POLARÍMETRO MANUAL MODELO 404 Y 404 LED
MANUAL POLARIMETER MODEL 404 AND 404 LED
POLARIMÈTRE MANUEL MODÈLE 404 ET 404 LED

Ref. HMB001 / HMB002 / HMB006

Este manual es parte inseparable del aparato por lo que debe estar disponible a todos los usuarios del equipo. Le recomendamos leer atentamente el presente manual y seguir rigurosamente los procedimientos de uso para obtener las máximas prestaciones y una mayor duración del mismo.

For your safety, please read the operating manual carefully before starting the operation. Parts are subject to heat,humidity and biological changes t hat can cause functional degradation or even loss of safety and cause accidents!

Ce manuel est une partie indissociable de l'appareil et doit être mis à la disposition de tous les utilisateurs de l'équipement. Nous vous recommandons de lire attentivement ce manuel et de suivre strictement les procédures d'utilisation afin d'obtenir des performances maximales et une plus longue durée de vie de l'équipement.

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Model manual polarimeter HMB001, HMB006 and HMB002

Thank you for choosing this equipment. We sincerely wish that you enjoy your Zuzi manual polarimeter. We highly recommend looking after this equipment according to what is stated in this manual.
Zuzi develops its products according to the CE marking regulations as well as emphasizing the ergonomics and security for its user.
The correct using of the equipment and its good quality will permit you to enjoy this equipment for years. The improper use of the equipment can cause accidents and electric discharges, circuit breakers, fires, damages, etc. Please read the point of Maintenance, where we expose the security notes.

TO GET THE BEST RESULTS AND A HIGHER DURATION OF THE EQUIPMENT IT IS ADVISABLE TO READ THOROUGHLY THIS MANUAL BEFORE OPERATING WITH THE EQUIPMENT.

Please bear in mind the following:

- This manual is inseparable from the Zuzi manual polarimeter HMB001, HMB002 and HMB006, so it should be available for all the users of this equipment.
- You should carefully handle the polarimeter avoiding sudden movements, knocks, free fall of heavy / sharp objects on it. Avoid spilling liquids inside the equipment.
- Never dismantle the different pieces of the polarimeter to repair it yourself, since it could produce a defective use of the whole equipment and a loss of the product warranty, as well as injuries on people that handle the polarimeter.
- To prevent fire or electric discharges avoid dry or dusty environments. In case it may happen unplug the equipment immediately.
- If you have any doubt about setting up, installation or functioning do not hesitate in contacting your wholesaler.
- This equipment is protected under the Warranties and consumer goods regulation (10/2003).
- Overhaul is not covered by the equipment warranty.
- Operations made by non-qualified staff will automatically produce a loss of the warranty.
- Neither fuses nor accessories (including their loss), are covered by the product's warranty. The warranty neither covers piece's deterioration due to the course of time.
- Please make sure you keep the invoice, either for having the right to claim or asking for warranty coverage. In case you have to send the equipment to Zuzi Technical Assistance Department you should enclose the original invoice or a copy as guarantee.
- Manufacturer reserves the right to modify or improve the manual or equipment.

ATTENTION!! IF EQUIPMENTS ARE NOT PROPERLY CLEAN AND DISINFECTED THEY WOULD NOT BE ALLOWED TO REPAIR BY OUR TECHNICAL SERVICE.

1. Uses of the instrument

The polarimeter is an instrument use for measuring the power of rotation of some optically active substances, thus obtaining important information related to specific weight, concentration, and sugar content of the analysed substance.
Zuzi manual polarimeters are easy-to-use and robust equipment for simple laboratory applications and for education and demonstration. They work according to the semi-shadow principle and reading is made through an eyepiece with 2 Verniers.
The structure consists of a strong metal support on which the sample compartment is placed; sample compartment can hold up to 220 mm-long tubes. They are also provided with analyser and polarizer and are supplied with accessories.

