

# GENERAL PROCESS AND OPERATION SPECIFICATION

## Caltex 3-D HI-Scope KH-1000 Microscope

I. SCOPE

- a. The purpose of this document is to describe requirements and basic operating instructions for the Caltex KH-1000 3D Microscope. The 3-D aspect of this microscope is especially useful in ensuring the integrity of wire bond connections. While also providing high quality measurements and images of both wafer and circuit board samples, the rotational view can provide better vision of connections that may be broken or not properly bonded.

II. SAFETY

- a. Read through this operation document to familiarize yourself with this equipment.
- b. If you are unsure about any procedure or indication while operating equipment, contact a staff member for assistance. This tool can produce high voltage, RF energy, and high temperatures. Take caution when you are around this tool.

III. APPLICABLE DOCUMENTS, MATERIALS AND REQUIREMENTS

- a. The Caltex hardware and AVM1 software have individual printed manuals that AggieFab can provide upon request. All information can also be found within the “Help” tab in the AVM1 software. This tool is intended for a wide range of substrate and target materials.

IV. OPERATION

- a. Power on and start software:
  - i. Begin by turning on the Main Control Unit (MCU) by flipping the Power switch on the bottom left.
  - ii. Turn on the Motor Controller by flipping the Power switch on the left.  
Note: This controller is only used when using a 3-D lens.
  - iii. Initiate the AVM1 software located in the center of the monitor.
- b. Set up sample image:
  - i. The color balance must now be set using the MCU.
    - 1. Place a pure white object beneath the microscope, such as a clean room wipe.
    - 2. Under “White Balance” section of the MCU, flip the switch to “Auto.”
    - 3. After waiting approximately 3 seconds, flip the switch to “Hold” to save the correct white balance.
  - ii. Place the sample within the field of view of the microscope.
  - iii. The image may be blurry or unrecognizable initially. This will be corrected using the physical adjustment on the microscope.
    - 1. The upper adjustment ring controls the light diaphragm to limit or increase the amount of light hitting your sample. If the video is too dark this may be the cause.
    - 2. On either side of the microscope are also the coarse focusing knobs which should be used to get the sample to at least a blurry state on the AVM1 live video.
    - 3. The magnification is below the light control and the fine focus is below the magnification. These two should allow the live video to focus to a sharp and defined image.
  - iv. Once focused, you may physically move the sample around to a desired location and save the live image. This can be done through “File” > “Save Image.”

- c. Taking measurements:
  - i. If measurements are needed, the microscope must be calibrated before measuring.
  - ii. Before calibrating, ensure there is a region of the sample where the actual distance is known.
    - 1. AggieFab has provided a calibration slide which should be located on the shelf right to the microscope. This will provide both a calibration value for X and Y calibration. Do not touch the holder plate, it may be very hot.
  - iii. After bringing that location onto the live capture screen, select “Setup” > “Point Calibration.”
  - iv. Left click on two points, one on either side of the known distance. A dialogue box will appear requiring the actual size to be entered.
  - v. Now that the calibration is complete, any measurement tool may be used to find any needed distances.
- d. Sign out of the tool:
  - i. Save all photos before leaving. All files will be lost once the program has been closed
  - ii. Close the AVM1 program, power off MCU and Motor Controller.

V. SIGNATURES AND REVISION HISTORY

- a. Author of this document: Mitchell Roselius
- b. Author Title or Role: Student Technician
- c. Date: 22 August 2018
- d. Revision: Original

Approvals:

Technical Manager Signature:  *Sandra G Malhotra*

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Revision History:

Revision	Author	Date	Change
Original Issue	M. Roselius	8/22/2018	
Rev A	R. Carreon	1/13/2022	Re-formatted Procedure
Rev B			
Rev C			

