

*SM-4 Series*

***AmScope***

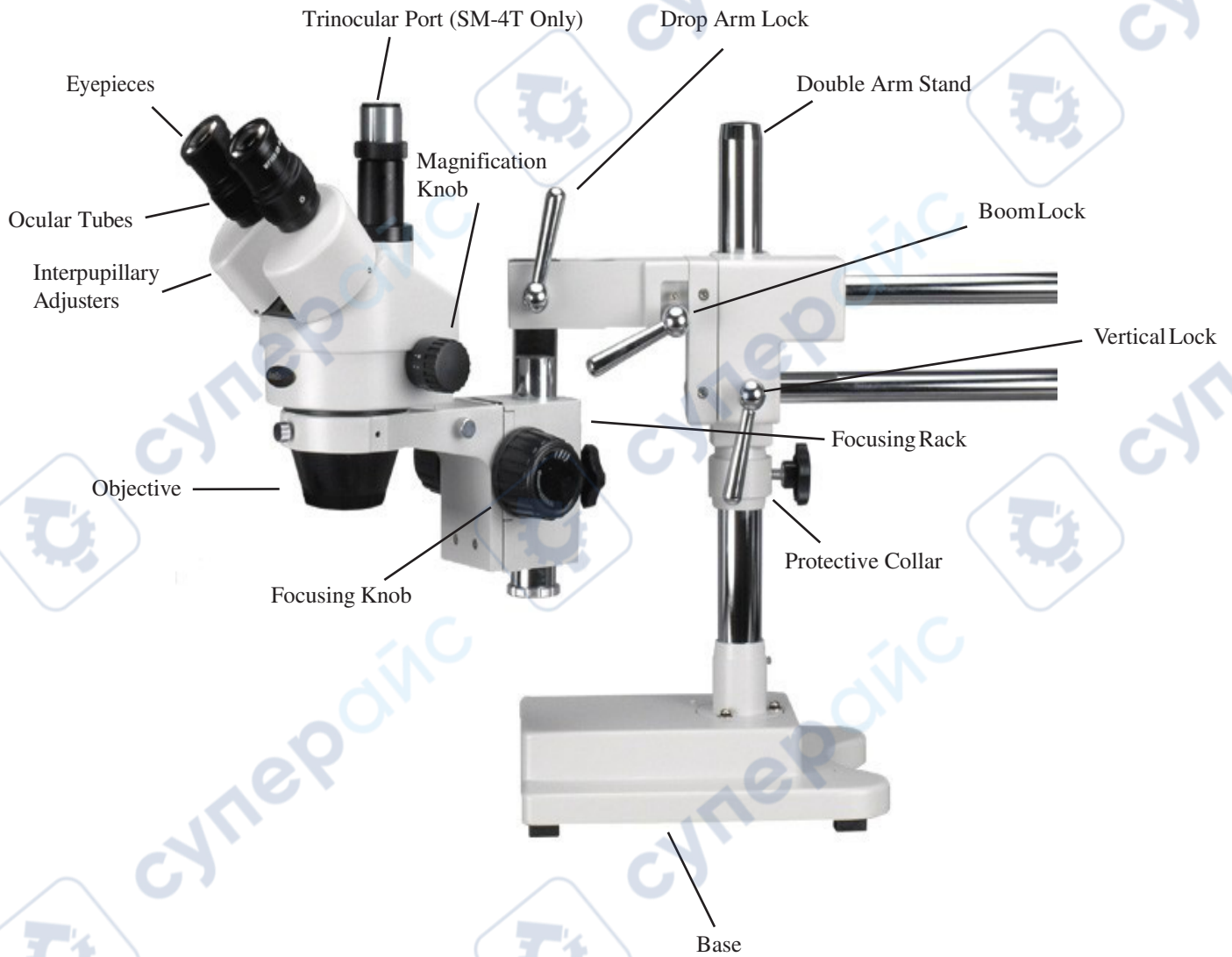
*User's Manual*

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## Safety Precautions

1. As the microscope is a precision instrument, always handle it with care, avoiding impact or abrupt movement during transportation. Do not shake the package.
2. Do not place the microscope in direct sunlight or in high heat. Keep it indoors in a dry and clean place with temperatures between 32-100 degrees F (0-40 degrees C), and in maximum relative humidity of 85%.
3. Avoid touching the lenses on the objectives and the eyepieces so that oil and dirt from your fingerprints do not obstruct your view.
4. Before turning the power on, make sure that the power supply voltage is consistent with the voltage of your microscope (for units with built in illumination).

