# UltraVim 9.5

## *UltraVim User Manual*

## *Version 9.5*

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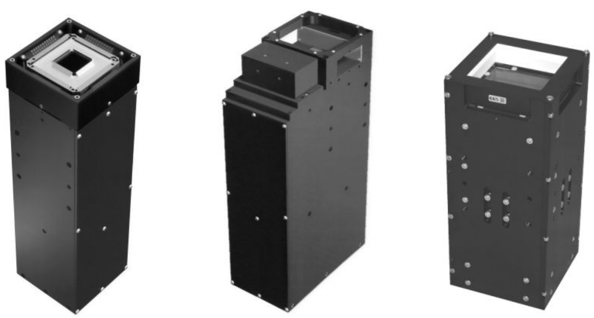
# 1. Introduction

The UltraVim software performs inspections on several types of semiconductor packages including gull-wing, leadless chip carriers and ball grid arrays. The software utilizes a user-friendly point and click interface with fast and accurate results. A summary of the features is shown below.

- User-Friendly Interface
- Interchangeable Part Files
- Multiple Hardware Options

## 1.1 Module Types

The UltraVim software can support many different module and camera configurations. The most common modules are the UltraVim VX and UltraVim UX. The UltraVim VX uses a single camera with an inspection reticle to inspect leaded semiconductor packages in three dimensions. The UltraVim UX adds an additional camera and the ability to inspect BGA devices in three dimensions.



## 1.2 Hardware Options

The UltraVim software can also be used with a number cameras for 2D inspections of packages, including mark and lead inspection. Various lighting and camera options are available for specific applications. Custom mounts can be used to fix a camera or cameras to a microscope base for 2D or 3D lead inspection.

It is possible to run more than one version of the UltraVim software on the same computer. You may wish to install an UltraVim module for 3D inspection and also a USB camera for 2D inspections of the package body or leads. To run multiple versions of the software, you must install each version into a separate directory. For example, the software running the UltraVim 3D module should be in the C:\UltraVim3D directory and the software controlling the mark inspection should be in the C:\UltraVim2D directory.

Note that each camera driver, CAMERA.DLL, must also be installed into the correct directory. Each type of camera will have a different camera driver file. The 3D and 2D cameras should be different brands or the drivers will not know which camera to initialize.

The picture below shows the Lead Inspection Head used by the VX and UX modules. The Inspection Reticle and Calibration Reticle are also included with the VX and UX modules. The Inspection Reticle must be installed to inspect Coplanarity. The Calibration Reticle is rarely used because the optics are fixed and recalibration is not normally required.

**Lead Inspection Head**

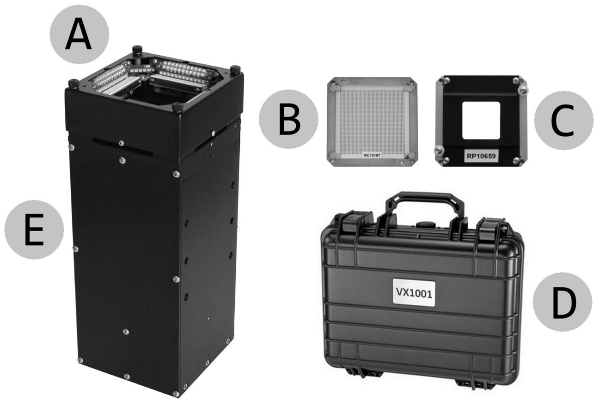

**Inspection Reticle**

**Calibration Reticle**

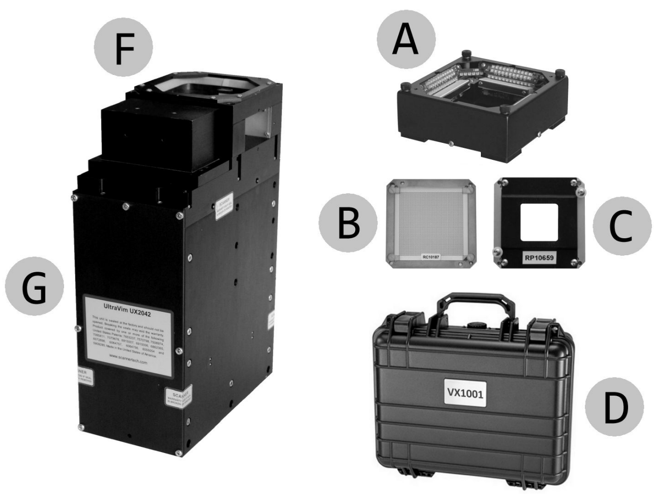
A picture of the BGA Inspection Head is shown below. It is normally included with the UX module and must be installed to inspect devices with balls. It is possible to put the head on a VX module to inspect ball devices, but the lack of a second camera makes it impossible to calculate Coplanarity with the VX module.

**BGA Inspection Head**

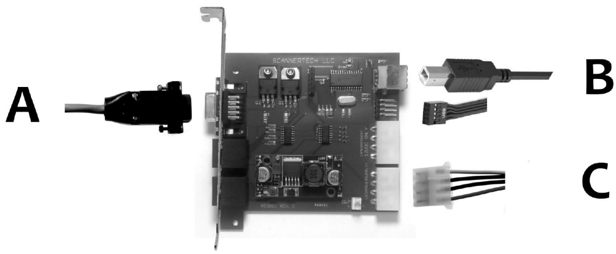
The standard items included with a VX module are (A) QFP Inspection Head, (B) Calibration Reticle, (C) Inspection Reticle, (D) Accessories Case and (E) Single Camera Module.




The standard items included with a UX module are (A) QFP Inspection Head, (B) Calibration Reticle, (C) Inspection Reticle, (D) Accessories Case, (F) BGA Inspection Head and (G) Dual Camera Module.

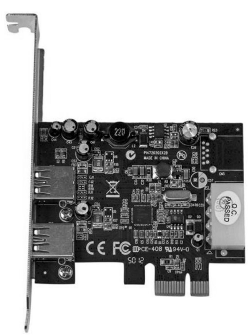


The image below shows the LED Control Board, which is normally included with a module. The connections include (A) DB9 light power cable, (B) internal or external USB2 cable and (C) Molex 12 volt connector cable. If two LED boards are used for 2D and 3D inspections they must have different product IDs such as PIC500 and PIC600. The DIGITAL.DLL driver shown in the Passwords screen must match the product ID of the correct LED board.




**LED Control Board**

Some systems may also require a third-party USB3 adapter like the one shown below. This may be determined by the specific requirements of the system and the capabilities of the computer and motherboard.

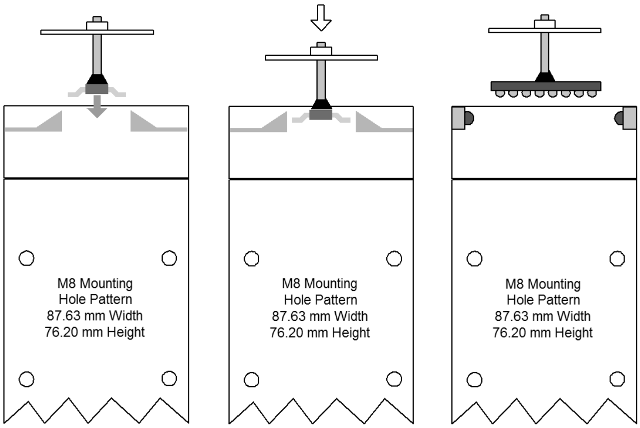


## 1.3 Module Installation

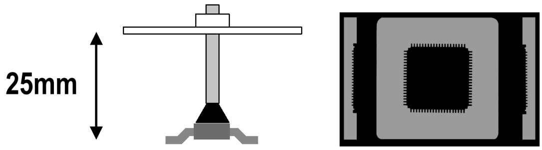
Each VX and UX module has a 3.45" x 3.00" (87.63 mm x 76.20 mm) pattern of M8 holes for mounting. This pattern is centered about 5.50" (139.7 mm) below the top of the module.

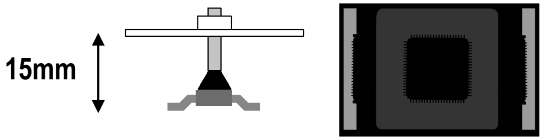
The UltraVim module should be installed into the handler so the pick and place nozzle holds the device 1-3 mm above the top of the module. On VX and UX modules a white, powder-coated reflector must also be installed about 30 mm above the device to provide a gray background for imaging and for leaded devices the handler must plunge down about 20 mm to provide a side image of the leads in each prism.

If the reflector is too close to the leaded device it will not provide a gray background and the handler must first request an image before the plunge using the GRABT command as explained in the Communications chapter.

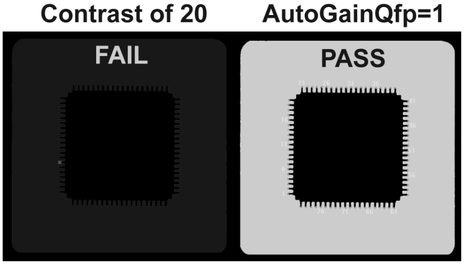


The example images below show the effects of a reflector that is too close to the device. As the reflector becomes closer to the device the center of the image becomes darker. If the reflector is too close the center of the image will become black and inspections are not possible.

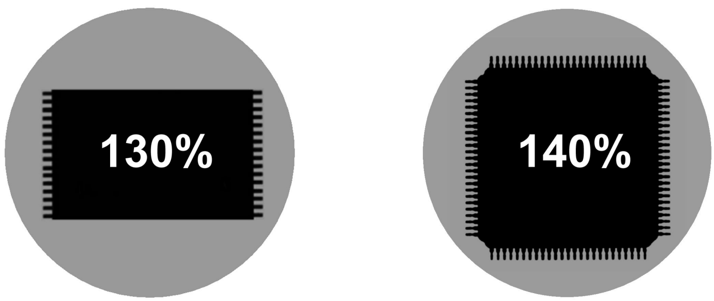



In addition to the GRABT method, the software also has the ability to automatically adjust the gain of the center image. In the example below the center has a background of 20. Setting AutoGainQfp=1 allows the software to increase the background brightness. Note that this method may cause some inaccuracies on measurements like Width if the contrast is too low. Increasing the gain of an image also increases the noise.



Sometimes it is beneficial to employ a round reflector instead of a square geometry. For a round reflector the diameter must be larger than the diagonal formed by the rectangle of the maximum dimensions of the device including the lead tips. A good rule of thumb is that the diameter should be about 150% of the maximum dimension although for rectangular devices a diameter of 130% is often large enough an 140% is large enough for many QFP devices if placement is centered.



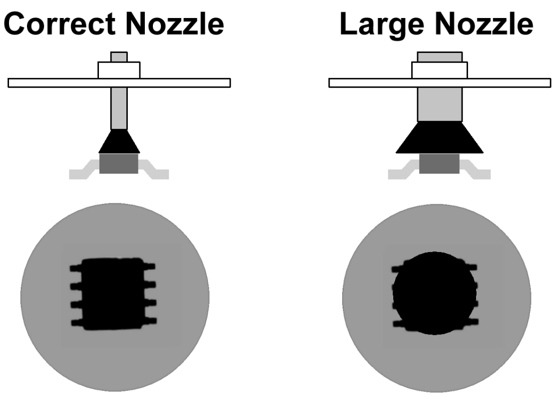

The table below shows some suggested diameter sizes based on the device dimensions. There is usually no problem if a larger diameter is used, however, in some rare cases if it is much larger than the device it could cause reflections in the image.

| X | Y | D |
|---|---|---|
| 2 | 3 | 5 |
| 4 | 6 | 8 |
| 6 | 8 | 11 |
| 8 | 11 | 15 |
| 10 | 14 | 18 |
| 12 | 16 | 21 |
| 14 | 19 | 25 |
| 16 | 21 | 27 |
| 18 | 24 | 31 |
| 20 | 27 | 35 |
| 22 | 29 | 37 |

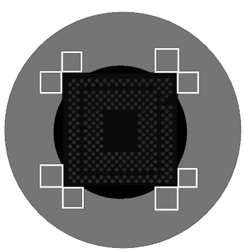
| X | Y | D |
|---|---|---|
| 2 | 4 | 5 |
| 4 | 7 | 9 |
| 6 | 10 | 13 |
| 8 | 13 | 16 |
| 10 | 17 | 21 |
| 12 | 20 | 24 |
| 14 | 23 | 28 |
| 16 | 26 | 32 |
| 18 | 29 | 35 |
| 20 | 33 | 40 |
| 22 | 36 | 43 |

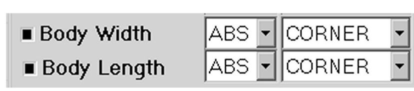
| X | Y | D |
|---|---|---|
| 8 | 8 | 12 |
| 10 | 10 | 15 |
| 12 | 12 | 18 |
| 14 | 14 | 21 |
| 16 | 16 | 24 |
| 18 | 18 | 26 |
| 20 | 20 | 29 |
| 22 | 22 | 32 |
| 24 | 24 | 35 |
| 28 | 28 | 41 |
| 32 | 32 | 46 |

In addition to the proper background the vacuum nozzle must also be the same size as the part body or smaller. In the example below the correct nozzle results in an image where all the leads are visible. However, the nozzle blocks the leads when it is too large. This effect can become even worse if the nozzle is not centered to the part body.




For BGA devices the nozzle may be slightly larger than body of the device if the Body Width and Body Length calculations are changed to CORNER in the Tolerance screen. It is also possible to inspect BGA devices without any background, but changes must be made to the Advanced Settings and some measurements like Body Width and Length will not be available.





## 1.4 Software Installation

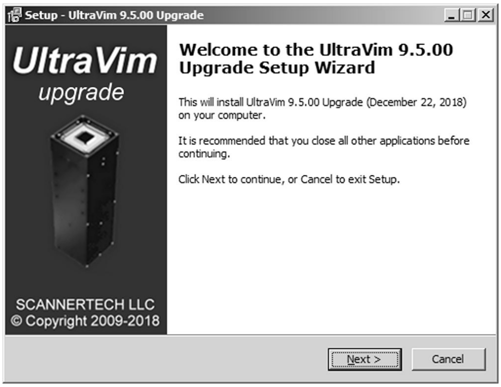
There are three different types of installation programs used by the UltraVim software: full, upgrade and feature. Before installing any change make sure you have administrator privileges and exit or close all programs. You may also want to back up your existing software or files on a thumb or network drive.

A full installation will include the UltraVim version number and hardware ID number of the system in the file name. The full installation will install all executable files and the default parts, configuration files and calibration files. It will create all UltraVim directories that are needed. Note that additional installations such as third-party camera drivers may also need to be installed for the full version to work correctly.

Examples: uvim9400_2d_3120012345.exe
uvim9410_vx2099_1230012345.exe


An upgrade installation will include only the version number in the file name. It will upgrade the executable files of any UltraVim software found in the C:\UltraVim, C:\UltraVim2D, C:\UltraVim3D and C:\UvimDemo directories. It may also install golden part files, but will not change other part files, configuration files or calibration files.

Examples: uvim9500.exe
uvim9510.exe




A feature installation file will include a description of the features installed. This type of installation will not change the UltraVim executable files or software, but instead may add part files, certificate files or change configuration parameters.

Examples: g16-100.exe
rp10345.exe
uvim9430_custom_settings.exe

## 1.5 License Code

The UltraVim software requires a license code to function or it will run in a “Demo” mode that will limit the number of images allowed. After a license code is entered or installed, it is compared to the hardware number which is usually supplied by the camera. The license code is based on the serial number of the hardware. Note that a full installation will automatically set the correct license code for the user and store the hardware identification and code in the License.ini file.


## 1.6 Subject to Change

Note that the product features, procedures, and specifications in this document are subject to change without prior notice. This document may contain errors and the provisions of this document do not constitute a contract or warranty, express or implied.

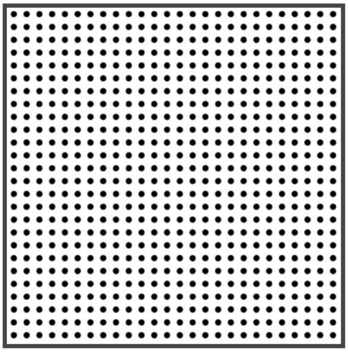
# 2. Methodology

The UltraVim inspection modules provide a three dimensional inspection apparatus for semiconductor packages using the following features:

- Fixed Optics
- Calibration
- Illumination
- Cameras
- Triangulation

## 2.1 Calibration

The UltraVim module is calibrated at the factory. Each camera in the system is calibrated using a precision pattern mask with a dot pattern of known spacing and size deposited on a glass reticle. The pattern of dots is accurate to less than a micron. The software finds the X and Y location of each dot in each view and stores it in a calibration file.

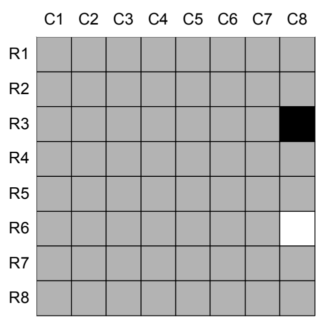


## 2.2 Calibration Files

By using robust statistical techniques, the UltraVim is able to create and store the calibration reference with sub-micron accuracy. The calibration files for each camera are stored in the "Files" directory with a ".CAL" extension. The UltraVim modules have no moving parts so the calibration should remain stable unless the module is dropped or damaged in some way.

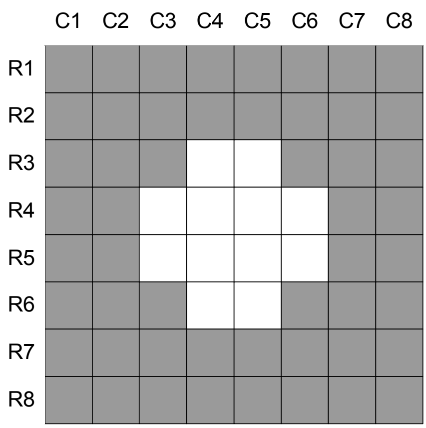
## 2.3 Pixel Coordinates

The first step in a machine vision application is to find the location of objects in pixel coordinates. Camera sensors are made of arrays of pixels. Each pixel has an address that locates its row and column as shown below. The camera converts each pixel into a number in memory. For example, the dark pixel below may be converted to 0, the bright pixel may be converted to 255, and the gray pixels will be between 50 and 200. If pixels in an image are white it is known as "blooming" and indicates a loss of resolution and should be avoided if possible.



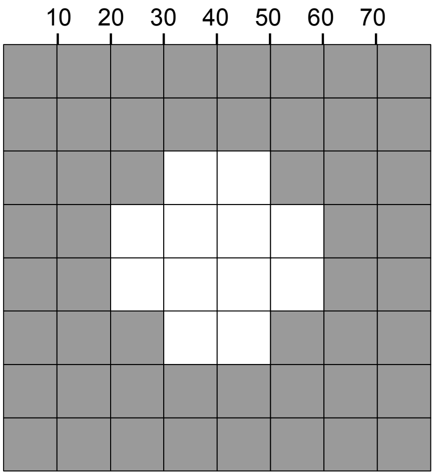

SENSOR

In the example below, a ball is seen as a group of bright pixels. A variety of image processing algorithms such as threshold or edge finding can be used to find the location of the ball center in pixel coordinates. Image processing applications use sub-pixel algorithms that can determine the locations of features to a fraction of a pixel if the image quality is good.



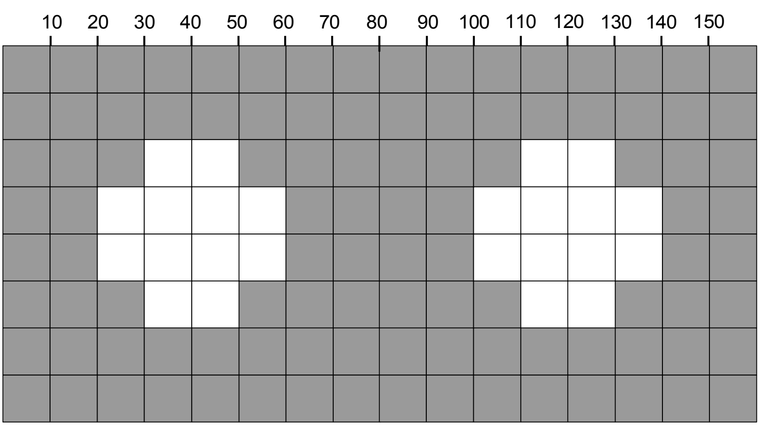

## 2.4 World Values

Pixel coordinates are converted into world values such as "mils" or "microns" using the information in the calibration file. In the example image above, the "ball" is four pixels wide. This may be converted to microns with a scale factor. If the calibration resulted in a calculation that each pixel represents 10 microns, the ball would be about 40 microns wide as shown below and the center would also be at 40 microns in the "X" direction.



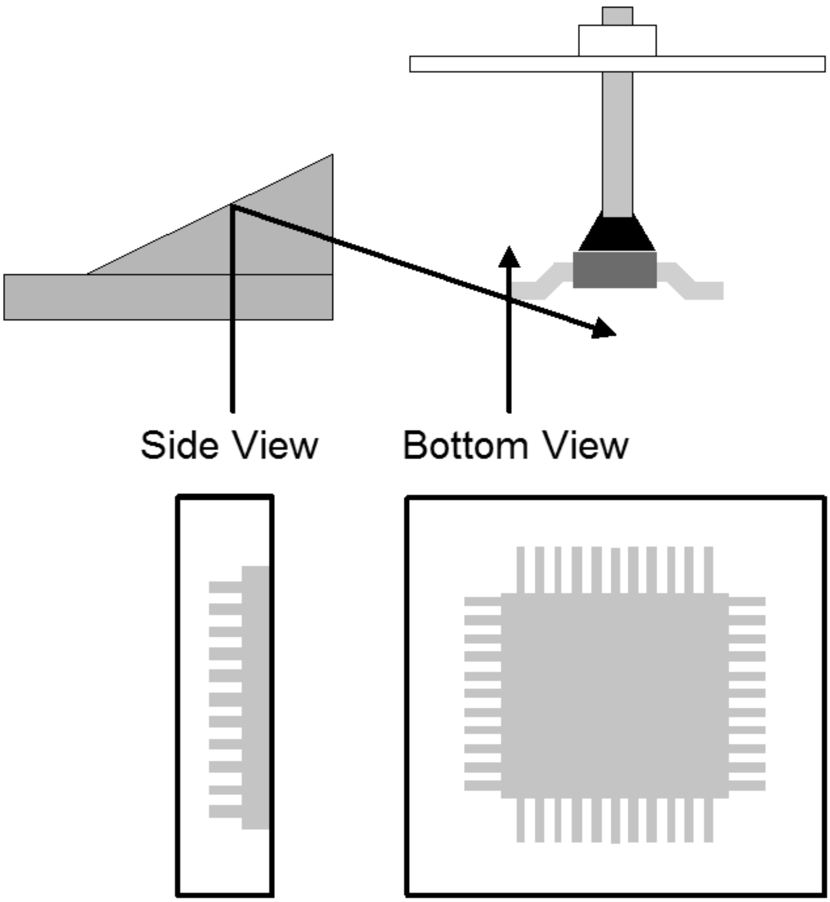

## 2.5 Part Values

After the world values have been calculated, the software calculates part values. These are the actual measurement items such as diameter, pitch, etc. that are reported. For example, the pitch between the two balls shown below would be about 80 microns.



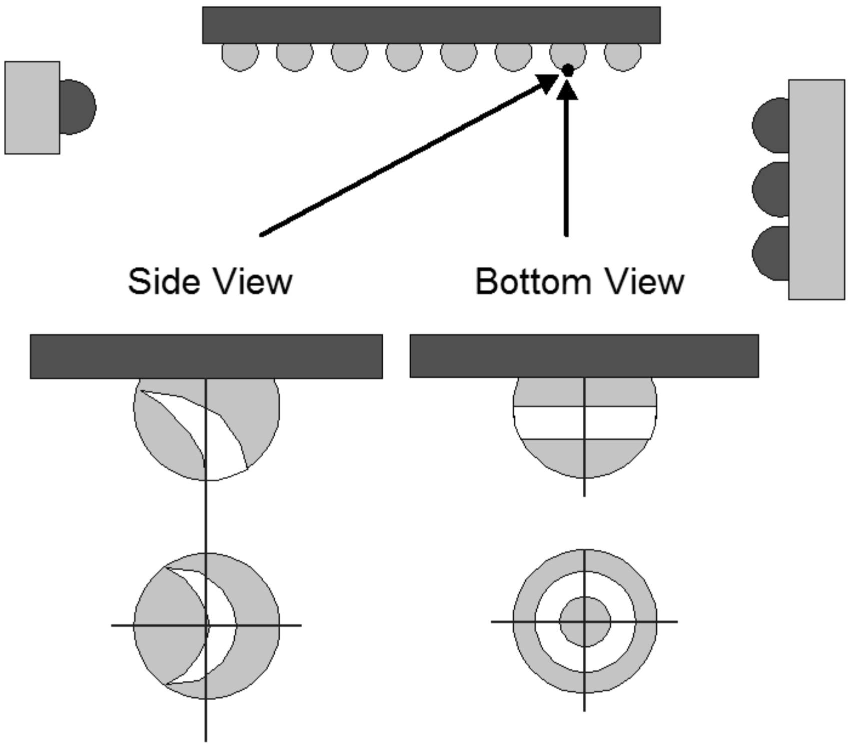
## 2.6 Leaded Devices Triangulation

The diagram below illustrates the methodology used by the VX and UX modules to inspect leaded devices. An inspection reticle with four prisms is first installed on the system. The reticle is shipped with a calibrated file, such as RP1000.RET, that is stored in the \Files directory. Next, the leaded device is plunged into the optical path of the prisms. This allows the camera to simultaneously image the bottom view and each side view of the device. Finally, the software calculates the three dimensional position of each lead.



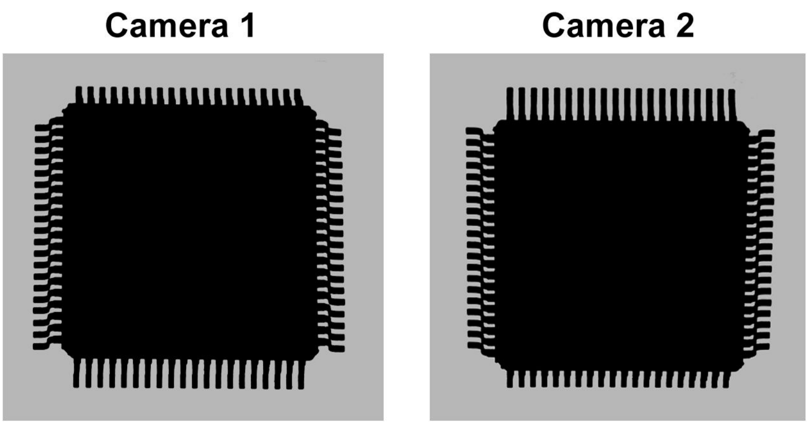
## 2.7 BGA Devices Triangulation

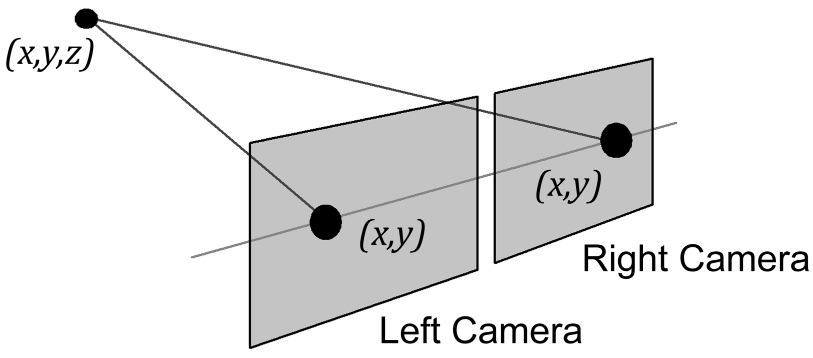
The diagram below illustrates the methodology used to inspect BGA devices. First, the BGA device is held just above the top of the module and the LED ring light is illuminated to provide donut shaped reflections of each ball. Next, the side LED light is activated to provide crescent shaped reflections of each ball. Finally, the software locates the donut and crescent shapes and calculates the three dimensional position of each ball.



## 2.8 Triangulation for 3D Systems

Systems may be configured with two or four side views and no bottom view. For example, the two images below show two images of the same device taken at different angles. Even though there is no bottom view, the software can use stereo triangulation to calculate the locations of the pads in three dimensions. Note the accuracy may vary depending on the quality of the lighting, the angle of the views and the resolution of the cameras.



## 2.9 Part Tolerances

After the part values are calculated, they are compared to the tolerances stored in the part file. The result can be Pass, Rework, or Fail. These results are reported back to the host system. Calculations can be applied to measurements by selecting ABS, REL, or POS (i.e., absolute, relative, or positive). These selections are defined as follows:

- ABS = the normal “absolute” calculation method
- REL = (ABS - Nominal Value)
- POS = Absolute Value (REL)

For example, assume the ABS measurement of Diameter is 40 microns. If the nominal value of Diameter is 50 microns, the REL measurement will be equal to -10 and the POS measurement will be equal to +10. For measurements that have a nominal value equal to zero, such as Coplanarity, the ABS measurement will be the same as the REL measurement.

If the minimum part tolerance is less than zero then the total part tolerances will be added to the nominal value. For example, if the nominal value is 30 and the part tolerances are –10 to +10 then the actual tolerance will be from 20 to 40.

# 3. File Organization

This chapter describes the operating system, the directories on the system, and the important files required for operation. The software should be installed at the root level and not in the Program Files (x86) directory. The default folders for the 3D and 2D versions of the software are C:\UltraVim3D and C:\UltraVim2D. Note that the executable file will be named UltraVim3D.exe and UltraVim2D.exe when installed in these directories.

The UltraVim software will run on most versions of Windows including Windows XP, 7, 8 and 10. However, some of the older hardware in legacy systems may require Windows 2000 or XP and some of the newer hardware like USB 3.0 cameras may require Windows 7 or higher.

## 3.1 UltraVim Folders

The folders for the UltraVim software are shown below. Note that the Library folder is optional. Certificate files may be copied directly into the Files directory.

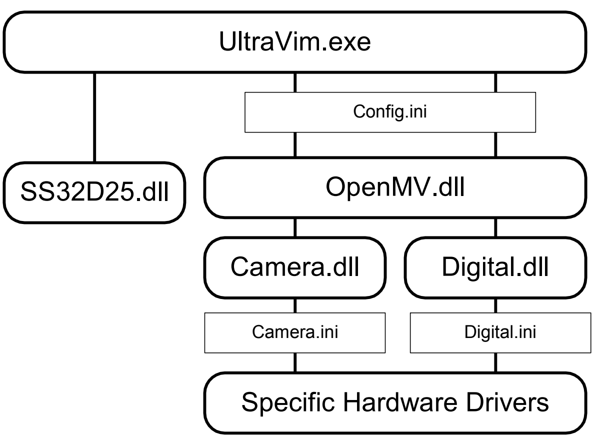
- C:\UltraVim3D Executable files and DLL's
- C:\UltraVim3D\Files System Files
- C:\UltraVim3D\Parts Part Files
- C:\UltraVim3D\Data Data Files

## 3.2 Program Files

The C:\UltraVim folder contains the binary files used for program execution. These files are described below:

- UltraVim3D.exe     Main Executable File
- OpenMV.DLL     Vision Processing Library
- CAMERA.DLL     Camera Driver
- DIGITAL.DLL     I/O and/or LED Driver
- SS32D25.DLL     Spreadsheet Control

The hierarchy of the UltraVim software is shown below. Note that all settings and files are contained in the UltraVim directory and the Windows registry is not used. Thus, the software is completely portable as long as the CAMERA.DLL file matches the installed camera driver and the DIGITAL.DLL file matches the digital I/O driver and the hardware vendor drivers are installed.



Making a copy of the C:\UltraVim folder to another folder such as C:\UltraVim9520 will still allow the software to function out of the new directory. All directories should be on the root and spaces in the names should be avoided.

The directories shown below are the recommended directories and will automatically be upgraded by running any upgrade software installation. The default executable files for the UltraVim.exe program are UltraVim2D.exe and UltraVim3D.exe in 2D and 3D directories. These versions are identical files, and only the file names have been changed to avoid confusion. All the files below will be updated when you install an upgrade version.

- C:\UltraVim2D\UltraVim2D.exe
- C:\UltraVim3D\UltraVim3D.exe
- C:\UltraVim\UltraVim.exe
- C:\UvimDemo\UltraVim.exe

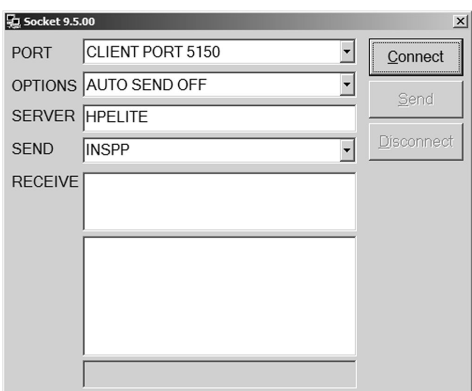
In addition to the UltraVim executable program, RunUvim.exe and Socket.exe may also be installed in the main folder. RunUvim.exe can be used to start the software after a delay, and Socket.exe will allow the user to manually test socket commands.

- RunUvim.exe
- Socket.exe

Adding the RunUvim.exe program to the Startup folder will automatically start the software after a delay. The default delay time can be changed with a command line parameter or in the RunUvim.ini file. Making the time negative will add a Cancel button.

- "RunUvim.exe 60"  Default to 60 Seconds.
- "RunUvim.exe –60"  Add a Cancel button


The Socket.exe program can be used to test socket commands. First, make sure the UltraVim software is running and the socket server has started. Next use Socket.exe to connect and test commands.

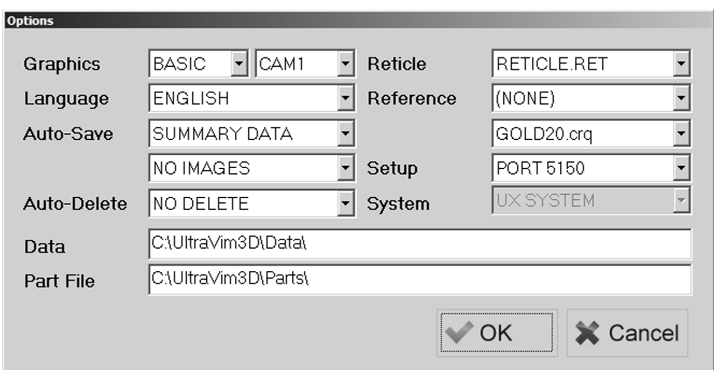



## 3.3 Configuration Files

The \Files folder contains configuration and calibration files. The folder may also contain golden device certificate files that end in a CRQ or CRB extension. The most important files are shown below.

| | |
|---|---|
| • Config.ini | User Configuration File |
| • Camera.ini | Camera Configuration File |
| • Digital.ini | Digital I/O Configuration File |
| • *.CAL | Calibration Files |
| • *.RET | Reticle Files |
| • *.CRQ | Golden QFP Certificate |
| • *.CRB | Golden BGA Certificate |

Note that the correct reticle file must be selected in the Options screen next in the Reticle section and the certificate files must be selected in the Reference section.



## 3.4 Part Files

The C:\UltraVim3D\Parts folder contains the part files that can be loaded by the system. These files define the dimensions and tolerances of a device that is to be inspected. Part files end with the extension BGA, PAR, LCC or MRK.

The part files for UltraVim can normally be used on other similar UltraVim modules. For example, a QFP208 file from a VX module could be used on a UX module. Note, however, there may be some small changes needed in Advanced Settings in some cases, which is explained in a later chapter. Also, new part files may not be fully compatible with older versions of the software. For example, you may run a version 8.7 part file with VERSION 9.5, but a VERSION 9.5 part file will not run correctly on an 8.7 versions of the software.

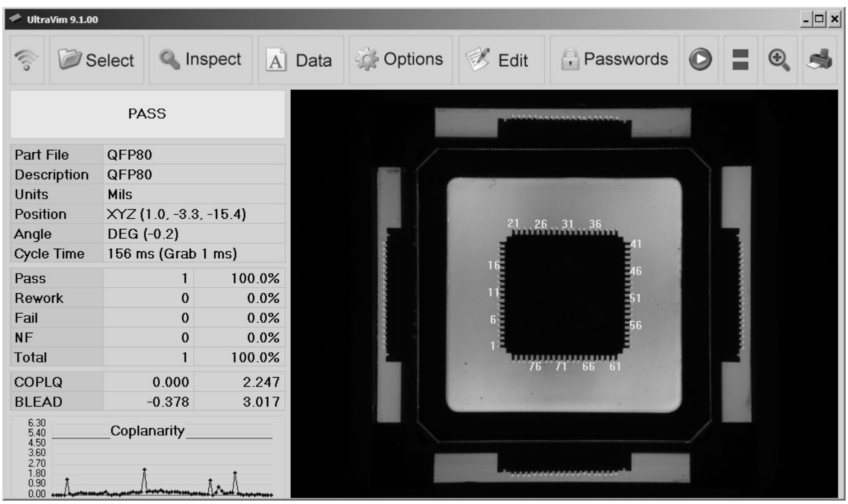
Also, there may be some changes in part files based on new hardware features. If you have an older system with 1-megapixel cameras and a new system with 2-megapixel cameras, some adjustments may be required because the resolutions are so different. Some older systems with lower resolutions may not be able to locate all features on small devices as well as new hardware with more capabilities. To compensate for this, the Resize=150 or Resize=200 command may be used in the Camera.ini file on older modules to resize the image to 150% or 200%.

# 4. UltraVim Operation

This chapter gives an overview of the UltraVim software and the features and commands found on the main screen. Additional commands can be entered in the Passwords screen. Press F1 or enter "HELP" to see additional commands.

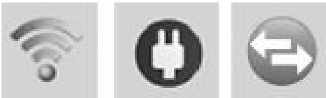
## 4.1 Main Screen

The main screen of the UltraVim software is shown above. The key elements are:

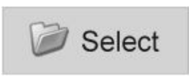



- Command Bar at Top of Screen
- Part File, Units, Position and Cycle Time
- Lot Summary, Pass, Rework, and Fails Totals
- Part Summary showing Minimum and Maximum
- Camera Images and Selection

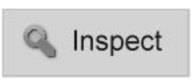
## 4.2 Commands



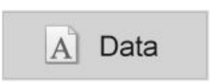
**Antenna –** The antenna icon shows the state of the software communications. When it is green the software is ready to communicate with another application. A green circle with white arrows will be shown when a socket is connected. When the icon shows a red plug communication has stopped. When digital communications are used, a user may click on a green antenna and it will turn purple to bypass inspections and give a pass result.



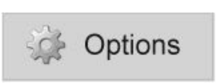

**Select –** Use this command to manually select a part file. Selecting a part file will clear all data.




**Inspect –** Use this command to manually inspect a part.




**Data –** Use this command to view, load, save and print reports.




**Options –** This command lets the user change options.


**Edit –** This command allows you to edit and create part files. If you are in password level 1, you can only view files and all parameters will be gray.


**Passwords –** Use this command to change password level, enter a license code or exit the program. The default passwords are shown below. More passwords are shown in the HELP screen.

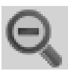
- 1 – Level 1
- 2 – Level 2
- 3 – Level 3
- 4 – Level 4
- EX – Exit
- CAL – Calibrate
- LOOP – Loop Inspection Cycles

**Override –** Use this command to override a mark failure.

**Play –** Use this command grab live images.

**Lights –** Use this to control the lights when grabbing images, if your system has that option.

**Zoom In –** Click on the Zoom button to view the image in full-screen mode.



**Zoom Out –** Click on the Zoom button to view the image in full-screen mode.

**Print –** Print the Lot Summary report.

**Save As –** Click the right mouse button on an image to display a "Save As" dialog that will save an image.

**Open –** Click the right mouse button on an image to display an "Open" dialog that will load an image. To load an image it must be PNG or TIF and have the same resolution as the camera.

**Mouse Zoom –** Draw a rectangle with the mouse while holding the shift key down to open a zoom window of that area.

**ANGLE –** Enter password ANGLE to calibrate the camera angles. This command should only be used when the optional GOLD device is loaded or a square QFP device with no bent leads.

**CAL –** Enter password CAL to display a dialog that can be used to calibrate the cameras. Note that password level 3 is required to change calibration data.

**CLOSE –** Password to perform a soft close which will avoid shutting down Windows of ShutDownOnExit =1 is set.

**CONFIG –** This password will show the current Config.ini file. To enable changes, save the file and restart the software.

**CONTROL –** Password to show the Windows Control Panel.

**DATA –** Password to show the Data dialog.

**DEVICE –** This password will open Windows Device Manager.

**DIO –** Enter password DIO to display a dialog that can be used to test the digital I/O connections.

**EDIT –** Password to show the Edit screen.

**FILE –** This password opens the UltraVim file folder.

**GAGERR –** Password to create a Gage Report. Note that SPCDATA must be active and there should be lot data that totals a multiple of the GageReportGroups=6 parameter.

**HELP –** Password to create and display the help file.

**INSPECT –** This password will inspect the part.

**LIGHT –** Enter password LIGHT to display a dialog that can be used to calibrate the LED lights.

**LOOP –** Password to loop inspection cycles and save the lot data. Note that the delay of the loop can be set in milliseconds. For example, LOOP500 will delay 500 milliseconds after an inspection.

**LOTDATA –** Password to toggle LOTDATA when the user manually clicks on the Inspect button.

**NOTEPAD –** This password will run Notepad.

**OPTION –** Password to show the options screen.

**RUNUVIM –** This password will add or delete RunUvim.exe from the "Run" section of the Windows Registry.

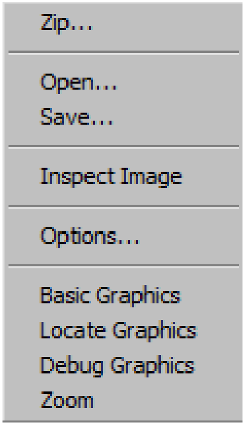
**SELECT –** Password to show Select dialog.

**SPCDATA –** Password to toggle SPCDATA. After SPCDATA is activated, the part file should be selected. Note that SPCDATA can be automatically activated with the AutoSaveSPC=1 parameter.

**TASKBAR –** Password to toggle the Windows Taskbar. The parameter HideTaskbar=1 in Config.ini or RunUvim.ini will automatically hide the taskbar.

**ZIP –** Enter password ZIP to show a "Save As..." dialog box that will grab an image from each camera and create a ZIP file that contains the images and all files in the \Files and \Parts directories. This is useful for backing up the system and sending files for customer support.