2. Description

Figure 1a. Polarimeter HMB001/HMB006 (with sodium lamp)

1.1 On/Off switch
1.2 Scale knob
1.3 Eyepiece
1.4 Scale
1.5 Sample compartment
1.6 Light source

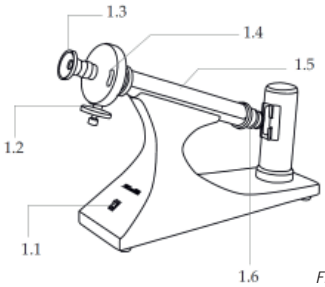


Figure 1a

Figure 1b. Polarimeter HMB002 (with LED)

1.1 On/Off switch
1.2 Scale knob
1.3 Eyepiece
1.4 Scale
1.5 Sample compartment
1.6 Light source

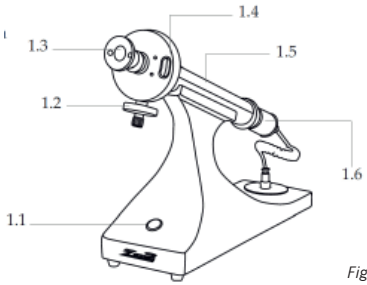


Figure 1b

3. Technical specifications

Code	HMB001	HMB006	HMB002
Model	404	404-110 V	404 LED
Measuring range	2 scales (0-180º)		
Scale division	1º		
Readability (through Vernier)	0.05º		
Magnification of lenses	4x		
Light source	Sodium vapor lamp		LED+ filter
Approx. stabilization time	10 min approx.		Immediate
Wavelength	589 nm		
Glass tubes	100 y 200 mm		
For tubes up to	220 mm		
Power	220 V / 50 Hz	110 V / 60 Hz	100-220 V /50 - 60Hz
Current	1A		
Consumption	20W 80W		
Weight	5 Kg		
Dimensions	540×220×380 mm		

4. Principles of operation

4.1. Equipment parts and functions

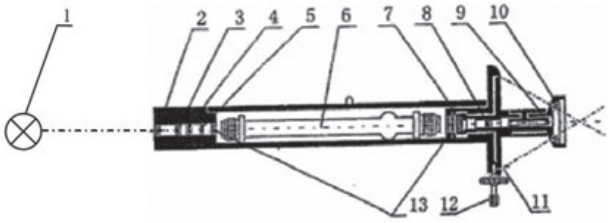


Figure 2

1. Light source
2. Condenser lens
3. Colour filters
4. Polarizer
5. Retarder of half wavelength quartz plate (1/2 λ)
6. Sample tube
7. Rotating analyser
8. Objective lens
9. Eyepiece lens
10. Reading magnifiers
11. Reading through Vernier scale
12. Rotation
13. Protection plate

The light generated by the steam of sodium lamp (2.1) is projected through the condenser (2.2), the colour filter (2.3) and the polarizer (2.4), turning it into a plane and linear polarized light, that passes by the retarder of half wavelength quartz plate (2.5) acquiring a triple display appearance in the optical field.

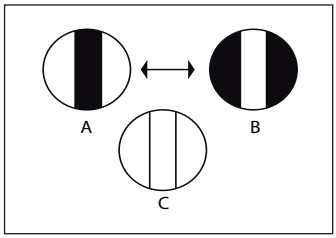


Figure 3

In the absence of sample in the path of the light beam, if the planes of polarization of the polarizer and analyser are in a parallel position, the triple optical field will be evenly lit (3.c). When inserting the tube (2.6) with the optically active sample compartment, the plane of polarized light rotated by a certain angle and the optical field will change. Looking through the eyepiece (2.9) a light central area will be observed (or dark) and two dark side areas (or light), i.e. three visual fields of different intensity of illumination (2.a or 2.b).

