

Polarimeter

POLAX-2L

Instruction Manual

Cat. No. 5223



Fisher Scientific

Part of Thermo Fisher Scientific

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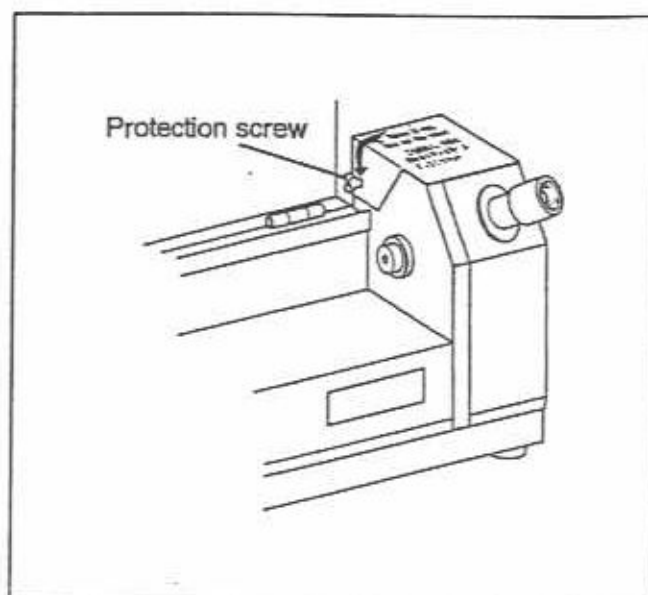
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Note:

To prevent the POLAX-2L from getting damaged 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 "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 correctly.

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 Δ .



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 $\bigcirc$.



This symbol denotes an action you must do.
The contents of instruction are described in detail in or near the $\bullet$.

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 the main body.
Application on the main body of the instrument may result in a malfunction.



◇The observation tube is made of glass. Do not drop or subject it to any strong shock.



1.Precautions for use

Handling of this instrument (Continued)



CAUTION

- ◇Always turn off the power switch after use.
- ◇When transporting the instrument, place it in its original box.



- ◇Carefully read this instruction manual and fully understand the function and operation of each part of the instrument before use.
- ◇Check that each part of the instrument operates normally before use.
- ◇Check the necessary operations such as zero setting according to the instruction manual.
- ◇The manufacturer shall not be held responsible for any or all damages as a result of use of the instrument for those other than its intended purposes (to measure angle of rotation or to measure the international standard sugar scale).
- ◇Ensure that if use of the instrument has undesired effects on the consumption of the measured materials, etc., ATAGO shall not be held responsible for the result.

Handling of plug



WARNING

- ◇ Be sure to use the power cable included with the POLAX-2L.
If a power cable other than the one included is used, the rated voltage and polarity of the power may change, and may cause smoking or fire.



- ◇ Do not insert the power plug in an outlet other than AC100 to 240V.
Inserting the power plug in any other outlet may result in shortcircuiting the unit, smoking or fire.



- ◇ Do not use the power cable if damaged or broken.
If used, fire, electrical shock, or burns may result.
For a new power cable, contact your ATAGO distributor.



CAUTION

- ◇ Do not insert or disconnect the power plug with wet hands.



- ◇ Be sure to hold and pull the plug when disconnecting the power cable from the outlet.
If the cable is pulled improperly, the plug may be broken, and may result in fire or electrical shock.



- ◇ When connecting the power cable to an AC outlet, properly connect the grounding wire 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°C.
- ◇Use the instrument where the humidity is below 80%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 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 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°C or lower falls linearly to 50% at 40°C).
- ◇Main supply voltage fluctuation should not to exceed $\pm 10\%$ 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 Confirm the contents so that the following things have been contained in the package without lack.

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

Note:

To prevent the POLAX-2L from getting damaged 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.

