



# MANUAL

## EXI-310

### INVERTED MICROSCOPE SERIES



**New York  
Microscope  
Company**  
Microscope Experts since 1979

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## **SAFETY NOTES**

1. Open the shipping carton carefully to prevent any accessory, i.e. objectives or eyepieces, from dropping and being damaged.
2. Do not discard the molded shipping carton; the container should be retained should the microscope ever require reshipment.
3. Keep the instrument out of direct sunlight, high temperature or humidity, and dusty environments. Ensure the microscope is located on a smooth, level and firm surface.
4. If any specimen solutions or other liquids splash onto the stage, objective or any other component, disconnect the power cord immediately and wipe up the spillage. Otherwise, the instrument may be damaged.
5. All electrical connectors (power cord) should be inserted into an electrical surge suppressor to prevent damage due to voltage fluctuations.
6. For safety when replacing the LED lamp or fuse, be sure the main switch is off ("O"), remove the power cord, and replace the LED bulb after the bulb and the lamp house has completely cooled.
7. Confirm that the input voltage indicated on your microscope corresponds to your line voltage. The use of a different input voltage other than indicated will cause severe damage to the microscope.

## **CARE AND MAINTENANCE**

1. Do not attempt to disassemble any component including eyepieces, objectives or focusing assembly.
2. Keep the instrument clean; remove dirt and debris regularly. Accumulated dirt on metal surfaces should be cleaned with a damp cloth. More persistent dirt should be removed using a mild soap solution. Do not use organic solvents for cleansing.
3. The outer surface of the optics should be inspected and cleaned periodically using an air stream from an air bulb. If dirt remains on the optical surface, use a soft cloth or cotton swab dampened with a lens cleaning solution (available at camera stores). All optical lenses should be swabbed using a circular motion. A small amount of absorbent cotton wound on the end of a tapered stick such as cotton swabs or Q-tips, makes a useful tool for cleaning recessed optical surfaces. Avoid using an excessive amount of solvents as this may cause problems with optical coatings or cemented optics or the flowing solvent may pick up grease making cleaning more difficult. Oil immersion objectives should be cleaned immediately after use by removing the oil with lens tissue or a clean, soft cloth.
4. Store the instrument in a cool, dry environment. Cover the microscope with the dust cover when not in use.
5. ACCU-SCOPE® microscopes are precision instruments which require periodic preventative maintenance to maintain proper performance and to compensate for normal wear. An annual schedule of preventative maintenance by qualified personnel is highly recommended. Your authorized ACCU-SCOPE® distributor can arrange for this service.

## INTRODUCTION

Congratulations on the purchase of your new ACCU-SCOPE® microscope. ACCU-SCOPE® microscopes are engineered and manufactured to the highest quality standards. Your microscope will last a lifetime if used and maintained properly. ACCU-SCOPE® microscopes are carefully assembled, inspected and tested by our staff of trained technicians in our New York facility. Careful quality control procedures ensure each microscope is of the highest quality prior to shipment.

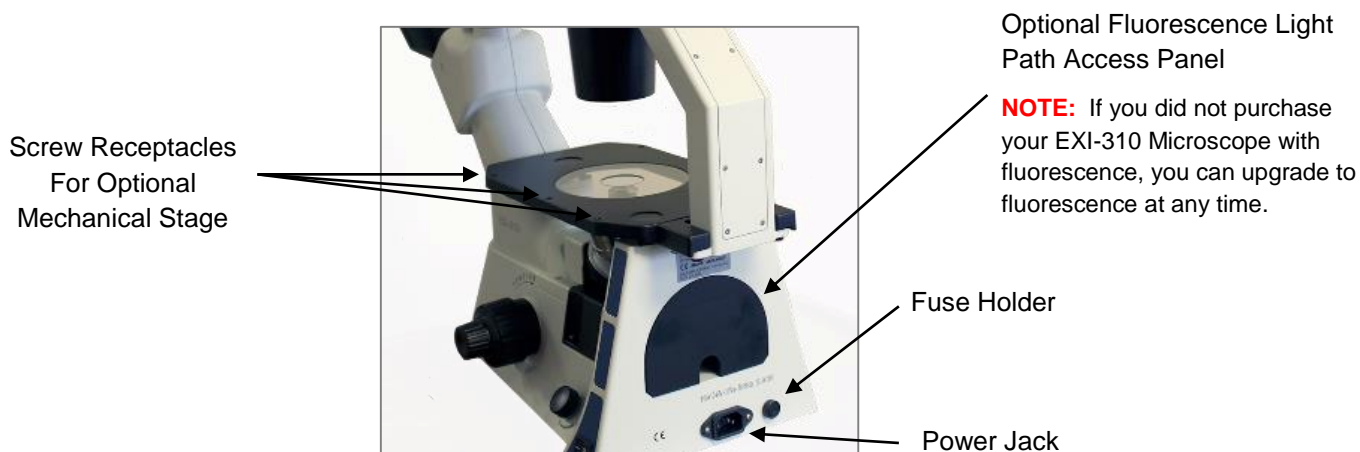
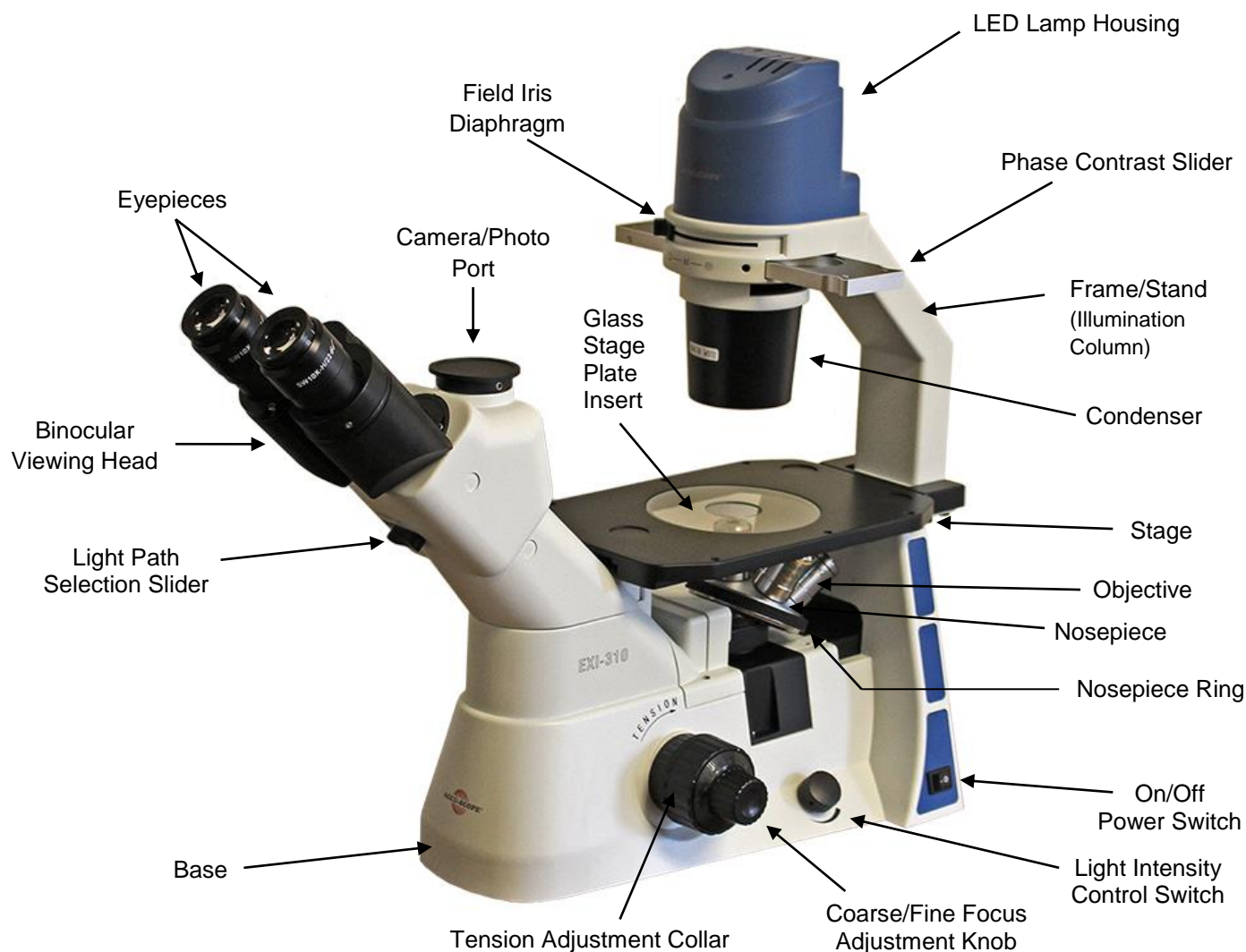
## UNPACKING AND COMPONENTS

