

Digital Refractometer

PRODUCT MANUAL

Item 2812

Spectrum[®]
Technologies, Inc.



⚠ WARNING

- ◇ When measuring hazardous materials, use proper safety procedures, materials, and clothing to avoid personal injury. Anyone handling hazardous materials should understand its properties and its safety requirements.
- ◇ If the instrument is dropped or subjected to a strong impact, contact your supplier for inspection.
- ◇ Do not attempt to repair, modify, or disassemble the instrument.

⚠ 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 use any metal tools when applying sample to the prism. The metal can damage the prism surface. If the surface of the prism is scratched or damaged, inaccurate measurements will occur.
- ◇ When the unit needs to be washed, use cold water at a temperature not exceeding 30°C.
- ◇ Before use, carefully read the instruction manual and fully understand the function and operation for each part of the instrument.
- ◇ Use the battery specified with this refractometer. Insert the batteries properly, paying attention to the polarities.
- ◇ 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 heat source for any extended period of time.
- ◇ Do not change the ambient temperature of the instrument suddenly.
- ◇ Do not place the instrument where it will be subject to strong vibrations.
- ◇ Do not use the instrument where there are excessive amounts of dust.
- ◇ Do not store the instrument in an extremely cool area.
- ◇ Do not set or drop heavy objects on top of the instrument.
- ◇ ~~When transporting the PAL-1 on an airplane, remove the batteries and battery case cover and store them in the case provided.~~

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-1 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 key is pressed. When this happens, shade the sample stage with your hand and press the START or ZERO key 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-1 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 key (when the warning message from the ELI function is displayed) will ensure accurate measurement results each time.

* External Light Interference (ELI)

< International Protection Classification IP65 >

Although the PAL-1 is water resistant and may be cleaned under running water, it is not water proof. Do not submerge the instrument under water.

Contents

The PAL-1 contains the following items:

- ◆ Pocket Refractometer PAL-11
- ◆ Size AAA Battery2
- ◆ Instruction Manual (this book)1

Parts

- (1) Liquid Crystal Display (LCD)
Displays the measured values and battery indicator.
- (2) Sample Stage
The prism is located at the center of the sample stage.
- (3) START Key
Press to begin measurement. To turn off the instrument, press and hold down for two seconds.
- (4) ZERO Key
Press to perform zero-setting.
- (5) Battery Case Cover
Remove the battery case cover to insert or replace the battery.
- (6) Strap Holder
Attach a strap for increased portability.



1. 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 case cover. Be sure to remove the protective tape located on the under side of the cover (Fig. 1-1).
- Refer to the illustration located on the back of the unit. Follow this diagram to properly insert the batteries, noting the positive and negative terminals. Insert the two AAA alkaline batteries provided (Fig. 1-2).
- After inserting the batteries, place the battery case cover on the slot, aligning the mark on the battery case cover to the mark on the lower part of the main unit. Then turn the battery case cover towards the right (clockwise), while holding the center tip of the battery case cover with your thumb and index finger and pressing it downwards, until it stops completely (Fig. 1-3, 1-4).

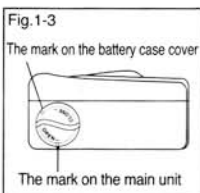
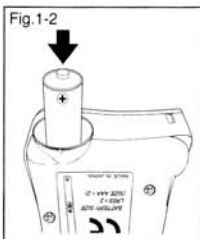
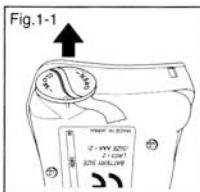
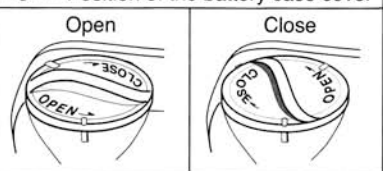


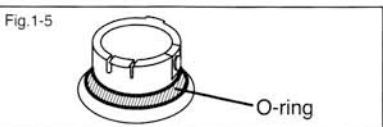
Fig. 1-4 Position of the battery case cover



CAUTION

[CAUTION]

- Confirm that the battery case cover is tightly closed in order to prevent troubles of liquids coming inside the unit which causes unstable electrical connection and not being able to measure. Turn the cover tightly after setting it correctly into the instrument.
- Check that the O-ring located on the battery case cover is clean and free of deformities. If the O-ring is dirty or deformed, water may enter the instrument causing damage to the electronic components (Fig. 1-5). After opening and closing the cover several times, apply oil (such as Vaseline) on the O-ring with a cotton swab.



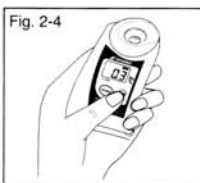
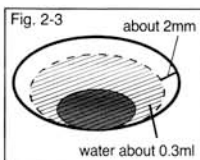
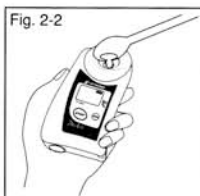
- Battery Power Indicator** When the battery power is low, as indicated by the symbol above, replace with new batteries as soon as possible. Use only 1.5V AAA batteries.
- When inserting batteries for the first time or replacing batteries, this step should be performed in an environment where there is relatively low humidity.
- Occasionally, the "battery indicator," a character or number mark may be present after the instrument is powered off. This occurs due to static electricity and is not a defect in the liquid crystal display (LCD). When these marks are present, there is no additional power drain on the battery.
- Always check the expiration date when purchasing batteries.
- Perform Zero Setting after replacing the batteries.