At this point, turn the analyser (2.7) with the control (2.12) until the brightness of the optical field is equal in the three visual fields. The angle that has rotated the analyser will correspond to the angle in which the optically active sample has rotated the plane of polarization of the light. This angle can be read on the scale (2.11) through the side magnification lenses (2.10).

The scale is divided into 180 parts each of which represents 1°, while the Vernier is divided into 20 parts corresponding to 19 subdivisions of the scale and can be used to read the angle with an approximation of 0.05 °. In the example that is shown in Figure 4 the angle of rotation is 9.30 °.

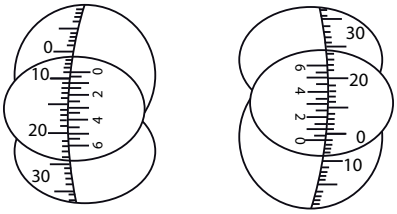
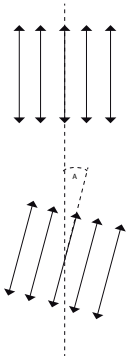


Figure 4

For greater accuracy, errors due to the eccentricity of the scale and the Vernier can compensate reading the value of the angles on both sides and making the average of the two.

4.2. Operating principles

The polarimeter is a tool used to determine the optic activity of a substance by measuring the rotational change undergone by the plane of vibration of a polarized light beam as it passes through said sample (Fig. 4).



Vibration plane of a polarized light beam before passing through the sample

Vibration plane of a polarized light beam after passing through the sample. The sample has rotated the plane of polarized light in an Aº angle.

Figure 4

The polarimeter is based on the semi-shade principle and it consists of a fixed polarizer and a rotating analyser. The analyser is mounted on a graduated scale so it allows measuring the angle of rotation. In this way, the analyser determines the polarization of the light beam that has passed through the sample compartment.

When the analyser is placed in a perpendicular position to the polarization plane of the light beam, this light beam is blocked; whereas the analyser is placed in the same position that the polarization plane, the maximum transmittance occurs. Therefore, the intensity of the transmitted light varies between these two states.

The vision field through the eyepiece allows visualising the semi-shade effect. The field is divided in 3 regions, a central band and two lateral areas, by a retarder sheet of ½ λ placed in a prior position to the samples box. This retarder sheet changes the polarization plane of the central band. If the analysers direction (Fig. 5, AA') is perpendicular to the separation line of the 3 regions (Fig. 5, OX), both halves will have the same but lower illumination intensity

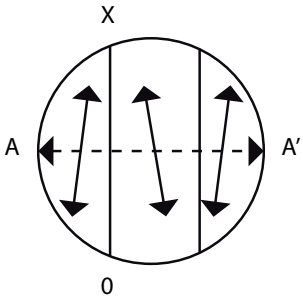


Figure 5

When you turn the analyser, the central band darkens while the illumination of the lateral zones increases. There are 4 positions in a 360 ° turn of the analyser where the illumination intensity is the same in 3 areas of the field of view. In 0º and 180º positions the illumination is the same but lower, while in 90º and 270º the illumination is the same but higher. None of these two last positions can be used to perform the measurement; the equipment has been configured to perform measures using only those positions in which illumination is equal but lower in the 3 regions of the vision field.

At this point, the rotation angle of the analyser is equal to the rotational power of the optically active substances. Knowing the rotation angle, the tube length where the sample is placed and the concentration, is possible to calculate the specific rotation $[\alpha]^t_\lambda$ of the substance to analyse, using the following formula:

$$[\alpha]^t_\lambda = (\alpha / LC) \times 100$$

Where:

α = rotation angle measured using a λ light at a t temperature.
L = tube length where the sample is placed in decimetres (dm).
C = substance concentration in grams per 100mL of solution (g/100 mL)

The rotation angle is also related to the temperature. If the measurements are made at a wavelength of 589.3 nm (used with most substance), the rotation angle is reduced 0.3% for every increase of 1º C temperature. For a maximum precision is recommended to work in a 20 ± 2º C temperature.

