Handheld Microscope Users Guide

Real
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Hand-Held Microscope User's Guide

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Introduction

This guide is intended to answer your questions about how to use your scope: the different parts and their functions, how to change lenses, how to take images, care and maintenance, etc. If you need further assistance, please visit *www.ScopeCurriculum.com*, where you will find directions on how to get further support, as well as instructional videos. You can also visit the LSU Scope-On-A-Rope Program site: *www.scopeonarope.lsu.edu*.

What is a Scope-On-A-Rope?

The Scope-On-A-Rope, abbreviated SOAR, is a hand-held microscope that shows focused, magnified images on a television, computer, or projector screen. First manufactured for medical applications, it was later developed for educational use at Louisiana State University. The SOAR has interchangeable lenses for viewing objects at different magnifications. Simply touching a sample with the lens tip produces an image that is well lighted and in focus. This is especially appealing to elementary students, who typically struggle with traditional microscopes.

Here are some of the many reasons why teachers and students can benefit from using a SOAR in the classroom:

1. It is easy to use, compact, and durable.

2. It serves many functions–operating as a regular video camera, document camera[1], microscope, and presentation aid.

3. The entire class can see an object at once.

4. Hands-on exploration and cross-curricular applications are endless!

5. All kinds of samples can be examined with it (no slide preparation necessary).

6. Still images and movies can be saved for discussion and analysis.

7. Connections to state and national education standards are easy.

8. It can be used in special needs classrooms.

9. It produces high-quality images that inspire and motivate students of all ages and ability levels with their "wow" factor!

10. Its use engages students and helps them to become better thinkers, inquirers, and problem solvers.

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[1] A document camera (also called docucam, visual presenter, digital overhead and digital visualizer) is basically a high-tech overhead projector. It is a specialized camera that can be used to take images of a document (or object) and project them onto a computer screen, TV screen, or projector screen. A document camera is similar to a web cam, but the camera is normally mounted on a movable "arm" that can be moved around to view the particular object or part of the document desired.

Which model do you have?

There are several types of hand-held microscopes, some of which are sold as toys. This manual provides detailed instructions for four models designed for classroom use: the "New" Scope-On-A-Rope (VL-7EX II), the "Old" Scope-On-A-Rope (VL-7EX), the L2, and the ProScope. The chart below will help you distinguish these different models.

The name *Scope-On-A-Rope* is trademarked to Louisiana State University and is used to denote the model used by its outreach program. Although there are several models of hand-held scopes available, the outreach program at Louisiana State University recommends the Scalar VL-7EX II (aka the "New" SOAR), which was introduced in the Fall of 2008. It is the most durable, has the highest resolution, and is the most versatile of all the hand-held scopes currently available. The original VL-7EX SOAR (aka the "Old" SOAR) was first sold in 1998. These two versions of the scope are virtually identical, and both have superior resolution and durability.

Model	LSU VL-7EX II ("New" SOAR)	LSU VL-7EX ("Old" SOAR)	L2	ProScope HR
Image				
Currently available for purchase?	Yes, it was released in Fall 2008	No (only available prior to 2008)	Yes	Yes
Analog or digital output? (see explanation below)	Analog, although output can be converted for digital use	Analog, although output can be converted for digital use	Analog, although output can be converted for digital use	Digital only
Other Features	Has a button labeled "LIGHT"	Has a button labeled "ON"	White color; has a yellow video cable for connecting to a TV	Silver color; has a USB cable that plugs into a computer

Analog vs. Digital

The type of output refers to the types of devices that can be used to display the images created by the scope. A *digital* scope has to be connected to a computer, usually via a USB cable. Software needs to be installed on the computer before using the instrument. *Analog* scopes, however, are true "plug and play" devices–you don't need to install any software to operate them. They can be connected directly to a television, DVD player, projector, interactive white board, or any other display that has a yellow video input.

Yellow video inputs jacks indicate devices that can display analog signals. On the left are shown typical connections for a television (yellow is video, red and white are audio), on the right are connections for a digital projector.

Any analog scope can be connected to a computer, but this must be done with the help of a converter. For example, the "New" Scope-On-A-Rope education kits come with a converter and software, but there are many other options available.

Converters change analog output of SOARs to digital format for display on computer or other digital device.   The converter on the left (black) is part of the VL-7 Education Kit; on the right (white) is a commercially available model.

Considering that everything is moving towards digital technology, why would anyone want an analog scope? There are several reasons:

• No installation disc is necessary; there is no software needed.
• You get **better** resolution. (This seems counterintuitive, but it's true!)
• You have more display options—any television, projector, or active board.
• You have more software options. (Again, this seems counterintuitive, but there are many digital converter/ software packages available that make it possible for your analog scope to work with a great variety of software. Some digital microscopes will only work with the software that comes with them.)

Where can I buy a SOAR?

Although ProScopes are available for purchase from several vendors, School Technology Resources (STR) is the sole vendor of the LSU Scope-On-A-Rope (VL-7EX II). Founded by a teacher, School Technology Resources has also created unique education kits for these instruments.

To contact STR, call 877-395-1001, or visit www.schooltr.com.

New Scope-On-A-Rope

The LSU VL-7EX II is the instrument used in Louisiana State University's education outreach program. This section describes parts and assembly of the SOAR, how to use lenses and buttons, and how to set up the SOAR in different ways using accessories.

Note: The information on the "new" scope contained in this section applies equally to the "old" scope. The only differences are (1) that where the new SOAR has a LIGHT button, the same button on the old SOAR says ON; and (2) that the new SOAR does not have an ERASE button.

Parts and Assembly of SOAR

The Scope-On-A-Rope comes with three cords, three lenses, a scope body, and a cradle. All cords connect to the cradle, with the curly, telephone-like cord connecting the body to the cradle–hence the name "Scope-On-A-Rope"!

1. Scope
2. Cradle
3. Cover
4. 30X lens
5. 1X lens
6. 200X lens
7. Camera cable (aka "rope")
8. Power cable
9. Video cable
10. Stand
11. XYZ stage
12. Lamp
13. Lamp shade

Connections

- The white camera cable (aka "rope") connects the scope to the cradle.

- The black power cable connects the cradle to a power outlet.

- The yellow-tipped video cable connects the cradle to your display–whether you choose to use a TV, projector, active board, or computer via digital converter.

Each cable has a differently shaped end, which means that unless you can fit a square peg in a round hole, you can't get it wrong!

Turning It On

1. Once all the cords are connected and you are ready to begin using the SOAR, make sure the power switch is turned on (it will glow red when it's on).

2. Press the LIGHT button to turn on the lights of the lens. Note: Skip this step if you are using the "Old" SOAR.

3. Turn on the television, projector, or other display device that you are using with the scope.

Depending on the display you are using, you might need to take steps to make sure the display finds the proper input. You'll know it's working when you see a letter "A" on the screen. If you have the "New" SOAR, the small, yellow letter will appear in the upper right hand corner. If you have an "Old" SOAR, the small, white letter will appear in the lower right hand corner. For more tips, refer to the Troubleshooting section.

New SOAR display
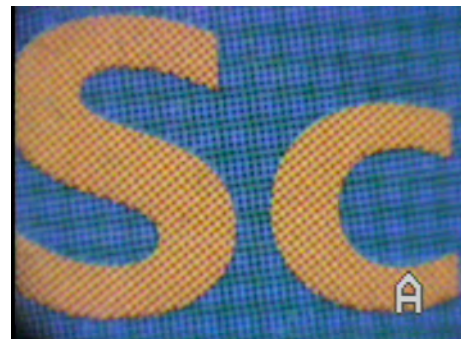
Old SOAR display

You are now ready to begin "scoping"!

Comparing and Installing Lenses

Both the New and Old Scope-On-A-Rope education kits come with three lenses: 1X, 30X, and 200X. Refer to the table below for general information on these lenses. Detailed instructions for using each lens are included in the following pages of this section.

Lens	1X	30X	200X
Image			
Magnification	Variable – depending on how far away the object is from the lens	30X	200X
How to use	This lens works like a video camera and/or document camera.	Touch an object to see it magnified 30 times.	Touch an object to see it magnified 200 times.
Focusing	The black ring can be used to focus the image.	This lens does not have a focusing mechanism.	The white, scalloped (having a pattern of semicircles) ring is for fine focusing.
Lighting	Does not have internal lights	Internal lights can be polarized by pressing the LIGHT/ON button	Has internal lights (but cannot be polarized)
Best used for…	Demonstrations, showing pictures in books, viewing whole objects	Examining any of a multitude of objects up close	Looking at prepared slides, cells, small and/or flat objects

To remove a lens, rotate it counterclockwise until the small index marks on the lens and the camera body line up. The lens should then be easily removed. To place a lens on, you must reverse the process. First, line up the small index marks on the lens and the camera body. Do not force the lens onto the scope! There are several contact points that need to meet up just right for the lens to function properly. Once the lens is in place, twist it clockwise until it firmly clicks into place. You should hear a satisfying "snap" when it's on correctly.