## Figures

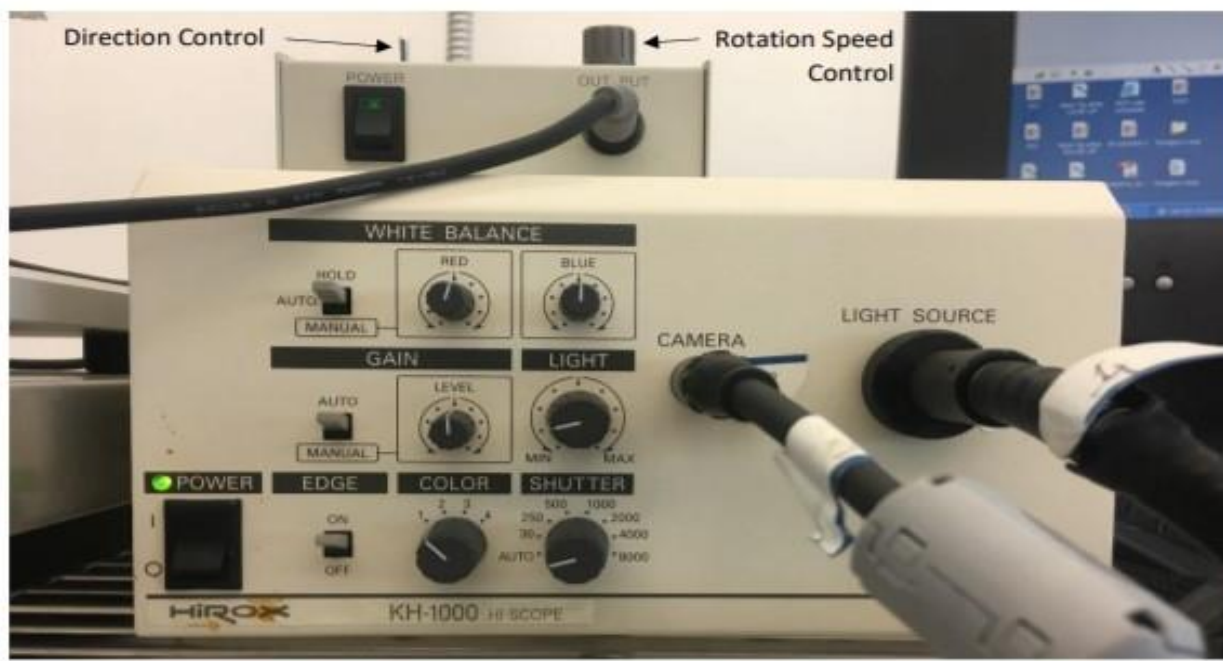


Figure 1: 3-D HI-Scope Main Control Unit and Motor Control CT-1

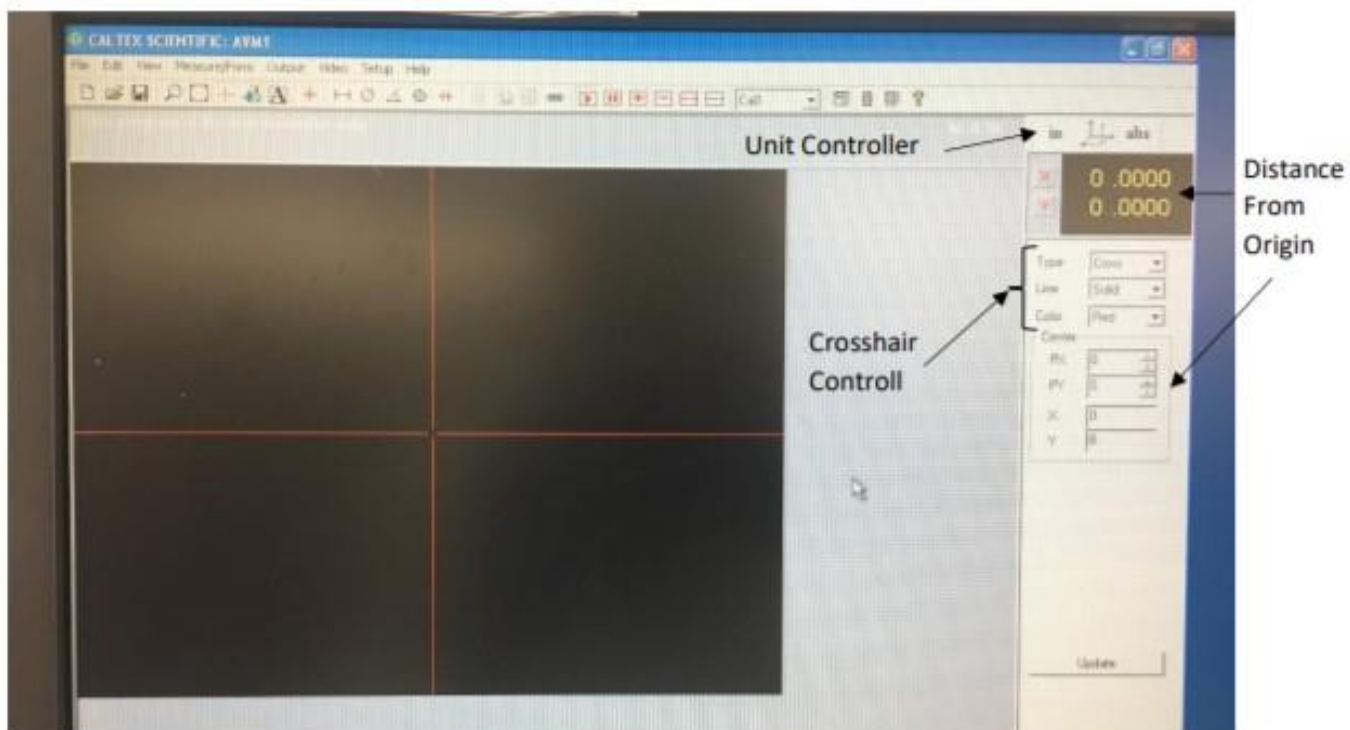


Figure 2: AVM1 Software Screen

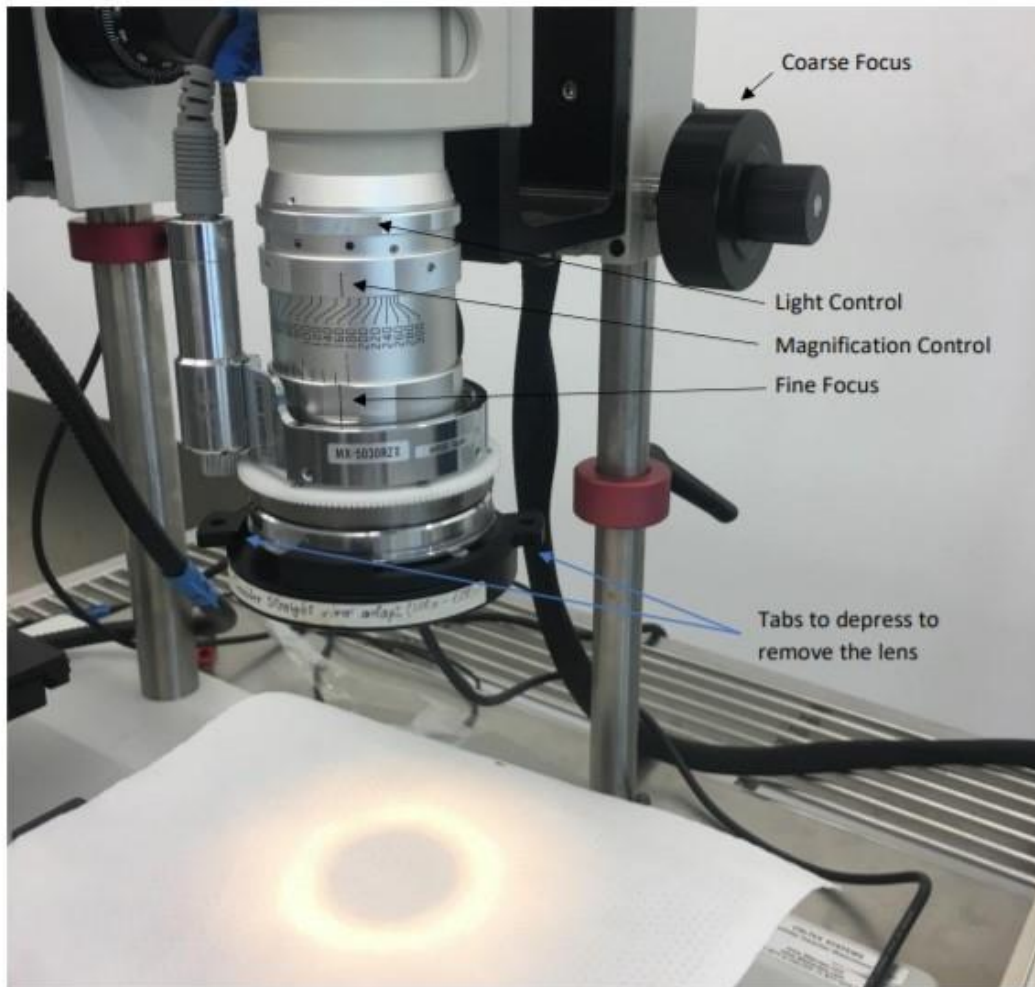


Figure 3: Microscope Set Up

## **Appendix A: Available Lenses**

- To change lenses, press the two tabs with holes on the side of the lenses. This will allow the lens to slide on and off the microscope. Ensure that there is enough room to comfortably fit the lens to avoid any damage to samples, the microscope, or the lenses.
- Available Lenses:
  - 3-D Reducer (25°-55°) (20x-120x) / AD-5030LOWRVS
  - 3-D Rotary Head (25°-55°) adapter (50x-300x) / AD-5030RVS
  - Reducer straight view adapter (20x-120x) / AD-5030LOWS2
  - Straight View Lens (50x-300x) / AD-5030HS
  - 2x Doubler Straight view adapter (100x-600x) / AD-5030HIS

## **Appendix B: Other Calibration Methods**

- Point calibration is the simplest method of calibration, but it assumes that the pixel size in X and Y are the same. It also does not correct the skewing of the calibration target. Four-point calibration correct the skewing and Eight-point calibration can correct both issues.
- The “Calibration” option will automatically calibrate based on the shape and size you provide the calibration option. This requires a fairly accurate shape that is clearly distinguishable from the background, which may be an issue for many samples. To attempt this, open “Calibrate” under the setup tab. Select the type desired and click “Calibrate.” Click “OK” when complete if happy with the results, otherwise “Cancel.”
- Calibrate X and Calibrate Y are very similar to Point Calibration. These two options are used when the X and Y pixel size are not the same. This is another safe and fairly easy option to use and is very similar to the 4-point calibration.
