA" Zero Setting Error (Fig. 4-1)

- There is no or an insufficient amount of water on the prism surface while performing zero setting.
- A substance other than water is used to perform zero setting.



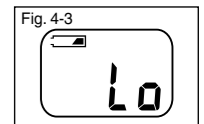
"LLL" Sampling, Measurement Error (Fig. 4-2)

- There is an insufficient amount of sample on the prism surface to perform measurements.



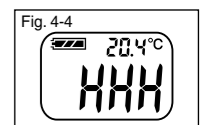
Battery Error (Fig.4-3)

- "Lo" will be displayed when the battery is low. Replace with new batteries.



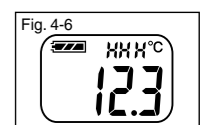
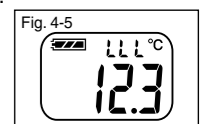
"HHH" Out of Range (Fig. 4-4)

- The measured value is out of the measurement range.



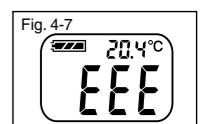
Measurement Temperature Error (Fig. 4-5 & 4-6)

- The prism temperature is below the temperature range.
- The prism temperature is above the temperature range.



"EEE" Malfunctioning Error (Fig. 4-7)

- With the instrument turned off, remove and reinsert the battery. In the case of a low battery, replace the batteries with new AAA alkaline batteries. If the instrument continues to display the error message, the instrument will need to be repaired. Please contact your Authorized ATAGO Distributor for information on repair.



Storage and Maintenance

- Store the instrument in a dry place away from direct sunlight. Exposure to humidity and heat may damage the instrument.
- Clean and dry the sample stage thoroughly, following the "Cleaning" instructions. Store the unit away from direct sunlight at a stable temperature with as little fluctuation as possible.

Brix Scale and Automatic Temperature Compensation

(1) Brix Scale

All Refractometers are designed to measure the refractive index of a solution. The Brix scale is based on a sucrose (sugar) and water solution. However, since most samples contain substances other than sugar - such as salts, minerals, and proteins - the Brix percentage represents the total concentration of all soluble solids in the sample. For certain samples, such as cutting oils and other industrial fluids, a conversion chart from the Brix percentage to the sample's total concentration may be necessary.

(2) Automatic Temperature Compensation

The readings are corrected, based on the temperature of the prism, within the automatic temperature compensation range.

[CAUTION]

Measurements may fluctuate with hot or cold samples. Wait for approx. 20 seconds to press the START button. Measurements will stabilize once the instrument acclimates to the sample temperature.

Specifications

Measurement range	Brix 0.0 to 93.0% Temperature 10.0 to 100°C
Resolution	Brix 0.1% Temperature 0.1°C
Measurement accuracy	Brix $\pm 0.2\%$ Temperature $\pm 1^\circ\text{C}$
Measurement temperature	10 to 100°C (Automatic Temperature Compensation)
Ambient temperature	10 to 40°C
Sample volume	0.3mL or more
Measuring time	Continuous measurement for 60 seconds after 5 to 15 seconds of analysis
Backlight	The backlight stays on for 30 seconds after any button is pressed.
Power supply	AAA alkaline battery $\times 2$
Maximum number of data history	100
Output	NFC Forum Type 4 Tag ISO/IEC 14443 Type A Output category : Date Time, Brix [%], Temp [degC] (e.g.) 2017/08/17 09:30:45, 12.3, 20.4
Battery life	About 1,500 measurements (60 seconds of continuous measurement after 5 to 15 seconds of analysis)
International Protection class	IP65 Water Resistant
Dimensions and weight	55(W) \times 31(D) \times 109(H)mm, 100g

ATAGO instruments are rigorously inspected to ensure each unit meets the highest standards of quality assurance.

Repair and Warranty

The instrument is warranted for one year from the date of purchase. This warranty is void if the instrument shows evidence of the following. Send the included batteries as well if they are still in use.

- Having been disassembled by unauthorized personnel
- Damages to the prism and/or sample stage
- Water damage or having been dropped
- Having been misused and/or operated outside the environmental specifications
- Leakage from batteries other than those included with the unit

Repair services are available for a fee after the warranty expires.

Contact an ATAGO authorized service center for service and support.

Have the serial number of your PAL-S available when asking about repairs.

CE Certification

The product is in conformity with the requirements of the EMC Directive 2004/108/EC.

Patent Granted in Japan, United States, Germany, China and Taiwan.

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