5223-E11

Polarimeter

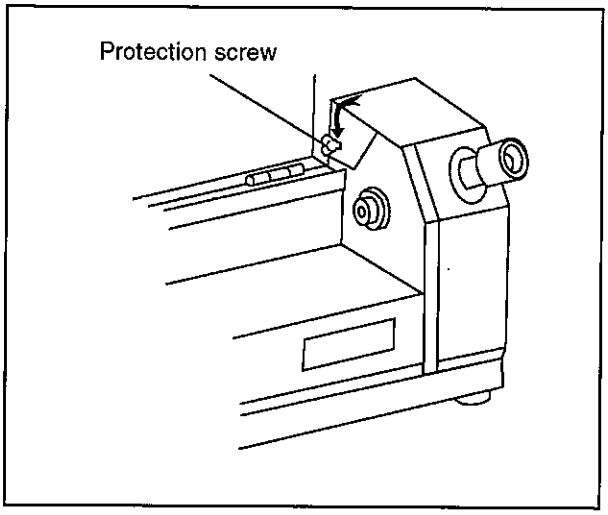
POLAX-2L

Instruction Manual **Cat.No.5223**

ATAGO®

Contents

To prevent the POLAX-2L from getting dameged during transportation, it is secured with a protection screw in the package as shown in the figure on the right hand. After taking it out of the package, remove the protection screw without fail and keep it carefully for future use.
On transporting the POLAX-2L to another place, make sure to secure it with the protection screw again.



1. Precautions for use

Introduction

Thank you for purchasing the "ATAGO, Polarimeter POLAX-2L". Before using your POLAX-2L, 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 --- Be sure to observe the following.

This operation manual describes the items which you are required to observe in order to use the POLAX-2L safely to prevent injury to you and other people and damage to your property. The explanation of the indications and symbols of those items are as follows. Understand them first and then read the following pages to use your POLAX-2L.

Explanation of indications

WARNING	If this indication is neglected and the instrument is handled incorrectly, the user may be seriously injured and may result in death.
CAUTION	If this indication is neglected and the instrument is handled incorrectly, the user may be injured and the user's property may be damaged.

Explanation of symbols

	This symbol denotes an item which you are warned (or cautioned) of. The contents of warning are described in detail in or near the △.
	This symbol denotes an action which you must not do (a prohibited item). The contents of prohibition are described in detail in or near the ○.
	This symbol denotes an action you must do. The contents of instruction are described in detail in or near the ●.

Handling of this instrument

⚠ 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 begins to smell abnormally, overheat, or emit smoke, turn off the power switch and disconnect the power plug immediately. Fire or malfunction may result if the instrument is continued to be used.
Ask your ATAGO distributor for an inspection.

◇Do not attempt to repair, modify, or disassemble the instrument yourself. Improper servicing may result in fire, electrical shock, or burns.

◇ If the instrument is dropped or is subjected to a strong shock, have it inspected by an ATAGO distributor.
Fire or malfunction may result if the instrument is used.

⚠ CAUTION

◇Do not apply water or sample over any part other than the surface of the prism. Application on any other part of the instrument may result in a malfunction.

◇Aboid neither dropping the observation tube nor giving a strong shock to it, becouse it is made of glass.

Handling of this instrument (Continued)

⚠ CAUTION

◇On ending a day's measurement, turn off the power switch.

◇When transporting the polarimeter, make sure to put it in the carton case which the polarimeter was initially contained in.

◇First of all, carefully read this instruction manual to know the function and operating method of each part of the polarimeter.
◇Before using this instrument, check to see if each part normally poerates or not.
◇Before starting measurement, make sure to perform check and adjustment work such as calibration (zero-setting), etc. according to the instructions.
ATAGO won't be liable for any trouble, damage or loss caused by improper use of the instrument as it is used for a purpose other than its orginal application (to measure angle of rotation or to measure the international sugar scale). Please understand this matter in advance.
◇ATAGO won't be liable for any loss and damage of the material that is sampled for measurement with this instrument at all.

Handling of plug

⚠ WARNING

◇Make sure to use the exclusive power cable that is supplied with the instrument. If any other power cable is used, it may cause smoke or fire in the instrument.

◇Don't plug the power cable into an outlet of specified mains supply of AC100 to 240V. Otherwise, it may cause smoke, fire or serious damage to the polarimeter.

◇If the power cable or plug is damaged, modified, or broken, don't use it. If such a cable or plug is used, it may cause electric shock or fire.
For repairing or replacing the cable or plug, ask the dealer or our distributor to do it.

⚠ CAUTION

◇Don't touch the plug with wet hand.

◇When disconnecting the power cable from the outlet, make sure to do it by holding the plug.
If the cable is pulled for disconnection, it may not only break the cable but also cause fire and electric shock.

◇When connecting the power cable to a mains AC outlet, connect the earth wire properly to the mains outlet or the ground without fail.

Items to be observed when using

Environmental conditions

◇Use the instrument at an altitude below 2,000 m (above sea level).
◇Use the instrument indoors.
◇Use the instrument on a flat level surface.
◇Use the instrument where the temperature is between 5 to 40℃.
◇Use the instrument where the humidity is below 90%RH.
◇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 product 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 leave the instrument in a damp place.
◇Do not place or drop heavy objects on the instrument.
◇Use this instrument under the condition of a relative humidity (humidity of 80% at a temperature of 31℃ or lower falls linearly to 50% at 40℃).
◇Main supply voltage fluctuation should not to exceed ± 10% the nominal voltage.
◇Installation categories (Overvoltage Categories): II
◇The pollution degree is 2 (according to IEC60664).