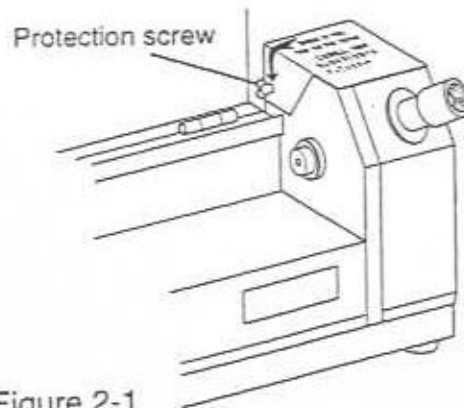


Figure 2-1

(2) Setting up

- ① Connect the POLAX-2L to an AC100 to 240V (voltage fluctuations not to exceed $\pm 10\%$), 50/60Hz, mains outlet with the power cable.
- ② Set up the POLAX-2L in a place where the ambient temperature is 5 °C to 40 °C and the POLAX-2L is free from such the environmental conditions as mentioned in ③ of the following.
- ③ Since 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.
- ④ Set 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.

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 measured value (angle of rotation or value in the internal standard 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 liquid on it.

⑥ Indication selector switch:

Indication of the display can be switched between the two scales (angle of rotation and the international standard 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 standard 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 Fuse holder:

1 A fuse is set in this holder.

⑩ Rating label:

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

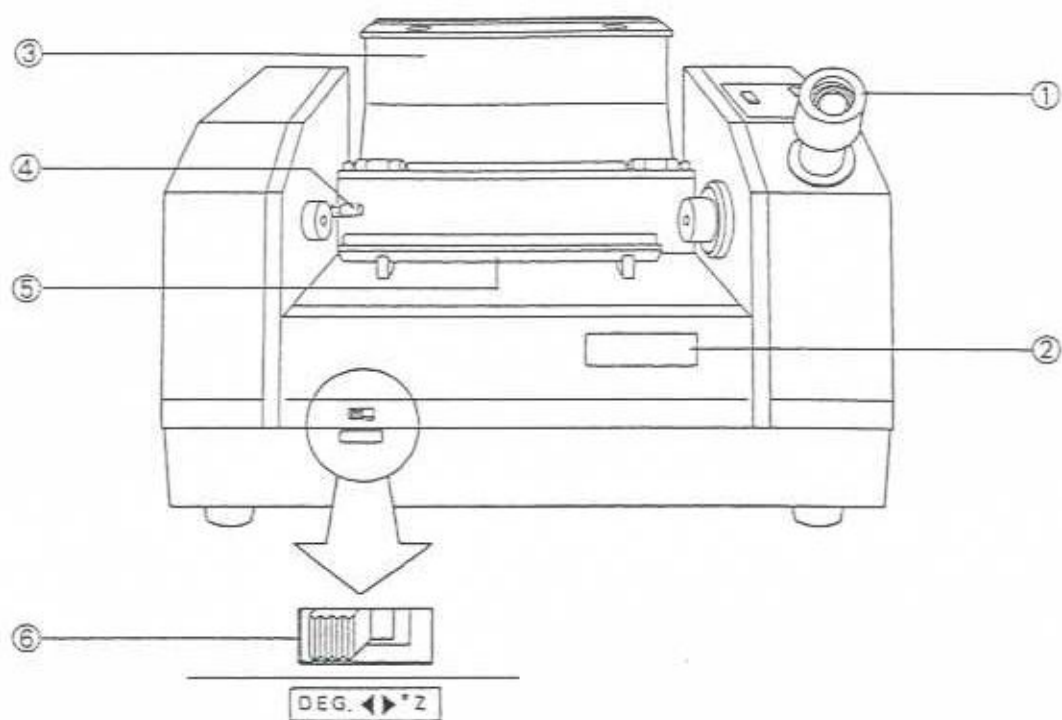


Figure 3-1

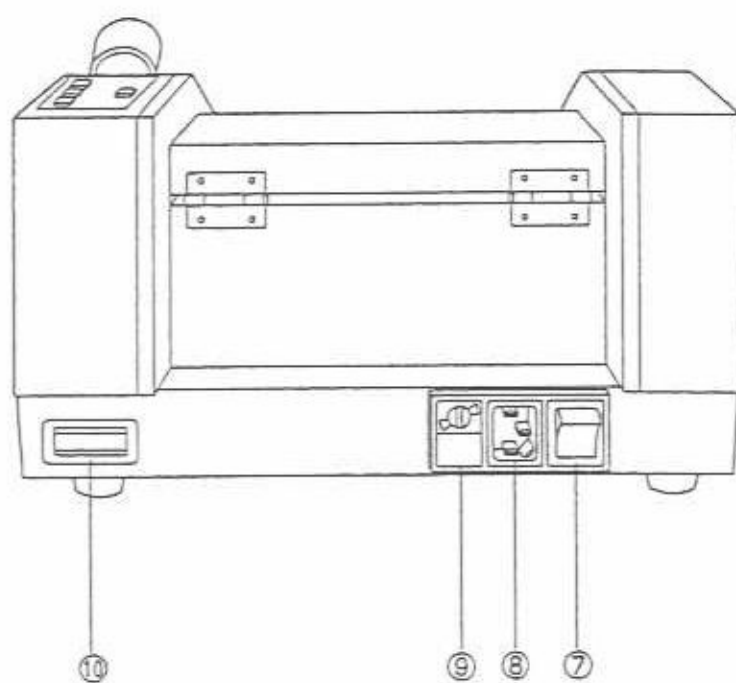


Figure 3-2

(3) Operation panel (Figure 3-3)

⑪ ZERO SET switch:

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

⑫ ZERO SET READY lamp:

When this lamp is on, it indicates that the instrument is ready for zero-setting operation.

⑬ 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)

⑭ 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)

⑮ 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 standard sugar scale for the temperature.

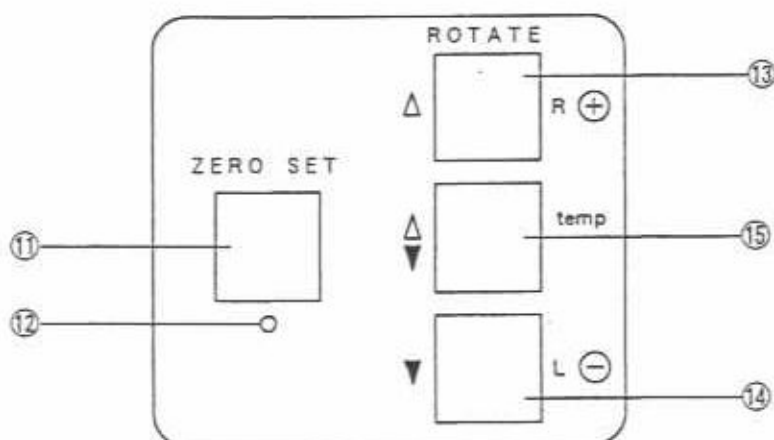


Figure 3-3

4. Preparation for measurement

(1) Connection of power cable and Turning POLAX-2L on



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 damaged 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.

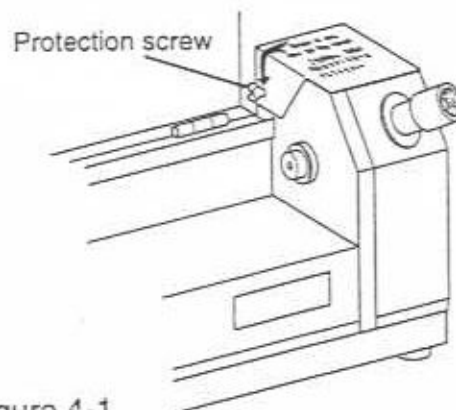


Figure 4-1

- ① Connect the female connector of the power cable to the power input connector on the rear panel.
- ② Plug the other connector of the power cable into an AC100 to 240V (voltage fluctuations not to exceed $\pm 10\%$), 50/60Hz, mains outlet.
- ③ Press 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 standard sugar scale is selected for indication).
* On shipmen, the indication selector switch is set to "DEG." for indicating angle of rotation, and "0.00" will accordingly appear.)