Your microscope arrived packed in a molded shipping carton. **Do not discard the carton:** the carton should be retained for reshipment of your microscope if needed. Avoid placing the microscope in dusty surroundings or in high temperature or humid areas as mold and mildew will form. Carefully remove the microscope from the EPE foam container by its arm and base and place the microscope on a flat, vibration-free surface. Check the components against the following standard configuration list:

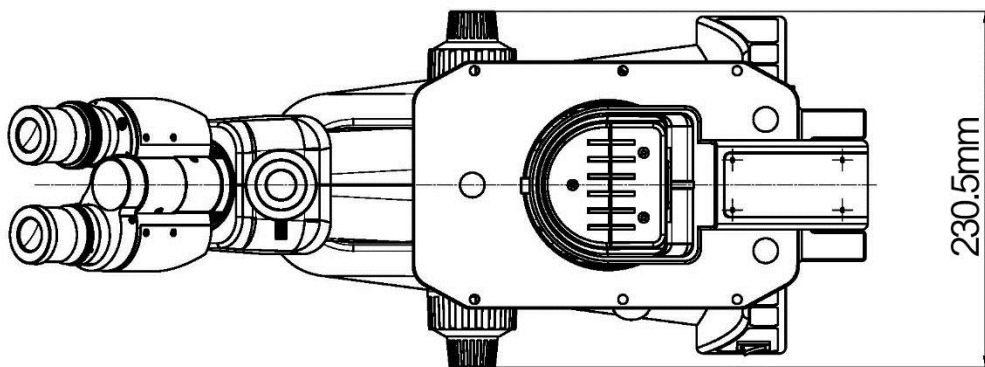
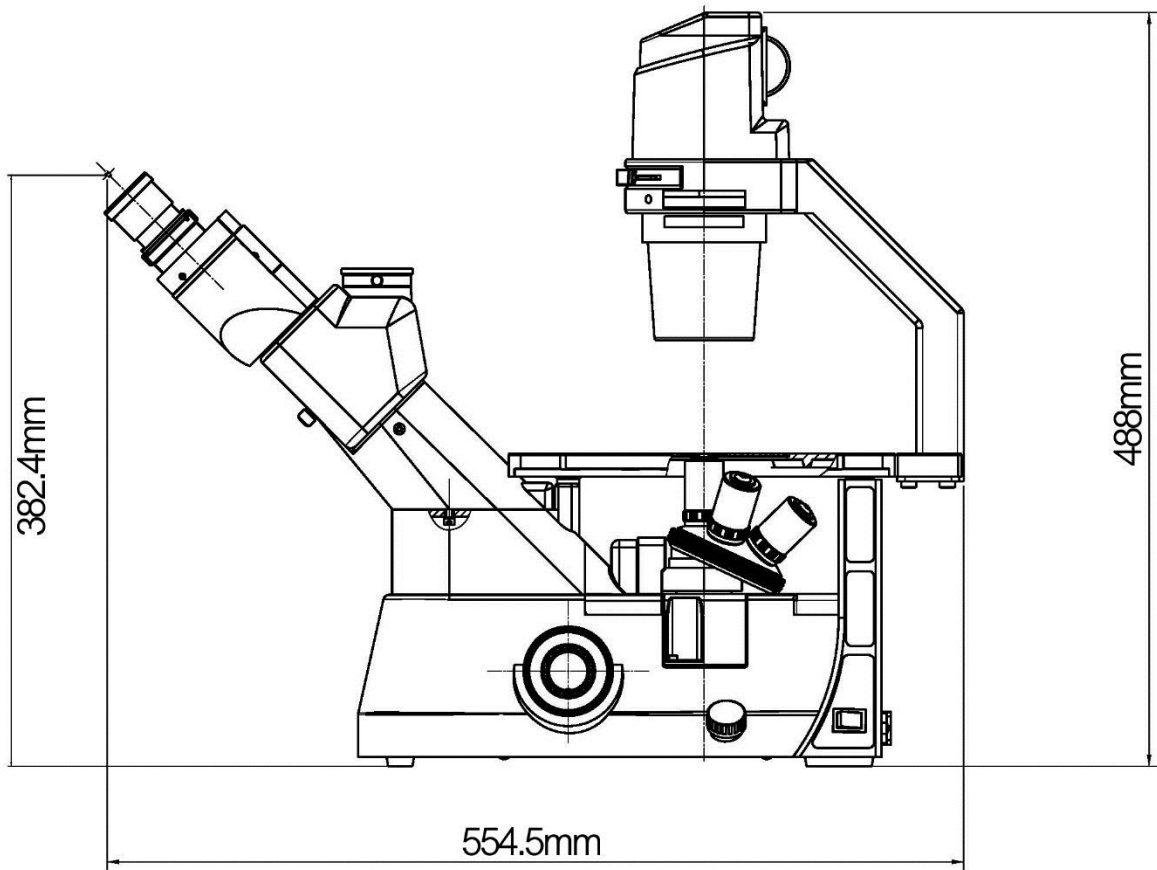
1. Stand, which includes the supporting arm, focusing mechanism, nosepiece, mechanical stage (optional), condenser with iris diaphragm, illumination system, and phase contrast accessories (optional).
2. Binocular viewing head
3. Eyepieces as ordered
4. Objectives as ordered
5. Stage plate inserts, green and yellow filters (optional)
6. Dust cover
7. 3-prong electric power cord
8. Camera adapters (optional)

