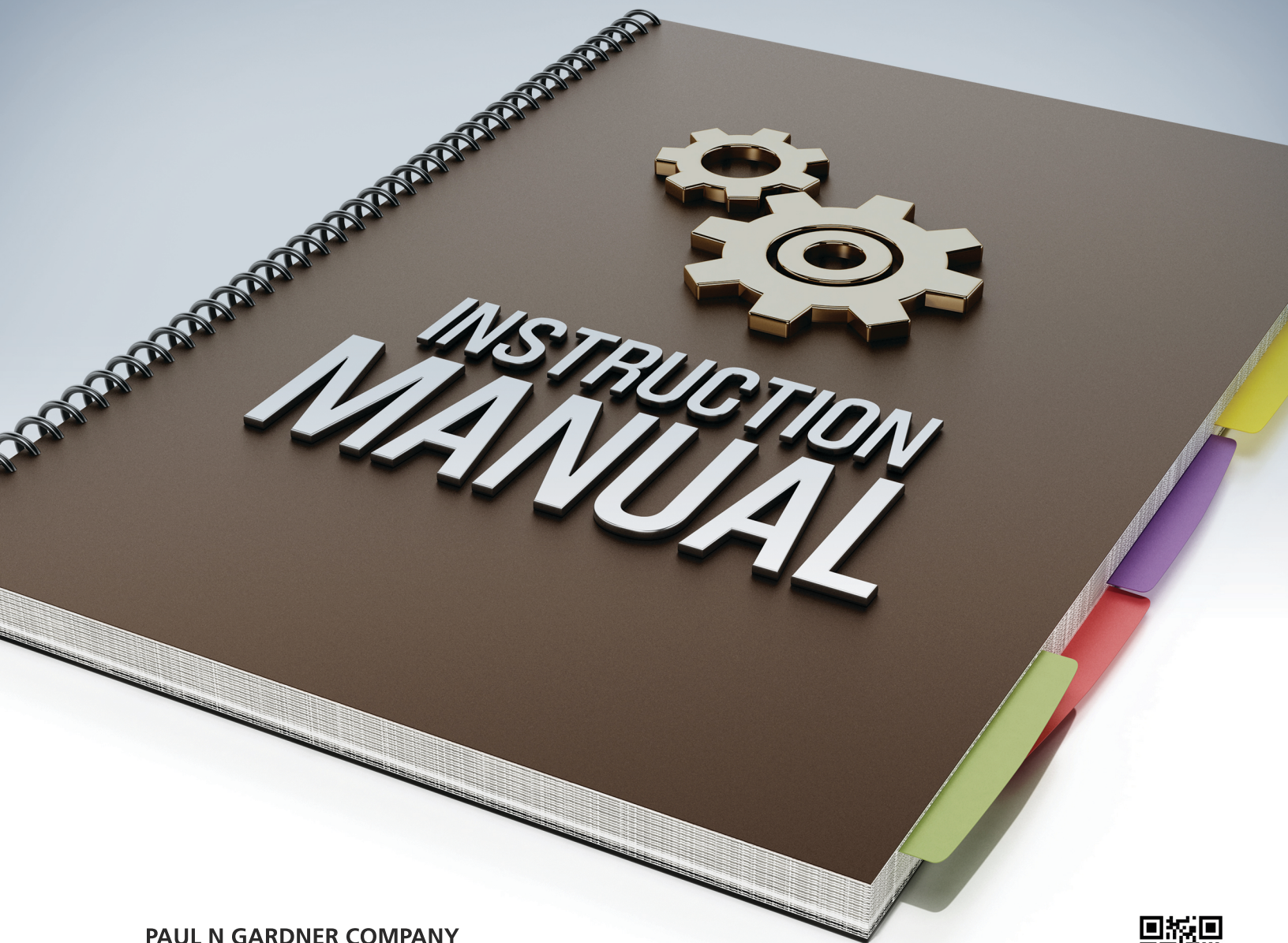




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INSTRUCTIONS

GARDCO DISTRIBUTED PRODUCTS



Pocket PAL-1

Instruction Manual

Pocket Refractometer



Introduction

Thank you for purchasing the "Pocket Refractometer PAL-1". Before using your PAL-1, read this instruction manual carefully and understand how to use it. After reading this manual, keep it on hand for future reference.

In this manual "For safe use" describes the important items necessary for safety. Read it carefully.

For safe use

This operation manual describes the items which you are required to observe in order to use the PAL-1 safely to prevent injury to you and other people and damage to your property. Understand them first and then read the following pages to use your PAL-1 correctly. Read it carefully.

WARNING

- ◇ When measuring a substance harmful to the human body, be well aware of its properties and put on protective gloves, mask, etc.
- ◇ If the instrument is dropped or is subjected to a strong shock, have it inspected by an ATAGO distributor.
- ◇ Do not attempt to repair, modify, or disassemble the instrument yourself.