Positions of index marks on lens and camera body before the lens is twisted into place

Positions of index marks after lens has been twisted into place and is securely attached

How to Use and Capture Images with the 30X Lens

When you are first using the Scope-On-A-Rope, it's best to begin with the 30X lens. Just remember some basic rules to share with your students:

- Never immerse the lens tip in a liquid.
- Never touch anyone's eye or mouth with the lens tip.
- Never point the lens at someone's eye.
- Take proper precautions to avoid spread of infection.

After setting up your scope, make sure the power is on for both the scope and the display (TV, projector, etc.). If you are using the "New" SOAR, you will also have to press the LIGHT button on the scope to ensure that the lights are on (refer to "Parts and Assembly" section). To get a focused image on the screen, you must touch the lens tip to the item you wish to view. It's that simple! Since the actual lens is inside the plastic housing, you cannot damage it by touching objects to the tip. Just remember the basic rules listed above.

Note: Holding the tip of the lens flat against the object will give you the best image.
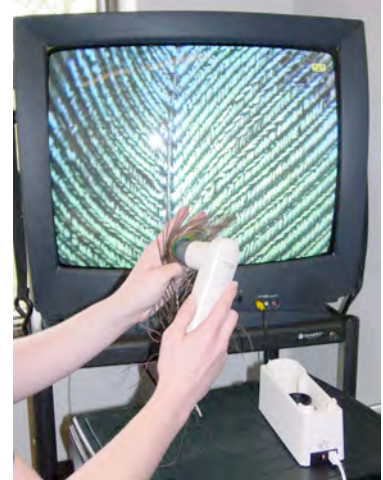
If you would like to save an image temporarily, press the REC button while keeping the lens touching the object. This will record a snapshot of what you were viewing. To see your snapshot, press the PLAY button.

The Scope-On-A-Rope can hold two images at a time; if you take more than two pictures, only the last two will be saved. To see more than one image on the screen, make sure to take two snapshots, then press PLAY three times. When you hit PLAY the first time, you'll see the first picture you took (labeled "A"). When you hit PLAY the second time, you'll see the second picture you took (labeled "B"). On the third push of the PLAY button, you'll see a split screen showing both images at once–the "A" image on the left and the "B" image on the right.

"A" image	"B" image	Split screen
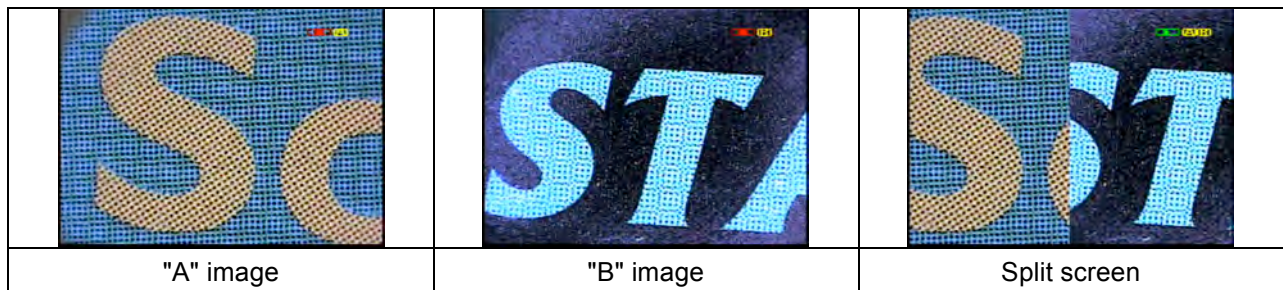
Press the REC button to get back to live capture mode. You can take as many pictures as you want during a class session, but these images will not be saved after the scope is turned off. To save these images permanently, you will need to use a converter and connect your scope to a computer.

The steps above can be used with any of the three lenses. In fact, you can switch lenses to compare items at two different magnifications at once. This split screen feature is great for students to compare and contrast two objects!
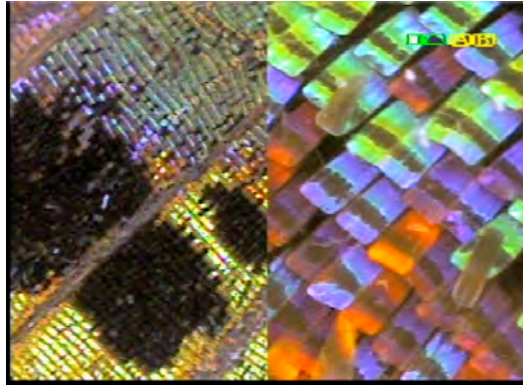
Butterfly wing split screen 30x/200x

Non-Contact Viewing

What if you want to examine an object that you cannot touch? Perhaps it's behind glass (such as a fish in an aquarium), the object is wet, or it has a complex structure that cannot be touched (such as the inside of a small geode). The contact tip of the 30X lens can be removed by simply pulling it off. Since you will not touch the object, it is best to put the scope in the stand before trying this "non-contact" setup (see section "Using the Stand" for set-up instructions).

Notice (at left) that the mouth of the sea star is not in focus because the scope isn't able to touch it. When the contact tip is removed, at right, the scope can see further into the sea star, bringing the mouth into focus.

Polarization with the 30X Lens

The lights in the 30X lens can be polarized (a process that reduces unwanted reflection/glare) by pressing the LIGHT/ON button. This should greatly reduce the reflection. You can continue to switch the LIGHT/ON button on and off to switch between polarized and unpolarized illumination. Try looking at different objects with polarized and unpolarized light. What differences do you notice?
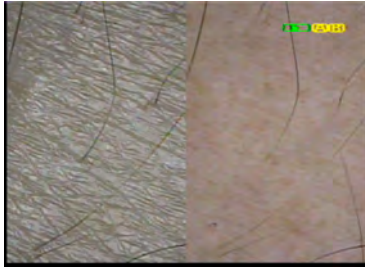
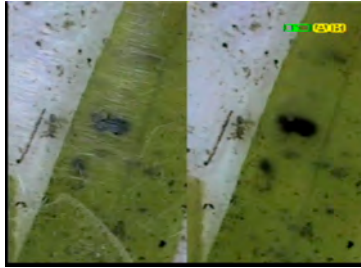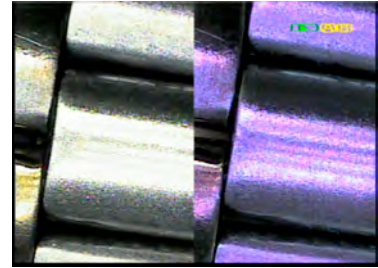| Unpolarized/polarized skin | Unpolarized/polarized glass slide | Unpolarized/polarized watch |

How to Use the 200X Lens

Once you have the hang of using the 30X lens, change to the 200X lens to see the same objects under higher magnification. (Follow instructions for changing lenses in previous section.) You will find that the 30X is best for looking at certain larger items, such as fingerprints, rocks, etc., but the 200X will allow much closer examination of smaller objects, such as salt crystals, cells, and clothing fibers. To adjust the focus with the 200X lens, twist the white, scalloped (having a pattern of semicircles) ring.

The 200X has a fine focus mechanism due to the smaller field of view of this lens. This means that the higher the magnification, the smaller the area (field) the lens can view at one time. For example, you can see an entire fingerprint pattern with the 30X, but you will only see part of a few ridges with the 200X.
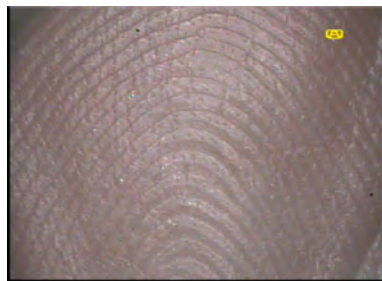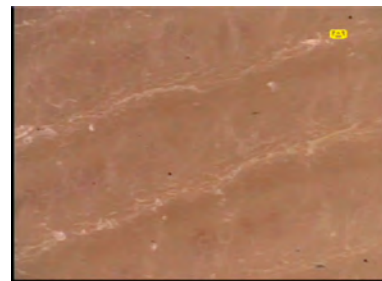
| Finger 30x | Finger 200x |

The 200X works the same way as the 30X—you touch the object with the tip of the lens housing to get a focused image. In this case, the tip of the lens is a clear dome with a small hole in it. The actual lens is inside this plastic housing, and it "sees" whatever is lined up with the hole in the plastic. (This image shows how the lens is focused by twisting the scalloped ring.)

200X lens tip with hole

When using the 200X lens for the first time, it's easiest to get a focused image of something flat (e.g. paper, fabric, or a prepared slide). Touch the tip of the clear dome to the object you'd like to view. While continuing to touch the object, rotate the white, scalloped ring in one direction. If the focus is not cleared up, try rotating the ring in the opposite direction. Keep in the mind that several turns of the ring may be necessary to achieve the proper focus. Once the lens is focused on the flat object, only slight adjustments will be necessary when viewing other objects.