SM-4B/T



## Definition of Parts

### **Adjustable Trinocular Port**

*Threaded port with adjustable length of attachment of digital or video camera*

### **Boom Stand**

*Stand for the microscope that allows the head to be moved in physical space in various directions*

### **Continuous Zoom**

*A microscope head with a knob to change magnification through a range*

### **Dimmer**

*Controls the amount of light that escapes from the illumination source*

### **Diopter**

*Allows the focus to be perfected for both eyes, independent of each other*

### **Fixed Power**

*Microscope head whose objectives are pre-set at certain levels and changed by rotating the objective*

### **Focusing Knob**

*Used to move the microscope head vertically to bring the sample into focus*

### **Gooseneck Illuminator**

*Illuminator independent of the unit that allows movement of one or two necks for controlled lighting*

### **Head Lock Screw**

*Screws the microscope head into place*

**Magnification Knob**

*Changes the magnification of the lenses on a continuous zoom microscope*

**Microscope Head**

*Contains the objective lens, eyepiece ocular tubes, and prisms used to magnify*

**Ocular Tube**

*Tube designed to hold the eyepieces or camera in place*

**Ring Light**

*An illuminator that mounts directly onto the objective to emit even light on the sample below*

**Simul-Focal Microscope Head**

*Head containing a focus adjustment for a trinocular port camera to simultaneously to match the eyepieces*

**Table Stand**

*A stand which sits on the table and holds the head directly above the sample without moving*

## Assembly

1. First, take the styrofoam container out of the cardboard carton and lay it on its side, paying attention to which side is labeled up. Remove the tape and open the container carefully so as to avoid dropping and damaging the optical items. Check carefully to ensure that all parts and accessories are intact.
2. Check the packing list to ensure that you're received all items. Please note that this can vary depending on which model you've purchased, and is generally listed on [www.amscope.com](http://www.amscope.com) at the items' details page for your specific model.
3. Remove the microscope from the box and remove the plastic protective covering. The body of the microscope is composed of the base and arm that comes with your unit, the focusing rack, and the head lock screw. Attach the vertical pillar to the base, the double arm boom stand to the vertical pillar (securing it with the protective collar and the locklever).
4. Installation of the Boom Stand.



Fig. 1

4.1 Insert the vertical pillar into the base stand and screw the pole securely.

4.2 Loosen the knob on protective collar and adjust the collar to the proper height. Tighten the knob.



Fig. 2a



Fig. 2b

4.3 Loosen the knob ① and place the horizontal arm's limit-stop housing onto the vertical pillar. Turn the horizontal arm 180° like Fig.2b .

Tighten knob ①.



Fig. 3a



Fig. 3b

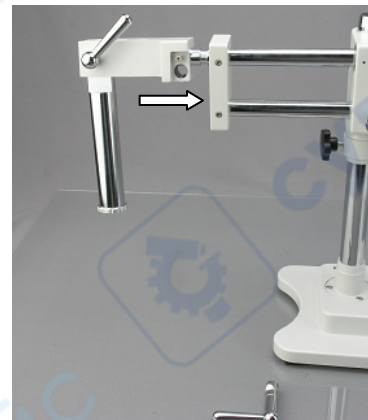


Fig. 3c



Fig. 3d

4.4 Take the focusing rack pole from the box (Fig. 3a).

Remove the lock knob ① (Fig.3b).