- NOTE: Calibration must be redone whenever the lens and zoom setup are changed. However, samples can be changed, the stage can be moved, and focus can be improved without having to recalibrate.

## **Appendix C: Possible Measurement Options**

- Distance: Measures distance between two points.
- Circle: Measures the diameter or radius of a circle established by placing three points.
- Angle: Uses four points to create two lines. The angle can then be calculated and adjusted using the pop-up dialogue box.
- Area: Found using any number of points. Must Click “Finish” when all points are placed.
- Linewidth: Provides the width between two lines chosen by the user. A better method for parallel lines would be to change the crosshairs with the “lines” option and rotate the lines to the desired region. This ensures the lines are parallel and provides a better average.
- The crosshair can also be moved by clicking and dragging the center of the crosshair. The values on the right provide the distance the crosshair is from the origin (center) in both pixel measurements and inch/mm measurements.

## **Appendix D: Video Options**

- All video comparison options need a reference image. This can either be selected when starting a video comparison or a reference image can be saved in the “Video” tab. Reference images can be taken from the live image or from a saved Bitmap file. Once a reference is chosen, 4 comparison movements can be selected. The reference density can be any number, but 1 is most common. -1 also works but will make the reference image seem clearer than the current live image.
  - Overlay: Overlay’s the reference image if positive reference density or current image if negative reference density.