The REC and PLAY buttons work the same with this lens, so follow the instructions in the 30X lens section. The lights in the 200X lens, however, cannot be polarized.

200x touch-and-view setup

How to Use the 1X Lens

The 1X lens is different from the 30X and 200X lenses in several ways:

- It does not have its own lights, so it cannot be used as a "touch lens."

- Its magnification is variable–the closer the object is to the lens, the higher the magnification. Objects that are far away will actually appear smaller than they are in real life.

- It can be used as a video camera and/or a document camera.

Since the 1X lens is not a "touch lens," it is recommended to secure the scope in a stand. This will help the scope remain stable and avoid the "home movie effect." After following the instructions in the following section ("Using the Stand") you will be ready to begin using the 1X lens.

1x lens in stand

The black ring around the tip of the lens is the focusing mechanism. Turn the ring to focus on the object of your choice. As with the 200X lens, if the image does not get clearer, try turning the ring in the opposite direction.

Try this tip if the color of your image does not seem right (everything might have a yellow hue):

- If you have the "New" SOAR, turn the scope off and then back on by pressing the power switch on the cradle. Press the LIGHT button to go back to the previous light setting.
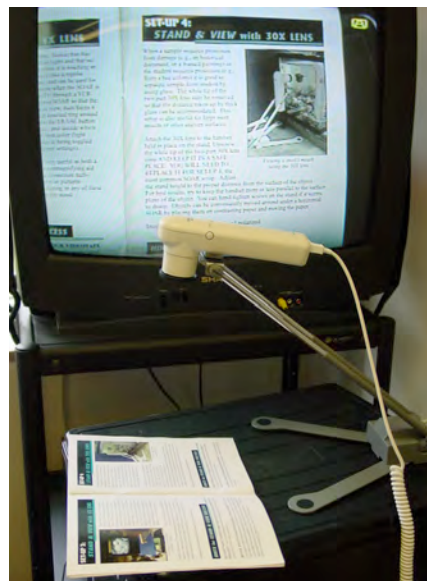
- If you have the "Old" SOAR, press the ERASE button, located on the underside of the scope. Pressing the ON button will allow you to go back to the previous light setting. Note: the ERASE button also erases any images previously taken with the SOAR.

How to Use the Stand

The stand that comes with the Scope-On-A-Rope kit comes in handy when using the 1X lens, using the 30X with the contact tip removed, or in any situation where you might want to use the scope hands-free. Some people find that it is difficult to hold and focus the 200X lens, so securing the scope in its stand can aid in obtaining well-focused images.

To put the scope in the stand, first remove the lens from the scope. This will give you greater freedom of movement. Next, locate the metal screw plate on the underside of the scope. If your scope does not have a screw plate, check your kit contents (a screw plate is included in all Scope-On-A-Rope education kits). There are two holes on the scope body used to attach the screw plate with two smaller screws.

<div align="center">Screw plate   Attaching scope to stand</div>

Once the screw plate is on the scope, hold it up to the screw on the stand. Turn the screw clockwise to secure it to the scope. Make sure to screw it on tightly so that the scope doesn't wiggle around.

Spread the legs of the stand to give you maximum stability. Once the scope is secure in the stand, attach the lens of your choice. You can use the stand in a variety of positions, and it can be extended to give greater distance from the object you wish to view. It can also be twisted at an angle for viewing the sides of objects.
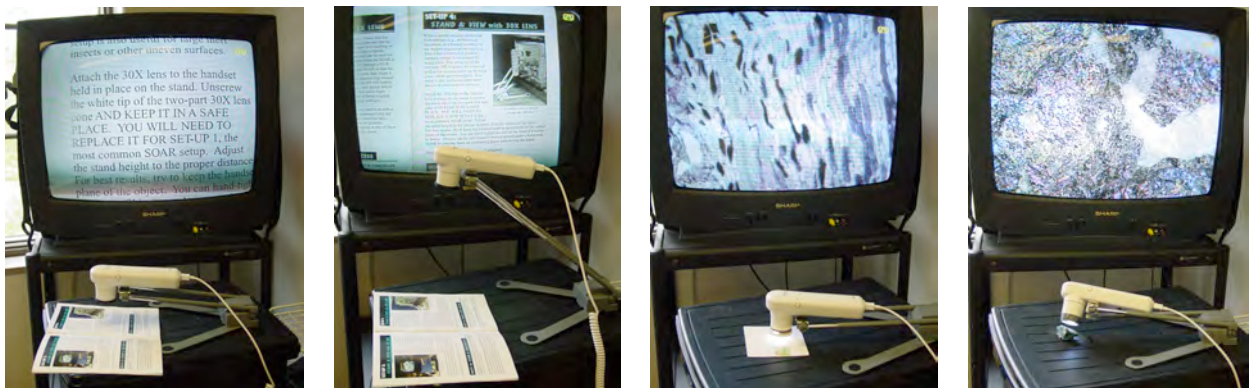
<div align="center">From left to right: 1X close to object, 1X far from object, 200x viewing slide, 30x viewing side of rock.</div>

Troubleshooting

A. No picture appears on the TV or projector.

1) Check that all cords are plugged in, especially the power cord, and that the TV or projector is on.

2) Check that the power switch on the scope's cradle is on (the red light will be illuminated).

3) Press the LIGHT/ON button on the scope to make sure the lights are on.

4) Check that the correct channel or input is selected in your display. See the table below for some tips:

	Step 1	Step 2
Television	Plug the video cable into a yellow video input port (this could be on the front or the back of the TV).	Depending on the type of TV you have, you will have to do one of the following: • go to the channel below 2 • press the input button on the remote until you see "AV, video, or composite" • go to the menu and select the input source to be one of the above choices
Projector	Plug the video cable into the yellow video input port (located on the back or side of the projector)	The projector might find the correct input on its own, but if not, press the input button and select "composite video."
DVD/VCR	If you have a DVD or VCR hooked up to your TV, you can have the SOAR go through it (so you don't have to unplug it from the TV). Plug the video cable into a yellow video input port on the DVD/VCR (this could be on the front or the back).	Make sure the TV is on the right channel to view the DVD/VCR. Then either press channel down on the DVD/VCR until you get to a channel below 2 (AV, video, etc.) or go to the DVD/VCR menu and select the proper input.
White Board	Plug the video cable into the yellow video input port.	There are many different brands of active board. You may need to consult the manual for your instrument or contact the school/district technology specialist.
Computer	Plug the video cable into the yellow video input port on a digital converter. Plug the converter's USB cable into your computer.	You have to install the software first. Refer to the software instructions if necessary.

B. Image produced by the 1X lens is a weird color.

1) For the "New" SOAR, turn the scope off, then back on, using the power switch on the cradle. This should correct the color balance. If that does not help, press the LIGHT button to return to the previous setting.

2) For the "Old" SOAR, press the ERASE button located on the underside of the scope. If that does not help, press the ON button to return to the previous setting.
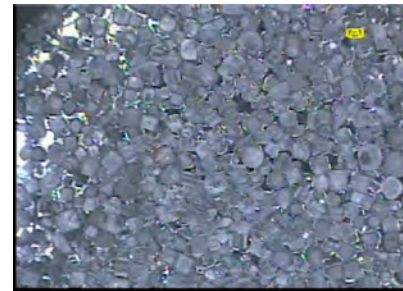
C. Image is too dark and/or details of the object aren't seen.

   1) If using the 30X or 200X lens, make sure the lights in the lens are on by pressing the LIGHT/ON button on the scope.

   2) If using the 1X lens or looking at a water sample with the 30X or 200X lens, try adding a lamp or changing the background on which the specimen is placed.
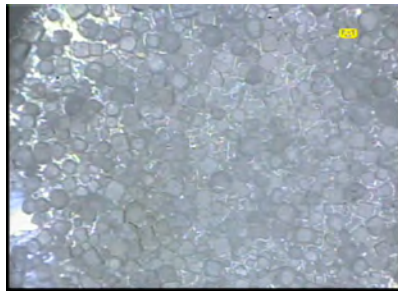
| salt on a white background | salt on a dark background |

D. Image appears fuzzy.

   1) 1X lens – rotate the black ring to adjust the focus.

   2) 30X lens – make sure you are touching the object and that the lens tip is flat against the object. If that doesn't help, try the using the stand and removing the contact tip, as described above (in the section "Viewing Without Contact Tip").

   3) 200X lens – make sure you are touching the object and rotate the white scalloped ring to adjust the focus.