Handling

◇Do not drop the instrument or subject it to any strong shock.
◇The power cable may be damaged if mis-handled in any of the following manner.
- Bending the cable.
- Pulling the cable.
- Twisting the cable.
- Placing the cable under heavy objects.
- Catching the cable between objects.

Daily maintenance

◇If the instrument becomes dirty, wipe it with a soft cloth.
◇Do not use benzine, paint thinner, etc. to clean the instrument.

2. Unpacking and setup

(1) Unpacking

① Take the contents out of the packing case and check every article so that there is no damage observed on the exterior.

② Confilm the contents so that the following things have been contained in the package without lack.

●POLAX-2L polarimeter·····1	●Observation tube, 200mm long·····1
●AC Power cable·····1	●Instructions (this instruction manual)·····1
●Observation tube, 100mm long·····1	

To prevent the POLAX-2L from getting dameged during transportation, it is secured with a protection screw in the package as shown in the figure 2-1. After taking it out of the package, remove the protection screw without fail and keep it carefully for future use. On transporting the POLAX-2L to another place, make sure to secure it with the protection screw again.

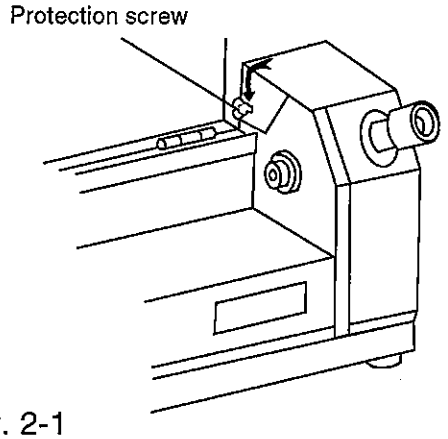


Fig. 2-1

(2) Setup

①Connect the POLAX-2L to an AC100 to 240V, 50/60Hz, mains outlet with the power cable.

②Set up the POLAX-2L in a place where the ambient temperature is 5℃ to 40℃ and the POLAX-2L is free from such the environmental conditions as mentioned in ③ of the following.

③Since the POLAX-2L incorporates very precise parts inside, avoid setting it up in a dusty place, near a heat source including heat generating apparatus, in a place where it catches direct rays of the sun, strong vibration, corrosive gas, etc.

④Set the POLAX-2L on the level surface of a stand/workbench that is free from vibration. During setting it up, be very careful not to give it a strong shock.

Power Cable
Use only the following power cable. Using the wrong power cable could result in danger or fire.
The protection Class I equipment should be connected to PE (protective earth) terminal.

- For AC100-120V area
  UL Listed, detachable power cable set, 3 conductor grounding Type SVT, No. 18 AWG, 3m long maximum, rated at AC125V minimum.
- For AC220-240V area
  Approved according to EU/EN standards, 3 conductor grounding Type H05VV-F, 3m long maximum, rated at AC250V minimum.

3. Names and functions of main parts

(1) Front side (Figure 3-1)

① Eyepiece:
To compare translucent semicircular fields by brightness by observing through the eyepiece. When the translucent semicircles are out of focus, turn the upper ring of the eyepiece to bring it into focus.

② Display panel:
Digitally shows a measurement value (angle of rotation or value in the international sugar scale) or the temperature of the sample stage at measurement.

③ Sample chamber cover:
This cover shades the sample chamber to shut off undesired incident light into it.
Make sure to shut this cover before starting zero-setting calibration or sample measurement.

④ Thermosensor:
Measures a temperature at the sample stage.

⑤ Sample stage:
For measuring a sample or zero-setting, put the observation tube containing lipuid on it.

⑥ Indication selector switch:
Indication of the display can be switched between the two scales (angle of rotation and the international sugar scale) by means of this selector switch. When this selector switch is set to the left position (DEG.), indication on the display shows angle of rotation. When it is set to the right position (° Z), indication shows the international sugar scale.

(2) Rear side (Figure 3-2)

⑦ Power switch:
To turn the POLAX-2L on/off.

⑧ Power input connector:
To connect the power cable supplied as an accessory of the POLAX-2L into this connector. On connecting the power cable, make sure that the power switch of the POLAX-2L is set to OFF.

⑨ Rating label:
Serial number, ratings of the POLAX-2L are shown on this label.

