



INSTRUCTION MANUAL

OPTECH POLARIMETER MODEL PL1 LED



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2.0 technical features

Classification :	device designed to measure the rotational power of organic substances
Functioning:	manual
Power	220 V 50 Hz
Absorption:	0.2 A
Fuses	250 mA
Safety class:	I tipo B
Optical rotation range:	$\pm 180^\circ$
Range precision:	1°
Resolution:	0,05
Reading eyepiece magnification:	4x
Led monochromatic light source	589 nm
Led lamp's life	10000 h
Polarimetric tubes supplied:	n.1 100mm; n.1 200mm
Dimensions:	540 x 220 x 380 (DxLxH)
Net weight:	4.5 Kg

The instrument complies with the applicable european norms

The manufacturer reserves the right to apply modifications without any advice according to the evolution of the rules and the technology.

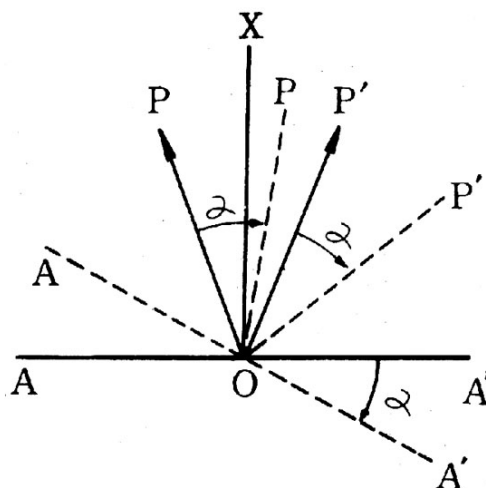
3.0 description

This polarimeter is usually used in food and chemical industries, schools & universities, scientific research.

It can be used to measure the specific gravity, purity and concentration in organic substances such as sugar solutions, oils, camphor and solutions of food.

3.1 functioning principle

It is based on the polarized light technique, to measure the rotational power of organic substances.



the principle is shown in the a.m. picture.

AA' and **OX** lines are respectively the vibration direction of the polarizer and the analyzer filter when the rotation is in 0° position.

OP and **OP'** indicate the vibration directions of the polarized lights of the two halves of the viewing field.

When the light beam passes through the optical rotatory substance, the plane of polarisation is rotated by an angle of α (dotted line in the above drawing). Now, the projections of the polarized lights of the two halves on **AA'** are not identical, the right half is bright, and the left half is dark.

Now, by rotating the polarization plane **AA'** of the analyzer by an angle of α in the same direction, the illumination intensity of the viewing field can be made equal again: at this time, the rotated angle of the polarization analyzer is the optical rotation of the substance.

Knowing the rotated angle (i.e. the optical rotation), the length of solution column (i.e. the length of the test tube) and the concentration, the specific optical rotation (i.e. the optical rotatory power of the specific rotation) of the substance can be calculated in accordance with the following formula:

$$[\alpha]_{\lambda}^t = \frac{Q}{LC} \times 100$$

where

Q = the rotation angle (optical rotation) measured by use of light λ , when the temperature is "t".

L = polarimetric tube length (1 dm)

C = concentration, i.e. the gram quantity of the solute in 100mm of solution.

From the above formula, we can see that the rotation angle Q is in direct proportion to the solution column (test tube) length L and the concentration C .

$$\text{i.e.: } Q = [\alpha] LC$$

Also, the optical rotation has relations with the temperature. As for most substances, $\lambda=589,3\text{nm}$ (sodium light) can be used in the measurement, when the temperature rises by 1°C , the optical rotation will reduce by $0,3\%$. Thus, for the measurement with higher requirements, it had better to make the measurement under a working circumstance of $20 \pm 2^\circ\text{C}$.

3.2 construction infos & main parts

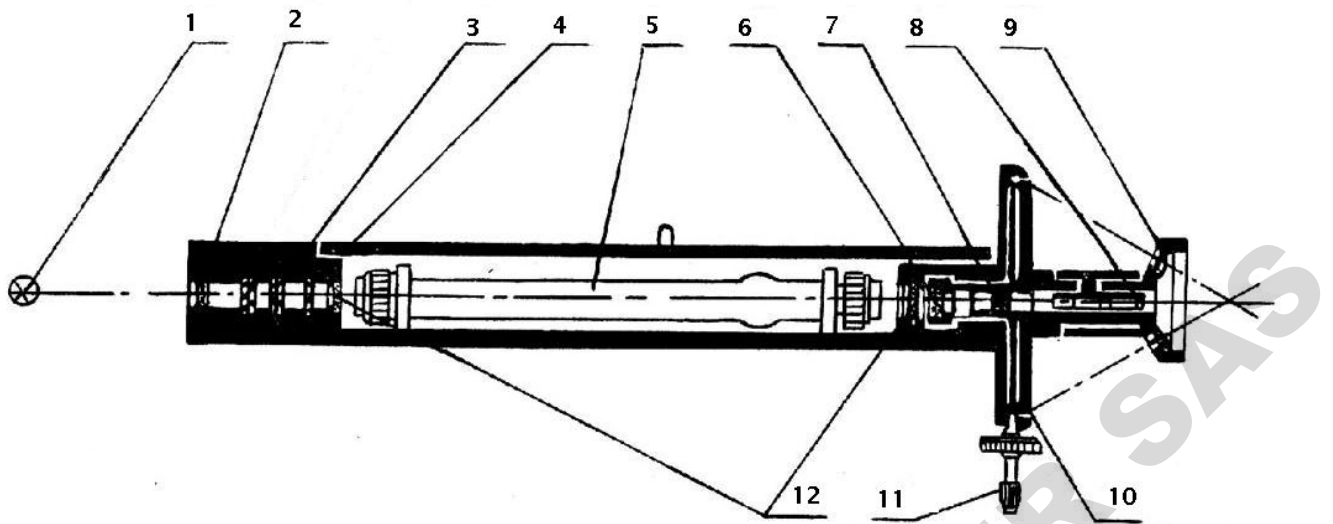
For easy operation, the optical system of the instrument should be mounted on the base frame in an inclination of 20° .

