PARALUX
precision optics

Ref. 6012 - 6013 - 6014 - 6202

Instructions

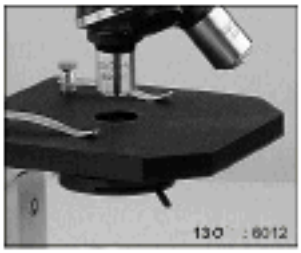
Paralux thank you for the confidence you have shown by choosing their product. The microscope has been checked and tested in our workshops.

The microscope has become an essential work tool for numerous applications. The student, doctor, biologist and naturalist find the microscope very useful in their everyday scientific work. It is therefore essential to know the instrument and its operation.

Principle of operation
Whatever the external shape of the microscope, the principle remains the same: two optical systems are associated to converge on a single axis:
One, the Objective, gives a larger image, real and inverted, of the subject under inspection.
The other, the Eyepiece, allows the eye to observe an enlarged view of the objective image.
A virtual image is thus obtained, whose total magnification is the product of the magnifications of the Objective system, and the Eyepiece.

Description
Two knobs control the vertical movement of the Optical system upon the Stem. The larger knob (4), provides for the fast adjustment of the Optical system, and the smaller knob (5), allows for finer precision adjustments to be exacted. A connecting hinge allows the whole assembly of the Optical system, Stage, Condenser and Mirror, to tilt forwards, or backwards, by moving the Stem upon its Horse shoe base. In this way, the observed specimen can be viewed at the angle which is most comfortable, and which provides the best lighting conditions for the Optical system via the Adjustable mirror. The focal length of optical microscope is 160 mm.

1 Eyepiece
2 Eyepiece tube
3 Adjustable height security stop
4 Fast focal adjustment
5 Fine focal adjustment
6 Adjustable Stem
7 Inclinable base hinge
8 Horseshoe shaped base ensures good stability of the microscope
9 Optical system focal length (160 mm)
10 Rotational nosepiece
11 Objective
12 Stage (stage round for the model L-201)
13 Models PCB 13 and PCB-900 -1600 only: have a superstage
13a - The PCB-640 model is equipped with a pair of clamps
13b - The L-201 model has a round plate (not available as an option)



14 Mounting screw for the condenser (except PCB-640)
15 Abbe condenser with Iris diaphragm and Filter
16 Adjustable condenser height (except PCB-640)
17 Adjustable biface plain / concave mirror