Optional accessories such as optional objectives and/or eyepieces, slides sets, etc., are not shipped as part of the standard equipment. These items, if ordered, are shipped separately.

## COMPONENTS DIAGRAM



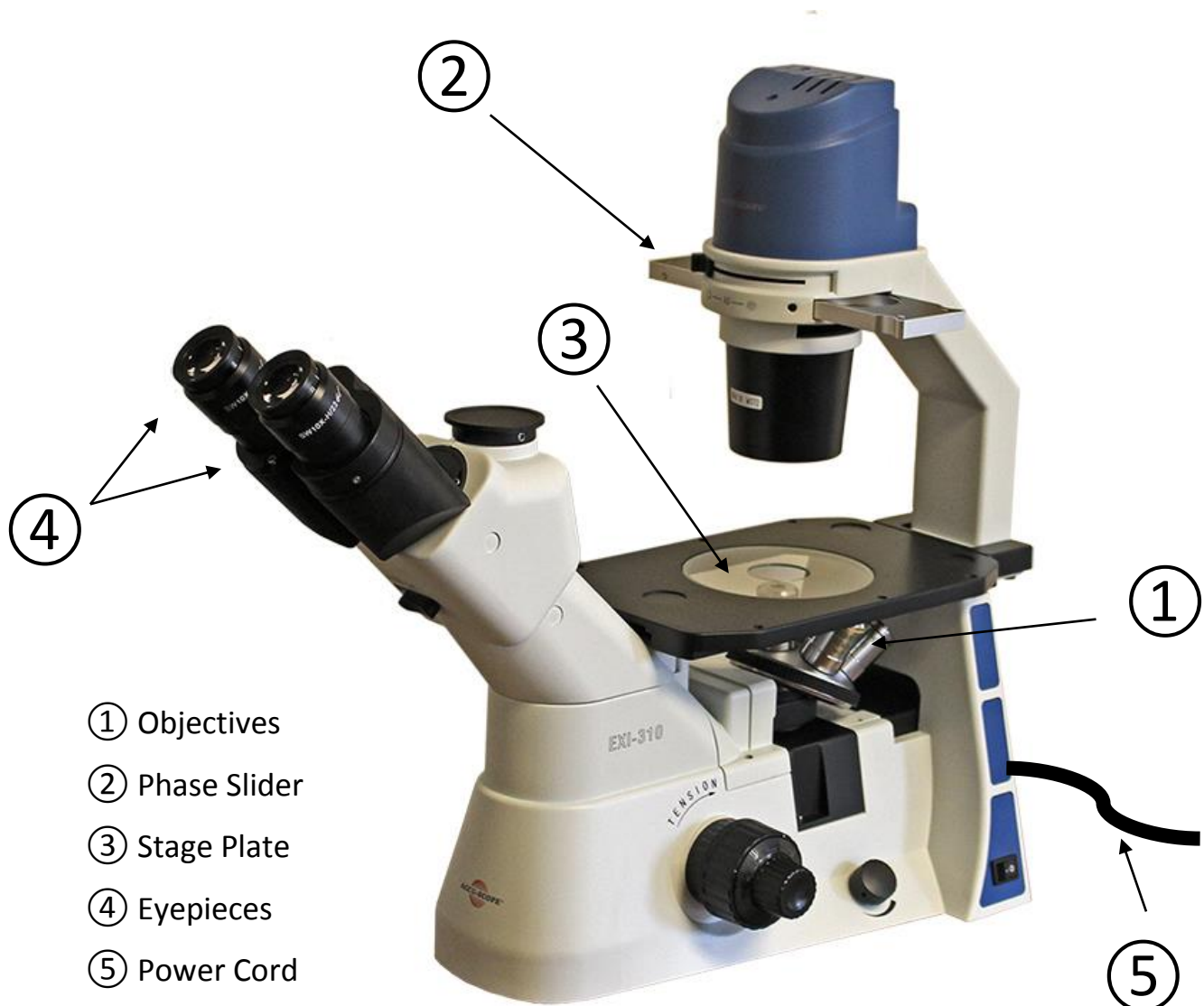
## MICROSCOPE DIMENSIONS



## ASSEMBLY DIAGRAM

The diagram below shows how to assemble the various components. The numbers indicate the order of assembly. Use the 1.5mm and 2mm hex wrenches that are supplied with your microscope when required. Be sure to keep these wrenches for changing out components or making adjustments.

