PACE® TECHNOLOGIES
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VM-500 Auto Focus Digital Stereo Microscope

INSTRUCTION MANUAL

3601 E. 34th St. Tucson, AZ 85713 USA Tel. +1 520-882-6598 Fax +1 520-882-6599 email: pace@metallographic.com Web: http://www.metallographic.com

Equipment Type:	Digital Stereo Microscope
Model:	***VM-500***
Electrical Requirements:	110/220 V
Frequency:	50/60 Hz
Manual Revision Date:	June 2021
Noise Levels:	>40 dB Idle >50 dB Working

Please read this instruction manual carefully and follow all installation, operating and safety guidelines.

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WARRANTY

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1. LIMITED WARRANTY AND DISCLAIMER:

PACE Technologies microscopes and hardness testers are warranted for one year from the purchase date to be free from defects in material and workmanship under correct use, normal operating conditions, and proper application. PACE Technologies obligation under this warranty shall be limited to the repair or exchange, at PACE Technologies option, of any PACE Technologies Product or part which proves to be defective as provided herein. PACE Technologies reserves the right to either inspect the product at Buyer's location or require it to be returned to the factory for inspection. Buyer is responsible for freight to and from factory on all warranty claims. The above warranty does not extend to goods damaged or subjected to accident, abuse or misuse after release from PACE Technologies warehouse, nor goods altered or repaired by anyone other than specifically authorized PACE Technologies representatives. PACE Technologies shall not in any way be responsible for the consequences of any alteration, modification or misuse unless previously approved in writing by an officer of PACE Technologies. Note: Corrosion is considered a maintenance issue and not a warranty issue.

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PACE Technologies maximum aggregate liability for loss and damage arising under, resulting from or in connection with the supply or use of the Equipment and Consumables provided under this purchase, or from the performance or breach of any obligation (s) imposed hereunder, whether such liability arises from any one or more claims or actions for breach of contract, tort, (including negligence), delayed completion, warranty, indemnity, strict liability or otherwise, unless otherwise limited by the terms hereof, shall be limited to one hundred percent (100%) of the purchase price.

3. DELIVERY:

Customer assumes and shall bear the risk of all loss or damage to the Products from every cause whatsoever, whether or not insured, and title to such Products shall pass to Customer upon PACE Technologies delivery of the Products to the common carrier of Pace Technologies choice, or the carrier specified in writing by Customer, for shipment to Customer. Any claims for breakage, loss, delay, or damage shall be made to the carrier by the Customer and Pace Technologies will render customer reasonable assistance in prosecuting such claims.

4. ACCEPTANCE:

Customer shall inspect the Products promptly upon receipt of delivery. Unless customer objects in writing within thirty (30) business days thereafter, customer shall be deemed to have accepted the Products. All

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5. PAYMENT:
Customer agrees to provide timely payment for the Products in accordance with the terms of payment set forth on the reverse side hereof or in any proposal submitted herewith. If any payment is not paid on or before its due date, Customer shall pay interest on such late payment from the due date until paid at the lesser of 12% per annum or the maximum rate allowed by law.

6. DEFAULT:
If Buyer is in default (including, but not limited to, the failure by Buyer to pay all amounts due and payable to Seller) under the work or purchase order or any other agreement between Buyer and Seller, Buyer's rights under the warranty shall be suspended during any period of such default and the original warranty period will not be extended beyond its original expiration date despite such suspension of warranty rights.

7. MISCELLANEOUS PROVISIONS:
This agreement has been made in and shall be governed by the laws of the State of Arizona. All disputes arising under or relating to the purchase of the equipment shall be brought and resolved solely and exclusively in the State of Arizona, Pima County . These terms and conditions and the description of the Products on the reverse side hereof or in any proposal submitted herewith constitute the entire agreement and understanding of the parties with respect to this sale and supersede all prior and contemporaneous agreements or understandings, inducements or representations, expressed or implied, written or oral, between the parties with respect hereto. Any term or provision of this Agreement may be amended, and any observance of any term of this Agreement may be waived, only by a writing signed by the party to be bounds. The waiver by a party of any breach shall not be deemed to constitute a waiver of any other breach. Should suit be brought on this Agreement, the prevailing party shall be entitled to recover its reasonable attorneys' fees and other costs of suit including costs and attorneys' fees incurred on appeal or in collection of any judgment., errors, or shortage in Products delivered shall be made by Customer in writing within such five (5) business day period. Failure to make any claim timely shall constitute acceptance of the Products.