Illustration

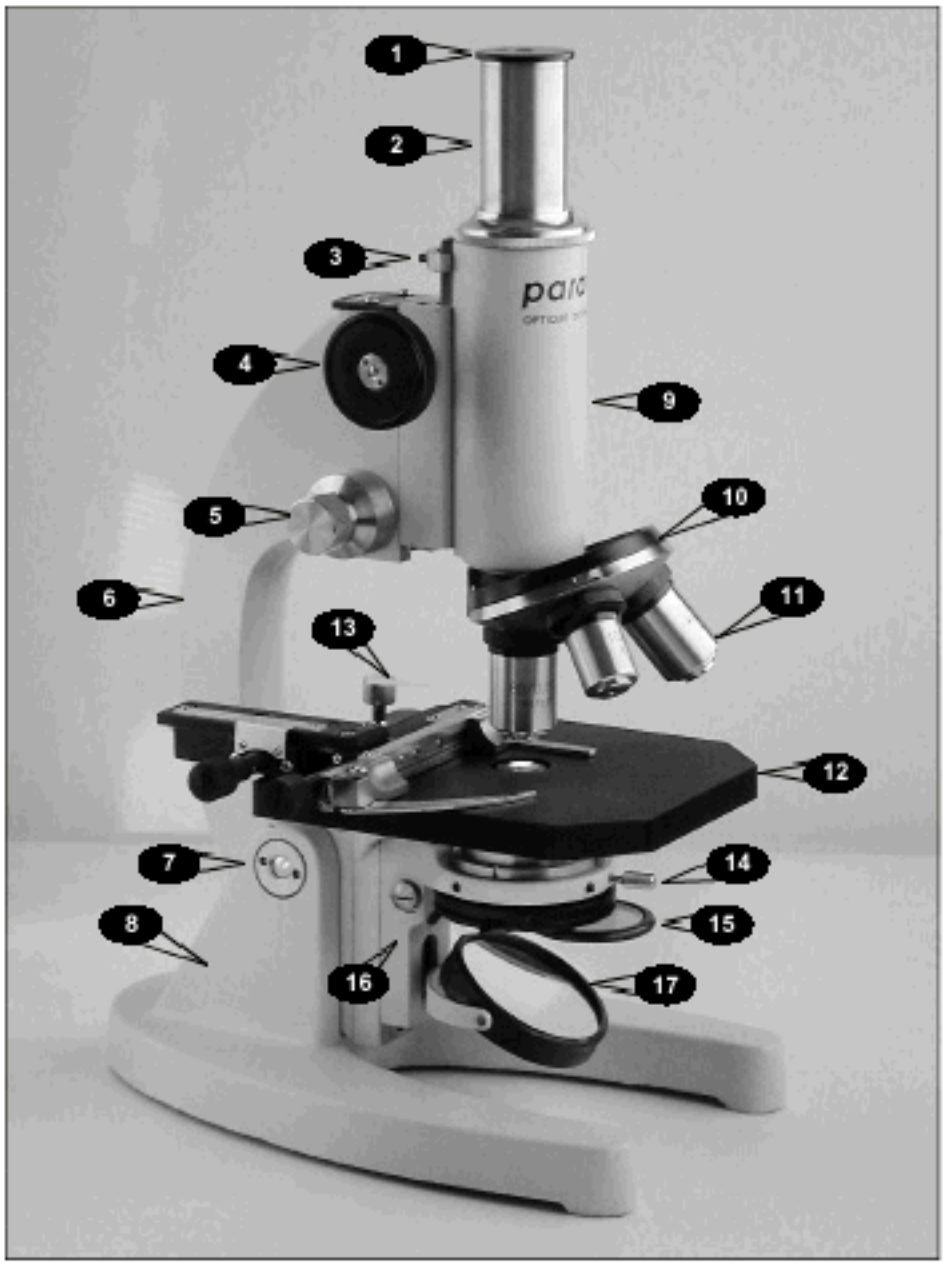


Fig. 1: Microscope L1000 ref. 61000 (descriptions on page 2: microscopes ref. 6012 and 6202)

Optical System

Mountings

The function of the Stem is to support the Optical system. The Stem is very rigid, and maintains the perfect alignment of all the different elements. The Stem forms an arc whose lower most part is connected to a Horse shoe base by means of an axial pivot which allows inclination of the Stem for comfortable observations through the Eyepiece.

The lower most end of the Eyepiece tube is abutted to a Rotational nosepiece which receives the microscope Objectives, and the upper end of the tube receives the Eyepiece.
The microscope is equipped with a Rotational nosepiece which may receive three Objectives of differing characteristics. Simply switching between them, by turning the Rotational nosepiece, changes the magnificatio of the microscope. The correct positioning of the objective lens, by the Rotational nosepiece, is obtained by a precision spring.

Focal adjustments

The Optical system is not fixed upon the Stem, so the system can be motivated parallel to the axis of observation to ensure a clearly focused image. The mechanical adjustments of the Optical system upon the Stem are very delicate and allow the precise focusing of the image through the Eyepiece. There are two focusing adjustments to the Optical system.

Course focal adjustments can be made by the Fast focal adjustment knob, which is useful when using low power Objectives on the Nosepiece, or when approximate focusing is required for high power Objectives (1, fig.2). A smaller knob provides the Fine precision focusing for high power Objectives (2, fig.2).

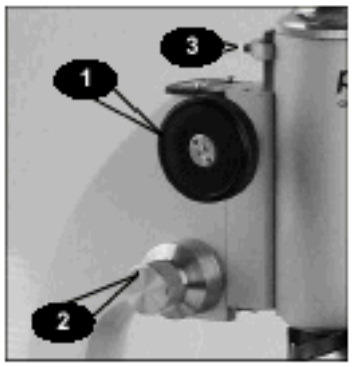


Fig. 2: The focusing system

The adjustable height stop

The stationary Stem part of Optical system is equipped with an Adjustable height security stop (3, fig.2) which prevents the tube of the Optical system falling below a desired point. This can be set so as to prevent the Objective colliding with the specimen under view, and thereby prevents the potential for damage to the Objective lens.

Stage

The Stage supports the specimen under examination. The specimen is placed upon a glass slide which is about one millimetre thick and has an area of about 26 x 76 mm. In most cases, the slide is then covered by a very thin glass plate which is about 0.16 to 0.17 mm thick called a Cover glass.

The Stage has a hole central to the axis of the Optical system through which light is passed onto and through the specimen.

The Stage of the PCB-640 model is 120 x 110 mm and is equipped with clamps that can be used to secure the glass slide to the stage.

The Stage of the L-201 model is 120 mm in diameter, and is equipped with clamps that can be used to secure the glass slide onto its Round Stage.