**RIGHT CLICK –** Several commands are available when you right click on the image as shown in the menu below.



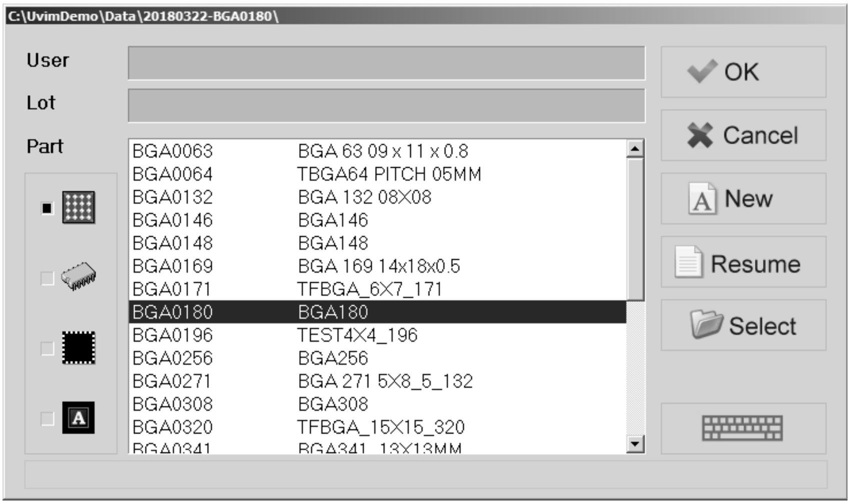
**HELP –** Enter password HELP to display the help file shown below which shows important passwords.

```
----------------------------------------------------------------------
MAIN SCREEN PASSWORDS
----------------------------------------------------------------------
2           Default Password for Level 2
3           Default Password for Level 3
EX          Default Password to Exit
ANGLE       Calibrate Camera Angle
AUTOCA      Auto-Contrast Normal
AUTOCX      Auto-Contrast Off
AUTOGQ      Auto-Gain QFP Center
CAL         Calibrate Camera
CAMERA      Open Camera File
CLEAN       Test prism cleaning
CLOSE       Soft Close UltraVim
CONFIG      Open Config File
CONTROL     Open Control Panel
DATA        Show Data Screen
DEVICE      Open Device Manager
DIO         Test Digital I/O
DRIVERS     Show Drivers Report
EDIT        Show Edit Screen
FILE        Show File Folder
GAGERR      Show Gage Report
GAGERL      Load Gage Report
HELP        Show This File
INSPECT     Inspect the Part
LIGHT       Test Lights
LOG         Create Log Files
LOOP        Loop Inspections
LOTDATA     Toggle Lot Data
NETWORK     Show Network Report
NOTEPAD     Open Notepad
OPTION      Show Options Screen
REPEAT      Show Repeatability Report
RESIZE      Allow Window Resize
RUNUVIM     Add RunUvim to Registry
SELECT      Show Select Screen
SPCDATA     Toggle SPC Data
SYSTEM      Show System Report
TASKBAR     Show or Hide Taskbar
ZIP         Zip Images and Files
```

## 4.3 Select Part

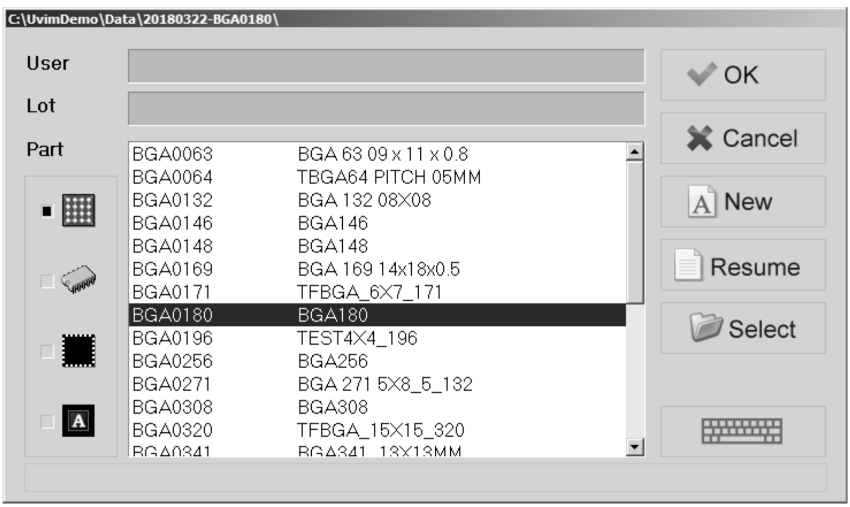
The Select Part dialog, shown below, allows a user to manually select a part and enter user and lot information. The icons in the lower-left corner of the screen let the user select the part type. When the part type is changed, the files listed will also change and only files with a BGA, PAR, LCC or MRK extension will be shown in the list. The file name of the part selected is shown at the top of the screen.

The edit boxes for the User and Lot information are shown in red until values are entered. The OK button remains gray until User and Lot information has been entered and a part file has been selected. These rules can by changed by setting LevelLot=1 in the Config.ini file. If you are in password level 3, you may click on the "New" button to go directly to the part editor to create a new file.



If the AutoSave feature is selected in the Options screen the Select Part dialog will display Resume and Select buttons. The Resume button will turn green when a resume (*.rsm) file is automatically found that matches the part and lot description. The software searches files in the data directory and the directory where the resume file was found is shown at the bottom of the dialog box. The new or existing directory that will store data when the OK button is pressed is shown at the top of the dialog box.

If the resume file is not automatically found or the user would like to select a different resume file, the Select button can be used to open a file dialog box that will allow the user to search for resume files that match the part name. In the example below the resume file would be BGA0180.rsm.



## 4.4 Inspect Part

When the system receives an inspect command, the UltraVim software performs the following steps:

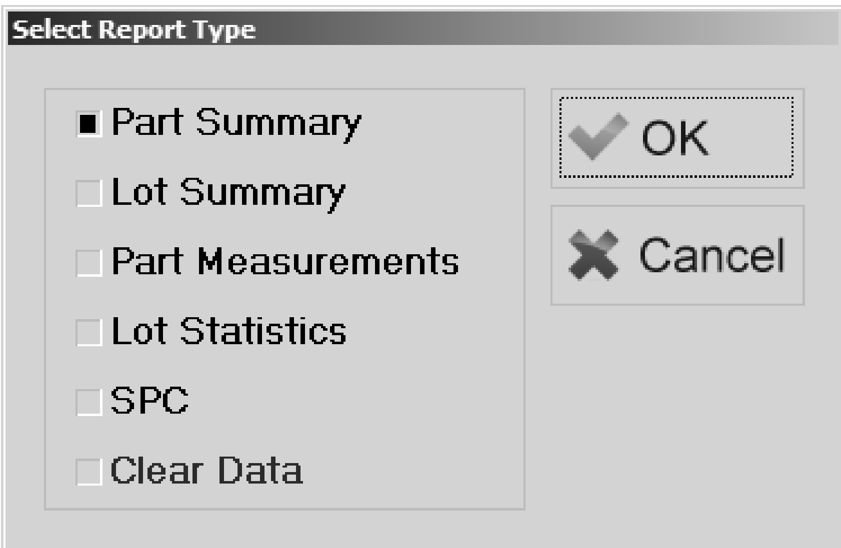
- Acquires Image(s)
- Sends a Move Response (Optional)
- Computes the Results
- Sends a Result Response
- Displays Results

If the device was not found in any of the images the result are shown as "NFND" and a red rectangle will be drawn at the expected location of the device. If the device was found, but a lead was not found, the label of the failing lead will be displayed and a red marker will be drawn at the expected location of that lead. There can be several causes for a "NFND" result. The most common causes are shown below:

- The Lead is Missing
- The Device is Missing
- Reflections in the Image
- The Part File is Incorrect
- A Light is Not Working
- A Camera is Not Working

## 4.5 Data

To view data, click on the "Data" button and the dialog below will be shown. To select a report, click on the report type then click on the OK button. The user may also double click on the report type to load the report in one step.



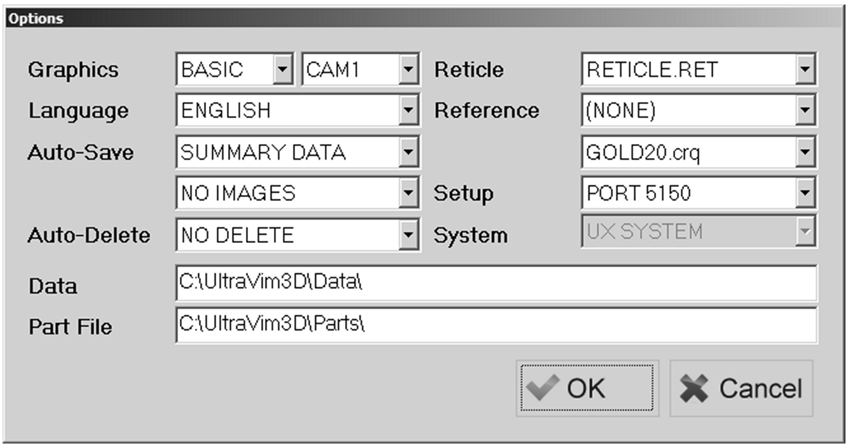

Descriptions of each type of report are shown below.

| | |
|---|---|
| • Part Summary | Text Report of Part Results |
| • Lot Summary | Text Report of Lot Results |
| • Part Measurements | Graph of Part Measurements |
| • Lot Statistics | Graph of Lot Statistics |
| • SPC | Graph of SPC Data (Optional) |

## 4.6 Options

**Graphics –** Use this to set DEBUG graphics, or you may select LOCATE to display only the graphics used to locate the position of the device and select which camera to display.

**Language –** Select the language you want displayed.




**Auto-Save -** If Auto-Save is selected, the system will automatically save data or images. Options to save data include just the Lot Summary file, data for failed inspections or all report data. Options to save images include the first image, failed images or all images.

**Auto-Delete -** If you turn on the Auto-Delete option, files in the data directory will automatically be deleted after a certain number of days. Select the number of days you wish to keep files, or select "NO DELETE" and data will not be deleted.

**Reticle –** Select the reticle file that is used with UltraVim and UltraVim Plus modules. Reticle files end with *.RET and are stored in the \Files directory.

**Reference –** Select the golden unit reference files. Golden QFP files end with *.CRQ and golden BGA files end with *.CRB. These files are located in the \Files directory.

**Setup –** This determines how the software will respond to host commands. You may select a COMM port, an Ethernet port or an optional Digital I/O device.

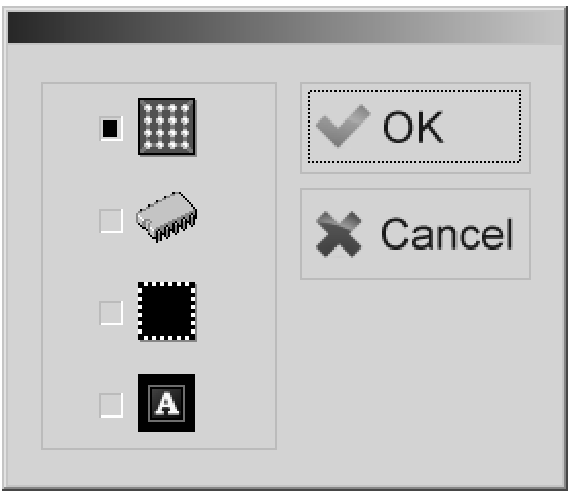
**System –** The system is used to specify the module type so the software can correctly inspect images with different lighting aspects and camera configurations. The choices include VX, UX, 2D, 3D and 4D modules. The license code entered in the Passwords dialog must match both the hardware and the system type.

**Data –** The data edit box specifies where the data is stored. Note that storing data on a network may slow down inspection times if Auto-Save is used. If you used Auto-Delete, make sure there are no files you need in the Data directory because they will be deleted.

**Part File –** The Part File edit box specifies where part files are located.

## 4.7 Edit

When you click on Edit, the dialog below will be shown. From this dialog, the user can click on the icon of the part type, then click OK to view or edit part files of that type. The user may also double click on the part type to edit devices of that type in one step. Note that part types may be disabled in the Config.ini file. For example, if "UseMRK=0" is set, the MRK part types cannot be selected. If only one part type is enabled, there is no need for the selection screen below to be shown.




After you select the part type and click "OK" the Edit screen for that device type will be shown. The edit boxes in the Maintenance screen may be grayed out if the part file is read only, or the current user level is lower than the level required to edit part files.

## 4.8 Passwords

The Passwords dialog box shows the software version, the license code, the hardware ID, the computer name, the Windows version and processor speed, and the camera, Digital I/O and LED driver names. The user can enter a password to change user level, show additional screens, perform commands, exit the program, or update the license code.


Note that you may change the serial number to any value or string, and setting HideConfigFiles=1 will hide the system files.

**[Config]**

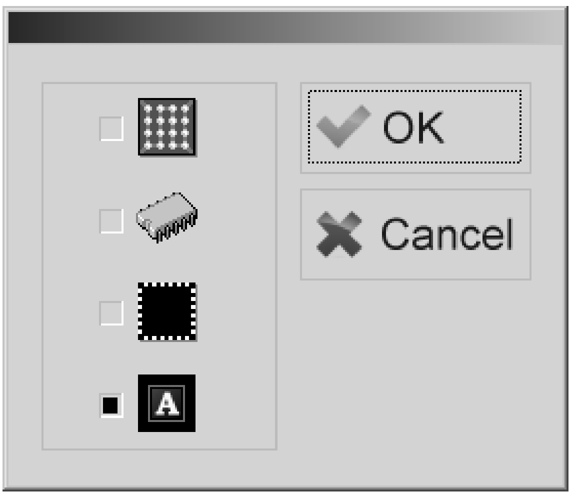
HideConfigFiles=0

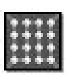
SerialNo=

The software requires a license code to be entered into the password dialog. Without the license code, the software will run in "Demo" mode that will limit the number of images allowed. After a license code is entered, it is compared to the hardware serial number. If a correct code is entered, the software will no longer display the text "Demo" after the version number and the license code will be stored in the License.ini file. If you change your hardware you may need a new license code. Note that a full installation for specific hardware will often include the License.ini file and the user will not need to enter the code.

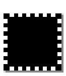
# 5. Part Files

This chapter describes how to create and edit part files for the UltraVim system. It is very important to make sure the values in the part files are correct for the system to operate correctly. It is best to use the CAD drawing of the part to verify the values you enter in the part file. When a user clicks on the "Edit" button in the UltraVim software, a dialog will be shown that allows the user to select the part type.




 *.BGA - Ball Grid Array Devices

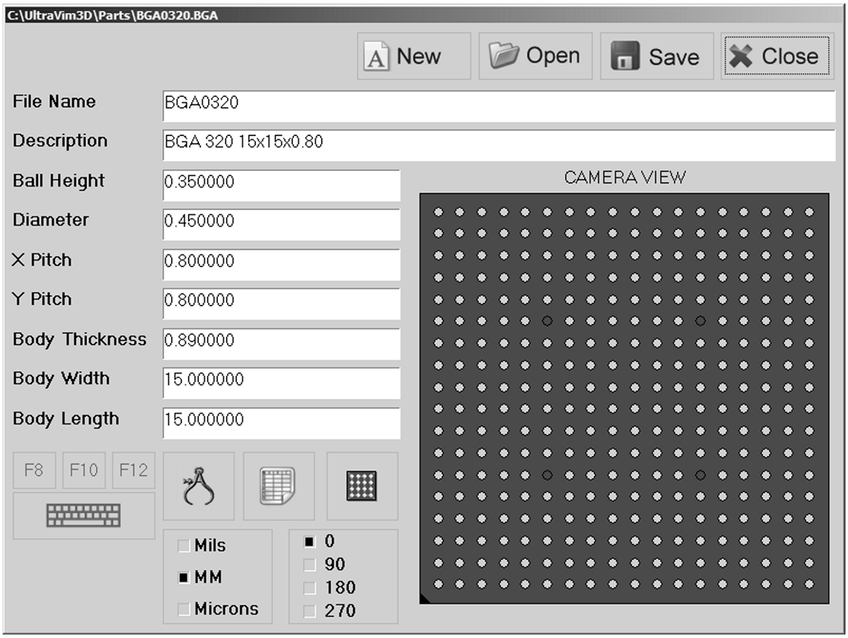
 *.PAR - Gull Wing and J-Lead Devices

 *.LCC - QFN and LCC Devices

 *.MRK - Mark & Package Inspection

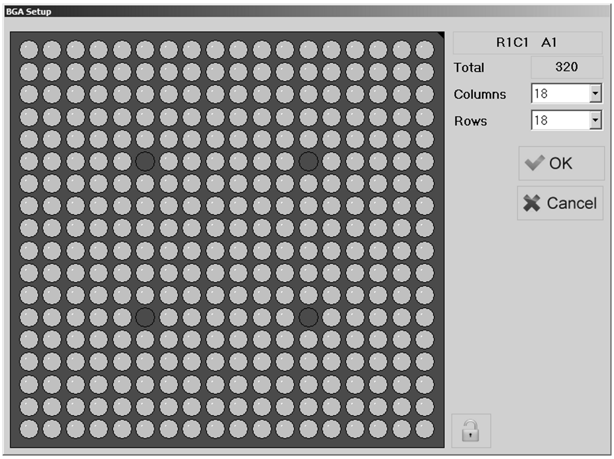
## 5.1 Ball Grid Array Screens

The Ball Grid Array screen is shown below. The user must enter parameters and select the units and orientation on the left. The setup buttons allow the user to select balls, enter or view spreadsheet data, and enter tolerance values.



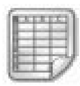

The File Name can be up to twelve characters long. File names of older UltraVim systems were eight characters long, and may have used only ones and zeros in the name. The user must enter the correct Ball Height, Ball Diameter, X Pitch, Y Pitch, Board Thickness, Board Width and Board Length. The Units and Orientation can be selected at any time. Changing the units will cause all parameters to convert automatically.

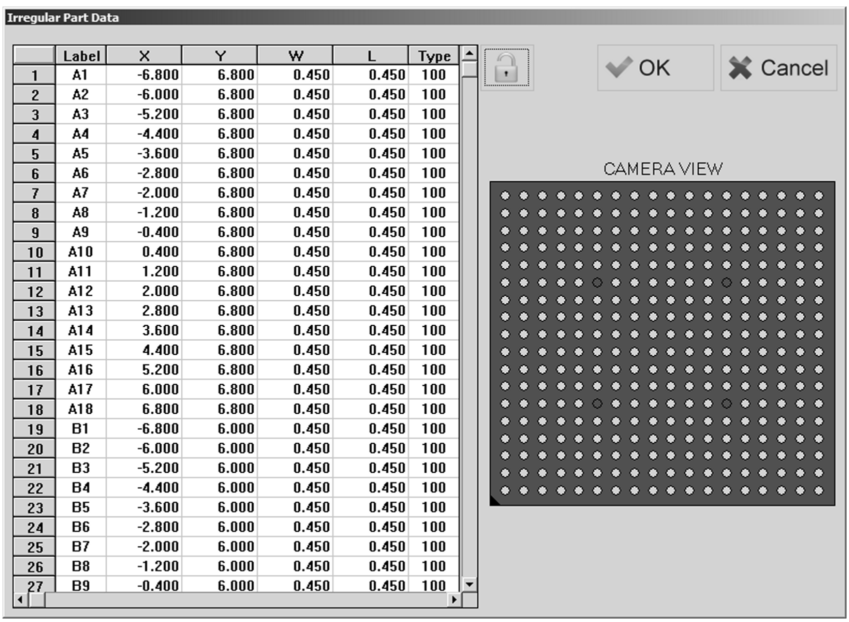
If the user clicks on the BGA setup icon, the screen below will be shown. From this screen the user can remove missing balls from your part file. To add or remove a ball, the user may click on the ball with the left button, or use the mouse to drag over a number of balls. As you move the mouse over a ball, the ball label will be shown on the right. If the number of columns or rows is changed, the array will default to a full matrix. To draw a staggered grid, drag the mouse from right to left.




The lock button, shown below, is used to set the device as an irregular part file. If the setup screen is locked, the software will not allow the user to select balls, and instead will define the device from the spreadsheet data.

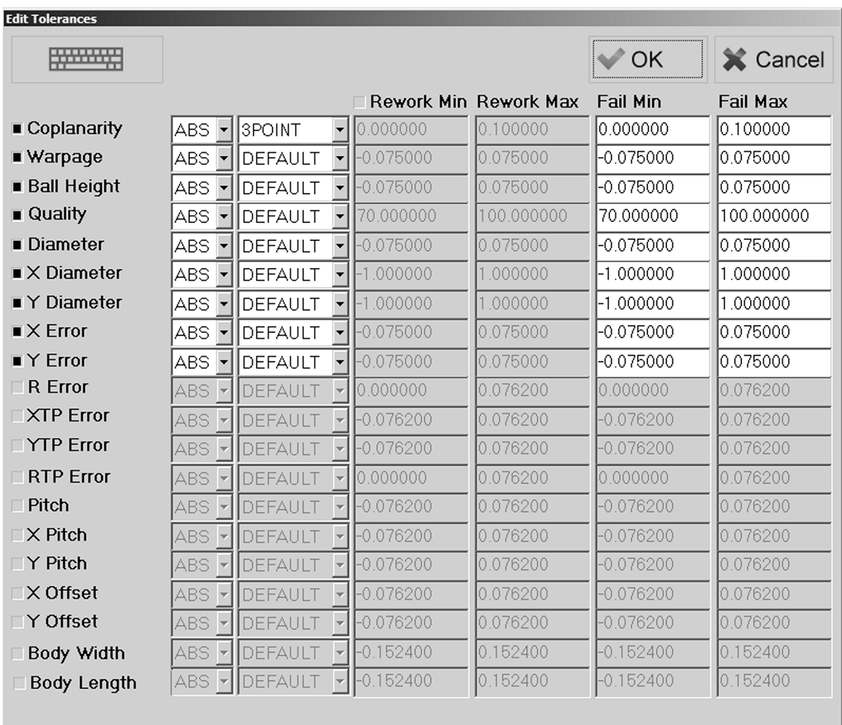
If the user clicks on the spreadsheet icon, the spreadsheet dialog will be displayed. The spreadsheet dialog allows the user to enter the label, X position, Y position, width, length and type to define irregular devices. For ball grid array devices, the type should be set to 101. If the spreadsheet is gray, click on the lock button to unlock the data. This will also cause the spreadsheet icon to appear green in the main setup screen. Clicking on the BGA device in this screen or the main screen will toggle between CAMERA VIEW and DRAWING VIEW.






| | Label | X | Y | W | L | Type |
|---|---|---|---|---|---|---|
| 1 | A1 | -6.800 | 6.800 | 0.450 | 0.450 | 100 |
| 2 | A2 | -6.000 | 6.800 | 0.450 | 0.450 | 100 |
| 3 | A3 | -5.200 | 6.800 | 0.450 | 0.450 | 100 |
| 4 | A4 | -4.400 | 6.800 | 0.450 | 0.450 | 100 |
| 5 | A5 | -3.600 | 6.800 | 0.450 | 0.450 | 100 |
| 6 | A6 | -2.800 | 6.800 | 0.450 | 0.450 | 100 |
| 7 | A7 | -2.000 | 6.800 | 0.450 | 0.450 | 100 |
| 8 | A8 | -1.200 | 6.800 | 0.450 | 0.450 | 100 |
| 9 | A9 | -0.400 | 6.800 | 0.450 | 0.450 | 100 |
| 10 | A10 | 0.400 | 6.800 | 0.450 | 0.450 | 100 |
| 11 | A11 | 1.200 | 6.800 | 0.450 | 0.450 | 100 |
| 12 | A12 | 2.000 | 6.800 | 0.450 | 0.450 | 100 |
| 13 | A13 | 2.800 | 6.800 | 0.450 | 0.450 | 100 |
| 14 | A14 | 3.600 | 6.800 | 0.450 | 0.450 | 100 |
| 15 | A15 | 4.400 | 6.800 | 0.450 | 0.450 | 100 |
| 16 | A16 | 5.200 | 6.800 | 0.450 | 0.450 | 100 |
| 17 | A17 | 6.000 | 6.800 | 0.450 | 0.450 | 100 |
| 18 | A18 | 6.800 | 6.800 | 0.450 | 0.450 | 100 |
| 19 | B1 | -6.800 | 6.000 | 0.450 | 0.450 | 100 |
| 20 | B2 | -6.000 | 6.000 | 0.450 | 0.450 | 100 |
| 21 | B3 | -5.200 | 6.000 | 0.450 | 0.450 | 100 |
| 22 | B4 | -4.400 | 6.000 | 0.450 | 0.450 | 100 |
| 23 | B5 | -3.600 | 6.000 | 0.450 | 0.450 | 100 |
| 24 | B6 | -2.800 | 6.000 | 0.450 | 0.450 | 100 |
| 25 | B7 | -2.000 | 6.000 | 0.450 | 0.450 | 100 |
| 26 | B8 | -1.200 | 6.000 | 0.450 | 0.450 | 100 |
| 27 | B9 | -0.400 | 6.000 | 0.450 | 0.450 | 100 |

The tolerance icon below will cause the tolerance dialog to be displayed. The tolerance screen defines how the values are calculated, and what values will cause the part to be rejected or reworked. If rework values are not required, the user may click on the "Rework Min" button to disable the rework columns. If rework is disabled, the values will automatically change to the same values in the fail column. Note that the screen will only display available measurements. For example, Coplanarity will not be shown on a 2D system because it is a 3D measurement.



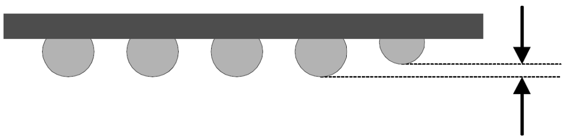
Edit Tolerances

OK Cancel

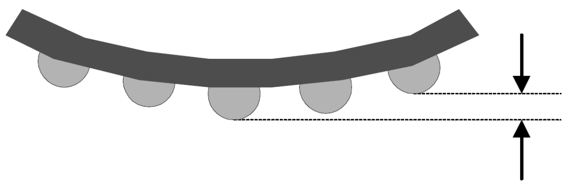
| | | | Rework Min | Rework Max | Fail Min | Fail Max |
|---|---|---|---|---|---|---|
| Coplanarity | ABS | 3POINT | 0.000000 | 0.100000 | 0.000000 | 0.100000 |
| Warpage | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Ball Height | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Quality | ABS | DEFAULT | 70.000000 | 100.000000 | 70.000000 | 100.000000 |
| Diameter | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| X Diameter | ABS | DEFAULT | -1.000000 | 1.000000 | -1.000000 | 1.000000 |
| Y Diameter | ABS | DEFAULT | -1.000000 | 1.000000 | -1.000000 | 1.000000 |
| X Error | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Y Error | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| R Error | ABS | DEFAULT | 0.000000 | 0.076200 | 0.000000 | 0.076200 |
| XTP Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| YTP Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| RTP Error | ABS | DEFAULT | 0.000000 | 0.076200 | 0.000000 | 0.076200 |
| Pitch | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| X Pitch | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Y Pitch | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| X Offset | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Y Offset | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Body Width | ABS | DEFAULT | -0.152400 | 0.152400 | -0.152400 | 0.152400 |
| Body Length | ABS | DEFAULT | -0.152400 | 0.152400 | -0.152400 | 0.152400 |

## 5.2 Ball Grid Array Measurements

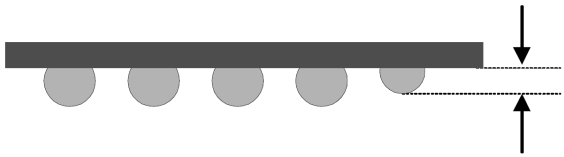
**COPLB (Coplanarity)** is the Z distance of the ball to the average Z measurement as defined by the LMS global regression plane, with the lowest ball set to zero.



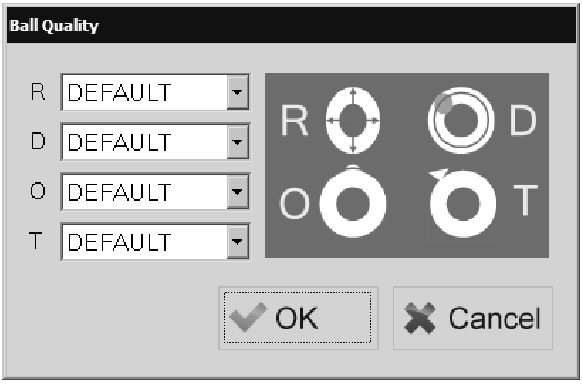
**BWARP (Warpage)** is the estimated Z position of the package substrate at the X, Y position of each ball.



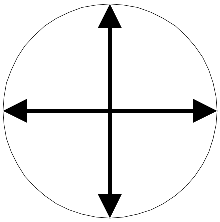
**BHGHT (Ball Height)** is the Z height of the ball relative to the board. This measurement is calculated by adding the nominal standoff to the ball height relative to the closest balls.



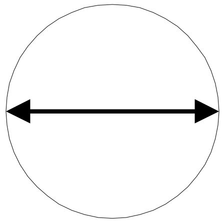
**BQUAL (Ball Quality)** is a measurement of the quality of the reflection of the ball in each image. It combines the roundness, donut, outside the donut and between balls to report a percentage of quality between 0% and 100%. Ball Quality measurement options include DEFAULT, WORST, REGRESS and BEST. Setting the measurement to WORST will typically fail more balls. The REGRESS measurement looks for 3-sigma deviations in Ball Quality that are worse than the average ball. Individual parameters can also be set with the F10 screen shown below.



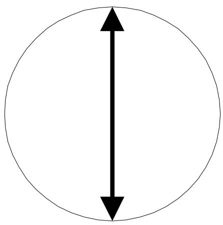

**BDIAM (Ball Diameter)** is the average diameter of the ball.



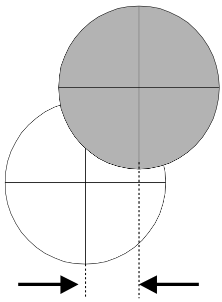
**XDIAM (X Diameter)** is the X diameter of the ball.



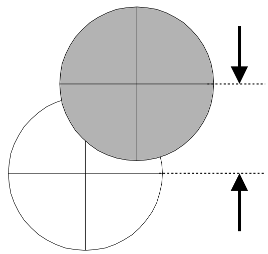
**YDIAM (Y Diameter)** is the Y diameter of the ball.



**XPERR (X Error)** is the distance a ball is located from its ideal distance in the X direction.

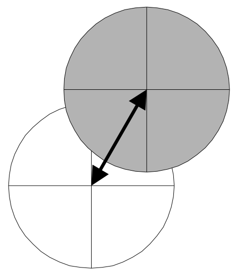


**YPERR (Y Error)** is the distance a ball is located from its ideal distance in the Y direction.

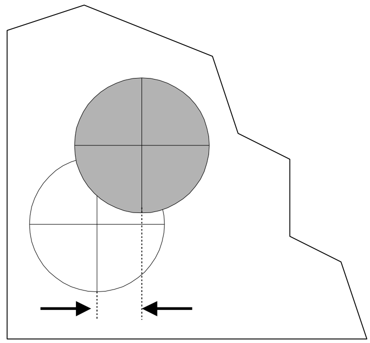


**RPERR (R Error)** is the distance from the X,Y center of the ball to the ideal X,Y center defined by the X and Y datum.

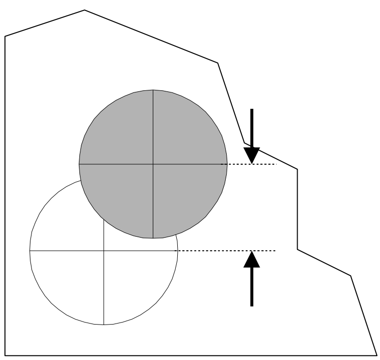
RPERR = sqrt(XPERR*XPERR + YPERR*YPERR)



**XTPOS (XTP Error)** is the distance a ball is located from its ideal distance in the X direction as defined by the edges of the board.



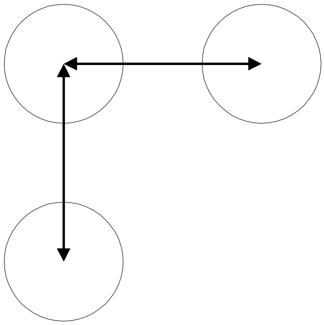
**YTPOS (YTP Error)** is the distance a ball is located from its ideal distance in the Y direction as defined by the edges of the board.



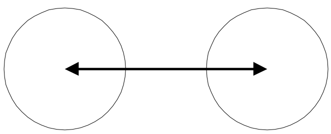
**RTPOS (RTP Error)** is the distance a ball is located from its ideal distance in the XY direction as defined by the edges of the board.

RTPOS = sqrt(XTPOS*XTPOS + YTPOS*YTPOS)

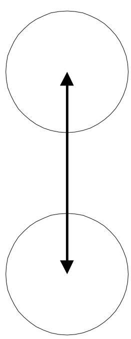
**BPTCH (Ball Pitch)** This is the average of X Pitch and Y Pitch.



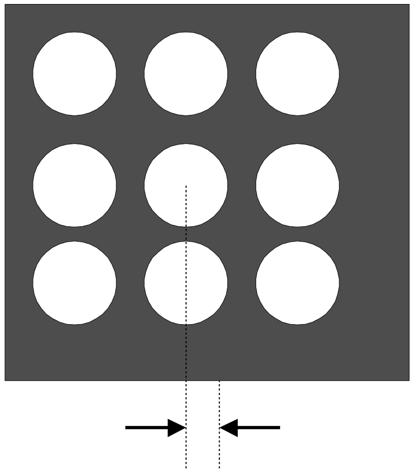
**XPTCH (X Pitch)** is the distance from one ball to the next adjacent ball in the X direction.



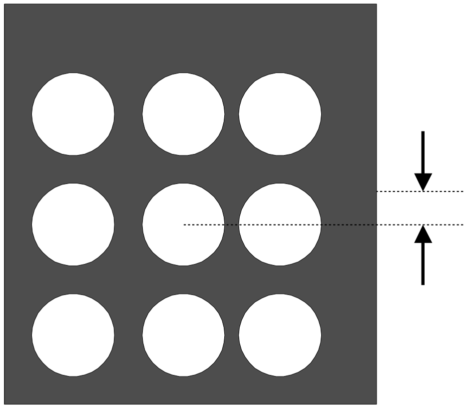
**YPTCH (Y Pitch)** is the distance from one ball to the next adjacent ball in the Y direction.



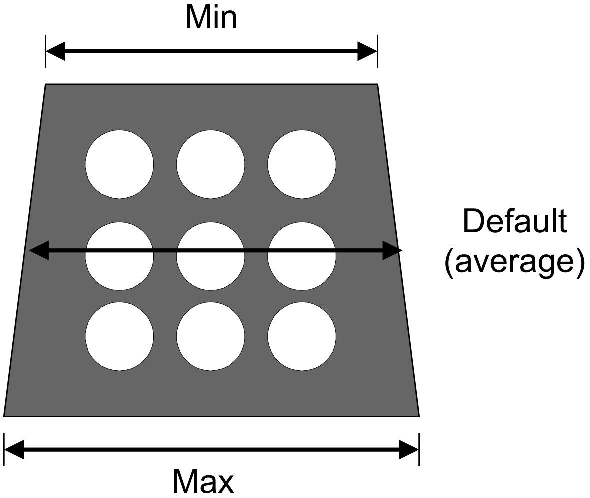
**GXOFF (X Grid Offset)** is the X offset of the center of the ball array grid to the center of the package.



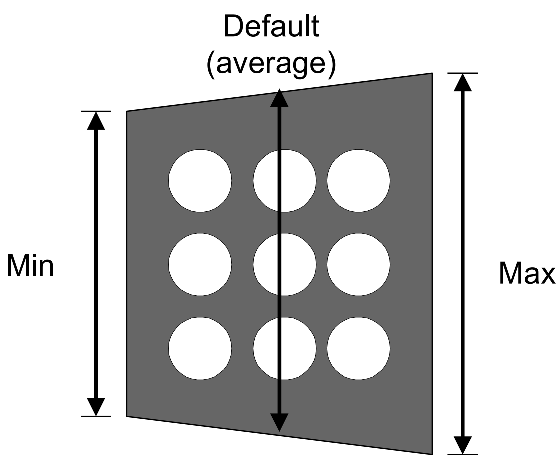
**GYOFF (Y Grid Offset)** is the Y offset of the center of the ball array grid to the center of the package.



**BRWID (Board Width)** is the X dimensions of the BGA package.

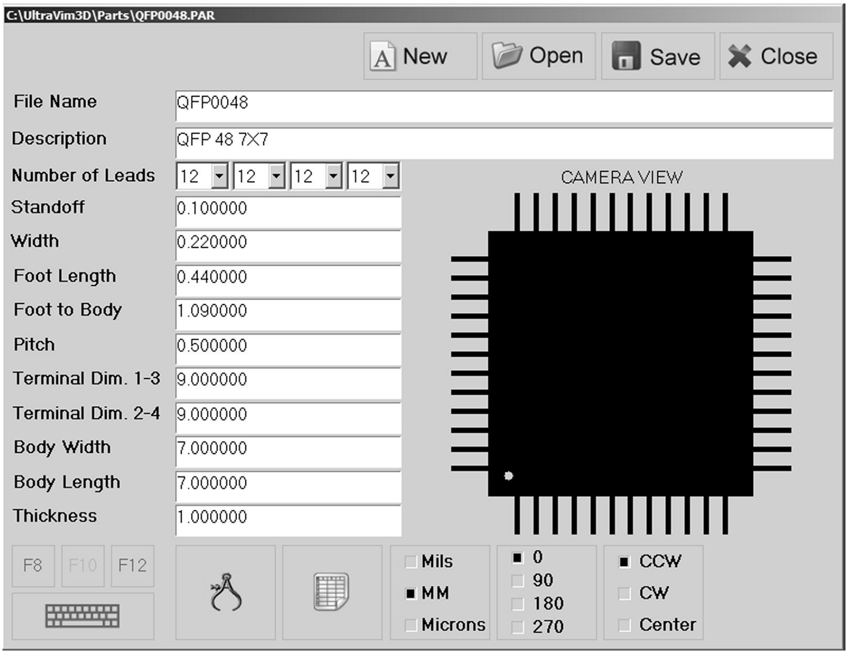



**BRLEN (Board Length)** is the Y dimensions of the BGA package.



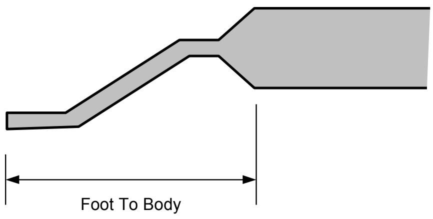
## 5.3 Leaded Part Screens

The Leaded Part screen is shown below. The user must enter parameters and select the units and orientation on the left. The setup buttons enter or view spreadsheet data, and to enter tolerance values.

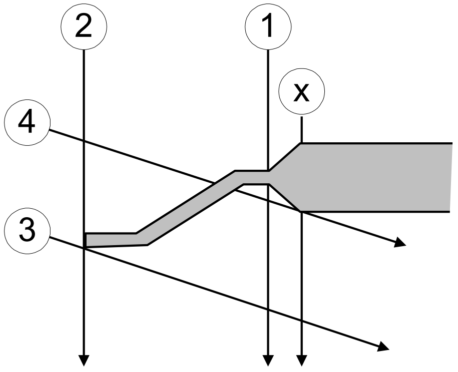



The File Name can be up to twelve characters long. The user must enter the Number of Leads, Standoff, Width, Foot Length, Pitch, Terminal Dimensions, Board Width and Board Length. The Units and Orientation can be selected at any time. Changing the units will cause all parameters to convert automatically.

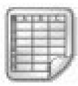
The "Foot to Body" dimension is shown below. This measurement is important for the Standoff calculation. If the user does not enter this information the software will estimate this dimension as the distance from the lead to the body plus 15% of the body thickness.

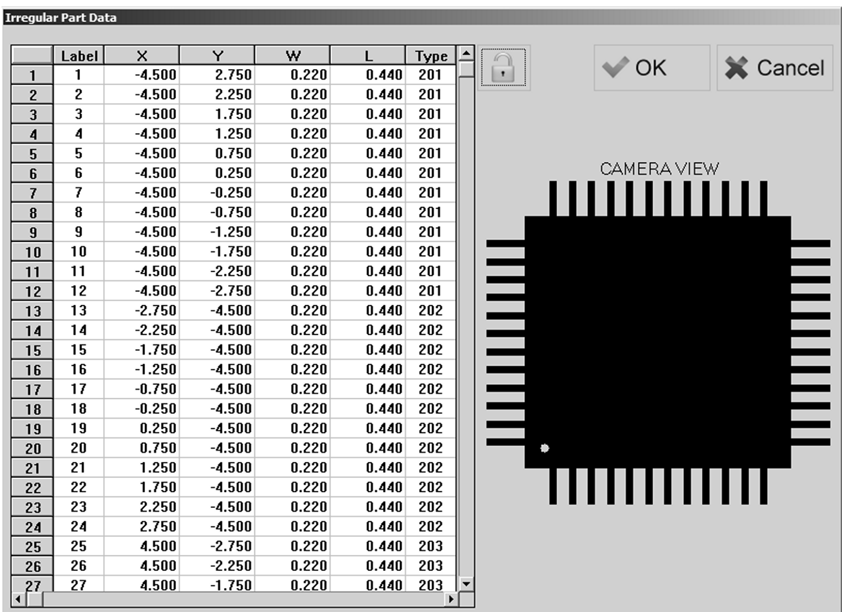



Standoff is calculated from the triangulation of the intersection of the rays shown in the diagram below. Rays 1, 2, 3, and 4 can be calculated from the information in the views, but ray X cannot be found because of the lighting configuration. To compensate for this, the software creates a "Virtual Ray X" during the inspection from the "Foot to Body" dimension.



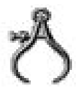
If the user clicks on the spreadsheet icon, the spreadsheet dialog will be displayed. The spreadsheet dialog allows the user to enter the label, X position, Y position, width, length and type to define irregular devices. For leaded devices, types 201, 202, 203 and 204 should be used to define leads on sides 1 (left), 2 (top), 3 (right) and 4 (bottom) of the device. If the spreadsheet is gray, click on the lock button to unlock the data. This will also cause the spreadsheet icon to appear green in the main setup screen.

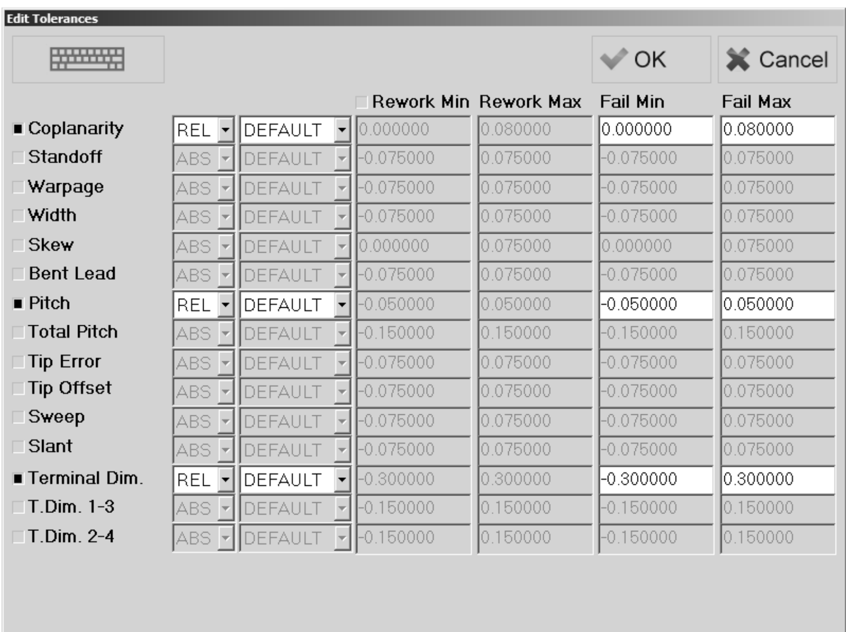




| | Label | X | Y | W | L | Type |
|---|---|---|---|---|---|---|
| 1 | 1 | -4.500 | 2.750 | 0.220 | 0.440 | 201 |
| 2 | 2 | -4.500 | 2.250 | 0.220 | 0.440 | 201 |
| 3 | 3 | -4.500 | 1.750 | 0.220 | 0.440 | 201 |
| 4 | 4 | -4.500 | 1.250 | 0.220 | 0.440 | 201 |
| 5 | 5 | -4.500 | 0.750 | 0.220 | 0.440 | 201 |
| 6 | 6 | -4.500 | 0.250 | 0.220 | 0.440 | 201 |
| 7 | 7 | -4.500 | -0.250 | 0.220 | 0.440 | 201 |
| 8 | 8 | -4.500 | -0.750 | 0.220 | 0.440 | 201 |
| 9 | 9 | -4.500 | -1.250 | 0.220 | 0.440 | 201 |
| 10 | 10 | -4.500 | -1.750 | 0.220 | 0.440 | 201 |
| 11 | 11 | -4.500 | -2.250 | 0.220 | 0.440 | 201 |
| 12 | 12 | -4.500 | -2.750 | 0.220 | 0.440 | 201 |
| 13 | 13 | -2.750 | -4.500 | 0.220 | 0.440 | 202 |
| 14 | 14 | -2.250 | -4.500 | 0.220 | 0.440 | 202 |
| 15 | 15 | -1.750 | -4.500 | 0.220 | 0.440 | 202 |
| 16 | 16 | -1.250 | -4.500 | 0.220 | 0.440 | 202 |
| 17 | 17 | -0.750 | -4.500 | 0.220 | 0.440 | 202 |
| 18 | 18 | -0.250 | -4.500 | 0.220 | 0.440 | 202 |
| 19 | 19 | 0.250 | -4.500 | 0.220 | 0.440 | 202 |
| 20 | 20 | 0.750 | -4.500 | 0.220 | 0.440 | 202 |
| 21 | 21 | 1.250 | -4.500 | 0.220 | 0.440 | 202 |
| 22 | 22 | 1.750 | -4.500 | 0.220 | 0.440 | 202 |
| 23 | 23 | 2.250 | -4.500 | 0.220 | 0.440 | 202 |
| 24 | 24 | 2.750 | -4.500 | 0.220 | 0.440 | 202 |
| 25 | 25 | 4.500 | -2.750 | 0.220 | 0.440 | 203 |
| 26 | 26 | 4.500 | -2.250 | 0.220 | 0.440 | 203 |
| 27 | 27 | 4.500 | -1.750 | 0.220 | 0.440 | 203 |

The tolerance icon below will cause the tolerance dialog to be displayed. The tolerance screen defines how the values are calculated, and what values will cause the part to be rejected or reworked. If rework values are not required, the user may click on the “Rework Min” button to disable the rework columns. If rework is disabled, the values will automatically change to the same values in the fail column.





