

**X-Mag<sup>TM</sup>**

High-Magnification Workstation  
User's Guide

[www.FSInspection.com](http://www.FSInspection.com)

440831-001 Revision A

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## Safety and Maintenance

To keep the unit in good condition and to ensure safe usage, observe the following guidelines:

- Read the instructions in this user's guide before attempting to use the unit.
- Do not attempt to repair the unit or open its case. This product contains no user serviceable parts.
- Do not attempt to modify the remote control. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- Keep the unit away from wet areas, rain, and other sources of liquids or high humidity. Do not submerge the unit.
- Always operate the unit in a place where the temperature is between 10° and 40° C (50° and 104° F).
- Always store the unit in a place where the temperature is between -20° and 65° C (-4° and 149° F).
- Always use the unit on a stable, level, hard surface such as a desk or table.
- When cleaning the screen, camera lens, or close-up lens, unplug the power cord and apply a small amount of non-abrasive cleanser, such as the following, to a soft, lint-free cloth and gently wipe:
  - Water
  - Isopropyl alcohol
  - Petroleum benzene
  - Vinegar mixed with water at a concentration of no more than 10 percent vinegar, for example, 1.5 tablespoons of vinegar per cup of water (100 ml per liter)

### **CAUTION:**

Do not apply excessive pressure to the screen, camera, or close-up lens. Do not spray cleanser directly on these items. Also, do not use any cleanser that contains the following agents: acetone, ethyl alcohol, ethyl acid, ammonia, or methyl chloride.

When cleaning the rest of the unit, make sure the unit is unplugged. Use a lightly dampened, soft, clean cloth with water or mild detergent.

## Soldering Under the X-Mag Camera

If soldering under the X-Mag camera, cross ventilation must be employed to prevent fumes and heat from rising vertically toward the camera. Maintain a minimum distance of 12 inches (30.5 cm.) between the heat source and the camera.

## Federal Communications Commission (FCC) Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio or television technician for help

**CAUTION:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## Industry Canada (IC) Compliance Statement

CAN ICES-3(B)/NMB-3(B)

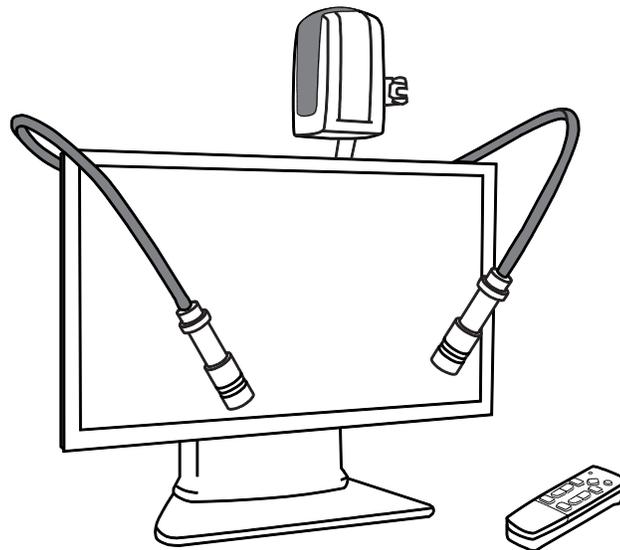
## Regulatory Compliance

RG-2: **CAUTION:** Do not stare at exposed lamp in operation. May be harmful to the eyes.

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The X-Mag™ allows detailed inspection of circuit boards, integrated components, and other intricate items. With its adjustable camera and high-intensity lighting, you can easily view objects from various angles and see it all displayed on a large LCD monitor. This ergonomic design reduces eye strain and fatigue by not having to peer through an eyepiece or large ring magnifier. In addition, its integrated carrying handle makes it very easy to move from one area of an inspection room to another.



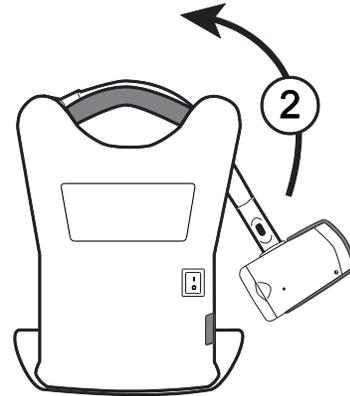
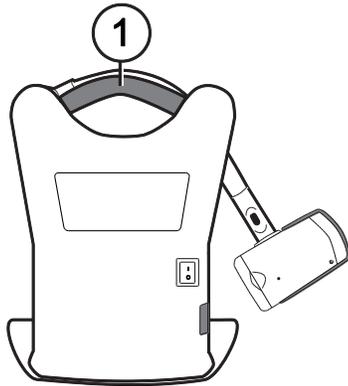
The unit includes the following features:

- High-definition camera that displays high-quality images
- Magnification from 1.7x to 96x (24-inch monitor), 1.5x to 87x (22-inch monitor), or 1.4x to 78x (20-inch monitor)
- Auto Focus creates the clearest view without any need to make adjustments
- Continuous zoom and manual focus
- Adjustable LED light intensity and screen brightness using remote control
- Four default color modes; 29 configurable color modes
- Adjustable Reference Lines to emphasize an area displayed on the screen
- Freeze Frame to capture the current image on screen for further analysis
- Find function to briefly zoom out and easily locate the center of the object displayed on the screen
- Large LCD flat panel monitor for improved physical ergonomics
- Camera arm rotates 330 degrees; camera tilts 315 degrees and swings 180 degrees

## Setting Up the Unit

Use the following procedures to set up and power on the unit.

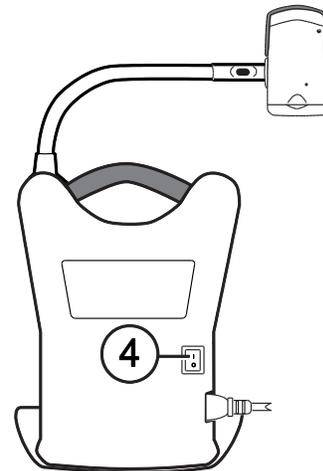
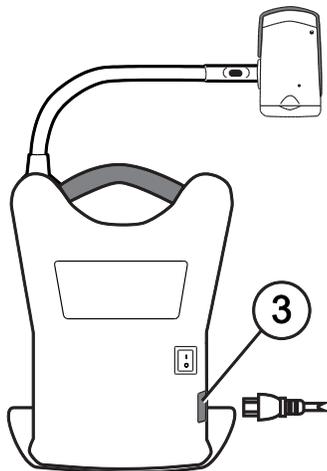
1. Use the unit's carrying handle to place it on a sturdy, stable work surface.
2. Raise the camera arm until it locks in the upright position.



3. Connect the power cord to the unit and an AC outlet.
4. Flip the main power switch on the back of the unit to power on both the monitor and the camera.

The green Power LED on the bottom of the camera indicates there is power to the unit.

After a moment, the LED lights turn on. The lights return to their same brightness if you have made previous adjustments.



5. Adjust the monitor tilt by holding the left and right sides of the monitor, and then gently tilting it forward or backward until it reaches a position that is comfortable.

## Powering the Unit Using the Remote Control

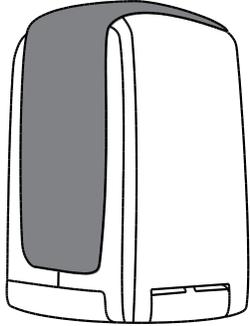
Press the green **POWER** button  to power the unit on and off. When the camera is on, a green LED on the bottom of the camera is lit.

If an image does not display on the screen, try the following:

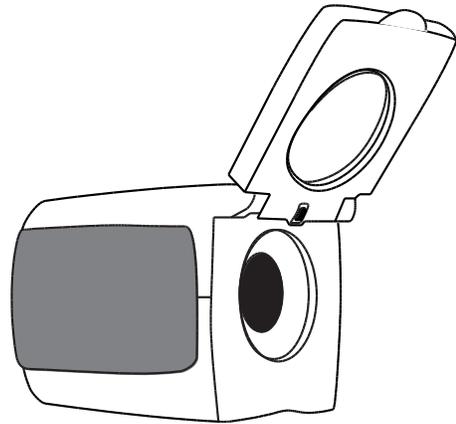
- Flip the main power switch on the back of the unit to the On (I) position
- Press  on the remote control and make sure that its LED flashes red
- Make sure the power cord is connected to the unit
- Make sure the power cord is plugged into a power outlet
- For more solutions, refer to *Troubleshooting* on page 14

## Positioning the Camera

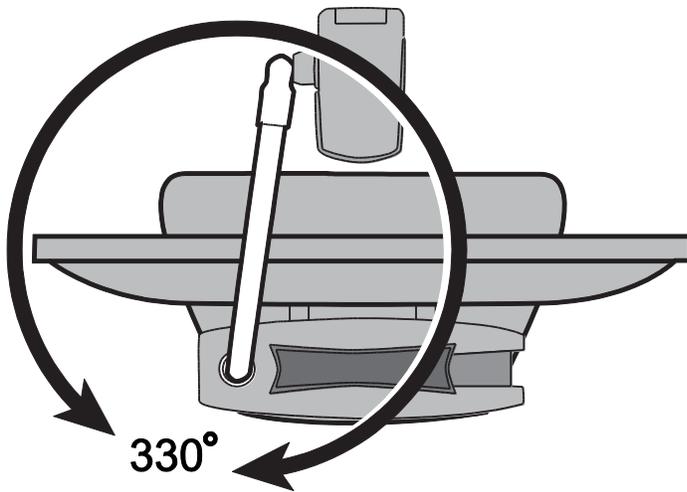
For inspecting items placed under the camera, keep the close-up lens closed and the camera pointing down.



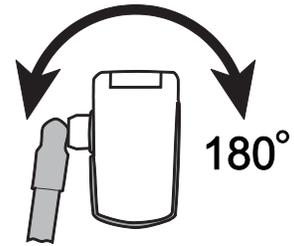
For long distance viewing, keep the close-up lens open.



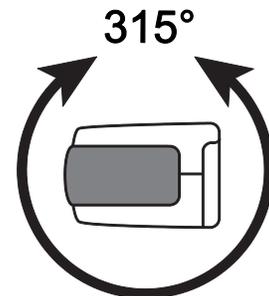
## Rotating and Tilting the Camera



Camera arm rotates 330°



Camera arm joint swings 180°

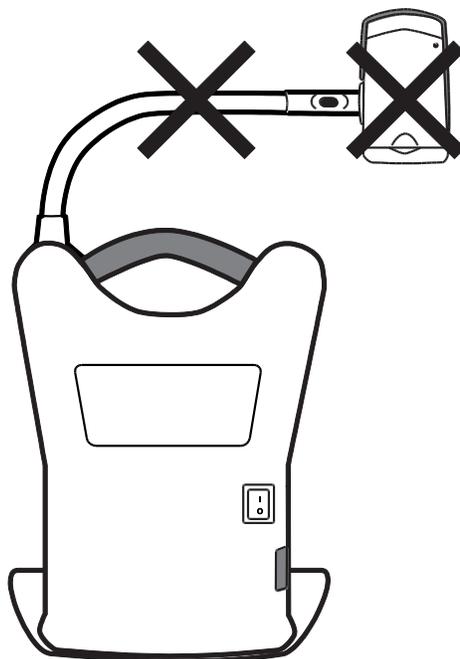
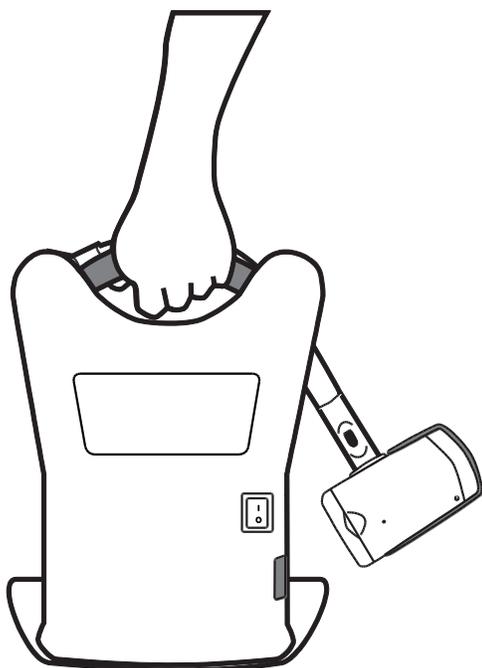


Camera tilts 315°

## Carrying the Unit

The unit has an integrated handle that makes it very easy to transport. When carrying the unit, always lower the camera arm first as shown in the next figure.

**Important:** Never move or carry the unit by the camera arm or camera.



The following describes how to quickly adjust focus and lighting of an object that you want to magnify. You can also use additional functionality such as manual focus and color contrast to fine-tune your inspection process.

**Before you begin**, raise the camera arm and power on the unit as described on page 2.

**Note:** When the unit powers on, the LED lights automatically turn on. The lights return to their previous intensity.

1. Place the object that you want to magnify onto the work surface directly below the camera so that it displays on the monitor's screen.

Make sure the camera is pointing down, and that the close-up lens is closed. Make any position adjustments necessary to both the camera and the object.

2. Press  or  on the remote control to zoom in or out and change the size of the image displayed on the screen. The magnification value briefly displays when you release the button.
3. When viewing objects of varying depth, you can manually adjust the focus by doing the following:
  - Press . The Lock icon  displays on the screen.
  - Press  or  to fine-tune focus on a specific area of the object
  - To turn off manual focus and restore automatic focus, press  again.
4. Move the unit's LED lights to provide the best illumination of the object that is displayed on the screen.
  - Slide the head of the LED lights forward to increase brightness
  - Slide the head of the LED lights back to decrease brightness

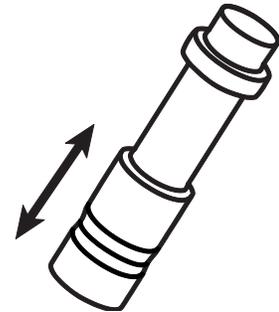
(See page 7 for more about adjusting LED lights.)
5. To adjust contrasts, press  to cycle through the four default color modes: true full color; black on white grayscale; and black on white (high-contrast positive). For more information about color modes, see page 8.
6. Finally, if necessary, you can adjust screen brightness by pressing  or .

This section describes how to change magnification and screen brightness, adjust LED lighting, locate objects, manually adjust focus, and more using the remote control.

## Adjusting LED Inspection Light Brightness

The unit has two LED lights that can easily be moved to provide the best illumination of the magnified object. When you power on the unit, the lights automatically turn on.

- To increase brightness, slide the head of the light forward until it shines a narrow, more intense beam of light.
- To decrease brightness, slide the head of the light back until it shines a wider, less intense beam of light.
- You can also move and aim both lights for better illumination. By raising, lowering, or changing the angle of the lights, you can eliminate glare and shadows on the object you are viewing.

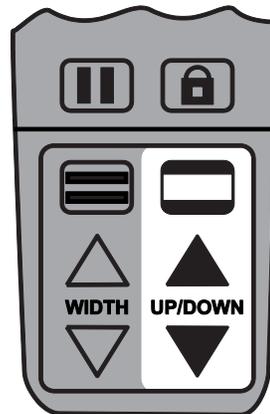


## Adjusting LED Inspection Light Brightness by Remote Control

To turn lights on or off, press .

To adjust brightness, do the following:

- Press  to increase brightness.
- Press  to decrease brightness.



## Changing Magnification

- Press  to zoom-in and enlarge the object that appears on the screen.
- Press  to zoom away from the object on the screen.

The magnification value briefly displays when you release the button. Due to tolerances in object height and camera location, this indicator is approximate.

## Adjusting Screen Brightness

- Press  to make the image lighter.
- Press  to make the image darker.

## Changing Color Modes

Press  to cycle through and select different color modes.

A color mode is a pre-defined color combination. You can use color modes to reduce glare and provide contrast. The unit has four default color modes:

- True Full Color – always available, cannot be deleted
- Black on White Grayscale
- Black on White (high-contrast positive)
- White on Black (high-contrast negative)

You can also activate up to 29 additional color modes. For a complete list, refer to *Color Modes* on page 12. To add more color modes, refer to *Adding and Removing Color Modes* on page 12.

## Freezing an Image

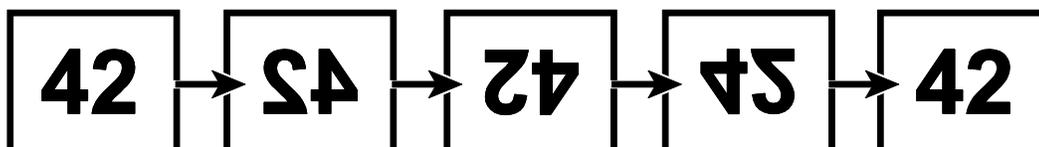
1. Press  to freeze the current image that appears on the screen. The Freeze Frame icon  displays on the screen.
2. Press the button again to turn off Freeze Frame and return to the camera's live view.

**Note:** To eliminate any screen vibration caused by an unsteady workbench, press . When you turn off Freeze Frame, automatic focus is restored.

## Flipping an Image

With the X-Mag camera, you can change the screen orientation so that the image is flipped and mirrored both horizontally and vertically.

Press  to cycle through the four different picture orientations.



## Using Focus Lock

Focus lock keeps the camera focused on the object being inspected rather than your hand, a tool, or any other item that passes in front of the camera.

1. With an item placed under the camera, press  or  to adjust magnification.
2. Press  to turn on Focus Lock. The Focus Lock icon  displays on the screen. The camera's focus setting will not change meaning that an object moved closer to or farther away from the camera lens will be out of focus.
3. Press  again. Focus Lock turns off, and the camera returns to normal operation.

## Using Manual Focus

By default, the camera automatically focuses on the closest object in view. However, when viewing a three-dimensional object, you can press  or  to adjust the focus on specific areas of the object. For example, this is useful if you are looking at a chip on a circuit board and you first want to inspect the solder joints, and then adjust focus to view the top or other areas of the chip. Manual focus allows for great flexibility when viewing items of varying depth.

To use manual focus, do the following.

1. Press . The lock icon displays on the screen.
2. Press  or  to focus on a specific area of the object.
3. To turn off manual focus and restore automatic focus, press  again.

## Reference Lines

Horizontal or vertical lines can be displayed on the screen while viewing an object on the screen. The buttons that control reference lines are located under the button cover at the bottom of the remote control.

To display reference lines, do the following:

1. Press  to display two horizontal lines.
2. Press it again to display two vertical lines.
3. Press it a third time to display none.

To move reference lines, use the white and black arrow buttons as described below.

Press ...	To ...
	Move the bottom horizontal reference line up the screen. Move the right vertical reference line to the left.
	Move the bottom horizontal reference line down the screen. Move the right vertical reference line to the right.
	Move both horizontal reference lines up the screen. Move both vertical reference lines to the left.
	Move both horizontal reference lines down the screen. Move both vertical reference lines to the right.

## Aiming with High Magnification

The Find feature allows you to quickly zoom out, aim the camera at another area of an object, and then return to the previous magnification level.

1. Press and hold .

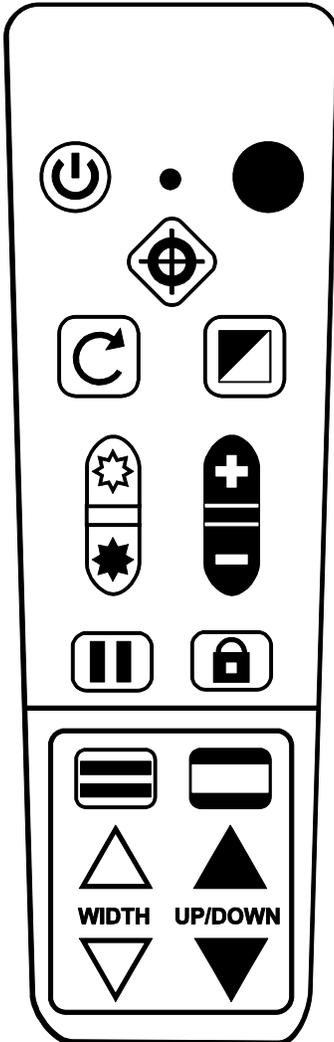
Crosshairs display on the screen (indicating the center of the image on the screen), and the camera zooms out.

2. While still holding the button, move the camera or the object until the crosshairs shown on the screen align with the area that you want to view.

3. Release .

The camera zooms in to its previous magnification level and the crosshairs turn off.

## Remote Control Functions



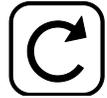
**Power (Green)** Powers unit on and off



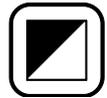
**Advanced (Black)** Use in combination with other buttons to perform advanced tasks. Always press and hold this button first, and then press another button to perform the task.



**Find (Red)** Displays crosshairs and zooms out to help aim the camera



**Flip (Light Blue)** Cycles through four different picture orientations



**Color Mode (Blue)** Cycles through different color modes



**Brightness (Yellow)** Changes screen brightness



**Zoom (Black)** (1) Zooms camera view in and out when Auto Focus is on; (2) Adjusts manual focus when Auto Focus is off



**Freeze Frame (Red)** Freezes the current image displayed on the screen



**Focus Lock (Orange)** Turns Auto Focus on and off



**Reference Lines (White and Black)** Displays two horizontal or vertical reference lines



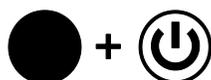
**Illumination (Black and White)** Turns LED lights on and off



**Width (White)** Increases and decreases space between reference lines



**Up and Down (Black)** (1) Moves reference lines when lines are displayed; (2) Adjusts brightness when LED lights are on



**Advanced + Power** Hold for approximately six seconds to enter or exit Configuration mode. While in this mode, you can add, remove, or reset color modes

## Color Modes

There are four factory default\* color modes and 29 additional color modes that you can activate and use.

* True Full Color (always available, cannot be disabled)	High-Contrast Full Color	* Black on White Grayscale
* Black on White (high-contrast positive)	* White on Black (high-contrast negative)	Yellow on Blue
Blue on Yellow	Yellow on Black	Black on Yellow
Violet on Black	Black on Violet	White on Blue
Blue on White	Green on Black	Black on Green
Red on White	White on Red	White on Green
Green on White	Black on Blue	Blue on Black
Black on Red	Red on Black	Violet on White
White on Violet	Black on Orange	Orange on Black
Green on Yellow	Yellow on Green	Amber on White
White on Amber	Amber on Black	Black on Amber

### Adding and Removing Color Modes

The unit has four default color modes. You can also activate and choose from a variety of 29 other color modes. Once a color mode is available, you can easily switch to it by pressing



To add or remove color modes, do the following:

1. Press and hold  first and then  for approximately six seconds to enter the Configuration menu.

The Enable check mark  displays on the screen indicating that the current color mode is active.

2. To disable the current color mode, press . An  displays and indicates that the color mode is disabled.

**Note:** True Full Color mode is always available and cannot be disabled.

3. To scroll to the next color mode, press .
  - A check mark  indicates that the color mode is enabled
  - An  indicates that the color mode is disabled

**Note:** To scroll faster through the list, you can also press  or  to move to the previous or next color mode. (The **UP/DOWN** buttons only work if reference lines are off.)

4. To enable or disable another color mode, press .
5. Repeat steps 3 and 4 to continue adding or removing color modes.
6. When you are finished, press and hold  first and then  for approximately six seconds to save your changes and exit Configuration mode.

## Resetting Default Color Modes

If you have added or removed color modes, you can always restore the unit to its four default color modes.

To do this, do the following:

1. Press and hold  first and then  for approximately six seconds to enter the Configuration menu.
2. Press and hold  for approximately three seconds.
3. Press and hold  first and then  for approximately six seconds to exit the Configuration mode.

Problem	Solution
<p>The screen is blank.</p>	<p>Make sure the main power switch is on.</p> <p>Ensure that the green Power LED for the camera is on. The LED is on the bottom of the camera.</p> <p>Make sure the power cable is correctly connected to the unit and a power outlet.</p> <p>Reduce the magnification level using .</p> <p>Try adjusting brightness using  or .</p> <p>Press  to switch to a different color mode.</p>
<p>The unit does not power on.</p>	<p>Make sure that the main power switch is in the on position.</p> <p>Ensure that the power outlets have power and are not malfunctioning. If the outlets are connected to a wall switch, make sure that the switch is on.</p>
<p>The LED lights do not turn on.</p>	<p>Press .</p>
<p>The brightness of the LED lights does not adjust.</p>	<p>If reference lines are on, press  to turn off the lines.</p> <p>Next, press  or  to adjust LED brightness. Once brightness is adjusted, press  to turn on the reference lines. The lines will display in the same place on the screen.</p>
<p>The image on the screen is too bright, or there is a glare from the screen that makes it difficult to see.</p>	<p>Slide the head of the LED lights forward or back to change brightness.</p> <p>Move the LED lights to reduce glare and improve illumination.</p> <p>Press  to reduce brightness.</p> <p>Press  to switch to a different color mode.</p>

Problem	Solution
<p>The image on the screen is too dark.</p>	<p>Slide the head of the LED lights forward or back to change brightness.</p> <p>Move the LED lights to reduce shadows and improve illumination.</p> <p>Press  to increase brightness.</p> <p>Press  to switch to a different color mode.</p>
<p>The object I am viewing is out of focus.</p>	<p>Make sure the close-up lens is closed while the camera is pointing down. See <i>Positioning the Camera</i> on page 4 for more information.</p>
<p>The image on the screen is blurry or unfocused.</p>	<p>Make sure the close-up lens is in the correct position: closed for inspection viewing, and open for distance viewing.</p> <p>Ensure that Focus Lock is off. Press  to turn Auto Focus on or off.</p> <p>Make sure the lens is clean.</p> <p>Check that the object that you are trying to view is centered on the screen. The camera might be trying to focus on something else.</p>
<p>The image is upside down.</p>	<p>Press  to invert the image.</p>
<p>There are smudges or blemishes on the screen.</p>	<p>Clean the screen using a damp, soft, lint-free cloth.</p>
<p>When I move the camera to a new position, I lose the previous position's settings.</p>	<p>This is normal operation since camera settings are saved based on the camera position. For example, if you have reference lines turned on for the downward inspection viewing position, and then change the camera to the horizontal distance viewing position, the reference lines will not appear unless you set them for that camera position.</p>
<p>Nothing happens while pressing buttons on the remote control.</p>	<p>Verify that the red LED on the remote control flashes when you press a button. If not, make sure the unit is plugged in and powered on.</p>
<p>The unit's settings are different after powering on the unit.</p>	<p>The last settings used are not preserved if you power off the unit using the power switch on the back of the unit. It is recommended that you power off the unit using the remote control.</p>

## Service and Support

You can contact Freedom Scientific Technical Support to receive technical assistance. Before contacting Technical Support, it is recommended that you refer to *Troubleshooting* on page 14 to try to resolve your problem quickly.

To contact Technical Support by Web, visit **www.FSInspection.com**, choose Support, and complete the form to submit questions.

To contact by e-mail, send questions to **Support@FreedomScientific.com**.

To contact by telephone, U.S. customers can call **(727) 803-8600**, Monday through Friday, from 8:30 AM to 7:00 PM (Eastern Time).

When you call, please have your questions ready and be prepared to provide the following information:

- Product name
- Product serial number
- What you were doing when the problem occurred
- How you tried to solve the problem

### Warranty Information

The X-Mag camera, monitor, and related accessories come with a two-year warranty against manufacturing defects.

**Note:** These devices have no user-serviceable components. Any unauthorized attempt to service or replace internal components will void the product warranty.

Please call Freedom Scientific Technical Support at (727) 803-8600 for assistance in troubleshooting any problems. If necessary, the technical support specialist will issue a Return Materials Authorization (RMA) number that must be referenced on the outside of the package containing your returned unit. The unit or its accessories will then be exchanged or repaired as needed.