4.5 Put the focusing rack pole into the horizontal rack as indicated in Fig.3c.

4.6 Use the included hex spanner to tighten the screw as Fig.3d.



Fig. 4a



Fig. 4b

4.7 Install the lock knob removed in Fig.3b as indicated in Fig.4a and Fig. 4b.

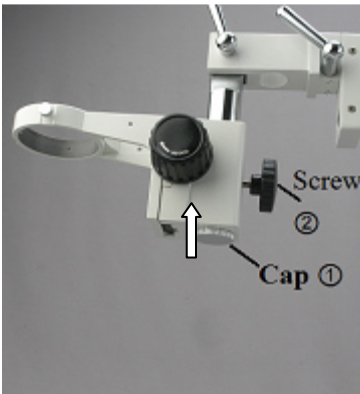


Fig. 5



Fig. 6

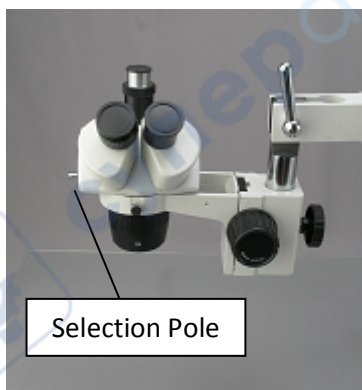


Fig. 7

4.7 Remove the cap ① and loosen the screw ② on focusing rack. Insert the focusing rack as Fig. 5 and hold it with hand.

4.8 Screw the focusing rack pole cap ①. Tighten screw ②.

4.9 Put the head into focusing rack. Tighten the lock screw ①. Remove the eyetube caps and drop the desired eyepieces into the eyepiece ocular tubes. Be sure to avoid touching the lens to ensure no artifacts appear in your image.

4.10 Remove the cap from the objective lens.

4.11 For the SM-4T models, screw the photo port onto the top of the microscope head (trinocular C-mount port).

You can alternate the binocular observation and video capture by pushing or pulling the selection pole.

- Push the pole in completely:
  - Binocular observation
- Pull the pole out completely:
  - Open the shutter on the trinocular port to get video capture.

4.12 If an external light source is included, refer to the instruction to mount the light source. Plug in the microscope and turn it on. If no light emerges from the light source, adjust the dimmer knob near the power switch.

## Setting Up

1. Once you have placed your sample on the table or base below the objective, center the sample as best as possible. A slide is neither needed nor required for a stereo microscope, although they can be used if desired. If using a slide, use the stage clips to hold it in place.
2. With both eyes open, look into the eyepieces. Adjust the interpupillary distance by holding the eyepiece tubes and rotating the eyepiece tubes either towards or away from each other until only one circle of light is seen by both eyes.
3. Adjust the magnification knob to the lowest setting (0.7) and move the microscope's focusing knobs (on the focusing rack) to adjust the height of the unit until at approximately 4 inches (101mm) away from the sample. If not clear after adjusting, please be sure that you have not installed any additional Barlow lenses onto the objective.
4. Center the object in the field of view once you have achieved focus.

## Focusing

1. A stereo microscope's focus differs from a compound microscope. Magnification and focal distance (working distance) are inversely related to each other. The more magnified one is, the lower the distance between the objective and the sample to achieve focus.
2. When first using the microscope, remove all Barlow lenses and set the magnification knob (on the microscope head) to the minimum setting (0.7x).
3. Begin focusing the microscope by moving the knob until the head is about 4 inches (101mm) away from the sample. This should bring the microscope in focus at 7x.
4. If you'd like to use greater magnification than the minimum setting, you will need to move the microscope head closer to the sample as well as adjust the magnification knob to a higher setting. The more magnified, the closer you need to be.
5. If you've achieved the maximum magnification (45x and 3/16 of an inch or 4.76mm) on the microscope, you can use other accessories to either further increase or further decrease the magnification, called Barlow lenses. These lenses screw onto the objective to either amplify or reduce the total magnification.

The SM microscope has two options available--the 0.5x and the 2.0x. The 0.5x will cut magnification in half down to a minimum of 3.5x (and double working distance to approximately 8 inches or 203mm), while the 2.0x will double your magnification (but half the working distance, down to 3/32 of an inch or 2.4mm).

## Using the Trinocular Port

The AmScope SM-4T model is uniquely designed so that you can view the image through the eyepieces and the trinocular port without removing the camera or using your eyepiece.

This feature allows the images through the microscope's eyepieces, and those displayed on your computer screen or television be viewed at the same time (although unless using 20x eyepieces to match your camera, the image may differ in magnification). You do not need an adapter to attach your AmScope camera to the trinocular port, however you may need one if you have a non-AmScope camera. Our photo port is a 23mm size.