When assembling the microscope, make sure that all parts are free of dust and dirt, and avoid scratching any parts or touching glass surfaces.





## ASSEMBLY

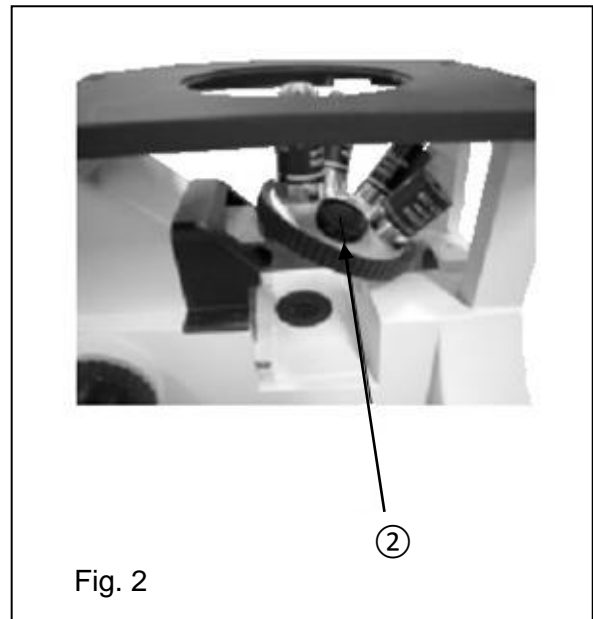
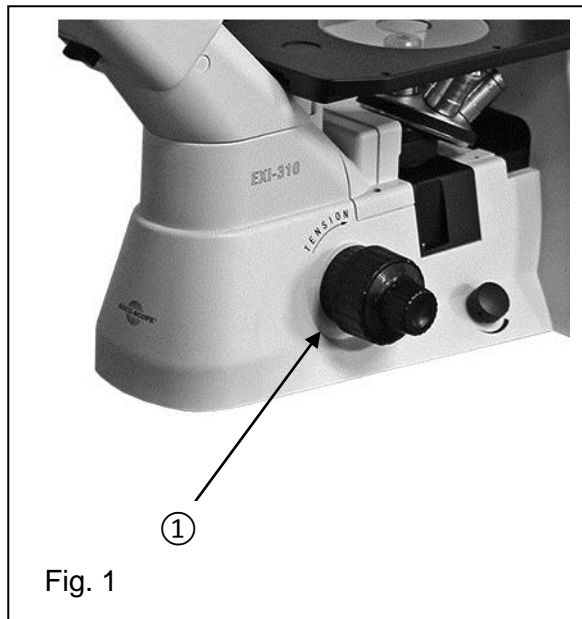
### Objectives (Fig. 1 & 2)

To install the objectives:

1. Turn the coarse adjustment knob ① (Fig. 1) until the revolving nosepiece is at its lowest position.
2. Remove the nosepiece cap ② closest to you and thread the lowest magnification objective onto the nosepiece opening, then rotate the nosepiece clockwise and thread the other objectives from low to high magnification. (Fig. 2)

NOTE:

- Always rotate the nosepiece by using the knurled nosepiece ring.
- Keep the covers on any unused nosepiece openings to prevent dust and dirt from getting inside.



## Stage Plate (Fig. 3)

Insert the clear glass stage plate ① into the opening on the stage. The clear glass allows you to view the objective in position.

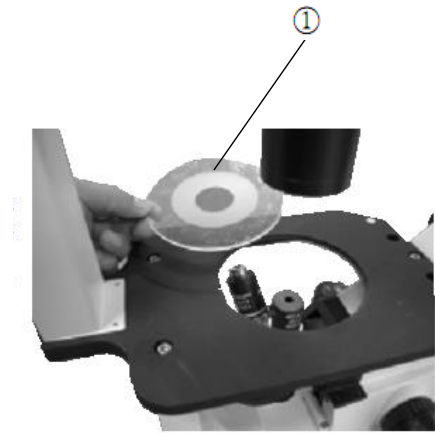


Fig. 3

## Eyepieces (Fig. 4)

Remove the eyetube plugs ① and insert the eyepieces ② into the eyepiece tubes ③. Lock in the eyepieces using the supplied 1.5mm hex wrench to tighten the screw on each eyetube.

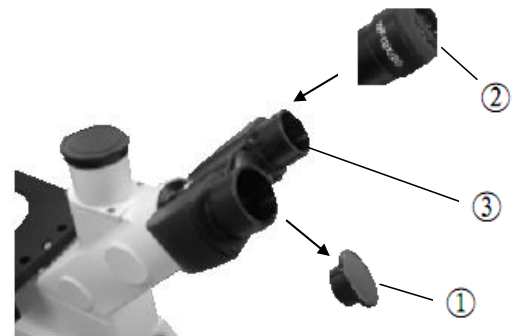


Fig. 4

## Power Cord

### VOLTAGE CHECK

Confirm that the input voltage indicated on the rear label of the microscope corresponds to your line voltage. The use of a different input voltage than indicated will cause severe damage to your microscope.

### Connecting the Power Cord

Make sure the On/Off Switch is "O" (the off position) before connecting the power cord.

Insert the power plug into the power jack of the microscope; make sure the connection is snug.

Plug the power cord into a power supply receptacle.

**NOTE:** Always use the power cord that came with your microscope. If your power cord becomes damaged or lost, please call your authorized ACCU-SCOPE dealer for a replacement.

## OPERATION

Plug the 3-prong line cord into the microscope and then into a grounded 120V or 220V A.C. electrical outlet. Usage of a surge suppressor outlet is highly recommended. Turn the illuminator switch ① to “—” (Fig. 6) For longer bulb life always turn the illuminator variable intensity knob ② to the lowest illumination intensity setting possible before turning the power on or off.

### Adjusting the Illumination (Fig. 5)

The light level may need adjustment depending upon the specimen density and objective magnification. Adjust the light intensity for comfortable viewing by turning the light intensity control knob clockwise to increase brightness. Turn counterclockwise to decrease brightness.