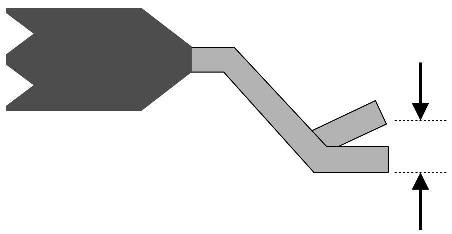
Edit Tolerances

OK Cancel

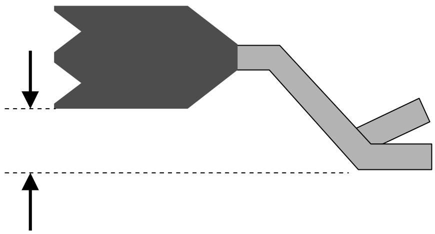
| | | | Rework Min | Rework Max | Fail Min | Fail Max |
|---|---|---|---|---|---|---|
| Coplanarity | REL | DEFAULT | 0.000000 | 0.080000 | 0.000000 | 0.080000 |
| Standoff | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Warpage | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Width | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Skew | ABS | DEFAULT | 0.000000 | 0.075000 | 0.000000 | 0.075000 |
| Bent Lead | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Pitch | REL | DEFAULT | -0.050000 | 0.050000 | -0.050000 | 0.050000 |
| Total Pitch | ABS | DEFAULT | -0.150000 | 0.150000 | -0.150000 | 0.150000 |
| Tip Error | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Tip Offset | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Sweep | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Slant | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Terminal Dim. | REL | DEFAULT | -0.300000 | 0.300000 | -0.300000 | 0.300000 |
| T.Dim. 1-3 | ABS | DEFAULT | -0.150000 | 0.150000 | -0.150000 | 0.150000 |
| T.Dim. 2-4 | ABS | DEFAULT | -0.150000 | 0.150000 | -0.150000 | 0.150000 |

## 5.4 Leaded Part Measurements

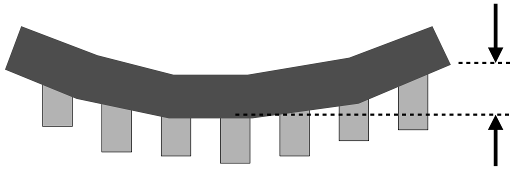
**COPLQ (Coplanarity)** is the distance from the lead to a flat surface when the part is placed on that surface.



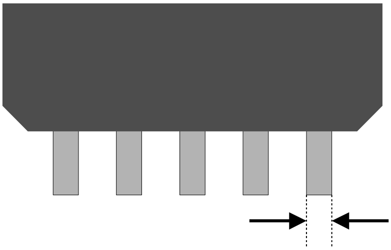
**STOFF (Standoff)** is the distance from the body to a flat surface when the part is placed on that flat surface.



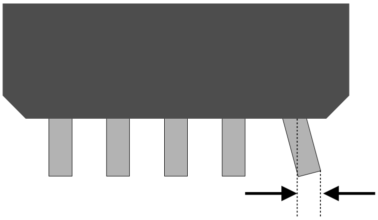
**QWARP (Warpage)** is an estimate of the amount that the part is warped based on a regression of the lead positions.



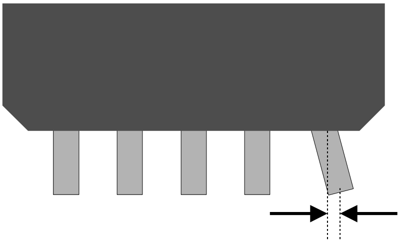
**WIDTH (Width)** is the distance from one edge of the lead to the other edge. This measurement is calculated 1/2 width from the lead tip.



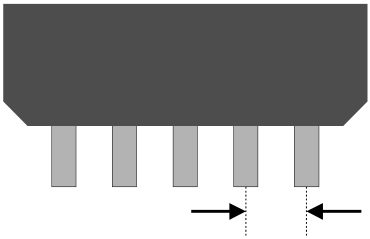
**LSKEW (Skew)** is the absolute value of the bent lead error combined with half the value of the width error. A lead that is bent and has a large width will produce the largest skew error.



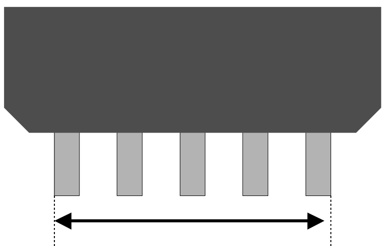
**BLEAD (Bent Lead)** is the distance from the center of the lead to the ideal center of the lead.



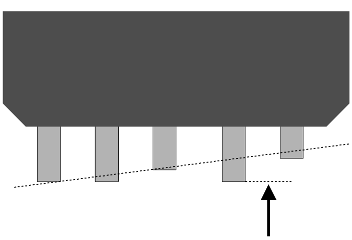
**PITCH (Pitch)** is the distance between the measured centers of two adjacent leads.



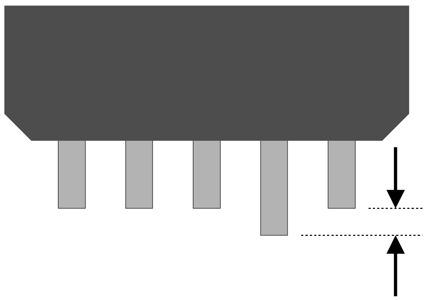
**TPTCH (Total Pitch)** is the distance from the first lead on a side to the last lead on the side.



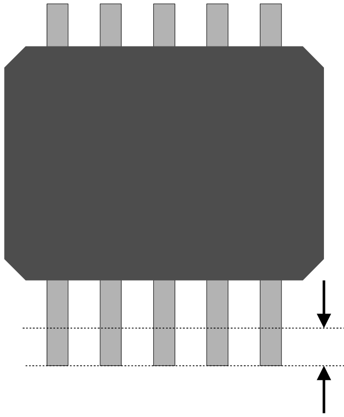
**TPERR (Tip Error)** uses a best-fit line to calculate the tip offset relative to the other leads on a side.



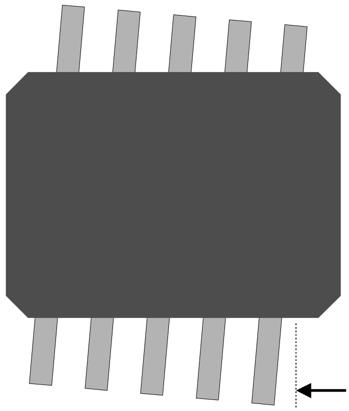
**TPOFF (Tip Offset)** is the distance from the tip of the lead to the ideal position of the lead.



**SWEEP (Lead Sweep)** is how far the leads are swept in the tip offset direction as defined by the location of the package body.



**SLANT (Lead Slant)** is how far the leads on a side are bent in a single direction based on the rotation and alignment of the package body.



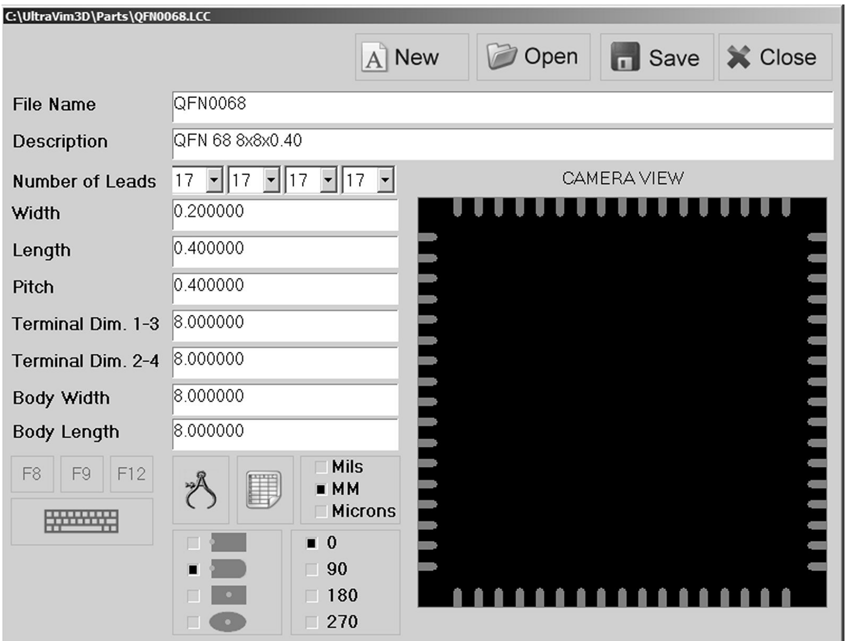
**TTTIP (Terminal Dimension)** is the tip-to-tip distance between two opposite leads.

**TTT13 (Terminal Dimension 1, 3)** is the terminal dimension between leads on sides 1 or 3. Leads on sides 2 or 4 are set to the nominal value for the terminal distance of sides 1 to 3.

**TTT24 (Terminal Dimension 2, 4)** is the terminal dimension between leads on sides 2 or 4. Leads on sides 1 or 3 are set to the nominal value for the terminal distance of sides 2 to 4.

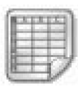
## 5.5 Leadless Part Screens

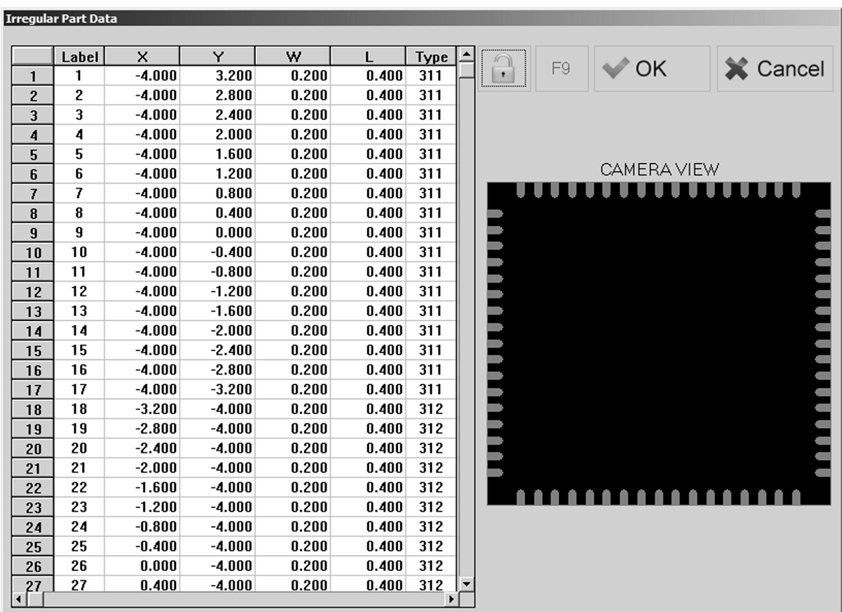
The Leadless screen is shown below. The user must enter parameters and select the units and orientation on the left. The setup buttons enter or view spreadsheet data, and to enter tolerance values.




The File Name can be up to twelve characters long. The user must enter the Number of Leads, Width, Length, Pitch, Terminal Dimensions, Board Width and Board Length. The Units and Orientation can be selected at any time. Changing the units will cause all parameters to convert automatically.

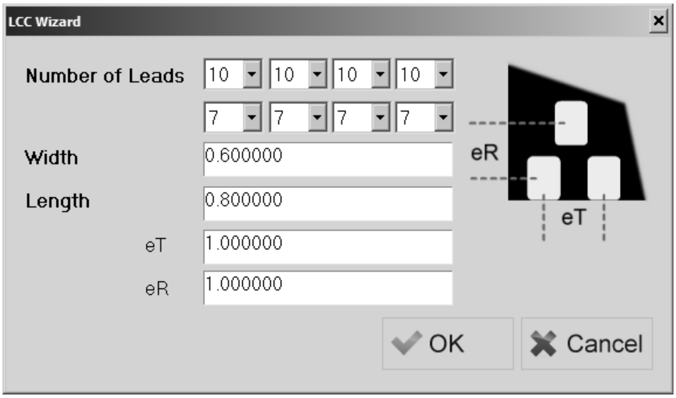
If the user clicks on the spreadsheet icon, the spreadsheet dialog will be displayed. The spreadsheet dialog allows the user to enter the label, X position, Y position, width, length and type to define irregular devices. For leadless devices, types 301, 302, 303 and 304 should be used to define leads on sides 1 (left), 2 (top), 3 (right) and 4 (bottom) of the device. Types 311, 312, 313 and 314 may be used to define leads with a rounded back pad edge. Type 320 is used to define rectangular pads from the center. Types 321, 322, 323 and 324 are used to define corner pad and must use the pad center location. Type 330 is used to define the centers of round pads.



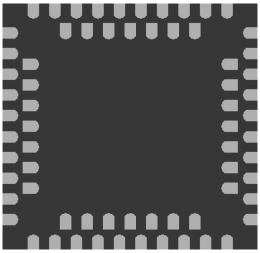



| | Label | X | Y | W | L | Type |
|---|---|---|---|---|---|---|
| 1 | 1 | -4.000 | 3.200 | 0.200 | 0.400 | 311 |
| 2 | 2 | -4.000 | 2.800 | 0.200 | 0.400 | 311 |
| 3 | 3 | -4.000 | 2.400 | 0.200 | 0.400 | 311 |
| 4 | 4 | -4.000 | 2.000 | 0.200 | 0.400 | 311 |
| 5 | 5 | -4.000 | 1.600 | 0.200 | 0.400 | 311 |
| 6 | 6 | -4.000 | 1.200 | 0.200 | 0.400 | 311 |
| 7 | 7 | -4.000 | 0.800 | 0.200 | 0.400 | 311 |
| 8 | 8 | -4.000 | 0.400 | 0.200 | 0.400 | 311 |
| 9 | 9 | -4.000 | 0.000 | 0.200 | 0.400 | 311 |
| 10 | 10 | -4.000 | -0.400 | 0.200 | 0.400 | 311 |
| 11 | 11 | -4.000 | -0.800 | 0.200 | 0.400 | 311 |
| 12 | 12 | -4.000 | -1.200 | 0.200 | 0.400 | 311 |
| 13 | 13 | -4.000 | -1.600 | 0.200 | 0.400 | 311 |
| 14 | 14 | -4.000 | -2.000 | 0.200 | 0.400 | 311 |
| 15 | 15 | -4.000 | -2.400 | 0.200 | 0.400 | 311 |
| 16 | 16 | -4.000 | -2.800 | 0.200 | 0.400 | 311 |
| 17 | 17 | -4.000 | -3.200 | 0.200 | 0.400 | 311 |
| 18 | 18 | -3.200 | -4.000 | 0.200 | 0.400 | 312 |
| 19 | 19 | -2.800 | -4.000 | 0.200 | 0.400 | 312 |
| 20 | 20 | -2.400 | -4.000 | 0.200 | 0.400 | 312 |
| 21 | 21 | -2.000 | -4.000 | 0.200 | 0.400 | 312 |
| 22 | 22 | -1.600 | -4.000 | 0.200 | 0.400 | 312 |
| 23 | 23 | -1.200 | -4.000 | 0.200 | 0.400 | 312 |
| 24 | 24 | -0.800 | -4.000 | 0.200 | 0.400 | 312 |
| 25 | 25 | -0.400 | -4.000 | 0.200 | 0.400 | 312 |
| 26 | 26 | 0.000 | -4.000 | 0.200 | 0.400 | 312 |
| 27 | 27 | 0.400 | -4.000 | 0.200 | 0.400 | 312 |

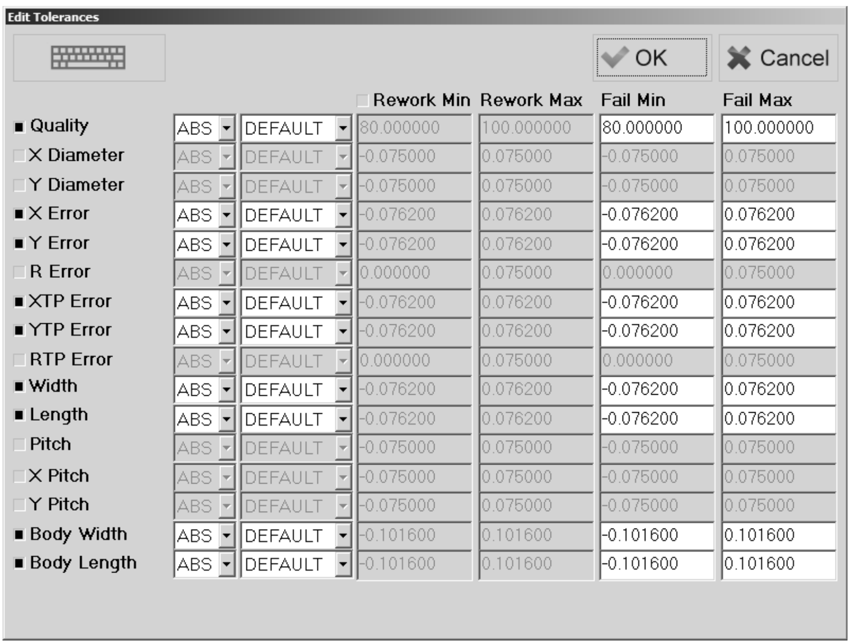
To show the "Wizard" dialog, press Alt-F9 while the spreadsheet is open. This will cause the dialog box below to be displayed. At the top of the dialog the number of leads will be shown with four dropdown lists. There is also a second row of leads that will be set to zero. These lists are for devices that have a dual set of rows.




To define a device with a dual set or rows, set the number of leads in the second row of lists and set eR, which is the distance from the first row to the second row of pads as shown in the diagram on the right side of the Wizard dialog.



The tolerance icon below will cause the tolerance dialog to be displayed. The tolerance screen defines how the values are calculated, and what values will cause the part to be rejected or reworked. If rework values are not required, the user may click on the "Rework Min" button to disable the rework columns. If rework is disabled, the values will automatically change to the same values in the fail column.



Edit Tolerances

OK Cancel

| | | | Rework Min | Rework Max | Fail Min | Fail Max |
|---|---|---|---|---|---|---|
| Quality | ABS | DEFAULT | 80.000000 | 100.000000 | 80.000000 | 100.000000 |
| X Diameter | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Y Diameter | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| X Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Y Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| R Error | ABS | DEFAULT | 0.000000 | 0.075000 | 0.000000 | 0.075000 |
| XTP Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| YTP Error | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| RTP Error | ABS | DEFAULT | 0.000000 | 0.075000 | 0.000000 | 0.075000 |
| Width | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Length | ABS | DEFAULT | -0.076200 | 0.076200 | -0.076200 | 0.076200 |
| Pitch | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| X Pitch | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Y Pitch | ABS | DEFAULT | -0.075000 | 0.075000 | -0.075000 | 0.075000 |
| Body Width | ABS | DEFAULT | -0.101600 | 0.101600 | -0.101600 | 0.101600 |
| Body Length | ABS | DEFAULT | -0.101600 | 0.101600 | -0.101600 | 0.101600 |

## 5.6 Leadless Part Measurements

**COPLQ (Coplanarity)** is the distance from the lead to a flat surface when the part is placed on that surface.

**XDIAM (X Diameter)** is the X diameter of the pad.

**YDIAM (Y Diameter)** is the Y diameter of the pad.

**WIDTH (Width)** is the width of the pad.

**LNGTH (Length)** is the length of the pad

**XPERR (X Error)** is the distance a pad is located from its ideal distance in the X direction.

**YPERR (Y Error)** is the distance a pad is located from its ideal distance in the Y direction.

**RPERR (R Error)** is the distance from the X,Y center of the pad to the ideal X,Y center defined by the X and Y datum.

RPERR = sqrt(XPERR*XPERR + YPERR*YPERR)

**XTPOS (XTP Error)** is the distance a pad is located from its ideal distance in the X direction as defined by the edges of the board.

**YTPOS (YTP Error)** is the distance a pad is located from its ideal distance in the Y direction as defined by the edges of the board.

**RTPOS (RTP Error)** is the distance a pad is located from its ideal distance in the XY direction as defined by the edges of the board.

RTPOS = sqrt(XTPOS*XTPOS + YTPOS*YTPOS)

**PITCH (Pitch)** is the distance between the measured centers of two adjacent pads.

**XPTCH (X Pitch)** is the distance from one pad to the next adjacent pad in the X direction.

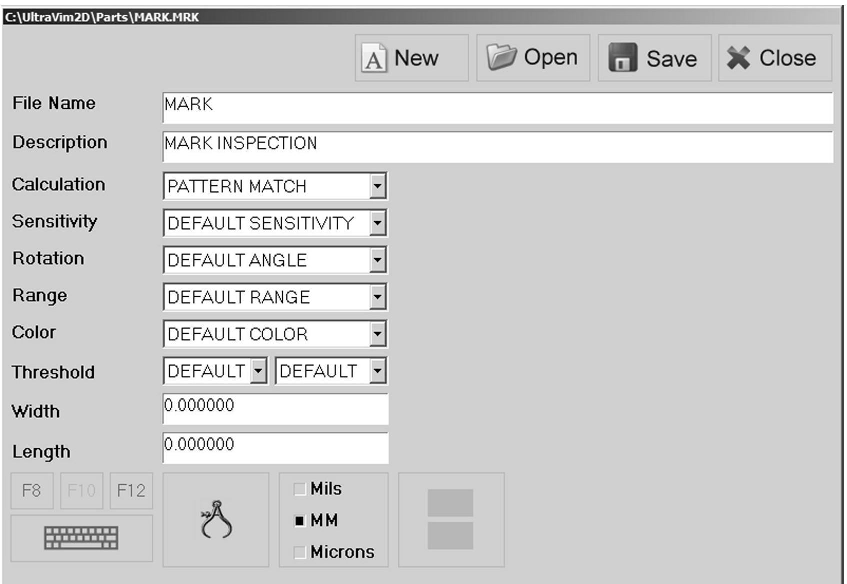
**YPTCH (Y Pitch)** is the distance from one pad to the next adjacent pad in the Y direction.

**BRWID (Board Width)** is the X dimensions of the package.

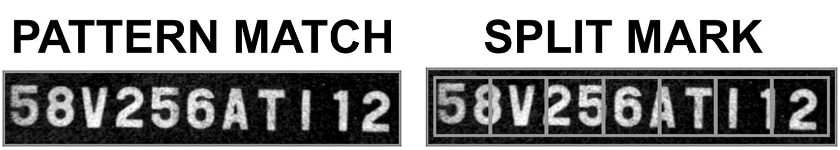
**BRLEN (Board Length)** is the Y dimensions of the package.

## 5.7 Mark Inspection Screens

The Mark Inspection screen is shown below. The user must enter the file name and select desired options. Unlike other part files the part data is not stored prior to inspection. Instead, a user must use the mouse to select the items in the image that should be inspected.




**Calculation** is set to PATTERN MATCH, which is normalized grayscale correlation. The SPLIT MARK setting will split a mark into smaller segments for more sensitive detection.



**Sensitivity** may be set to LOW, MEDIUM, or HIGH. This setting will adjust the correlation of each search box or character. For example, a correlation of 0.80 will be set to 0.64 (0.8x0.8) on the HIGH setting and 0.89 sqrt(0.8) on the LOW setting.

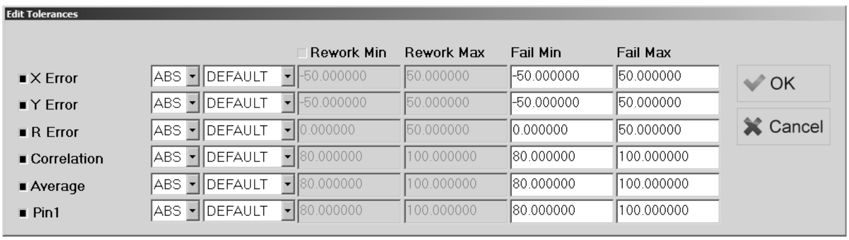
**Rotation** is the allowable rotation of the image. The default angle allowed is +/-6 degrees. Setting the allowable rotation to higher settings may slow down the inspection results.

**Range** is the range in pixels that the software will search for a match. It can be set from 1 to 256 pixels.

**Color** can be set to BLUR or NEGBLUR. The first BLUR number is the blur filter used before the Threshold is applied and the second BLUR number is the filter used after thresholding.

**Threshold** is used to calculate the BINARY image. The first threshold parameter defines how large of an image area is used to calculate an adaptive threshold. The second parameter determines a fixed offset that adjusts the image. The AUTO1 and AUTO2 selections automatically select the threshold and offset.

The tolerance icon below will cause the tolerance dialog to be displayed. The tolerance screen defines how the values are calculated, and what values will cause the part to be rejected or reworked. If rework values are not required, the user may click on the "Rework Min" button to disable the rework columns. If rework is disabled, the values will automatically change to the same values in the fail column.




**XPERR (X Error)** is the pixel distance a search is located from its learned position in the X direction.

**YPERR (Y Error)** is the pixel distance a pad is located from its learned position in the Y direction.

**RPERR (R Error)** is the distance from the X,Y center of the pad to the ideal X,Y center defined by the X and Y datum.

$$RPERR = sqrt(XPERR*XPERR + YPERR*YPERR)$$

**MKCOR (Correlation)** is the correlation result of each character or search.

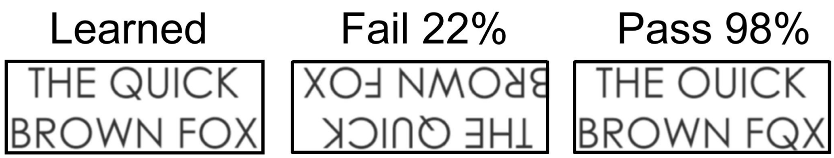
**MKAVE (Average Correlation)** is the average correlation of all characters.

**MKPIN (Pin 1 Correlation)** is the correlation of any character that has been defined as Pin1, or 100.0 for characters that have not been set to Pin1.

The XPERR and YPERR parameters record the distance of each search from where the search was drawn in world units. The Position is the average distance of all mark search boxes from the center of the camera. For example, below the two searches will average close to the center of the camera.

## 5.8 Split Mark Inspection

The mark inspection calculation is designed to reject missing marks, marks that are upside down or the wrong mark. The method finds the correlation between the current image and the learned image and reports a percentage. If only a few characters have been changed the mark may still pass as shown below.




The "Q" and "O" characters were not rejected in the example image because the differences are a very small percentage of the overall search box. To reject character changes the search box must be split into several regions. This can be accomplished by manually drawing search boxes around the characters or with software assistance by changing the calculation type from PATTERN MATCH to SPLIT MARK.

If the SPLIT MARK setting is selected the software will automatically split each search box the user draws. When PATTERN MATCH is selected the user may still right click on the search box and manually split the mark from the popup menu. The Width and Length can be the number of columns and rows or if a number of 20 or greater is used these parameters will define the character size.

In the example image below the Width was set to 10 columns and the Length was set to 3 rows. This caused the large search box to become split into 30 smaller boxes.


In the example image below the Width was set to 70 pixels and the Length was set to 100 pixels. An individual search box was drawn around each string of text.

## 5.9 2D Lead Inspection

For some 2D systems user must define the location of the leads by drawing a rectangle around them with the mouse. In the screen below a part file has been selected and the message displayed in the upper left corner of the screen is: Use mouse to locate lead tips.

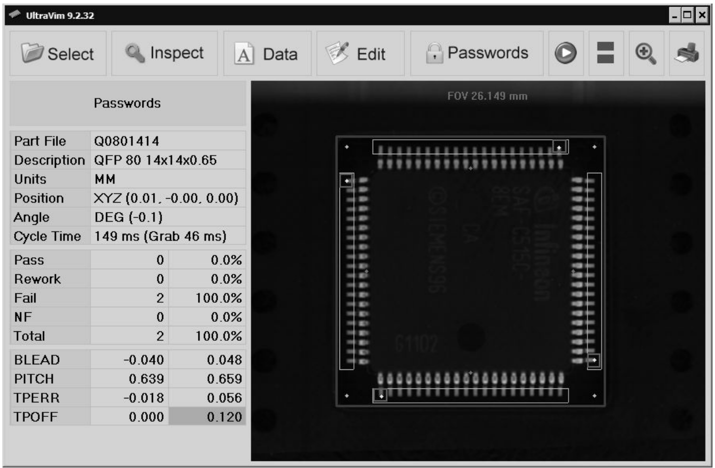

The user must use the mouse with the left mouse button to draw a rectangle from the tip of the first lead to the tip of the last lead. If the software successfully locates the leads, the rectangle will turn green. If the software does not find the leads, the rectangle will turn red.

The screen below shows the green rectangle displayed by the software after the user has located the leads. Note that the rectangle directly on the lead tips in the X direction but has been expanded in the Y direction to include all of the part body. For parts with four sides of leads the rectangle will be directly on the lead tips on each side.

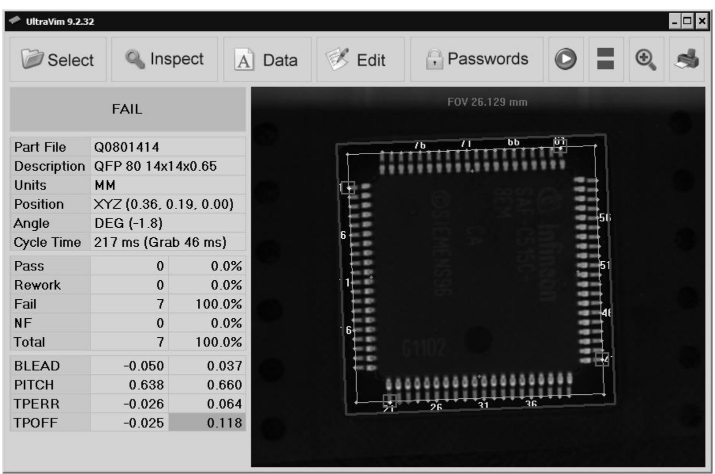
Note that the orientation of the device must be correctly defined in the part file. For example, if this device had been rotated by 90 degrees, the software would not be able to find the leads until the user corrects the part file to match the orientation.

After the leads have been found, the device is ready to inspect unless the MKCOR measurement is selected. In that case, the software will require the user to also learn the mark.

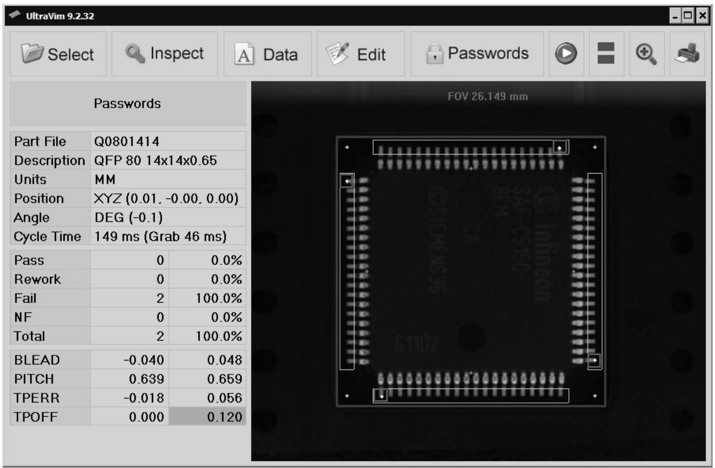
With LOCATE graphics on a light blue search box will appear on each side around the leads. The size of the search box can be changed with the Foot Length parameter in the part file.



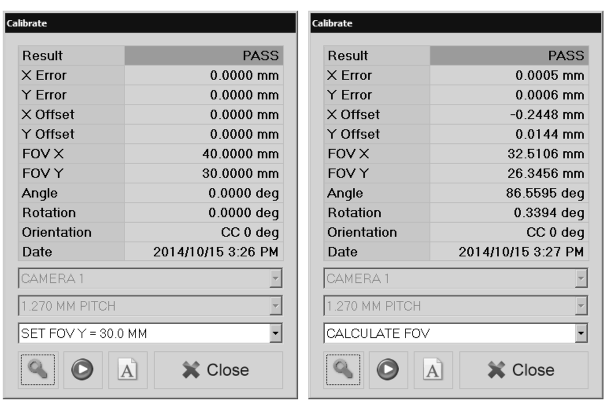

Changing SEARCH to PATTERN MATCH in the Advanced Alt-F8 screen will cause only one search box to be used that contains all the leads and the part body.



The LOCATE graphics will also show the calculated Field of View (FOV) at the top of the image after an inspection. This calculation is accurate to better than 10% when a known good device with more than ten leads is used. If the calibration is off by more than 10% the FOV text display will be shown in red.

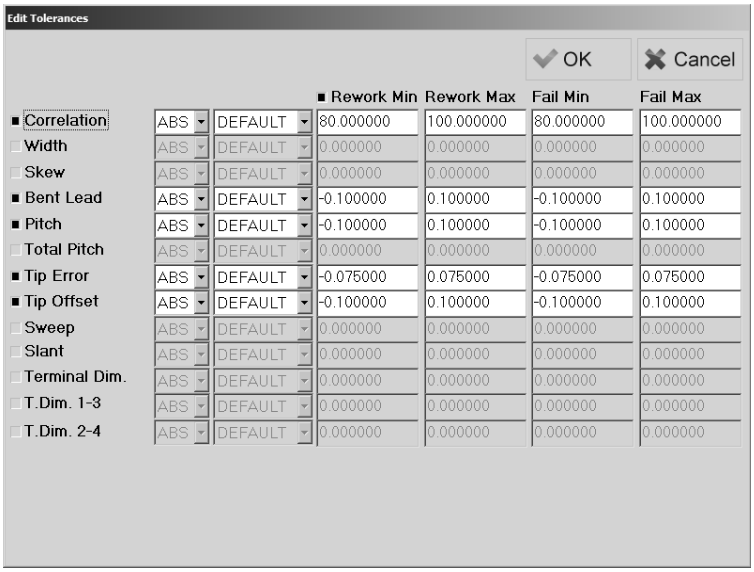



For the best results the calibration should be set to the correct size using SET FOV in the calibration screen or by using CALCULATE FOV with a calibration grid.



## 5.10 Combined Mark and Lead Inspection

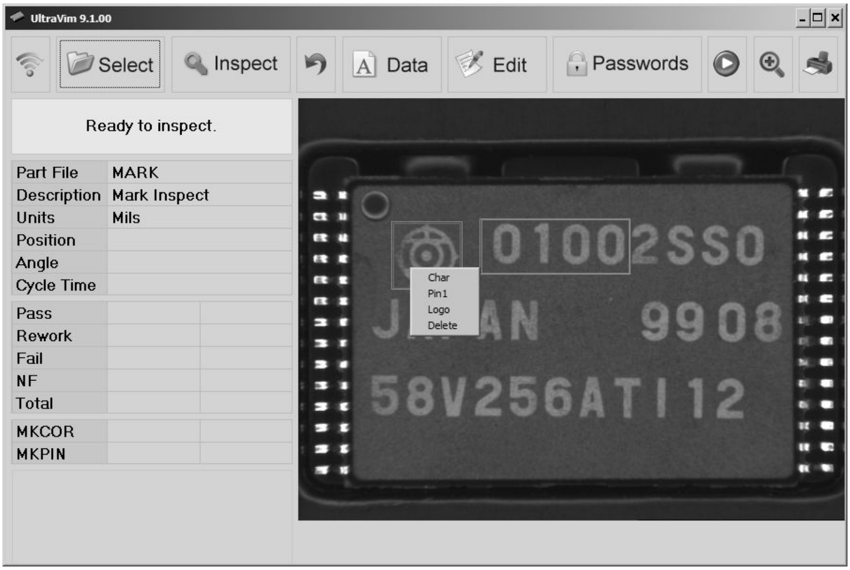
Some 2D systems may include both lead and mark inspection. When this is the case, the Correlation (MKCOR) measurement will appear in the QFP tolerance screen as shown below.




For combined mark and lead inspection, the appropriate lighting must be used and the system must have a valid calibration. Note that if the lights used for images 1 and 2 do not match in the advanced setup screen, a second image will be used for mark inspection with the defined lighting.

## 5.11 Mark Inspection Setup

The screen below shows a mark inspection image after the user has drawn a search box over some of the characters. A user may draw up to 256 boxes, but in most cases only one box is needed for an accurate match.




If the MKPIN measurement is selected, the Pin1 character can be defined by right clicking on the correct search box as shown above. The boxes drawn around normal characters will be purple, while the box drawn around the Pin1 characters will be light blue. Setting a character to Logo has the same effect as setting the sensitivity to LOW, however using the Logo method allows the sensitivity of individual characters to be adjusted.

## 5.12 Automatic Mark Setup

Each time the lead inspection image is learned the image is stored in the Files directory as LEAD.png and each time the mark is learned the images is stored as MARK.png. These images are used to automatically resume the last part file if the software exits and restarts.

C:\UltraVim2D\Files\LEAD.png
C:\UltraVim2D\Files\MARK.png
C:\UltraVim2D\Files\RESUME.rsm

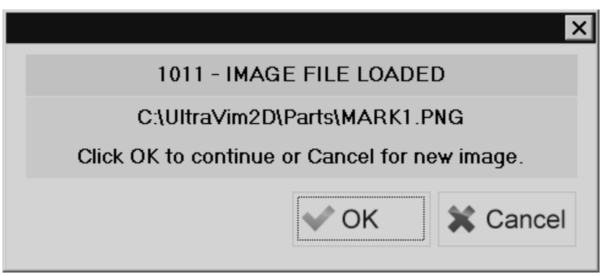
To store a mark image for each individual part file the setting SaveEachLearn=0 must be changed to SaveEachLearn=1 in the Config.ini file. When this parameter is changed the mark image and learn locations will be stored for each part.

For example, if the part file MARK1.mrk is loaded, when the user learns the mark the image MARK1.png will be stored in the Parts directory. Each subsequent time the MARK1.mrk file is loaded the MARK1.png image will also be loaded and the software will learn the last regions of interest used for mark inspection in that file.

C:\UltraVim2D\Parts\MARK1.mrk
C:\UltraVim2D\Parts\MARK1.png

If automatic mark inspection is used, the LevelLearn=1 parameter in the Config.ini file should be changed to a higher level. For example, LevelLearn=3 will require a password level of 3 before the user can add or delete mark inspection regions. If the *.png image file is not found in the Parts directory when the file is loaded an error will be shown.

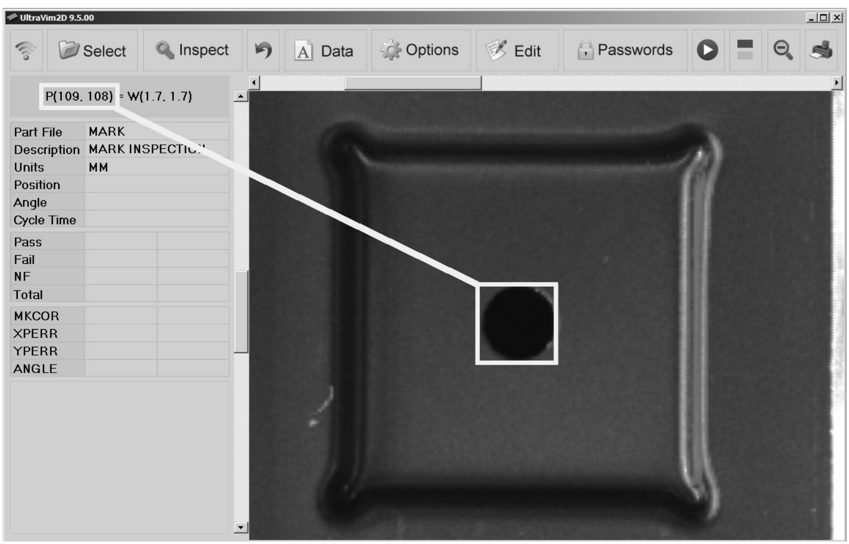

If the user is in password level 3 the error will not be shown if the image file is not found. The file will be created as the user learns the mark. If an image is found when the user is in password level 3 the message below will be shown. If the user clicks the OK button the saved image file will remain in memory and the stored regions of interest will be automatically learned. If the user clicks on the Cancel button the software will grab a new image and the user must learn the mark normally.



## 5.13 Empty Pocket Detection

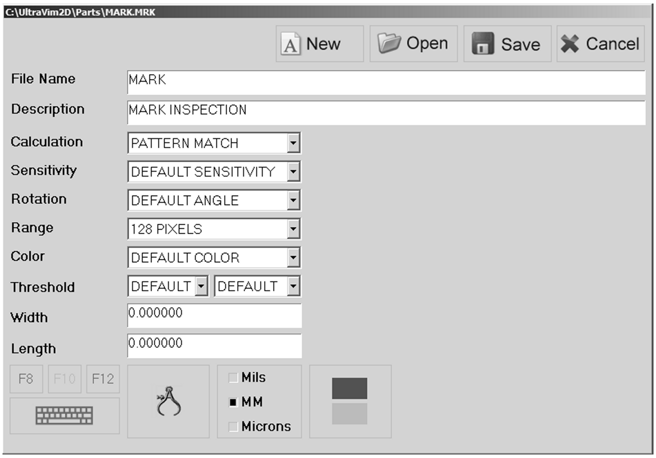
The mark inspection software may be configured to return a result of NFND for what it calculates to be an empty pocket. To turn on the NFND result set MarkNotFound= in the Config.ini file. The parameter shows the mark correlation (MKCOR) that will result in a NFND result. For example, setting MarkNotFound=10 will cause a NFND result for any correlation that is 10% or lower.

If the tape has a black hole in the center of the pocket the reliability of the calculation can be improved by setting MarkTapeHole= in the Config.ini file. This setting should be the diameter of the hole in pixel values. The pixel diameter can be determined by drawing a box around the hole with the mouse. In the example below MarkTapeHole=110 should be set in the Config.ini file.



## 5.14 Mark Pixel Range

The Range setting tells the software how far to search for each main search box. For a box that is inside a main search, like a split mark box, the Range setting does not apply.

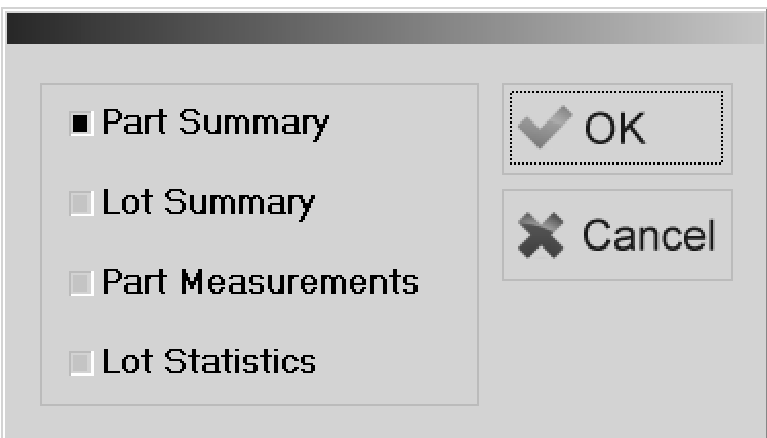


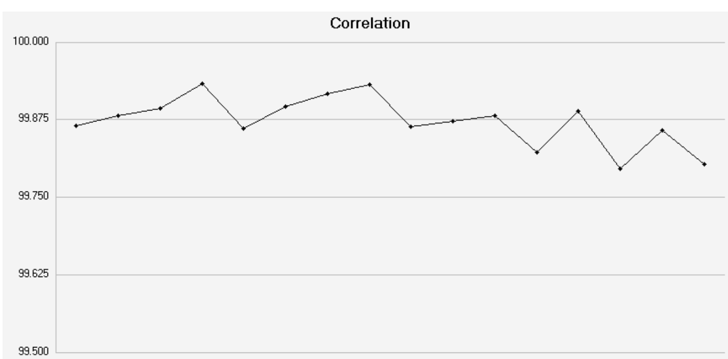

If some marks on the device can move independently from other marks then they should have their own main search box. For example, in the image below the LABEL should have its own independent search box and the Range should be set to the expected amount of pixel movement of that mark.