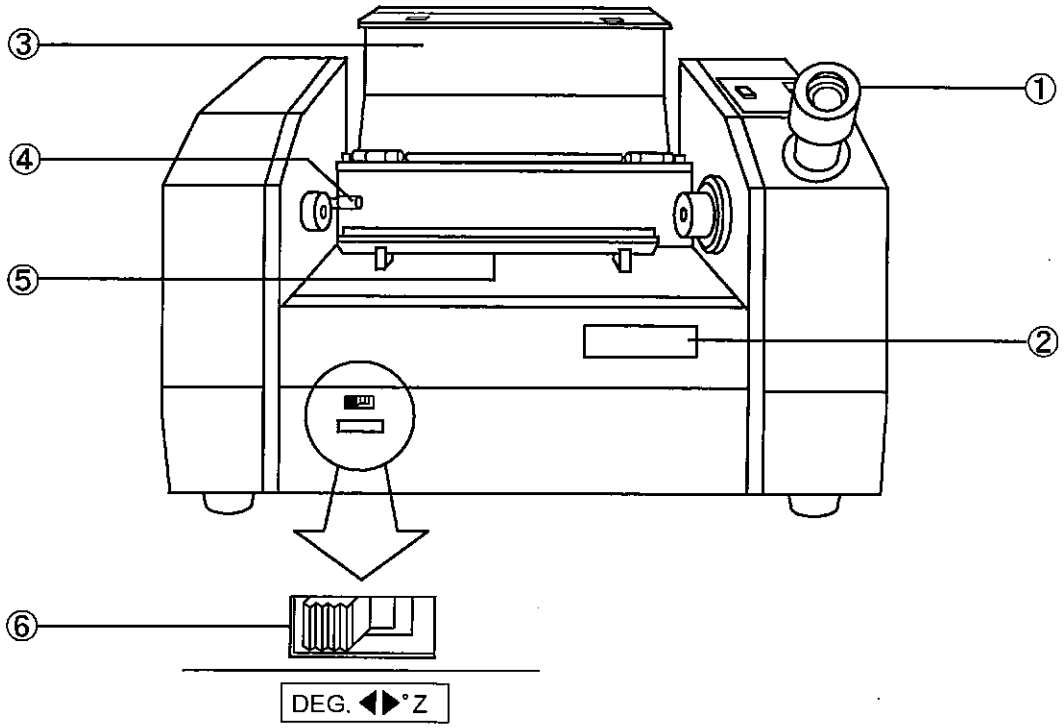


Fig. 3-1

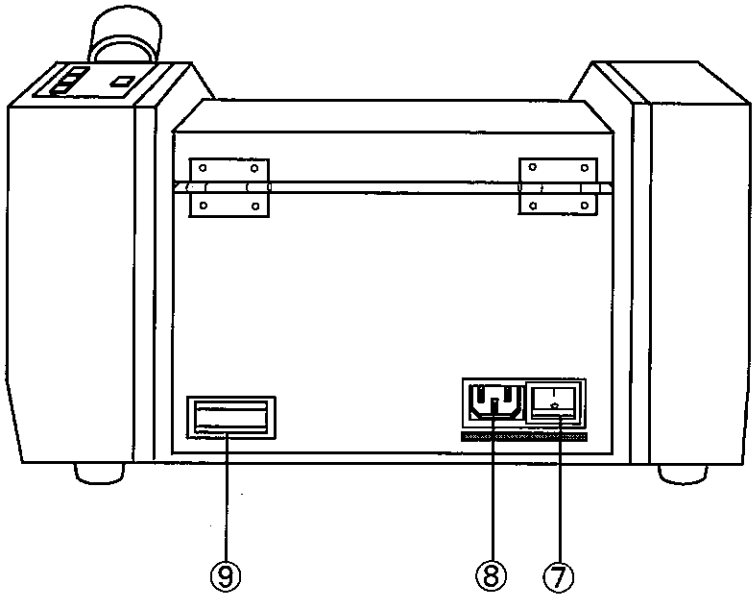


Fig. 3-2

(3) Operation panel (Figure 3-3)

⑩ ZERO SET switch:
To reset the digital indication of the display to "0". Don't press this switch except for zero-setting.

⑪ ZERO SET READY lamp:
When this lamp is on, it indicates that the instrument is ready for zero-setting operation.

⑫ ROTATE (right-handed rotation) switch:
While this switch is being pressed, the field of translucent semicircles observed through the eyepiece slowly rotates counterclockwise and the value indicated on the display becomes high (increase) (Normal rotation mode).

⑬ ROTATE (left-handed rotation) switch:
While this switch is being pressed, the field of translucent semicircles observed through the eyepiece slowly rotates clockwise and the value indicated on the display becomes low (decrease) (Normal rotation mode).

⑭ SHIFT/TEMP switch:
When this switch is pressed together with either of the ROTATE switches (right-handed or left-handed rotation switch), rotation of the field of translucent semicircles is speeded up with fast change (increase or decrease) in the indication value (Fast rotation mode).
When this switch is held pressed for 2 seconds or more, the temperature of the sample stage is indicated on the display panel.
When this switch is released from pressing, the display panel again indicates an angle of rotation or a value in the international sugar scale for the temperature.

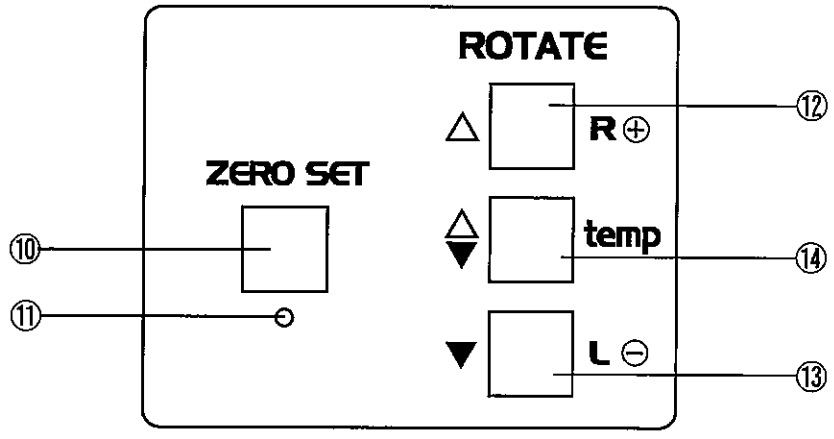


Fig. 3-3

4. Preparation for measurement

(1) How to connect the power cable

⚠ WARNING

◇Make sure to use the exclusive power cable that is supplied with the instrument. If any other power cable is used, it may cause smoke or/and fire in the instrument.
◇Don't plug the power cable into an outlet of specified mains supply of AC100 to 240V. Otherwise, it may cause smoke, fire or serious damage to the polarimeter.
◇If the power cable or plug is damaged, modified, or broken, don't use it. If such a cable or plug is used, it may cause electric shock or fire.
For repairing or replacing the cable or plug, ask the dealer or our agent to do it.
◇When connecting the power cable to a mains AC outlet, connect the earth wire properly to the mains outlet or the ground without fail.

⚠ CAUTION

◇Don't touch the plug with wet hand.
When disconnecting the power cable from the outlet, make sure to do it by holding the plug.
◇If the cable is pulled for disconnection, it may not only break the cable but also cause fire or electric shock.