E. 30X lens comes apart.

1) Check to make sure you have all pieces of the lens.		2) Take the donut shaped piece (with the light bulbs and visible circuitry) and place it on the base of the lens, with the lights facing up (circuitry side down). Turn it in place until it fits snuggly into the base.	
3) Locate the gray plastic tip with the screw threads on it. Screw it into the white housing counterclockwise until it is screwed in all the way.		4) If the top of the gray plastic tip is not attached, simply pop it on.	

For other problems, contact your vendor or consult the LSU Scope-On-A-Rope Program: http://www.scopeonarope.lsu.edu.

Old Scope-On-A-Rope

This is the instrument previously used in Louisiana State University's education outreach program.

To learn about this model, please refer to the section above ("New Scope-On-A-Rope"). The above information on the new SOAR equally applies to the old SOAR. The minor differences are that where the new SOAR has a LIGHT button, the same button on the old SOAR says ON, and that the "new" SOAR does not have an ERASE button. These differences are addressed above where applicable.

If you have the collar and stage set up for aquatic viewing, refer to LSU's SOAR website for instructions on how to use it: www.scopeonarope.lsu.edu.
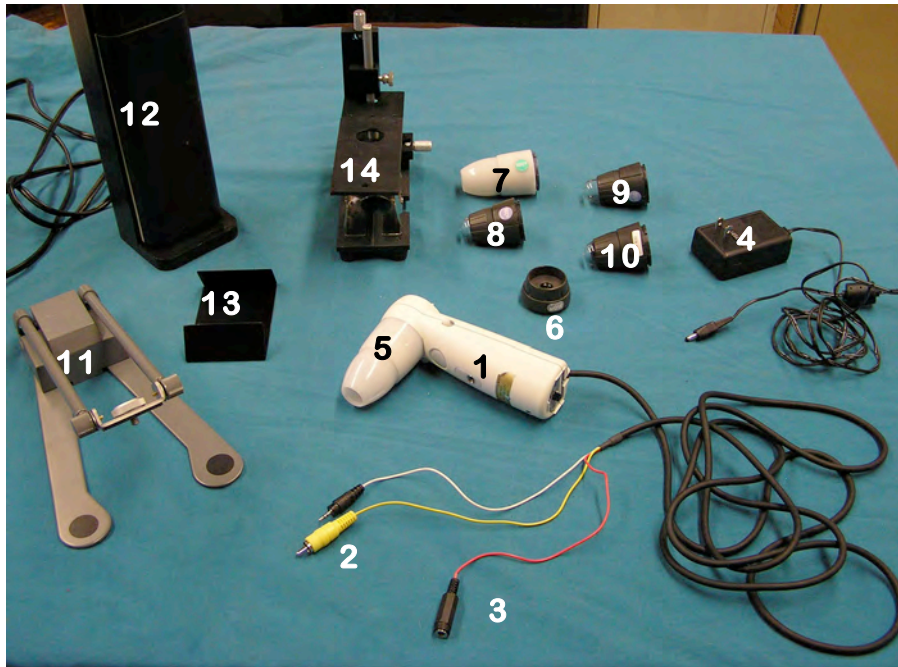

collar and stage

SOAR in inverted setup

L2 Scope

The L2 Scope connects to a TV or projector like the Scope-On-A-Rope, but is designed to work with the same accessories as the ProScope (see next section). This section describes parts and assembly of the L2, how to use lenses, and how to set it up in different ways using accessories.

Parts and Assembly of the L2

1. L2 scope
2. Video cable
3. Power cable
4. Power supply
5. 50X lens
6. 1X lens
7. 30X lens
8. 200X lens
9. 100X lens
10. 400X lens
11. Stand
12. Lamp
13. Lamp shade
14. XYZ stage

The L2 comes with a scope with a cord attached to the bottom of it, a separate power cord, and one or more lenses.

Turning the L2 On

1. Locate the black cord coming out of the bottom of the scope. It has three connectors at the end of it–for video (yellow), audio (white), and power (red).

2. Connect the black power supply cord to the red cable coming out of the scope, and plug the other end into a power outlet.

3. Connect the yellow-tipped video cable coming out of the bottom of the scope to your display–whether you choose to use a TV, projector, active board, or computer via digital converter.

L2 with cords connected

4. Once all the cords are connected and you are ready to begin using the scope, make sure the power switch is turned to the AUTO position.

5. Find the light switch on the side of the scope and put it on the "A" setting.

6. Turn on the television, projector, or other device that you are using with the scope.

Depending on the kind of display you are using, you might need to go through a couple of steps to make sure the display finds the proper input. (Refer to the Troubleshooting Section below if you need further assistance.)

You are now ready to begin "scoping"!

Comparing and Installing Lenses

There are several lenses that can be used with the L2 and ProScope: 1X, 30X, 50X, 100X, 200X, and 400X. Refer to the table below for general information on the lens types. Detailed instructions for using each lens are included later in this section.

Lens	1X	30X & 50X	100X, 200X, & 400X
Image			
Magnification	Variable – depending on how far away the object is from the lens	30X or 50X	100X, 200X, or 400X
How to use	This lens works like a video camera and/or document camera.	Touch an object to see it magnified 30 or 50 times.	Touch an object to see it magnified 100, 200, or 400 times.
Focusing	The gray, grooved ring can be used to focus the image.	This lens does not have a focusing mechanism.	The gray, grooved ring is for fine focusing.
Best used for…	Demonstrations, showing pictures in books, viewing whole objects	Examining any of a multitude of objects up close	Looking at prepared slides, cells, small and/or flat objects

To remove a lens, press the lens release button and, while holding it, rotate the lens counterclockwise until the small index marks on the lens and the camera body line up. The lens should then be easily removed. To place a lens on, simply reverse the process. First, line up the small index marks on the lens and the camera body. Do not force the lens onto the scope! There are several contact points that need to meet up just right for the lens to function properly. Once the lens is seated properly, twist it clockwise until it firmly clicks into place–you do not need to press the button. You should hear a "snap" when it's on correctly.

Index marks

Lens release button
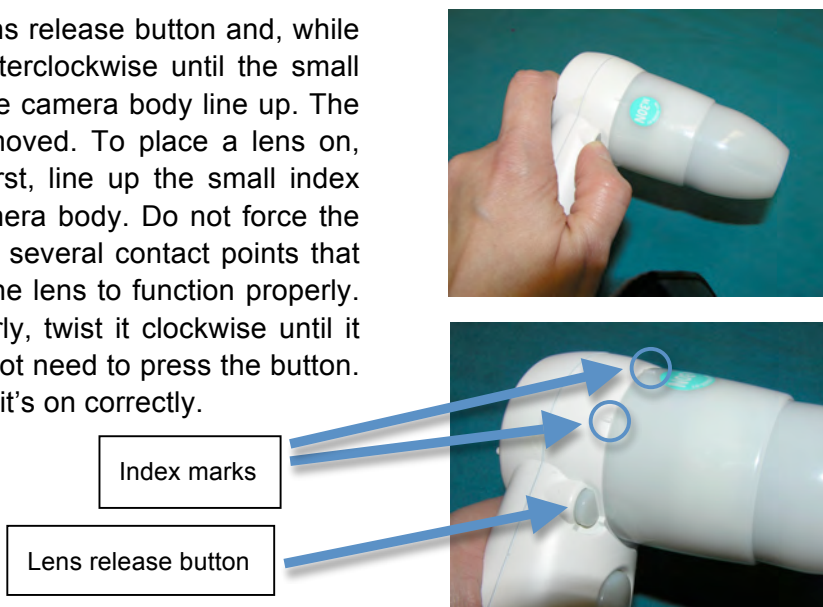
How to Use the 50X Lens

When first using the L2, it's best to begin with the 50X lens; it's the lens that comes with all kits. Just remember some basic rules to share with your students:

• Never immerse the lens tip in a liquid

• Never touch anyone's eye or mouth with the lens tip

• Never point the lens at someone's eye

• Take proper precautions to avoid spread of infection

After setting up your scope, make sure the power is on both the scope and the display (TV, projector, etc.). If there are no lights shining in your lens, check to be sure that the power is set to AUTO and the light switch is on "A". To get a focused image on the screen, you must touch the lens tip to the item you wish to view. It's that simple! Since the actual lens is inside the plastic housing, you cannot damage it by touching objects to the tip. Just remember the basic rules listed above.

Note: holding the tip of the lens flat against the object will give you the best image.

Non-Contact Viewing

What if you want to examine an object that you cannot touch? Perhaps it's behind glass (such as a fish in an aquarium), or the object is wet, or it has a complex structure that cannot be touched (such as the inside of a small geode). The contact tips of the 30X and 50X lenses can be depressed by twisting the conical tip. Since you will not touch the object, it is best to put the scope in the stand before trying this "non-contact" setup (see "Using the Stand" for setup instructions).

Viewing sea star with contact tip. Notice that the mouth of the sea star is not in focus because the scope isn't able to touch it.

Viewing sea star with contact tip depressed. When the contact tip is depressed, the scope can see further into the sea star, bringing the mouth into focus.