(2) Usage of observation tube



Caution

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

Two observation tubes, 100 mm (vol. 5 ml) and 200 mm (vol. 10 ml), are supplied with the POLAX-2L. For obtaining satisfactory measurement results, use the 200 mm long observation tube for measuring samples which are high in transparency, and 100 mm long tube for measuring cloudy or colored samples. Since polarized light (measuring light beams) penetrates sample liquid in the 100 mm or 200 mm 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 beforehand. 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.

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

- ① Turn either of the fastening rings counterclockwise to remove it, and remove the rubber ring and deck glass in the same side.
- ② While holding a proper observation tube vertically, carefully pour sample liquid into it until the sample surface 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.
- ③ Put 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 of measuring.

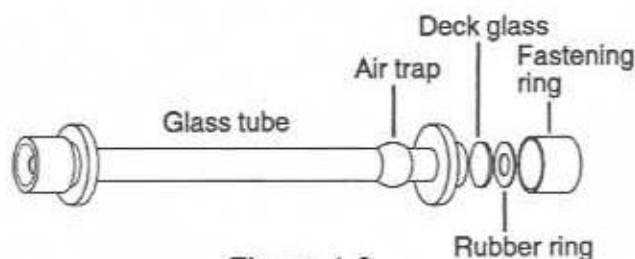
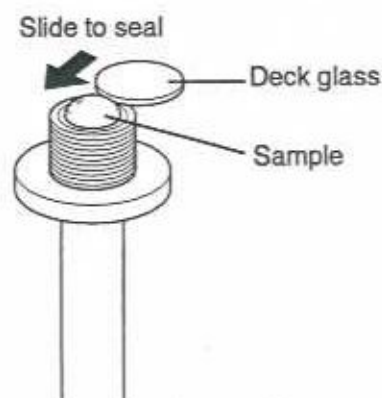


Figure 4-2



- Make sure to use a clean and dry observation tube always.

Figure 4-3

Note: Observation tube, deck glass, rubber ring, fastening ring are supplied as spare parts. 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.

- ① Press down the power switch on the rear panel to the "I" side to turn the POLAX-2L on.
- ② Put 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 simultaneously and continue pressing the two switches until the ZERO SET READY lamp goes on. (Figure 5-1)

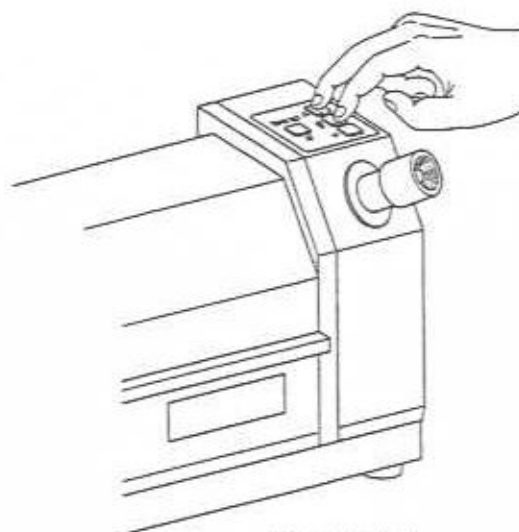


Figure 5-1

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. (Figure 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.

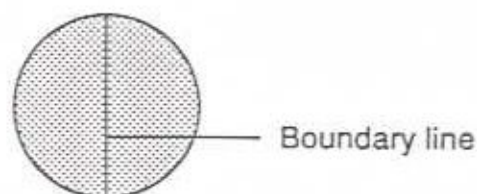
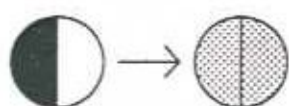


Figure 5-2

- ③ After 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. (Figure 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.

Figure 5-3

- When the translucent semicircular fields are equalized in the brightness, press the ZERO SET switch.
- ④ Make sure that the digital indication of the display is "0.00" (or "0.0" when the international standard 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 knowledge 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 damage 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.



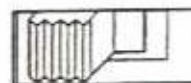
Caution

- 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 standard 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 standard 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 standard sugar scale. (Figure 6-1)
On shipment, the indication selector switch is set to the left side to indicate angle of rotation.