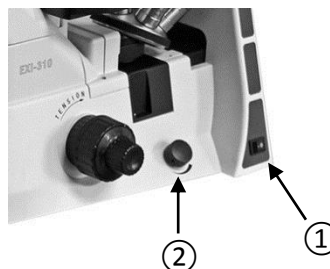


Fig. 5

### Adjusting Interpupillary Distance (Fig. 6 & 7)

To adjust the interpupillary distance, hold the left and right eyetubes while observing a specimen. Rotate the eyetubes around the central axis until the fields of view of both eyetubes coincide completely. A complete circle should be seen in the viewing field when viewing the specimen slide. An improper adjustment will cause operator fatigue and will disrupt the objective parfocality.

Where the “•” ① on the eyepiece tube lines up, that is the number for your interpupillary distance. The range is 54-75mm. Be sure to write down your interpupillary number for future operation.



Fig. 6

### Adjusting the Focus (Fig. 7)

To ensure that you obtain sharp images with both eyes, (since eyes vary, especially for those wearing glasses) any eyesight variation can be corrected in the following manner. Set both diopter collars ② to “0”. Using your left eye only and the 10X objective, focus your specimen by adjusting the coarse adjustment knob. When the image is in view, refine the image to its sharpest focus by turning the fine adjustment knob. Rotate the diopter collar to obtain the sharpest focus. To obtain the same sharp image using your right eye, do not touch the coarse or fine adjustments. Instead, rotate the right diopter collar until the sharpest image appears. Repeat several times to check.



Fig. 7

**IMPORTANT:** do not counter rotate the focusing knobs as this will cause severe problems and damage to the focusing system.

## Operation *(continued)*

### Adjusting the Focusing Tension (Fig. 8)

If the feel is very heavy when focusing with the focusing knobs ②③, or the specimen leaves the focus plane after focusing, or the stage lowers by itself, adjust the tension with the tension adjustment ring ①.

Turn the tension adjustment ring clockwise to loosen or counterclockwise to tighten according to user preference. (Fig. 8).



Fig. 8

### Using the Stage Plates *(Optional)* (Fig. 9 & 10)

**NOTE:** for optimal viewing, ensure the thickness marked on each objective (0.17mm or 1.2mm) is the same as the container, dish or slide.

With the mechanical stage ②, a user can use any of the optional stage plates for flasks, well plates, culture dishes or slides. The appropriate stage is inserted into the slide holder and can be moved by turning the X ③ and Y ④ stage movement controls.

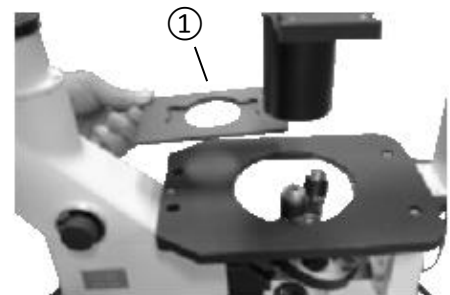


Fig. 9

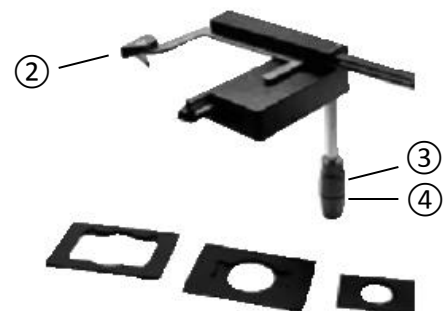


Fig. 10

## Operation *(continued)*

### Selecting the Light Path (Fig. 11)

The EXI-310 is outfitted with a binocular viewing head with one photo port for HDMI/digital imaging. You must select the appropriate light path for observing specimens.

The light path is set to 100% to the binocular eyepieces as the default setting at our facilities where the light path selection slider is set to the “OUT” position (pushed all the way to the right).

Slide the light path selection slider to the left to the “IN” position. This will send 20% of the light to the binocular viewing head and 80% to the top photo port for HDMI/digital imaging and documentation.

For fluorescence units, the light path is configured for either 100% to the binocular viewing head (“OUT” position), or 100% to the top photo port (“IN” position).



Fig. 11

Light Path Selection Knob	Light Intensity Ratio	Application
“OUT” Position	100% for binocular observation through the eyepieces	Dark specimen observation
“IN” Position	20% for binocular eyepieces 80% for top photo port	Observation for digital imaging and documentation

## Operation *(continued)*

### Using the Aperture Diaphragm (Fig. 12)

The iris diaphragm determines the numerical aperture (N.A.) of the illumination system in bright field observation. When the N.A. of the objective and the illumination system match, you can obtain higher image resolution and contrast, as well as an increased depth of focus.

To check the iris diaphragm: remove the eyepiece and insert the centering telescope (if you purchased one). When observing through the eyepiece, you will see the field of view as shown in Fig. 13. Adjust the iris diaphragm lever to the desired contrast.

When observing a dyed specimen, set the iris diaphragm ② to 70-80% of the N.A. of the objective ① in use. However, when observing a culture specimen, which is not dyed, set the iris diaphragm lever to 75% of the N.A. of the objective in use.

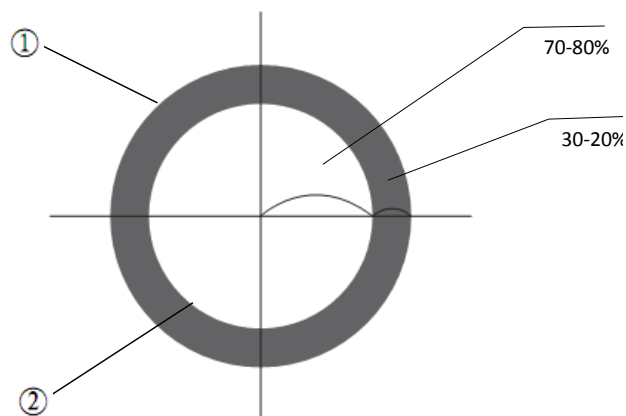


Fig.24  
Fig. 12

### Phase Contrast Observation

Depending on the configuration ordered, the EXI-310 can be used for phase contrast observation with LWD phase contrast objectives: 4x, 10x, 20x and 40x.