Note:
To prevent the POLAX-2L from getting dameged during transportation, it is secured with a protection screw in the package as shown in the figure 4-1. After taking it out of the package, remove the protection screw without fail and keep it carefully for future use.
On transporting the POLAX-2L to another place, make sure to secure it with the protection screw again.

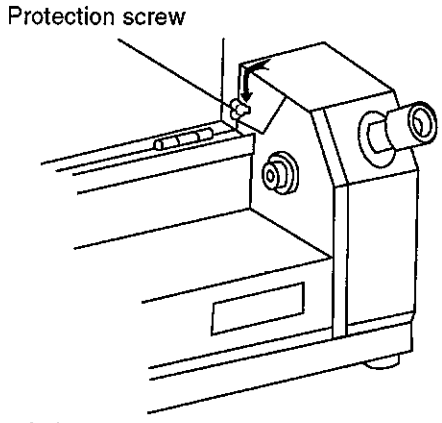


Fig. 4-1

①Connect the female connector of the power cable to the power input connector on the rear panel.
②Plug the other connector of the power cable into an AC100 to 240V (voltage fluctuations not to exceed ±10%), 50/60Hz, mains outlet.

(3) How to turn on the POLAX-2L

①Press down the power switch on the rear panel to the "I" side like a seesaw. The POLAX-2L is turned on and "0.00" appears on the display panel ("0.0" appears when the international sugar scale is selected for indication).
The factory default setting for the indication selector switch is "DEG." for indicating the angle of rotation, and "0.00" will appear accordingly.

(3) Usage of observation tube

⚠ CAUTION

◇Avoid neither dropping the observation tube nor giving a strong shock to it, becouse it is made of glass.

Two observation tubes, 100mm (vol.5ml) and 200mm (vol.10ml), are supplied with the POLAX-2L. For obtaining satisfactory measurement results, use the 200mm long observation tube for measuring samples which are high in transparency, and 100mm long tube for measuring cloudy or colored samples. Since polarized light (measuring light beams) penetrates sample liquid in the 100mm or 200mm long observation tube for measurement, dirty, cloudy, colored conditions of samples greatly hinder the POLAX-2L from measuring them accurately. On measuring cloudy samples, filter them beforefand.
Each observation tube is composed of a glass tube, two deck glasses, two rubber rings, and two fastening rings (Figure 4-2). Each of these parts except the glass tube can be used for either end of the glass tube.

(4) Pouring sample into observation tube (Figure 4-3)

①Turn either of the fastening rings counterclockwise to remove it, and remove the rubber ring and deck glass in the same side.
②While holding a proper observation tube vertically, carefllly pour sample becomes round by the surface tension. Next, gently slide the deck glass onto the end of the glass tube from a side so as to slice off the liquid surface. If the deck glass is well slid to seal the glass tube, there is no air bubble remaining in the glass tube.
③Put the rubber ring on the deck glass and then tighten the fastening ring by screwing it.

Note: If there are air bubbles in the glass tube, gather them in the air trap.

Note: If there are too much air bubbles contained in the sample liquid in the glass tube, they interfere the flux or measuring.

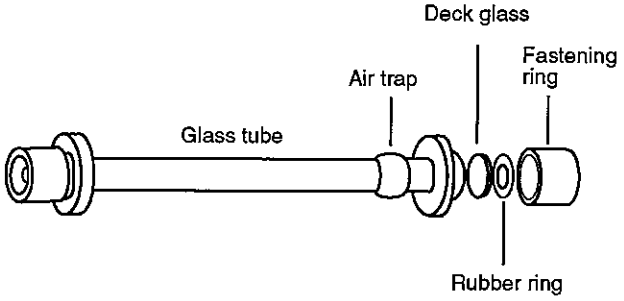


Fig. 4-2

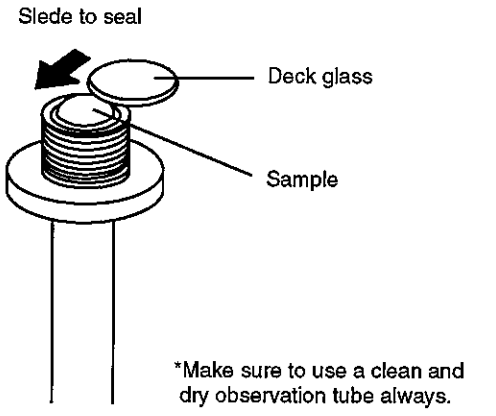


Fig. 4-3

Note: Observation tube, deck glass, rubber ring, fastening ring are supplied as spare patrs. In case of need, place an order for necessary article(s) with the dealer or our distributor.

5. Procedure of zero-setting (calibration)

⚠ CAUTION

◇Be very careful not to spill water or sample on the main body of the instrument. Otherwise, it may cause trouble of the instrument.

If the power switch or any of switches on the operation panel has not been operated for 5 minutes or more as the POLAX-2L is held turned on, the translucent semicircular fields disappear from the view of the eyepiece because the illuminator is automatically turned off by the power-saving function. In such the event, press the SHIFT/TEMP switch to turn on the illuminator again.

①Press down the power switch on the rear panel to the "I" side to turn the POLAX-2L on.

②Put an observation tube which is filled up with distilled water (or general tap water) on the center part of the sample stage. At that time, make sure that the ZERO SET READY lamp is on. If the ZERO SET READY lamp is off, the zero point comes off the correct point by 6° or more in angle of rotation. In such a case, press both the SHIFT/TEMP switch and the right-handed or left-handed ROTATE switch simulraneously and continue pressing the two switches until the ZERO SET READY lamp goes on (Figure 5-1).