How to Use the 30X Lens (Including Polarization)

The 30X lens works the same way as the 50X lens, except that its lights can be polarized (a process that reduces unwanted reflection/glare). When first using the 30X lens, change the light setting to "B" using the switch on the side of the scope. (If you are using any other lens except for the 30X, this setting will turn the lights off.) It is recommended to begin with unpolarized light, because the details are best seen in most objects with this light setting.
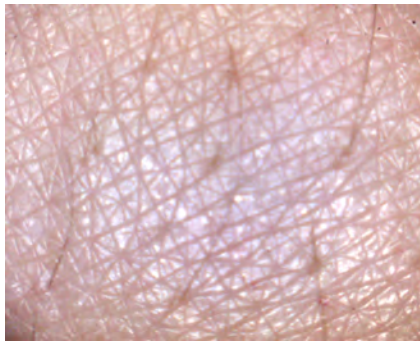

light switch

To polarize the lights, change the light switch to the "A" position. This should greatly reduce the reflection. (There is a short delay when changing light settings, so don't be alarmed if the lights turn off temporarily.) Try looking at different objects with polarized and unpolarized light, and notice the differences.
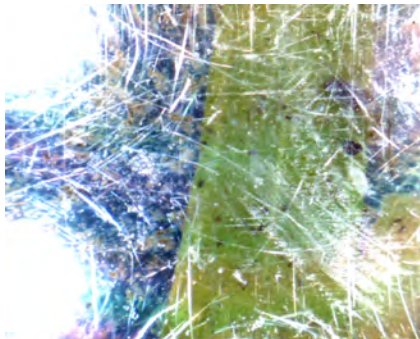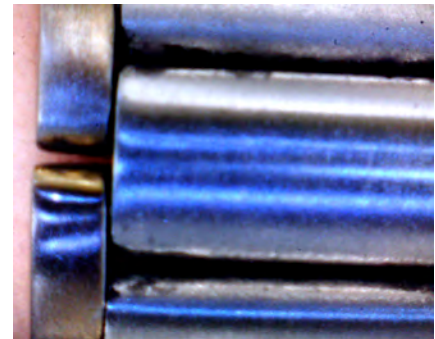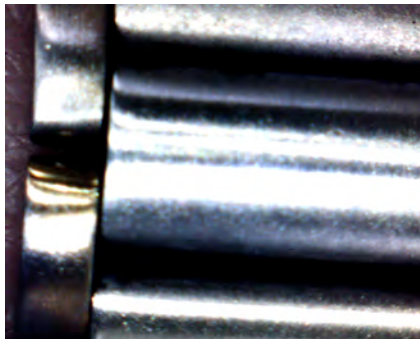
18

	Unpolarized light	Polarized light
Skin		
Glass slide		
Watch		

How to Use the 100X, 200X and 400X Lenses

Once you have the hang of using the 30X and 50X lenses, change to the 100X or 200X lens to see the same objects under higher magnification. (Follow above instructions for changing lenses.) You will find that the 30X/50X is best for looking at certain larger items, such as fingerprints, rocks, etc., but the 100X/200X will allow much closer examination of small objects, such as salt crystals, cells, and clothing fibers. Each of these higher powered lenses has a fine focus mechanism due to the smaller field of view. This means that the higher the magnification, the small the area (field) the lens can view at one time. For example, you can see an entire fingerprint pattern with the 50X, but you will only see part of a few ridges with the 200X.
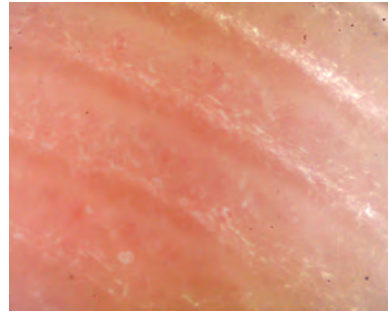
Fingerprint at 50x   Fingerprint at 200x

The 100X, 200X, and 400X work the same way as the 30X/50X–you must touch the object with the tip of the lens housing to get a focused image. In this case, the tip of the lens is a clear dome with a small hole in it. The actual "lens" is inside this plastic housing, and it sees whatever is lined up with the hole in the plastic.

When you are using the 100X or 200X lens for the first time, it's easiest to get a focused image of something flat (e.g. paper, fabric, or a prepared slide). Touch the tip of the clear dome to the object you'd like to view. While continuing to touch the object, rotate the gray, grooved ring in one direction. If the focus is not cleared up, try rotating the ring in the opposite direction. Keep in the mind that several turns of the ring may be necessary to achieve the proper focus. Once the lens is focused on the flat object, only slight adjustments will be necessary when viewing different objects.

The 400X lens is best used for slides and other flat objects. Its field of view is so small–only a half a millimeter–that it might take you some practice to become proficient in getting well-focused images with this lens.

How to Use the 1X Lens

The 1X lens is different from the other lenses in several ways:

It does not have its own lights, so it cannot be used as a "touch lens."

Its magnification is variable–the closer the object is to the lens, the higher the magnification. Objects that are far away will actually appear smaller than they are in real life.

It can be used as a video camera and/or a document camera.
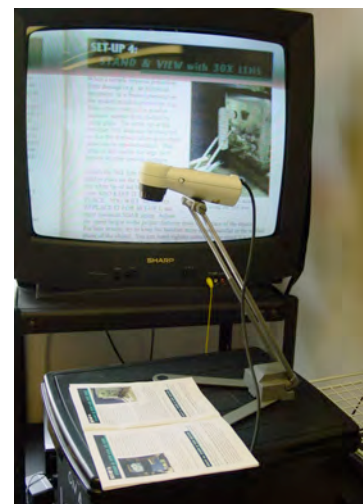
L2 with 1x lens in stand

20

Since the 1X lens is not a "touch lens", it is recommended to secure the scope in a stand. This will help the scope remain stable and avoid the "home movie effect." After following the instructions in the following section–"How to Use the Stand"–you are ready to begin using the 1X lens.

The gray, grooved ring around the tip of the lens is the focusing mechanism. Turn the ring to focus on the object of your choice. If the image does not get clearer, try turning the ring in the opposite direction.

How to Use the Stand

The stand that comes with the L2/ProScope education kit comes in handy when using the 1X lens, using the 30X/50X with the contact tip depressed, or in any situation where you might want to use the scope hands-free. Some people find that it is difficult to hold and focus the higher magnification lenses, so securing the scope in its stand can aid in obtaining well-focused images.

To put the scope in the stand, locate the screw attachment on the underside of the scope.

Hold the scope up to the screw on the stand. Turn the screw clockwise to secure it to the scope. Make sure to screw it on tightly so that the scope doesn't wiggle around.

Spread the legs of the stand to give you maximum stability. You can use the stand in a variety of positions, and it can be extended to give greater distance from the object you wish to view. It can also be twisted at an angle for viewing the sides of objects.

Prepared slide viewed with 200x lens on stand

Rock sample viewed with 30x lens on stand

## Troubleshooting

A. No picture appears on the TV or projector.

1) Check that all cords are plugged in, especially the power cord, and that the TV or projector is on.

2) Check that the power switch on the base of the scope is set on AUTO.

3) Check that the light switch is set to position "A" and that light is coming out of the lens.

4) Check that the correct channel or input is selected in your display. Refer to the Troubleshooting table in the New SOAR section of this guide for additional tips.

B. Image is too dark and/or details of the object aren't seen.

1) For any lens except the 1X, make sure the lens lights are on by putting the light switch in the "A" position. If using the 30X lens, try changing the light setting to the "B" position.

2) If using the 1X lens or looking at a water sample with any lens, try adding the lamp or changing the background on which the specimen is placed.
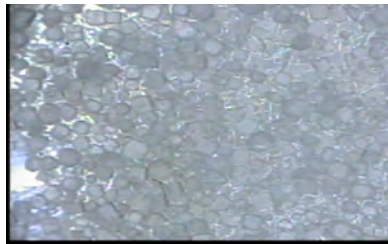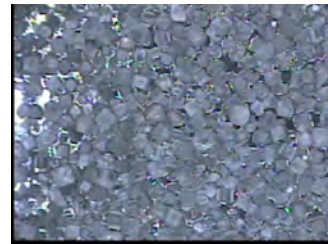
salt on a white background   salt on a dark background

C. Image appears fuzzy.

1) 1X lens – rotate the gray, grooved ring to adjust the focus.

2) 30X/50X lens – be sure you are touching the object and that the lens tip is flat against the object. Then check that the lens tip is not depressed (twist the conical tip to the tallest position). If that doesn't help, try using the stand and depressing the contact tip.

3) 100X/200X/400X lens – make sure you are touching the object with the clear dome–holding it flat against the object–and rotate the gray, grooved ring to adjust the focus.

For other problems, contact your vendor, go to www.ScopeCurriculum.com, or consult the LSU Scope-On-A-Rope Program: http://www.scopeonarope.lsu.edu.