DEG. ◀ ▶ °Z

Figure 6-1

- ① Put an observation tube which is filled up with sample liquid on the center part of the sample stage.
- ② Observe 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. (See Figure 6-2.)

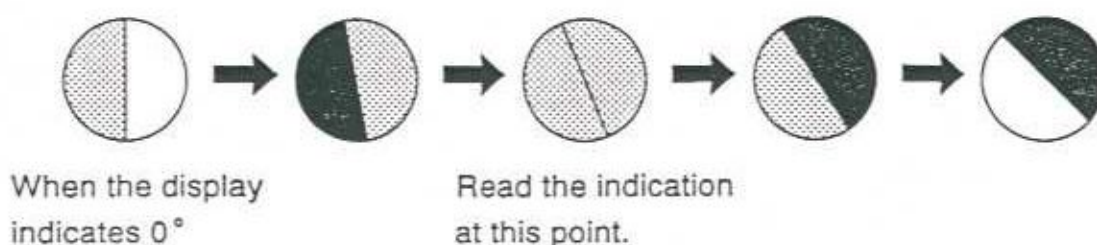


Figure 6-2

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 standard 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. (See Figure 6-3.)

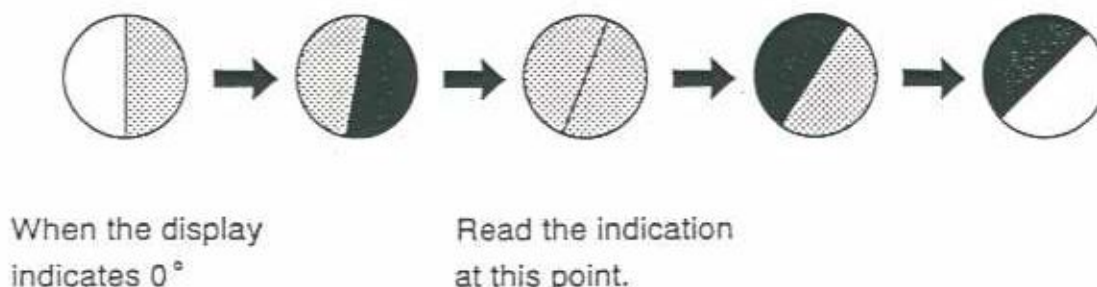


Figure 6-3

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 standard sugar scale) of the sample.

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 stage, the rotation angle (or the international standard 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.

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 standard sugar scale.



Figure 6-4

7. Advice on measurement

- ① If 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 measurable condition for several minutes until it becomes stable.
- ② If 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 because the distance that the measuring light penetrates the sample in the observation tube is considerably long.
- ③ When 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 1.5 ml.
- For purchasing a micro observation tube, place an order for it with the dealer or our distributor.

④ Mutarotation

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 be found by the following equation.

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

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

<Example>

Aqueous solution of L-sodium ascorbate is measured with a 100 mm (1 dm) observation tube, and its angle of rotation is found as 3.25°. The specific rotation of 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 2.80 g/100 ml.

- 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

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

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 standard for sugar scale

Since the international standard sugar scale was adopted by the International Commission for Uniform Methods of Sugar Analysis (ICUMSA), the international standard 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 26.000 g is dissolved in water to make 100mℓ of solution and poured into a 200 mm long observation tube to be measured with D-ray (589 nm) 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 standard sugar scale, the international standard sugar scale ($^{\circ}$ 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 standard sugar scale

The POLAX-2L is capable of indicating sugar content in the international standard 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 standard sugar scale.

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

10. Replacement of consumable supplies and component parts

If the display does not become light though the power switch has been turned on, it is thinkable that the fuse has blown out. In such a case, check the fuse and replace it following the instructions written below.

The fuse is only the part that can be replaced by the user.

If the POLAX-2L still shows the above-mentioned phenomenon after the fuse is replaced with new one, contact the dealer or our distributor.