2. Zero Setting

[CAUTION]

- Perform Zero Setting each day prior to using the PAL-1.
- The temperature of the distilled or tap water used for zero-setting should be the same as the ambient temperature. If not, allow the water temperature to adjust to the prism temperature before pressing the ZERO key 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 key again.

- Prepare distilled or tap water.
- Clean the prism surface (Fig. 2-1).
- Place approximately 0.3 ml of water onto the prism surface (Fig. 2-2, Fig. 2-3).
- Press the START key. The measured value will be displayed on the screen after the arrow blinks 3 times.
- If the display indicates "0.0%", zero setting does not need to be performed. Wipe the water off of the prism surface with a lint free tissue. The PAL-1 is ready to use.
- If the indicated value is not "0.0", press the ZERO key while the water is covering the prism. (Fig. 2-4).
- After blinking 3 times, "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 key again.
- After "000" is displayed, zero setting has been successfully completed. Dry the water off of the prism surface by wiping with a tissue. The PAL-1 is ready to use.

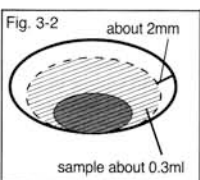


3. Measuring Method

[CAUTION]

- Do not use any metal tools when applying sample to the prism. Metal can damage the prism surface.
- The temperature of the sample should be the same as the ambient temperature. If the temperature is different, allow the sample temperature to adjust to the prism temperature before pressing the start key to take a measurement.
- The instrument should not come in contact with any sample over 30°C. Warping of the outer casing may occur, which will diminish the water resistant feature of the instrument. When measuring hot samples, care should be taken to apply the sample onto the sample stage (onto the prism surface) only. Avoid using water over 30°C to clean a sample that has dried and hardened on the prism surface. The proper procedure to clean an encrusted prism surface is to use absorbent gauze dipped in hot water, then carefully wipe the sample off. Avoid wetting the outer casing of the instrument with the hot water. The excessive heat can warp the outer casing, which will diminish the water resistant feature of the instrument.
- If the ELI* function indicates the [nnn] warning message on the LCD screen while measuring a sample, shade the sample stage with your hand and press the START key again.

- Clean the prism surface.
- Place approximately 0.3 ml of sample onto the prism surface (Fig. 3-1, Fig. 3-2).



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

(4) The measurement value will be displayed on the screen after the arrow blinks 3 times (Fig. 3-4).

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

(6) Remove the sample by wiping it off with a tissue. Use water to remove any remaining sample. Dry off any excess moisture with a clean, dry tissue.

Fig. 3-3



Fig. 3-4



4. Error Messages

Improper operation of the PAL-1 will result in one of the following error messages:

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

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

Fig. 4-1



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

- There is an insufficient amount of sample on the prism surface to perform measurements.
- The batteries are low. If the batteries are not replaced, the instrument may shut off.

Fig. 4-2



[HHH] Out of Range (Fig. 4-3)

- The sample's measured value is out of the measurement range.

Fig. 4-3



Ambient Temperature Error (Fig. 4-4)

- The PAL-1 is designed to be used within the ambient temperature range of 10-40°C. If the PAL-1 is used out of the 10-40°C ambient temperature range, the Brix(%) value will be displayed along with a blinking arrow. When measuring a sample that has a temperature higher than 40°C, the blinking arrow may be displayed even though the ambient temperature is within the 10-40°C range. The stabilized Brix value acquired after taking repeated measurements may be used as an accurate measurement value.

Fig. 4-4



6. 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 Automatic Temperature Compensation feature of the PAL-1 displays the measured value of the sample at the standard 20°C (within the measurement temperature range of 10-75°C). As the temperature of a solution changes, so does the refractive index. The Automatic Temperature Compensation feature of the PAL-1 is performed by a temperature sensor which measures the change in prism temperature (when a sample is placed on the prism) and then calculates the actual measured value in relation to the temperature change. Since the prism temperature is changing, allow time for the temperature of the prism and sample to conform for the Automatic Temperature Compensation to work properly.

7. Specifications

| | |
|--------------------------------|--|
| Measurement range | Brix 0.0~53.0% |
| Resolution | Brix 0.1% |
| Measurement accuracy | Brix $\pm 0.2\%$ |
| Measurement temperature | 10~75°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 $\times 2$ |
| Battery life | About 11,000 times measurement (when an alkaline battery is used) |
| International Protection class | IP65 Water Resistant |
| Dimensions and weight | 55(W) \times 61(D) \times 109(H)mm, 100g |

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

9. CE Certification

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

It is applying for the registration of a design and the patent of the Pocket to the all countries around the world. It is registered in China and Taiwan as follows.
Patent for Registration No.: ZL200310103015.2 (China)
Design for Registration No.: ZL03303431.1 (China) and 089244 (Taiwan)

5. Storage and Maintenance

- (1) Store this instrument in a dry and shaded area. A damp storage area may cause the optical system to blur or encourage molding. Extended exposure to direct sunlight may cause the casing to warp.
- (2) Do not use organic solvents (paint thinner, benzene, gasoline, etc.) on the instrument because it will severely damage the casing.
- (3) Clean the prism surface immediately after completing each measurement. Any sample left on the prism surface for any extended period of time will damage the prism. Clean the prism with water and then dry any excess moisture with a clean, dry tissue.