# 6. Reports and Graphs

There are four types of reports that the UltraVim software creates. Descriptions of each type of report are shown below.

| | |
|---|---|
| • Main Screen | Quick Chart of Measurements |
| • Part Summary | Text Report of Part Results |
| • Lot Summary | Text Report of Lot Results |
| • Part Measurements | Graph of Part Measurements |
| • Lot Statistics | Graph of Lot Statistics |

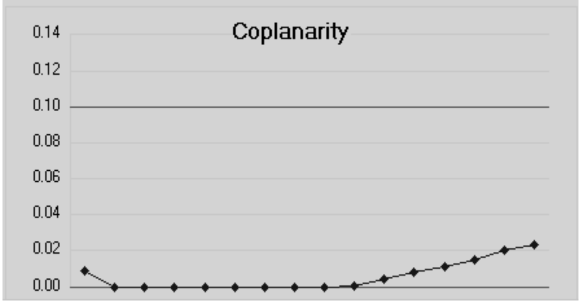


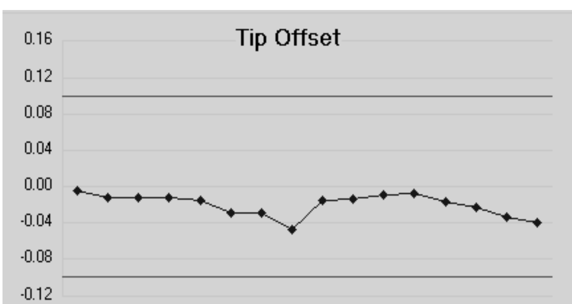
## 6.1 Main Screen Graph

If there is enough room on the display, the main screen will show a quick chart of the last inspection results. In the example below each Coplanarity measurement is shown.

| | | |
|---|---|---|
| COPLQ | 0.000 | 0.023 |
| STOFF | 0.268 | 0.293 |
| BLEAD | -0.012 | 0.014 |
| PITCH | 1.260 | 1.285 |
| TPERR | -0.014 | 0.010 |
| TPOFF | -0.047 | -0.004 |




To display other measurements use the mouse to click on each item above the chart. For example, below the user has clicked on TPOFF to display the Tip Offset results. Note that the failure tolerance settings are displayed in the chart with red lines.

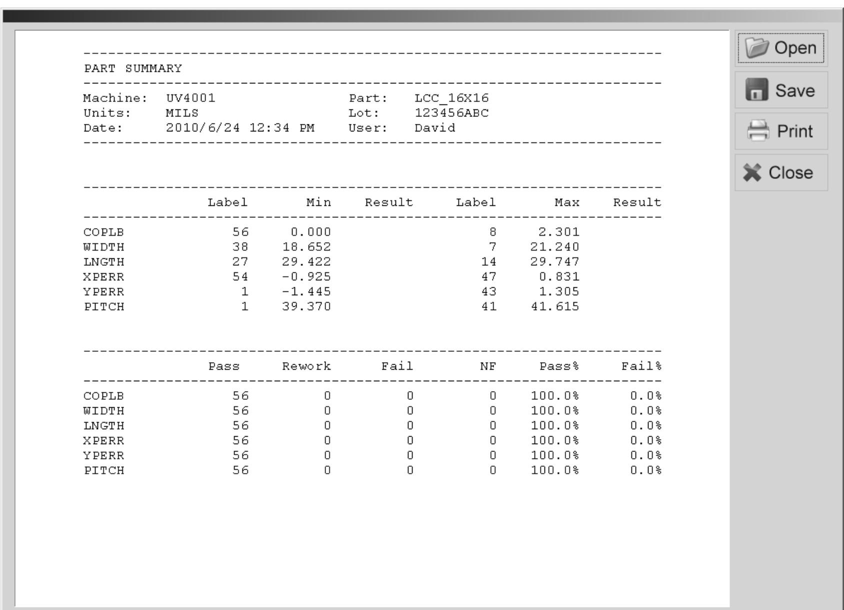


## 6.2 Part Summary

The header section of the Part Summary shows the serial number of the UltraVim module, the units, the date, the part file used, the lot and the user.

The next section of the report shows the minimum and maximum leads for each measurement selected. It also shows the result for the minimum and maximum leads if the result was rework, fail or not found.

The last section records the total lead results for each measurement. For example, the report below shows that all 56 leads on this device passed the inspection.

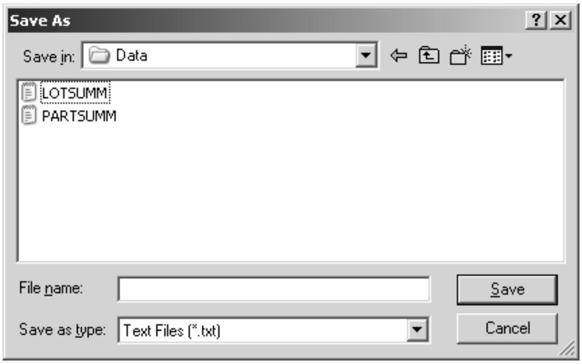

PART SUMMARY

Machine: UV4001    Part: LCC_16X16
Units: MILS    Lot: 123456ABC
Date: 2010/6/24 12:34 PM    User: David

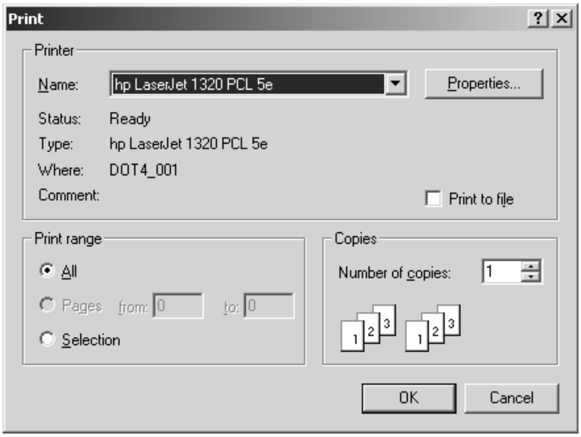
| | Label | Min | Result | Label | Max | Result |
|---|---|---|---|---|---|---|
| COPLB | 56 | 0.000 | | 8 | 2.301 | |
| WIDTH | 38 | 18.652 | | 7 | 21.240 | |
| LNGTH | 27 | 29.422 | | 14 | 29.747 | |
| XPERR | 54 | -0.925 | | 47 | 0.831 | |
| YPERR | 1 | -1.445 | | 43 | 1.305 | |
| PITCH | 1 | 39.370 | | 41 | 41.615 | |

| | Pass | Rework | Fail | NF | Pass% | Fail% |
|---|---|---|---|---|---|---|
| COPLB | 56 | 0 | 0 | 0 | 100.0% | 0.0% |
| WIDTH | 56 | 0 | 0 | 0 | 100.0% | 0.0% |
| LNGTH | 56 | 0 | 0 | 0 | 100.0% | 0.0% |
| XPERR | 56 | 0 | 0 | 0 | 100.0% | 0.0% |
| YPERR | 56 | 0 | 0 | 0 | 100.0% | 0.0% |
| PITCH | 56 | 0 | 0 | 0 | 100.0% | 0.0% |

Clicking on the "Save" button will open a "Save As" dialog box that allows the user to save the report as a text file.

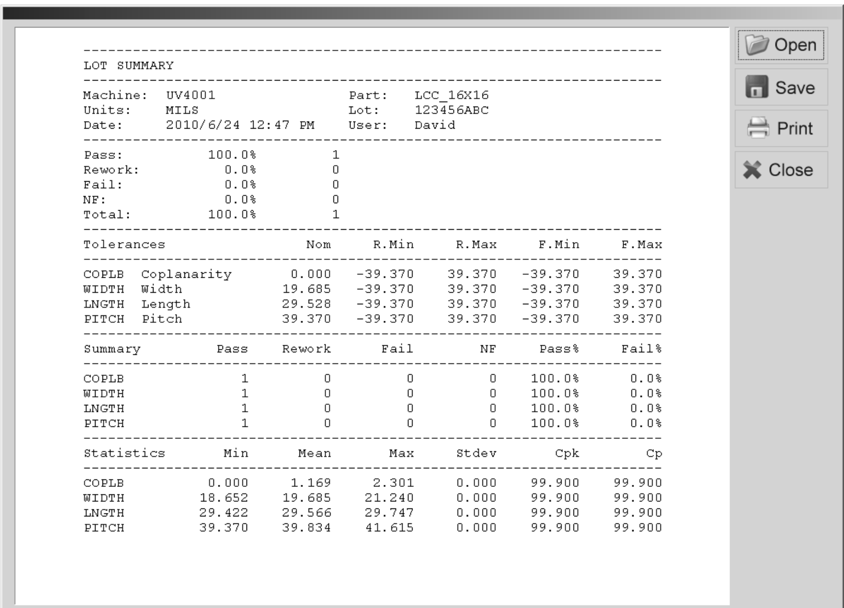



Clicking on the "Print" button will open a "Print" dialog box.



## 6.3 Lot Summary

The first section after the header of the Lot Summary report shows the totals and percentages were a pass, rework, fail and not found. If a part failed any of the measurements, that part will count as a fail or not found, if that was the cause of the failure.




LOT SUMMARY

| | | | |
|---|---|---|---|
| Machine: | UV4001 | Part: | LCC_16X16 |
| Units: | MILS | Lot: | 123456ABC |
| Date: | 2010/6/24 12:47 PM | User: | David |

| | | |
|---|---|---|
| Pass: | 100.0% | 1 |
| Rework: | 0.0% | 0 |
| Fail: | 0.0% | 0 |
| NF: | 0.0% | 0 |
| Total: | 100.0% | 1 |

| Tolerances | | Nom | R.Min | R.Max | F.Min | F.Max |
|---|---|---|---|---|---|---|
| COPLB | Coplanarity | 0.000 | -39.370 | 39.370 | -39.370 | 39.370 |
| WIDTH | Width | 19.685 | -39.370 | 39.370 | -39.370 | 39.370 |
| LNGTH | Length | 29.528 | -39.370 | 39.370 | -39.370 | 39.370 |
| PITCH | Pitch | 39.370 | -39.370 | 39.370 | -39.370 | 39.370 |

| Summary | Pass | Rework | Fail | NF | Pass% | Fail% |
|---|---|---|---|---|---|---|
| COPLB | 1 | 0 | 0 | 0 | 100.0% | 0.0% |
| WIDTH | 1 | 0 | 0 | 0 | 100.0% | 0.0% |
| LNGTH | 1 | 0 | 0 | 0 | 100.0% | 0.0% |
| PITCH | 1 | 0 | 0 | 0 | 100.0% | 0.0% |

| Statistics | Min | Mean | Max | Stdev | Cpk | Cp |
|---|---|---|---|---|---|---|
| COPLB | 0.000 | 1.169 | 2.301 | 0.000 | 99.900 | 99.900 |
| WIDTH | 18.652 | 19.685 | 21.240 | 0.000 | 99.900 | 99.900 |
| LNGTH | 29.422 | 29.566 | 29.747 | 0.000 | 99.900 | 99.900 |
| PITCH | 39.370 | 39.834 | 41.615 | 0.000 | 99.900 | 99.900 |

The next section of the report shows each of the measurements selected, its long name and the nominal and tolerance values for the measurement.

The summary section of the report displays the pass, rework, fail and NF totals for each measurement. For example if all devices failed for coplanarity, it could be seen in the summary section.

The statistics section records the minimum, mean, maximum and standard deviation for each measurement selected. The Cpk and Cp ratios are also displayed. The formulas used are shown below:

Cpl = (Mean - LSL)/(3*Stdev)

Cpu = (USL-Mean)/(3*Stdev)

Cpk = Min(Cpl,Cpu)

Cp = (USL - LSL)/(6*Stdev)

The LotCalculation=0 parameter in the Config.ini file can be set to "1" to change the lot statistics to record only the maximum values. Note that for percentage values like Ball Quality the minimum value will be recorded. For relative measurements like X Error and Y Error the absolute value of each measurement will be recorded. For example, in the data below the maximum YPERR becomes 0.031 when LotCalculation=1 is set.

**LotCalculation=0**

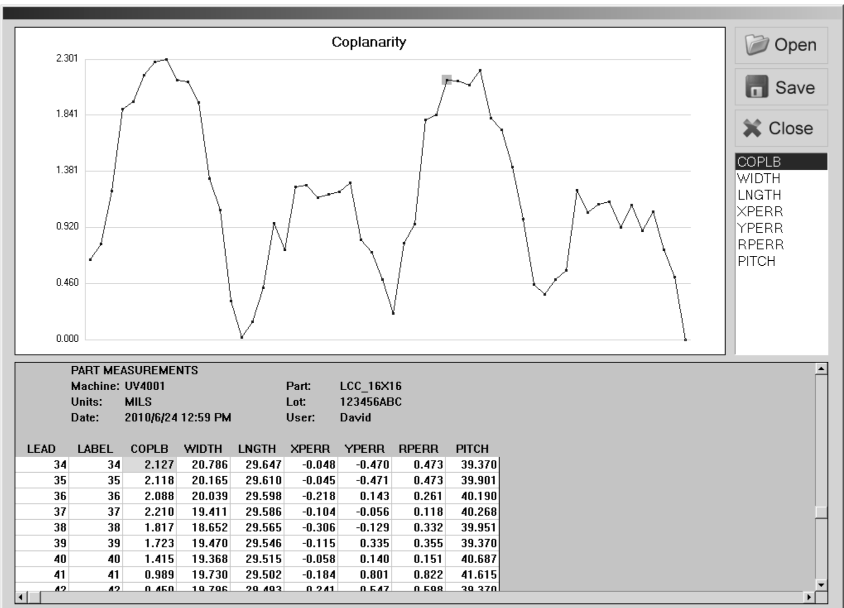
| Statistics | Min | Mean | Max | Stdev | Cpk | Cp |
|---|---|---|---|---|---|---|
| COPLB | 0.000 | 0.025 | 0.053 | 0.002 | 18.665 | 11.608 |
| BQUAL | 91.133 | 98.244 | 99.990 | 0.000 | 99.900 | 99.900 |
| BDIAM | 0.824 | 0.850 | 0.870 | 0.000 | 99.900 | 99.900 |
| XPERR | -0.025 | 0.000 | 0.045 | 0.000 | 99.900 | 99.900 |
| YPERR | -0.031 | -0.000 | 0.030 | 0.000 | 99.900 | 99.900 |

**LotCalculation=1**

| Statistics | Min | Mean | Max | Stdev | Cpk | Cp |
|---|---|---|---|---|---|---|
| COPLB | 0.047 | 0.050 | 0.053 | 0.003 | 9.947 | 8.225 |
| BQUAL | 91.133 | 91.133 | 91.134 | 0.000 | 99.900 | 99.900 |
| BDIAM | 0.866 | 0.868 | 0.870 | 0.002 | 99.900 | 11.345 |
| XPERR | 0.039 | 0.042 | 0.045 | 0.002 | 22.891 | 28.844 |
| YPERR | 0.027 | 0.029 | 0.031 | 0.001 | 42.297 | 49.368 |

## 6.4 Part Statistics

The Part Statistics report shows each measurement for each lead for the last part measured. A graph of each measurement may also be displayed. You can change the graph to show a different measurement by clicking on that measurement.

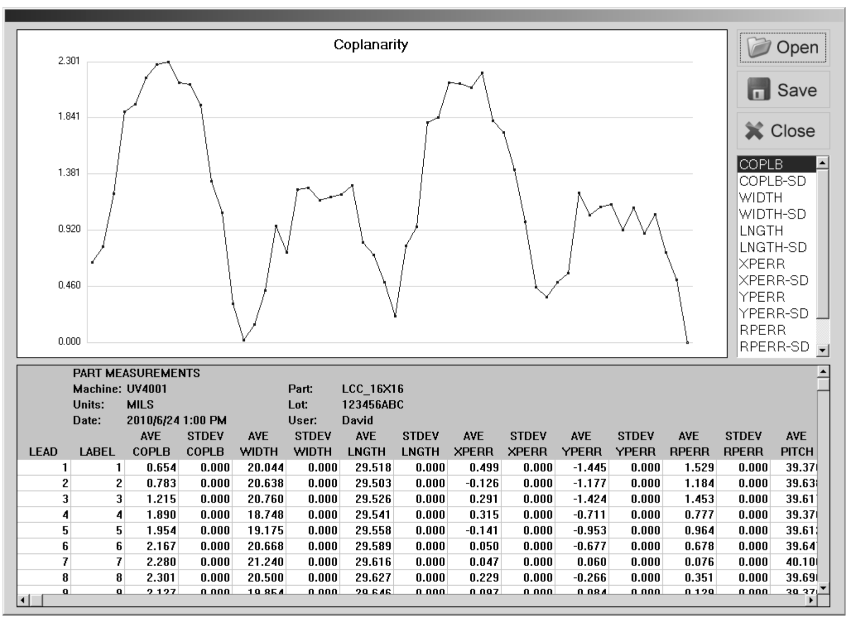


## 6.5 Lot Statistics

The Lot Statistics report shows the average measurement and standard deviation of the measurements for each lead for the entire lot. The graph can be changed by clicking on the measurement in the list at the right of the screen.

Clicking on a measurement with "-SD" appended to its name will display the standard deviation column. This chart is useful to see trends in the lot, or to check the repeatability of the machine by measuring the same part many times.

Clicking on a point in the graph or a cell in the spreadsheet will cause the lead and cell to become highlighted in a light purple color.



## 6.6 3-Sigma Accuracy Report

The 3-Sigma Accuracy Report is an optional report that will appear in the Part Summary if a golden device is measured. Golden devices may be purchased from the factory.

To run the 3-Sigma Accuracy report, first run the golden device installation program. This program will copy the CRB, CRQ or CRL certificate file to the UVIM4D\Files directory, copy the part file for the golden device to the UVIM4D\Parts directory, and select the certificate file in the Options screen. These steps can also be completed manually.

Once the correct files are installed, place the golden device on the UltraVim 4D module. Next, select the correct part file click on the Inspect button several times to inspect the device. A sample size of 30 inspections is normally used. After you have completed the inspections, click on Data then select Part Summary.

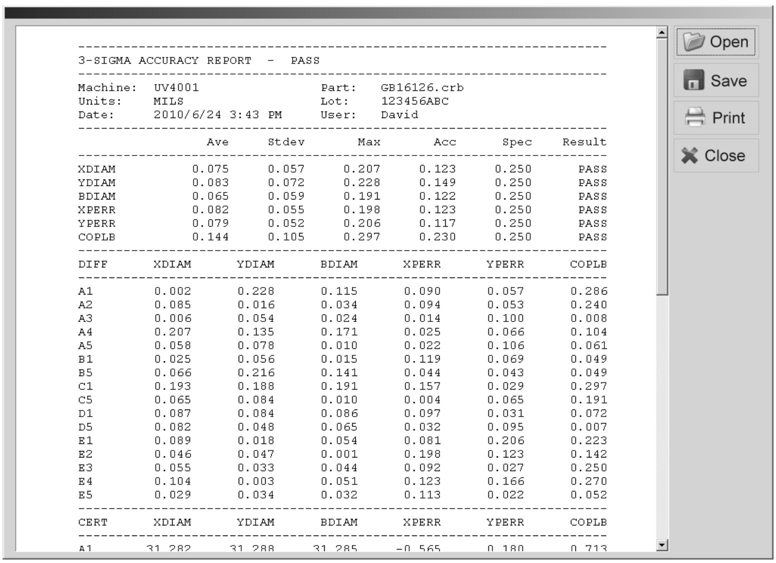
The software will compute the differences between the average measured results and the stored results in the certificate file, as shown below:

```
DIFF[i] = abs(C[i] - M[i])
          C is certificate value.
          M is measured value.
```

From the calculated differences, the 3-Sigma accuracy values are calculated and a pass or fail result is displayed. The formula the software uses for accuracy is shown below.

```
Accuracy = (Ave + 3*Stdev)/2
```

The "3-Sigma" results are halved to correct for errors in the certificate file from the "true" values of the device. With such small measurements, even moderate changes in temperature and other factors like lead shape can affect the physical locations of the leads on the golden device.



3-SIGMA ACCURACY REPORT - PASS

Machine: UV4001 Part: GB16126.crb
Units: MILS Lot: 123456ABC
Date: 2010/6/24 3:43 PM User: David

| | Ave | Stdev | Max | Acc | Spec | Result |
|---|---|---|---|---|---|---|
| XDIAM | 0.075 | 0.057 | 0.207 | 0.123 | 0.250 | PASS |
| YDIAM | 0.083 | 0.072 | 0.228 | 0.149 | 0.250 | PASS |
| BDIAM | 0.065 | 0.059 | 0.191 | 0.122 | 0.250 | PASS |
| XPERR | 0.082 | 0.055 | 0.198 | 0.123 | 0.250 | PASS |
| YPERR | 0.079 | 0.052 | 0.206 | 0.117 | 0.250 | PASS |
| COPLB | 0.144 | 0.105 | 0.297 | 0.230 | 0.250 | PASS |

| DIFF | XDIAM | YDIAM | BDIAM | XPERR | YPERR | COPLB |
|---|---|---|---|---|---|---|
| A1 | 0.002 | 0.228 | 0.115 | 0.090 | 0.057 | 0.286 |
| A2 | 0.085 | 0.016 | 0.034 | 0.094 | 0.053 | 0.240 |
| A3 | 0.006 | 0.054 | 0.024 | 0.014 | 0.100 | 0.008 |
| A4 | 0.207 | 0.135 | 0.171 | 0.025 | 0.066 | 0.104 |
| A5 | 0.058 | 0.078 | 0.010 | 0.022 | 0.106 | 0.061 |
| B1 | 0.025 | 0.056 | 0.015 | 0.119 | 0.069 | 0.049 |
| B5 | 0.066 | 0.216 | 0.141 | 0.044 | 0.043 | 0.049 |
| C1 | 0.193 | 0.188 | 0.191 | 0.157 | 0.029 | 0.297 |
| C5 | 0.065 | 0.084 | 0.010 | 0.004 | 0.065 | 0.191 |
| D1 | 0.087 | 0.084 | 0.086 | 0.097 | 0.031 | 0.072 |
| D5 | 0.082 | 0.048 | 0.065 | 0.032 | 0.095 | 0.007 |
| E1 | 0.089 | 0.018 | 0.054 | 0.081 | 0.206 | 0.223 |
| E2 | 0.046 | 0.047 | 0.001 | 0.198 | 0.123 | 0.142 |
| E3 | 0.055 | 0.033 | 0.044 | 0.092 | 0.027 | 0.250 |
| E4 | 0.104 | 0.003 | 0.051 | 0.123 | 0.166 | 0.270 |
| E5 | 0.029 | 0.034 | 0.032 | 0.113 | 0.022 | 0.052 |

| CERT | XDIAM | YDIAM | BDIAM | XPERR | YPERR | COPLB |
|---|---|---|---|---|---|---|
| A1 | 31.282 | 31.288 | 31.285 | -0.565 | 0.180 | 0.713 |

The calculation can be changed to the average of the absolute value of the differences, which is an industry standard, by setting GoldCalculation=1 in the Config.ini file. If that change is made you may also want to run the Repeatability Report to check the system repeatability. The example reports below show the differences in the result when the GoldCalculation=1 is set in the Config.ini file. The specification for the report is 6.35 microns and can be changed by setting GoldSpecification=0.00 in the Config.ini file. The value is set in mils so setting GoldSpecification=0.40 is about 10 microns.

GoldCalculation=0

```
----------------------------------------------------------------------
3-SIGMA ACCURACY REPORT  -  PASS
----------------------------------------------------------------------
Machine:  UX2060                   Part:   GT54129.crq
Units:    MICRONS                  Lot:    GOLD
Date:     2016/5/3 11:38 AM        User:   DAVID
----------------------------------------------------------------------
                 Ave      Stdev       Max        Acc       Spec    Result
----------------------------------------------------------------------
COPLQ            1.0        0.8       2.9        1.7        6.3      PASS
TPOFF            0.6        0.5       2.2        1.0        6.3      PASS
BLEAD            0.6        0.5       2.0        1.0        6.3      PASS
WIDTH            0.3        0.2       1.0        0.5        6.3      PASS
STOFF            1.4        0.1       1.7        0.9        6.3      PASS
PITCH            0.8        0.7       3.2        1.5        6.3      PASS
----------------------------------------------------------------------
```

GoldCalculation=1

```
----------------------------------------------------------------------
3-SIGMA ACCURACY REPORT  -  PASS
----------------------------------------------------------------------
Machine:  UX2060                   Part:   GT54129.crq
Units:    MICRONS                  Lot:    GOLD
Date:     2016/5/3 11:37 AM        User:   DAVID
----------------------------------------------------------------------
                 Ave      Stdev       Max        Acc       Spec    Result
----------------------------------------------------------------------
COPLQ            1.0        0.8       2.9        1.0        6.3      PASS
TPOFF            0.6        0.5       2.2        0.6        6.3      PASS
BLEAD            0.6        0.5       2.0        0.6        6.3      PASS
WIDTH            0.3        0.2       1.0        0.3        6.3      PASS
STOFF            1.4        0.1       1.7        1.4        6.3      PASS
PITCH            0.8        0.7       3.2        0.8        6.3      PASS
----------------------------------------------------------------------
```

## 6.7 Rich Text Files

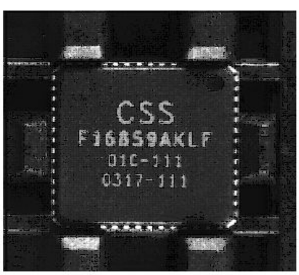
The software is capable of producing *.RTF files for the Part Summary and Lot Summary reports. To enable this feature, UseRTF=1 must be set in the Config.ini file. When writing the files the software will search for HEADER.rtf in the \Files directory and if found it will insert that header into the reports.

{This is My Header\par}

Note that pictures may be used in the header file, and if Auto-Save is used to save the first image, the report will include that image as shown below. The size of the image can be controlled by setting UseRTF= to 120, 200, 280, 320 or 400. Setting UseRTF=2 will remove the image from the report.

SCANNER
SCANNERTECH LLC

```
----------------------------------------------------------------------
LOT SUMMARY
----------------------------------------------------------------------
Machine:  3506353452             Part:   DEMO_MRK
Units:    MILS                   Lot:    LOT
Date:     2011/11/9 12:49 PM     User:   USER
----------------------------------------------------------------------
Pass:          100.0%        1
Rework:          0.0%        0
Fail:            0.0%        0
NF:              0.0%        0
Total:         100.0%        1
----------------------------------------------------------------------
Summary          Pass    Rework      Fail        NF     Pass%     Fail%
----------------------------------------------------------------------
MKCOR               1         0         0         0    100.0%      0.0%
```



An RTF file can include pictures created with other applications. These pictures can be in hexadecimal (the default) or binary format. Pictures are destinations, and begin with the \pict control word. A picture destination has the following syntax:

{ \pict <picttype> & <pictsize> & <data> }

To save an image in the header of the RTF report the HEADER.rtf file must include the \pict data similar to the example below.

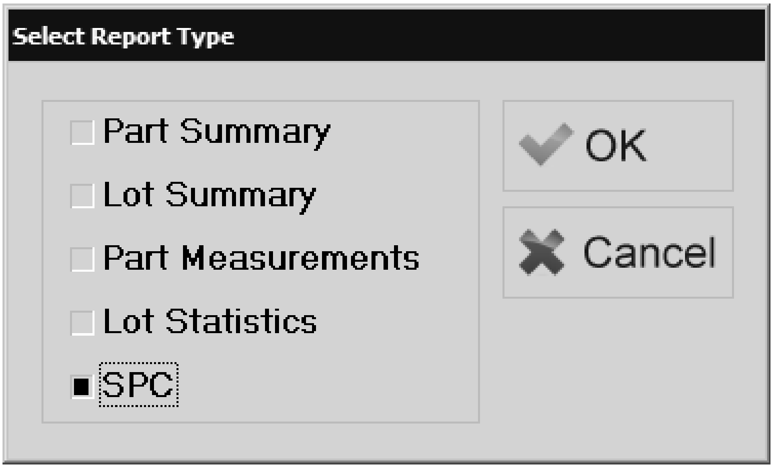
```
{\pict\wmetafile8\picw900\pich100
010009000003742e00000100522c00000000050000000
b0200000000050000000c025b061d260520000f700000
300010000000080604000a0708000b0a05000b0a0a00}
```

To create an RTF header file with a picture, first start the Windows program WordPad with a blank document. Second, paste the image you want into the document and save it as HEADER.rtf. Third, open the file with a text editor like Notepad and delete the text before the "{\pict" keyword. Finally, delete everything after the closing brace "}" for the picture and save the file. It is a good idea to keep the HEADER.rtf file as small as possible because the software must insert the header each time it saves a report, which could slow down inspections if the header is large.

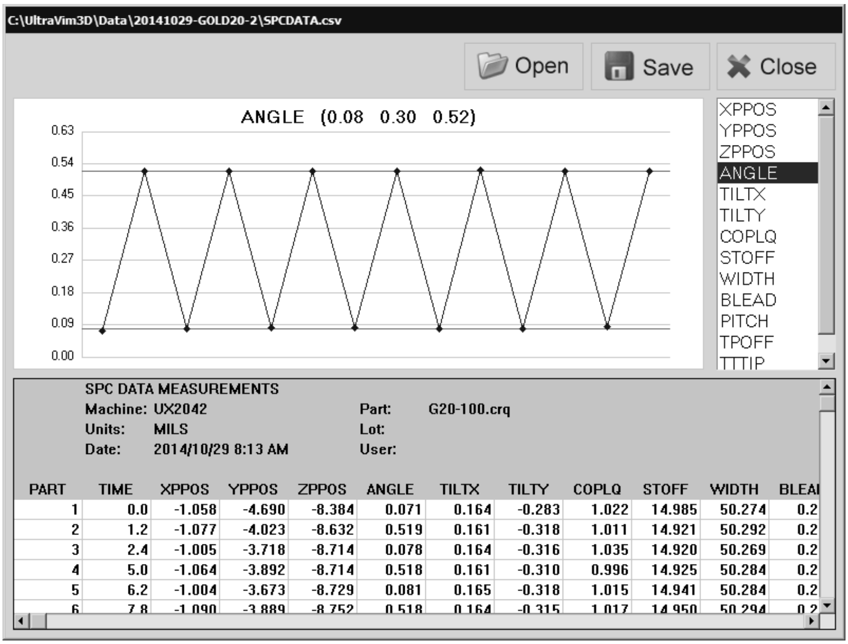
## 6.8 SPC Data File

The software is capable of saving the maximum results for each measurement in the SPCDATA.csv file, which is stored in data directory for the lot. Setting AutoSaveSPC=1 in the Config.ini file will cause the software to always save the SPCDATA.csv file. Also, the user can enter the password "SPCDATA" to toggle the file on or off which can be useful for a temporary test or buyoff. The SPCDATA command should be used before the part file has been selected.

When the SPCDATA.csv file is activated, the Data report screen will show the SPC report as the last selection. The Part Measurements, Lot Statistics and SPC selections all use the same graph report and spreadsheet control to display data that is saved in a comma separated value (CSV) format.



An example SPC report is shown below. The report shows the time in seconds, the position, angle and tilt of each device and the averages of the lower and upper halves of the data with pink control lines. In the example below, the average angle is 0.30 degrees, the average of all the data below 0.30 degrees is 0.08 degrees and the average of all the data greater than the average is 0.52 degrees.




The AutoSaveSPC parameter in the Config.ini file may also be used to save additional data as shown below.

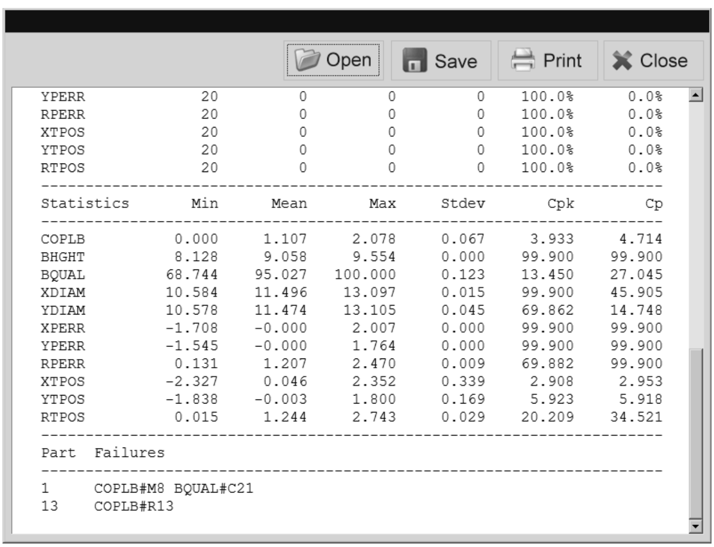
| | |
|---|---|
| AutoSaveSPC=2 | Save the worst-case relative measurements. |
| AutoSaveSPC=3 | Save the minimum and maximum measures. |
| AutoSaveSPC=4 | Save the minimum, average and maximum. |

## 6.9 Failure Summary

When the Auto-Save data option is set to FAILED DATA the FAILSUMM.txt report will be created in the lot data directory. The report shows the part number that failed and the items that failed with the lead or ball number. If several items fail the report may be truncated.

```
----------------------------------------------------------------------
FAILURE SUMMARY
----------------------------------------------------------------------
Machine:  UX1289                  Part:   BGA416
Units:    MILS                    Lot:    LOT123
Date:     2015/8/26 10:24 AM      User:   DAVID
----------------------------------------------------------------------
Part  Failures
----------------------------------------------------------------------
5     BQUAL#B20
15    COPLB#M8 BQUAL#C21
18    COPLB#R13
```

Setting AutoSaveFail=1 in the Config.ini file will cause the Failure Summary will always be created and automatically appended to the Lot Summary report as shown below.




```
YPERR          20       0       0       0   100.0%     0.0%
RPERR          20       0       0       0   100.0%     0.0%
XTPOS          20       0       0       0   100.0%     0.0%
YTPOS          20       0       0       0   100.0%     0.0%
RTPOS          20       0       0       0   100.0%     0.0%
----------------------------------------------------------------------
Statistics    Min     Mean      Max    Stdev      Cpk       Cp
----------------------------------------------------------------------
COPLB       0.000    1.107    2.078    0.067    3.933    4.714
BHGHT       8.128    9.058    9.554    0.000   99.900   99.900
BQUAL      68.744   95.027  100.000    0.123   13.450   27.045
XDIAM      10.584   11.496   13.097    0.015   99.900   45.905
YDIAM      10.578   11.474   13.105    0.045   69.862   14.748
XPERR      -1.708   -0.000    2.007    0.000   99.900   99.900
YPERR      -1.545   -0.000    1.764    0.000   99.900   99.900
RPERR       0.131    1.207    2.470    0.009   69.882   99.900
XTPOS      -2.327    0.046    2.352    0.339    2.908    2.953
YTPOS      -1.838   -0.003    1.800    0.169    5.923    5.918
RTPOS       0.015    1.244    2.743    0.029   20.209   34.521
----------------------------------------------------------------------
Part  Failures
----------------------------------------------------------------------
1     COPLB#M8 BQUAL#C21
13    COPLB#R13
```

## 6.10 Gage R&R Report

Gage R&R, which stands for gage repeatability and reproducibility, is a statistical tool that measures the amount of variation in the measurement system and the variation of the process itself.

To run the Gage R&R Report the SPCDATA must be active and saving in a lot directory after each inspection. Select the correct part and inspect between two and thirty devices. After the parts have been inspected, repeat the process six times.

For example, if you have ten parts the lot total should be sixty after all inspections are complete. To change the number of times the devices are inspected, the parameter GageReportGroups=6 in the Config.ini file may be changed to a number between two and six.

After all the devices have been inspected the correct number of types, enter the password GAGERR to create the report. An example report for Coplanarity is shown below. Each measurement item selected will appear in the report.

```
-----------------------------------------------------------------------
COPLQ - Coplanarity
-----------------------------------------------------------------------
Part Tolerance                 5.000
Repeatability                  0.269    5.382%
Reproducibility                0.309    6.175%
Combined R&R                   0.410    8.191%
-----------------------------------------------------------------------
PART            R1       R2       R3       R4       R5       R6    STDEV
P1           2.046    2.078    2.025    2.130    2.023    2.095    0.042
P2           2.054    2.061    2.124    2.032    2.064    2.062    0.031
P3           2.368    2.099    2.062    1.992    2.096    2.074    0.130
P4           2.133    1.974    1.985    2.025    2.316    2.163    0.131
P5           2.071    2.084    2.138    2.052    2.075    2.167    0.045
-----------------------------------------------------------------------
```

The Repeatability in the report is the percentage of variation recorded in measurements of the same part, while the Reproducibility is the variation caused by differences in measurements between parts. Note that with some parts the Coplanarity variability can be artificially high due to the seating plane calculation. Using the REGRESS measurement method will provide a more stable calculation.

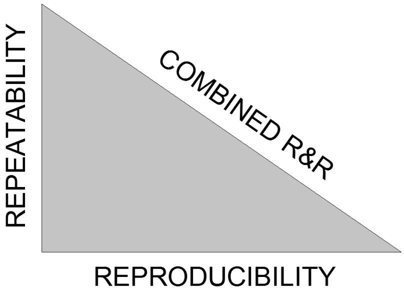
An example report below is shown with GageReportGroups=2 set in the Config.ini file and a total of ten devices measured. Since the number of groups can change in this report, standard deviation is used for calculations instead of range, which is often used with three groups in many Gage R&R reports. This allows the report to be customized to match the number of pick heads, for example.

```
----------------------------------------------------------------------
GAGE R&R REPORT
----------------------------------------------------------------------
Machine:  UX2048                      Part:   REG20
Units:    MILS                        Lot:
Date:     2014/11/10 5:40 PM          User:
----------------------------------------------------------------------
COPLQ - Coplanarity
----------------------------------------------------------------------
Part Tolerance                     5.000
Repeatability                      0.398     7.955%
Reproducibility                    0.300     6.001%
Combined R&R                       0.498     9.964%
----------------------------------------------------------------------
PART          R1        R2      STDEV
P1         2.203     2.067     0.096
P2         2.097     2.025     0.051
P3         2.230     2.134     0.068
P4         2.086     2.120     0.024
P5         2.186     2.047     0.098
P6         2.227     2.135     0.065
P7         2.486     2.106     0.269
P8         2.456     2.018     0.310
P9         2.214     2.055     0.112
P10        2.488     2.159     0.233
----------------------------------------------------------------------
```

The calculations for the Gage R&R report are shown below. The Repeatability is the 3-Sigma calculation of the average standard deviation of the inspections of each part. The Reproducibility is the 3-Sigma calculation of the standard deviation of the standard deviations of part inspections.

| PART | R1 | R2 | STDEV |
|---|---|---|---|
| P1 | 2.203 | 2.067 | 0.096 |
| P2 | 2.097 | 2.025 | 0.051 |
| P3 | 2.230 | 2.134 | 0.068 |
| P4 | 2.086 | 2.120 | 0.024 |
| P5 | 2.186 | 2.047 | 0.098 |
| P6 | 2.227 | 2.135 | 0.065 |
| P7 | 2.486 | 2.106 | 0.269 |
| P8 | 2.456 | 2.018 | 0.310 |
| P9 | 2.214 | 2.055 | 0.112 |
| P10 | 2.488 | 2.159 | 0.233 |
| **Repeatability** | **3-AVE** | | 0.398 |
| **Reproducibility** | **3-STDEV** | | 0.300 |

The Combined R&R shows the effects of both Repeatability and Reproducibility. The relationship is similar to the hypotenuse of a right triangle as shown below.



## 6.11 Repeatability Report

The Repeatability Report measures the repeatability of measurements on each lead. The report calculates a 3-Sigma result for each measurement based on the standard deviation of the result for each individual lead. To create the report select the correct part and inspect a single device thirty times. After the part has been inspected, enter password REPEAT to generate the report.

The number of maximum leads shown in the report can be set with the GoldRepeatLeads=0 in the Config.ini file. The specification for the report is 6.35 microns and can be changed by setting GoldRepeatability=0.0 in the Config.ini file. The value is set in mils so setting GoldRepeatability=0.40 is about 10 microns.

```
----------------------------------------------------------------------
3-SIGMA REPEATABILITY REPORT  -  PASS
----------------------------------------------------------------------
Machine:  UX_TEST                 Part:   G080148A.crq
Units:    MICRONS                 Lot:
Date:     2016/5/3 9:22 AM        User:
----------------------------------------------------------------------
                 Min       Mean        Max    3-Sigma      Spec    Result
----------------------------------------------------------------------
COPLQ            0.0        3.8       53.2        2.9       6.3      PASS
STOFF          205.4      211.1      217.6        1.3       6.3      PASS
WIDTH          308.2      313.4      320.9        1.3       6.3      PASS
BLEAD          -47.9        1.1       79.6        2.6       6.3      PASS
PITCH          569.0      649.8      731.9        3.5       6.3      PASS
TPOFF          -19.0       -4.1       16.9        2.6       6.3      PASS
SWEEP            1.3        1.4        1.6        0.3       6.3      PASS
SLANT            0.3        0.4        0.6        0.3       6.3      PASS
TTTIP        15982.3    15993.7    16006.5        3.7       6.3      PASS
----------------------------------------------------------------------
     COPLQ      STOFF      WIDTH      BLEAD      PITCH      TPOFF      SWEEP
----------------------------------------------------------------------
1      1.8        0.5        0.4        0.8        1.2        0.9        0.1
2      0.8        0.5        0.5        0.8        1.2        0.8        0.1
3      1.8        0.5        0.4        0.8        1.1        0.8        0.1
4      1.5        0.5        0.5        0.9        1.1        0.9        0.1
5      0.7        0.5        0.4        0.9        1.1        0.8        0.1
```

## 6.12 System Report

The System Report provides an overview of the system, software and calibrations. To create the system report, enter the password SYSTEM in the Passwords dialog box. An example system report is shown below.

```
-----------------------------------------------------------------
SYSTEM REPORT  2016/4/25 8:46 PM
-----------------------------------------------------------------
Serial No:      UX2064
Version:        UltraVim3D 9.4.25
Filename:       C:/UltraVim3D/UltraVim3D.exe
Hardware:       1543674700
License:        3378258835
Reticle:        RP10688.ret
Gold BGA:       G16-126.crb
Gold QFP:       G080148A.crq
Server:         Port 5150
Digital:        PIC-18F-501-A
Lights:         PIC-18F-501-A
Camera:         F20E-273-2400x1800-K8   78 ms Grab Time
UltraVim3D:     2016/04/22  2596 KB  9.4.2.5
  CAMERA.DLL    2016/04/07  36 KB
  DIGITAL.DLL   2015/02/19  124 KB
MFC42.DLL:      2009/07/13  1360 KB  6.6.8063.0
MFC100.DLL:     2011/02/19  5443 KB  10.0.40219.1
HidUsb.sys:     2010/11/20  29 KB  6.1.7601.17514
iusb3xhc.sys:   2014/02/21  772 KB  3.0.0.16
UsbHub.sys:     2010/11/20  335 KB  6.1.7601.17514
-----------------------------------------------------------------
CALIBRATIONS
-----------------------------------------------------------------
Camera1:        PASS  71.8179 mm x 53.8596 mm  2016/4/22 12:23 AM
                CALIBX1.cal CALIBY1.cal        2016/04/22   73 KB
Camera2:        PASS  46.2048 mm x 34.6617 mm  2016/4/22 12:25 AM
                CALIBX2.cal CALIBY2.cal        2016/04/22   40 KB
Angles:         PASS  -0.09,-0.02 RP10688.RET  2016/4/24 10:33 PM
Lights:         PASS  152, 152, 151, 153, 9    2016/3/22  5:08 PM
Cycles:         PASS  163000 Cycles  GOLD100A  2016/4/25  8:40 PM
Gold:           PASS  G080148A.crq 0.130 MILS  2016/4/25  8:43 PM
                PASS  G16-126.crb  0.130 MILS  2016/4/25 12:51 AM
-----------------------------------------------------------------
WINDOWS SETTINGS
-----------------------------------------------------------------
Computer:       ULTRAVIM-PC
Windows:        7.0 7601 x64 3.5 GHz
Action Center:  UAC - Notify Enabled
Security:       wscsvc RUNNING
Themes:         Themes RUNNING
Win Defender:   WinDefend RUNNING
Win Firewall:   MpsSvc RUNNING
Win Updates:    wuauserv RUNNING
Power Plan:     powrprof.dll,-13,High Performance
Screen Saver:   Active
Memory:         4062+ MB Available, 4062+ MB Total
Hard Disk:      1459037901  85.3 GB FREE  111.7 GB TOTAL
-----------------------------------------------------------------
```

Additional reports include the driver and network reports. These reports are created by using the DRIVER and NETWORK passwords. The driver report executes the "driverquery" command to create a list of all installed device drivers. The network report executes the "getmac" and "netstat" commands to display MAC addresses and active TCP connections.

```
----------------------------------------------------------------------
DRIVER REPORT  2016/5/3 2:43 PM
----------------------------------------------------------------------
Serial No:     UX2060
Version:       UltraVim3D 9.4.26
----------------------------------------------------------------------
Module Name  Display Name           Driver Type   Link Date
============ ====================== ============= ======================
1394ohci     1394 OHCI Compliant Ho Kernel        11/20/2010 3:44:56 AM
ACPI         Microsoft ACPI Driver  Kernel        11/20/2010 2:19:16 AM
AcpiPmi      ACPI Power Meter Drive Kernel        11/20/2010 2:30:42 AM
adldio64     adldio64               Kernel        12/19/2006 6:27:32 PM
adp94xx      adp94xx                Kernel        12/5/2008 4:54:42 PM
adpahci      adpahci                Kernel        5/1/2007 10:30:09 AM
adpu320      adpu320                Kernel        2/27/2007 5:04:15 PM
AFD          Ancillary Function Dri Kernel        12/27/2011 8:59:20 PM
agp440       Intel AGP Bus Filter   Kernel        7/13/2009 4:38:43 PM
aliide       aliide                 Kernel        7/13/2009 4:19:47 PM
amdide       amdide                 Kernel        7/13/2009 4:19:49 PM

----------------------------------------------------------------------
NETWORK REPORT  2016/5/3 2:44 PM
----------------------------------------------------------------------
Serial No:     UX2060
Version:       UltraVim3D 9.4.26
----------------------------------------------------------------------
Physical Address    Transport Name
=================== ==========================================================
C8-AB-F9-B7-BB-92   Media disconnected
7A-1A-C4-AD-39-84   \Device\Tcpip_{7355F81D-82BD-4E91-816B-8A3E314C549E}
===========================================================================
Interface List
 13...70 1b 14 2d 49 89 ......802.11n Wireless LAN Card #2
 11...c4 0a c9 17 bb 91 ......Realtek PCIe GBE Family Controller
  1...........................Software Loopback Interface 1
 21...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter
 10...00 00 00 00 00 00 00 e0 Microsoft Teredo Tunneling Adapter
 17...00 00 00 00 00 00 00 e0 Microsoft ISATAP Adapter #2
===========================================================================
```

## 6.13 Log Files

Entering password LOG in the Passwords dialog box will create system log files. Each activity will be stored in the LOGCUR.CSV file. Every time a part file is loaded that file will be saved as LOGBAK.CSV. The system time for each action is recorded along with the action as shown in the example below.