8. RESTOCKING FEE:
All Returns are subject to a restocking charge equal to 15% (fifteen percent) of the Invoice, unless the Goods are proved to be non-conformed by PACE Technologies.

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1.0 Safety Guidelines

1.1 Warning Sign

! This sign points to special safety features on the machine.

1.2 Safety Precautions

! Careful attention to this instruction manual and the recommended safety guidelines is essential for the safe operation of the ***VM-500***.

! Proper operator training is required for the operation of the ***VM-500***. Any unauthorized mechanical or electrical modifications made to the ***VM-500***, as well as improper operation, voids all warranty claims. All service issues need to be reported to the manufacturer or supplier.

! Operate unit as specified in this manual.

! Disconnect from power before opening unit.

! Ensure that any air slots on the machine remain unobstructed.

1.3 Emergency Statement

Do not attempt to service the machine without expert help. Contact your PACE representative before attempting repairs. Failure to do so could result in breaking the warranty provided with the machine.

The ***VM-500*** is a digital stereo microscope designed for capturing images of samples under light and magnification. Be mindful of surroundings and follow all operational guidelines. In the event of an injury, report to appropriate medical service.

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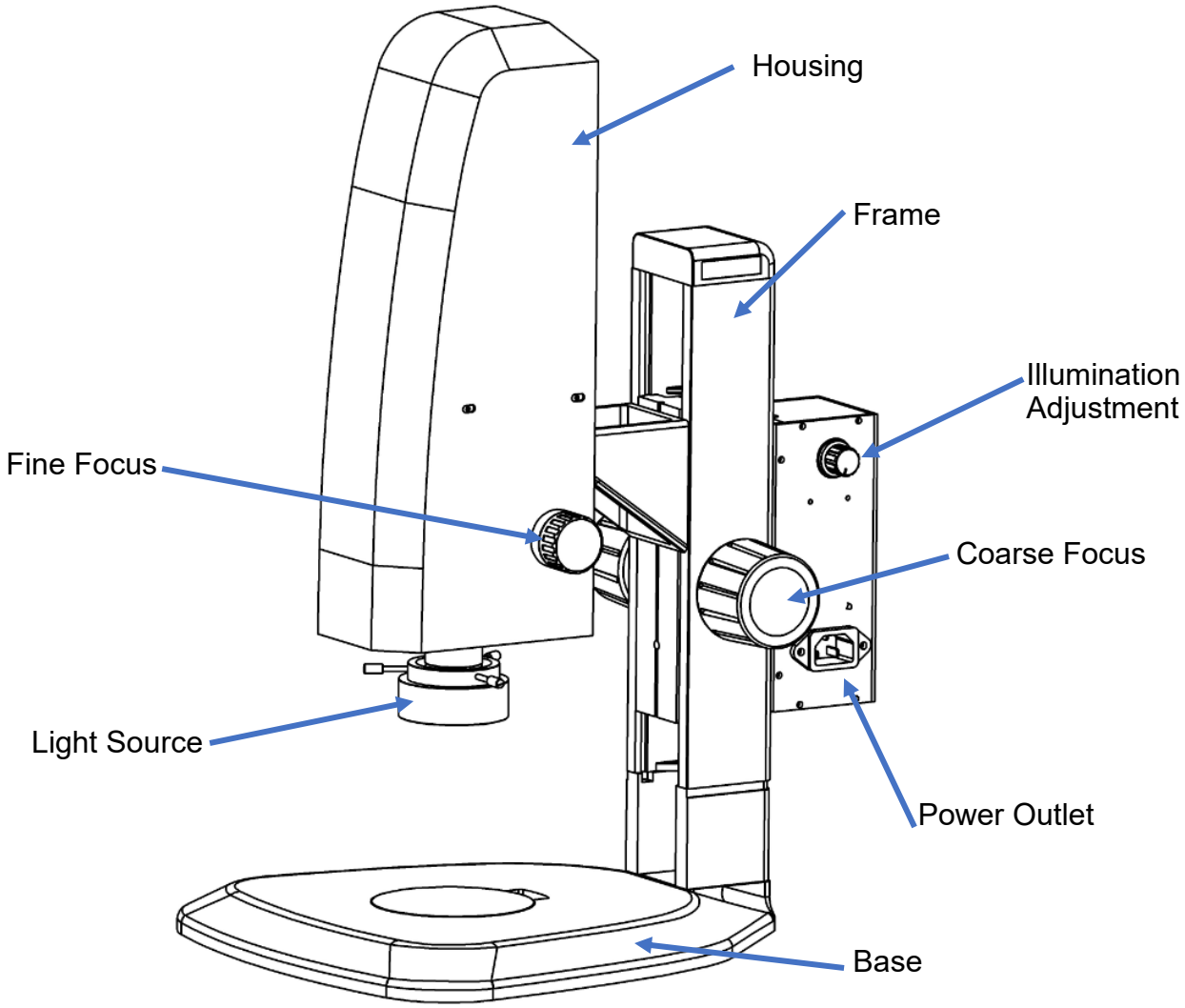
2.0 Product Description