CAUTION

- ◇ If this instrument is used to measure highly acidic samples, the prism and sample stage may be damaged resulting in inaccurate measurements.
- ◇ The prism is made of optical glass. Do not tap or contact its surface with any metal tool such as a spoon or tweezers. If the surface of the prism is damaged, inaccurate measurements will occur.
- ◇ After taking a measurement, completely wipe off any sample on the surface of the prism and surrounding area with tissue paper soaked in water. Then remove any remaining moisture completely with dry tissue paper.
- ◇ Carefully read this instruction manual and fully understand the function and operation of each part of the instrument before use.
- ◇ Make sure to use the specified battery or that which was supplied with the refractometer as an accessory. When loading the refractometer with a battery, pay heed to the polarities of the battery.
- ◇ Use the instrument at an altitude below 5,000 m (above sea level).
- ◇ Do not leave the instrument in a location exposed to direct sunlight or near a heating unit where the temperature may rise.
- ◇ Do not change the environmental temperature of the instrument suddenly.
- ◇ Do not place the instrument in a place where it may be subject to strong vibrations.
- ◇ Do not use the instrument where there is much dust.
- ◇ Do not leave the instrument where the temperature is extremely low.
- ◇ Do not place or drop heavy objects on the instrument.

<Taking Accurate Measurements Outdoors>—— Be sure to observe the following.

Observance of direct sunlight, light at dusk or spotlights, should be considered when using digital refractometers (that apply the principle of light refraction) in the measurement of sugar content/concentration. Such light may interfere with the instrument's sensor resulting in inaccurate readings. In general, when operating a digital refractometer outdoors, intense light should always be avoided. In such environments (to ensure 100% accurate measurement results) where a refractometer is exposed to intense light, shade the sample stage with your hand or turn your back to the light to shade the refractometer. Placing the utmost priority to ensure proper measurement, the PAL-1 is programmed to automatically cancel the measurement and display an error message when intense and/or direct light is detected.

<Prove Protection against Ingress of water (IP 65)>

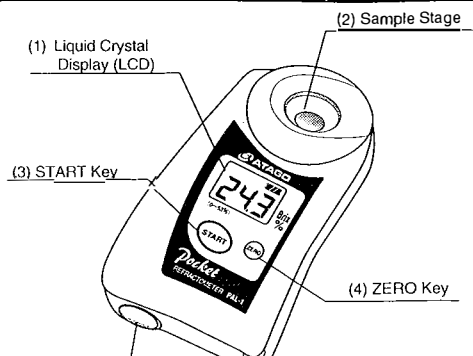
Although the PAL-1 is water resistant and may be cleaned under running water, it is not water proof. Avoid from submerging it under water.

Confirmation of Package

- Please confirm the following contents of the package immediately when the Unit is unpacked.
- | | |
|------------------------------------|--|
| ◆ Pocket Refractometer PAL-1.....1 | ◆ Size AAA Battery.....2 |
| ◆ Inspection Card1 | ◆ Instruction Manual (this book).....1 |

Names and Roles of Each Part

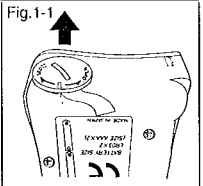
- 1) Liquid Crystal Display (LCD)
Measurement values (Brix(%)) and battery power indicator are displayed on the Liquid Crystal Display.
- 2) Sample Stage
The prism is located at the center of the Sample Stage. The sample stage is made of stainless steel.
- 3) START Key
Press this Key to start measurement. Note that the measurement value goes off if this switch is kept pressed for over 2 seconds.
- 4) Zero Key
Press the Zero Key at zero setting of the Unit.
- 5) Battery Case Cover
Remove this cover to set or replace the battery.
- 6) Strap Attachment Hole



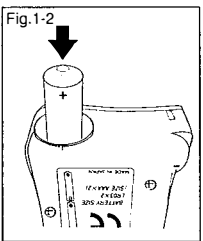
Prior to use, read the following section.

1. Inserting Batteries

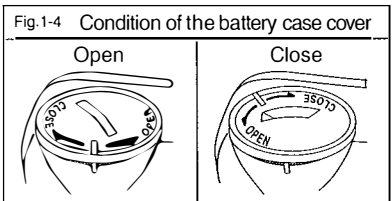
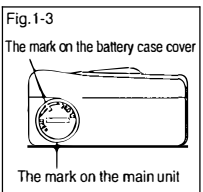
- (1) Remove the battery case cover. Be sure to remove the protective tape located on the under side of the cover (Fig. 1-1).



- (2) In reference to the illustration located on the backside of the main body, insert the two AAA alkaline batteries provided. Be sure to check and properly insert noting the positive and negative terminals of the batteries (Fig. 1-2).