The Stages of the PCB-900 and PCB-1600 models are also 120 x 110 mm, but are equipped with a Superstage, that allows orthogonal movement of the mounted slide by means of a knob and two side buttons (13, fig.1).

Precise adjustment of the Superstage is afforded by two Side buttons, that provide the accurately controlled guidance of the slide through scales and vernier readings. The Superstage can be motivated so as to explore all of the specimen on the glass slide. The constraints of travel are 28 mm for movement in a longitudinal plane (1, fig.3. Coordinate Y) and 68 mm for movement in the lateral plane (2, fig.3. Coordinate X).

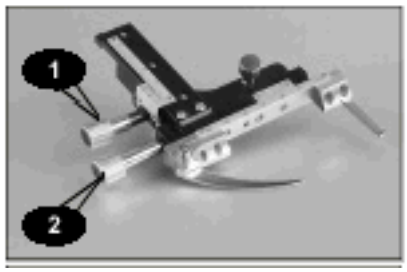


Fig. 3: Superstage PCB-900 and 1600

The Round Stage of the L-201 model is equipped with clamps that can be used to secure the glass slide to the Stage. The Round Stage also allows movement of the specimen and glass slide through an orthogonal rotation of 360º.

The location of the plate, slide, and specimen, can be adjusted with Set screws (1 and 2, fig.4) so as to correctly align the specimen in the field of view. The Stage may then be rotated so as to explore all the specimen. This makes the L-201 particularly suited to the task of mineralogy and the observation of crystals.

Fig. 4: Round stage L-201

Objectives

The Objective is the essential part of the Compound microscope. (The Objective provides a magnified optical image for the Eyepiece). The magnification and complexity of the Objective lens increases as its focal length decreases. The physical sizes of the lenses, particularly those of Oil immersion objectives, make them fragile and sensitive to shock. A fall or a clash of the lens upon the Stage or upon the specimen is sufficient to put a lens out of use. There are two types of Objectives: Dry objectives and Oil immersion objectives.

The Rotational nosepiece houses a selection of Objectives which include Dry objectives with low and medium capacities of magnification, and an Oil immersion objective which provides magnification of the specimen, up to, and approaching, the highest physical limits of visible power. Dry objectives perform with air space before the specimen, and by simply rotating the Nosepiece, so as to place the desired Objective under the Stem, it is possible to observe specimens upon a glass slide, relatively easily, by making only a few focal adjustments. The higher the magnification of the Objective, the lower the focusing distance between the Objective and the slide. With high power Objectives, the focusing distance will approach only a few hundredths of a millimetre, and therefore, it is necessary to exercise additional precautions.

Dry objectives

Fig. 5: Dry objective 4 x

In the application of Dry objectives upon a specimen, it is necessary to consider the thickness of the Cover glass over the specimen, which has generally been set at 0.17 mm.
Low power Dry objectives are not very sensitive to the thickness of the Cover glass.

Special purpose high power Dry objectives, whose magnification reaches or exceed 30 x, are very sensitive to slight changes in the thickness of the Cover glass, so it

becomes preferable to choose Oil immersion objectives for the inspection of specimens that require higher powers of magnification.

Better results can be achieved when employing high power Dry objectives, if the specimen is presented as a smear. Because the focal distance between high power Dry objectives and the specimen is so small, it is not always possible to cover the specimen. When it is possible to employ a Cover glass, particular care is required in ensuring that the Cover glass is kept very clean.

As light passes through a glass medium, the refractive index of the glass creates a distortion in the direction of light rays from their natural path. Light rays are bent on their entry point and exit point of a translucent medium. The design of all of the glass optical components, including the lenses, slides and Cover glasses, have to match each other in a way which creates the least distortion.

Oil immersion objectives
Because high power Objectives have much smaller lenses, the deviation of light rays from their natural path diminishes the brightness of the image, so it becomes much more critical to match the refractive index of the glass components so as to create a minimum in the deviation of light rays. This is achieved by the use of an Immersion oil which provides a better refractive index in the transition of light rays from glass to oil to glass, than Dry objectives can provide in the transition of light rays from glass to air to glass.

Fig. 6: 100 x Oil immersion

With high power Oil objectives, it is necessary to use a special Immersion oil which is characteristically homogeneous. Like Dry objectives, Oil immersion objectives can be used either with or without a Cover glass mounted on the slide.

A 100 x Oil immersion objective is provided with the original PCB-1600 and is available as an optional accessory for other models.