ProScope HR

This instrument is a digital scope, meaning that it connects to a computer via a USB cable. It was designed to work with the same accessories as the L2 Scope (outlined in the previous section). This section outlines the setup and general use of the ProScope, but for detailed instruction on using the lenses and accessories, see the section on the L2 Scope.

Parts and Assembly of the ProScope HR

The ProScope comes with a USB cord attached to its bottom, a software installation disc, and one or more lenses.
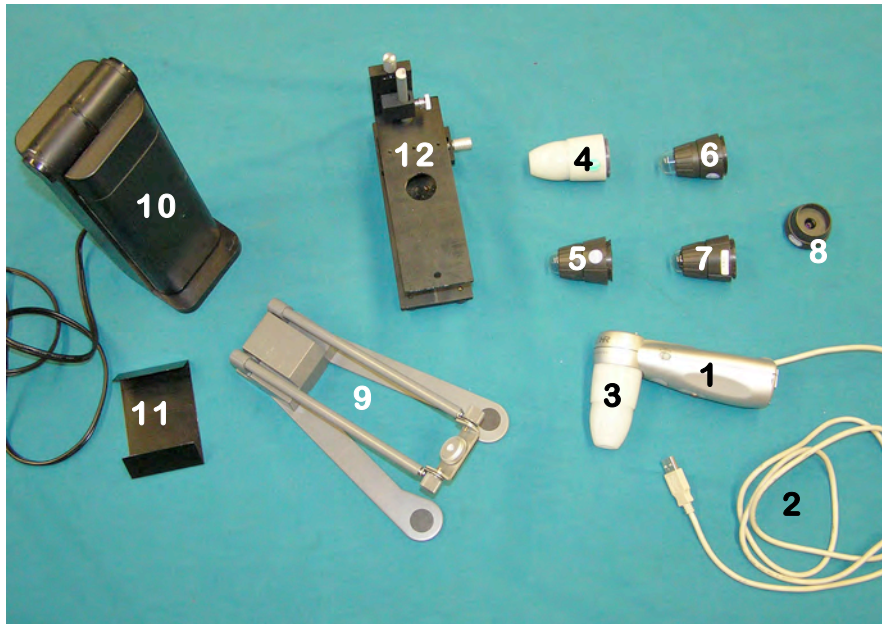
1. ProScope
2. USB cable
3. 50X lens
4. 30X lens
5. 200X lens
6. 100X lens
7. 400X lens
8. 1X lens
9. Stand
10. Lamp
11. Lamp shade
12. XYZ stage

Setting Up and Turning on the ProScope HR

1. Insert the installation disc into your computer. Follow the instructions provided for downloading the ProScope HR software: (a) Click on "Windows" or "Macintosh." (b) Click "install." (c) A Proscope HR icon will appear on your desktop (along with a Quicktime Player icon, if not already installed on your computer). Note: If you have the old ProScope HR software, it only works with Windows XP up to Service Pack 2. If you have Service Pack 3, then you will need to download and install the free upgraded software version from this website: *http://www.bodelin.com/proscopehr/support_proscopehr*.

2. Connect the scope's USB cable to a USB port on your computer.

3. Then, click on the Proscope HR icon on your desktop.

4. Find the light switch on the side of the scope and put it on the "A" setting.

You are now ready to begin "scoping"!

Lenses and Setups

The lenses and setups for the ProScope are identical to those for the L2, described in the earlier section "Comparing and Installing Lenses."

How to Use the ProScope HR and its Software

When you begin using the ProScope, it's best to begin with the 50X lens; it's the lens that comes with all kits. Just remember some basic rules to share with your students:

- Never immerse the lens tip in a liquid
- Never touch anyone's eye or mouth with the lens tip
- Never point the lens at someone's eye
- Take proper precautions to avoid spread of infection

After setting up your scope, make sure the software is running. If there are no lights shining in your lens, check to be sure that the light switch is on "A." To get a focused image on the screen, you must touch the lens tip to the item you wish to view. It's that simple! Since the actual lens is inside the plastic housing, you cannot damage it by touching objects to the tip. Just remember the basic rules listed above.

Note: Holding the tip of the lens flat against the object will give you the best image.
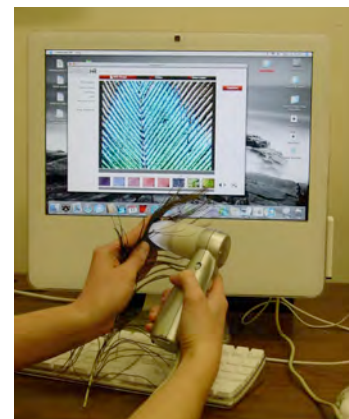
Saving Images with the ProScope HR

The ProScope HR software allows you to save images, movies, and time-lapse videos. The tabs at the top of the screen allow you to select which format you want. To capture pictures, make sure the "Still Image" tab is selected; it will appear red (instead of black). While holding the tip of the lens on your object of choice, click your mouse on the "Capture!" button on the upper right-hand side of the screen to save your image. You can also take pictures by pressing the white button located on the bo.y of the scope just below the lens.
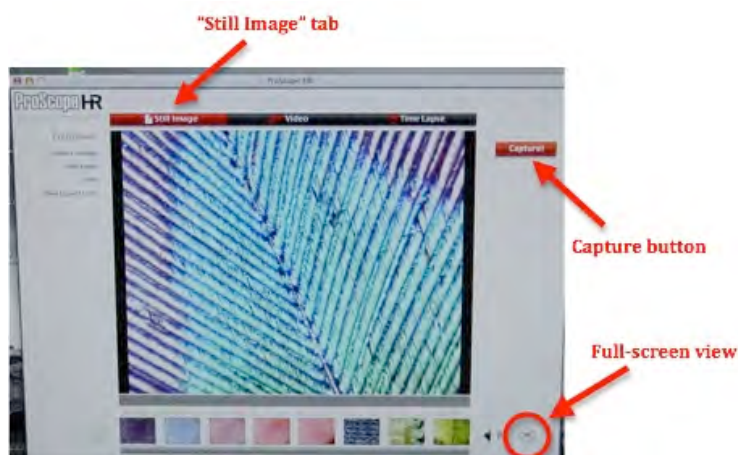
Thumbnails (smaller versions) of captured images appear on the bottom of the screen. Click on any of them to view the picture at full size. Click on the arrows to the right of the thumbnails to scroll through all your images. To return to live mode, click on the image window (you will then see whatever the scope sees).

On the Macintosh computer, you can change to full-screen view by clicking the small button on the bottom right-hand corner of the screen. Press any key on your computer keyboard to exit full-screen mode.
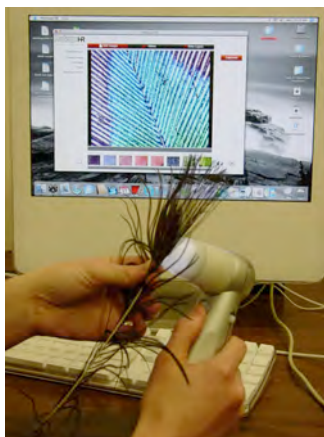
Switching to full-screen mode

Using the ProScope HR as a Video Camera

To use your scope as a "video camera," click on the "Video" tab at the top of the screen. To start recording, click on the "Capture" button (or press the button on the handle of the scope). To stop recording, click on the "Capture" button (or scope button) again.   To play and watch your video, go to the thumbnails at the bottom of the screen, click on the video, and then click on the "play" button.

To record a time-lapse movie, click on the "Time Lapse" tab at the top of the screen. To start recording, click on the "Capture" button (or press the button on the handle of the scope).   To stop recording, click on the "Capture" button (or scope button) again.   To play and watch your time-lapse move, go to the thumbnails at the bottom of the screen, click on the video, and then click on the "play" button.

To set up your preferences for the time-lapse movie, go to the left-hand side of the screen where it says "Preferences," and click on "Time Lapse Movies." From there you will choose how many total pictures you want to record (where it says "Recording Count").   Then, under "Recording Interval," you will note how often you want a "snapshot" to be taken—such as one shot every 30 minutes, one shot every hour, etc. [The "HH" indicates hours, the "MM" indicates minutes, and the "SS" indicates seconds.]

As an example, if you set it up to capture 55 pictures, one picture every minute, you must wait 55 minutes for the process to complete. After it completes, the software automatically combines those images into a movie that you can play back. You have to leave the scope set up and stationary (the stand works best) for the full duration of the capture. Usually this is done over a number of hours or days in order to capture something that moves or changes very slowly.

You will also find other options under the "Preferences" heading. From these menus, you can select how you'd like your images saved, set the length of your videos, etc.

To change the preferences for each capture mode (still image, video, or time-lapse), select the options on the left side of the screen. From these menus, you can select how you'd like your images saved, you can make all captured movies a certain length, and you can set up the recording interval for time-lapse videos.