4.3. Equipment construction

For an easier use of the optical system of the polarimeter, it has been installed with a 20º inclination over a firm and stable base; the light source uses a 20 W sodium lamp (HMB001/HMB006) or a LED (HMB002) with a wavelength of 589.3 nm. The lamp fuse is assembled on the base of the equipment.

The polarizing filters are made in polyvinilalcohol disks and the triple division of the optical field is achieved using a sheet of Laurent quartz of half wavelength of delay.
To facilitate the reading of the rotation angle, 2 small loupes of 4x have been assembled in front the scale window.

5. Operation mode

5.1. Preliminary inspection

Unpack the polarimeter, remove the protection of expanded polystyrene that is embedded and remove the plastic that surrounds it. Make sure that there is no damage caused by transport. If so, notify immediately to your carrier or supplier in order to make the claims on time.

Please save the packing, since the returns should be made in its original packaging with all supplied accessories.

Check the accessories that you should get together with the equipment:

- 1 spare sodium lamp (only HMB001/HMB006)
- 1 100 mm tube
- 1 200 mm tube
- 1 Screwdriver
- 1 Cover
- 4 Rubber joint
- 4 Circular glass discs
- 1 Fuse
- 1 Instruction manual

Equipment returns may be made within 15 days after shipment and always when they came complete in its original packaging with all supplied accessories.

5.2. Installation

Before you begin to use the instrument, it is convenient to familiarize yourself with its components and fundamentals, as well as the functions of its controls.

PLEASE READ THOROUGHLY THE INSTRUCTIONS BEFORE CONNECTINGAND OPERATING WITH THIS EQUIPMENT WITH THE AIM OF ACHIEVING THE HIGHEST FEATURES AND THE MAXIMUM DURABILITY OF THE INSTRUMENT.

- Preferred work environment: internal temperature of 20 ± 2 ° C and maximum relative humidity of 85% (in the absence of condensation).
- Place the polarimeter on a flat and stable surface, creating a space free of at least 30 cm per side to ensure the correct ventilation of the equipment.
- Do not place the equipment close to heat sources (burners, blowlamps...), nor expose it directly to the Sun light, etc.
- During the operation of the equipment, dangerous material such as infectious or flammable liquids must be outside the working area
- Insert the Schuko standard cable supplied with the equipment at the base of current 220 V, 50 Hz ± 10% provided with earthing.

Neither the manufacturer nor the Distributor will assume any responsibility for any damage caused to the equipment, facilities or injuries to persons due to failure to observe the correct electrical connection procedure. The voltage should be 220 V, 50 Hz ± 10% (HMB001), 110V /60Hz ± 10% (HMB006) or 100-220V/50-60Hz ± 10% (HMB002).

- When you have finished the working session is recommended to disconnect the equipment from the power supply and protect it from dust, covering it with the cover.

5.3. Operation mode

1. Prepare the solution to be measured and let it stabilize.
2. Pour the solution into the corresponding tube **Note:** Be careful not to over tighten the plugs on both sides to avoid mechanical stresses, which could affect the accuracy of the measurement.
3. Turn on the equipment, using the on/off switch **Note:** in the HMB001/HMB006 polarimeter, before doing measurements, you should wait about 10 min until the sodium lamp heats up and emits yellow light. For the HMB002 polarimeter, it can be used immediately after the turn on.
4. Turn the control knob of the scale until you obtain a low and uniform illumination in the entire field of vision; verified the zero position over the scale. If is not correct, loosen the four fixing screws placed in front of the top of the scale and turn the inner scale to zero position (the maximum correction allowed by this procedure is 0.5º). In case where the correction is insufficient, the error can be add or subtract to the real measurement.
5. Open the compartments lid and place the tube with the solution, taking care that the bulb remains on the top; this way, possible air bubbles will be kept in the bulb without hindering the display or influencing the measurement results. Close the lid.