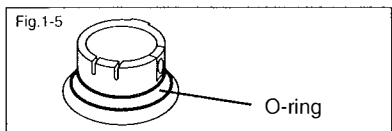


- (3) When the batteries are inserted screw on the battery case cover so that the marking on the cover is in line with that located on the main body. Using a coin, tighten the battery case cover by turning it clockwise (Fig. 1-3, Fig. 1-4).



[CAUTION]

- An O-ring is attached to the battery case cover. Ensure that the O-ring is clean and not deformed at all times. Dirty or deformed O-rings may allow water to enter the unit, thus damaging the electronic components inside.



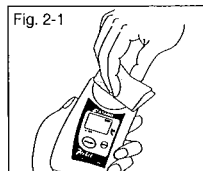
- Battery Power Indicator When the battery power indicator displays the minimum amount of battery power remaining (as shown in the figure), replace the batteries with new ones as soon as possible. Use only 1.5V LR03 AAA batteries.
- When purchasing batteries be sure to check the expiration date.
- After changing batteries be sure to conduct zero setting.

2. Zero Setting

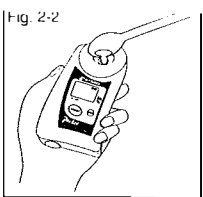
[CAUTION]

- Be sure to perform zero setting each day before using the PAL-1.
- If the temperature of distilled or tap water used for conducting zero setting (when placed on the prism) is higher or lower than the ambient temperature, before pressing the START key, allow some time for the temperature of the water to conform (cool down or warm up) to the temperature of the prism surface.
- When conducting zero setting outdoors be sure to shade the sample stage with your hand. The same should be done indoors where intense light from outside enters the room.

- (1) Prepare distilled or tap water.
- (2) Clean the prism surface (Fig. 2-1).

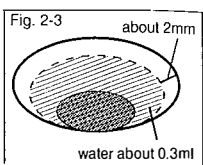


- (3) Place approximately 0.3 ml of water onto the prism surface (Fig. 2-2, Fig. 2-3).

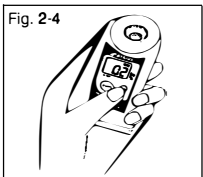


- (4) Press the START key. The Brix(%) value will be displayed on the screen after the arrow blinks 3 times.

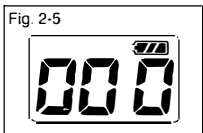
- (5) If the display indicates 0.0%, zero setting has been successfully completed. Wipe the water off the prism surface with tissue. The PAL-1 is now ready for sample measuring.



- (6) If the indicated value is not 0.0%, press the ZERO key with the water left on the prism (Fig. 2-4).



- (7) After blinking 3 times, "000" will be displayed on the screen (Fig. 2-5). If the display indicates "AAA," add some water onto the prism surface, and then press the ZERO key again.



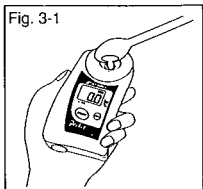
- (8) "000" should be displayed now, indicating that the zero setting has been successfully completed. Wipe the water off the prism surface with a dry tissue. The PAL-1 is now ready for sample measuring.

3. Measuring a Sample

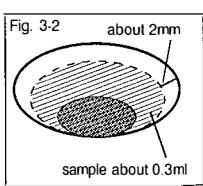
[CAUTION]

- Do not use any metallic implements for sampling. The metal can possibly damage the prism surface.
- If the temperature of the sample stage and that of the sample to be measured are different, allow some time for the temperature of the sample stage to conform to the sample before taking a measurement to eliminate the temperature differences.
- For measuring high-temperature samples that have been heated or boiled, put the appropriate amount of sample (approximately 0.3 ml) onto the sample stage. Press the START key. Wait for the Brix value to be displayed, and then press the START key again. Repeat until the Brix value becomes almost invariant, which may then be used as an effective measurement value. The indicated Brix value fluctuates due to the temperature difference between the sample and the prism, but will stabilize after repeating the above steps a few times.
- Be sure to shade the sample stage with your hand when using the PAL-1 outdoors. The same procedure should be observed indoors where intense light from outside enters the room.

- (1) Clean the prism surface.

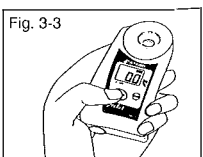


- (2) Put approximately 0.3 ml of the sample to be measured onto the prism surface (Fig. 3-1, Fig. 3-2).



- (3) Press the START key (Fig. 3-3).

- (4) The Brix(%) value (of the sugar concentration when measuring a sucrose solution) will be displayed on the screen after the arrow blinks 3 times (Fig. 3-4).



- (5) The measurement value will remain displayed for approximately one minute. To turn off the display, press and hold down the START key for 2 approximately seconds.