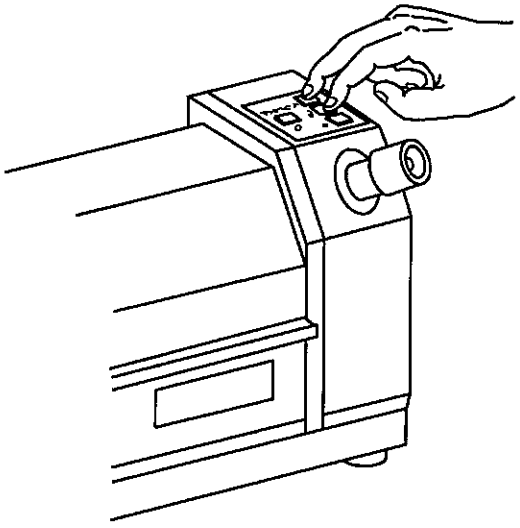


Figure 5-1

5. Procedure of zero-setting (calibration)

Note:
When the ZERO SET READY lamp is on to indicate that zero-setting is possible, the boundary line between the translucent semicircles is observed vertical in the field of view. Check to see if it is vertical or not observing through the eyepiece (Fig.5-2).
In the case the boundary line is vertical but the ZERO SET READY lamp is not on, the field of view is in a wrong position such as turned around by 180° (upside-down). If so, continuously press the SHIFT/TEMP switch and ROTATE (right-handed or left-handed) switch until the lamp goes on.

Boundary line between translucent semicircular fields is observed vertical.

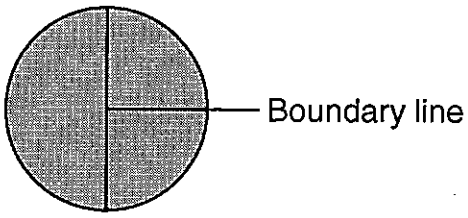
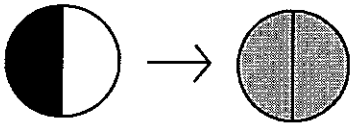
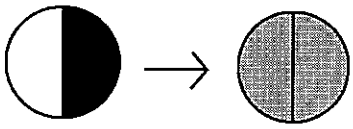


Fig. 5-2

①After confirming that the ZERO SET READY lamp is on, equalize the brightness of the right and left translucent semicircular fields with the switches while observing the field through the eyepiece. When the translucent semicircular fields are equalized in the brightness, press the ZERO SET switch (Fig.5-3).



When the right semicircular field is the brighter:
Press the right-handed ROTATE switch continually to equalize the right and left semicircular fields in the brightness.



When the left semicircular field is the brighter:
Press the left-handed ROTATE switch continually to equalize the right and left semicircular fields in the brightness.

Fig. 5-3

● When the translucent semicircular fields are equalized in the brightness, press the ZERO SET switch.

④Make sure that the digital indication of the display is "0.00" (or "0.0" when the international sugar scale is selected).
That is all for the zero-setting operation.

6. Measuring method

⚠ WARNING

◇When using this instrument for measuring matters harmful to humans, very carefully do it with gloves and a proper mask as well as with a good knowledgh of the characters of the matters.

◇When the polarimeter smells nastily, smokes or is overheated, immediately turn it off with the power switch and unplug the power cable from the outlet.
If the polarimeter is continuously operated in such a condition, it may cause a fire or damege to the polarimeter. In such a case, ask the dealer or our distributor to inspect the polarimeter as well as to investigate the cause.

◇Don't disassemble, repair, modify the polarimeter by yourself because there is fear to get electric shock or burnt.

◇If the polarimeter is dropped or shocked strongly, immediately ask the dealer or our distributor to inspect it. If our instrument is continuously operated in such a condition, it may cause smoking, burning or fire.

⚠ CAUTION

◇Avoid neither dropping the observation tube nor giving a strong shock to it, because it is made of glass.

Note: When the POLAX-2L is turned on again or for the first time, the value appearing on the display panel is "0.00" (or "0.0" when the international sugar scale is selected for indication) whether the indicated value is correct or not. Therefore, be sure to calibrate zero-indication (to perform zero-setting) each time after the POLAX-2L is turned on.

If the power switch or any of switches on the operation panel has not been operated for 5 minutes or more as the POLAX-2L is held turned on, the translucent semicircular fields disappear from the view of the eyepiece because the illuminator is automatically turned off by the power-saving function. In such the event, press the SHIFT/TEMP switch to turn on the illuminator again.

● Before starting measurement, make sure to set the indication selector switch to a desired position, angle of rotation or the international sugar scale. When the indication selector switch is set to the left position, the display indicates angle of rotation. When it is set to the right position, the display indicates sugar content in the international sugar scale(Figure 6-1).
The factory default setting for the indication selector switch is set to the left side to indicate the angle of rotation.

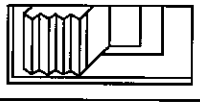


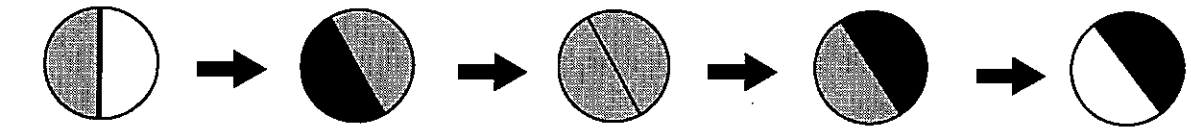
Figure 6-1

6. Measurement method

①Put an observation tube which is filled up with sample liquid on the center part of the sample stage.
②Observe the field through the eyepiece. The translucent semicircular fields may be observed differently in the brightness.

②-1: When the right semicircular field is the brighter (right-handed rotating sample)

Continuously press the right-handed ROTATE switch, and the translucent semicircular fields gradually change as shown below (Figure 6-2).