2.1 General Description



The ***VM-500*** digital stereo microscope with autofocusing and built-in measurement capabilities has 0.7X ~ 4.5X electronic magnification with a zoom ratio of 6.5:1. High-resolution photo and video recordings are easy to obtain (includes 22-inch Full HD Widescreen LCD monitor or better) The ***VM-500*** digital stereo microscope is ideal for low magnification documentation of metallographic specimens prior to polishing and grinding. It is also very useful for measuring cracks, weld penetration depth, and other topographical features.

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2.2 Features and Benefits

The ***VM-500*** is a high-definition Auto-Focusing Digital Stereo Microscope that is capable of capturing optimal images of targeted areas. The high-definition camera communicates automatically with the included monitor for better viewing than traditional microscopes. The built-in image processing software has easy-to-use mouse controls that make the image capturing process easier and hassle-free. Use the screen image capture capability to create detailed pictures for reporting results.

High-definition close-up of a screen crack taken on ***VM-500***

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2.3 Technical Specifications

Optical Objective:	0.7 X ~ 4.5X Horizontal zoom lens Zoom ratio: 6.5:1
Camera Parameters:	2 million pixels (1920 x 1080) Image size: 1/2.86-inch Frames per second: 60 fps
Camera Function:	White balance Brightness control Digital noise reduction Photograph and video recording. HDMI/USB Output USB storage OSD: Comprehensive digital UI design Wireless USB mouse/keyboard combination
Measuring Function:	Measuring software can measure image in the field of view
Illumination:	Bottom: Adjustable LED Illumination Surface: Adjustable LED Illumination
Microscope Stand:	Z-axis Travel: 150 mm Coarse/fine lifting system
Electrical Parameters	110~240 V; 50~60 Hz
Working Temperature:	41 - 104°F (5 - 40°C)
Maximum Relative Humidity:	88°F (31°C) - 80% 93°F (34°C) - 70% 99°F (37°C) - 60% 104°F (40°C) - 50%
Environmental Information:	Voltage fluctuation: ±10% Pollution level: 2 (according to IEC664) Classification of installation voltage: II (IEC664)

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3.0 Shipping, Unpacking, and Installation

3.1 Shipping

The VM-500 is packaged in a custom box with securing foam and a horizontal crossbar. The foam and box may be discarded after the removal of the machine.

! **Caution:** Heavy sensitive electronic equipment. Take care to avoid bodily injury and damage to the unit.

3.2 Unpacking

When moving box, lift from bottom.

Measures WxHxD:	13.5 x 24 x 13-inch (343 x 610 x 330 mm)
Weight:	35 lbs (16 kg)

3.3 Installation

The ***VM-500*** should be installed on a flat and sturdy surface. Extra care should be taken to ensure the surface is secure enough to reduce any vibrations or wobbling. Excess outside motion can reduce image quality.

Locate a power outlet within range specified under Electrical Requirements in the previous section titled Technical Specifications. Plug in the supplied power cable to the wall outlet and secure the other end into the back of the ***VM-500***.