The lens optical systems of our Objectives are designed and machined with great precision and extremely accurately centred. The user should refrain from making any modifications or adjustments to the microscope assembly, and prevent its exposure to shocks that might cause damage to these standards. Disassembly by the user must be considered a deterioration in precision. You may occasionally clean the external lenses.

All Objectives are engraved with their specific optical characteristics. For example, the words 40 / 0.65 - 160 0.17 mean that the lens has a 40 x magnification, which represents the function of its focal length (in this case: 1.8 mm). The 0.65 represents the numerical aperture of the lens. The final characteristics indicate that for a 160 mm mechanical tube length, the distance between the Objective mounted on the Nosepiece, and the Eyepiece must be 160 mm for there to be a magnification equal to 40 x, and that the Objective has been designed to be used with a Cover glass that has a thickness of 0.17 mm.

Objectives with a magnification capacity greater or equal to 40 x are retractable. This mechanical protection takes the form of a spring system that prevents their contact with the specimen. This acts to prevent a deterioration of the front lens of the Objective and the specimen slide.

The mounts of the Objectives on the Rotary nosepiece are offset, and the focal length of the Objectives are designed so that when in rotation with each other, the image remains roughly in focus and requires only the slightest Fine focal adjustment to obtain perfect clarity. This is not necessarily the case if you encounter and use Objectives from different manufacturers on the Nosepiece of the microscope.

The PARALUX 37 mm achromatic objectives:

Ref. 6604: 4 x L-201	Ref. 6620: 20 x retractable
Ref. 6606: 5 x PCB	Ref. 6641: 40 x retractable
Ref. 6610: 10 x L-201	Ref. 6662: 60 x retractable
Ref. 6612: 10 x PCB	Ref. 6691: 100 x retractable oil

Mounting objectives
Remove the microscope from its packaging. Adjust the Optical system with the Fast focal adjustment knob (1, fig.2, page 4) so as to allow for the provision of enough space between the Stage and Rotational nosepiece. Screw the Objectives into the openings provided in the Rotational nosepiece so that in a clockwise direction, they increase in order of their magnification powers (Fig. 9).

Huygens eyepiece
The Eyepiece magnifies the image provided by the Objective so that the eye can distinguish, easily, all the detail of a specimen. Like Objective lenses, Eyepieces, also have characteristics which differ according to their focal length. On their frames, around the circumference of the lens through which the eye looks, is carved a figure denoting the magnification capacity of the Eyepiece.

Fig. 7: Eyepiece 10 x provided

A powerful Eyepiece distributes, more easily, the details given by the Objective, which, it must be remembered, presents a field image which decreases in size, as the magnification increases. The same is true for the clarity of the image and depth of field. So, an Eyepiece which is more powerful, presents, a smaller opening through which the eye can observe the magnified view of the Objective.

Spectacle wearers should remove their glasses when using the microscope, and may use the Fine focal adjustment to develop a distinctive and sharp image throughout the field at view. Microscopic examination generally requires the use of an Eyepiece with magnifications of between 16 and 10 x. Your microscope comes with Eyepieces with magnifications of 6 x, 10 x, and 16 x.

The various Paralux Huygens eyepieces

Ref. 6555: 5 x	Large field	Field number: mm
Ref. 6556: 6 x	Large field	Field number: mm
Ref. 6560: 10 x	Large field	Field number: 18 mm
Ref. 6564: 12.5 x	Large field	Field number: mm
Ref. 6565: 15 x	Large field	Field number: mm
Ref. 6566: 16 x	Large field	Field number: 11 mm

Table of optical lenses by model.

		Eyepieces					Objectives				
		5 x	6 x	10 x	15 x	16 x	4 x	10 x	20 x	40 x	60 x
PCB-640	ref. 6012			◆		◆		◆	◆	◆	
PCB-960	ref. 6014	◆		◆		◆		◆		◆	◆
L-201	ref. 6202		◆	◆	◆		◆	◆			◆

Table of magnifications possible with the Paralux Eyepieces and Objectives.

	4 x	10 x	20 x	40 x	60 x
5 x	*20 x*	*50 x*	*100 x*	*200 x*	*300 x*
6 x	*24 x*	*60 x*	*120 x*	*240 x*	*360 x*
10 x	*40 x*	*100 x*	*200 x*	*400 x*	*600 x*
15 x	*60 x*	*150 x*	*300 x*	*600 x*	*900 x*
16 x	*64 x*	*160 x*	*320 x*	*640 x*	*960 x*

Lighting

The lighting provided by the Mirror is enough to illuminate specimens at low levels of magnification. An Iris diaphragm provides an easy means by which to control the amount of light which falls upon the glass slide. The microscope can also be fitted with an Artificial lighting system.
The use of an Artificial lighting source provides a light yellow hue of light which slightly taints the colours of the specimen under view. This inconvenience can be eliminated by positioning the Blue, Daylight filter, on the underside of the condenser stage, in line, between the Iris and the light source.