The light source is a monochromatic 589 nm Led.

The polarizer of the instrument are all polyvinyl-alcohol artificial polarizing discs. The triplex viewing-aspect uses Laurent quartz slab device (half wave-plate).

The instrument uses double vernier in reading. The dial is divided into 360 divisions and each division indicate 1° . The vernier is divided into 20 divisions having an accuracy of $0,05^\circ$. The hand-wheel (12) can be used to make coarse and fine rotation. Two pieces of magnifying glasses (the magnifying factor is 4 times) are mounted in front of the vernier window, which can be used in reading.

3.3 functional and schematic description



1. light source (monochromatic 589nm Led lamp)
2. collector lens
3. polarizer filter
4. half-wave plane
5. measurement polarimetric tube
6. analyzer filter
7. Lens
8. viewing field eyepiece
9. magnifying lens for the reading scale
10. dial vernier
11. dial rotary hand-wheel
12. sample protective plates

The light source (1) sent to the collector lens (2), goes through the polarizer (4). After the polarized light passes through the half-wave plate (5) and is decomposed into normal light and abnormal light, a triplex view-aspect will occur in the viewing field. The test tube (6) containing the optical rotatory substance is put into the sample chamber for measurement. Since the solution has optical activity, the plane polarized light is rotated by an angle, so that the polarization analyzer (7) can play a role of analysis. Observing through the eye lens (9), we can see a mid-bright (or dark) and left / right dark (or bright) triplex viewing field of unequal intensity of illumination (see fig.2a and fig.2b). Rotate the dial rotary hand-wheel (12) so as to drive the dial (11) and the polarization analyzer (7), until the illumination intensity of the viewing field (dark viewing field) becomes equal (see fig. 2c). Then, the angle of dial rotation can be read out from the magnifying glass (see fig. c).

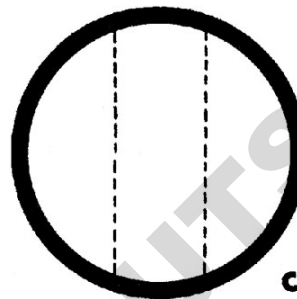
Fig.2

a

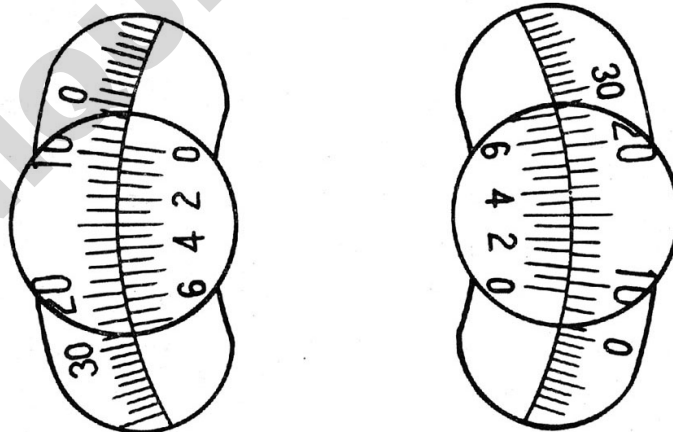
b



When the dial is at the zero-position, after putting in the test tube filled with optical rotatory solution, the viewing field changes.



After rotating the polarisation analyser, the illumination intensity become equal (i.e. the zero-position viewing field before putting in the solution)



$Q = 9.30^\circ$

4.0 starting working with the instrument

Place the package stuff on a wide and stable surface, able to support the instrument's weight. Carefully extract the instrument from the carton and place it on the top.

Remove the transparent film without using knives which can damage the container or some of the accessories.

Check all standard accessories are present.

Keep the packaging stuff for future possible shipments.

Pls.read "method of use" before starting working with the instrument.

5.0 cleaning and maintenance

When the instrument is not used for a period of time, it shall be protective with its supplied duct cover to prevent dust infiltrations.