Caution

- Before starting replacement of the fuse, make sure not only to turn off the power switch but also to disconnect the power cable from the AC outlet.
- 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.
- Make sure to replace the fuse with new one of the specified rating.
If any fuse other than that of the specified rating is used, it may cause internal burns and trouble of the instrument.

1. Supply of spare fuse

The part number and rating of the fuse are shown in the following table. In case of need, contact the dealer or our distributor.

Note: A list of ATAGO's foreign distributors appearing on page 26 will help you for consultation.

Part Name	Part Number	Remark
Fuse	RE-5784	F-type, quick break type Rated current: 1 A, 250 V

2. Checking and replacing fuse

- ① Unscrew (turn counterclockwise) the fuse holder on the rear panel (see Figure 10-1) and remove the fuse from it (see Figure 10-2).
- ② Check to see if the fuse has blown out or not by eyes. If it is difficult to judge it by eye-check, check the connection between the both ends of the fuse by measuring the resistance with a tester. If the measured resistance is infinite, the fuse has blown out. On the other hand, if the resistance is $0\ \Omega$, the fuse is normal.
- ③ When the fuse has blown out, set a new fuse of the specified rating in the fuse holder.
- ④ Screw the fuse holder with a new fuse into the socket on the rear panel as it was.

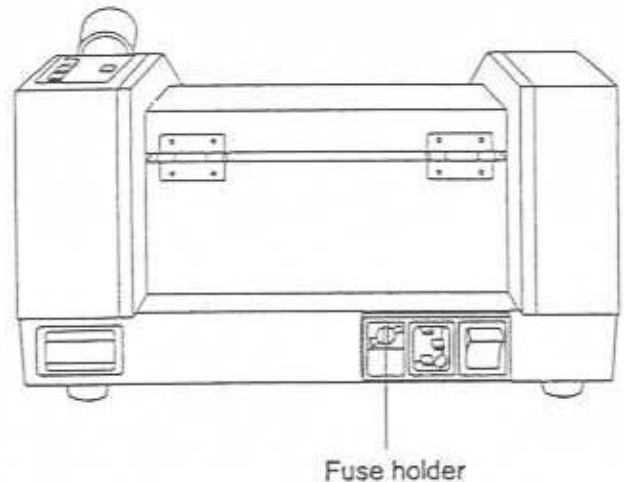


Figure 10-1

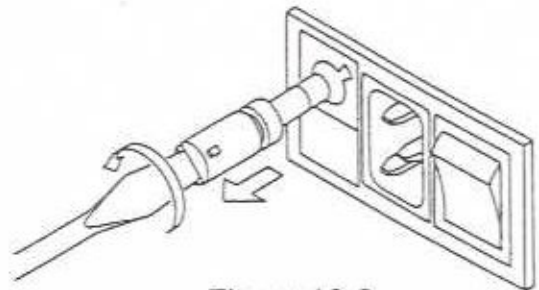


Figure 10-2

11. Specifications of POLAX-2L

Measurable range	Angle of rotation : +180° to - 179.95° International standard sugar scale : +130° to - 130° Z (Selective with the indication selector switch)
Minimal indication unit	Angle of rotation : 0.05° International standard sugar scale : 0.1° 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 2,000 m above sea level. Use this instrument at an ambient temperature of 5 ° 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 240 V (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.
Power consumption	40 VA
Dimensions	43 × 22 × 30 cm
Weight	11.5 kg

12. Repair and warranty

The Polarimeter POLAX-2L is a complicated precision electronic instrument consisting of optical and electronic parts. Since light and electricity are combined in the operation of this instrument, their mutual actions may make it difficult to isolate operational problems.

For this reason, repair and adjustment can be complicated and each serviceman is required to have special knowledge of optics and electrical engineering.

Do not disassemble or perform any repair on the unit other than the basic inspection and replacement of parts described in this operation manual (unless you have taken the maintenance technology course in our company and has been certified).

The warranty of this unit 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.