Place the monitor next to the ***VM-500***. Follow the instructions located inside the monitor box to ensure proper installation.

Plug the HDMI into the back of the monitor and then secure into the back of the ***VM-500***.

Install the two-pronged power cable into the back of the ***VM-500***.

Plug in the wireless keyboard USB receiver into the back of the unit.

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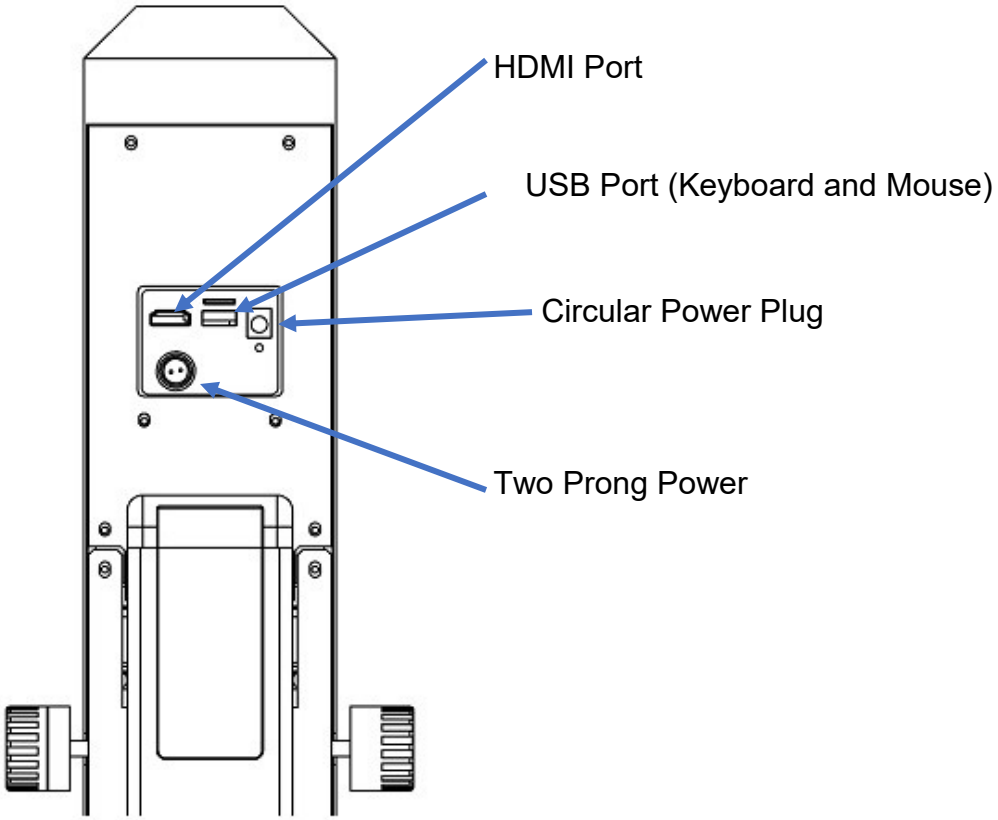
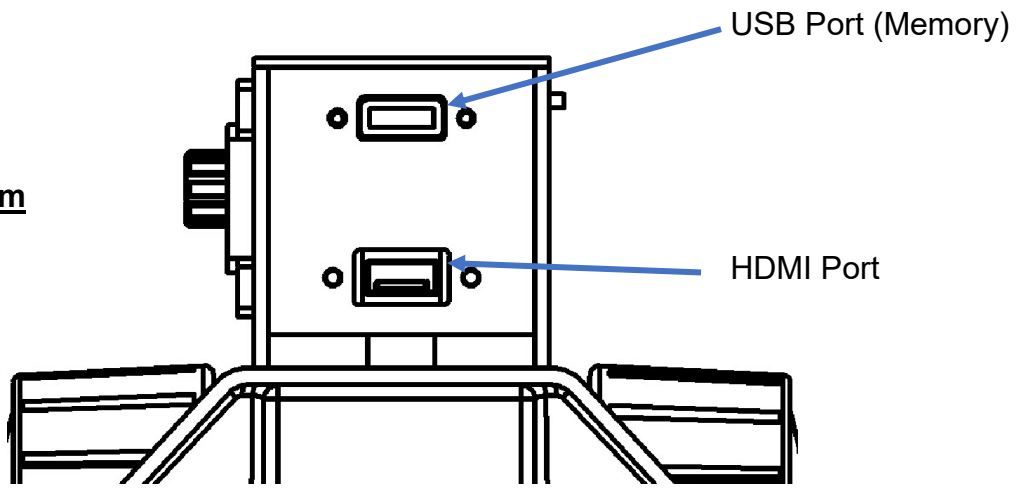
Backside Connections