When the display indicates 0°

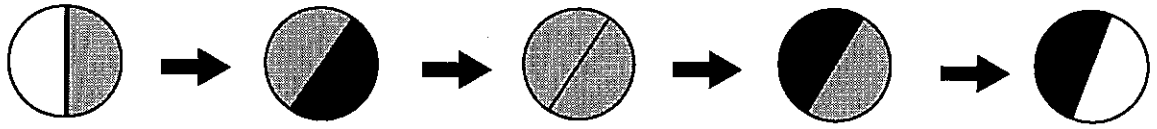
Read the indication at this point.

Figure 6-2

Although the right semicircular field is the brighter in the first stage, it becomes dark and the left semicircular field becomes the brighter than the right half with continuous pressing of the ROTATE switch. In the middle of change in the brightness of the semicircular fields, there is a point that the right and left fields are equalized in the brightness. The value appearing on the display at that point indicates the angle of rotation (or the international sugar scale) of the sample.

②-2: When the left semicircular field is the brighter (left-handed rotating sample)

Continuously press the left-handed ROTATE switch, and the translucent semicircular fields gradually change as shown below (Figure 6-3).



When the display indicates 0°

Read the indication at this point.

Figure 6-3

As same as the right-handed rotating sample, there is a point that the right and left fields are equalized in the brightness in the middle of change in the brightness of the semicircular fields. The value appearing on the display at that point indicates the angle of rotation (or the international sugar scale) of the sample.

⚠ CAUTION

The measurement range of POLAX-2L for International Sugar Scale is minus 130.0° Z to 130.0° Z. The indicator blinks when the measurement is over 130.0° Z or below minus 130.0° Z. The correct measurement range for International Sugar Scale is between minus 130.0° Z and 130.0° Z.

Method to equalize the right and left semicircular fields in the brightness

Continuously press the SHIFT/TEMP switch and the right-handed or left-handed ROTATE switch together until the right and left translucent semicircular fields approximate to each other in the brightness. When the right and left semicircular fields become nearly equal to each other in the brightness, momentarily press the right-handed and left-handed ROTATE switches alternately and check the point where the brighter and darker halves are replaced by each other. Then, fine adjust the brightness of the right and left halves until they are even in the brightness, and read the value indicated on the display at that time. It is recommended to repeat the above-mentioned procedure 3 to 5 times and to find an average of the measured values.
Pressing the right-handed ROTATE switch darkens the right semicircular field, while pressing the left-handed ROTATE switch darkens the left semicircular field.

- The field of translucent semicircles rotates counterclockwise as the right-handed ROTATE switch is pressed. On the other hand, it rotates clockwise as the left-handed ROTATE switch is pressed.
- If there is little difference in the brightness between the right and left semicircular fields when an observation tube filled up with sample liquid is put on the sample srage, the rotation angle (or the international sugar scale) is nearly 0° (Z). In such a case, repeat momentary pressing of the right-handed or left-handed ROTATE switch until the right and left semicircular fields become even in the brightness.
- In the case it is hard to find the point where the right and left semicircular fields are equalized in the brightness for the reason of excessive rotation of the field, continuously press the SHIFT/TEMP switch and right-handed or left-handed ROTATE switches together until the indication of the display becomes "0.00" or "0.0". Confirming that "0.00"or "0.0" is appearing on the display, try to equalize the right and left semicircular fields in the brightness once again.

6. Measuring method

On finishing a day's work, make sure to continuously press the SHIFT/TEMP switch and right-handed or left-handed ROTATE switches together until the indication of the display becomes "0.00" or "0.0" before turning off the POLAX-2L. This will make zero-setting operation easy when the POLAX-2L is turned on next time.

Reading of temperature (°C)

To know the temperature of the sample stage, hold the SHIFT/TEMP switch pressed for 2 seconds or more, and the temperature (°C) resultingly appears on the display panel (Figure 6-4).

When the SHIFT/TEMP switch is released from pressing, the display panel again indicates the last measured value, namely, the angle of rotation or the value in the international sugar scale.

Figure 6-4

7. Advice on measurement

①If the concentration of sample is too high, the sample is uneven and poor in the transparency. Therefore, it is hard to observe the brightness of such a sample and measurement may occasionally result in failure. In such a case, leave the sample in the measureble condition for several minutes until it becomes stable.

②If the sample is cloudy, filter it before measurement as far as circumstances permit. If it is still poor in the transparency, measurement may result in failure bedause the distance that the measuring light penetrates the sample in the observation tube is considerably long.

③When the quantity of available sample is very small, use a micro observation tube (optional) for measuring a small amount of sample. The capacity is 1.0 to 1.5ml.

● For purchasing a micro observation tube, place an order for it with the dealer or our distributor.

④Mutarotation

Before D-glucose dissolves in water, it exists as alpha particles, however, after it dissolves in water, the alpha particles continuously changes to beta particles. Since the specific rotations of the alpha particle and the beta particle are different from each other, measured value of incompletely dissolved D-glucose changes with time elapse. Therefore, a correct value can be obtained when the sample completely dissolves in water, in other words, when alpha particles completely change to beta particles. Such phenomenon is called mutarotation. Users are requested to pay careful attention to samples of such matters having special characteristics.