  - Subtract: Shows difference between reference and live image by subtracting the pixel value of the display image from the reference image.
  - Blink: Will switch between live image and reference image based on a time interval chosen by the user.
  - Compare places the reference image above the live image to visually compare side by side.

## **Appendix E: Main Control Unit Options**

- White Balance
  - White Balance should be found using “Auto” and maintained using “Hold.” There is red and blue manual control to adjust white balance if necessary.
- Gain
  - The image brightness can be adjusted using the “Level” dial under Gain, but “Auto” is recommended
- Light
  - The light dial controls light source output. To provide the best image quality, this dial should usually be between the middle and maximum values.
- Edge
  - To provide the best image quality, edge should always be on. This lets the machine know that the sample is not flat and adjust measurement readings if edges are detected.
- Color
  - The four options are preset to no color, red, green, and blue respectively. Changes are subtle and any option can be used, but typically no color (1) is the best option.
- Shutter
  - The shutter speed control should only be set to 30 or “Auto,” any other option greatly reduces the amount of light the camera can receive which may limit or stop or sample from being viewed by the microscope entirely.

## **Appendix F: Main Control CT-1**

- The motor control allows the microscope to view the other side of the sample without having to rotate the sample. However, the sample may still need to be moved to find the area of interest once rotation has completed. The switch changes between clockwise (right) and counterclockwise (left) with the middle being off. The right dial determines the speed of rotation.