Back Side



Bottom



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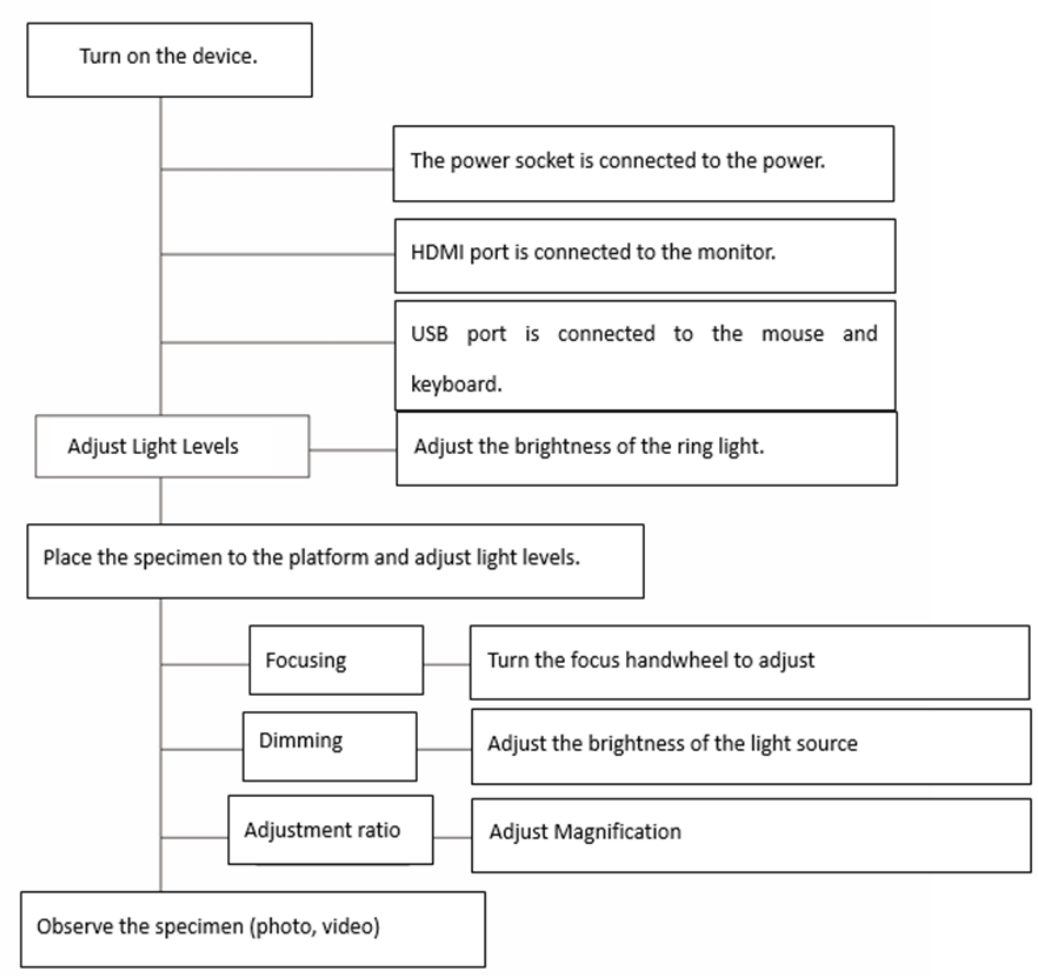
4.0 Steps for Observation

1. Turn on ***VM-500*** using main power switch on back of unit.
2. Adjust light source using Surface and Contour Illumination switches.
3. Place sample onto the stage. Secure specimen using Sample Clips if needed.
4. Use Coarse Adjustment knob to find general focus.
5. Use Fine Adjustment knob to find final focus. Adjust light again if needed.
6. Zoom in using the Magnification switch.
7. Fine Adjustment might be needed again to focus sample.
8. Observe sample.