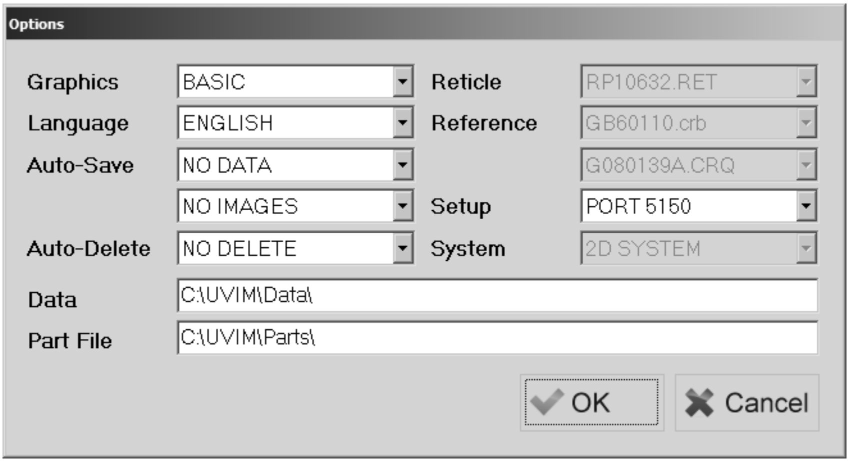
```
LOGBAK.CSV
[Log]
1=     15225184   Select Part
2=     15239396   SOCKET CONNECTED
3=     15245620   LOADP:QFP0080

LOGCUR.CSV
[Log]
1=     15245870   Part file loaded.
2=     15250581   INSPP
3=     15250674   PASS
4=     15251408   INSPP
5=     15251501   PASS
6=     15251985   INSPP
7=     15252078   PASS
8=     15252406   INSPP
9=     15252500   PASS
10=    15252734   INSPP
11=    15252827   PASS
12=    15255464   GETPS
```

# 7. Host Communications

This chapter describes the protocol required to communicate with the UltraVim system using RS232 or Ethernet protocols. An Internet socket is an interface between an application process or thread and the TCP/IP protocol stack provided by the operating system.

The host communications protocol is selected in the Setup section of the Options screen. In the screen shown below, PORT 5150 has been selected and the software will respond to TCP/IP commands when an Internet socket connects to that port on the computer. Examples of protocols are shown below:

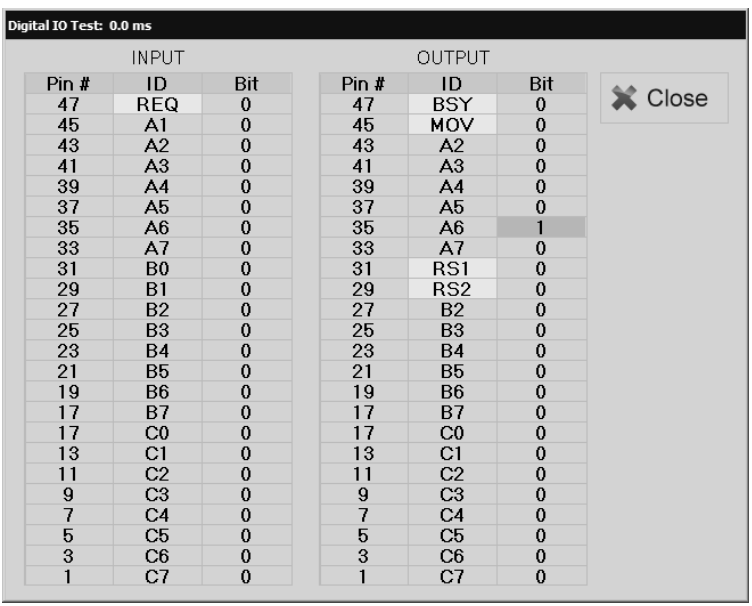
| | |
|---|---|
| PORT5150 | Ethernet Communication |
| COMM1 | RS232 Port |
| DIGITAL A0 | Digital I/O A0 Protocol |



## 7.1 Digital I/O Communications

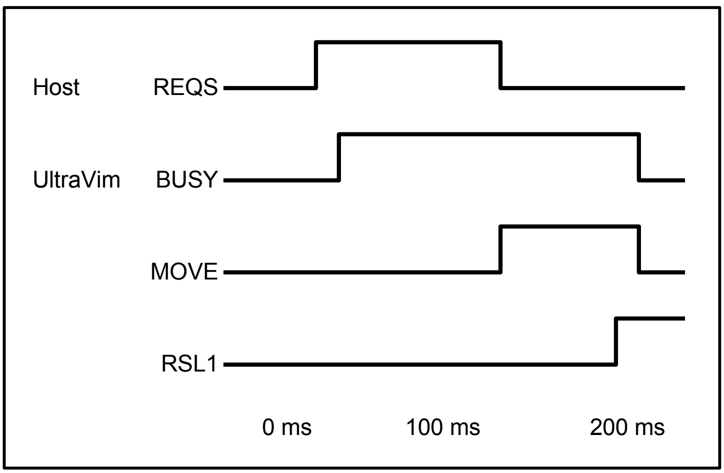
If your system includes a digital I/O board or digital USB module, you may use digital I/O communications to trigger an inspection and read the results. It is important to note that the DIGITAL.DLL driver file must match your hardware. If your system does not include digital hardware, a "dummy" file must still be present, but it will not attempt to initialize any hardware. Also, the correct digital protocol must be selected in the Options dialog.

To test Digital I/O the connection, enter password DIO to display Digital I/O Test dialog shown below. You can test individual output lines by clicking on the "0/1" text next to the line you wish to test. If you need to invert the signals, edit the DIGITAL.ini file and set InvertInp=1 and/or InvertOut=1.




| INPUT | | | OUTPUT | | |
|---|---|---|---|---|---|
| Pin # | ID | Bit | Pin # | ID | Bit |
| 47 | REQ | 0 | 47 | BSY | 0 |
| 45 | A1 | 0 | 45 | MOV | 0 |
| 43 | A2 | 0 | 43 | A2 | 0 |
| 41 | A3 | 0 | 41 | A3 | 0 |
| 39 | A4 | 0 | 39 | A4 | 0 |
| 37 | A5 | 0 | 37 | A5 | 0 |
| 35 | A6 | 0 | 35 | A6 | 1 |
| 33 | A7 | 0 | 33 | A7 | 0 |
| 31 | B0 | 0 | 31 | RS1 | 0 |
| 29 | B1 | 0 | 29 | RS2 | 0 |
| 27 | B2 | 0 | 27 | B2 | 0 |
| 25 | B3 | 0 | 25 | B3 | 0 |
| 23 | B4 | 0 | 23 | B4 | 0 |
| 21 | B5 | 0 | 21 | B5 | 0 |
| 19 | B6 | 0 | 19 | B6 | 0 |
| 17 | B7 | 0 | 17 | B7 | 0 |
| 17 | C0 | 0 | 17 | C0 | 0 |
| 13 | C1 | 0 | 13 | C1 | 0 |
| 11 | C2 | 0 | 11 | C2 | 0 |
| 9 | C3 | 0 | 9 | C3 | 0 |
| 7 | C4 | 0 | 7 | C4 | 0 |
| 5 | C5 | 0 | 5 | C5 | 0 |
| 3 | C6 | 0 | 3 | C6 | 0 |
| 1 | C7 | 0 | 1 | C7 | 0 |

The following diagram shows the general timing of the host communications to inspect a part with the UltraVim. The host must first set the REQ line high. The UltraVim will acknowledge this by holding the BSY line high. The host should then acknowledge this by setting the REQ line low. If the command is for an inspection and UseMoveSignal=1 in the Config.ini file, the UltraVim will set the MOV line high after it has acquired an image and it is safe to move the device away from the inspection module. When the UltraVim has completed the command or inspection, it will set the RS1 and RS2 high and the BSY and MOV lines low.

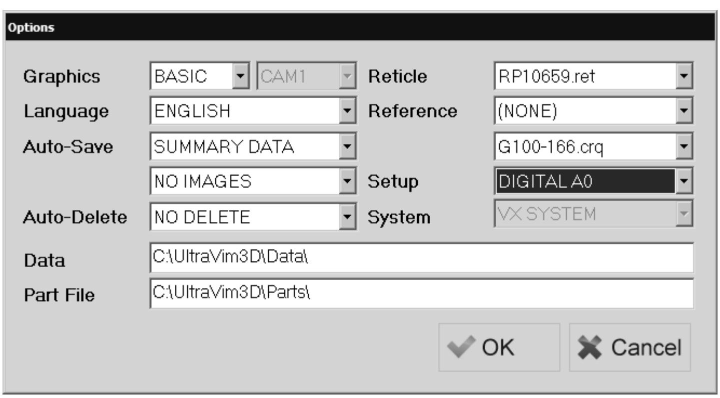



If the inspection result was PASS, both RS1 and RS2 will be set high by the software. If the inspection result was NF (Not Found) or FAIL, both RS1 and RS2 will be set low. If the result was REWORK, RS1 will be high and RS2 will be set low.

| RESULT | RS1 | RS2 |
|---|---|---|
| PASS | 1 | 1 |
| REWORK | 1 | 0 |
| FAIL | 0 | 1 |
| NOT FOUND | 0 | 0 |

The Digital I/O configuration is set in the Options dialog shown below. Password level four is required to set the configuration for the Digital I/O, the module type or the data and part paths. A description of different I/O configurations is show below. Note that the MOV line is only set when using UseMoveSignal=1. Also, output bit A6 will always be set high when using DIGITAL AB mode. When using DIGITAL PF the result bits will show PASS and FAIL results only.

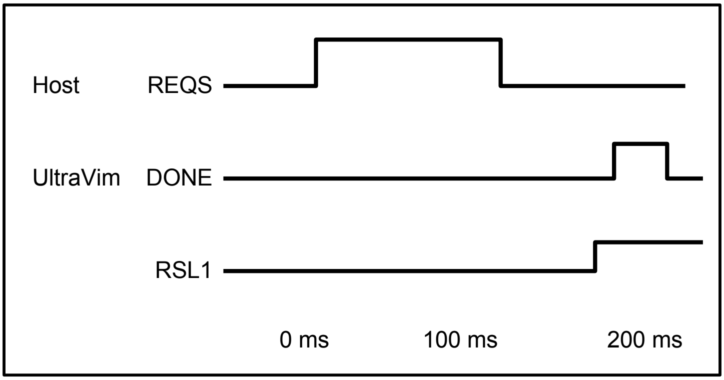
| | INPUT | OUTPUT | | | |
|---|---|---|---|---|---|
| **SETUP** | **REQ** | **MOV** | **BSY** | **RS1** | **RS2** |
| DIGITAL AB | A0 | A1 | A0 | B0 | B1 |
| DIGITAL A0 | A0 | A3 | A0 | A1 | A2 |
| DIGITAL PF | A0 | A3 | A0 | A1 | A2 |



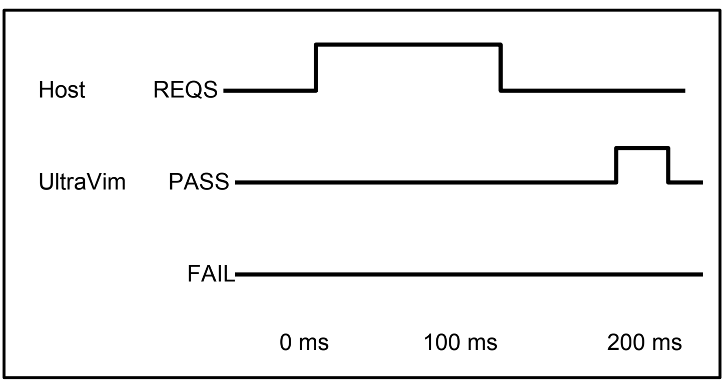
The diagram below shows the pins used on a 5-pin ribbon cable for the DIGITAL AB and DIGITAL A0 settings. The last column shows the pins used on older software versions for comparison. Much of the complexity of using multiple commands was removed from the Digital I/O interface in favor of using Ethernet communication to support commands. The only command supported with the Digital I/O interface in current software versions is the INSPP inspect command.

| | | | | DIGITAL AB | | DIGITAL A0 | | VER 8.6 | |
|---|---|---|---|---|---|---|---|---|---|
| Ground | 50 | 49 | +5V | INP | OUT | INP | OUT | INP | OUT |
| Ground | 48 | 47 | A0 | REQ | BSY | REQ | BSY | REQ | BSY |
| Ground | 46 | 45 | A1 | | MOV | | RS1 | INP | MOV |
| Ground | 44 | 43 | A2 | | | | RS2 | | ERR |
| Ground | 42 | 41 | A3 | | | | MOV | | ER1 |
| Ground | 40 | 39 | A4 | INS | | | | CM1 | ER2 |
| Ground | 38 | 37 | A5 | | | | | CM2 | ER3 |
| Ground | 36 | 35 | A6 | | MOD | | | CM3 | MOD |
| Ground | 34 | 33 | A7 | | | | | CM4 | |
| Ground | 32 | 31 | B0 | | RS1 | | | DA1 | RS1 |
| Ground | 30 | 29 | B1 | | RS2 | | | DA2 | RS2 |
| Ground | 28 | 27 | B2 | | | | | DA3 | XN |
| Ground | 26 | 25 | B3 | | | | | DA4 | X1 |
| Ground | 24 | 23 | B4 | | | | | DA5 | X2 |
| Ground | 22 | 21 | B5 | | | | | DA6 | X3 |
| Ground | 20 | 19 | B6 | | | | | DA7 | X4 |
| Ground | 18 | 17 | B7 | | | | | DA8 | X5 |
| Ground | 16 | 15 | C0 | | | | | | X6 |
| Ground | 14 | 13 | C1 | | | | | | YN |
| Ground | 12 | 11 | C2 | | | | | | Y1 |
| Ground | 10 | 9 | C3 | | | | | | Y2 |
| Ground | 8 | 7 | C4 | | | | | | Y3 |
| Ground | 6 | 5 | C5 | | | | | | Y4 |
| Ground | 4 | 3 | C6 | | | | | | Y5 |
| Ground | 2 | 1 | C7 | | | | | | Y6 |

The diagram below shows the timing when UseDoneSignal=1 is set in the Config.ini file. This setting will cause the BUSY line to act as a DONE signal that will toggle at the end of the inspection. The length of time that the DONE signal is held high can be set by changing the ProcessDelay=100 parameter in the Config.ini file.

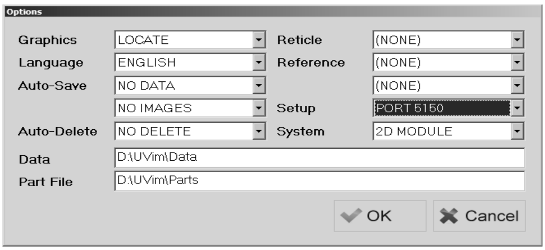



The diagram below shows the timing when UseDoneSignal=1 is set in the Config.ini file and the DIGITAL PF configuration is selected. In this case the PASS or FAIL line will act as a signal to let the host know when inspection is complete.



## 7.2 Socket Communications

An Internet socket (or commonly, a network socket or socket) is an end-point of a bi-directional process-to-process communication flow across an IP based network, such as the Internet. A socket is an interface between an application process or thread and the TCP/IP protocol stack provided by the operating system.




To set the software in a socket server mode, select a port in the Options dialog as shown below. Available ports include 5150, 5151, 5152 and 5153. Other systems should connect to the socket using the computer name that is shown in the passwords dialog or the actual IP address.

The supported socket commands are shown below.

| | |
|---|---|
| **Command:** | **Auto Gain QFP** |
| **Usage:** | AUTOG, AUTOG:150, AUTOG:200 |
| **Return:** | OK – The command succeeded.<br>ERROR – The program could not close. |

| | |
|---|---|
| **Command:** | **Check Prism Cleaning** |
| **Usage:** | CLEAN |
| **Return:** | PASS – The prisms are clean.<br>FAIL – The prisms are not clean.<br>NFND – The prisms were not found. |

| | |
|---|---|
| **Command:** | **Close Program** |
| **Usage:** | CLOSE |
| **Return:** | OK – The command succeeded.<br>ERROR – The program could not close. |

| | |
|---|---|
| **Command:** | **Exit Program** |
| **Usage:** | EXITP |
| **Return:** | OK – The command succeeded.<br>ERROR – The program could not exit. |

| | |
|---|---|
| **Command:** | **Find Edges** |
| **Usage:** | FINDE:CX, CY MM, THRESHOLD<br>FINDE:X1, Y1, X2, Y2 MM, THRESHOLD<br>FINDE:CX, CY MM, DIRECTION<br>FINDE:X1, Y1, X2, Y2 MM, DIRECTION |
| **Example:** | FINDE:3.0,2.5<br>FINDE:3.0,2.5, RIGHT |
| **Return:** | X MM, Y MM, % FOUND |

| | |
|---|---|
| **Command:** | **Find Black Pixels** |
| **Usage:** | FINDB:CX, CY MM, THRESHOLD<br>FINDB:X1, Y1, X2, Y2 MM, THRESHOLD<br>FINDB:X1, Y1, X2, Y2 MM, DIRECTION |
| **Example:** | FINDB:3.0,2.5<br>FINDB:3.0,2.5, UP |
| **Return:** | X MM, Y MM, % FOUND |

**Command:** **Find White Pixels**
**Usage:** FINDW:CX, CY MM, THRESHOLD
FINDW:X1, Y1, X2, Y2 MM, THRESHOLD
FINDW:CX, CY MM, DIRECTION
FINDW:X1, Y1, X2, Y2 MM, DIRECTION
**Example:** FINDW:3.0,2.5
FINDW:3.0,2.5, DOWN
**Return:** X MM, Y MM, % FOUND

**Command:** **Get Exposure**
**Usage:** GETEX
**Return:** ##
Note: The exposure is the total for all images.

**Command:** **Get Hardware ID**
**Usage:** GETID
**Return:** ##########

**Command:** **Get Version**
**Usage:** GETVR
**Return:** 9.#.##

**Command:** **Get Device Position Result**
**Usage:** GETPS
**Return:** X.###, Y.###, Z.###, A.###
"1.230, 2.340, 0.000, -0.500"
ERROR – There was an error.
Note: Values are in millimeters and degrees.

**Command:** **Get Last Result**
**Usage:** GETRS
**Return:** PASS - The last result was a pass.
FAIL - The last result was a fail.
REWORK - The last result was a rework.
NFND - The last result was a not found.

**Command:** **Grab Image**
**Usage:** GRABI, GRABI:Camera Starting at Zero
**Example:** GRABI or GRABI:0
**Return:** OK – The grab was successful.
ERROR – There was an error.

**Command:** **Grab Temporary Image**
**Usage:** GRABT
**Return:** OK – The grab was successful.
ERROR – There was an error.
Note: The image will update in debug graphics.

**Command:** **Inspect the 2D Position (VX, UX only)**
**Usage:** INS2D
**Return:** X.##, Y.##, Z.##, A.##
"1.23, 2.34, 0.00, -0.50"
NFND – The device was not found.
Note: Values are in millimeters and degrees.

**Command:** **Inspect Merge Center (VX, UX Only)**
**Usage:** INSMC
**Example:** INSMC
**Return:** PASS – The inspection passed.
FAIL – The inspection failed.
RWRK – The inspection result was rework.
NFND – The device was not found.
ACKN – The command was received.
MOVE – The image exposure is complete.
Note: Used only after GRABT command.

**Command:** **Inspect Multi Part (UX BGA Only)**
**Usage:** INSPM:offset MM
**Example:** INSPM:-10.50
**Return:** PASS – The inspection passed.
FAIL – The inspection failed.
RWRK – The inspection result was rework.
NFND – The device was not found.
ACKN – The command was received.
MOVE – The image exposure is complete.

**Command:** **Inspect Multi Part (Without Grab)**
**Usage:** INSPN:offset MM
**Example:** INSPN:-10.50
**Return:** PASS – The inspection passed.
FAIL – The inspection failed.
RWRK – The inspection result was rework.
NFND – The device was not found.
ACKN – The command was received.
MOVE – The image exposure is complete.

**Command:** **Normal Inspect Part**
**Usage:** INSPP
**Return:** PASS – The inspection passed.
FAIL – The inspection failed.
RWRK – The inspection result was rework.
NFND – The device was not found.
ACKN – The command was received.
MOVE – The image exposure is complete.

**Command:** **Inspect Part without Counting Data**
**Usage:** INSPX
**Return:** PASS – The inspection passed.
FAIL – The inspection failed.
RWRK – The inspection result was rework.
NFND – The device was not found.
ACKN – The command was received.
MOVE – The image exposure is complete.

| | |
|---|---|
| **Command:** | **Learn Mark** |
| **Usage:** | LEARN:CX, CY MM |
| | LEARN:X1, Y1, X2, Y2 MM |
| **Example:** | LEARN:3.0,2.5 |
| **Return:** | OK – The mark was learned |
| | ERROR – The mark failed to learn. |

| | |
|---|---|
| **Command:** | **Load Part** |
| **Usage:** | LOADP:part file, lot name, user name |
| **Example:** | LOADP:QFP208.par |
| | LOADP:QFP208.par, LOT123 |
| | LOADP:QFP208.par, LOT123, DAVID |
| **Return:** | OK – The part file loaded. |
| | ERROR – The part file did not load. |

| | |
|---|---|
| **Command:** | **Load Image** |
| **Usage:** | LOADI:image file |
| **Example:** | LOADI:C:\Image1.png |
| **Return:** | OK – The image file loaded. |
| | ERROR – The image file did not load. |

| | |
|---|---|
| **Command:** | **Print Lot Report** |
| **Usage:** | PRINT |
| **Return:** | PASS - The last result was a pass. |
| | FAIL - The last result was a fail. |
| | REWORK - The last result was a rework. |
| | NFND - The last result was a not found. |

| | |
|---|---|
| **Command:** | **Ready** |
| **Usage:** | READY |
| **Return:** | OK – The software is ready. |
| | BUSY – The software is busy. |

| | |
|---|---|
| **Command:** | **Resume Part File** |
| **Usage:** | RESUM:part file, lot name, user name |
| **Example:** | RESUM:QFP208.par |
| | RESUM:QFP208.par, LOT123 |
| | RESUM:QFP208.par, LOT123, DAVID |
| **Return:** | OK – The part file loaded or was resumed. |
| | ERROR – The part file did not load. |
| | Note: If no resume file is found LOADP is used. |

| | |
|---|---|
| **Command:** | **Save Image** |
| **Usage:** | SAVEI:image file |
| **Example:** | SAVEI:C:\Image1.png |
| **Return:** | OK – The image file loaded. |
| | ERROR – The image file did not load. |

| | |
|---|---|
| **Command:** | **Output to Port** |
| **Usage:** | OUTPA:byte |
| **Return:** | OK – The command succeeded. |
| | ERROR – The command failed. |

| | |
|---|---|
| **Command:** | **Window Hide** |
| **Usage:** | WINHD |
| **Return:** | OK – The command succeeded. |
| | ERROR – The user has a dialog open. |

| | |
|---|---|
| **Command:** | **Window Minimize** |
| **Usage:** | WINMN |
| | WINMN: X, Y, CX, CY |
| **Note:** | The optional parameters must be positive. |
| **Return:** | OK – The command succeeded. |
| | ERROR – The user has a dialog open. |

| | |
|---|---|
| **Command:** | **Window Maximize** |
| **Usage:** | WINMX<br>WINMX: X, Y, CX, CY |
| **Note:** | The optional parameters must be positive.<br>Window size should be 800x600 or larger. |
| **Return:** | OK – The command succeeded.<br>ERROR – The user has a dialog open. |

| | |
|---|---|
| **Command:** | **Window Show** |
| **Usage:** | WINSH |
| **Return:** | OK – The command succeeded.<br>ERROR – The user has a dialog open. |

| | |
|---|---|
| **Command:** | **Get Min and Max Data** |
| **Usage:** | Measurement Code |
| **Example:** | WIDTH |
| **Return:** | Result, Lead, Min, Lead, Max<br>"PASS, A1, 39.40, A3, 40.450"<br>ERROR – The measurement was not found. |

## 7.3 Custom Command Strings

The default command strings used for both socket and COMM protocols can be changed by editing the Config.ini file section shown below. For example, if you would like the software to respond to the command "I" instead of "INSPP" then set "INSPP=I" in the file. If you would like the software to report "1" instead of "PASS" then set "PASS=1" in the file. Note that the "MOVE" and "ACKN" commands will not be sent by default. When set, the "MOVE" command will return after all images have been grabbed, and the "ACNK" command will return immediately after the software receives an inspect command.

**[Commands]**

| | |
|---|---|
| INSPP=INSPP | Inspect a part. |
| INSPX=INSPX | Inspect with no data. |
| LOADP=LOADP | Load a part (LOADP:XXXX.PAR). |
| GETRS=GETRS | Get the result. |
| GETPS=GETPS | Get device position. |
| PRINT=PRINT | Print lot summary report. |
| PASS=PASS | PASS return string. |
| FAIL=FAIL | FAIL return string. |
| RWRK=RWRK | RWRK return string. |
| NFND=NFND | NFND return string. |
| MOVE= | MOVE return string. |
| ACKN= | ACKN return string. |

## 7.4 Using MOVE and ACKN

When set, the "MOVE" command will return after all images have been grabbed, and the "ACKN" command will return immediately after the software receives an inspect command. The client must then send the "GETRS" command to receive the result. If the inspection has not been completed, the software will return "BUSY." The client should then delay for a short time and try sending the command again, as shown in the example psuedocode below. Note that when using "ACKN" the handler should delay for the exposure time before moving the device away from the camera.

```
int FunctionSendInspect()
{
  if (Send("INSPP") == error) return error_1;
  if (Recv(result) == error) return error_2;
  if (result == "ACKN" or result == "MOVE")
  {
    for(i=0;i<10;i++)
    {
      Sleep(100);
      if (Send("GETRS") == error) return error_3;
      if (Recv(result) == error) return error_4;
      if (result != "BUSY") break;
    }
  }
  if (result == "PASS") return inspp_pass;
  if (result == "FAIL") return inspp_fail;
  if (result == "RWRK") return inspp_rwrk;
  if (result == "NFND") return inspp_nfnd;
  return error_5;
}
```

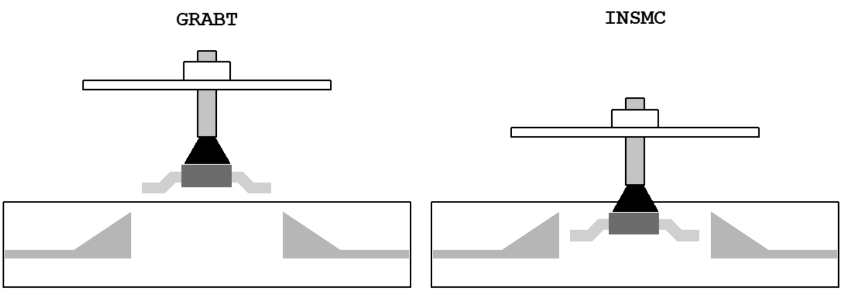
## 7.5 Alternatives to MOVE and ACKN

Instead of using "MOVE" or "ACKN", another approach is to improve speed is to send the standard "INSPP" command with an asynchronous socket, assume it was successful, delay for exposure and latency time, and then move to the pass position and wait for the command to complete or timeout. The example psuedocode functions below show how to calculate the delay and inspect a device using this method. The inspection function sends the "INSPP" command, pauses and moves to the pass position and waits for the result. If the result was fail, the handler must then move to the fail position to complete the cycle.

```
int CalculateDelay()
{
  network_delay = 5;
  Send("GETEX");
  Recv(exposure);
  if (exposure < 1) exposure = 30;
  total_delay = exposure + network_delay;
  return total_delay;
}

int FunctionFastInspect()
{
  if (Send("INSPP") == error) return error_1;
  Delay(delay_calculated_at_start_of_lot);
  if (MoveTo(PASS) == error) return error_2;
  if (Recv(result) == error) return error_3;
  if (result == "PASS") return inspp_pass;
  if (MoveTo(FAIL) == error) return error_4;
  return inspp_fail;
}
```

## 7.6 Using GRABT and INSMC

For some QFP, TSOP, and SOP configurations on the VX and UX modules it may not be possible to place the reflective diffuser far enough above the device and as a result the image in the center will look dark when the device is in the correct inspection position. In these instances, a temporary image must first be grabbed using the "GRABT" command while the diffuser is 20-30mm above the top of the module and the "INSMC" command must be used to merge the images when the device is in the lower inspection position. The example psuedocode function FunctionInspectMerge below shows and example that merges the two images.




```
int FunctionInspectMerge()
{
  if (Send("GRABT") == error) return error_1;
  if (Recv(result) == error) return error_2;
  if (result != "OK") return error_3;
  if (MoveTo(INSPECT) == error) return error_4;
  if (Send("INSMC") == error) return error_5;
  if (Recv(result) == error) return error_6;
  if (result == "PASS") return inspp_pass;
  return inspp_fail;
}
```

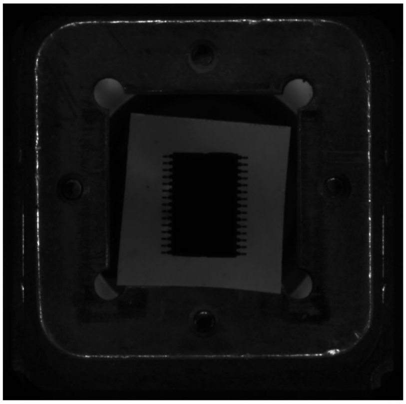
Using the technique shown in the example FunctionFastInspect psuedocode, it may be possible to also optimize the merge inspection. The sample function FunctionFastInspectMerge below shows and example that merges the two images with a delay that was calculated at the beginning of each new lot. Note that these optimized methods may require additional programming to account for error recovery when network or camera functions have failed or time out.

```
int CalculateDelay()
{
  network_delay = 5;
  Send("GETEX");
  Recv(exposure);
  if (exposure < 1) exposure = 30;
  total_delay = exposure + network_delay;
  return total_delay;
}

int FunctionFastInspectMerge()
{
  if (Send("GRABT") == error) return error_1;
  Delay(delay_calculated_at_start_of_lot);
  if (MoveTo(INSPECT) == error) return error_2;
  if (Recv(result) == error) return error_3;
  if (result != "OK") return error_4;
  if (Send("INSMC") == error) return error_5;
  Delay(delay_calculated_at_start_of_lot);
  if (MoveTo(PASS) == error) return error_6;
  if (Recv(result) == error) return error_7;
  if (result == "PASS") return inspp_pass;
  if (MoveTo(FAIL) == error) return error_8;
  return inspp_fail;
}
```

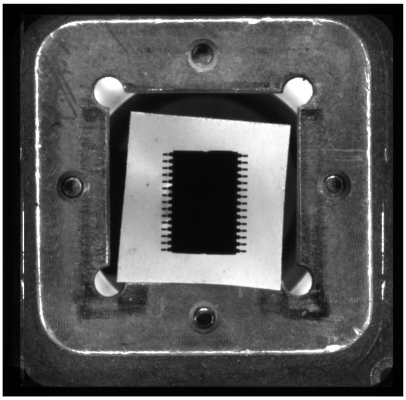
## 7.7 Using Auto Gain

For some QFP, TSOP, and SOP configurations on the VX and UX modules it may not be possible to place the reflective diffuser far enough above the device and as a result the image in the center will look dark when the device is in the correct inspection position. If the diffuser is high enough to reflect some light it may be possible to use a gain function instead with the INSPP command instead of using the GRABT and INSMC commands.

The example image below shows a dark image without the gain function and the same image on the right with AutoGainQFP=200 set in the Config.ini file. When the gain is set to 200 the software sets the average background to a gray level of 200 out of 255. To override the gain setting for a specific part the AUTOG command may be used or the ProcThr1 parameter may be set in the part file. Note that the side views of the part are not affected by AutoGainQFP or ProcThr1 but may be set with the ProcThr2 parameter in the part file.



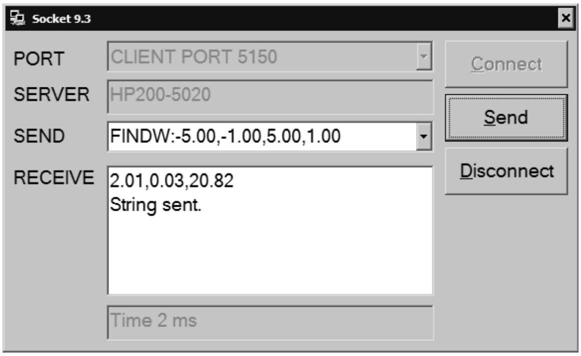
**AutoGainQFP=0**

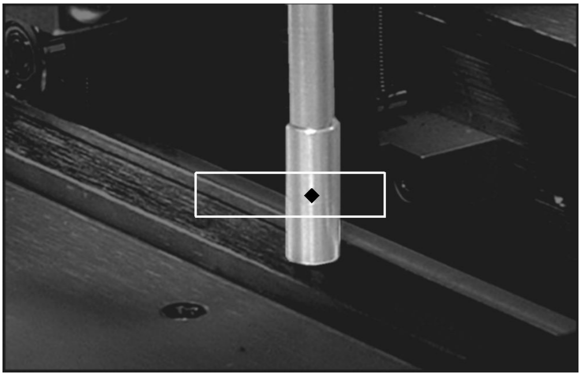


**AutoGainQFP=200**

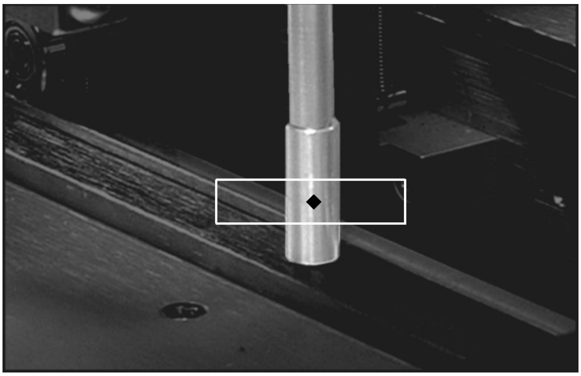
## 7.8 Using FIND Socket Commands

The FINDB, FINDE and FINDW commands can be used in a calibrated image to find features or objects. These commands can locate black pixels, edges or white pixels using thresholds or edge finding. The example below shows a pick nozzle in a 30 x 20 mm image. The "FINDW:-5,-1,5,1" command has been used to locate a white threshold. The result was +2,+0 mm with 20% of the pixels found. Note that the FIND commands do not grab an image each time, so use the GRABI command to grab a new image.

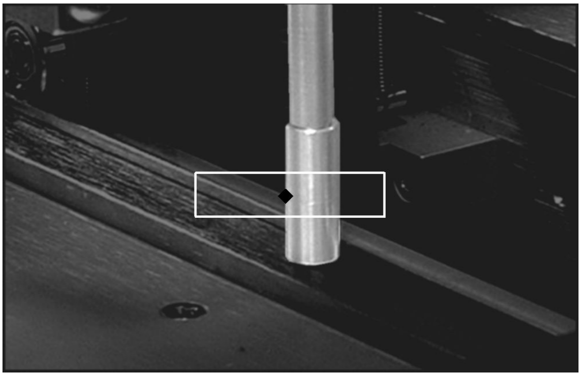


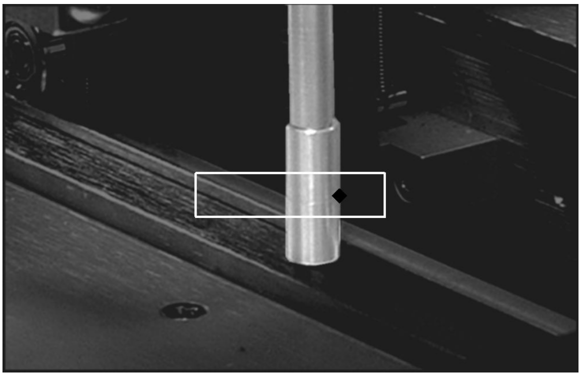
One strategy to with thresholds is to use the result data to adjust the search location and locate the pixels multiple times. Using the original search and the results of +2,-0 mm a new command of "FINDW:-3,-1,7,1" was sent in the example below which again resulted in a location of +2,+0 mm.



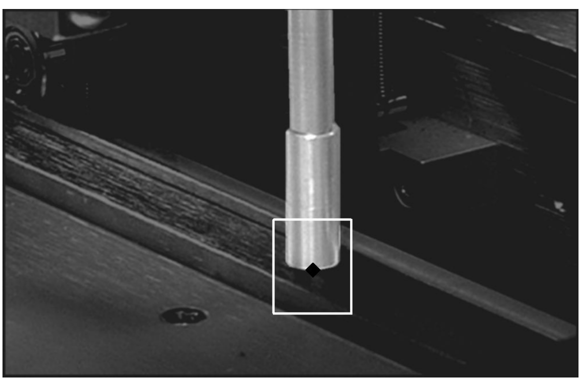
The FIND commands may also be used with the directions UP, DOWN, LEFT or RIGHT to find edges. In the image below, the command "FINDW:-5,-1,5,1,RIGHT" was used.



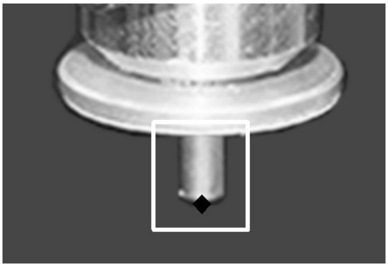
The RIGHT search resulted in +1.1,+0 mm. In the image below, the command "FINDW:-5,-1,5,1,LEFT" was used which resulted in +2.74,+0 mm. The average of the RIGHT and LEFT commands is +1.92 mm.



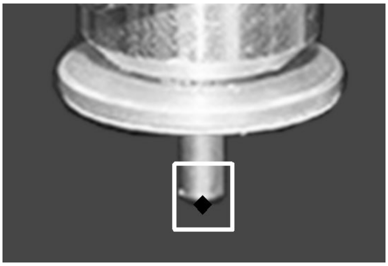
In the image below, the command "FINDW:-1,-8,5,0,UP" was used which returned a location of +2.0,-2.8 mm. Note that coordinate system depends on the camera orientation in the calibration screen.



The accuracy of the results depends on the camera resolution, lighting, edge quality, calibration and the appropriate use of the commands. For example, in the image below the command "FINDE:1.5,-5.0,2.5,-3.0,UP" was used to find the small white tip at the end of the nozzle. Note that the search box is correctly centered over the features that are to be located. The FINDW command was not used because there are two white edges – the bottom of the tip and the edge of the round part of the nozzle. The command would not know which edge to locate.

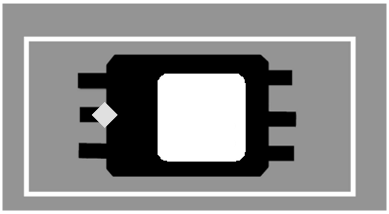


In the example below, the command "FINDW:1.3,-4.5,2.2,-3.4,UP" was used. In this example, the FINDW command was successful because the search box was smaller and did not include the upper white part of the round ring.

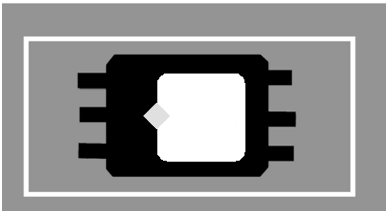


The examples below further illustrate the differences between the FINDB, FINDE and FINDW commands. The FINDB command will look for the strongest white-to-black edge while the FINDW command finds the strongest black-to-white edge. The FINDE command searches for the strongest edges 90 degrees from the search direction.

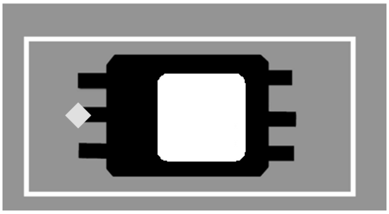
**FINDB:10,6,RIGHT**



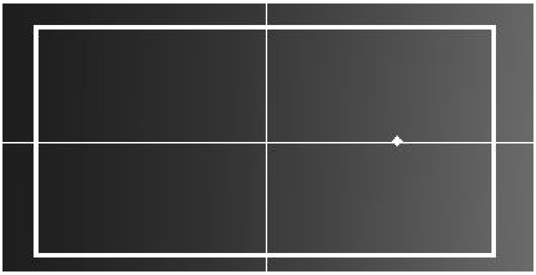
**FINDW:10,6,RIGHT**



**FINDE:10,6,RIGHT**



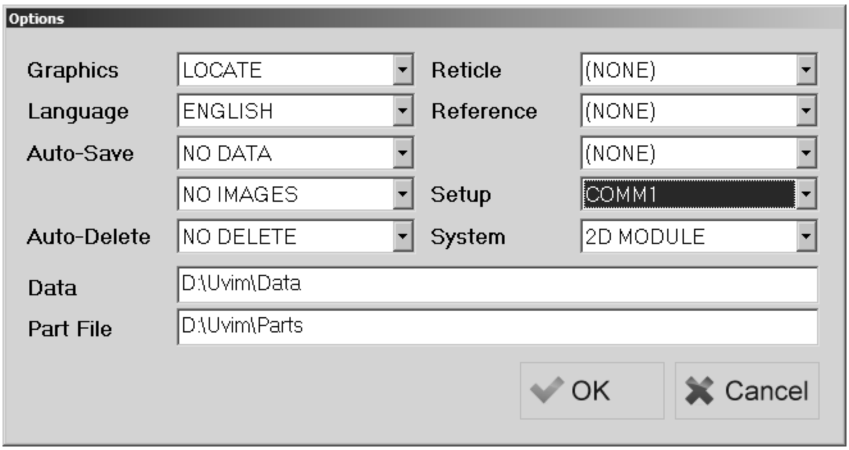
The results of the FIND commands will return the result in X, Y mm and the strength of the edge or the percentage of pixels found as a number between 0 and 100. For example, the command "FINDW:10,5,RIGHT" on the blurry image below results in a return string of "0.77,-0.03,3.95". The edge strength of 3.95 is not good because there is not a good black to white edge in the image. Sending the command "FINDW:10,5,LEFT" results in an edge of 0.0 because moving left-to-right the image is getting darker.