Condenser

All of the Microscopes with inclinable Stems, with the exception of the L-640, come equipped with Condensers. For applications which require high optical powers of magnification, it is essential to have light concentrated about the specimen by means of the Condenser. The role of the Condenser is to ensure that the slide and specimen is properly illuminated. The Condenser is mounted underneath the Stage upon a sliding bracket which facilitates the adjustment of its distance from the slide and Stage above (5, fig.8). The Condenser always remains central to the specimen and axis of the Optical system above. The underside of the Condenser is equipped with an Iris diaphragm, (4, fig.8) and a Filter ring (2, fig.8).

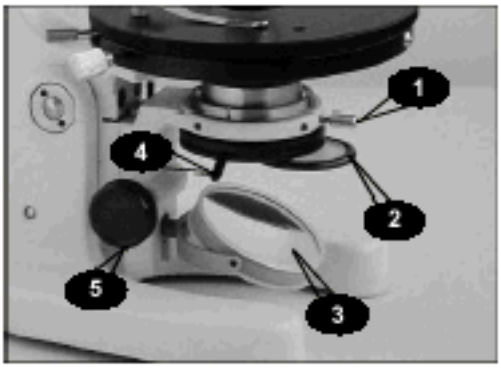


Fig. 8: The condenser mounted on its adjustable bracket:

1. Screw securing the condenser to its bracket.
2. Sliding filter ring.
3. Mirror.
4. Iris diaphram aperture control.
5. Condenser Height adjustment knob.

Numerical aperture 1.2.

Use

The microscopy enthusiast requires great precision. In accordance with certain rules, it is possible to work several hours every day without feeling any discomfort. If practised in good conditions, using a microscope dose not weaken the eyesight. The microscope should be used upon a level table which is stable, and which is at a comfortable height.

Typically, it is essential for the specimen to be evenly illuminated by a light source which has a uniformity of wavelength. The Iris diaphragm can be adjusted to achieve an aperture which presents the best results in observation. The more powerful the Objective, the greater the aperture necessary to maintain clarity and good definition of the image.

Light

You may choose a regular light source which can be either Natural or Artificial. Natural light is softer and more pleasant to use.

Artificial light can be presented by means of a light bulb placed on the table next to the microscope. It is preferable to use an Opal spherical lamp of 25 watts, but Krypton bulbs and Halogen lights grant a more even, and whiter illumination.

Alternatively, you can choose a strong lamp and illuminate the microscope indirectly by the reflection of light from a white surface.

Paralux offer an Artificial light source which can be placed under the microscope as an additional option. These optional Micro-lights, ref. 6511 or 6531 (see page 14), can be fitted to take the place of the Mirror at the bottom of the Stem. They tilt as the inclination of the microscope is adjusted, and always remain aligned with the axis of the Optical systems above them.

Important:	Before fitting any form of luminaire directly onto the microscope Stem, always ensure that its electricity supply is completely isolated from the metalwork of the microscope

The intensity of a light source depends upon its distance from the source and the power of the bulb.

Set the illumination with a low power Objective and an average power Eyepiece. Check that the light illuminates the entire background surface area of the Objective lens.

As the magnification decreases the field of observation, so it diminishes the amount of light which can pass through the Objective, and the image at the Eyepiece appears darker. To overcome this, you must concentrate more light onto Objectives that have high powers of magnification.

Too little light diminishes both brightness and contrast, which greatly affects definition:
- The Plane mirror gives a parallel beam of light with a large diameter to the specimen. It is best used for applications which require low levels of magnification.
- The Concave mirror focuses and concentrates light onto the specimen. It is best used with high power Objectives with magnifications of 40 x and above, or when there are low levels of Natural light.

Resolution

The resolving power (or definition) of an optical system is a key concept of micrographics. The power of the Optical system to separate detail within a structure depends upon the proportion of light rays that pass through the specimen to the Eyepiece. The greater the proportion of light passing through the Optical system, the better definition the image will be.

Any object, providing that it is sufficiently thin, and providing that it is translucent to light rays, can be easily observed through the microscope, but observation of objects which are thicker, or dense, is limited to lower levels of magnification because of the diminished intensity of light entering the Optical system.

It will be recalled that microscopic examination usually requires the use of an Eyepiece which has a magnifying capacity of between 16 x and 10 x. The use of Eyepieces with magnifications beyond the values necessary to present clarity of detail in the Objective image is inefficient and should be avoided. This is because both the intensity of light, and diameter of the field of view, decreases in proportion to any increase in Eyepiece magnification. Similarly, the size of the practical level of magnification that one can use, is limited greatly by the thickness of specimen under view: a thinner sectioning of a specimen, allows for, a greater capacity of magnification.

Comment
It is advisable to begin microscopic examination with a low power magnifying Objective so as to provide a maximum diameter to the field of exploration. In this way it is easier to identify a particular area of the specimen for closer inspection. The Objective may be exchanged later, by rotating the Nosepiece to increment magnification levels, progressively, up to the resolution of the desired image. The magnification of the image may then be further incremented, by changing the Eyepiece in the Stem for one which grants a greater magnifying capacity. There are a wide variety of Eyepieces available which can be fitted to the microscope by simple insertion into the slot in the topmost part of the microscope Stem. Several Paralux Eyepieces are available as optional extras. These are manufactured with precision so as to be central about the Stage. The specimen, mounted on a glass slide, can be secured to either the Stage or the Superstage of the microscope depending upon the model.

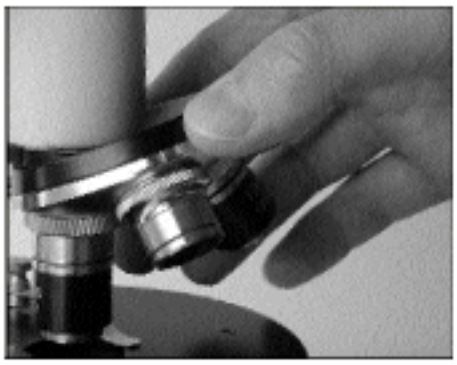


Fig. 9: Changing objectives on the nosepiece

- If you have a L-640 microscope (ref. 6012) or a L-201 microscope (ref. 6202), the slide is secured to the stage with two Spring clips.

- If you have a L-900 microscope (ref. 6014) or a L-1600 (ref. 6013), the slide is attached to an adjustable Superstage by two Spring clips, and can be positioned on a lateral plane "X" by a Knob (13, fig.1).

Select a low power Objective, a 10 x, (or a 4 x Objective for the L-201), by rotating the Nosepiece so that the correct lens forms part of the Optical system.

First ensure that the lighting correctly illuminates the background of the viewed image, evenly. Alter the Fast focal adjustment (1, fig.2) and Fine focal adjustment (2, Fig.2) so that the image of the specimen appears with the greatest clarity.

Increase the power of the Objective lens to the desired magnitude by rotating the Nosepiece, usually, in a clockwise direction (Fig.9). The Objective lenses are precision engineered and very fragile, so it is good practice to raise the Optical system slightly, before rotating the Nosepiece, and then afterwards, the Objective can be lowered into close proximity to the slide and specimen. This prevents their being any damage to the slide or Objective lens during the interchange of Objectives.

Further focal adjustments can be performed in a similar way as before, by looking at the specimen through the Eyepiece of the microscope and making Fast focal adjustments first, followed by Fine focal adjustments, to reveal the finest definition to the image.

Condenser (except L-640)
Microscopes equipped with Condensers ensure that specimens are illuminated evenly and with the correct intensity of light. The function of the Condenser is to concentrate as much light upon the specimen as is possible through provisions which allow for the Adjustment of condenser height, and consequently, the distance of the Condenser from the Stage, such that the brightness of image which appears through the Eyepiece can be maintained at a maximum.

First select a low power Objective, a 10 x, (or a 4 x Objective for the L-201), by rotating the Nosepiece so that the correct lens forms part of the Optical system and lower the Condenser (fig.7, page 8) to illuminate all of the image evenly, by gently turning the knob that Adjusts the condenser height (16, Fig.2). The Condenser can be readjusted when using more powerful Objectives, so as to increase the concentration of light available to the Optical system.

Iris diaphragm
The Iris diaphragm is used to adjust the quantity of light which falls upon a specimen. The more powerful the Objective, the greater the aperture or opening of the Iris diaphragm necessary to achieve fine definition. The correct use of the Iris diaphragm and the Condenser is very important to resolving an image of the specimen in the finest definition.

One should start, if possible, by setting the aperture of the Iris diaphragm to the same size as that of the Objective, so that when the lens is fully illuminated, the image of the Iris diaphragm is only barely visible through the lens behind the Objective.

Afterwards, one can gradually close the Iris diaphragm until the details of the specimen become more apparent. The size of the Iris diaphragm aperture obviously depends upon the power of the Objective selected, and should be readjusted after making any rotation of the Nosepiece. As changes to the Eyepiece do not affect the light entering the Objective, it is not necessary to adjust the aperture of the Iris diaphragm after changing the Eyepiece.

Practice in using the microscope will develop your skill in using the Iris diaphragm, as you are able to observe the correct settings which grant the best results in definition.

Here is a very simple setup:
Place the specimen under the Objective. Remove the Eyepiece from the Stem of the tube and look through the Eyepiece tube to observe the rear side of the Objective lens. Ensure that Iris diaphragm is clearly visible. Adjust the diameter of the Iris diaphragm that appears on the rear of the Objective lens: the best resolutions are obtained when the Iris diaphragm is open between 2 / 3 and 3 / 4 of the diameter of the Objective lens.

Oil immersion objectives
Having identified the area of the specimen one wishes to view in greater detail by using a powerful Dry objective, one can place a drop of Immersion liquid onto the specimen slide. The Immersion liquid will actually make contact with the front glass of the Oil immersion objective lens and so any focal adjustment will have to be made slowly, and with great care through utility of the Fine focal adjustment knob.

The 100 x Oil immersion objective provided with the PCB-1600 microscope is equipped with a spring mount.

Put a small drop of Immersion oil onto the glass slide of the specimen. Lower the Optical system with the Oil immersion objective set in place, until the front of the lens touches the uppermost part of the film of oil. Remember to make these fine adjustments only with the Fine focus adjustment. Any visible air bubbles can be removed by gently agitating or rotating the Nosepiece. Bubbles appear in the form of bright spots in the objective image as seen by looking through the Eyepiece tube.

Wipe the lens of the Objective immediately after every application by using a soft cotton cloth moistened with Xylene. Do not use Immersion oil that is over two years old.

Specimens

The beginner will be limited to observing specimens on manufactured slides which are available to suit a variety of different interests. One can easily buy a vast variety of specimens to suit an interest: animal, plant, and mineral.

One can also create slides of more complex specimens, but this requires additional resources of equipment (such as slide cases, preservatives and stains) which can prove costly in some specialist catalogues.

Sometimes specimens can prove evasive to view for various reasons: they might be opaque to light, or conversely, too transparent and devoid of contrast.

Fig. 10 Paralux box of specimens (optional).

Example applications

Stagnant waters

Remove water from a swimming pool, a sink or a pond with algae. Fill in a jar, and then expose it to light, and one may see within, a reserve of wildlife.

Use a concave slide, to create a micro aquarium. Place a sample from the jar complete with fragments of algae onto the slide with a pipette. Cover the slide with a Cover glass to prevent evaporation. Inspect the fragments of the micro aquarium on the Stage of the microscope.

To build the pipette, heat the end of a hollow glass tube to red heat and rotate it so that it does not bend. When it becomes flexible, pull the end slightly so as to create a thinner part to the tube. After cooling, break apart the part of the tube which is thinned.

Opaque specimens

Examination of opaque objects can only be done at low powers of magnification with a biological microscope. Such objects can not be illuminated by through transparency and must be illuminated from above, with a relatively powerful light source which concentrates light onto the Stage.

After a little practice, one will discover that the major difficulty which exists with observing opaque specimens is the matter of how to properly illuminate the subject under examination, because often, the light source becomes obstructed, as the distance is narrowed between the lens and the specimen.

Opaque objects cannot reflect enough light from their rough and irregular misshapen surfaces to the Objective. When the light illuminating the specimen is incidental, and too oblique to the Optical system of the microscope, too little light is reflected from the specimen to be captured by the Objective lens, and so, the brightness of the image which appears, becomes diminished.

The practice of experimenting with opaque samples and specimens under the microscope will ultimately reveal that the limits in the possibilities of the microscope depend upon the light source that is available.

Microscopic measurement

The micrographer will be interested to know the real dimensions of various specimens which they have the opportunity to observe. The most common measures made are those concerned with the measurement of the length of a specimen (lateral distance), and it is less often necessary to measure the thickness of an object (longitudinal distance). One should not be too dependant on the measurements found at your fingertips: they are capable of errors which are difficult to estimate, if only due to the fact that the images of small objects portrayed by optical microscopes is not linear.

Horizontal distances

To perform these measures, it is essential to have a Blade micrometer which comprises of a graduated scale. This scale must be clear to the eye of the observer, who sees, at the same time, the image of the specimen. The Blade micrometer (fig.11) presents an image of a blade of 76 x 26 mm upon which is marked a precision scale. Each graduation on the scale represents 10 µmm or 1mm in total.

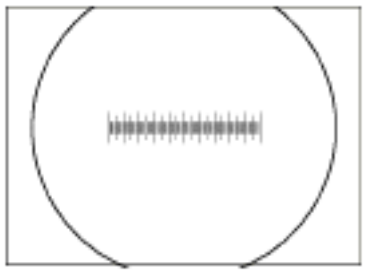


Fig.11 Blade Micrometer(optional)

To make a measure of length under a microscope, one places the blade over the points on the specimen to be reckoned. By reading the number of graduations corresponding to the length of the measure, and by multiplying that number by 10 microns, it is possible to deduce the length in microns of the object under view.

Accessories

Filters

Ref. 6530: filters

The following list of the most common filters provides a guide to their suitable application. Natural light (Day light) tends to be blue and differs in colour temperature to that of the tungsten filament lamp or Artificial lighting.

Blue filters increase the contrast in the yellow or orange of specimens.
Light green filters increase the contrast in the red and carmines of specimens.
Green filters have a similar effect but the contrast is more accentuated.
Yellow filters increase the contrast in the blue of specimens.

Microscope lighting

Ref. 6511: Micro-light 220 V - 15 W for PCBs

Ref. 6531: Micro-light 220 V - 15 W for L-201

Fig.12: Micro-lighting

Superstage

Ref. 6529: Superstage adjustment for L-640.

The Superstage is available as an option for the PCB-640 microscope and allows exploration of a specimen by orthogonal movement through precision movements through scales and vernier readings (see fig.3, page 5).
It comes supplied with the L-960s and L-960 models.

Polarisation system

Ref. 6546: polarization system for L-640.

This comprises of a system of two elements which can be installed on the models L-960s and L-960 which are equipped with clamps. The two components consists of a Superstage rotatary polarising filter, and an Analyser filter which installs on the Eyepiece.

The rays that make up Natural light beams fall in all directions. By restricting these rays in a uniform fashion to a single plane by means of a filter, one is able to select for, only that light which falls orientated to a particular desired pathway. This is known as polarised light.

In nature, the light reflected from any non-metallic surface is polarised when captured in a certain angle. The production of polarised light involves the application of polarising filters which only allow light to pass in one single plane.

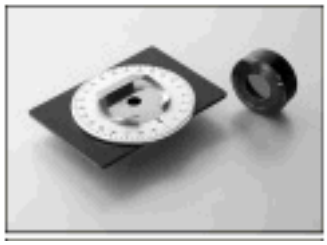


Fig.13: Polarisation system

Polarising microscopy depends upon the birefringence of an object, that is to say, when polarised light falls upon an object, it is reflected not in one plane, but two, one in the polar light plane, and one perpendicular to the polar plane.

Were one to cross the two filters, such that polar light is controlled to fall in one plane, and the observational filter only allows for light to pass in the plane perpendicular to the polar plane, one would naturally expect to observe no light: this is, however, not the case if an object placed between the light source and observer is birefringent. This means that one is able to differentiate between objects with similar optical characteristics according to their capacities to alter the direction of rays of light. Consequently, specimens which might appear to be invisible to view, in normal conditions, become apparent under polar light disparities.

Replacement parts

Ref. 6514: 15 W bulb for micro-lighting
Ref. 6516: Abbe condenser
Ref. 6522: Iris diaphragm
Ref. 6518: Mirror tilting Plane and Concave
Ref. 6517: Pair of stage clamps

Maintenance of the microscope

The microscope has been assembled with care, and its mechanical parts are lubricated and can serve a very long time without the need to be greased.

All of the optical parts must be kept very clean. When not used, the microscope should be protected from moisture, acid fumes, and especially not exposed to dust. Dust is made up of elements of all kinds. The most dangerous are microscopic grains of sand, which should be prevented from entering everywhere: rubbed on glass objects, they cause indelible scratches. An abused lens is unusable. A grain of sand, when inadvertently placed between the sprocket and its rack, or in a screw hole, is enough to deteriorate the body permanently. Also, it is prudent to keep the microscope in its packaging or covered under a plastic material.

The Objective lenses and Eyepieces should never be handled with your fingers. If, however, it becomes necessary to remove a fingerprint or another stain on the lens, this operation can be carried out with a very clean rag of fine cotton, or a lint-free cloth, soaked in a solvent such as Xylene or toluene.

PARALUX