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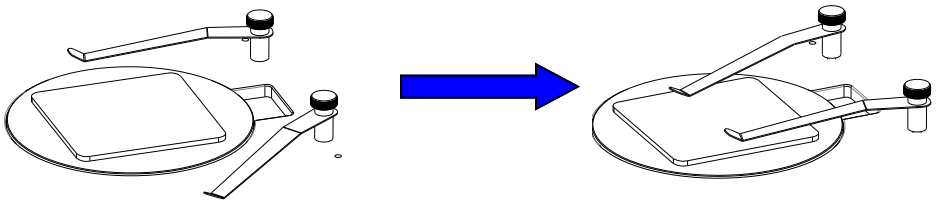
5.0 Adjustment Features

5.1 Illumination Adjustment

The illumination adjustment knob is located on the stem of the ***VM-500***, near the backside of the machine. See illustration on page 6 for a diagram.

Adjust light levels by turning the knob. Adjust light as necessary for best picture quality.

5.2 Specimen Placement



The sample clips are for fixing the object being observed, and can effectively prevent vibrations in the environment from moving the image. Steps for securing specimen:

1. Loosen both spring screws.
2. Place sample on stage and position in desired location.
3. Position both sample clip arms onto sample.
4. Tighten sample clip arms using spring screws.

TIP: Use gloves to avoid leaving finger prints on samples when adjusting position on stage.

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5.3 Adjusting Focus

! Do not use force movement, knobs should operate without applying excessive force.

5.3.1 Auto Focus

The ***VM-500*** has an automatic focusing feature. This is enabled inside the side menu screen. See the following section titled “Interface” for more information on this feature’s activation.

1. Put the microscope into Autofocus mode. (AF option under the Control Tab)
2. Place sample onto the stage.
3. Use the Coarse Focus knob to get the sample into view (it may still be slightly blurry at this point).
4. Allow the ***VM-500*** to find a focus spot.
5. Move the sample as needed for observation.

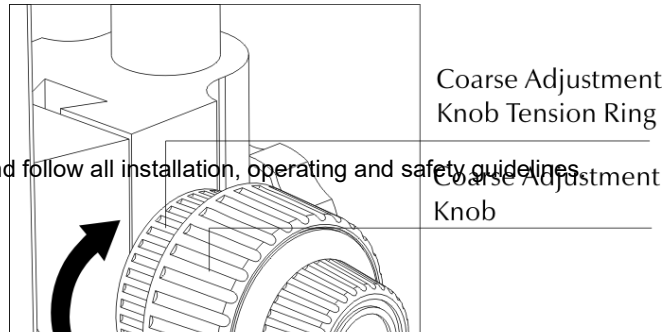
5.3.2 Manual Focus

The ***VM-500*** allows manual focusing as well. This feature uses the coarse focus knob in conjunction with the MF slider under the control tab.

1. Put the microscope into Manual mode. (MF option under the Control Tab)
2. Place sample onto the stage.
3. Use the Coarse Focus knob to adjust the sample into view.
4. Use the MF slider to fine focus the image.
5. Move sample and adjust as necessary.

IMPORTAN
Knob is sec
Column. Sli
stage causi
the Limit Fix

NOTE: Ensure Coarse Adjustment Knob Tension Ring is tensioned (VM-100 ships already tensioned for ease of use)



1. After placing sample on stage, move the Coarse Adjustment knob until the object is in focus on the LCD monitor.
2. If the object is too far or too close, adjust the Lens Height Adjustment