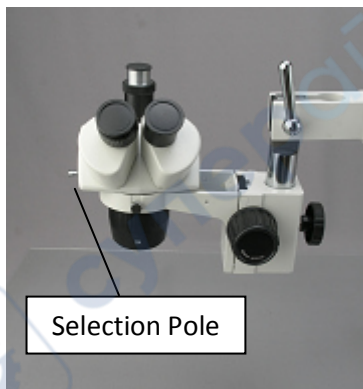


Fig. 7

You can alternate the binocular observation and video capture by pushing or pulling the selection pole.

- Push the pole in completely:
  - o Binocular observation
- Pull the pole out completely:
  - o Open the shutter on the trinocular port to get video capture.

If using a simul-focal microscope head (one with a focusing adjustment on the third port), then you can use the middle portion to focus the camera. This allows the camera to be in focus even if the magnifications between the eyepieces and the camera are different. The SM-4T models do not come standard with a simul-focal feature, but the SM-4TP models do.

## Attaching a Camera

1. If your microscope has a C-mount, you can simply screw the camera onto the trinocular port.
2. If your camera has a 23mm mounting size, remove the C-mount cap (if present) from the top of the trinocular port by loosening the screw. Then, drop the camera with reduction lens directly into the trinocular port. It should slide in without issue.
3. To focus through the trinocular port (simul-focal models only), simply turn middle portion of the tube. Otherwise, you will need to focus it individually using the microscope's focusing mechanisms.

## Adjusting Focusing Tension

1. To adjust the tension of the focusing knobs, grab both sides of the focusing knob and twist them opposite of each other.
2. To decrease tension, rotate in the opposite direction. Typically, adding tension is done by rotating the right knob clockwise and the left counterclockwise, so the opposite would hold true if releasing tension (if it is too hard to adjust the focal height, for example).

Note: If your focusing rack/head is slipping down, you need to increase the tension.

## Maintenance/Precautions

- All glass surfaces must be kept clean. Fine dust on the optical surface should be blown off using a hand blower or gently wiped off with a soft lens paper tissue/nonabrasive lint free cloth.
- Carefully wipe off oil or fingerprints on the lens surfaces using tissue moistened with a small amount of lens cleaner (we recommend Sparkle brand optical cleaner).
- Do not use Sparkle to clean other elements of the microscope. Use a neutral detergent on any plastic or painted surfaces.
- Do not assemble or disassemble the microscope's electrical components yourself without advisement from one of our technicians. Doing so will void your warranty unless by advisement of one of our technicians to do so.
- After use, cover the microscope with the provided dust cover.
- Keep your AmScope microscope in a dry, clean location in order to prevent rust or other damages.

## SM-4 Series Specifications

- Head: 45 degree inclined 360 degree swiveling trinocular
- Eyepieces: 30mm super widefield high-eyepoint WF10X/20
- Objective: 0.7-4.5X
- Zoom Range: 6.5:1
- Maximum Field of View: 1-1/4" (33mm)
- Minimum Field of View: 3/16" (4.75mm)
- Diopter Adjustment: +/-5dp
- Interpupillary Distance: 2-3/16" - 2-15/16"(55-75mm)
- Working Distance: 4" (100mm)
- Boom Stand: 20" double-arm (overall length: 30"), 17" high pillar, 10-1/4"x8-1/4"x2-0" solid cast steel base
- Accessories: eye-guards