For phase contrast observation, replace the normal objectives with phase contrast objectives on the nosepiece – refer to page 8 for objective installation instructions.



Fig. 13

### Phase Contrast Slider (Fig. 13)

The adjustable phase slider is centered at our facilities so no further adjustment should be necessary. If the phase ring is not centered, you can adjust it by centering the bolt with the 2mm hex wrench provided with the microscope – see instructions on page 14.

The EXI-310-PH includes a 3-position phase slider. Position 1 is for the 4x/10x objectives; Position 2 is for the 20x/40x objectives. Position 3 is “open” for use with optional filters.

Match the 4x/10x or 20x/40x light annulus with phase contrast objectives.

## Operation *(continued)*

### Installing the Phase Slider (Fig. 14) *(Optional)*

1. Hold the phase slider ① face up (printed side up) by the finger slots on the right side of the slider and insert it into the slot on the illumination column.
2. Each light ring or opening has its own position so you need to move the slider until you hear a “click” to ensure the ring or opening is positioned in the center of the light path.
3. When using phase contrast for observation, fully open the iris diaphragm adjustment lever ② to the “O” position.

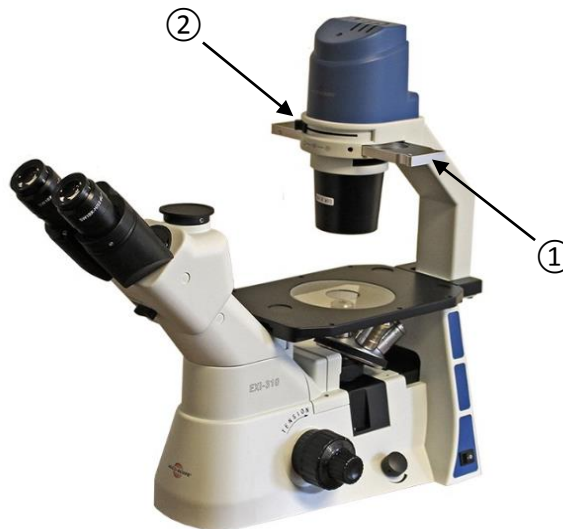


Fig. 14

### Centering the Light Annulus (Fig. 15 & 16)

The phase slider is pre-aligned at our facilities. If realignment is necessary, follow these steps:

1. Place a specimen on the stage and bring it into focus.
2. Replace the eyepiece in the eyepiece tube with the centering telescope (optional).
3. Make sure the magnification of the objective in the light path matches that of the light annulus on the phase slider.
4. While observing through the centering telescope, adjust its position to focus on the phase annulus ② of the objective corresponding to the light annulus. ①
5. Insert the 2mm hex wrench into the two centering screw holes on the phase slider ③. Tighten and loosen the centering screws until the light annulus is superimposed on the phase annulus of the objective.
6. Repeat the steps above to adjust centering with other objectives and corresponding light annulus.

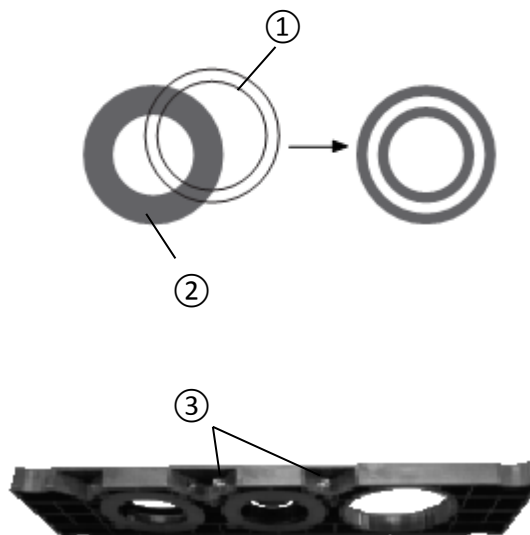


Fig. 15 & 16

## **Operation** *(continued)*

### **Centering the Light Annulus** *(Continued)*

#### **NOTES:**

- Halo-like ghost images of the light annulus may sometimes appear. If this occurs, superimpose the brightest light annulus image over the phase annulus.
- When a thick specimen is moved or replaced, the light annulus and the phase annulus may deviate. This is usually due to the amount of media or wellplate inconsistencies. This can reduce image contrast. If this occurs, repeat steps 1-5 for readjustment.
- The centering procedure may have to be repeated in order to get the best possible contrast if a specimen slide or the bottom surface of a culture vessel is not flat. Center the light annulus using objectives in the order of lower to higher magnifications.

### **Using a Microscopy Camera**

*(Optional)*

#### **Installing Couplers**

1. Remove the dust cap on the top photo port.
2. Attach the camera to a c-mount adapter.
3. Thread the c-mount adapter with camera in the top photo port.

#### **Selecting the Light Path for Observation With a Camera**

Refer to page 12.



## Using Fluorescence

If you purchased your EXI-310 with fluorescence, your complete fluorescence system is pre-installed, aligned and tested by our trained technicians to your specifications prior to shipment.

The complete fluorescence illumination light path includes:

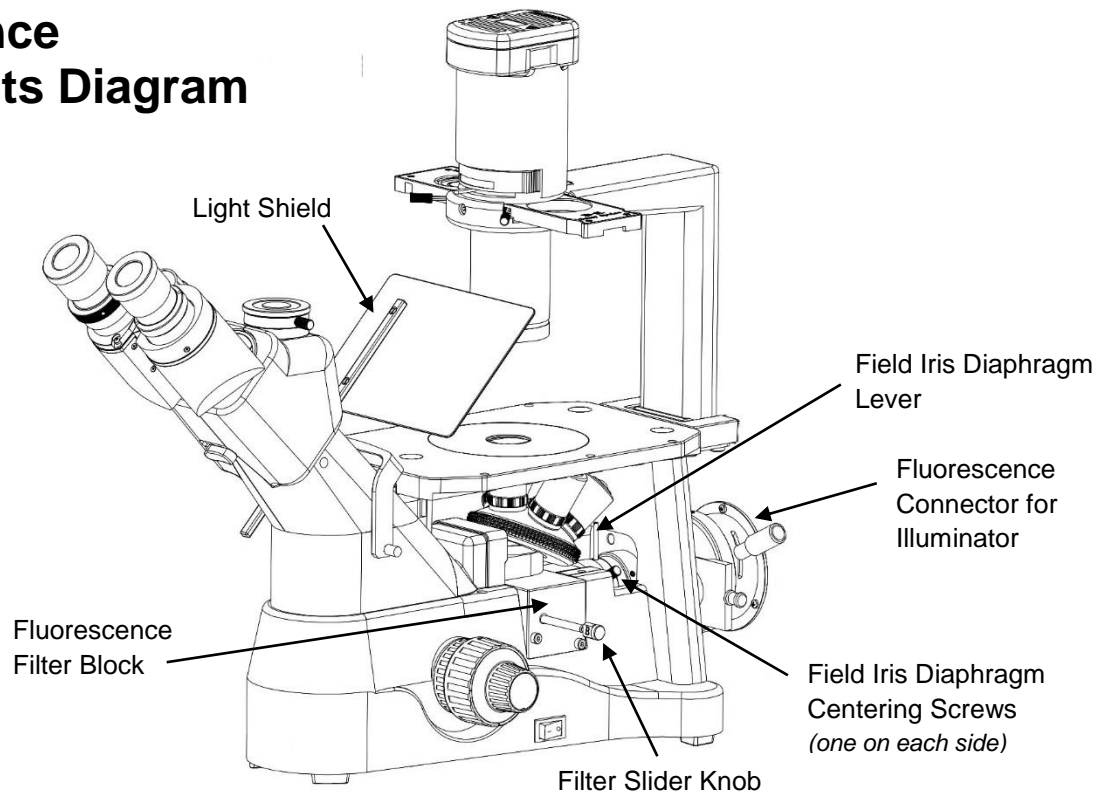
- Field iris diaphragm
- Dovetail filter slider
- 4 position filter holder: 3 for filter sets and 1 open position for brightfield or phase contrast observation
- Dust caps for slider and push rod for filter position and selection

Each position of the slider clicks securely into position due to click stop ball-bearing positioning.

Alternate light sources are available for metal halide systems, LED spectral illumination, or mercury lamp housing and power supply.

Various filter sets are also available for installation. Contact your authorized ACCU-SCOPE dealer, or call us at 631-864-1000 for a list of available filter sets and illumination options.

## Fluorescence Components Diagram



## Using Fluorescence *(continued)*

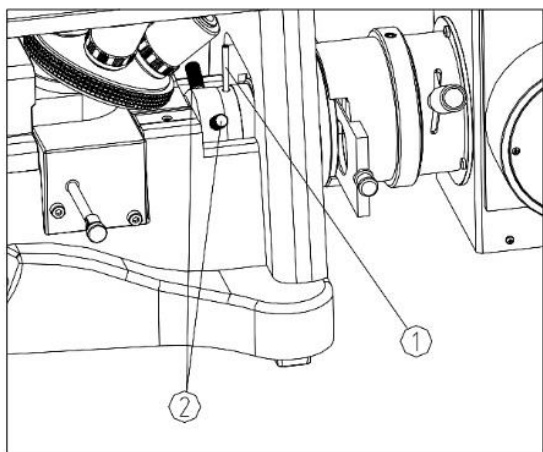


Fig. 17

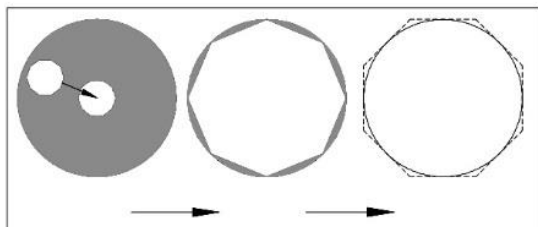


Fig. 18

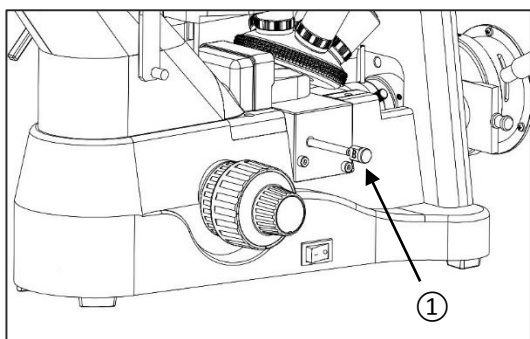


Fig. 19

### Using the Field Iris Diaphragm (Fig. 17 & 18)

By limiting the diameter of the light entering the condenser, the field iris diaphragm can prevent other light and strengthen the image contrast. When the image is just on the edge of the field of view, the objective can show the best performance and obtain the clearest image.

Push the field iris diaphragm lever ① clockwise to open the field iris diaphragm, counter-clockwise to close it.

Observe your specimen through the eyepieces and open the field iris diaphragm gradually to find the image in the field of view. If your image is not centered in the field of view, adjust the two screws ② at both sides of the field iris diaphragm to center the image. Then, open the field iris diaphragm just past your field of view for optimal observation.

### Using the Filters (Fig. 19)

The fluorescence filter block allows for 3 fluorescence positions and one for brightfield or phase contrast observation.

To position a filter in the light path, pull the filter slider knob ① to select the desired filter.

**NOTE:** a UV light shield is included in the EXI-310-FL version to reduce extraneous light from the fluorescence sample.

## TROUBLESHOOTING

Under certain conditions, performance of this unit may be adversely affected by factors other than defects. If a problem occurs, please review the following list and take remedial action as needed. If you cannot solve the problem after checking the entire list, please contact your local dealer for assistance.