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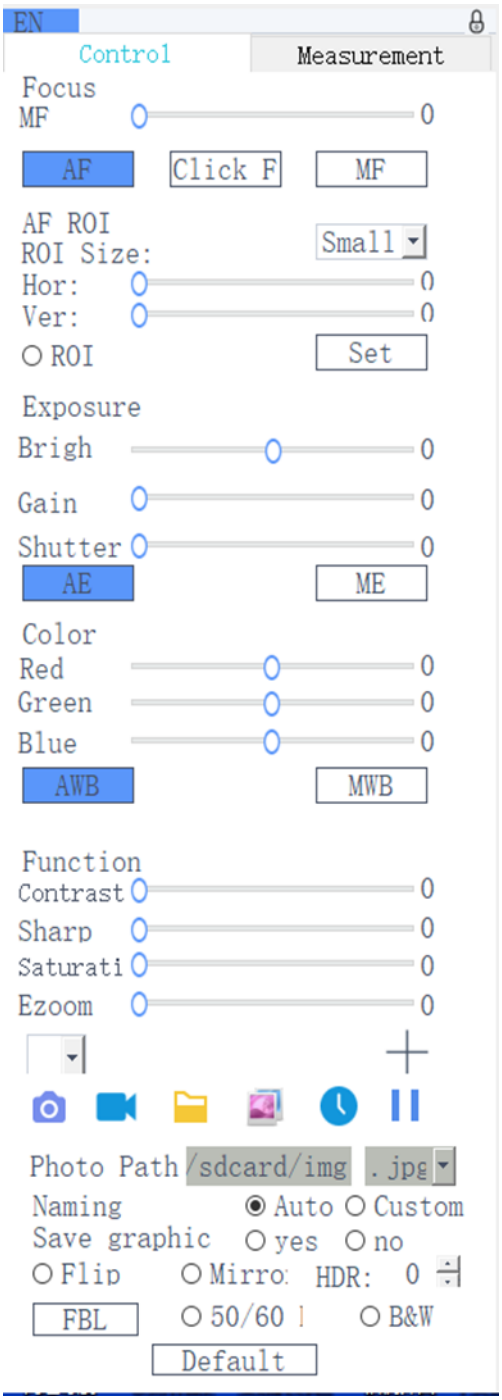
6.0 Image Software Operation

The ***VM-500*** is provided with an HD monitor for use with the microscope. Many of the features are accessible through the user interface. The following sections will provide information on these features.

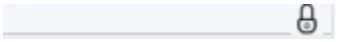


6.1 Activating the User Interface

Move the mouse to the upper left corner of the screen to have the user interface appear.

6.1.2 Locking the User Interface

Move the mouse to the upper left corner of the screen to have the user interface appear.



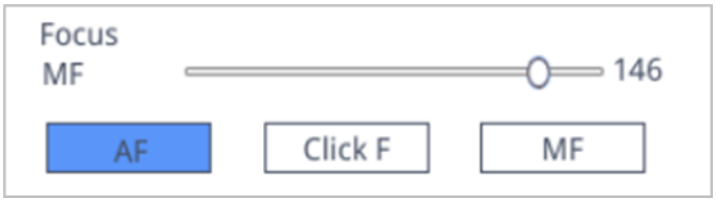
Locked User Interface

Unlocked User Interface

6.2 Control Settings

6.2.1 Focus Settings

The Focus Settings are located under the Control Tab. Use these to adjust how the focus behaves.



Click AF to enter autofocus mode. This mode allows the ***VM-500*** to automatically focus on the image. The Click F mode is a one-click autofocus. This mode works similar to the AF mode. However, the microscope will only focus once a click is registered. The MF mode is for manual focusing. Use this to manually control the focus of the machine. There is a slider located above these buttons which is used to fine-tune the focus for MF mode.

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6.2.2 Auto Focus Region of Interest

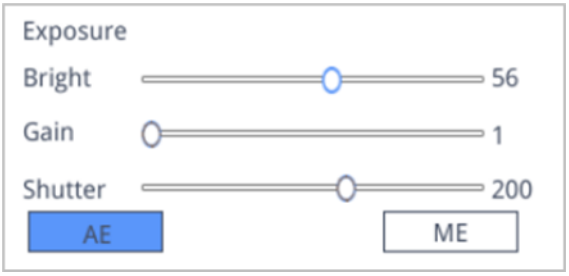
The ***VM-500*** has a region of interest feature for the autofocus mode. Use this to select a spot on the sample that requires the focusing. This is useful if the sample surface is uneven, or if the region of interest is near the edge of a part.