- (6) After wiping on the sample from the prism surface put some water on the prism and wipe off again. Ensure that the prism and the sample stage are cleaned by wiping with a dry tissue.



4. Error Messages

When the PAL-1 is improperly operated, an error messages is indicated on the display.

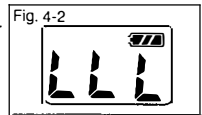
[AAA] : Zero Setting Error (Fig. 4-1)

- Indicates when the ZERO key is pressed and there is no water on the prism.
- Indicates when the ZERO key is pressed with a substance other than water is on the prism.



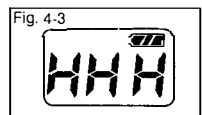
[LLL] : Sampling Error, Measurement Error, and Battery Error (Fig. 4-2)

- Indicates when the START key is pressed with no sample or insufficient amounts of sample is on the prism.
- Indicates when the START key is pressed while the prism is exposed to direct or intense sunlight (including weak, late afternoon sunlight).
- Indicates when the START key is pressed and the battery power is too low to perform the measurement. (Continued usage will result in the display to automatically shut off.)



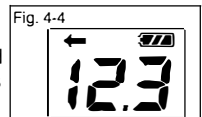
[HHH] : Over Range (Fig. 4-3)

- Indicates when the sample measured has a Brix(%) value exceeding the measurable range.



Ambient Temperature Error (Fig. 4-4)

- When the start key is pressed and the temperature of the prism is lower or approximately 10°C or approximately 40°C or higher, the Brix(%) value will be displayed along with a blinking arrow. This indicates that the temperature of the prism is below or above the manufactured conditions of operation (10~40°C). When measuring a high-temperature samples that have been heated or boiled, the same message may be displayed although the temperature of the sample may be below 40°C. However, as the temperature compensation is effective up to 60°C, the stabilized Brix value acquired after taking repeated measurements may be used as an effective measurement value.



5. Storage and Maintenance

- (1) When storing this instrument, avoid a damp place or a place which is exposed to the direct sunrays. Dampness will cause blurs on the optical system or it will gather mold, and direct sunrays will deform the casing, disabling the instrument from performing measurements.
- (2) Because the casing is made of plastic, it is strictly prohibited to use organic solvents (paint thinner, benzene, gasoline or the like).
- (3) After taking a measurement, completely wipe off any sample on the surface of the prism and surrounding area with tissue paper soaked in water. Then remove any remaining moisture completely with dry tissue paper.

6. Brix (%) and Automatic Temperature Compensation

(1) About the Brix (%) Scale
The Brix (%) shows the concentration percentage of the soluble solids content of a sample (water solution). The soluble solids content is the total of all the solids dissolved in the water, beginning with sugar, salts, protein, acids, etc., and the measurement reading value is the sum total of those. Basically, Brix (%) is calibrated to the number of grams of cane sugar contained in 100g of cane sugar solution. So, when measuring a sugar solution, it (Brix(%)) should perfectly match the actual concentration. With solutions of other components, especially when one wants to know, quantitatively, the concentration, a conversion chart is necessary.

(2) Automatic Temperature Compensation
The automatic temperature compensation of the PAL-1 is performed by the temperature sensor based on the temperature of a prism which should be from 10°C to 60°C. The temperature compensation is accurate therefore when the temperature of the sample on the prism is the same as that of the prism. After dripping a cold or hot sample on the prism, the stabilized Brix value acquired after a few times of repeated measurements may be used as an effective measurement value.

7. Specifications

Measurement range	Brix 0.0~53.0%
Resolution	Brix 0.1%
Measurement accuracy	Brix ±0.2%
Measurement temperature	10~60°C Automatic Temperature Compensation
Ambient temperature	10~40°C
Sample volume	0.3ml or more
Measuring time	3 seconds
Power supply	Size AAA alkaline battery x 2
Battery life	About 11, 000 times measurement (when an alkaline battery is used)
Prove Protection against Ingress of water	IP65
Dimensions and weight	55(W)X31(D)X103(H)mm, 100g

8. Repair and Warranty

- When transporting the PAL-1 on an airplane, remove the batteries and battery case cover and keep them in the storage case provided.

The warranty of this instrument is one year after the date of purchase. Any trouble detected during the warranty period will be performed without charge. After the warranty has expired, the cost of repairs will be subject to evaluation. Ask your ATAGO distributor concerning this matter. During the warranty period, if a person who has not taken the maintenance technology course at our company and has opened and tampered with the components within the casing, the warranty will be invalidated and a charge for repair will be assessed. The prism is considered a consumable item. Therefore, any damage to the prism is not covered under the warranty and is subject to repair costs.

When asking about repair or other matters, be sure to notify us of the serial No. of your PAL-1.

CE Certification

The product is in conformity with the requirements of the EMC Directive 93/68/EEC.