● Performance parts for repair

ATAGO will endeavor to secure the performance parts for repair up to seven years after manufacturing of this instrument is discontinued. Performance parts are those which are necessary to maintain the operation of this instrument. However, ATAGO may not be able to supply all parts due to discontinuation or modifications by our parts manufacturers. Please understand this matter. Performance part are available through your ATAGO distributor.

● Recommendation of periodic inspection and maintenance(Charged)

We recommend to have your POLAX-2L inspected periodically (once in two years, or so) to ensure years of dependable and accurate use.

Ask your ATAGO distributor for the periodic inspection (charged).

Periodic inspection includes:

- Inspection, confirmation, and replacement of performance parts
- Inspection 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. List of ATAGO's foreign distributors

When your instrument is in need of consumable supplies, replacement parts, repair service or periodical maintenance, contact the dealer that you purchased the instrument from or the nearest distributor. Refer to the following list.

NORTH AMERICA

U.S.A. Subsidiary Office

ATAGO U.S.A., INC.
13005 NE 126th Place,
Kirkland, WA 98034 U.S.A.

PHONE: 1-425-821-9050
TOLL FREE: 1-877-ATAGO-USA
(1-877-282-4687)
FAX: 1-425-825-5525

MEXICO EL CRISOL, S.A. DE C.V.
San Luis Potosi No.25, 06700
Mexico, D.F. Mexico

PHONE: 52-5-264-7529
FAX: 52-5-264-7798

CENTRAL AMERICA

COSTA RICA

INTERTEC S.A.
36 Street, 4 & 6 Ave.
Edificio Don Bosco #3 San Jose

PHONE: 506-221-7831
FAX: 506-222-7055

SOUTH AMERICA

ARGENTINA GRIENSU
AV. Santa Fe 1429(1060)
Buenos Aires

PHONE: 54-11-4814-2619
FAX: 54-11-4814-5767

BRAZIL IMP.E EXP. DE MEDIDORES
POLIMATE LTDA.
AV. Cel Lucas De Oliveira 3640,
90440-010- Porto Alegre- RS

PHONE: 55-51-332-9400
FAX: 55-51-332-2777

PERU KOSSODO S.A.C.
Chota 1161, Lima

PHONE: 51-1-431-0918
FAX: 51-1-431-4783

EUROPE

GERMANY LEO KUEBLER GMBH
Stephanienstr. 42-44
D-76133 Karlsruhe

PHONE: 49-721-22491
FAX: 49-721-27903

ENGLAND JENCONS (SCIENTIFIC) LTD
Cherrycourt Way,
Stanbridge Road, Leighton
Buzzard Bedfordshire LU7 8UA

PHONE: 44-1525-372010
FAX: 44-1525-853617

FRANCE FISHER BIOBLOCK SCIENTIFIC
Parc D'innovation Blvd Sebastien
Brant F-67400 Illkirch

PHONE: 33-3-88671414
FAX: 33-3-88671168

SPAIN GOMENSORO, S. A.
C/.Aguate, 15
28044 Madrid

PHONE: 34-91-508-6586
FAX: 34-91-508-6511

NETHERLANDS

GOFFIN MEYVIS B. V.
Ecustra 11
4879 NP Etten Leur Netherland

PHONE: 31-76-5086000
FAX: 31-76-5086086

ITALY

ANALYTICAL CONTROL SPA
P.O. Box 122 Via Copernico, 15
20092 Cinisello Balsamo

PHONE: 39-02-612-28-41
FAX: 39-02-612-76-46

BELGIUM

ANALIS S.A.
Rue Dewez 14, 5000 Namur

PHONE: 32-81-22-50-50
FAX: 32-81-23-07-79

OCEANIA

AUSTRALIA JOHN MORRIS SCIENTIFIC PTY
NEW ZEALAND LIMITED
P.O. Box 447
Willoughby NSW 2068

PHONE: 61-2-9417-8877
FREE CALL: 1-800-25-1799
FAX: 61-2-9417-8855

ASIA**KOREA**

J M INSTRUMENTS CORP.
219-2, Suhge-Dong,
Young San-ku, Seoul C.P.O.
Box 3462, Seoul

PHONE: 82-2-752-1777
FAX: 82-2-755-9078

TAIWAN

HORIZON INSTRUMENTS
CO., LTD.(SIFO GROUP)
9F, No. 2, Sec. 2, Ren-Ai Road
Taipei, Taiwan, R. O. C.