Troubleshooting

A. No picture appears on the computer.

  1) Check that the USB cord is plugged into the computer and that the computer is on.

  2) Make sure that the ProScope HR software is running. (You'll need to have installed the program from the installation disc included in the kit.)

  3) Check that the light switch is set to position "A" and that lights are coming out of the lens.

 Refer to the Troubleshooting section for the L2 scope for other issues.

Information and Features that Apply to all Models

This section contains information and features that apply to all of these models: LSU VL-7EX ("old" SOAR), LSU VL-7EX II ("new" SOAR), L2, and ProScope HR.

Capturing Digital Images and Movies

The ProScope HR is a digital microscope, and information on capturing images with it is included in the previous section. Both the Old and New Scope-On-A-Rope and the L2 Scope are analog scopes, meaning that they connect to a television or video projector through a yellow, video cable. Although the benefits of using these analog scopes are outlined in the beginning of this guide (page 3), many teachers would like to be able to save their images and videos on a computer. Fortunately, any "TV" scope can be connected to a computer through the use of an analog-to-digital converter. This converter digitizes the video signal so a computer can recognize it. There are many types of converters, and they can be found in electronics stores or by searching the web. Two examples are shown below:


The converter shown on the left is included in many of the scope education kits sold by School Technology Resources *www.schooltr.com*. It has a place to plug in the yellow, video cable of the scope on one end of the device, and a USB cable for insertion into a computer. As with most converters, it comes with software and instructions on how to install and use it. These instructions include how to capture images.

Pictured on the right is the converter used to capture all the scope images in this book. It works the same way as the previous converter, except that it connects to the computer via a firewire cable instead of a USB cable [Firewire and USB cables are methods of transferring information between digital devices]. This converter was used to capture video clips in iMovie, a free program for Macintosh computers. The pictures seen in this book were taken from such video clips.

How to Use the XYZ Mechanical Stage

The "New" Scope-On-A-Rope, L2, and ProScope education kits come with a mechanical stage. It is particularly useful for viewing water samples and slides. It can be used with any lens, but it was designed primarily for use with the 200X lens. It is called an XYZ mechanical stage because it has knobs that allow you to move a sample in three planes: left to right (X axis), towards you and away from you (Y axis), and up and down (Z axis).
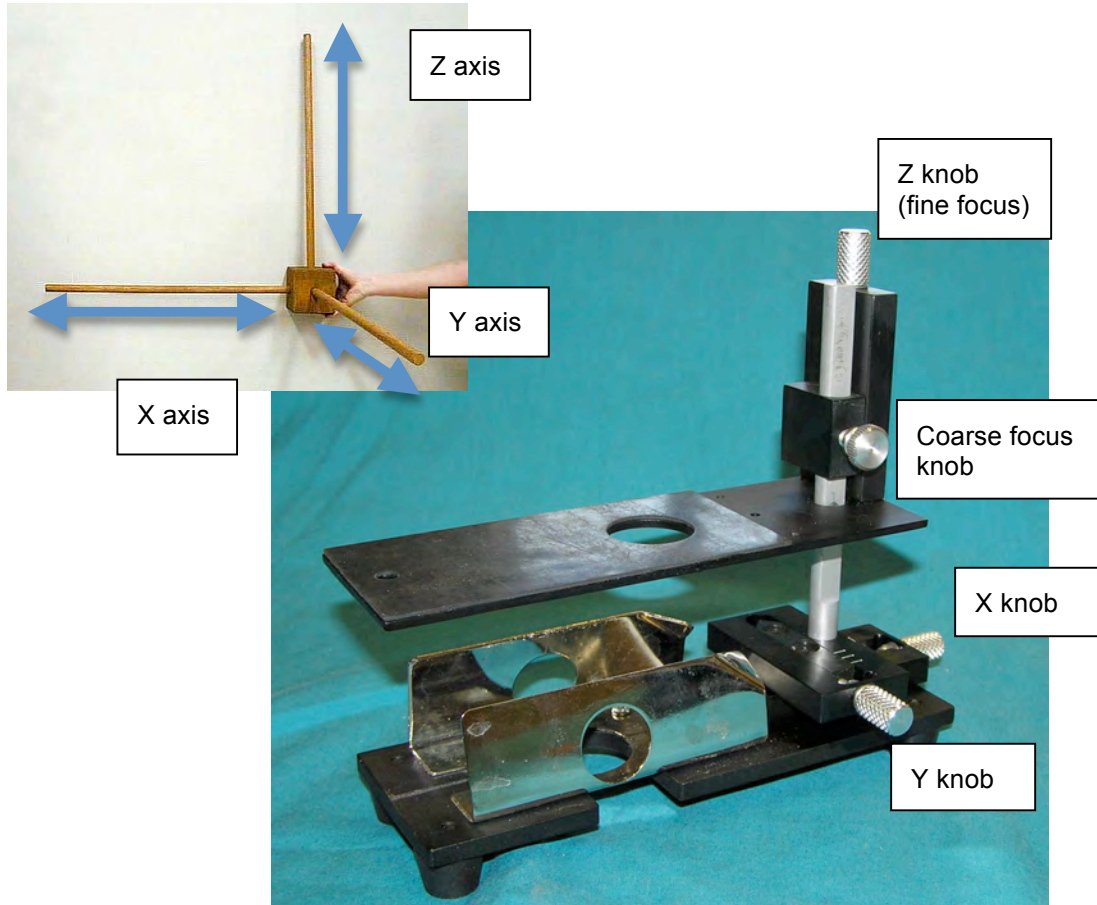
To use the stage with the 100X, 200X, or 400X lens, follow these directions:

1. Turn the focus knob of the lens clockwise until it is almost flush with the lens housing (it will feel tight).

2. Loosen the coarse focus knob on the stage to raise the stage platform as high as it will go. [A coarse focus knob makes larger adjustments to the focus; a fine adjustment knob makes very small adjustments to the focus.] Then tighten the knob to hold the stage in place.
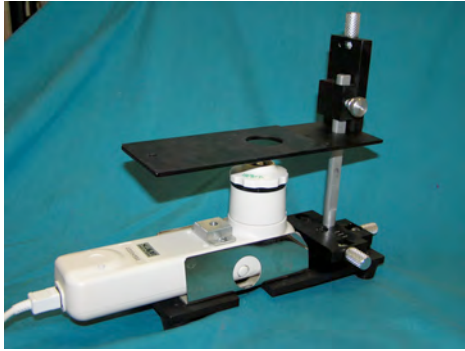
3A. If you have a Scope-On-A-Rope, slide the scope with the lens facing up into the metal holder on the base of the stage. The lens should be underneath the hole in the stage platform.

3B. If you have the L2 or the Proscope, the XYZ stage will be different (instead of a metal holder, a screw is used to hold the scope in place). Locate the screw attachment on the back of the scope and the screw on the bottom of the stage. Place the scope face up onto base of the stage and screw it onto the base to secure it in place. The lens should be underneath the hole in the stage platform.
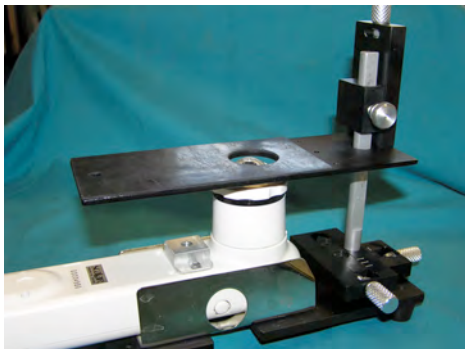
4. Loosen the coarse focus knob again to lower the stage so that it is just above the lens (almost touching it). Tighten the knob to hold it in place.

5. Place the slide (or other object you'd like to view) on the stage platform over the hole. To focus your image, use the Z knob to move the stage up and down. This is similar to using a fine focus knob on a traditional microscope. If you can't get your sample into focus, try adjusting the coarse focus knob. You'll find that with practice you will become proficient in operating the stage controls.

6. Once the proper lighting and focus have been achieved, use the X and Y knobs to move your sample from right to left and backwards and forwards, respectively.

Lamp and Light Blocker

You may need to provide additional lighting to get the best image of your object, especially if it's a water sample. Use the lamp and light blocker included in your scope kit to achieve optimal lighting. Slide the light blocker onto the lamp, place the lamp over your sample, and adjust the position of the lamp and/or blocker until you get the desired image.
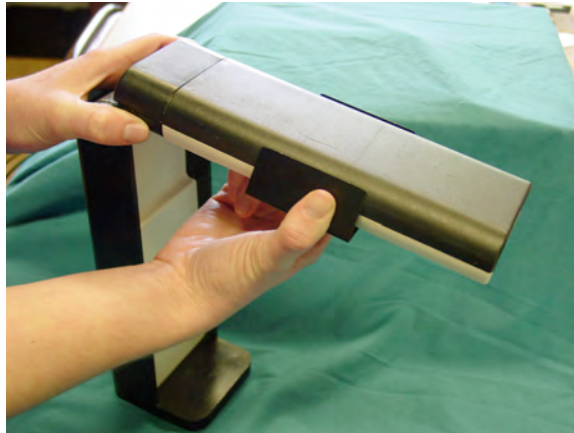
The light blocker allows light to strike the object from sides, but not directly overhead


Water sample without lamp

Water sample with lamp and light blocker. Colors in the sample are much more clearly seen.