## Optional Accessories

Parts	Description	Model #	Purpose
Eyepieces	20x	EP20X30	For obtaining higher magnification powers
	25x	EP25X30	For obtaining higher magnification powers
	10x w/ Pointer	EP10X30P	For easier identifying of objects
	10x w/ Reticle	EP10X30R	For measuring objects
Barlow (Auxiliary Lens)	0.5X	SM05	For halving the magnification (and doubling working distance)
	2.0X	SM20	For doubling the magnification (and halving the working distance)
Camera	CMOS Digital	MU035 (350k) MU130 (1.3mp) MU300 (3mp) MU500 (5mp) MU800 (8mp) MU900 (9mp) MU1000 (10mp)	To capture images, video, or view live display on a computer (PC/Mac OS X)
	Calibration Micrometer	MR400	To calibrate the camera software for on screen measurements
	CCD Digital (VGA, Trinocular Only)	CCD-MT	To view live display on a computer monitor (VGA)
	CCD TV/Video (Trinocular Only)	CCD-NP	To view live display on a television (RCA)
Stands	Single Arm	SAW	Single arm boom stand for larger samples
	Double Arm	DAW	Double arm boom stand for larger samples
	Ball Bearing	BBB	Ball bearing boom stand for ease of motion
	Articulating Arm w/ Clamp	ASC	Articulating arm for maximum freedom of movement with clamp for maximum work space area
	Articulating Arm w/ Stand	ASB	Articulating arm for maximum freedom of movement with table stand for flexibility
	Super Large Flat Stand	TS100-FR	Flat stand and focusing rack for X-Y table use or dissection
	Dual LED Pillar Stand	TS130-LED	Top and bottom lit table stand with pillar design
	Dual LED Track Stand	TS130R-LED	Top and bottom lit table stand with track design

## Technical Terms & Concepts

### Total Magnification

Total magnification of a microscope is calculated by the magnification of the objective multiplied by the magnification of the eyepieces.

-Ex: (10x Eyepieces) x (4x Objective) = 40x Total Magnification

### Field of View

Linear field of view of the eyepiece divided by the magnification of the objective

### Numerical Aperture (N.A)

Calculated by  $n \sin \alpha$  (max), the Numerical Aperture (N.A) is an important parameter that marks the features of the objective and condenser's image quality and resolution. The "n" is a refractive index of the medium (air or immersion cedar oil) between the objective lens and the specimen. The " $\alpha$ " is 1/2 of the angle between the aperture on the objective and path of light. The larger the N.A, the higher the resolution of the objective (and better quality of the image) is.

### Object to Primary Image Distance

The distance between the object plane and the primary image plane. The conjugate distance is fixed.

### Mechanical Tube Length

The distance between the objective shoulder and the ocular shoulder

### Infinity

Infinity is an optic lens system that allows the entire field of view to be in focus at the same time, allowing for higher quality images to be displayed through the microscope. The focal distance is set to infinity between the objective and the eyepiece prism, also allowing filters to be inserted into the system more easily due to the parallel path of light, rather than focusing on a specific point.

## Common Issues (Optical)

Symptom	Cause	Remedy
<b>OPTICAL ISSUES</b>		
<b>Obstructions are observed in the field of view</b>	Stains, dust, or dirt has accumulated on the specimen	Clean the slide or use a new specimen if sample is destroyed
	Stains, dust, or dirt have accumulated on the lenses	Clean the objective and eyepiece lenses
<b>Unclear Image</b>	Stain or dust has accumulated on the lens in the inlet of the head	Clean the lens with lens cleaner or a nonabrasive lint free cloth, as well as spray with compressed air
	The microscope head is not in the right position to be focused	Adjust the height of the microscope with the focusing knob on the focusing rack until image appears in focus. <b>Note:</b> Higher magnification will require the head to move closer, while lower will require more distance between the sample and the lens.
<b>One side of the field of view is dark or the image moves while focusing</b>	The specimen is not fixed	Secure the slide to the stage with clips or another manner so that the sample does not move
<b>The field of view is not bright enough</b>	The light source is not present	A light source must be used with this model microscope to view a sample (ring light, built in illuminator, or gooseneck illuminator)
	The light source is too dim	The light source used is not bright enough, or is set to too low of an intensity setting. Adjust setting to a higher or change light sources
	Stains, dust, or dirt has accumulated on the condenser, objective, eyepieces, or base lens	Thoroughly clean all lenses with lens cleaner or a lint free nonabrasive cloth

## Common Issues (Mechanical)

Symptom	Cause	Remedy
<b>MECHANICAL ISSUES</b>		
<b>Focus knob does not turn</b>	The tension knob is too tight	Loosen it by adjusting the tension by grabbing both knobs on the focusing rack and twisting them in opposite directions.
<b>Stage declines by itself</b>	The tension knob is too loose	Loosen it by adjusting the tension by grabbing both knobs on the focusing rack and twisting them in opposite directions.
<b>The focusing knob won't raise/lower the head</b>	The focusing rack has reached the max travel distance in either direction	Move the focusing rack higher or lower on the pillar if using a stand with a pillar