The command "FINDW:10,5" performs a threshold on the region of interest and returns that 42% of the pixels are above the threshold. The software finds an automatic threshold between the high and low pixels. The threshold can also be set in the command string. For example, "FINDW:10,5,200" will find all the white pixels above 200, which will result in 0% in the example image above because the range of pixel values is from about 30 to 100. All of the images in the UltraVim software are converted to 8-bit monochrome images with a range of pixel values between 0 and 255.

## 7.9 COMM Port Communications

A COMM port may be selected in the Options dialog. This will allow communications to the software through an RS-232 null modem cable. The commands supported for COMM port communications are the same commands used for socket communications described above except that the "MOVE" and "ACKN" options cannot be used.

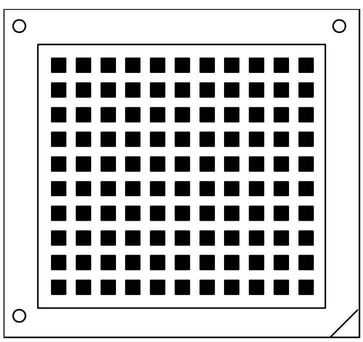


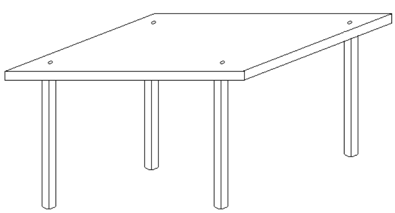
# 8. Calibration

This chapter describes how to calibrate the cameras and lights. Camera calibration is required any time there is a change in the optics. Light calibrations may be necessary if the illumination is changed, or as it ages.

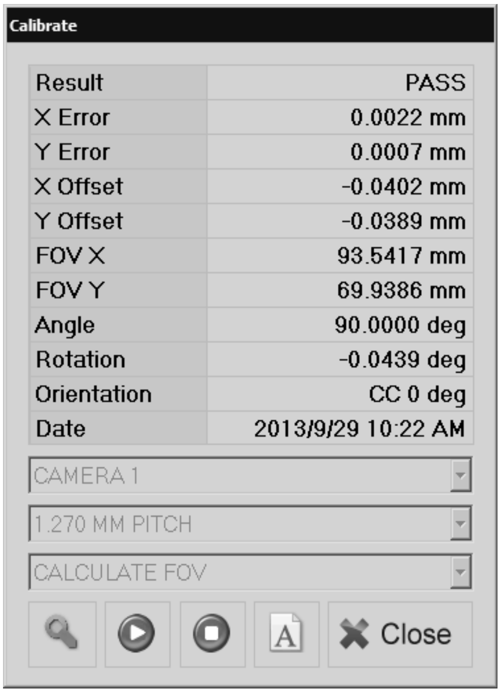
## 8.1 Dot Pattern Calibration

A grid pattern of precision dots with a known pitch is required to calibrate each camera. A reticle with a pitch of 1.27 mm is included with UltraVim and UltraVim Plus modules. Other configurations may use other glass or plastic targets. A diagram of a calibration reticle is shown below. For the UX and VX modules the plastic reflector table shown below may also be required for calibration.





The default pitch for the calibration grid is 1.270 mm, but other pitches may be used if the CalibrationPitch=1270 parameter is changed in the Config.ini file. To access the calibration dialog shown below enter the password CAL in the passwords dialog. This password may be changed by setting PasswordCal= in the Config.ini file.

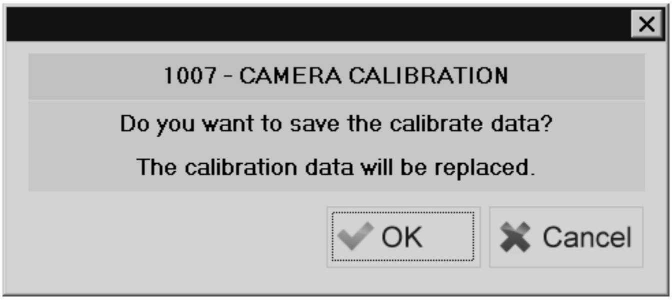



Make sure the optics and pattern are clean and click on the inspection icon to perform a calibration. If the calibration was successful the software will measure several dots and report the placement results as X Error and Y Error. It will also calculate the center of the pattern and the field of view.

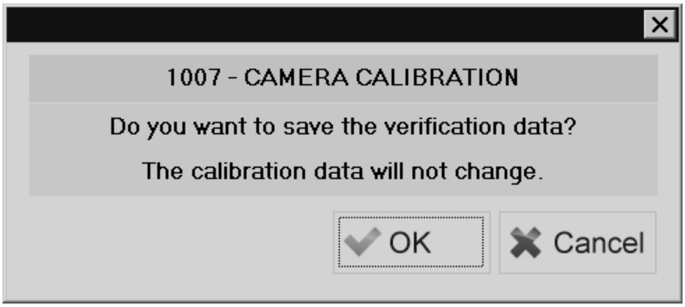
For some configurations the software can simulate a calibration by setting the field of view in to a fixed number. For example, to simulate a 30 mm calibration changed "CALCULATE FOV" to "SET FOV Y = 30.0 MM" and click the "OK" button. This will simulate a perfectly centered calibration and set "FOV Y" to 30.0 mm as shown below.


The software will only simulate cameras that are perfectly orthogonal to the view. This can be useful for 2D applications, like 2D lead inspection, where you may not have a calibration target but still would like to estimate world units in the image. Note that the calculated field of view will be shown with debug graphics when you successfully inspect a leaded part. This can be a useful method to help you set the FOV in a 2D application. When doing this it is very important to use a "known good" part with accurate and correct parameters in the part file.

After a calibration has been successfully completed the software will ask the user if the calibration data should be saved. To save the new calibration data click "OK" or click "Cancel" to reject the calibration.




The default calibration for user level 2 is a verification of the calibration. If the calibration was successful the user may save the verified values and the date the verification was completed.



If the calibration dialog shows the report icon the user may click on it to view and print the calibration data. If the CALRPT1.csv file is found, the report will include calibration results shown in microns for the twenty five center dots in the calibration grid as shown below.

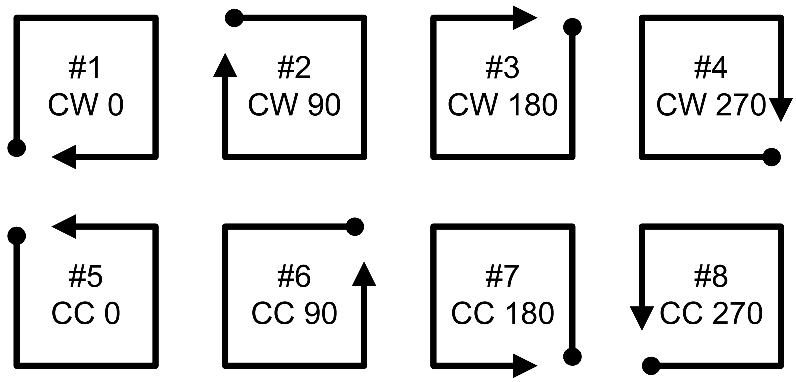
CALIBRATION REPORT

| | |
|---|---|
| Machine: | 1221476933 |
| Version: | UltraVim2D 9.1.30 |
| Date: | 2013/9/29 10:22 AM |

| | |
|---|---|
| Result: | PASS |
| Camera: | 1 |
| X Error: | 0.0022 mm |
| Y Error: | 0.0007 mm |
| X Offset: | -0.0402 mm |
| Y Offset: | -0.0389 mm |
| X View: | 93.5417 mm |
| Y View: | 69.9386 mm |
| Angle: | 90.0000 deg |
| Rotation: | -0.0439 deg |
| Orientation: | CC 0 deg |

| Reference | X Microns | Y Microns | X Error | Y Error |
|---|---|---|---|---|
| 1 | -2540.000 | -2540.000 | 0.507 | 0.098 |
| 2 | -2540.000 | -1270.000 | 0.963 | 0.102 |
| 3 | -2540.000 | 0.000 | 1.208 | 0.271 |
| 4 | -2540.000 | 1270.000 | 0.057 | 0.001 |
| 5 | -2540.000 | 2540.000 | 0.148 | 0.270 |
| 6 | -1270.000 | -2540.000 | 0.576 | 0.049 |
| 7 | -1270.000 | -1270.000 | 0.003 | 0.356 |
| 8 | -1270.000 | 0.000 | 0.640 | 0.240 |
| 9 | -1270.000 | 1270.000 | 0.277 | 0.183 |
| 10 | -1270.000 | 2540.000 | 0.778 | 0.027 |
| 11 | 0.000 | -2540.000 | 0.797 | 0.079 |
| 12 | 0.000 | -1270.000 | 0.873 | 0.113 |
| 13 | 0.000 | 0.000 | 1.353 | 1.086 |
| 14 | 0.000 | 1270.000 | 1.575 | 0.376 |
| 15 | 0.000 | 2540.000 | 0.377 | 0.082 |
| 16 | 1270.000 | -2540.000 | 0.535 | 0.090 |
| 17 | 1270.000 | -1270.000 | 0.002 | 0.085 |
| 18 | 1270.000 | 0.000 | 0.515 | 1.236 |
| 19 | 1270.000 | 1270.000 | 0.278 | 0.236 |
| 20 | 1270.000 | 2540.000 | 0.643 | 0.178 |
| 21 | 2540.000 | -2540.000 | 0.440 | 0.014 |
| 22 | 2540.000 | -1270.000 | 0.724 | 0.052 |
| 23 | 2540.000 | 0.000 | 1.461 | 1.271 |
| 24 | 2540.000 | 1270.000 | 1.823 | 0.108 |
| 25 | 2540.000 | 2540.000 | 0.017 | 0.476 |

The Orientation describes how the leads on a device are arranged in an image. Each camera orientation is either clockwise (CW) or counter clockwise (CC) and 0, 90, 180 or 270 degrees. The codes, shown below, for each camera are stored in the Config.ini file.




The orientation values stored in the Config.ini file for an UltraVim UX module are shown below.

CameraOrient0=1 (Clockwise 0 degrees)

CameraOrient1=5 (Counter Clockwise 0 degrees)

The values for an UltraVim 4D module are shown below.

CameraOrient0=5 (Counter Clockwise 0 degrees)

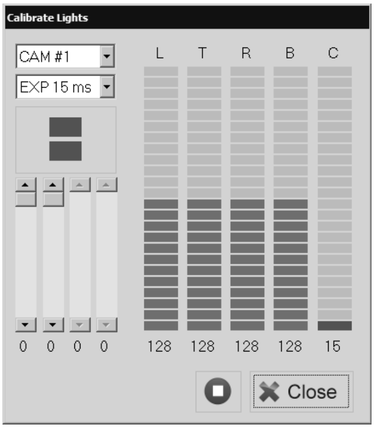
CameraOrient1=6 (Counter Clockwise 90 degrees)

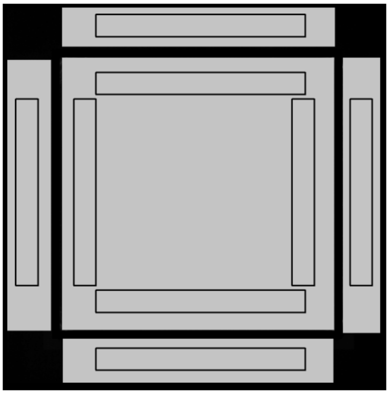
CameraOrient2=7 (Counter Clockwise 180 degrees)

CameraOrient3=8 (Counter Clockwise 270 degrees)

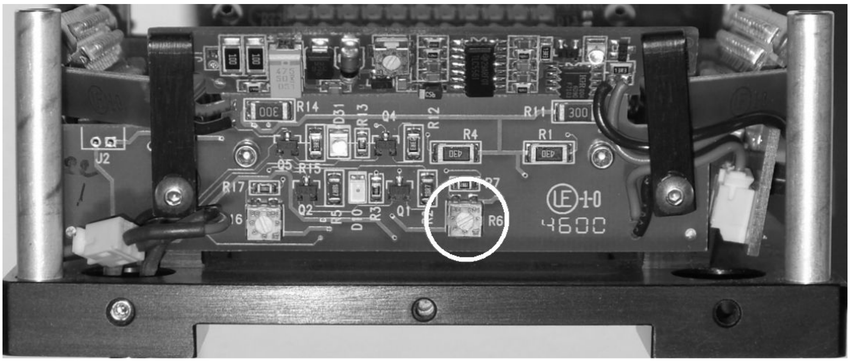
## 8.2 Inspection Light Head Calibration

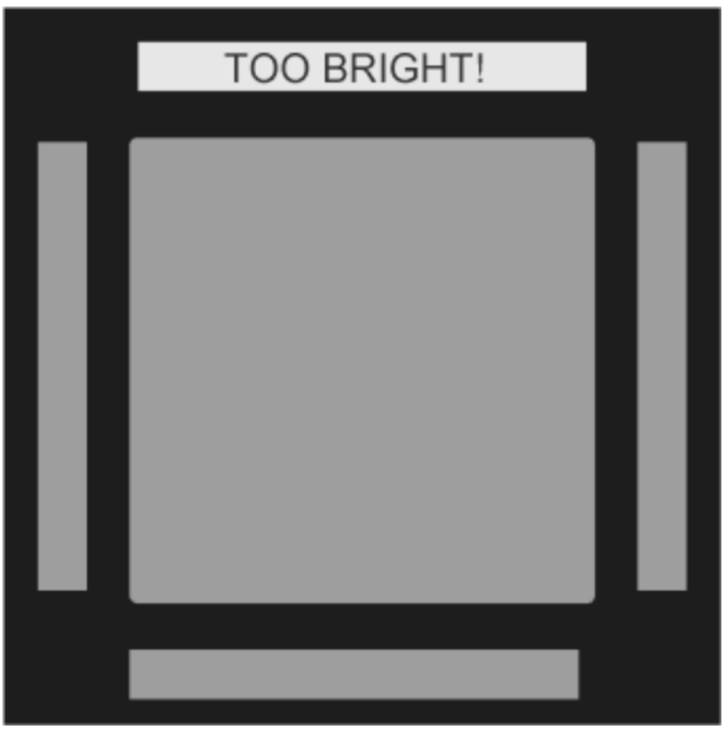
For systems using a lead inspection reticle, it is important that all of the side views presented by the inspection light head are in the grayscale range from 140 to 160. To test the light level of the inspection head, install the head on the system with an inspection reticle, and place the white plastic calibration table on top of the reticle. After you have installed these items, enter password LIGHT to view the results.



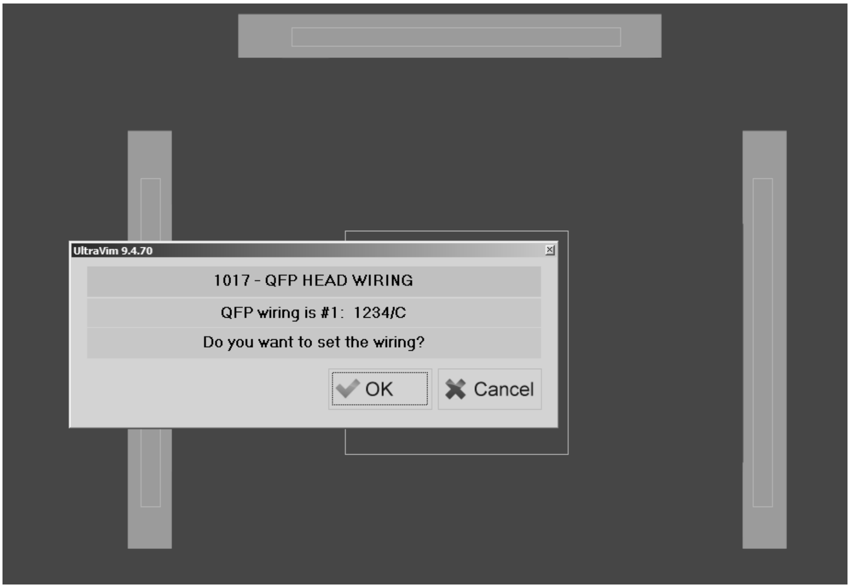
In the example below, all views are in the acceptable range, except for side 2, which is too bright. The side light brightness can be adjusted by carefully turning potentiometer R6 on the PB1038D board as shown below.



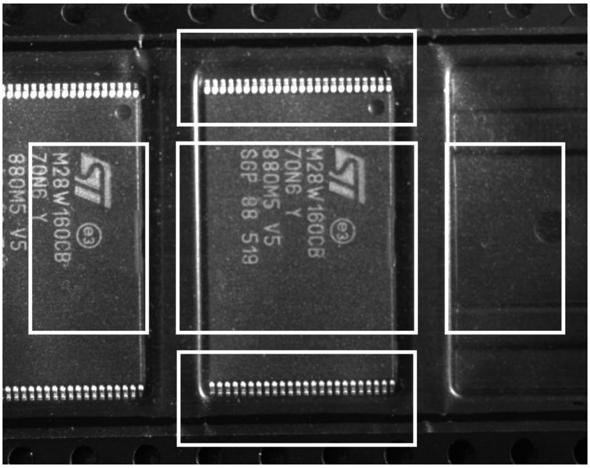
The QFP inspection head may have different wiring. For some handlers the head needs to be wired so all the top lights act as one light and the side lights function as the other light. To test the wiring, make sure the inspection area is clear and enter WIRING in the Passwords dialog.

| | CHANNEL #1 | CHANNEL #2 |
|---|---|---|
| WIRING #0 | 2, 3 | 1, 4, T |
| WIRING #1 | 1, 2, 3, 4 | T |
| WIRING #2 | 1, 2, 3, 4, T | |

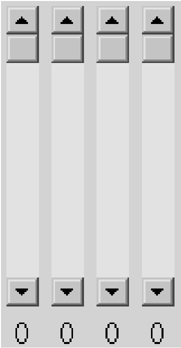


## 8.3 General Light Calibration

The light calibration screen can be used for any light calibration. When an inspection reticle is not used the software will test the average gray level in five sections of the image and report the results.

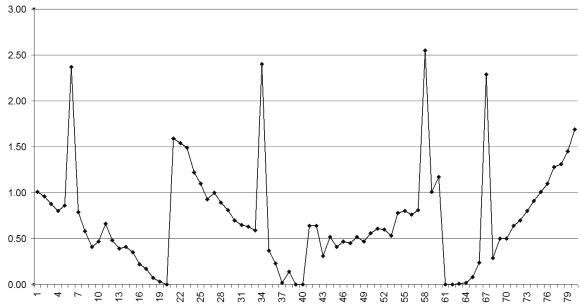


If you system has a DIGITAL.dll driver that can control the light level, you can use the sliders shown below to control the level of lights 1, 2, 3 and 4.



## 8.4 Optics Angle Calibration

For systems using a lead inspection reticle, it is important that the optics do not shift even by a small amount. If the optical path shifts by as much as 0.1 degrees it can have a significant impact on the inspection results, as shown in the Coplanarity graph below.




This type of shift can be calibrated with a GOLD QFP Device. To calibrate the shift in the optics angle, follow these steps:

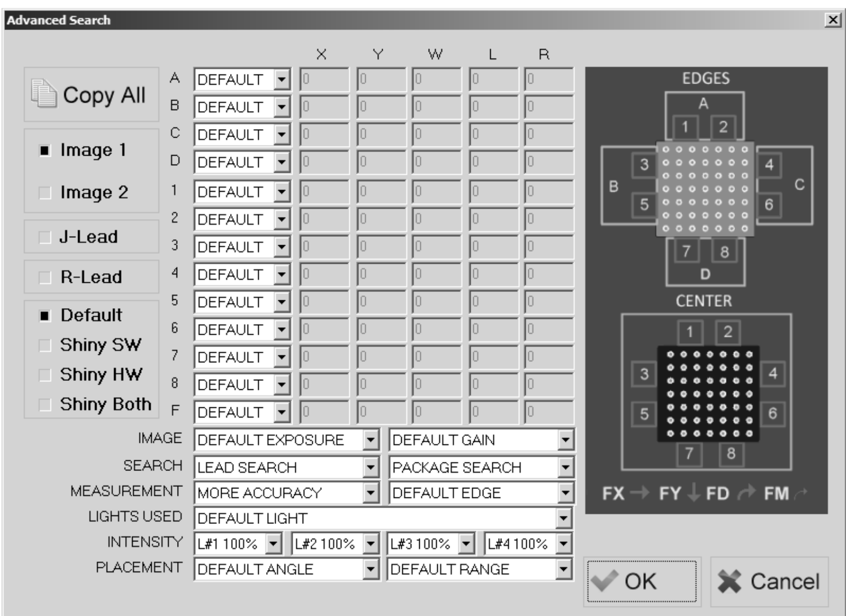
1. Enter password level 3.
2. Verify the system and inspection light head are calibrated and the correct inspection reticle is installed on the system.
3. Verify that the reticle serial number matches the reticle file name selected in the “Options” dialog box.
4. Select the correct GOLD or REFR part file.
5. Click on the “Inspect” button and verify the inspection is working.
6. Enter password ANGLE to perform the angle calibration.

# 9. Advanced Settings

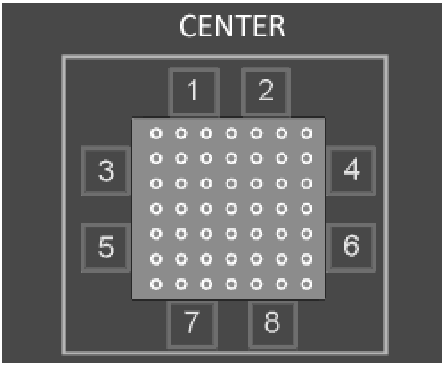
While the default part files will work for most devices, there may be times when the search and inspection algorithms may need to be adjusted by the user. This is done with the advanced search settings dialog.

## 9.1 Advanced Search Settings

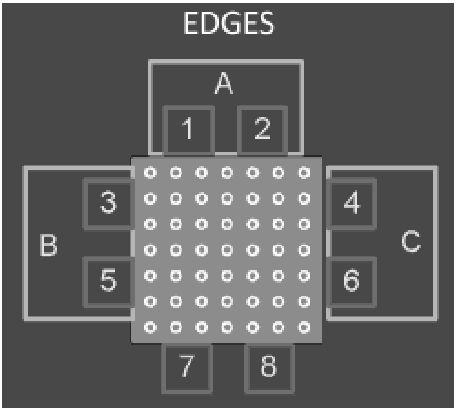
Most of the time the default values in the software will find the location of the device correctly, however, there may be some times when you will need to adjust the search settings. For example, if there is some unexpected object in the image or if the device is not centered or is not symmetrical. To access the Advanced Search dialog shown below, press Alt-F8 while you are editing the part file.



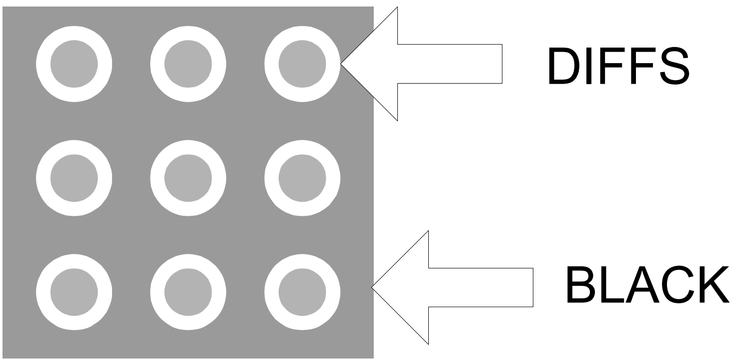
There are two types of rough searches – CENTER and EDGES. The CENTER search determines an automatic threshold and then finds the average location of all pixels above that threshold. This can be useful for leads with front lighting. To force the software to use the CENTER search change Search A from DEFALT to CENTER.



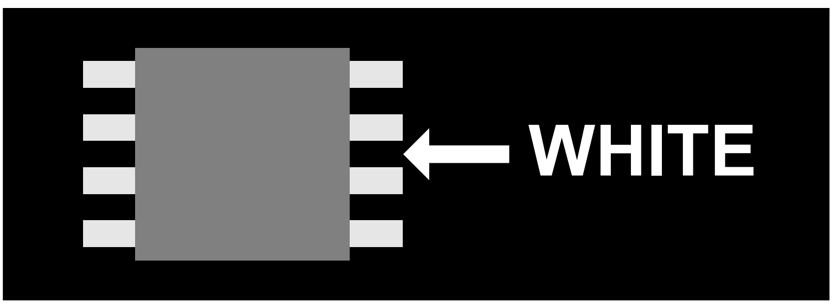

The EDGES search uses Search A to find the top of the device, Search B to find the left side of the device and Search C to find the right of the device.



There are three types of selections for finding the edges of objects. These are WHITE, BLACK and DIFFS. The diagram below illustrates the difference between finding a BLACK edge and the DIFFS. The BLACK edge finds the white-to-black edge at the package body, white the DIFFS looks for differences, which is the first row of balls in the image.




The diagram below illustrates finding a WHITE edge where the leads are front-lit and the background is black. Using a DIFFS search would also find the leads because the black space between the leads creates differences in the image.




If you change DEFAULT to WHITE, BLACK or DIFFS for any of the searches, you will be able to edit X, Y, W, L and P. The description of these items is shown below.

X – The number of pixels to adjust the search in X.

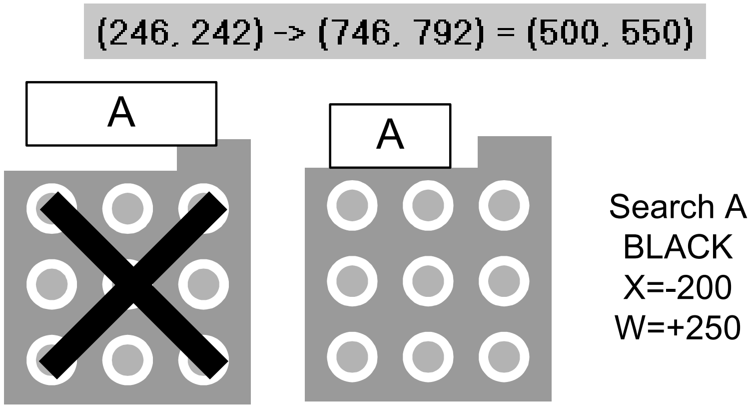
Y – The number of pixels to adjust the search in Y.

W – The width of the search in pixels

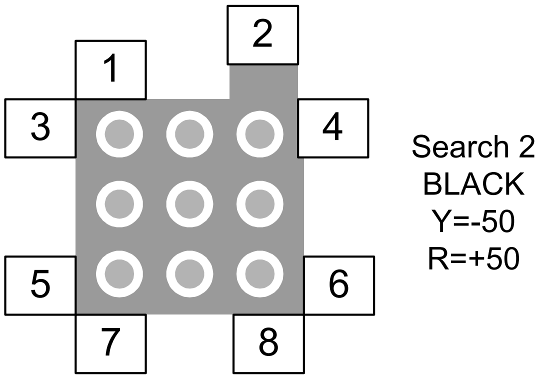
L – The length of the search in pixels.

R – The number of pixels to adjust the search result.

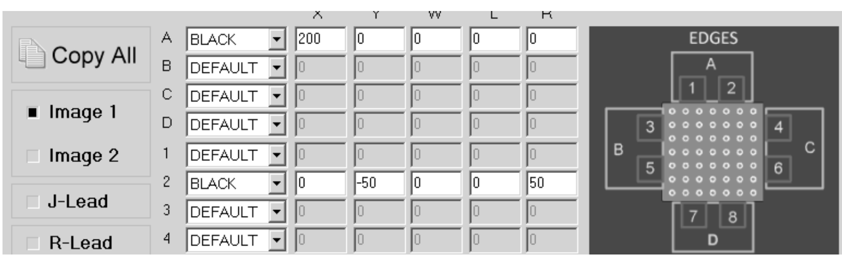
The diagram below shows an example of a hypothetical device with an irregular feature. For this example, assume the package is about 500 by 550 pixels. You can use the mouse to drag a box on the image and the software will calculate the size of the box in pixels. As you can see on the left, the default Search A will give inconsistent results. By changing it to BLACK and setting the X parameter to –200 and the W to +250, the problem is solved.



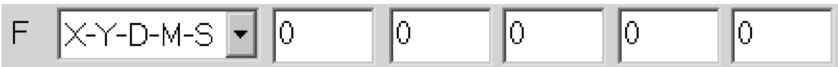
However, more adjustments are required for this irregular device before we are ready to inspect. Searches 1 to 8 are used to calculate the fine location of the device. Search 2 must be adjusted so the software knows where to find the irregular feature on the device. This can be done by setting the search to BLACK, setting Y to –50 and setting R to +50.




The final adjustments in the Advanced Search are shown below.



Search F is actually not a search, but instead is a final adjustment to the results calculated from Searches 1 through 8. By changing Search F from DEFAULT to X-Y-D-M-S, you can adjust the final search location in X, Y, degrees, minutes and seconds.




At the bottom of the Advanced Search dialog are several settings. These parameters are described below.

**IMAGE** — Used to change the exposure and gain of the camera.

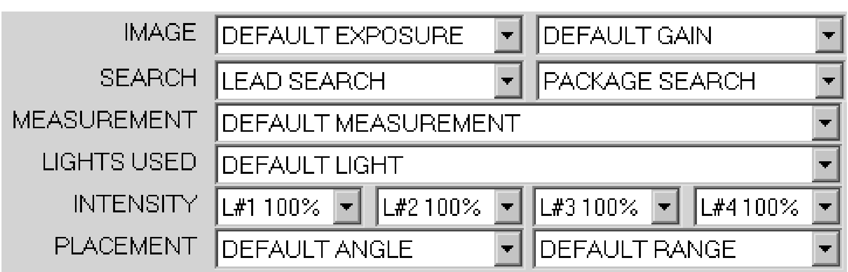
**SEARCH** — Used to change the type of searches used for the leads and package body.

**MEASUREMENT** — Used to increase the speed or accuracy of the measurement.

**LIGHTS USED** — Used to change which lights are used for an image.

**INTENSITY** — Sets the intensity of each light

**PLACEMENT** — Used to change the tolerance of the angle and range in the search.



## 9.2 Lead Types

The Irregular Part Data dialog allows the user to enter data for each lead. There is also a parameter for the lead type. Each lead must be set to the correct type for the software to work correctly. Each type of lead is described below.

100 – Standard donut or crescent image.
101 – Estimate the ball position in all cameras.
111 – Estimate the ball position in camera 1.
121 – Estimate the ball position in camera 2.
122 – Find the bottom of the crescent only.
123 – Use a threshold to locate the crescent.
131 – Estimate the ball position in camera 3.
141 – Estimate the ball position in camera 4.
201 – Standard lead, side 1.
202 – Standard lead, side 2.
203 – Standard lead, side 3.
204 – Standard lead, side 4.
211 – Body reference, side 1.
212 – Body reference, side 2.
213 – Body reference, side 3.
214 – Body reference, side 4.
221 – Body reference with no XY, side 1.
222 – Body reference with no XY, side 2.
223 – Body reference with no XY, side 3.
224 – Body reference with no XY, side 4.
231 – Allow only one left or right edge, side 1.
232 – Allow only one left or right edge, side 2.
233 – Allow only one left or right edge, side 3.
234 – Allow only one left or right edge, side 4.
241 – Body reference with no Z, side 1.

242 – Body reference with no Z, side 2.

243 – Body reference with no Z, side 3.

244 – Body reference with no Z, side 4.

301 – Rectangular pad, side 1.

302 – Rectangular pad, side 2.

303 – Rectangular pad, side 3.

304 – Rectangular pad, side 4.

311 – Rectangular rounded pad, side 1.

312 – Rectangular rounded pad, side 2.

313 – Rectangular rounded pad, side 3.

314 – Rectangular rounded pad, side 4.

320 – Rectangular or square pad, find the center.

321 – Upper left corner pad.

322 – Upper right corner pad.

323 – Lower right corner pad.

324 – Lower left corner pad.

325 – Orientation rectangle.

330 – Oval or circular pad find the center.

900 – Extra lead, default sensitivity.

901 – Extra lead, 25% sensitivity.

902 – Extra lead, 50% sensitivity.

903 – Extra lead, 150% sensitivity.

904 – Extra lead, 200% sensitivity.

905 – Extra lead, 300% sensitivity.

906 – Extra lead, 400% sensitivity.

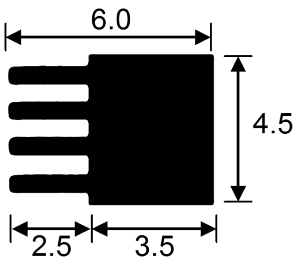
907 – Extra lead, 500% sensitivity.

908 – Extra lead, 700% sensitivity.

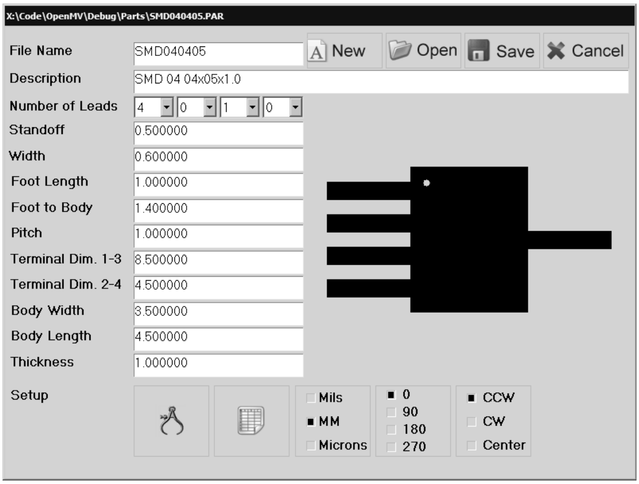
909 – Extra lead, 900% sensitivity.

## 9.3 One-Sided Part 3D Inspection

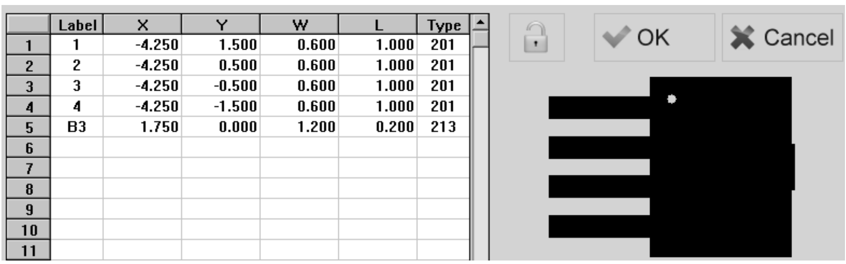
The UltraVim software is designed to inspect leaded devices that have leads on either two or all four sides. If a device only has leads on one side a custom part file will need to be created. The example device below has four leads that are only on the first side.




To create the part file, enter all the dimensions off the drawing but add an additional lead on the third side and calculate what the terminal dimension would be with leads on the third side, which is 8.5 in the example below. These dimensions will act as a reference point that will allow the software to make calculations.



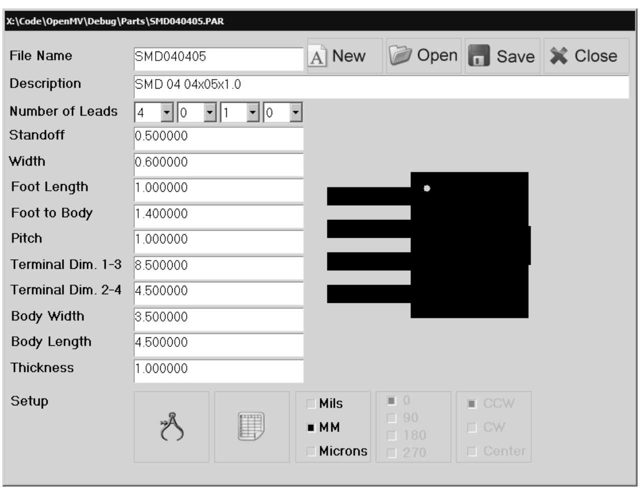
Next click on the spreadsheet icon to define custom lead types and locations. Unlock the spreadsheet and change the label of the fifth lead to B3, the position to half of the body width (1.75) and the type to 213 to define a body reference on side 3. Finally, make the lead width (W) about double the size of the other leads and decrease the length (L) to a smaller number.



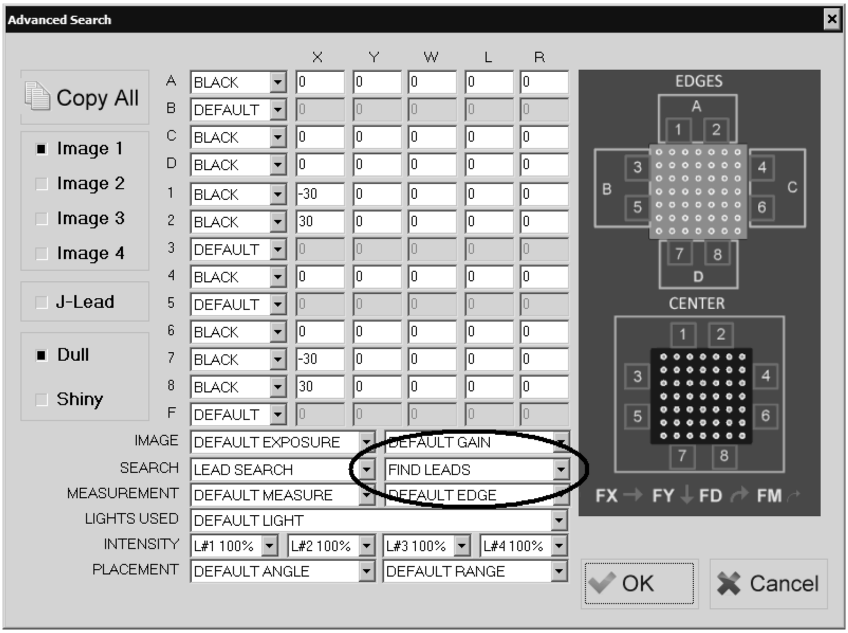
| | Label | X | Y | W | L | Type |
|---|---|---|---|---|---|---|
| 1 | 1 | -4.250 | 1.500 | 0.600 | 1.000 | 201 |
| 2 | 2 | -4.250 | 0.500 | 0.600 | 1.000 | 201 |
| 3 | 3 | -4.250 | -0.500 | 0.600 | 1.000 | 201 |
| 4 | 4 | -4.250 | -1.500 | 0.600 | 1.000 | 201 |
| 5 | B3 | 1.750 | 0.000 | 1.200 | 0.200 | 213 |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | | | | | |



The editing screen will now show the device which should look similar to the drawing with a small black rectangle on side 3 that represents the body reference.

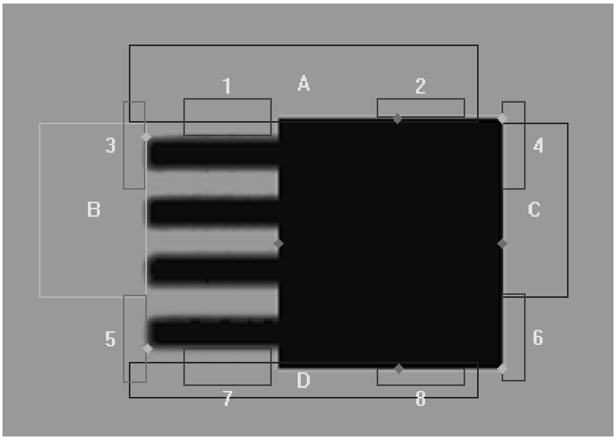


Finally, press Alt-F8 to display the Advanced Search settings screen. The searches on the side with leads are B, 3 and 5 and may remain at DEFAULT. Change all other searches to BLACK. Use the LOCATE graphics setting in the Options dialog to check the locations of search boxes. You may need to adjust the locations of some search boxes to find the most reliable area of the device.

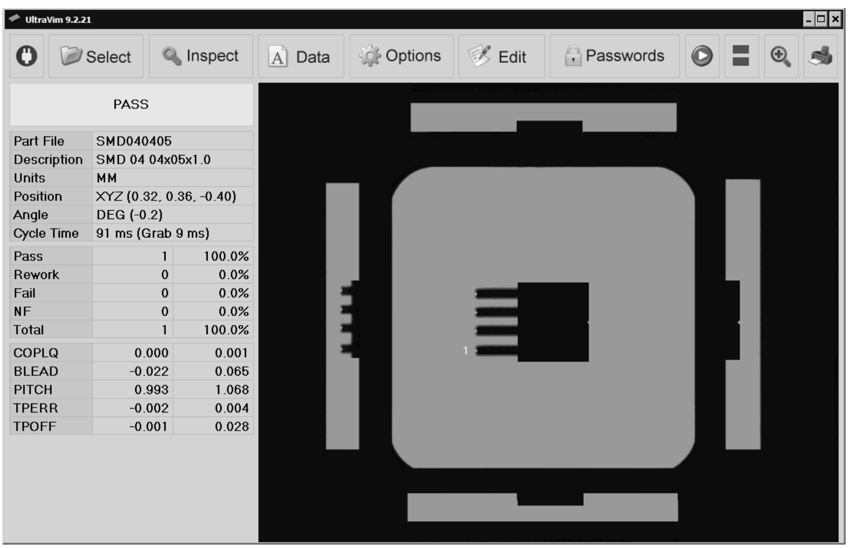



Make sure the SEARCH settings at the bottom of the screen are set to LEAD SEARCH and FIND LEADS. Even though the search is finding the body on side 3 the software considers this a virtual lead that it uses to make calculations.

The LOCATE graphics for the search are shown below. Search boxes 1 and 7 have been adjusted 30 pixels to the left and search boxes 2 and 8 have been adjusted 30 pixels to the right.

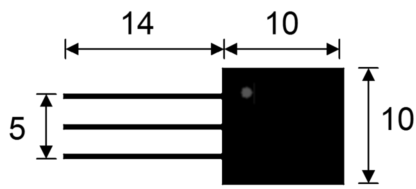



The main screen below shows the final three-dimensional inspection with the custom part file.

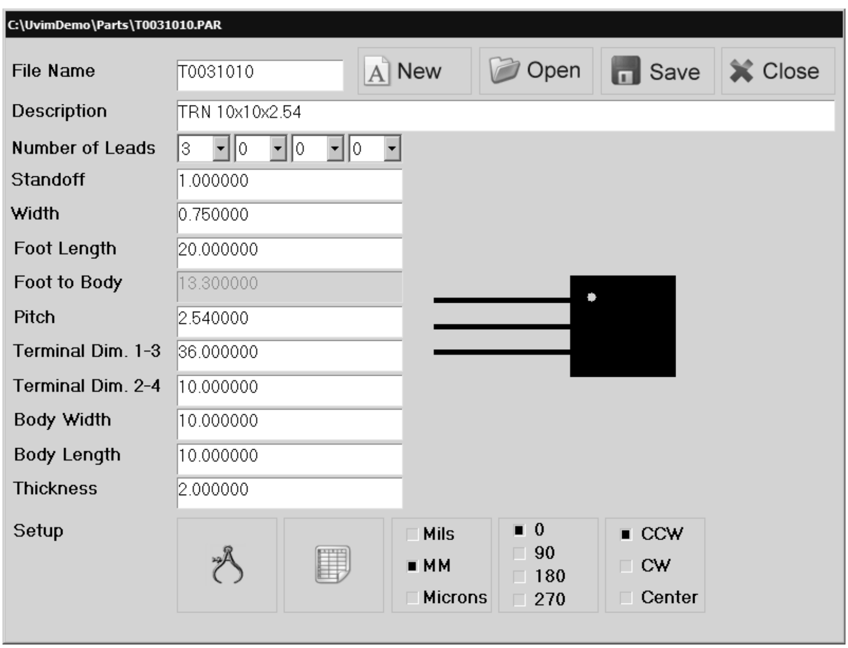


## 9.4 One-Sided Part 2D Inspection

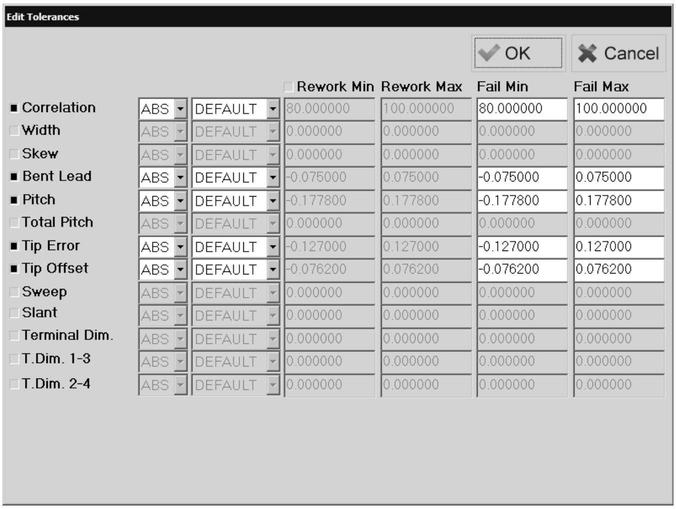
One-sided parts may also be inspected with the UltraVim 2D software. If a device only has leads on one side a custom part file will need to be created. The example transistor below has leads that are only on the first side.