6. Rotate the eyepieces dioptre adjustment until vision is sharp and well defined, clearly appearing the three parts of the visual field.
7. Turn the control knob of the scale until obtaining a low and even illumination in the entire vision field.
8. Read the optical rotation angle over the scale through the magnifying lens.

Note: in the case of the HMB001/HMB006 polarimeter, sodium vapour lamps continuous use time should never exceed 4 h. Once this time has passed since the switch on of the lamp, you should turn off the equipment and let the lamp cools down.

6. Mantenimiento y limpieza

For a proper use of the polarimeter, is necessary to follow some recommendations.

Note: All the rules of use listed above have no value if there is a continuous maintenance work.

- Follow the instructions and warnings related to this manual. Keep this manual on hand so anyone can check it.
- Protect the polarimeter from jerks and hits, as well as from direct light of the Sun or air currents. This is a precisions instrument, so treat the equipment carefully.
- Always use original components and spares. Although other devices are similar, them use may damage the equipment.
- For any manipulation of cleaning, components testing or replacement (e.g.: replacement of fuse) is essential to switch off the equipment and disconnect it from the power outlet.
- The polarimeter has a Schuko cable; this has to be connected to the power outlet and it has to be handy for an emergency disconnection.
- Do not attempt to repair it yourself; besides losing the guarantee it can causes damage to the general operation of the polarimeter, as well as injury people (burns, wounds...) and damage electric installation or nearby electric equipment.
- When the working session is finished, is recommended to leave the equipment off using the main switch and disconnected from the mains.
- Use the plastic cover as long as the polimeter is not in sue to prevent dust settle over optic parts.
- Save the original packaging to transport the polarimeter or to send it to review, as well as for storage when it is not going to be used for a long time.
- If for any reason it liquid falls and comes into contact with the electrical parts, turn off and disconnect the equipment from power immediately, and send it as the soon as possible to the technical service for a review.
- In case of failure please contact your provider for the reparation through the Zuzi technical service.
- Made under the European regulations for electrical safety, electromagnetic compatibility and security on machines.

6.1. Lamp replacement (only HMB001 / HMB006)

Attention! Lamp replacement should be done once the equipment has cooled down. Before changing the lamp, make sure that the polarimeter is disconnected from the net. Check you are using the proper lams, as other type can provoke malfunction.

- For the lamp replacement, remove the lid of the lamp compartment.
- Loosen the 3 screws that hold the lamp, located at the base of the lamp-holder.
- Firmly grip the lamp and remove it by pulling upwards.
- Remove the protective plastic ring from the base of the lamp and place it in the new lamp.
- Place the new lamp in the lamp-holder and tighten the screws.
- Place the lid of the compartment in such a way that the light output of the lamp matches the direction of the tube where the sample is placed.

6.2. Fuse replacement

Attention! Before changing the fuse, make sure that the polarimeter is disconnected from the net. Check you are using the proper fuses, as other type can provoke malfunction.

- For fuse replacement remove the fuse-holder from the base of the polarimeter, replace the fuse and place it in the same position.

6.3. Cleaning

- After every use, clean the simple tube with distilled water and dry it carefully.
- Lents should not be dismantled by the user. For the cleaning of the optic parts use a soft hair brush or a fluff-free soft cloth.
- For the cleaning of the metallic parts of the equipment never use organic solvents or scouring pads or products that can scratch, as they may damage the paint limiting the life of the equipment. Use a fluff-free cloth dampened with soaped water that does not contain abrasives
- After using the polarimeter cover it with the protective cover to prevent dust accumulation.

Instructions on environmental protection

Do not dispose of this equipment with normal household waste at the end of its life cycle; take it to a collection point for the recycling of electrical and electronic equipment.
It does not contain elements that are hazardous or toxic to humans but improper disposal will harm the environment.
The materials are recyclable as indicated on the marking. By recycling materials or other forms of reuse of old equipment, you are making an important contribution to the protection of the environment. Please contact your local authority for advice on collection points.