To make the Polarimeter work properly, we suggest to clean it once a month using cleaning solutions and soft cloth, particularly caring about the polarimetric tube.

Before starting cleaning the instrument, always disconnect it from the power socket.

Pls.do not use water flows or vapours which may cause drops entering the instrument with strong risk of electric circuit's damage.

Do not use aggressive substances which may damage the instrument structure.

In case of liquid infiltrations inside the metal container or optical parts, pls.disconnect the instrument from the power socket and call your technical service assistance.

6.0 supplied accessories

N.1 100 mm polarimetric tube

N.1 200 mm polarimetric tube

N.4 closing glass

N.10 rubber sealing O-ring

N.3 250 mA fuses

N.1 dust cover

N.1 instruction manual

6.1 accessories: usage

6.1.1 polarimetric tube replacement:

The polarimetric tube has its own housing in the upper part of the instrument optical system. To access this part, it is necessary to lift its cover; then insert the polarimetric tube in its seat and close the cover again.

6.1.2 polarimetri tube cleaning:

- a) extract the polarimetric tube from its seat;
- b) remove the closing glass from both edges;
- c) wash the tube and glass with distilled water
- d) wipe them using a clean soft cloth, caring it is not abrasive and it does not leave tissue residues;
- e) place the tube on its seat again.

6.1.3 fuses replacement:

- a) disconnect the power plug from the socket;
- b) extract the polarimetric tube from its seat and leave it in a safe place;
- c) incline the instrument on a side;
- d) untighten the fuse cap located in the middle of the lower panel;
- e) replace the defective fuse;
- f) screw the fuse cap in its seat again.

7.0 working environment & storage

The Polarimeter is designed to be used in proper environments such as clinical and/or research laboratories, didactic or industrial laboratories and so on; in any case, rooms free from powders and mechanical vibrations and having low humidity percentage.

Place the instrument far from sources generating temperatures higher than 50°C and far from air currents generated by conditioners and convectors.

In case the instrument is not used for a period of time, pls.store it in its packaging stuff being careful to place it in safe place.

8.0 ordinary maintenance

Action	Who should perform it	When to perform it
Instrument body cleaning	User	Monthly
Accessories cleaning	User	When used
Polarimetric tube cleaning	User	When used
Sample compartment cleaning	User	Monthly
Visual check of power cable condition (in case it is damage pls.contact the Service)	User	Daily

9.0 damages detection

The lamp does not turn on:

- check the plug is correctly inserted into the power socket;
- check the fuse (if defective, replace it according to paragraph 6.1);
- in case it is not possible to solve the problem, pls.contact the Service.

10.0 method of use

Before starting using the instrument, pls.check it is safe and sturdy in its position.

10.1 connection to power socket (220V 50Hz)

The power socket (220V 50Hz) shall have its own earth discharge.

(Exacta+Optech Labcenter S.p.A. rejects all responsibilities on damages due to its absence)

10.2 starting & using the instrument

To light the instrument on, place the switch to "1" position.

a) sample preparation

The solution shall have clarity features and should be gas bubbles free.

After having removed the closure glass, set the polarimetric tube in vertical position, then pour the solution inside the tube till a convex form of the liquid appears.

Close the tube screwing the closure glass without tightening too fast as a strong constriction of the glass could make it birefringent, making the reading not correct.

b) turn the instrument on

turn the lamp on by moving the switch to "1".

c) dials calibration

check the "zero" position as described in paragraph 3.1. If it is not correct, it is necessary to:

- 1) unscrew, untightening them, the screws located near the eyepiece;
- 2) rotate the internal dial till the internal zero corresponds to the external one;
- 3) screw the 4 screws again

d) measurement

- 1) lift the cover of the sample compartment;
- 2) insert the polarimetric tube keeping the bulb in the higher;
- 3) check the possible air bubbles are collected into the bulb.

e) focussing

rotate the ring located near the eyepiece, adjust the viewing field focussing, till the triple field can be seen properly and clearly.

f) Illumination adjustment

Act on the knob moving the external dial, located under the eyepiece, till the triple field illumination is flat.

g) Reading

Read the rotating angle on the dial through the two magnifying lenses located beside the eyepiece.

h) Reading result

Applying the formula mentioned in paragraph 3.1, it is possible to calculate:

- specific gravity
- concentration

- purity
- substance's content

IMPORTANT

To get proper measuring values, it is recommended to repeat the measurement of one sample for 3–4 times at intervals of 2 minutes approximately and then calculate the average value among the detected ones.

CE CONFORMITY DECLARATION

EXACTA+OPTECH Labcenter Spa

declares:

that its own Optech LED Polarimeters comply with the following European directive and its consequent modifications:

- Electromagnetic Compatibility Directive 89/336/EEC modified with 92/31/EEC, 93/68/EEC;

And that:

The following armonized norm has been applied:
Norma EN 61010–1 (06–97).

EXACTA+OPTECH Labcenter Spa

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