To activate ROI, click on the “ROI” toggle shown in the above image. Use the dropdown to adjust the size of the ROI. Adjusting the Hor and Ver sliders will adjust the horizontal and vertical box boundaries respectively. Select Set to save the parameters.

Click anywhere on the image to select the ROI. A red box will appear indicating where the camera will now try to focus.

6.2.3 Exposure Settings

Use these settings to adjust the Exposure, Brightness, Gain, and Shutter for the camera.



Adjusting the sliders will modify the values. AE is the auto exposure feature. This will allow the computer to automatically select the most optimal exposure for the image. Changing this to ME (manual exposure) will allow the user to adjust the exposure as needed.

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6.2.4 Color Menu

Use these settings to adjust the White Balance and Color for the camera.

AWB is auto white balance. This setting will allow the computer to select the most optimal white balance for the image.

MWB is manual white balance. This setting will allow the user to manually adjust the white balance of the image. Each of the color sliders will add a color filter to the image.

6.2.5 Function Menu

Use these settings to adjust Contrast, Sharpness, Saturation and Ezoom.

The default values and ranges for these settings are as follows:

	Value Range	Default Value
Contrast	0-15	0
Sharp	0-15	4
Saturation	0-254	128
Ezoom	0-50	0

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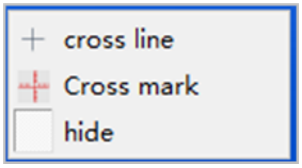
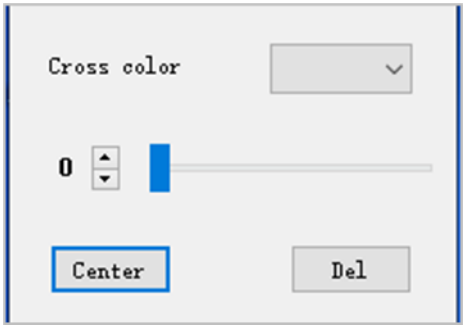
6.2.6 Crosshair Tool

This tool allows the user to place a crosshair overlay on the image. The Cross Line tool can be used to place several grid lines across the image. Click and drag to move the cross lines around the screen. Double click the line to set its color. Click Hide to remove these lines.





6.3 Image and Video Capturing

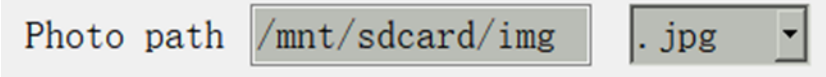
6.3.2 Storage Device

Ensure that there is a USB slotted into the ***VM-500***. This allows the operator to save the images and videos taken on the ***VM-500***. The USB indicator will display when there is a USB detected.

USB indicator

6.3.3 Setting the File Path

The line labeled “Photo Path” is where the images and videos will be saved on the storage device. Edit this to change directory paths.



6.3.4 Changing Image Format

The dropdown menu shows the exportable file formats available.

6.3.5 Image Naming

The operator can use the default naming scheme to save the images and videos. There is also an option to use custom naming each time. Select Custom and a prompt will show each time image naming is needed.

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7.0 Trouble Shooting

Use this page to help with some issues that an operator could be experiencing. If this page is not helping solve an issue, call a PACE Technologies technical assistant.

NO.	*Problems*	*Cause*	*Solutions*
1	Poor visibility Image is blurry	Dirty Lens Surface dust or dirty Focus is not correct	Clean the lens (see manual and maintenance) Cleaning surfaces Adjust the focus
2	Head moves when adjusting focus	Focus wheel is too loose	Appropriately lock Coarse Adjustment Knob Tension Ring
3	Power light is not working	Power supply connection is bad	Check the power connections
4	No image on the monitor	VGA cable	Check the VGA cable connection
5	Incorrect image zoom	Monitor resolution settings	Moving the mouse pointer to the edge of the underside of the monitor (middle) button, select the appropriate resolution.
6	Sample not displaying on monitor	Samples are not placed correctly on the stage/sample surface is not vertical to the lens	Place samples in view on loading plate and/or use sample clips .
7	Hard to turn focus knobs	Tension becomes very tight	Relax Coarse Adjustment Knob Tension Ring