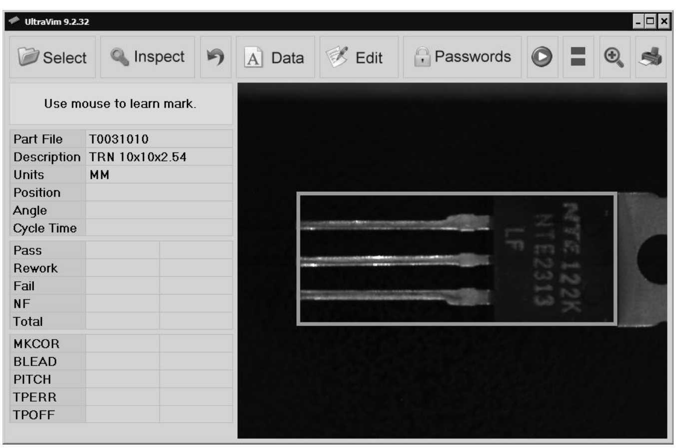

To create the part file, enter all the dimensions from the drawing but calculate what the terminal dimension would be with leads on the third side. These dimensions will create reference points that will allow the software to make calculations.



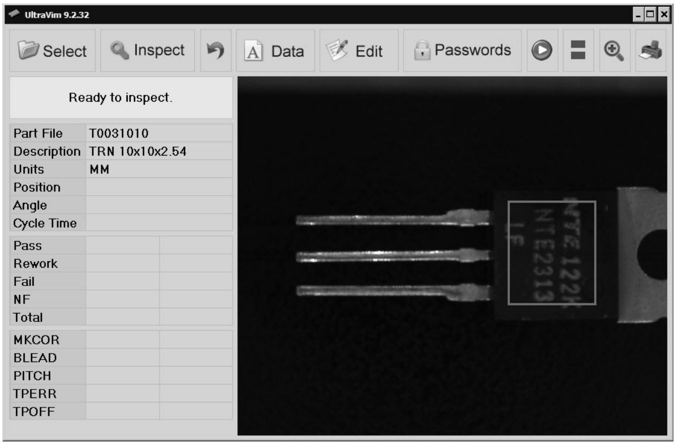
In the Tolerance screen select Correlation, Bent Lead, Pitch and Tip Error. These will be the most useful measurements.



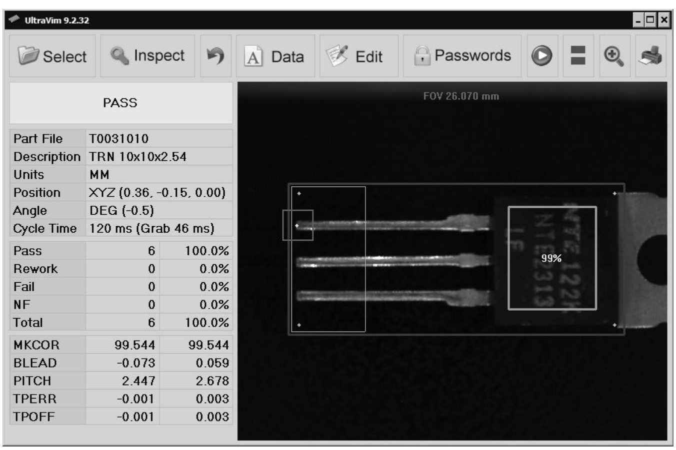

After you load the part file in the Main screen, use the mouse to draw a purple box around the body of the device and the tips of the leads. If the software can locate the leads the purple box will turn green.



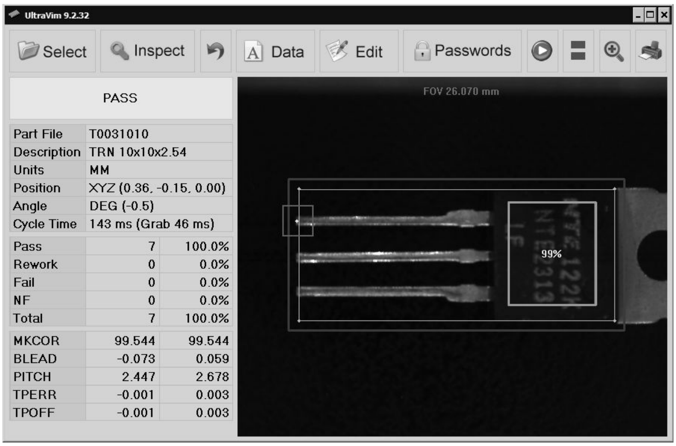
If you have selected the Correlation measurement use the mouse to draw a purple box around the mark.

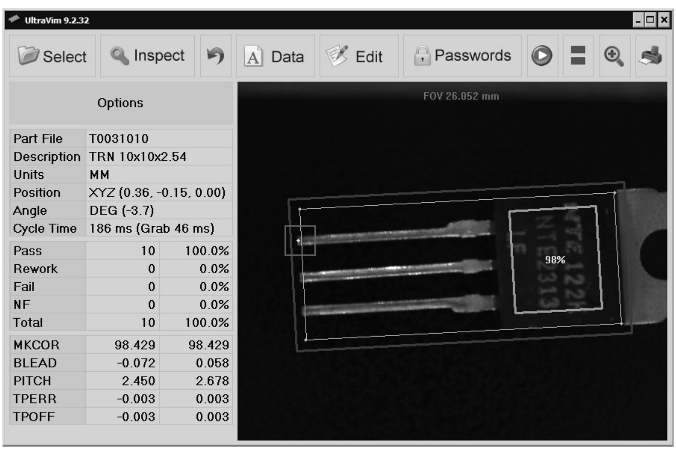



With the LOCATE graphics on you can see the light blue search box that locates the leads of the part. The size of this box can be controlled with the Foot Length setting. In the example below the Foot Length has been set to 5.



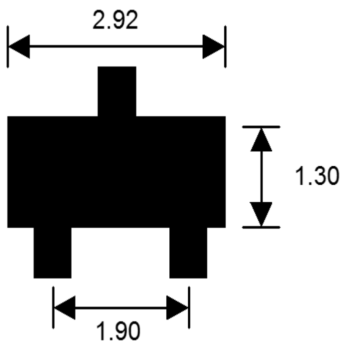
In some cases you may wish to have a larger search box. This can be accomplished by increasing the foot length. Changing SEARCH to PATTERN MATCH in the Advanced Alt-F8 screen will cause the software to search for the entire device as shown below. Note that this method may not be reliable if the mark on the part is changing position or is a label.



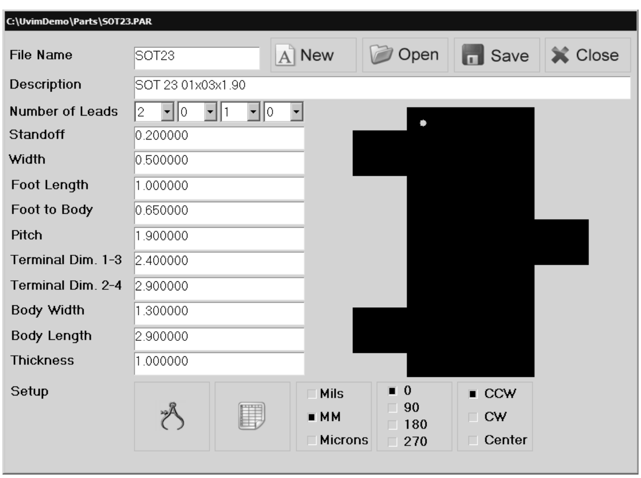



## 9.5 Three-Leaded Part Inspection

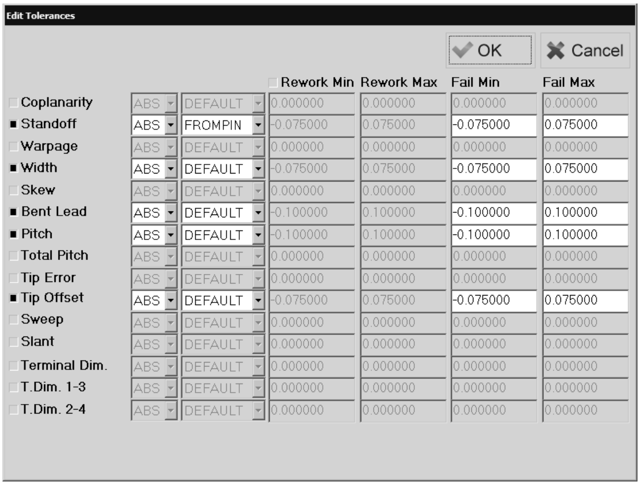
Some devices like the SOT23 package, shown below, may only have three leads. Using the JEDEC definitions for references, the Bent Lead error of the third lead will always be zero and the Coplanarity of all leads is always zero.



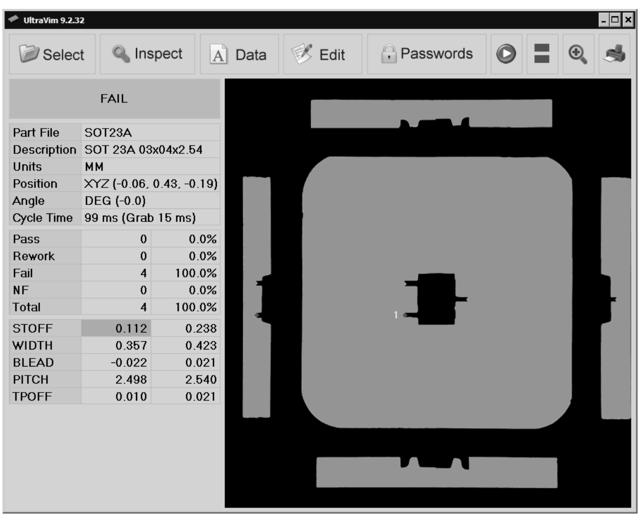

The package may be defined with the dimensions from the drawing as shown in the screen below.



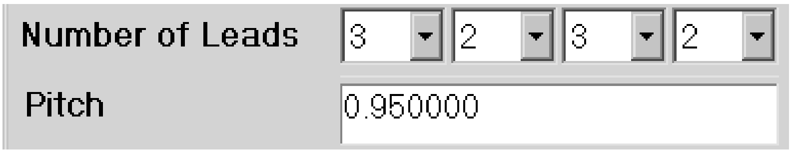
If a 3D inspection is available, select the Standoff FROM PIN measurement instead of Coplanarity. The software will calculate the Standoff of each pin to the part body.



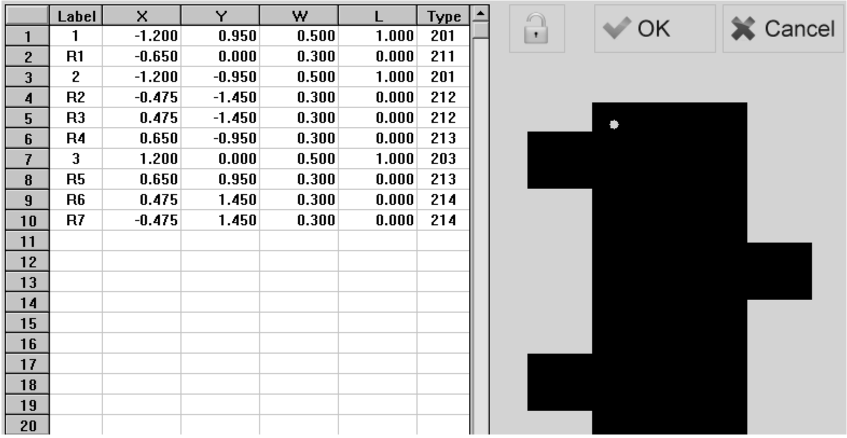

Using the standard part file the software may detect Pitch errors between the first two leads and Standoff errors.



To detect Bent Lead errors more references are needed on the device. To create more references, change the pitch to half of the pitch on the drawing and increase the number of leads from two to three on the first side. Also, add two leads on sides two and four and three leads on side three.

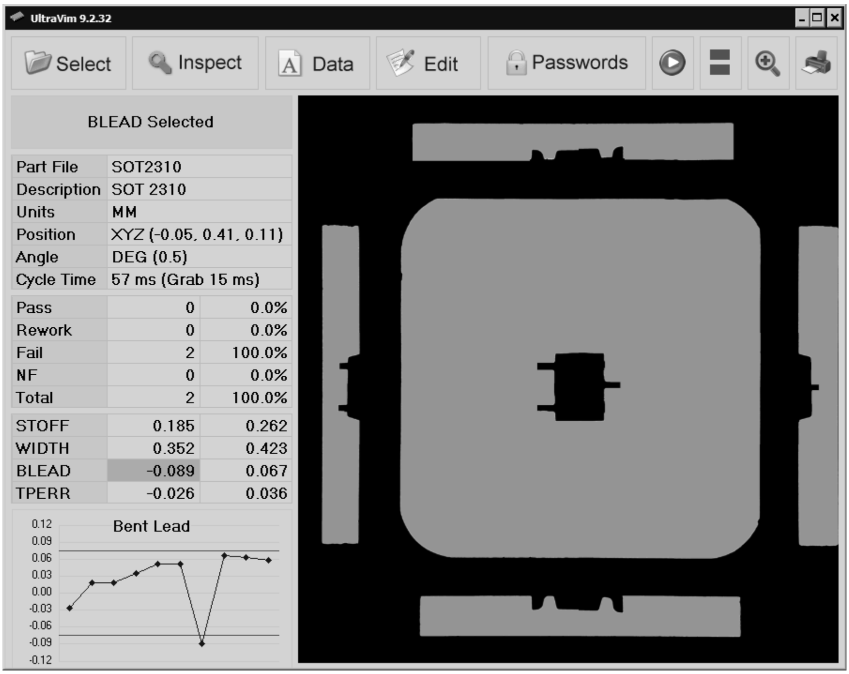



Next used the spreadsheet icon to change the positions of the virtual leads so they are located on the body. Set the lead type to 211, 212, 213 and 214 depending on what side the lead is on. You may also want to change the label of each lead to keep track of the original three leads and the additional reference leads.




| | Label | X | Y | W | L | Type |
|---|---|---|---|---|---|---|
| 1 | 1 | -1.200 | 0.950 | 0.500 | 1.000 | 201 |
| 2 | R1 | -0.650 | 0.000 | 0.300 | 0.000 | 211 |
| 3 | 2 | -1.200 | -0.950 | 0.500 | 1.000 | 201 |
| 4 | R2 | -0.475 | -1.450 | 0.300 | 0.000 | 212 |
| 5 | R3 | 0.475 | -1.450 | 0.300 | 0.000 | 212 |
| 6 | R4 | 0.650 | -0.950 | 0.300 | 0.000 | 213 |
| 7 | 3 | 1.200 | 0.000 | 0.500 | 1.000 | 203 |
| 8 | R5 | 0.650 | 0.950 | 0.300 | 0.000 | 213 |
| 9 | R6 | 0.475 | 1.450 | 0.300 | 0.000 | 214 |
| 10 | R7 | -0.475 | 1.450 | 0.300 | 0.000 | 214 |
| 11 | | | | | | |
| 12 | | | | | | |
| 13 | | | | | | |
| 14 | | | | | | |
| 15 | | | | | | |
| 16 | | | | | | |
| 17 | | | | | | |
| 18 | | | | | | |
| 19 | | | | | | |
| 20 | | | | | | |

The results of the custom part file are shown below. The third lead has a been bent to show that the inspection can detect that failure with the additional virtual leads that use the body of the device as a reference.




Note that some search boxes including C, 4 and 6 may need to be adjusted on the third side to avoid unstable results of a single lead in the search.

## 9.6 Ball Quality Factors

Pressing Alt-F10 will cause the Ball Quality dialog to be displayed. There are four factors that may be adjusted from 0% to 1000%. These parameters are described below.

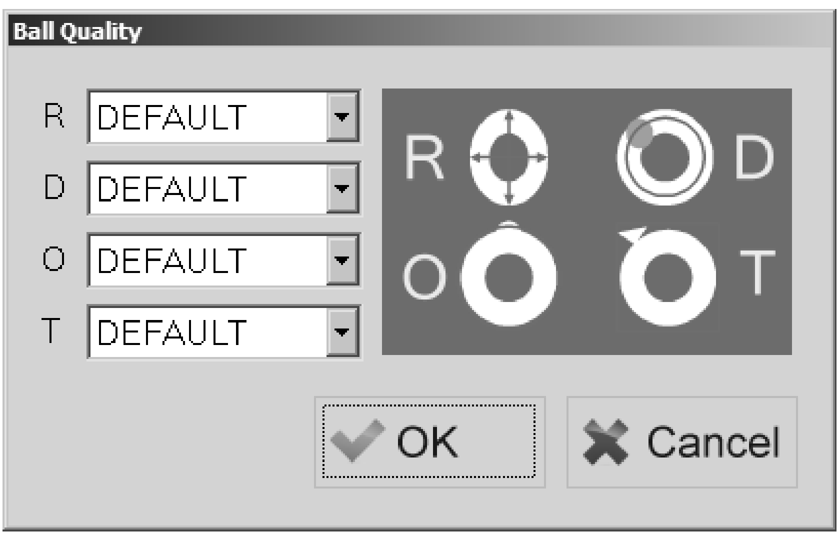
R – The roundness of the donut.

D – The consistency of the donut.

O – The dark area directly outside the donut.

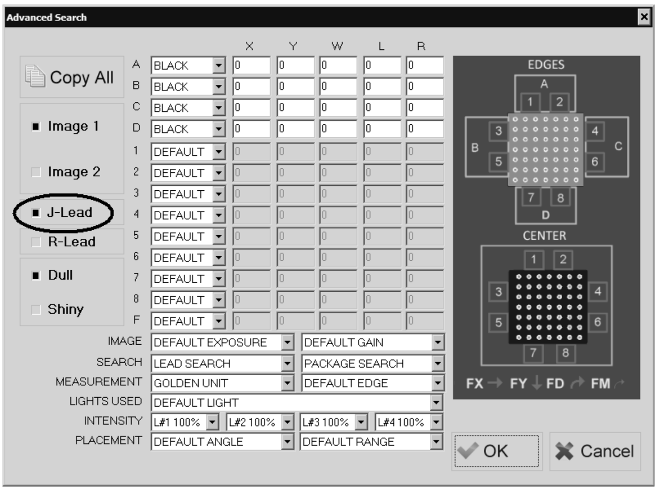
T – The dark area between donuts.

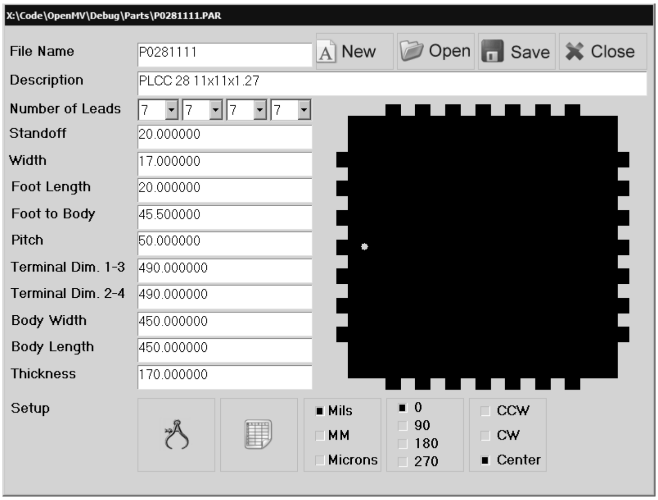
One method to adjust the Ball Quality is to set three of the factors to 0% and adjust each factor individually for the best results. For example, if the D parameter is too sensitive, set it to 50%. If it is not sensitive enough, set try 150% and increase by 50% until the results are acceptable. Do this for all four parameters.



## 9.7 PLCC J-Lead Devices

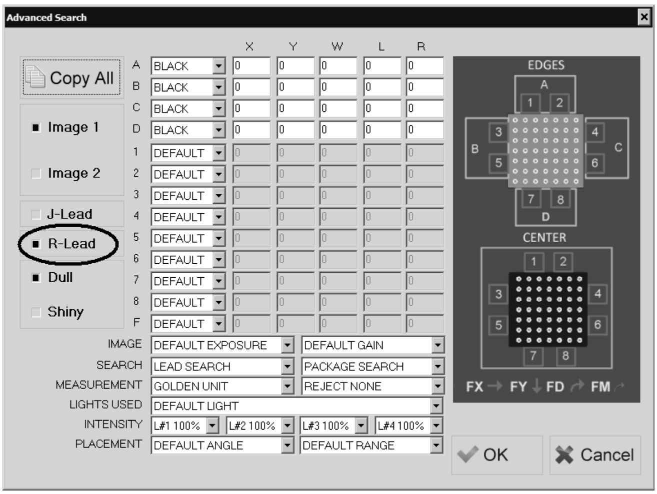
A plastic leaded chip carrier (PLCC) is a plastic, four-sided chip carrier, with a J-lead and a pitch of 0.05". Lead counts range from 20 to 84. To define a PLCC device, check the "J-LEAD" selection in the advanced Alt-F8 screen or select an existing PLCC part file.

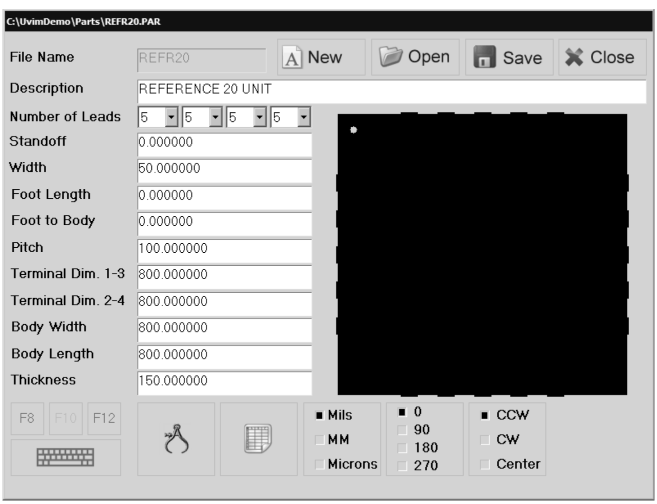


## 9.8 REFR R-Lead Devices

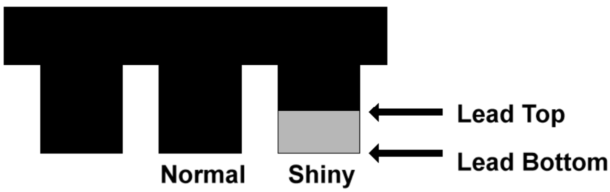
A reference component (REFR) is a stable, machined golden unit that can be used to verify the calibration. To define a REFR device, check the "R-LEAD" selection in the advanced Alt-F8 screen which allows the software to locate the leads from the side views.



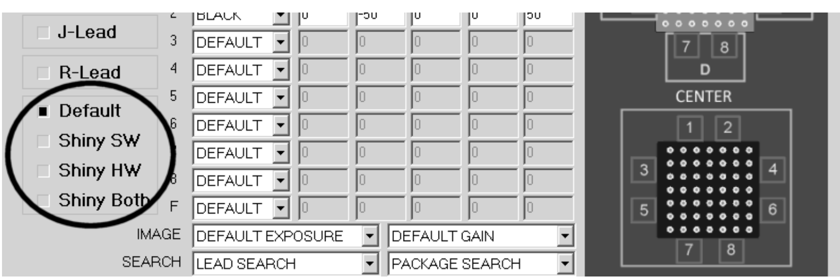



## 9.9 Shiny Leads

Some TSOP and QFP devices may have shiny leads that cause reflections on the lead tips as shown in the diagram below. This can cause the software to locate the top of the lead instead of the bottom and can result in coplanarity failures. This can be corrected with software, hardware or both.

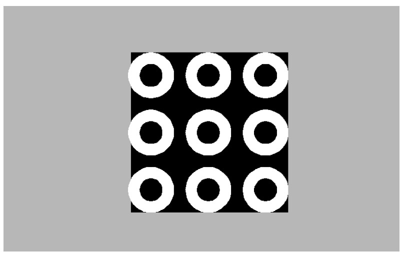


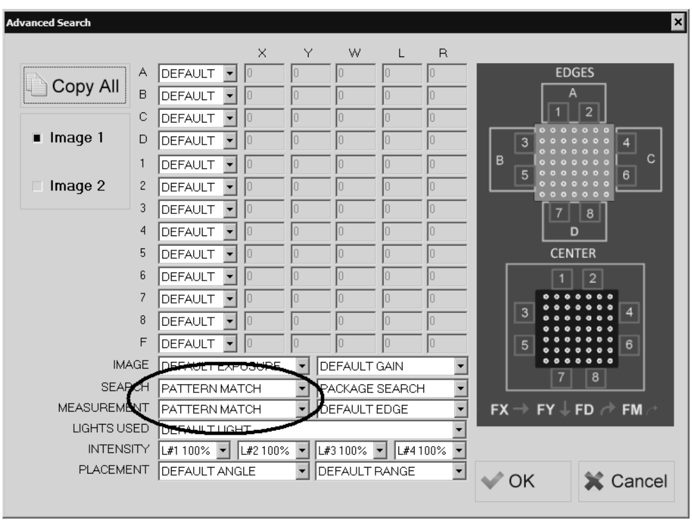

The Shiny selection in the F8 screen allows the user to select software (Shiny SW) or hardware (Shiny HW) compensation. The software compensation will cause the software to automatically adjust the contrast of lead tips. The hardware compensation will cause the software to take two images with opposing side lights turned off if the QFP head is wired to support that. A head wiring with configuration #0 has lights 2,3 on channel one and a head #1 has lights 1,2,3,4 on the first channel.



## 9.10 Small Balls Close to Edge

Some CSP and BGA devices may have small balls that are very close to the package edge as shown in the diagram below. This will caused a failure when the measurement looks for a black to white edge. To improve the results change the MEASUREMENT and SEARCH parameters to PATTERN MATCH in the F8 screen. Note that some measurements like Ball Quality may not be possible with this type of device and Board Width should be set to calculate CORNERS if the pick nozzle is larger than the center of the part.





## 9.11 Config.ini File

The parameters in the Config.ini file are described below. Note that you should always make a backup of your \Files directory before you make changes to any configuration files. Changing some of the parameters may make your system function incorrectly.

**[Config]**

| | |
|---|---|
| AddDateToDir | Set to 1 to add date to start of lot directory. |
| AddPartToDir | Set to 1 to add part to end of lot directory. |
| AllowSleep | Allows screen saver to activate. |
| AngleResult | Stores angle calibration result. |
| AutoDelete | Set to the number of days to delete old data. |
| AutoGainBGA | Set to 1 to allow automatic gain of BGA center. |
| AutoGainLCC | Set to 1 to allow automatic gain of LCC center. |
| AutoGainQFP | Set to 1 to allow automatic gain of QFP center. |
| AutoSaveData | Stores the auto-save data setting. |
| AutoSaveFail | Appends failure data to Lot Summary report. |
| AutoSaveImages | Stores the auto-save image setting. |
| AutoSaveImageExt | Set to 1 to save PNG or 2 to save JPG. |
| AutoSaveSPC | Stores if the SPCDATA.csv file is saved. |
| CalCalcFOV | Stores the last FOV selection. |
| CalibrationExpo | Stores the calibration exposure. |
| CalibrationGain | Stores the calibration gain. |
| CalibrationPitch | Stores the calibration dot pitch. |
| CalibrationText | Stores the calibration text selection. |
| Camera | Stores the name of the camera. |
| CameraAngleX | Stores the X angle of the first camera. |
| CameraAngleY | Stores the Y angle of the first camera. |
| CameraAngleT | Stores the Theta angle of the first camera. |
| CameraOrient0 | Stores the orientation of the first camera. |
| CameraOrient1 | Stores the orientation of the second camera. |
| CameraOrient2 | Stores the orientation of the third camera. |

| | |
|---|---|
| CameraOrient3 | Stores the orientation of the fourth camera. |
| CamerasShown | The number of camera images shown on screen. |
| CamerasUsed | Stores the number of cameras used. |
| CleanTolerance | Set to percentage to cause a clean failure. |
| ColorGrid | Stores the color of the display grid. |
| ColorText | Stores the color of the display text. |
| DataPath | Stores the path where data is saved. |
| DefaultGraphCX | Stores the default width of the graph. |
| DefaultRotation | Stores the default module 0,1,2,3 rotation. |
| DefaultTolerance | Stores the default search tolerance in mils. |
| DefaultWinMaxCX | Stores the width of the large window. |
| DefaultWinMaxCY | Stores the height of the large window. |
| DefaultWinMaxX | Stores the X location of the large window. |
| DefaultWinMaxY | Stores the Y location of the large window. |
| DefaultWinMinCX | Stores the width of the small window. |
| DefaultWinMinCY | Stores the height of the small window. |
| DefaultWinMinX | Stores the X location of the small window. |
| DefaultWinMinY | Stores the Y location of the small window. |
| DefaultWinToMin | Set to 1 to default to the small window. |
| DefaultZoomOut | Stores the default size of the image. |
| DemoData | Set to variance percent or number of demo parts. |
| DigDeviceNum | Stores the default digital device number. |
| Digital | Stores the name of the digital driver. |
| DisableAltTab | Set to 1 to disable the Alt-Tab key function. |
| DisableResume | Set to 1 to disable the resume feature. |
| DisableScreenMove | Set to 1 to disable screen dragging. |
| DisableScreenSize | Set to 1 to disable min/max screen buttons. |
| DisableTitleBar | Set to 1 to disable screen title bar. |
| DiskVolume | Records the hard disk volume. |
| DoneDelay | Sets the milliseconds of the done signal. |
| EnableMarkVoids | Set to 1 to enable mark void inspection. |
| FailNotFound | Set NF leads to failures instead. |
| FileLength | Set allowable file length from 8-64 characters. |

| | |
|---|---|
| GageReportGroups | Number of groups used in the Gage report. |
| GoldAccuracy | Set the gold accuracy in mils. |
| GoldBGA | Stores the gold BGA certificate file name. |
| GoldCalculation | The gold report calculation method. |
| GoldQFP | Stores the gold QFP certificate file name. |
| GoldRepeatability | Set the gold repeatability in mils. |
| GoldRepeatLeads | Maximum leads in repeatability report. |
| GoldResult | Stores result of gold calibration test. |
| GoldWarnings | Allow gold warnings about file date. |
| HardwareID | Stores the hardware number. |
| HideConfigFiles | Set to 1 to hide the config files. |
| HideDisplay | Set to 1 to hide display or 2 to hide buttons. |
| HideKeyboard | Set to 1 to hide the onscreen keyboard. |
| HideLogo | Set to 1 to hide the logo. |
| HideLotStats | Set to 1 to hide the lot stats display. |
| HideShutdown | Set to 1 to hide Windows shutdown dialog. |
| HideTaskbar | Set to 1 to hide Windows taskbar. |
| Hysteresis | Set to force hysteresis in mils. |
| IdealHeightBGA | Set to MM to show a warning for ideal height. |
| IdealHeightQFP | Set to MM to show a warning for ideal height. |
| IdealHeightTol | Set to MM to show a warning tolerance. |
| IgnoreReqHigh | Set to 1 to ignore REQ HIGH warning. |
| ImagesUsed | Sets the images shown in the F8 screen. |
| InspectDelay | Stores the delay in milliseconds before an inspect. |
| InspectStartsLoop | Set to 1 to make inspect button start LOOP mode. |
| Language | Stores the default language. |
| LastAuto | Stores the last auto-save path. |
| LastLot | Stores the last lot name. |
| LastPart | Stores the last part name. |
| LastUser | Stores the last user name. |
| LeadColor | Stores the default lead color. |
| LeadShiny | Stores auto-contrast settings. |
| LevelSeconds | The number of seconds before level defaults to 1. |

| | |
|---|---|
| LightDefault | The sum of the lights used by default. |
| LightDelay | The delay in milliseconds after lights are set. |
| LightPersist | The delay in milliseconds for lights to remain on. |
| Lights | Stores the name of the lights driver. |
| LightsUsed | The number of lights used. |
| LiveImageDelay | Stores the millisecond delay between live images. |
| LotCalculation | Set to 1 to use only maximum values. |
| MarkNotFound | Set to percentage to cause a not found. |
| MarkPocketSensor | Set to 1 to enable digital pocket sensor. |
| MarkTapeHole | Diameter of tape hole in pixels. |
| ModuleType | Stores the number of the module type. |
| MoveDelay | Stores the delay after the move signal. |
| PartPath | Stores the path where part files are saved. |
| PixelErode1 | Stores pixel tuning values. |
| PixelErode2 | Stores pixel tuning values. |
| PixelErode3 | Stores pixel tuning values. |
| PixelOffset1 | Sets the offset for the second camera. |
| ProcessDelay | The delay in milliseconds after inspection is done. |
| RegisterHotKeys | Set to 1 to allow hot F2, F8, F10, etc. keys. |
| RegressData | Stores the default regression setting. |
| ReticleFile | Stores the last reticle file name. |
| SaveEachLearn | Set to 1 to store an image for each mark file. |
| SaveLog | Save the Log.ini file to track commands. |
| SerialNo | Stores the name of the serial number. |
| Server | Stores the server selection in Options. |
| ShowErrorGrab | Shows an error after a camera grab failure. |
| ShutdownOnExit | Set to 1 to shutdown Windows on exit. |
| SplashSeconds | Number of seconds to show splash screen. |
| TriggerDelay | Total milliseconds to trigger digital inspection. |
| UpperCaseLot | Set to 1 to force lot to upper case. |
| UpperCaseUser | Set to 1 to force user to upper case. |
| UseBGA | Stores if BGA devices are used. |
| UseDoneSignal | Set to 1 to use done instead of busy signal. |

| | |
|---|---|
| UseLCC | Stores if LCC devices are used. |
| UseMoveSignal | Set to 1 to use move signal. |
| UseMRK | Stores if MRK devices are used. |
| UsePAR | Stores if PAR devices are used. |
| UserLocateLeads | Stores if user locates leads with the mouse. |
| UseRTF | Set to 1 to use RTF report files. |
| Version | Stores the version of the software. |
| ViewAngle0 | Stores the view angle of the first camera. |
| ViewAngle1 | Stores the view angle of the second camera. |
| ViewAngle2 | Stores the view angle of the third camera. |
| ViewAngle3 | Stores the view angle of the fourth camera. |
| ViewerRTF | The name of the program used to view reports. |
| ViewScaleZ | Stores the perspective calibration factor. |
| Windows | Stores the version and speed of Windows. |
| WindowTitle | Sets the title of the main window. |
| WiringQFP | Stores the QFP head wiring. |

**[Passwords]**

| | |
|---|---|
| Password2=2 | Password level 2. |
| Password3=3 | Password level 3. |
| Password4=4 | Password level 4. |
| PasswordExit=EX | Password to exit. |
| PasswordCal=CAL | Password to calibrate. |
| LevelCalibrate=3 | Level to calibrate. |
| LevelCalReport=1 | Level to show calibration report. |
| LevelData=1 | Level to show Data screen. |
| LevelEdit=3 | Level to edit part files. |
| LevelExit=4 | Level to show Exit button. |
| LevelFiles=3 | Level to allow FILES password. |
| LevelHost=4 | Level to allow host bypass mode. |
| LevelInspect=1 | Level to allow manual inspections. |
| LevelLearn=1 | Level to learn mark. |
| LevelLive=1 | Level to allow live images. |

| | |
|---|---|
| LevelLot=1 | Level to allow empty lot data. |
| LevelOptions=3 | Level to allow options changes. |
| LevelOverride=1 | Level to override mark results. |
| LevelPassword=1 | Set to 5 to remove Password button. |
| LevelPrinter=1 | Set to 5 to remove Printer button. |
| LevelResume=1 | Level to allow resume. |
| LevelSelect=1 | Level to allow Select part. |
| LevelZoom=1 | Set to 5 to remove Zoom button. |

**[Commands]**

| | |
|---|---|
| INSPP=INSPP | Inspect a part. |
| INSPX=INSPX | Inspect with no data. |
| LOADP=LOADP | Load a part (LOADP:XXXX.PAR). |
| GETRS=GETRS | Get the result. |
| GETPS=GETPS | Get device position. |
| PRINT=PRINT | Print lot summary report. |
| PASS=PASS | PASS return string. |
| FAIL=FAIL | FAIL return string. |
| RWRK=RWRK | RWRK return string. |
| NFND=NFND | NFND return string. |
| MOVE= | MOVE return string. |
| ACKN= | ACKN return string. |

## 9.12 Camera.ini File

The Camera.ini file sets a number of parameters for the camera. Note that not all of these setting are available on all cameras. For some USB cameras with a CMOS sensor, decreasing the size of the image will increase the frame speed. For example, if a 1280x1024 image takes a total grab time of 90ms, setting the image to 800x800 will take about 60ms because the transfer time of 60ms will be cut in half. Setting the default exposure to a lower number will also increase the speed of the camera.

Note that if the image size or orientation is changed the camera will need to be calibrated. For example, if the image size is 1280x1024, setting the Cols to 1024 will require camera calibration. Also, setting the Resize=150 to create a 1920x1536 image will require camera calibration. The Resize setting is sometimes used to create a larger display when using the zoom icon.

**[Config]**

| | |
|---|---|
| Cols=1280 | Columns in the Image. |
| Rows=1024 | Rows in the Image. |
| FlipX=0 | Flip the image in X. |
| FlipY=0 | Flip the image in Y. |
| Resize=100 | Resize image to 150% or 200%. |
| DefExpo=30 | Default camera exposure. |
| DefGain=0 | Default camera gain. |

## 9.13 Digital.ini File

The Digital.ini file sets the polarity of the input and output signals. In some cases it also can be used to set the milliamps and pulsing used by the LED controller, if one is being used. Note that not all items below are used in some Digital.ini files.

**[Config]**

| | |
|---|---|
| InvertInp=0 | Invert the Input Signal. |
| InvertOut=0 | Invert the Output Signal. |
| InvertOA1=0 | Invert Output A1 signal. |
| Milliamps=70 | Set the LED Milliamps or pulse byte. |
| PulsingOn=1 | Pulse the LEDs. |

## 9.14 Custom Screens

If you are running two copies of the software on one computer, it may be helpful to change the screen size, set the colors of the grid or set the title of the main window. Below are some example settings that could be used in the C:\UltraVim2D\Files\Config.ini file.

WindowTitle=Mark Inspection

ColorGrid=111111

ColorText=FF00FF

DefaultWinMaxCX=800

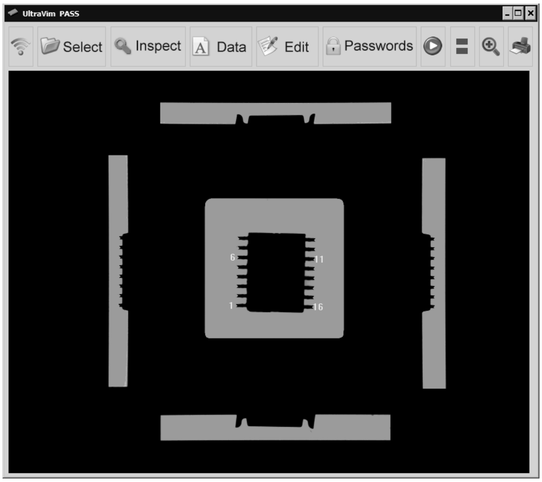
DefaultWinMaxCY=600

Note that if the screen width is lower than 1024 the Options, Data or Edit buttons may not be shown. Theses screens can be accessed by entering OPTIONS, DATA or EDIT in the password dialog. Buttons may also be removed by setting the password level to 5 in the Config.ini file.

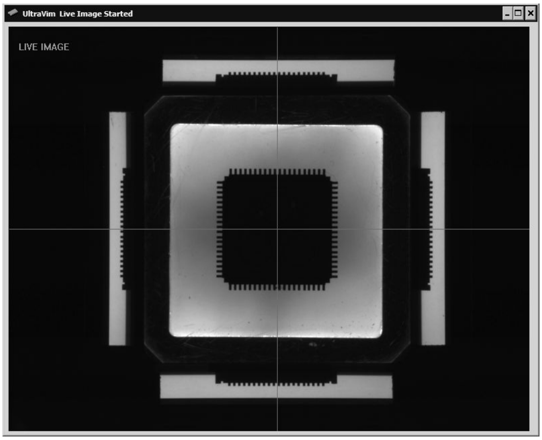

The size of the graph and results on the left of the screen can be changed using the DefaultGraphCX parameter, which must be at least 300 pixels wide. Setting HideDisplay=1 will remove the displays on the left side of the screen.

Setting DefaultWinMaxCX=-1 and DefaultWinMaxCY=-1 will set the screen size to about 80% of the monitor resolution. Setting the DefaultWinMaxCX parameter to a positive value and setting DefaultWinMaxCY=0 will automatically size the height of the main screen to match the aspect ratio of the camera image.

Below is an example screen with HideDisplay set to 1 and DefaultWinMaxCX set to 1024.




Setting the HideDisplay=2 parameter removes the display on the left side of the screen and all the buttons in the command bar. In this mode the software will start and stop Live Image each time the user clicks on the image.



## 9.15 Windows Shutdown & Control

There are a number of parameters that allow the UltraVim software to limit access to Windows functions. For example, setting the commands to disable screen size and move will keep the UltraVim software displayed in most cases. Also, hiding the taskbar and Shutdown dialog will help to prevent users from selecting sleep mode or restart. Setting LevelExit=1 will show an Exit button in the Passwords screen. The ShutdownOnExit=1 command will shutdown Windows when the user exits UltraVim software.

DisableScreenSize=1

DisableScreenMove=1

HideTaskbar=1

HideShutdown=1

LevelExit=1

ShutdownOnExit=1

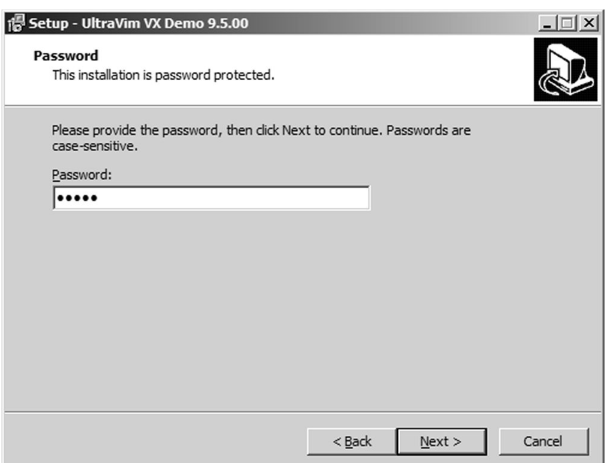
# 10. Troubleshooting Failed Images

A demonstration version of the UltraVim software can run on nearly every computer running the Windows operating system. To avoid hardware errors, the CAMERA.DLL and DIGITAL.DLL files must be replaced with the demonstration versions of those files that do not link to any hardware.

- CAMERA.DLL Camera Driver
- DIGITAL.DLL I/O and/or LED Driver

## 10.1 UvimDemo Version

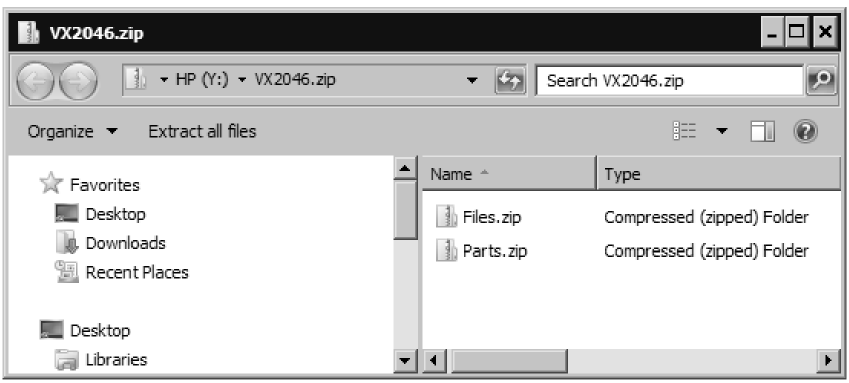
To create the C:\UvimDemo directory with the correct CAMERA.DLL and DIGITAL.DLL files run the uvdemo9500.exe installation program. Enter the password to complete the installation.