8. Reading of measured value

① When the specific rotation of the measured sample (solute) is already known, the concentration of optically active matters contained in the sample can found by the following equation.

$$C = \frac{100\alpha}{\ell \cdot [\alpha]_D^t}$$

C = Concentration of optically active matters in sample (g/100ml)
α = Measured value (angle of rotation)
ℓ = Length of observation tube (dm) *1dm = 100mm
$[\alpha]$ = Specific rotation
t = Temperature (℃)
D = Symbol to show the wavelength of measuring light (D-ray = 589nm, in case of POLAX-2L)

< Example >

Aqueous solution of L-sodium ascorbate is measured with a 100mm (1dm) observation tube, and its angle of rotation is found as 3.25°. The specific rotation If aqueous solution of L-sodium ascorbate is 116°.

$$C = \frac{100\alpha}{\ell \cdot [\alpha]_D^t} = \frac{100 \times 3.25}{1 \times 116} = 2.80$$

From the above equation, the concentration of the aqueous solution of L-sodium ascorbate is 2.80g/100ml.

② Specific rotation $[\alpha]_D^t$ can be found by measuring optically active matters contained in the sample after weighing them accurately and dissolving them into non-optically-active liquid. In this case, it is advised to note down the name and solubility of the solvent because specific rotation depends on the kind and concentration of the solute.

$$[\alpha]_D^t = \frac{100\alpha}{\ell \cdot C}$$

③ In case of pure liquid

$$[\alpha]_D^t = \frac{\alpha}{\ell \cdot d}$$

d = Density

If the specific rotation of the sample is known according to the above equation, it is convenient to know the purity of the sample or to identify it.

9. International sugar scale

Since the international sugar scale was adopted by the International Commission for Uniform Methods of Sugar Analysis (ICUMSA), the international sugar scale has widely been used for measuring sugar content of sucrose in the world. The scale provides that the 100° Z of sugar content is equivalent to 34.626° of angle of rotation of sugar solution which pure sucrose of 26.000g is dissolved in water to make 100ml of solution and poured into a 200mm long observation tube to be measured with D-ray (589nm) measuring light. Therefore, 1° Z corresponds to 0.34626° of angle of rotation, while 1° of angle of rotation corresponds to 2.8880° Z.
From the above-mentioned relation between angle of rotation and the international sugar scale, the international sugar scale (° Z) of a sample can be known by measuring the sample which solute of 26.000g is dissolved in water to make 100ml of solution in the same manner as mentioned above.

Indication in international sugar scale

The POLAX-2L is capable of indicating sugar content in the international sugar scale by switching the indication selector switch on the front panel (See Figure 3-1).
When the selector switch is set to the left side, the digital indication of the display is switched to show angle of rotation. When the selector switch is set to the right side, the digital indication is switched to show the international sugar scale.

- The indication selector is set to the left side (angle of rotation) on shipment.
- The unit of the international sugar scale has been changed from "° S" to "° Z" since July, 1988.

10. Replacement of standard spare parts

Supply of spare parts

All of spare parts and parts number is as follows. In case of need, contact the dealer or our distributor.

Parts name	Parts No.	Remarks
Observation tube 100mm long (OT-100(P))	RE-6705	Length: 100mm Capacity: 5ml
Observation tube 200mm long (OT-200(P))	RE-6706	Length: 200mm Capacity: 10ml
Observation tube 100mm long (OT-100M)	RE-6708	Length: 100mm Capacity: 1～1.5ml
Deck glass for observation tube	RE-6712	For OT-100(P), OT-200(P)
Rubber packing for observation tube	RE-6713	For OT-100(P), OT-200(P)
Ring nut for observation tube	RE-6714	For OT-100(P), OT-200(P)
Rubber packing for small volume tube	RE-6715	For OT-100M
Ring nut for small volume tube	RE-6717	For OT-100M
Quartz control plate 8°	RE-72043	Angle of rotation : 8° International sugar scale : 25°Z
Quartz control plate 17°	RE-72044	Angle of rotation : 17° International sugar scale : 50°Z
Quartz control plate 34°	RE-72045	Angle of rotation : 34° International sugar scale : 100°Z
Quartz control plate -8°	RE-72048	Angle of rotation : -8° International sugar scale : -25°Z
Quartz control plate -17°	RE-72049	Angle of rotation : -17° International sugar scale : -50°Z
Quartz control plate -34°	RE-72050	Angle of rotation : -34° International sugar scale : -100°Z

11. Specificatons of POLAX-2L

Measurement range	Angle of rotation : - 179.95° to +180.00° International sugar scale : - 130.0° Z to +130.0° Z (Selective with the indication selector switch)
Minimum indication unit	Angle of rotation : 0.05° International sugar scale : 0.1° Z
Measurement accuracy	Angle of rotation : ±0.10° International sugar scale : ±0.3° Z
Light source	LED + interference filter (589 nm)
Environmental conditions	Operation temperature: +5°C to +40°C Use this instrument in a place where it is lower than 2,000m above sea level. Use this instrument at an ambient temperature of 5°C to 40°C. Use this instrument under the condition of a relative humidity that the humidity of 80% at a temperature of 31°C or lower falls linearly to 50% at 40°C. The pollution degree is 2 (according to IEC60664)
Power Supply	100 to 240V (50/60Hz) (voltage fluctuation not to exceed ±10%) Transient overvoltage is the Category Ⅱ according to the installation Categories (Overvoltage Categories) Ⅰ, Ⅱ and Ⅲ.
Input rating	AC100 to 240V, 50/60Hz, 35VA
Dimensions	43 × 21 × 29 cm
Weight	11.1 kg (Main unit only)

12. Repair and warranty

The POLAX-2L is a very and complex instrument that is composed of optical parts and electronic parts. Since it basically functions by interactions of the optical and electronic components, it is very difficalt to detect the cause of a trouble if there is something wrong in the polarimeter. Therefore, the POLAX-2L requires special knowledge of not only optics and electricity but also the POLAX-2L itself for adjusting and repairing it.
In those circumstances, only the servicemen of our company and authorized servicemen who took our technical training course in maintenance of the polarimeter are permitted to perform such service work. General users are not permitted to disassemble, adjust the polarimeter and to replace parts except some limited work such as simple inspection and fuse replacement that are explained in this instruction manual.
ATAGO warrants the polarimeter for one year after purchase. If the polarimeter has something wrong in the term of the warranty, it will be repaired free of charge. In such an event, consult with the dealer or our distributor about the trouble in detail. All instruments received for repair are subject to a possible inspection fee. ATAGO does not warrant the problems which are caused by user's fault even though the unit is under warranty.