PHONE: 886-2-3322-1589
FAX: 886-2-3322-1619

**CHINA
HONG KONG**

EURO TECH(FAR EAST) LTD.
18/F, Gee Chang Hong Centre,
65 Wong Chuk Hang Road,
Hong Kong

PHONE: 852-28140311
FAX: 852-28700479

THAILAND

BECTHAI BANGKOK EQUIPMENT &
CHEMICAL CO., LTD.
300 Phaholyothin Road, Phayathai,
Bangkok, 10400

PHONE: 66-2-615-2929
FAX: 66-2-615-2350

**INDONESIA
MALAYSIA
SINGAPORE**

GLOBAL INSTRUMENTS PTE LTD
Blk 65A Jalan Tenteram
#06-04 Singapore 328958

PHONE: 65-62533538
FAX: 65-62533885

PHILIPPINES

YANA CHEMODITIES INC.
151 Kaliraya St., Quezon City

PHONE: 632-732-2329
FAX: 632-732-0171

14. List of ATAGO's service centers in foreign countries

When ATAGO instruments are in need of repair, please make inquiries to one of our service centers nearest you.

EUROPE

FRANCE	AVANTEC Bld Sebastien Brant, Parc d'innovation 67400 Illkirch	PHONE: 33-3-88-66-67-24 FAX: 33-3-88-67-01-76
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NORTH AMERICA

U.S.A.	NATIONAL MICROSCOPE EXCHANGE, INC. 11405 West Lake Joy Drive NE Carnation, WA 98014-6809	PHONE: 1-425-788-2662 TOLL FREE: 1-800-851-7635 FAX: 1-425-788-3563
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MEXICO	EL CRISOL, S.A. DE C.V. San Luis Potosi No.25, 06700 Mexico, D.F. Mexico	PHONE: 52-5-264-7529 FAX: 52-5-264-7798
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SOUTH AMERICA

BRAZIL	IMPE EXP. DE MEDIDORES POLIMATE LTDA. AV. Cel Lucas De Oliveira 3640, 90440-010-Porto Alegre-RS	PHONE: 55-51-332-9400 FAX: 55-51-332-2777
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PERU	KOSSODO S.A.C. Chota 1161, Lima	PHONE: 51-1-431-0918 FAX: 51-1-431-4783
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ASIA

KOREA	J M INSTRUMENTS CORP. 219-2, Suhge-Dong, Young San-ku, Seoul C.P.O. Box 3462, Seoul	PHONE: 82-2-752-1777 FAX: 82-2-755-9078
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TAIWAN	HORIZON INSTRUMENTS CO., LTD.(SIFO GROUP) 9F, No. 2, Sec. 2, Ren-Ai Road Taipei, Taiwan, R. O. C.	PHONE: 886-2-3322-1589 FAX: 886-2-3322-1619
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CHINA HONG KONG	EURO TECH(FAR EAST) LTD. 18/F, Gee Chang Hong Centre, 65 Wong Chuk Hang Road, Hong Kong	PHONE: 852-28140311 FAX: 852-28700479
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INDONESIA MALAYSIA SINGAPORE	GLOBAL INSTRUMENTS PTE LTD Blk 65A Jalan Tenteram #06-04 Singapore 328958	PHONE: 65-62533538 FAX: 65-62533885
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Main Office: 32-10, Honcho, Itabashi-ku, Tokyo 173-0001, Japan
TEL: 81-3-3964-6156 FAX: 81-3-3964-6137
export@atago.net <http://www.atago.net/>

 ATAGO U.S.A., Inc.

13005 NE 126th Place, Kirkland, WA 98034 U.S.A.
TEL: 1-425-821-9050 FAX: 1-425-825-5525
customerservice@atago-usa.com <http://www.atago.net/>



Printed in Japan

0307M