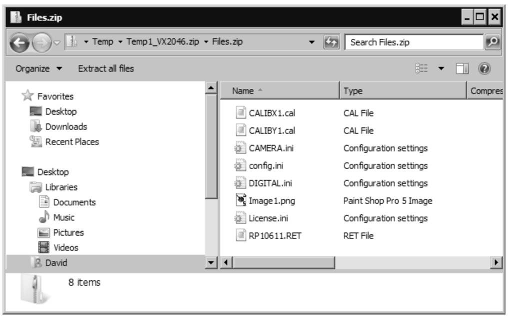
To create the C:\UvimDemo directory with the correct CAMERA.DLL and DIGITAL.DLL files run the uvdemo9300.exe installation program. Enter the password "1941" to complete the installation. Test the installation by running the "UvimDemo" icon on the desktop or running the C:\UvimDemo\UltraVim.exe program.

## 10.2 Customer Parts & Files

To simulate a customer environment you will need the Parts and Files directories they are using and an image of the device or devices in question. The customer can enter "ZIP" in the Passwords dialog to create a ZIP file that will include these files. For example, the screen below shows a ZIP file from the VX2046 inspection module. The ZIP file will contain Files.zip with the \Files directory and Parts.zip with the \Parts directory.



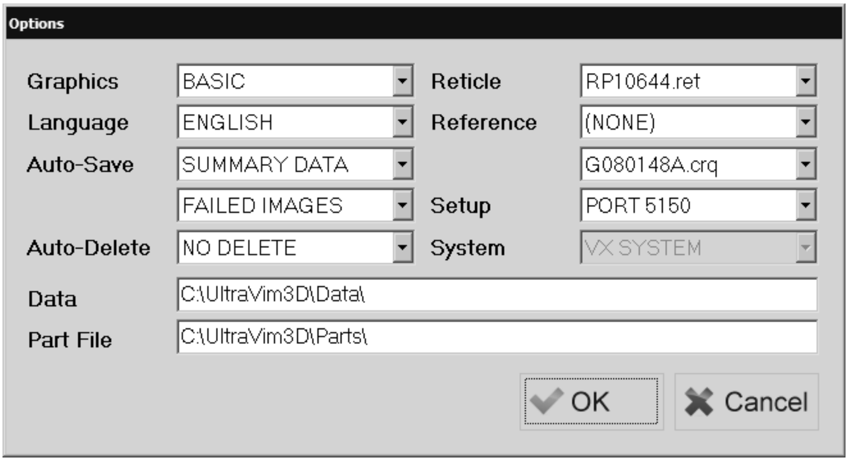
The contents of the example Files.zip are shown below. Note that the calibration files, reticle files and other configuration files are in the ZIP file. The Image1.png contains the last image on the screen when the customer created the ZIP file. The UvimDemo will load the Image1.png each time you select a part file.



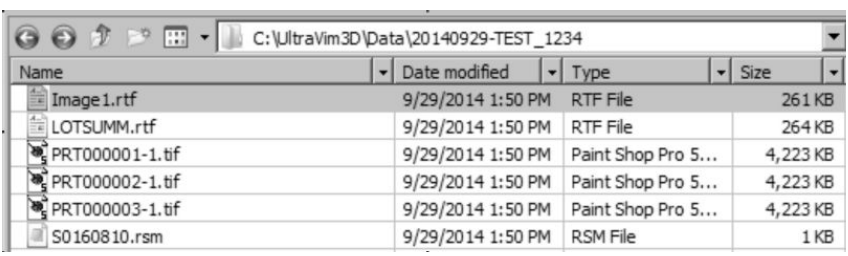

To simulate the customer environment, unzip and copy the contents of File.zip and copy it to the C:\UvimDemo\Files directory and unzip and copy the contents of Parts.zip to the \Parts directory. When you run the UvimDemo software the passwords screen will now show the module serial number.

## 10.3 Saving Failed Images

If a customer would like to examine the images that fail in a lot, the Auto-Save function can be set to save FAILED IMAGES.

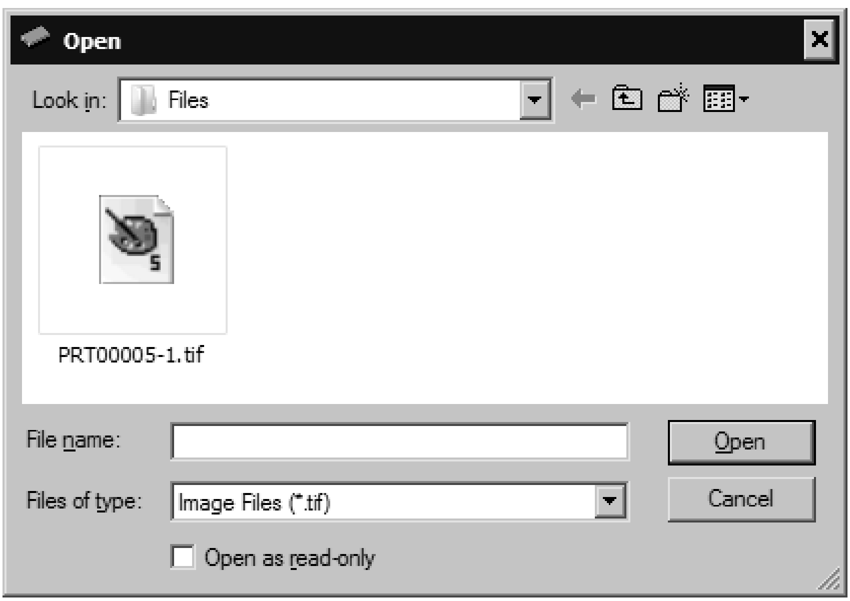



Failed images will be saved in the lot data directory and will start with "PRT" and end "-1.tif" for the first camera and "-2.tif" for the second camera, if the inspection module uses more than one camera. The raw TIF file format is used because it is not compressed which allows the computer to save images faster.

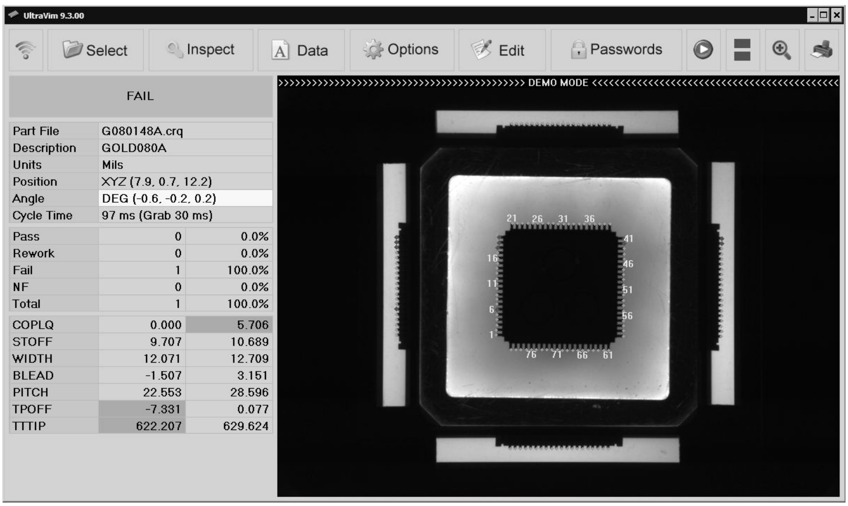


Failed images will be saved in the lot data directory and will start with "PRT" and end "-1.tif" for the first camera and "-2.tif" for the second camera, if the inspection module uses more than one camera. The raw TIF file format is used because it is not compressed which allows the computer to save faster.

To inspect a failed TIF first right click on the image and select Open. Then open the "-1" image into the first camera. The "-2" image will automatically load if there is a second camera. Finally, right click on the image and select "Inspect Image". This will cause the image in memory to inspect without allowing the camera to grab a new image.



You can also install the UltraVim Demo Software to inspect images. To do this, copy all the Files.zip to the Files directory and all the Parts.zip to the Parts directory. Then start the demo software and right click on the image to load it. After you load the TIF image you can click on the Inspect button and this will simulate the results of the customer system when the part failed. Note that the top of the image will display “>DEMO MODE<” in yellow each time an image is loaded. After more than 100 images the display will turn red and the software must be started again.




## 10.4 Software Versions

If a customer is using a different version of the software you may need to also use that version by running the upgrade installation. For example, running uvim9220.exe will convert your 9.4 software to version 9.2.20 automatically.

# 11. Frequently Asked Questions

This chapter answers many frequently asked questions about the UltraVim systems. If you cannot find the answer you are looking for, please visit www.scannertech.com for contact information.

**Why do I get the LICENSE NOT FOUND error?**

When the software starts it looks for a hardware identification number from the camera. If the camera has not been found the software will use the hardware number from the hard disk. The hardware number shown in the Passwords dialog must match the codes in the License.ini file. If these codes do not match the error will be shown. The causes could be that the camera is not working correctly, or the hardware is connected to a camera that is not the camera in the License.ini file. If a full version of software is installed it will replace the License.ini file to match the description in the installation software.

**Why do I get the 2400 - CAMERA INIT ERROR?**

When the software starts it attempts to initialize all cameras. If this cannot be done the software will show an error. Possible causes for this error are a missing camera, the wrong drivers for the camera have been installed, a bad camera adapter board, a bad camera cable or a faulty camera. If the camera cannot be initialized the cable and adapter should be swapped and tested for failures.

**Why do I get the 2401 - DIGITAL I/O INIT ERROR?**

When the software starts it attempts to initialize the digital I/O control. If it cannot complete this task it will display an error. Possible causes for this error include a missing I/O control, the wrong drivers for the controller are installed, a bad controller, a faulty cable or a bad USB2 port if that is controlling the I/O box.

**Why do I get the 2402 - LIGHT LED ERROR?**

When the software attempts to turn on the LED lights it will return an error if it cannot complete that task. Possible causes for this error include the DIGITIAL I/O was not initialized, the digital controller has failed, a faulty cable or a bad USB2 port if that is controlling the I/O box.

**Why do I get the 2403 - CAMERA GRAB ERROR?**

The camera grab error is shown if the camera attempts to grab an image and cannot complete that task. Possible causes for this error are a bad camera adapter board, a bad camera cable or a faulty camera. In some cases the software will allow the user to attempt a second grab. If the camera cannot restart the best action is to reboot the computer to see if the camera can be initialized. If the camera cannot be initialized the cable and adapter should be swapped and tested for failures.

**Why do I get the 9002 - CANNOT SAVE FILE?**

If the software attempts to create a file but cannot do so it will show an error. Causes for this error could include a full disk drive or the operating system has been configured in a way that the software does not have permission to save data. Make sure the hard disk has ample space for data and the software has write privileges.

**Why do I get the 9003 - CANNOT LOAD FILE?**

If the software cannot load a file it could mean that the file is too large, or the file is corrupt or the operating system has been corrupted. To test the file try loading it on another system or with a word processor or spreadsheet program.

**Why do I get the 9011 - INCORRECT CERTIFICATE?**

The gold certificate files must be stored in the \Files directory and selected in the Options screen. If the file that is selected does not match the number of leads in the gold part file selected the software will display an error.

**Why do I get the 9012 - CERTIFICATE EXPIRED?**

If GoldWarning=1 is set in the Config.ini file the software will check the date of the gold certificate file and if the date is more than a year old the software will display this error. Note that the date is the actual date set in the file and not the file date determined by the operating system.

**Why do I get the 9013 - PART SIZE IS TOO LARGE?**

If a user selects a part that is larger than the camera field of view the software will display an error. The field of view can be viewed in the Calibration dialog by entering CAL in the Passwords dialog.

**Why do I get a black image in one or more camera?**

A camera can get a black image if the LED light is not working or the hardware driver reports a successful image grab but an image is not transferred to the software. The camera and lights should be tested by manually inspecting a device. If the device can be inspected successfully then the problem may be an intermittent failure caused by a faulty adapter, cable or camera. The drivers should be checked to make sure they are the correct versions. The adapter and cable should also be replaced and if the issue continues the camera may be faulty.

**How do I verify the correct drivers are installed?**

The camera driver versions are shown in the system report. To generate this report the user must enter SYSTEM in the Passwords dialog. To create a report with the operating system drivers the user can enter DRIVERS in the Passwords dialog. If there are questions about drivers these reports should be emailed to the factory for verification.

**Can I replace the camera on my vision system?**

The camera supplies the hardware identification code and must match the codes in the License.ini file. If a camera is replaced you will probably need to contact the factory for a license. Also, for a sealed 3D system replacing the camera will probably invalidate the calibration. Cameras are centered with precision so replacements must be completed by the factory.

**Can I inspect parts if the second camera is not working?**

If you have a two-camera UX inspection module and the second camera fails the software will still allow inspections that do not require the second camera. The module will operate like a single-camera VX module and leaded parts may be inspected. The module can also inspect BGA devices if all 3D measurements are disabled.

**How do I email an image of a device?**

First, make sure the handler is holding the device in the inspection area. If it is a leaded device, it must be plunged to the correct depth. Next, enter password ZIP and the software will grab an image (or images) of the device and display a "Save As" dialog box. Enter a name like "TEST" and click on the "Save" button. The software will create the "TEST.ZIP" file. You can email this to info@scannertech.com.

**How to I backup a software version?**

All configuration files of the software are stored in the \Files folder. This allows you to make a backup of your software. For example, if you wish to create a backup of your current VERSION 9.5.00, just make a copy of the C:\UltraVim3D folder to a thumb drive or network drive. We also recommend that you create a restore point on the computer to save registry settings.

**Can I replace the motherboard?**

Microsoft Windows does not do a good job of configuring the system after a motherboard has been replaced. In some cases, customers have been able to replace the motherboard with an identical version and the system will operate. However, most of the time the hardware will not operate correctly and you will need to contact us for assistance with driver installations or use the full installation program.

**Can I upgrade the version of Windows?**

New versions of Microsoft Windows may require new hardware drivers or older hardware may not even have current hardware drivers. Upgrading the version of Windows should not be done without consulting the factory.

**Why do the LEDs not light up?**

If the LEDs do not illuminate, it could be the result from a failure in the LED power supply, the Digital I/O board, the cable, the driver or the light. Check the power in the socket on the UltraVim, and also check to see that the plug extends far enough down to properly mate with the socket. If all these items are verified, an LED board has probably failed.

**Why is my GOLD QFP device failing?**

Verify that you are using the correct reticle and have selected the proper reticle file. Verify that the GOLD device is in the correct orientation. Select the device file to clear the data and rotate the device by 90 degrees and test it again. Do this for each rotation. If the device still fails, you may need to use password ANGLE to calibrate the angles, or send the GOLD device to the factory for re-certification.

**Why is this specific package failing?**

After reading the Advanced Settings chapter, you should inspect the device with debug graphics turned on. The most common causes of failures are dirty optics and incorrect part files. If a BGA device does not have all the perimeter balls you may need to make Advanced Settings adjustments. If you still cannot determine the cause of the problem, please email the ZIP image to the factory for evaluation.

**Why can't I see the reticle prisms?**

There are different sizes of inspection reticles: 19mm, 32mm and 35mm. The sizes relate to the maximum package terminal dimension that can be inspected using that reticle. The module field of view (FOV) must be at about 13-14mm larger than the terminal dimension to account for the size of the prisms. Field of view options for modules include 25mm, 33mm, 46mm and 48mm. Thus, a 25mm FOV cannot use any reticle, a 33mm FOV can use a 19mm reticle, a 46mm FOV can use a 19mm or 32mm reticle, and a 48mm FOV or larger can use all three reticles.

**What is a Field of View?**

The Field of View (FOV) is the size of the image the camera is looking at in real-world unit. The FOV is calculated during calibration and is stored in the Config.ini file.

**What is sub-pixel resolution?**

Image processing algorithms can find features in an image with better resolution that one pixel. The actual resolution obtained is dependant on the lighting, number of pixels and the algorithm used. Most vision-based inspection systems claim a resolution of about 10% of the size of the pixel.

**What does calibration do?**

The calibration of a vision system serves two purposes. First, it maps out the distortion in the optics. Second, it determines the size of the pixels at the given FOV. With this information, the system can now find any point in the image and determine real-world information such as the distance between objects, or the width of an object.

**Should I calibrate the system?**

Sealed UltraVim modules have fixed optics and are calibrated at the factory. Other than the ANGLE calibration with a gold unit, it is best to not calibrate the units with the dot grid reticle. Any dust or dirt on the reticle could result in an invalid calibration. Note that the VERIFY CALIBRATION option can be done and will only test, but not change, the calibration values.

**How do I calibrate the offset for the second camera?**

When the software searches for a device in the second camera it uses searches B and C to locate the left and right positions. For some complicated devices these searches could be difficult and may need to be adjusted. If PIXOFF1 is entered in the Passwords dialog after a BGA has been inspected the software will calibrate the offsets between the first and second cameras. This allows the user to create more precise B and C searches for complicated devices.

**Why are parts failing after I replaced the reticle or head?**

Swapping reticles and heads between systems is not recommended. If a reticle is changed the new *.RET file must be copied to the \Files directory and selected in the Options screen. It is also recommended that users enter the ANGLE command in the Passwords screen after inspecting a golden device or a four sided device that does not have any defects.

**What is a telecentric lens?**

Generally, when an object is closer to the camera, it looks larger and when the object is farther away, it looks smaller. This makes gaging very difficult, because your results can change if the object is not the same distance from the camera each time you measure it. With telecentric optics, the image looks the same even if it is not the same distance from the camera.

**Why is my RTF report always blank?**

If there is no data you may have a blank report, however, a corrupt \Files\HEADER.rtf file will also cause the report to look blank. Try renaming the HEADER.rtf file to HEADER_TEST.rtf to see if that file is causing the problem.

**How can I display a custom splash or logo?**

Create a 256-color bitmap file with your custom splash screen and name it SPLASH.bmp or create a logo named LOGO.bmp. Save the file or files in the UVIM\Files directory. You can control the number of seconds the splash screen is displayed by setting SplashSeconds= in the Config.ini file.

**How large should a round reflector be?**

As a rule-of-thumb a round reflector should be about 150% larger than the largest body size for a leaded device. For example, if the largest device is 14 x 20 mm the round reflector should be 30 mm. For BGA devices the reflector can be smaller, however making it smaller than 150% of the body size may require changes to the part file in Advanced Settings and may affect board width measurements.

**What Windows settings are recommended?**

When using a Windows computer as a controller it is recommend to change the Power Options to "High performance" and change "Put the computer to sleep: Never." It is also recommended to change "Windows Update" to "Never."

**What Disk Drive settings are recommended?**

When using a Windows computer as a controller it is recommend to turn off any drive compression and to change the Policies for the disk drive to "Enable write caching" and "Turn off Windows write-cache buffer flushing." Note that a universal power supply is recommended.

**What USB settings are recommended?**

When using USB cameras or other hardware devices it is recommended to change "USB selective suspend setting" to "Disabled" and "USB Root Hub Properties" to not allow the computer to turn off the device to save power.

**Why is my USB are not off when the PC is off?**

To save power, Windows automatically shuts down the power to USB ports if the "Allow the computer to turn off this device" is set in the USB Root Hub Power Management section. However, some computers may override this command and leave power turned on. The most reliable way to turn off USB power is to remove the power going into the computer. In some cases if the USB does not turn off the camera will not reboot which can cause a camera initialization error.

### How do I create a Restore Point?

After you have changed all the power settings in Windows and have tested the system it is a good idea to create a Restore Point. In System Properties select "System Protection" and select "Create" to create a restore point called DEFAULT SETTINGS.

### Can I use my part file on another UltraVim?

Generally part files are interchangeable between UltraVim modules. However, if you have modules with different resolutions part files may need some small adjustments. This is especially true if the advanced settings have been changed in the Alt-F8 screen because many of the values in that screen are in pixel units.

### How do I make a new part file?

Enter password level 3 and select the closest part file that currently exists in the part library. In the Select screen click on the New button and change the part name and other parameters to match your new part drawing.

**How do I compare accuracy with another system?**

Every system has accuracy errors. If you want to compare two systems this must be accounted for. The best method to compare systems is to use a certified golden device or a third system with a known accuracy. Note that even gold devices will have accuracy errors that must be known and accounted for. If actual production devices are used they should be in tolerance. Some defects may be used but defects should not be more than 20% out of the specification and no more than 10% of the devices should have defects. To calculate the variance of each system the formula A*A + B*B = C*C should be solved where C*C is the total variance between the two systems.

**Why does Ball Quality fail?**

Ball Quality is not a JEDEC or drawing measurement. It basically finds differences in the ball images and reports a quality percentage between 0% and 100%. The quality may fail if the ball is not round enough or does not reflect enough or there is some sort of reflection off the board. The individual quality tests can be adjusted with the F10 dialog. If this measurement is not useful for your process then it is acceptable to not use it since it is not a required measurement.

**When should I use a log file?**

During the development of the handler interface it may be useful to set the SaveLog=1 in the Config.ini file to create a list of the commands that the software processes. This will also show the timing from the Windows GetTickCount() function. This can also be useful if for some reason you have a software crash. The LOGCUR.csv file can be emailed to the factory to help determine the cause of the crash.

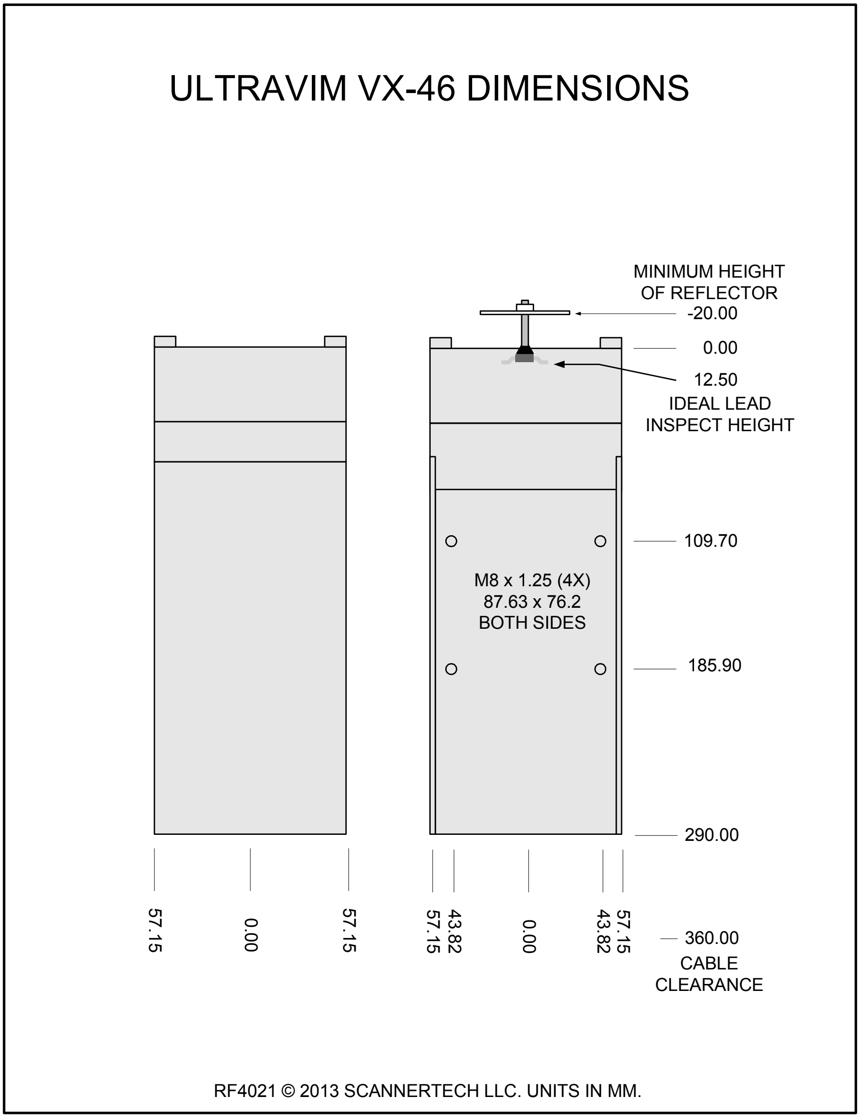
**Is there a way to pass all the parts for demonstration?**

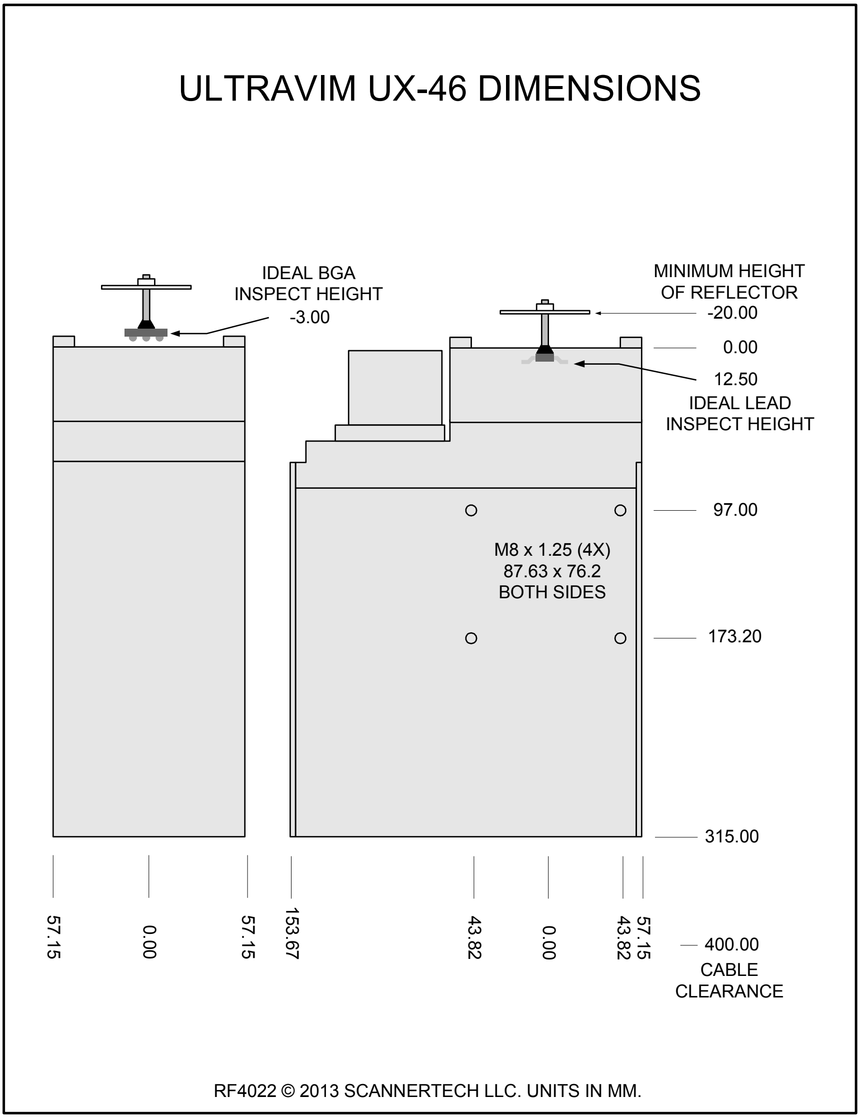
If the edge rejection is set to REJECT NONE in the F8 screen for each image used the software will pass all parts as long as the part outline can be found. Some measurements may still fail because the software will still do calculations. These measurements can be adjusted by setting the A parameter to a small value like 0.01 in the F12 screen.

**How do I test my part files offline?**

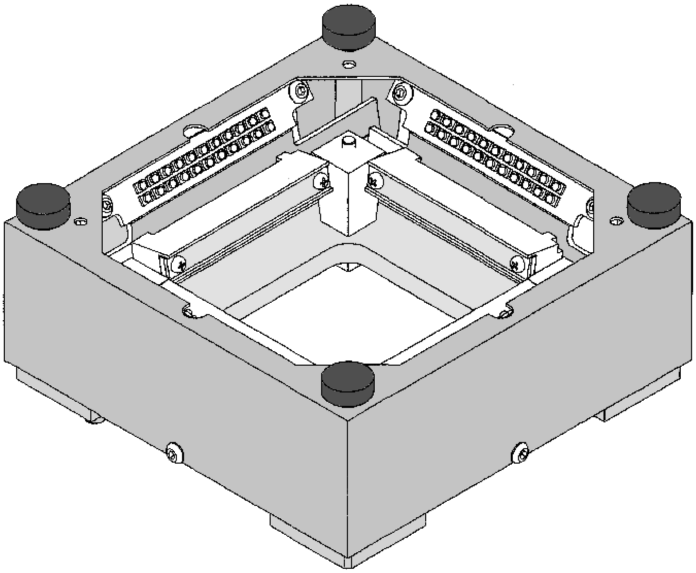
If you install a demo version of the software offline you can replace the files in the Parts and Files directories with those from an active system. To do this use password "ZIP" to create a zip file on the active system after you inspect a device. The zip file will contain Files.zip and Parts.zip. Copy those files to C:\UvimDemo\Files and C:\UvimDemo\Parts. If the demo version is old you can run the upgrade software to upgrade the demo.

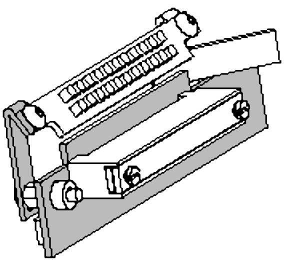
# 12. Technical Drawings




ULTRAVIM UX-46 DIMENSIONS
IDEAL BGA
INSPECT HEIGHT
-3.00
MINIMUM HEIGHT
OF REFLECTOR
-20.00
0.00
12.50
IDEAL LEAD
INSPECT HEIGHT
97.00
M8 x 1.25 (4X)
87.63 x 76.2
BOTH SIDES
173.20
315.00
57.15
0.00
57.15
153.67
43.82
0.00
43.82
57.15
400.00
CABLE
CLEARANCE
RF4022 © 2013 SCANNERTECH LLC. UNITS IN MM.

## AS01065 – LEAD INSPECT HEAD

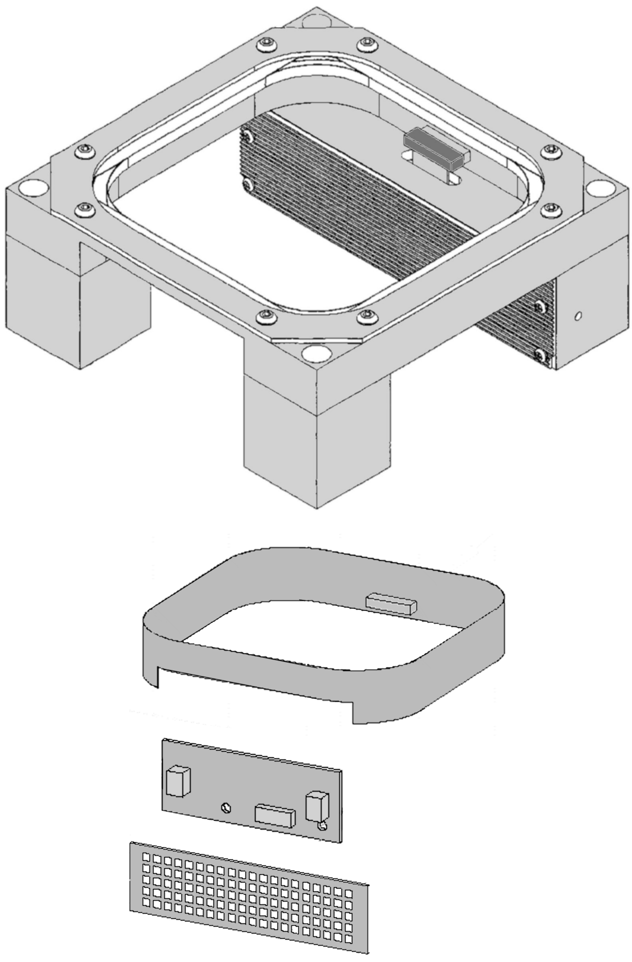




**SPARES**

| | |
|---|---|
| AS01040 | PB1038 LED LOWER LIGHTS |
| AS01041 | PB1040 LED CORNER LIGHTS |
| AS01061 | PB1046 LED OVERHEAD LIGHTS |

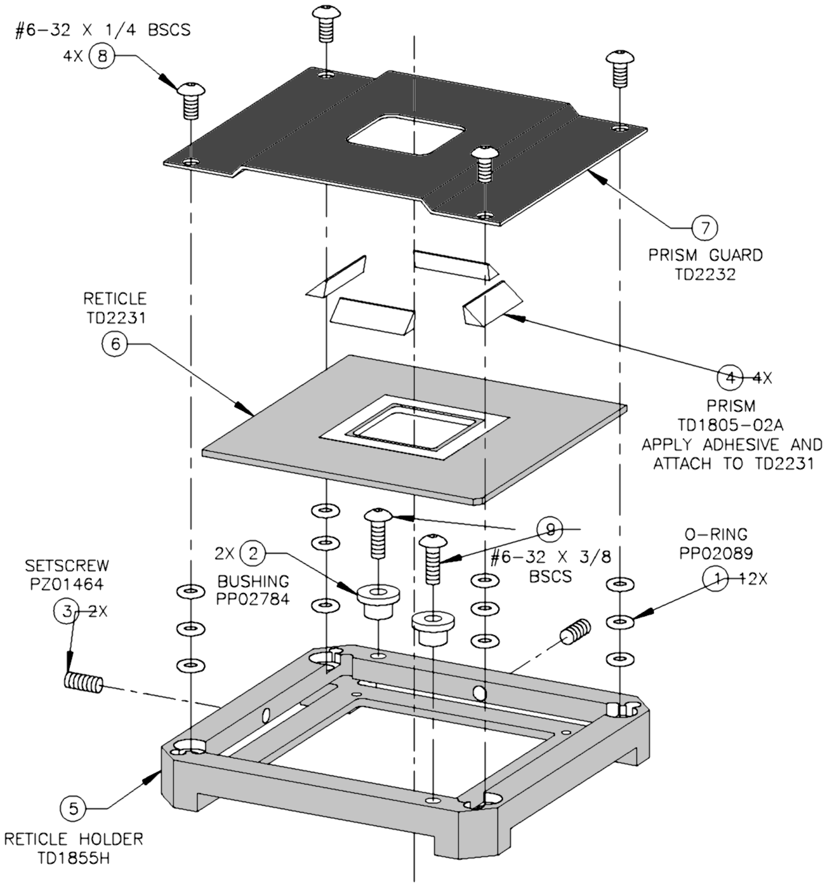
## AS01092 – BGA INSPECT HEAD



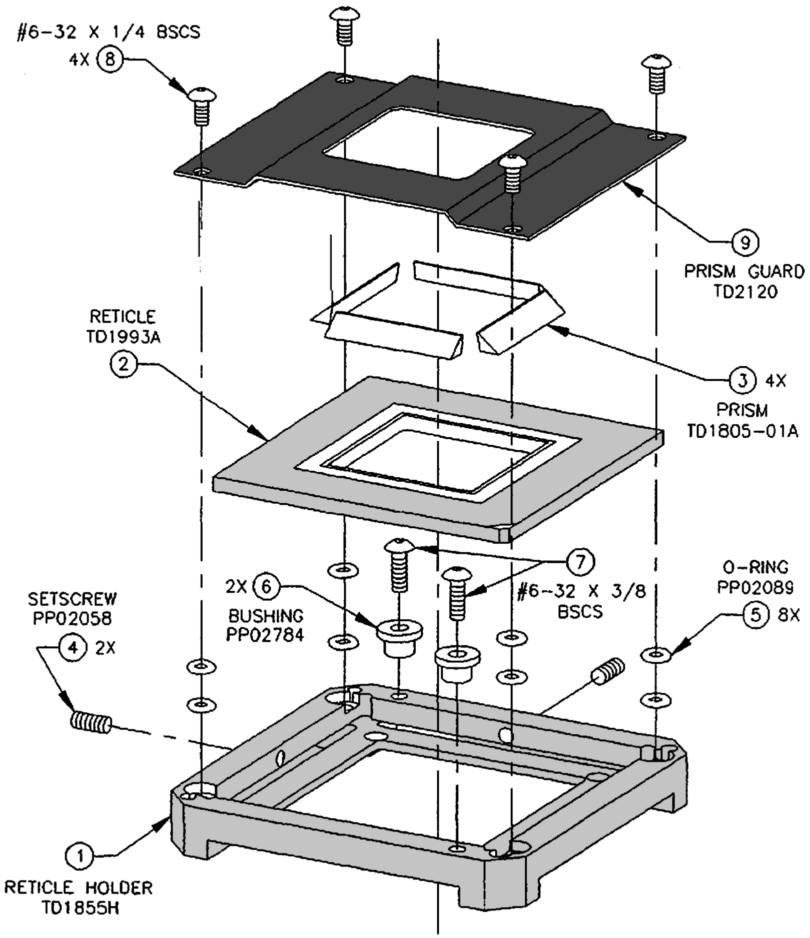
**SPARES**

| | |
|---|---|
| AS01057 | PB1042 BGA RING LIGHT |
| AS01059 | PB1044 BGA RING LIGHT CONTROL |
| AS01158 | PB1054 BGA SIDE LIGHT & CONTROL |

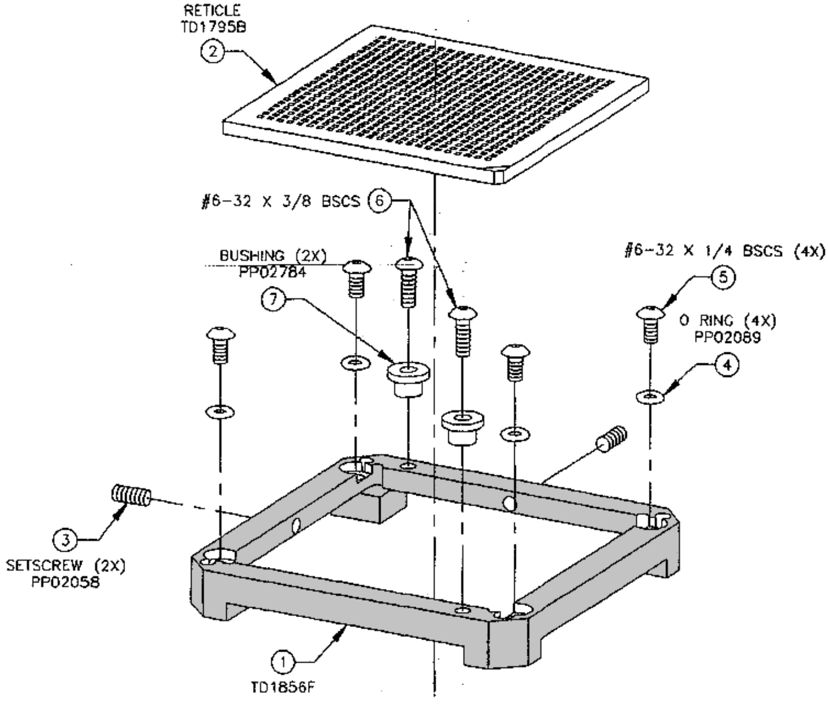
# AS01265 – 19mm RETICLE



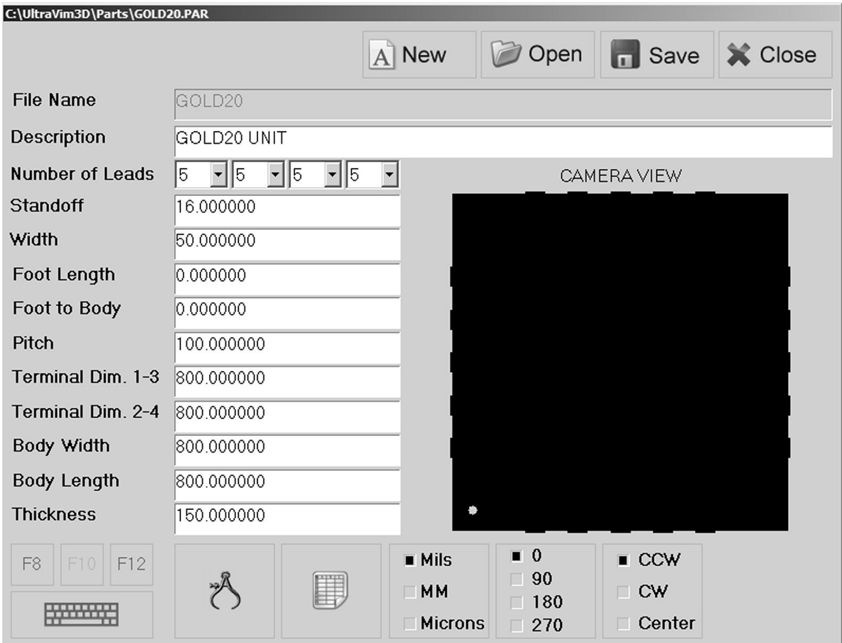
## AS01161 – 32mm RETICLE



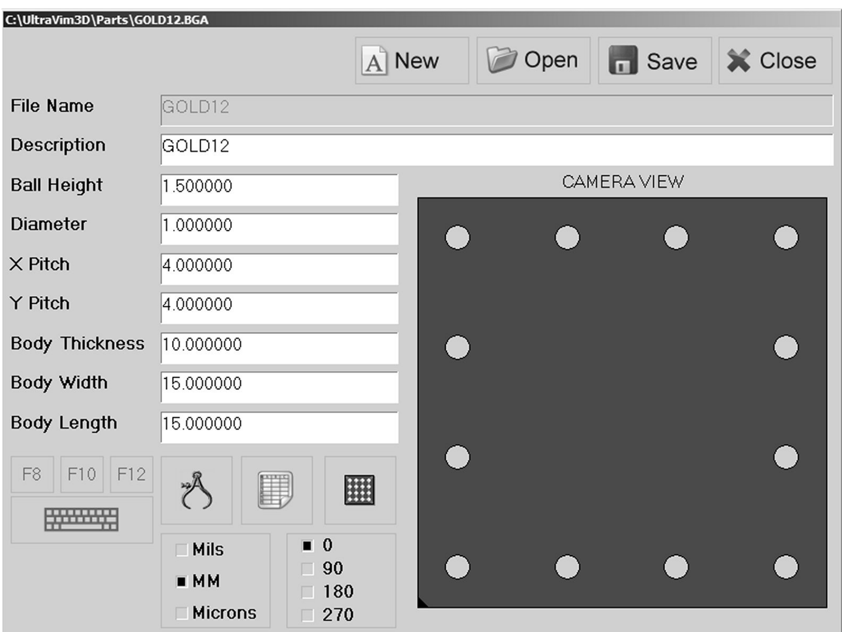
# AS01044 – CALIBRATION RETICLE



## GOLD20




## GOLD12



## COMMON CONVERSIONS

| MILS | MMETERS | MICRONS |
|---|---|---|
| 0.250 | 0.006 | 6.350 |
| 1.000 | 0.025 | 25.400 |
| 2.000 | 0.051 | 50.800 |
| 3.000 | 0.076 | 76.200 |
| 4.000 | 0.102 | 101.600 |
| 5.000 | 0.127 | 127.000 |
| 6.000 | 0.152 | 152.400 |
| 7.000 | 0.178 | 177.800 |
| 8.000 | 0.203 | 203.200 |
| 9.000 | 0.229 | 228.600 |
| 10.000 | 0.254 | 254.000 |
| 15.000 | 0.381 | 381.000 |
| 17.000 | 0.432 | 431.800 |
| 20.000 | 0.508 | 508.000 |
| 50.000 | 1.270 | 1270.000 |
| 100.000 | 2.540 | 2540.000 |

| MMETERS | MICRONS | MILS |
|---|---|---|
| 0.001 | 1.000 | 0.039 |
| 0.002 | 2.000 | 0.079 |
| 0.003 | 3.000 | 0.118 |
| 0.004 | 4.000 | 0.157 |
| 0.005 | 5.000 | 0.197 |
| 0.010 | 10.000 | 0.394 |
| 0.025 | 25.000 | 0.984 |
| 0.050 | 50.000 | 1.969 |
| 0.075 | 75.000 | 2.953 |
| 0.100 | 100.000 | 3.937 |
| 0.125 | 125.000 | 4.921 |
| 0.150 | 150.000 | 5.906 |
| 0.175 | 175.000 | 6.890 |
| 0.180 | 180.000 | 7.087 |
| 0.200 | 200.000 | 7.874 |
| 0.220 | 220.000 | 8.661 |
| 0.500 | 500.000 | 19.685 |
| 0.750 | 750.000 | 29.528 |
| 1.000 | 1000.000 | 39.370 |
| 1.270 | 1270.000 | 50.000 |
| 2.540 | 2540.000 | 100.000 |