● Assurance of genuine service parts

ATAGO assures that new genuine parts of the polarimeter will be supplied for replacement for seven years after production of the polarimeter is discontinued.
Genuine service parts that are very important to maintain the original performance of the polarimeter will be supplied through a dealer or our distributor.

● Recommendation of periodical inspections (to be charged)

To make the polarimeter demonstrate its original performance and accuracy for long time, it is recommended to inspect and repair the polarimeter periodically (once every two years).
Consult with the dealer or our distributor about periodical inspection and repair (to be charged).

● Details of periodical inspection are as follows

- Check and adjustment of the polarimeter in shole and functional parts, and parts replacement (if necessary).
- Check and adjustment of span.

ATAGO CO.,LTD

When asking about repair or other matters, be sure to notify us of the serial No. of your POLAX-2L

13. ATAGO CO.,LTD. Service Center

ATAGO has Authorized Service Centers around the world. Below is the list of countries where you can find an ATAGO Authorized Service Center. If your ATAGO instrument requires servicing please contact ATAGO at the following e-mail address.

service@atago.net

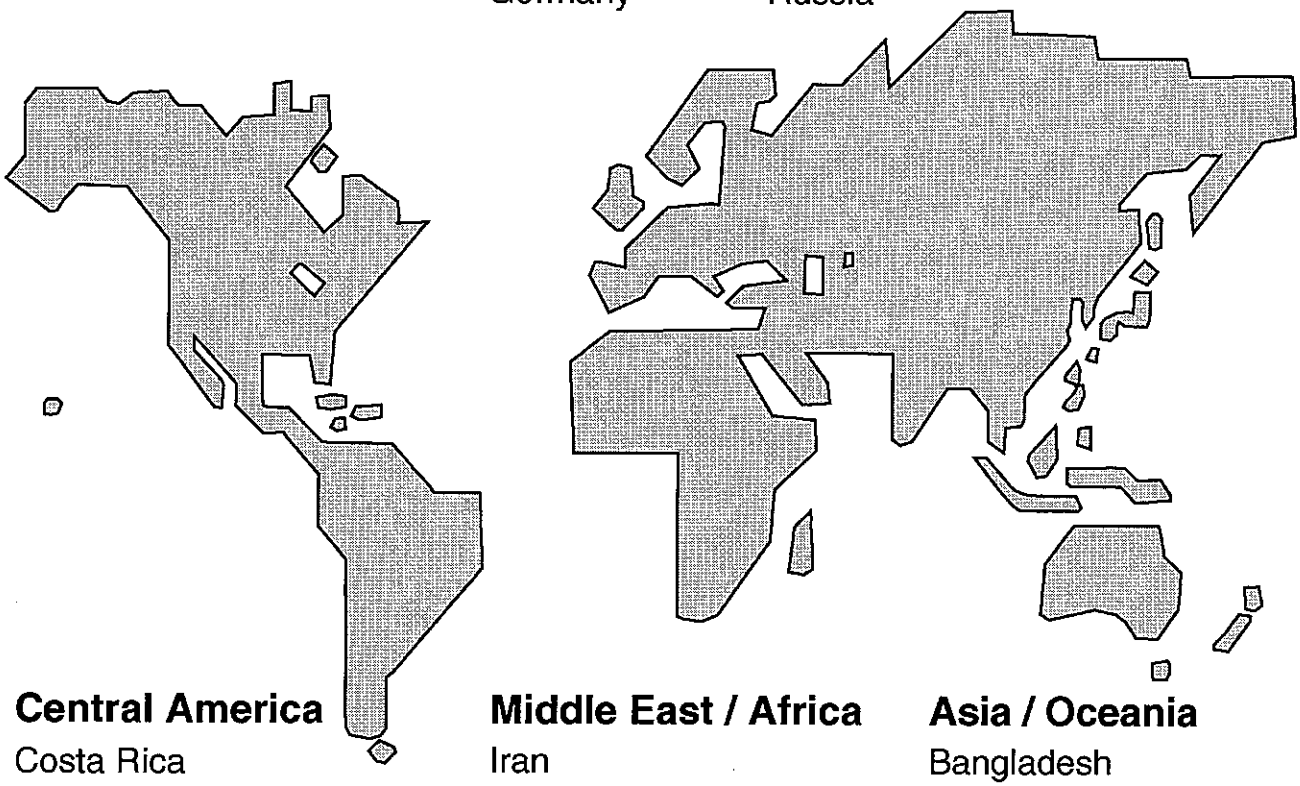
Please provide your company name, address and telephone number so that we can direct your inquiry to the Authorized Service Center nearest you. The Authorized Service Center in your area will contact you within 1 to 2 business days.

North America

Canada
U.S.A.
Mexico

Europe

Belarus
Belgium
Croatia
France
Germany
Greece
Italy
Poland
Romania
Russia
Serbia
Spain
U.K.
Ukraine



Central America

Costa Rica
El Salvador

South America

Argentina
Brazil
Colombia
Chile
Paraguay
Peru

Middle East / Africa

Iran
Israel
Turkey
U.A.E.
Kuwait
Egypt
South Africa

Asia / Oceania

Bangladesh
China
India
Indonesia
Hong Kong
Korea
Malaysia
Pakistan
Philippines
Singapore
Taiwan
Thailand
Vietnam
Australia

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