How to Prepare Slides

These hand-held scopes are not water resistant, so care must be taken when viewing aquatic samples. There are many activities that can be done with the scope that involve wet samples (pond water, cheek cells, etc.), so detailed instructions are included below on how to make slides. For elementary students, we recommend using either plastic Petri dishes (30-60 mm diameter) or deep well slides (described below). Both are included in the Scope Manual Material Kit, and they also can be ordered from a variety of science education supply catalogs.

A. The Deep Well Slide

These plastic slides are perfect for use with the hand-held microscope! The depressed, circular area in the center holds a few drops of water and other small objects, such as algae. It has a 1-2mm thick ridge with a cover, so your organisms do not get crushed and the water does not spill out! Organisms can live in a deep well slide for as much as a week, as long as the water does not dry up and you have some plant matter inside of it to produce oxygen.
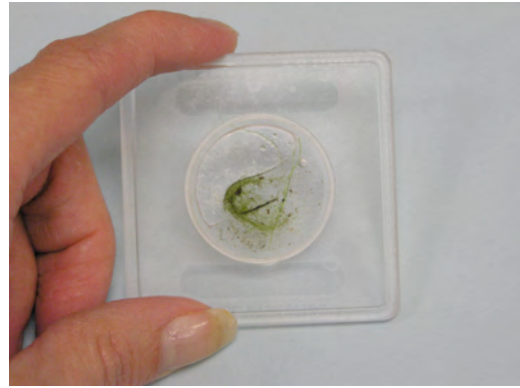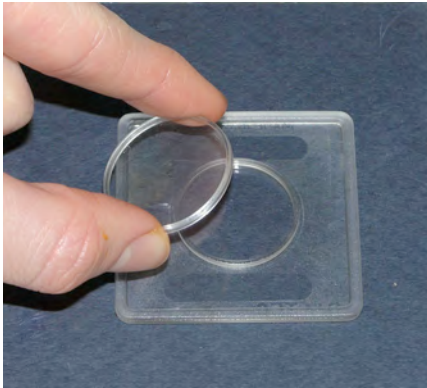
B. The Petri Dish Sandwich

Since not everyone has deep well slides handy, Petri dishes are a good alternative. You can "sandwich" your specimens in between the cover and the bottom of the dish to create a slide. Just place your sample (a few drops of pond water, onion skin, etc.) inside the lid of the Petri dish. Then cover it with the bottom of the dish, creating a sandwich. There are small ridges inside the lid of Petri dishes, so your organisms will not get crushed in this setup either. Care must be taken when using a Petri dish, as water will spill out if it is disturbed.
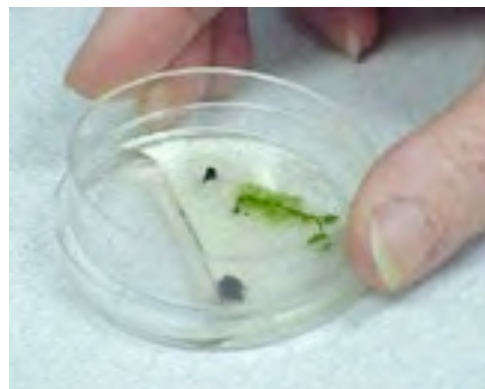

Care & Maintenance

General

Your scope should give you years of successful use, as long as you follow some basic rules of use. There are a few tips that will ensure its optimal performance and longevity.

- Follow the safety rules for using the scope: never immerse the lens tip in a liquid; never touch anyone's eye or mouth with the lens tip; and take proper precautions to avoid the spread of infection (e.g. don't touch mouths, scabs, or open wounds).

- Always store the scope with a lens on to prevent dust and/or moisture from accumulating on the camera chip.

- Store all pieces in a safe place when not in use, as lenses and other small parts are frequently lost.

Cleaning

When using your scope, the lenses might get dirty, and/or dust might collect on the camera chip. To clean your scope:

1. With the scope off and unplugged, you can use a dry cloth to wipe any dirt or dust that has collected on the scope. It is not advisable to use a damp cloth, as water could get inside of the scope and damage the electronic components.

2. The tip of most lenses cannot be removed, but you may carefully wipe the plastic tip with disinfectant, if needed. Just be careful not to drip any liquid inside the hole in the lens tip! (Note: If you have the new or old SOAR, the tip of the 30X lens can be removed for cleaning.)

3. If you find that your images have the same dark spots no matter what sample is viewed, you most likely have dust accumulated on the camera's chip. These specks are usually so small that they are only visible when using the 200X lens. To clean the chip:

    a. Remove the lens from the scope so that you can see the green camera chip in the scope.

    b. Get a condensed air canister, such as what is used to clean keyboards (most scope education kits come with one).

    c. Hold the air canister <u>upright</u> and bend the tube to blow air onto the chip. DO NOT TILT THE CANISTER OR MOISTURE WILL COME OUT AND RUIN YOUR SCOPE!

    d. If there are still visible dark spots on the screen, you can LIGHTLY brush off these particles from the green chip with a cotton swab.
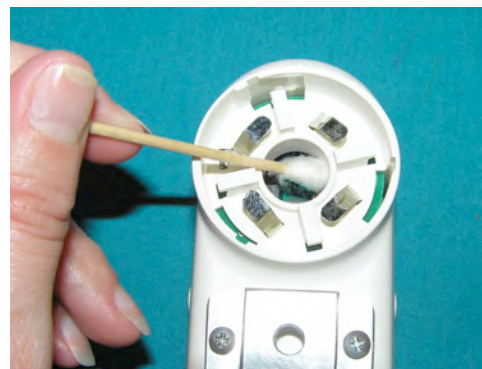
Stand

The screws at the bottom of the stand loosen over time with use. The stand should be able to be placed at any angle and stay where it is placed. If the stand begins drooping–that is, if it won't stay where you put it–you probably need to tighten it. To tighten, all you need is two coins (pennies work best). Place a coin in the slot of each screw and turn the right screw away from you while turning the left screw towards you.

XYZ Stage Care & Maintenance

Over time and with use, you may find that the XYZ stage is wobbly when trying to focus an image with the 200X lens. If the stage seems to wiggle a lot, especially when adjusting the focus using the Z knob, you need to tighten the mast. The mast is the long metal cylinder that holds the stage in place over the scope. There are two screws at the base of this cylinder that keep it in place. First, remove the stage from its base (loosen the coarse focus knob and slide the stage off the mast). Then use the hex wrench tool included with your XYZ stage to gently tighten the two screws at the base of the mast. Be careful not to tighten the screws too much, though, because they will make the X knob too tight to move fluidly.
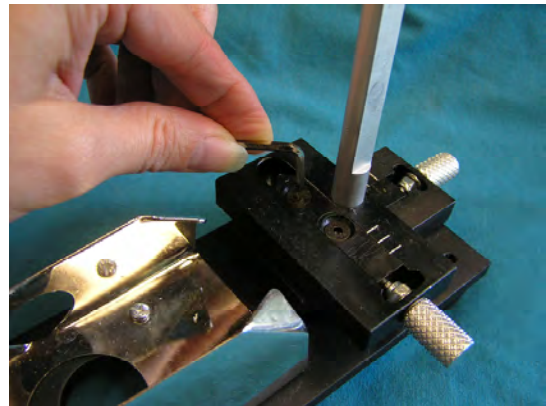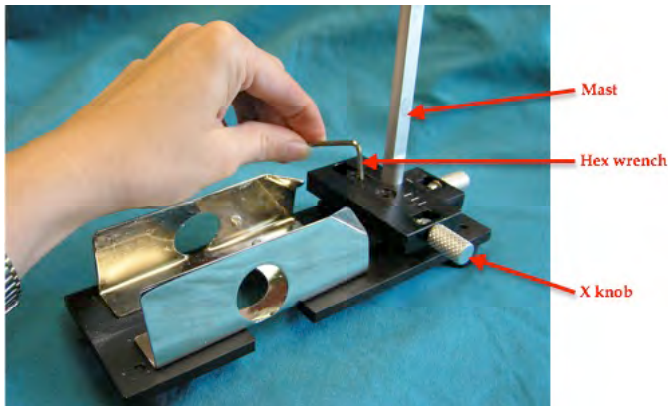
If the X or Y knobs become too hard to turn, you can loosen (or tighten) the bolt using the other tool that was included with your XYZ stage: