



## **DM745-HDM9-3MP**

Digital Microscope for Industrial Inspection  
with 0.7X-4.5X Zoom and 9" Screen

Product Manual

## Introduction

This manual applies to the DM745-HDM9-3MP digital-integrated microscope and accessories. The information in this manual is provided to help you familiarize yourself with the assembly and use of the products. Please read thoroughly before using the products, and keep this manual with the product for reference.

## Safety

Before using your AmScope microscope, please read the following safety precautions carefully to avoid causing damage to your AmScope product, or injury to yourself or others.

**Turn off power if the instrument exhibits unusual or dangerous behavior** such as emitting smoke or unusual odors. These can be indications of electrical problems, in which case the instrument should be disconnected from any power source if safe to do so. Other indicators can be a loud buzzing sound or crackling. Contact AmScope to report such behavior.

**Do not use around flammable liquids or gases.** Electric instruments can ignite flammable substances which could result in an explosion or fire.

**Do not use in a wet environment.** Electrical components of the instrument can discharge when exposed to water, potentially resulting in damage to the instrument, or injury to yourself or others.

**Only use with the provided power adapter or an authorized replacement.** Incompatible power adapters can cause damage to the instrument. If you should lose the included power adapter, please contact AmScope for information about a replacement.

**Do not dismantle.** Dismantling can result in damage to the instrument, and potential exposure to dangerous materials or electric current.

## Notices

AmScope reserves the right to change the specifications of the hardware and software at any time without notice. Continuous efforts are made to improve performance and reliability, which can result in changes to design and compatibility. Please contact AmScope for any concerns regarding such changes.



### Proposition 65 Notice for California Residents

Cables included with the products described in this manual can expose you to chemicals including lead, which is known by the state of California to cause cancer, birth defects or other reproductive harm. Visit [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov) for more information.

Microscope Specifications	
Model	DM745-HDM9-3MP
Zoom Magnification	0.7X-4.5X
Working Distance	100mm
Camera Specifications	
Sensor	IMX335
Sensor Type	CMOS
Sensor Optical Format	1/2.8"
Integrated Reduction	0.33X
Active Pixels	4MP (2592x1536) [cropped]
Pixel Size	2.0µm x 2.0µm
Active Sensor Area	5.18mm x 3.07mm
Shutter	Electronic Rolling Shutter
Monitor Specifications	
Display Size	9"
Monitor Magnification	37.96X
Displayed Magnification	8.8X~56X
Native Resolution	1024 x 600
Aspect Ratio	16:9.375
Brightness	400 lumens

## What's In The Box

The DM745-HDM9-3MP standard outfit includes:

- One microscope with track stand and monitor
- One USB wireless mouse
- One AC power adapter
- One 32GB micro SD card
- One frosted glass stage plate

## 1. Assembly

### 1.1 Digital Peripherals



The microscope has one USB port on the right underhand side of the monitor. This is used to connect the included mouse. The microscope also has one micro SD card slot on the right side of the monitor, labelled TF-Card.

#### **Wireless Mouse**

The included mouse is required to navigate the microscope's software. Remove the battery cover on the underside of the mouse, remove any insulator strip if present, then replace the cover. A USB dongle will be inserted into a dummy slot on the underside of the mouse. Remove the dongle, and insert it into the USB port on the microscope. Locate the power switch on the underside of the mouse, and move it to the "ON" position.

#### **Storage Devices**

A micro SD card is required to save photos and other files. This microscope includes a 32GB micro SD card. Compatible storage devices will be automatically detected when properly inserted. The micro SD card is inserted into the TF-Card slot on the right side of the display with the metallic pins facing the back of the display. The card can be engaged or disengaged by pressing it into the slot until it clicks.

## 2. Operation

### 2.1 Focusing

Each side of the microscope's focusing column is equipped with a focusing knob. Rotating either knob will raise or lower the microscope's head.

Tension can be adjusted for the knobs by securing one in place, then rotating the other. Rotating clockwise will increase tension, and counter-clockwise will decrease tension.

## 2.2 Magnification



### 2.2a Zoom Dial

The zoom dial controls the magnification of the microscope by adjusting the internal zoom mechanism. The dial can be rotated in a continuous movement from the 0.7X setting to the 4.5X setting. Rotating the dial to the right will decrease the magnification, and rotating the dial to the left will increase the magnification.

### 2.2b Optical Magnification

This microscope uses a zoom optics to provide its 0.7X-4.5X magnification range. This is the optical magnification range which is typically listed. An additional 0.33X magnification stage is used to compensate for the format of the digital image sensor. This document refers to this stage as integrated reduction, since the purpose is to reduce the size of the image to better fit the specific image sensor. While this reduction stage modifies the overall magnification prior to being imaged, it is typically not referenced in listed magnifications due to its association with the image sensor. However, it should be used when calculating total system magnification as described in the following section about monitor magnification.

### 2.2c Monitor Magnification

Since the image displayed on the monitor is larger than the camera's sensor, the monitor is considered to have its own magnification referred to as monitor magnification. The magnification factor is calculated by dividing the diagonal of the on-screen image by the diagonal of the camera's sensor.

$$229\text{mm}/6.02\text{mm} = 38$$

Total system magnification includes all of these factors, and can be calculated using the formula:

$$M_{\text{OBJ}} \times M_{\text{RED}} \times M_{\text{MON}} = M_{\text{TOT}}$$

where  $M_{\text{OBJ}}$  is objective magnification,  $M_{\text{RED}}$  is integrated reduction,  $M_{\text{MON}}$  is monitor magnification, and  $M_{\text{TOT}}$  is total magnification. The low and high magnifications would be as follow:

$$0.7 \times 0.33 \times 38 = 8.8$$

$$4.5 \times 0.33 \times 38 = 56$$

### 2.3 Illumination



This microscope is equipped with an LED ring light and an under-stage LED light array to provide illumination. The ring light is fixed in place around the objective lens. The under-stage light array is fixed in place underneath the stage plate of the microscope, and it can be useable when the glass stage plate is in place under the objective rather than the plastic opaque stage plate.

The ring light's intensity is controlled by a button on the left side of the microscope labelled Inc. The under-stage light array is controlled by the button on the left side of the microscope labelled Tra. Pressing either button will step through the six light settings of increasing light intensity: off, 1, 2, 3, 4, 5.

## 3. Software

The DM745-HDM9-3MP uses internal software to manage camera and display settings, as well as to perform image-capture and measuring functions. All of these functions are accessed from the display. The software has four major menus including the main toolbar, the settings menu, the measurement toolbar, and the calibrations menu.

### 3.1 Calibration

The calibration section is used to select precalibrated magnification profiles or to define custom profiles. A magnification profile defines the relationship between camera pixels and real units of measure such as millimeters. Once this relationship is defined, any shape drawn on the screen will provide accurate measurements by translating the number of pixels into the desired unit of measure.

### 3.2 Calibration Tool

The calibration tool has two options: “Line Calibration” and “Calibration by Circle”. To select the desired tool, click on the down arrow next to the icon.

### 3.3 Profiles

Profiles are predefined for key magnifications, and can be selected for use with the corresponding magnifications to perform accurate measurement functions. When using any magnification which is not already have a profile, the calibration process must be performed to produce accurate results.

### 3.4 Units

Units defines the measurement unit to be displayed when performing measuring functions.

### 3.5 Line Calibration

To perform the calibration process, a ruler will be needed for reference. For low magnifications, a ruler with millimeter graduations is usually adequate. For high magnifications, a ruler with finer graduations may be needed, such as a micrometer slide. Place the ruler under the microscope’s lens so it can be viewed on the screen. The ruler needs to be in clear focus with multiple, clearly-distinguishable graduations visible on the screen.

Click on the ruler icon in the main panel’s calibration section. Using this tool, a line will be drawn over the image of the ruler. Click the left mouse button to create the first anchor point. As the cursor is moved, a line will be displayed. The line should span as many readable graduations as possible, and should be parallel to the ruler’s edge to improve the precision. Move the cursor along the image of the ruler until it has spanned an adequate number of graduations, then click the left mouse button again to create the second anchor point. A popup window will be displayed. Enter a name for the profile, the length of the measurement, and the current magnification. If you are not using a keyboard, double-click on each appropriate field to enable the on-screen keyboard. Once finished with the calibration, click on any measurement tool to use the profile.

Once saved, the profile will be listed in the main panel’s drop-down selector. With the profile selected, you can select the desired unit of measure to display on-screen measurements in that unit.

### 3.6 Calibration by Circle

This calibration is similar to line calibration, except it uses a circle which can be useful when referencing premeasured diameters. Click the left mouse button to create the first anchor point on the edge of the reference circle. As the cursor is moved, a line will be displayed. Move the cursor to the opposite side of the circle, then click the left mouse button again to create the second anchor point. A circle will now be displayed. Move the cursor to enlarge or reduce the size of the circle. Once the circle is properly sized, click the left mouse button. A popup window will be displayed. Enter a name for the profile, the length of the measurement, and the current magnification. If you are not using a keyboard, double-click on each appropriate field to enable the on-screen keyboard. Once finished with the calibration, click on any measurement tool to use the profile.

Once saved, the profile will be listed in the main panel’s drop-down selector. With the profile selected, you can select the desired unit of measure to display on-screen measurements in that unit.

### 3.7 Main Toolbar

The Main Toolbar contains display setting options, simple primary functions, and shortcuts to access settings and measurement menus. It also includes a display for time and date, as well as a means to set this data.

Icon or Representation	Tool or Shortcut Name	Description
	Settings	Shortcut opens the settings menu
	Snap	Saves a still image capture of the video feed as .jpg in /sd/DCIM
	Record	Begins recording a video from the video feed as .avi in /sd/DCIM
	Browser	Opens the file browser in the software to display saved images or video located on the microSD card.
	Zoom In	Increases the digital zoom on the display (maximum of 10X)
	Zoom Out	Reduces the digital zoom on the display (minimum of 1X)
	Mirror	Flip the image along the vertical display axis
	Flip	Flip the image along the horizontal display axis
	Black & White	Toggle between colour display and greyscale display
	Freeze Preview	Pauses the displayed preview
	Flags	Displays the crosshair reticle as an overlay of the preview
	Division	Splits the display into two halves
	Quarter Screen	Splits the display into four parts
	High Dynamic Range	Toggles High Dynamic Range. While active, image appears dimmer, but bright and shadowy regions appear closer to normal
	Region of Interest	Activates region of interest white balancing. Displays a rectangular overlay element that can be moved by clicking and dragging it to a new region. Size can be adjusted by using the mouse wheel within the region of interest. While active, the automatic white balance will be taken from the region of interest rather than the whole viewing area
	Auto Exposure	Toggles auto exposure
	Parameter Reset	Resets parameters across the main toolbar, settings menu, and measurement menu. Retains calibration information
	Measurement	Displays the measurement toolbar in place of the main toolbar
	Time and Date	Opens the dialog box for setting time and date. Hover the cursor over each portion of the time/date display and use the mouse wheel to set the elements individually.

### 3.8 Measurement Toolbar

The Measurement Toolbar contains measurement and calibration options, as well as simple measurement export functions.

Panel	Function	Description
		Point: marks cursor click location with a cross marker and pixel location
		Free line: draw along an arbitrary measurement path.
		Horizontal line: draw a horizontal line
		Vertical line: draw a vertical line
		Features: draw an arrow into the measurement overlay layer
		Point spacing: draw a line with an arbitrary angle
		Line spacing: draw a pair of lines, and the second will be parallel to the first
		Point line distance: draw perpendicular lines
		Angle: measure an angle
		Rectangle: draw a rectangle
		Polygon: draw a polygon
		Radian: draw an arc
		Radius circle: draw a circle using a centre point and a point on the circumference
		Two point circle: draw a circle using the end points of the diameter
		Three point circle: draw a circle using three points on the circumference
		Point circle distance: measure the distance from the center of a circle to a line
		Circular margin: draw concentric circles
		Center distance: measure the distance between the centers of two circles

	<b>T</b>	Notes: add text
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### 3.9 Additional Measurement Tools

The additional measurement tools section provides the tools necessary for managing measurement settings, capturing, and exporting measurements.

Panel	Function	Description
		Color: select a measurement or label color
		Line width: change the line width of shapes and labels
		Clear screen: removes all measurement label elements. This cannot be undone
		Screenshot: saves a snap with all overlay elements
		Export: exports a file with all measurement element values and a screenshot of the display in a .xlsx file
		Calibration selector: select a saved measurement calibration to apply to all measurement elements
		Calibrate: manage saved measurement calibrations, including creation and deletion
		Undo: undoes last created measurement element
		Home: exit measurement mode and restore main toolbar

### 3.10 The Exp&Col&Freq Panel

The Exp&Col&Freq panel provides controls for manipulating camera settings which can optimize image quality for specific subjects.

Panel	Function	Description
		Auto Exposure: automatically adjusts exposure settings.
		Bright: adjust the brightness of the image.
		Exposure: adjust the exposure time of the camera.
		White Balance: enable automatic white balance, or detect and lock the white balance level the one push
		Red: manually adjust the proportional Red level of the RGB image.
		Green: manually adjust the proportional Green level of the RGB image.
		Blue: manually adjust the proportional Blue level of the RGB image.
		Temp Color: adjust the colour temperature of the image.
		Power Frequent: adjust the set power frequency for ambient lighting between 50Hz and 60Hz.
		Reset: return this panel to default settings.

### 3.11 The Pict&Overlay Panel

The Pict&Overlay panel provides controls for manipulating picture and overlay settings which can adjust image stylization and highlight certain elements.

Panel	Function	Description
		Contrast: adjust the contrast of the image.
		Saturation: adjust the colour saturation of the image.
		Gamma: adjust the gamma of the image.
		Sharpness: adjust the sharpness of the image.
		Denoise: adjust the compensation for the noise in the image.
		Overlay Reset: deactivates and resets all overlay elements from this panel to default.
		Object: select the active object overlay object for editing.
		Width: set the line width for the active overlay object.
		Color: set the line colour for the active overlay object.
		Open All: activate all overlay objects, or toggle all overlay objects off.
	Open: toggle current active overlay object visibility.	
	Mode: select overlay preset mode.	

## **4. Image Exposure**

### **4.1 Manual Exposure**

The brightness setting is used to manually control the amount of light captured by the imaging device. Manual control is preferable when imaging light or dark specimens which do not appear properly exposed when using auto exposure.

### **4.2 Auto Exposure**

Auto exposure automatically adjusts the brightness of the image by calculating an average of light levels in the viewable area. The process attempts to adjust the brightness level until the average is approximately middle grey.

## **5. Color**

### **5.1 White Balance**

The color of an object is influenced by the color of light reflecting off of it or passing through it. Different light sources produce light with different color-biases. Common examples are incandescent lamps which typically produce warm colors compared to fluorescent or LED lamps which produce cooler colors. This sort of bias is referred to as color temperature. Due to this phenomenon, a white object may appear slightly yellow in morning sunlight, and slightly blue in afternoon shade. To compensate for these variations, digital imaging devices can process images using what is called "white balance." The white balance process shifts colors based on the color of the light source, with the goal of producing a more neutral white or grey.