### OPTICAL

PROBLEM	CAUSE	SOLUTION
The illumination is on, but the field of view is dark.	The socket pin is not connected to the illumination column  The bulb is burnt out. The brightness is set too low Two many filters are stacked	Connect it securely  Replace it with a new one Set it to the appropriate position Reduce them to the minimum required number
The edge of the field of view is obscured or not evenly illuminated.	The nosepiece is not in the located position  the color filter is not inserted fully The phase contrast slider is not located in the proper position	Turn the nosepiece into the position where you can hear it engaged Push it in all the way Move the slider until it clicks into place
Dirt or dust is visible in the field of view	Dirt/dust on the specimen Dirt/dust on the eyepiece	Replace with a clean specimen Clean the eyepieces
The image glares	The iris diaphragm is closed too much	Open up the iris diaphragm
Visibility is poor <ul style="list-style-type: none"> <li>● Image is not sharp</li> <li>● Contrast is poor</li> <li>● Details are indistinct</li> <li>● Phase contrast effect cannot be obtained</li> </ul>	The objective is not correctly engaged in the light path the aperture diaphragm is opened or stopped down too far in brightfield observation The lens (condenser, objective, ocular or culture dish) become dirty In the phase contrast observation, the bottom thickness of the culture dish is more than 1.2mm. Use a brightfield objective The light annulus of the condenser does not match the phase annulus of the objective. The light annulus and the phase annulus are not centered The objective used is not compatible with phase contrast observation When looking at the edge of the culture dish, the phase contrast ring and the light ring is deviated from each other	Turn the nosepiece into the engaged position  adjust the aperture diaphragm properly  Clean it thoroughly  Use a the culture dish whose bottom thickness is less than 1.2mm  Change to the phase contrast objective Adjust the light annulus so that it matches the phase annulus of the objectives Adjust the centering screws to center it  Please use the compatible objective  Moving the culture dish until you obtain the phase contrast effect. You also could demount the slider, and set the field diaphragm lever to "⑤"
One side of the image is blurred	The objective is not in the center of the light path The specimen is not correctly mounted on the stage. The optical performance of the culture vessel bottom plate is poor (profile irregularity, etc.)	Insure the nosepiece is in the "clicked" position Place the specimen on the stage correctly.  Use a vessel with a good profile irregularity characteristic.

## TROUBLESHOOTING *(continued)*

### MECHANICAL PART

PROBLEM	CAUSE	SOLUTION
The coarse adjustment knob is too difficult to rotate	The tension adjustment ring is tightened too much	Loosen it appropriately
The image goes out of focus during observation	The tension adjustment collar is too loose	Tighten it appropriately

### ELECTRICAL SYSTEM

PROBLEM	CAUSE	SOLUTION
The lamp can't light	No power to the lamp	<p>Check the power cord is connected correctly</p> <p><b>NOTE: Lamp Replacement</b> The LED illuminator will provide approximately 20,000 hours of illumination under normal use. If you should need to replace the LED bulb, please contact an authorized ACCU-SCOPE service center or call ACCU-SCOPE at 1-888-289-2228 for an authorized service center near you.</p>
The light intensity is not enough	<p>Not use an designated lamp</p> <p>The brightness adjustment knob is used wrong</p>	<p>use an designated lamp</p> <p>Adjust the brightness adjustment knob in a correct way</p>

### MISCELLANEOUS

The field of view of one eye does not match that of the other	<p>The interpupillary distance is not correct</p> <p>The diopter is not right</p> <p>Your view is not accustomed to the microscope observation and widefield eyepieces</p>	<p>Adjust the interpupillary distance</p> <p>Adjust the diopter</p> <p>Upon looking into eyepieces, try looking at the overall field before concentrating on the specimen range. You may also find it helpful to look up and into distance for a moment before looking into the microscope again.</p>
The indoor window or the fluorescence lamp is photographed.	The stray light entered through the eyepieces or viewfinder is reflected	Cap both the eyepieces and photomicroscope system's viewfinder

## MAINTENANCE

Please remember to **never** leave the microscope with any of the objectives or eyepieces removed and always protect the microscope with the dust cover when not in use.

## SERVICE

ACCU-SCOPE® microscopes are precision instruments which require periodic servicing to keep them performing properly and to compensate for normal wear. A regular schedule of preventative maintenance by qualified personnel is highly recommended. Your authorized ACCU-SCOPE® distributor can arrange for this service. Should unexpected problems be experienced with your instrument, proceed as follows:

1. Contact the ACCU-SCOPE® distributor from whom you purchased the microscope. Some problems can be resolved simply over the telephone.
2. If it is determined that the microscope should be returned to your ACCU-SCOPE® distributor or to ACCU-SCOPE® for warranty repair, pack the instrument in its original Styrofoam shipping carton. If you no longer have this carton, pack the microscope in a crush-resistant carton with a minimum of three inches of a shock absorbing material surrounding it to prevent in-transit damage. The microscope should be wrapped in a plastic bag to prevent Styrofoam dust from damaging the microscope. Always ship the microscope in an upright position; **NEVER SHIP A MICROSCOPE ON ITS SIDE**. The microscope or component should be shipped prepaid and insured.

### LIMITED MICROSCOPE WARRANTY

This microscope and its electronic components are warranted to be free from defects in material and workmanship for a period of five years from the date of invoice to the original (end user) purchaser. LED lamps are warranted for a period of two years from the date of original invoice to the original (end user) purchaser. The mercury power supply is warranted for a period of one year from the date of invoice to the original (end user) purchaser. This warranty does not cover damage caused in-transit, misuse, neglect, abuse or damage resulting from improper servicing or modification by other than ACCU-SCOPE approved service personnel. This warranty does not cover any routine maintenance work or any other work, which is reasonably expected to be performed by the purchaser. Normal wear is excluded from this warranty. No responsibility is assumed for unsatisfactory operating performance due to environmental conditions such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage or other conditions beyond the control of ACCU-SCOPE INC. This warranty expressly excludes any liability by ACCU-SCOPE INC. for consequential loss or damage on any grounds, such as (but not limited to) the non-availability to the End User of the product(s) under warranty or the need to repair work processes. Should any defect in material, workmanship or electronic component occur under this warranty contact your ACCU-SCOPE distributor or ACCU-SCOPE at (631) 864-1000. This warranty is limited to the continental United States of America. All items returned for warranty repair must be sent freight prepaid and insured to ACCU-SCOPE INC., 73 Mall Drive, Commack, NY 11725 – USA. All warranty repairs will be returned freight prepaid to any destination within the continental United States of America, for all foreign warranty repairs return freight charges are the responsibility of the individual/company who returned the merchandise for repair.

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