Content

Page 1..... Setting up the camera
Page 7..... AVS Camera Overview
Page 8 ..... AVS Application (App)
Page 10 ..... AVS License
Page 11 ..... AVS Jogging Controls
Page 11 ..... AVS Navigator
Page 12 ..... AVS Slider
Page 12 ..... Yellow dot command
Page 13 ..... Vision Control
Page 13 ..... Dot size and Auto diameter
Page 14 ..... Camera calibration and camera angle
Page 15 ..... Camera X and Y offset
Page 17 ..... Camera filter
Page 17 ..... Turn camera off during job
Page 17 ..... Dry run
Page 18 ..... Print to cut
Page 19 ..... Alignment
Page 19 ..... Dot types
Page 20 ..... Creating dot types
Page 21 ..... Importing into CAM software
Page 21 ..... Tool pathing the cut line
Page 22 ..... The NC file
Page 23 ..... Sample files
Page 23 ..... Running ghostbusters
Page 29 ..... Trouble shooting

Setting up the Camera

1. Set the camera up on the machine.
2. Plug the POE (power over Ethernet) device in.
3. Plug a CAT5 cable from Power over Data connection on POE.
4. Plug another CAT5 cable from Power over Data connection on POE.

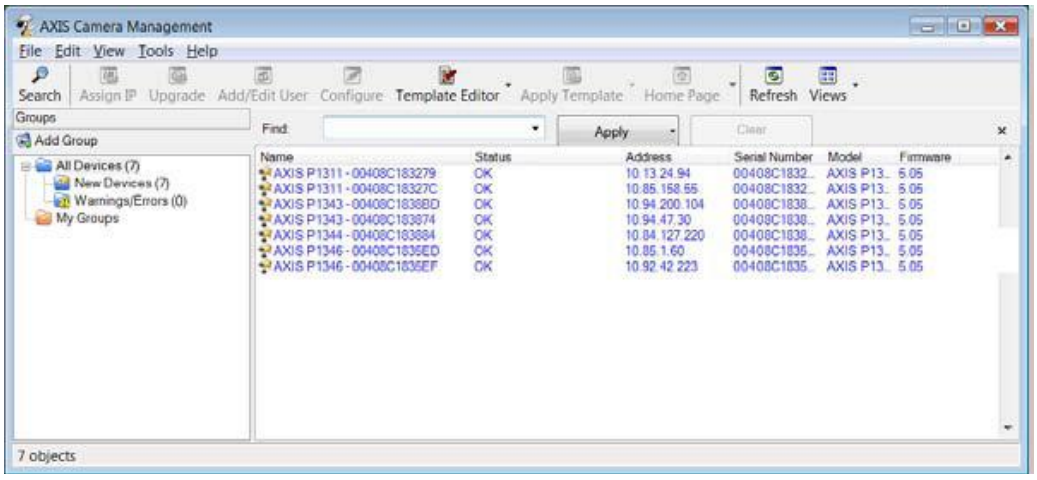
The camera should now get power. An orange ligth wil turn on while the camera tries to find the network connection and obtain an IP address. When the light turn green it has the IP address and the camera is ready to use.

You cannot proceed until the ligth is green. **It will not work!**

AXIS Camera Manager

Click on AXIS Camera Manager Icon:

The AXIS camera manager will open up and show the screen below. In the list will be all the cameras the system has ever found so this list will grow with time unless you clear it. The camera you are looking for will usually be the last one as it is the newest one. It should show a warning because it has a “credentials mismatch”. The ones with red “x’s” are disconnected.



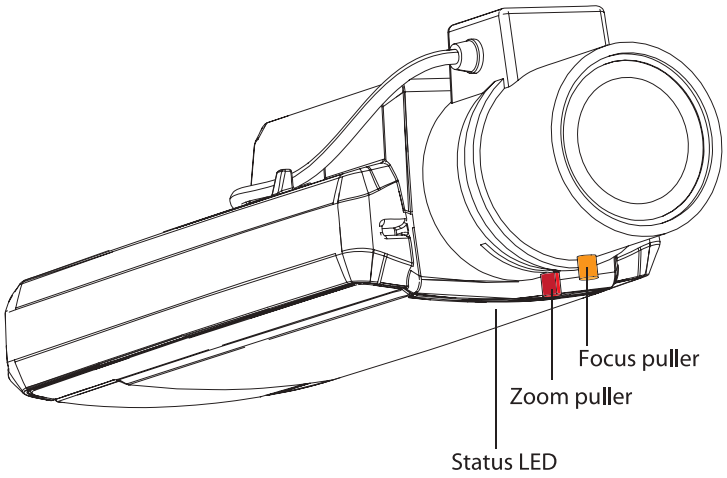
Right click on the camera to be set up. In the picture right click on the circled camera in the list.

You will get a dialog box. Select “Enter device Credentials” and you get the following dialog box:

For user name enter “a2mc” and password “avs”. Press “OK”. You will go back to the original screen. It will probably say that there is still a credentials mismach. That is because the camera still does not have the right credentials.

Right click on the camera again and the dialog will come up again. This time select “Live View Home Page”. Now you will go online and access the camera over the internet. The screen should look like this:

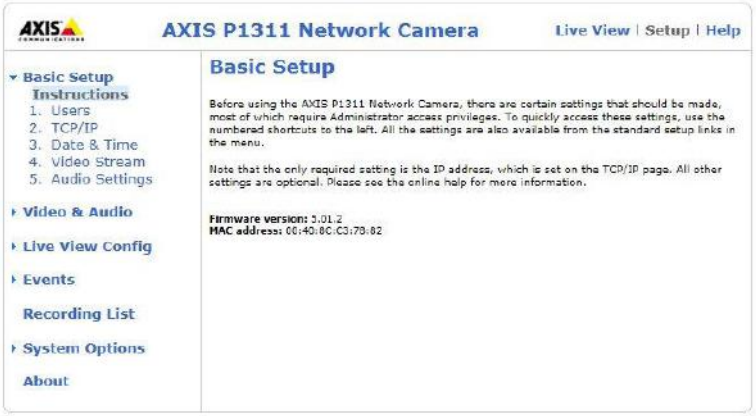
The user name should be “root” and the password should be “root”. This is the normal default password that the camer-as come with. If the camera has already been set up by AXYZ then the user name is “a2mc” and the password is “avs”. Enter the credentials and press “OK”.



You should get a picture but it will likely be blurry and upside down. The first thing to do is fix the focus as best you can. First set the camera up so the lens is 6 inches from the table base of the machine. Loosen the little thumb screw on the focus puller and rotate the focus until the picture clears up. Get it as best as you can.

It will still be upside down.

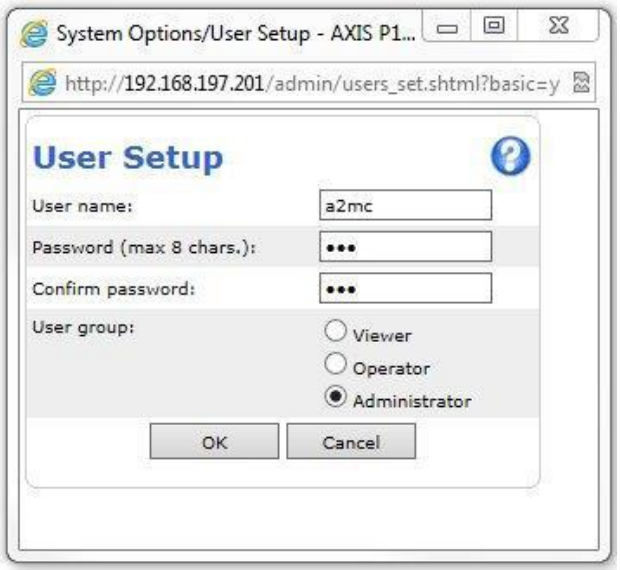
Once it is focused as best as you can get it select “Setup” on the top right.



The setup screen shows as shown on the left. You can go back and forth between “Setup” and “Live View” as you set up the parameters.

We will use two categories of setup; “Basic Setup” and “Video & Audio”.
First go to “Users” by clicking on that...

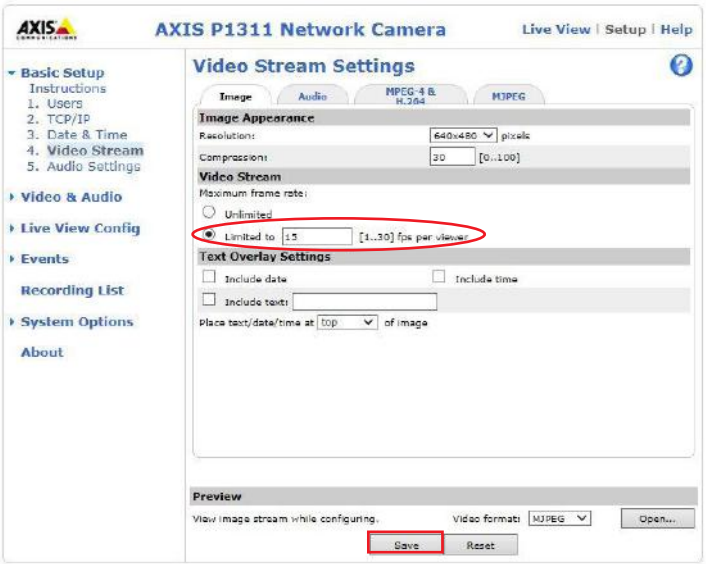
This screen allows you to add, modify, or remove user from the camera. Remember we set up a user “a2mc” with a password “avs” back in the camera management software. Now we have install the same credentials on the camera itself. Simply hit “Add...”



Enter in the user name “a2mc” and enter and confirm the password “avs”. Also make sure the “administrator” radio button is clicked. Press OK.

You will go back to the user screen and you should now see the user “a2mc” as “admisnistrator”. If you have it wrong you can modify it.

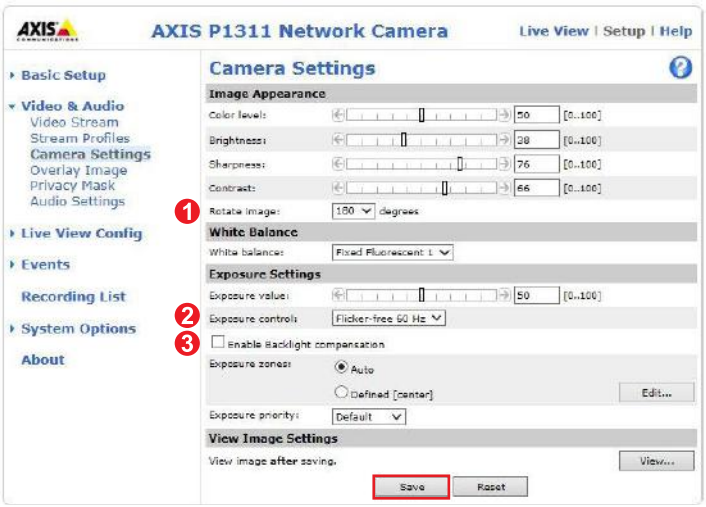
The user and password is now set up correctly.



Next select “Video stream” and make the change circled.

This limits the video feed to 15 frames per second. This is the correct settings for AVS operation.

Press “Save”



Now go to the video and audio category and select camera settings.

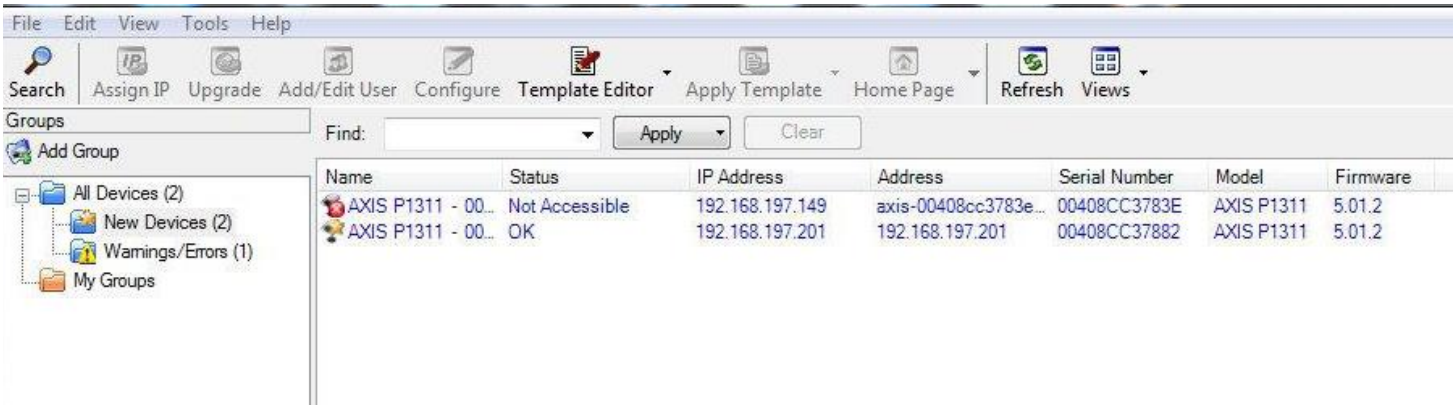
There are severals things to change:

1. Rotate image 180 degrees to get it right side up.
2. Set exposure control to flicker-free 60 Hz.
3. Disable Backlight compensation.

Press save.

Once you have done this then click “View” to see the picture. It should now be right side up and have reasonable lighting. Now fine tune the focus and tighten the thumb screw.

The camera is now all set up properly! Go back to the camera manager and you should see “OK” under status. The credentials mismatch should be gone because now the camera and the manager have the correct credentials.

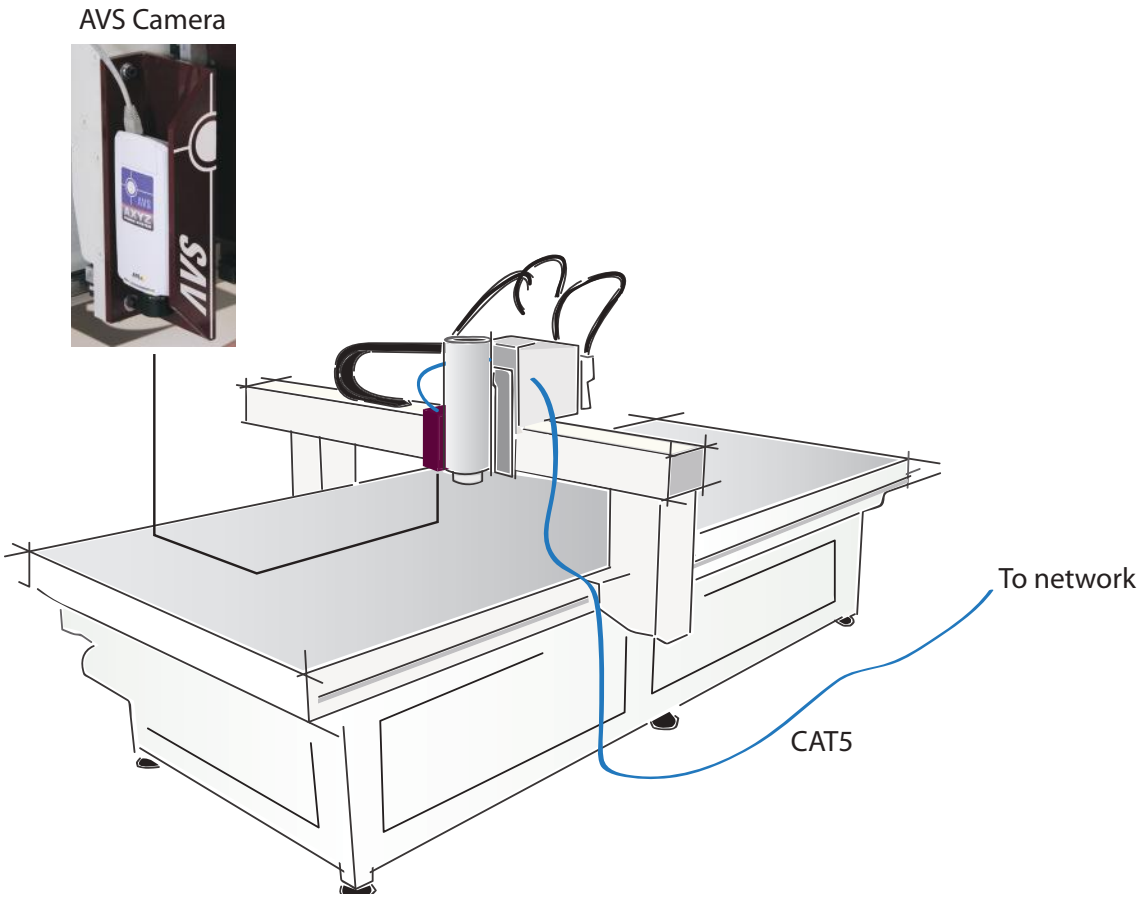


NOTE: Record the IP address, you will required for use in the GUI.

IP Address:_____

Shut down the camera manager and the browser.

The AVS Camera



Overview

The AVS Vision System consists of two parts:

1. The AVS camera which is generally an IP camera plugged into your network. It can be pretty much any camera mounted on the machine's carriage that will generate a video image. The AVS Vision system really doesn't care what camera it is as long as it produces a video image.

2. The AVS App which is a piece of licensed software that runs inside the A2MC Setup GUI and connects to the A2MC controller. The AVS App is what enables you to move the machine and run tasks like "print to cut".

AVS can be used with most machine configurations. This is also true if advanced CAM features like tabs, complex multi pass, profile bits, or any other similar features are required.

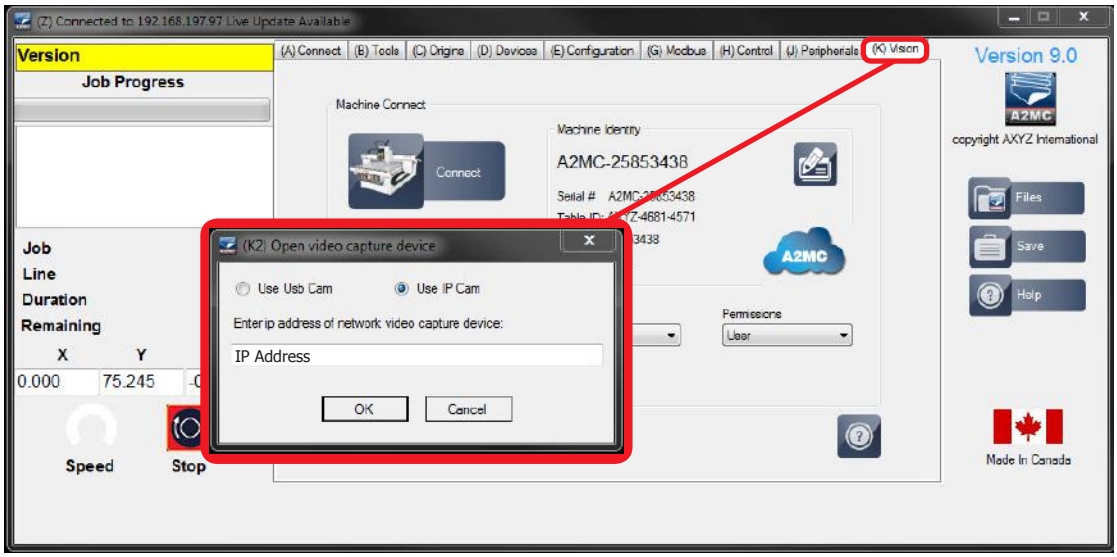
The actual AVS camera system is quite simple, it consists of a IP Camera that is plugged into your network thus generating a IP address.

The AVS camera is mounted on the side of the carriage so that it is about 6 inches or 150 mm above the surface of the table.

Shielded, stranded CAT5 cable must be used to run through the machine's cable tracks. Normal CAT5 cable typically used to wire up networks is solid wire and must not be used. It will break!

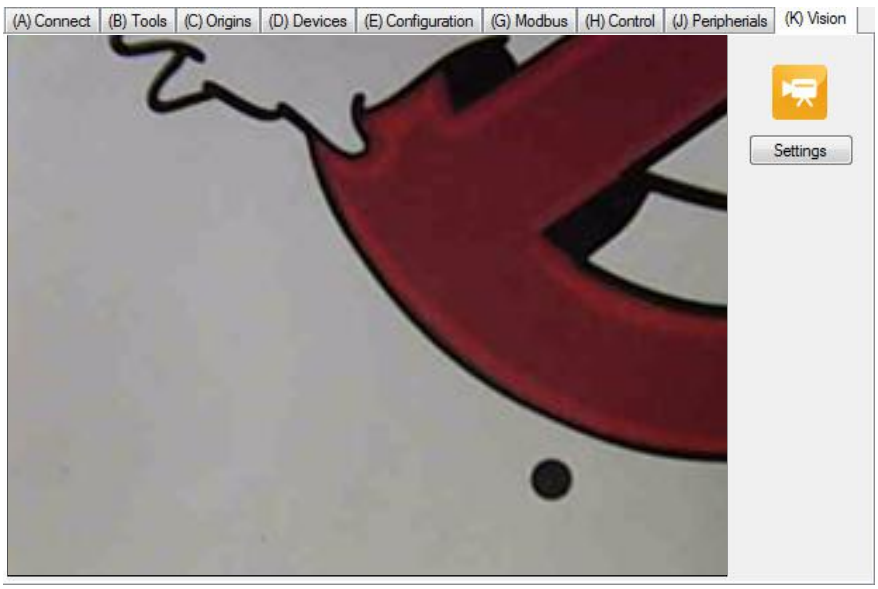
The cable is run through the machine and out to the network.

AVS Application (App)



To start the AVS App connect the A2MC setup GUI to the machine and select the "Vision" tab.

The " Open video capture device" form will open.



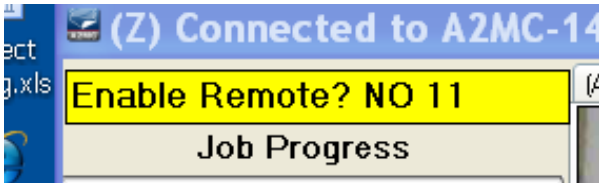
The AVS App will now try to open up the camera and obtain a video image.

If everything is working right you will get a screen that looks like this after a few seconds.

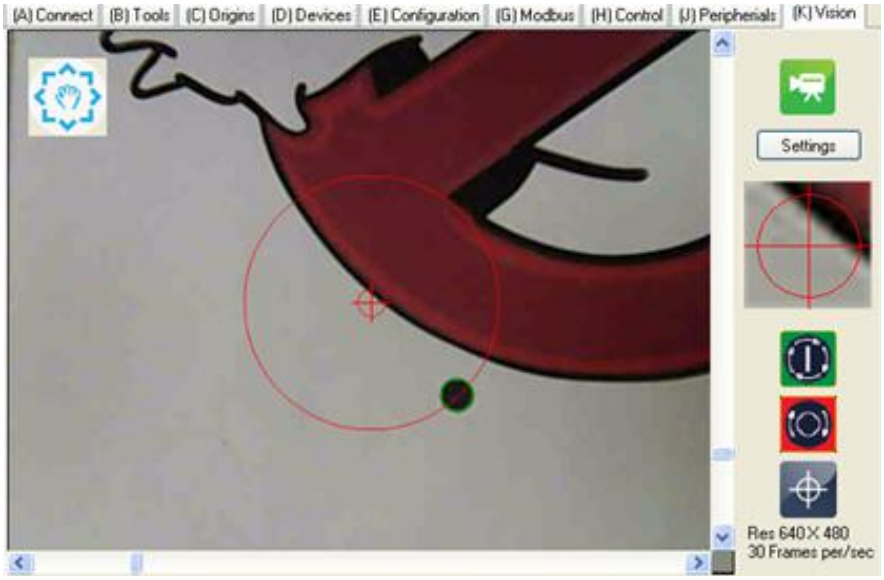
A 640 by 480 pixel, full colour, image should appear. If it fails check the trouble shooting section at the end of this manual.

At this point the video image is connected to the AVS App but the AVS App is not yet connected to the machine.

Click the orange "camera button"...



The operator console will ask to enable remote operation. This is a safety requirement of any app that will remotely operate the machine. You have 15 seconds to go to the machine and select “YES”.



Once the machine “remote” is enabled the full AVS App will appear on the screen.

The resolution of the video and the frame rate is shown in the lower right and should be 640 x 480 and at least 15 frames per second.

The various features of the AVS App are discussed in subsequent sections.

AVS License

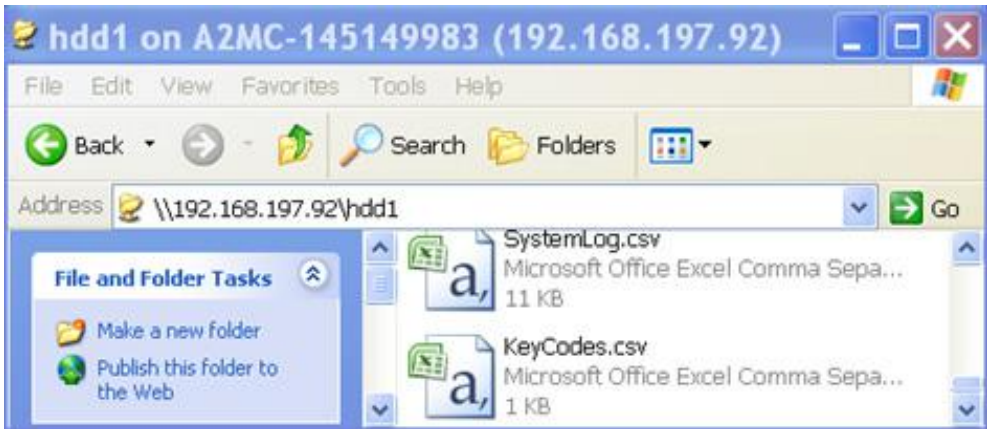
The AVS App does require a valid license. The license is connected to the machine itself so any number of computers can have the AVS App installed but the App itself will only work on a licensed machine. If the machine does not have license then the following screen will appear:

"N1" is a number that is unique to every A2MC. It is actually part of the MAC ID of the mini ITX computer in the A2MC. "N2" is the table ID of the machine.

In order to obtain a license request the AVS key from AXYZ CPS.

Once the key is obtained type it into the appropriate field and click the "check". The A2MC will now be AVS enabled.

A "KeyCodes.csv" file will be created on the A2MC compact flash as shown below:

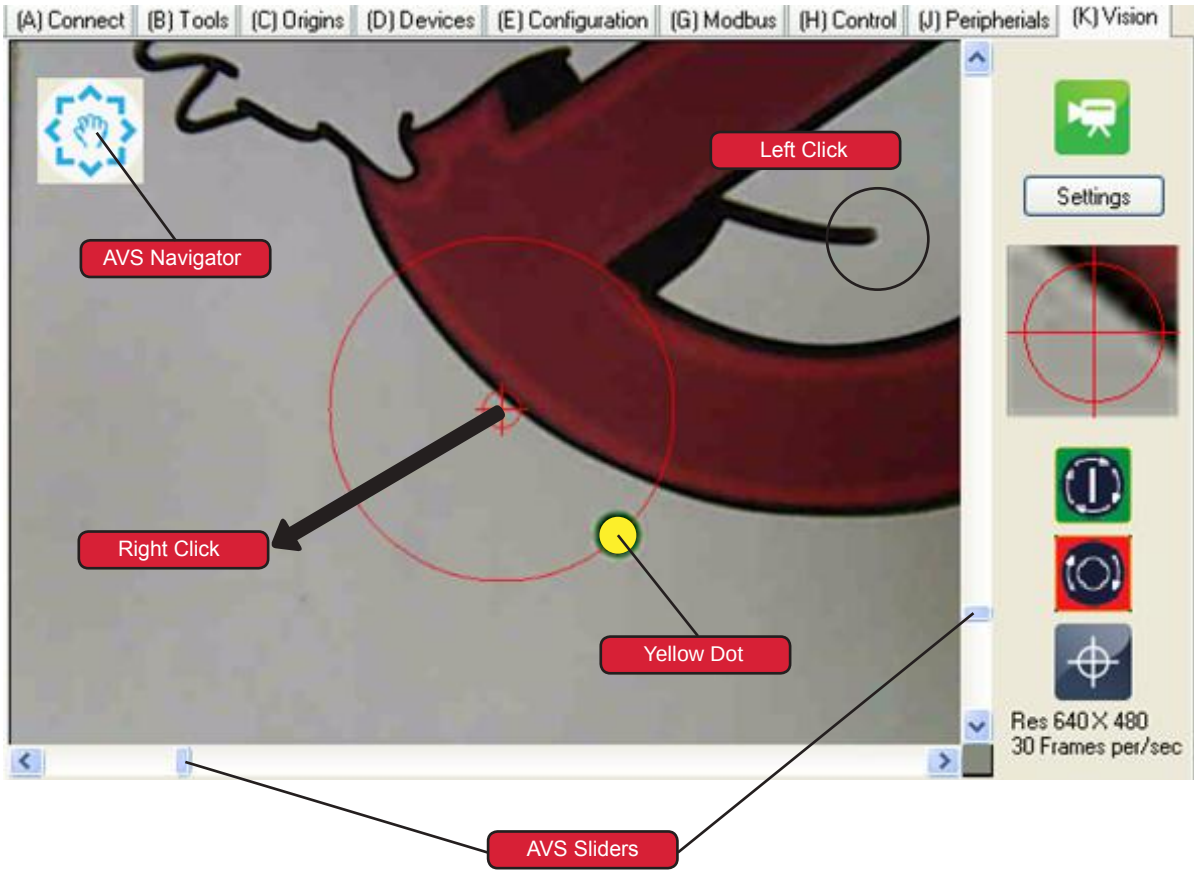


As long as the "KeyCodes.csv" file, the A2MC itself, and the table ID stay the same the AVS App will be enabled. If any change, by changing the A2MC hardware, losing the file, or changing the table ID the AVS App will be disabled.

Since it is possible that the A2MC fails or something gets lost it is very important that the correct customer details are supplied with the license request so that replacement licenses can be issued if required.

AVS Jogging Controls

The AVS App has a number of jogging controls:



There are five jogging methods; “Navigator”, “Left Click”, “Right Click”, “Sliders”, and “Yellow Dot”.

AVS Navigator

This works just like the navigator on Google maps, it even looks like that navigator. Clicking on any arrow will simply jog the machine half a screen (about 3 inches or 75 mm) in the indicated direction. Clicking on the “hand” in the middle will simply back up the moves. If the machine is too close to the edge of the table then the arrows in that direction will not work.

Left Click

Left click is used by simply pointing to a place on the screen where you want the machine to move and left clicking on the mouse. The machine will move to that position. You can left click anywhere on the screen.

Right Click

Right clicking anywhere on the screen will create a red arrow from the centre of the screen to the clicked location. As long as the right button on the mouse is held down this arrow will remain, when you let go the arrow disappears. The machine will jog in the direction of the arrow and at a speed proportional to the length of the arrow, short arrow is a slow jog, long arrow is a fast jog.

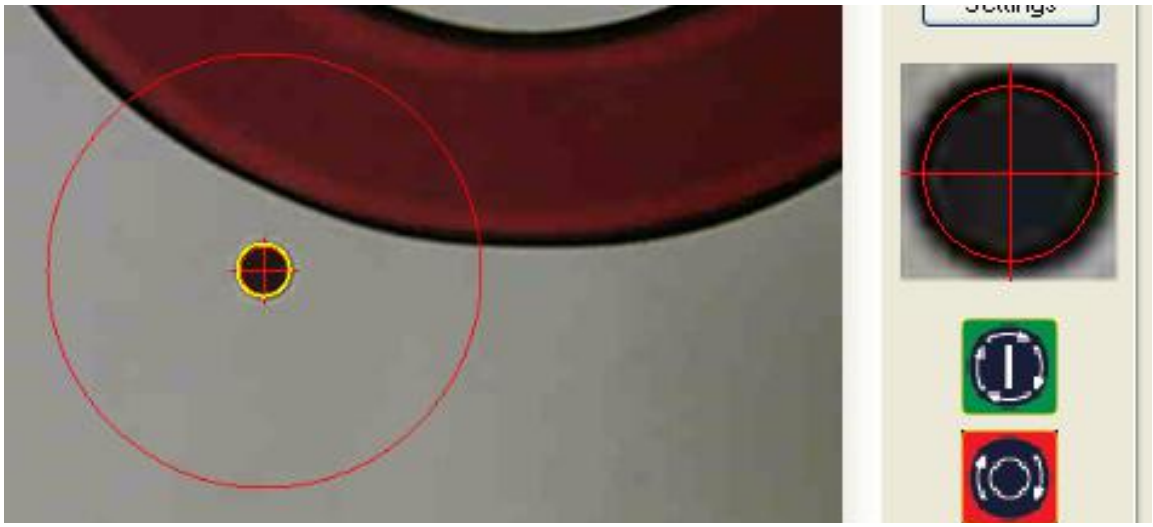
AVS Sliders

The sliders allow you to jog quickly anywhere on the table. There is an X and a Y slider. The ends of the sliders are the extents of the machine. Holding down and pulling the slider to any position will rapidly move the machine. Be careful with this control as you can move the machine from one end to the other at full speed!

Yellow Dot Command

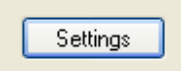
Yellow dot commands are initiated by simply left clicking into the middle of any dot that is visible on the screen and has either a yellow or green border.

When you click on it a yellow dot will appear in the centre of the dot and the machine will automatically move to exactly center the dot:



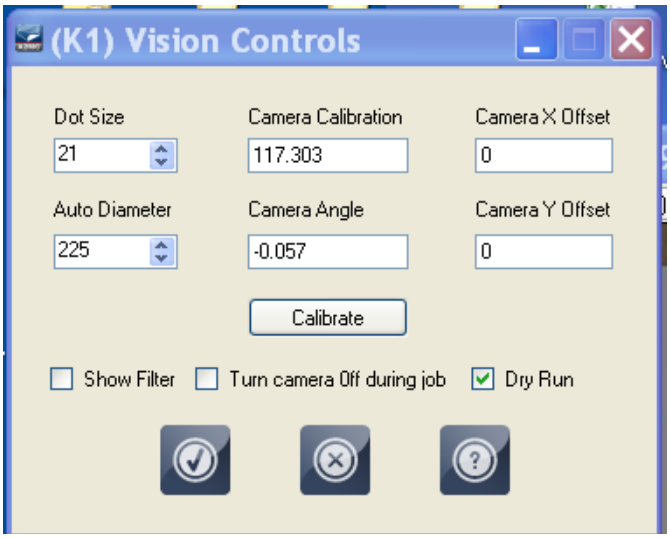
Vision Control

The sliders allow you to jog quickly anywhere on the table. There is an X and a Y slider. The ends of the sliders are the extents of the machine. Holding down and pulling the slider to any position will rapidly move the machine. Be careful with this control as you can move the machine from one end to the other at full speed!

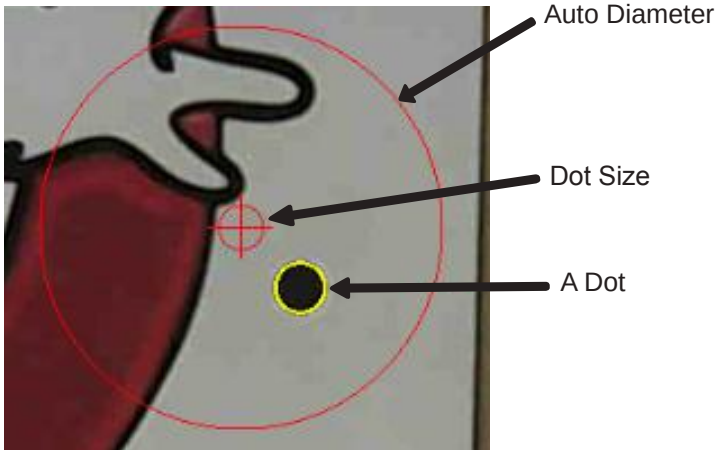


The Vision Controls are accessed by clicking the “Settings” button.

The following form will appear that control how the AVS software will work:



Dot Size and Auto Diameter



Vision Control

Both the dot size and the auto diameter are measured in “pixels”.

The dot size should be set to approximately match the size of the dots that will be normally used. Position the camera so that at dot is visible near the centre of the screen. Adjust the dot size until the dot is circumscribed by a yellow border.

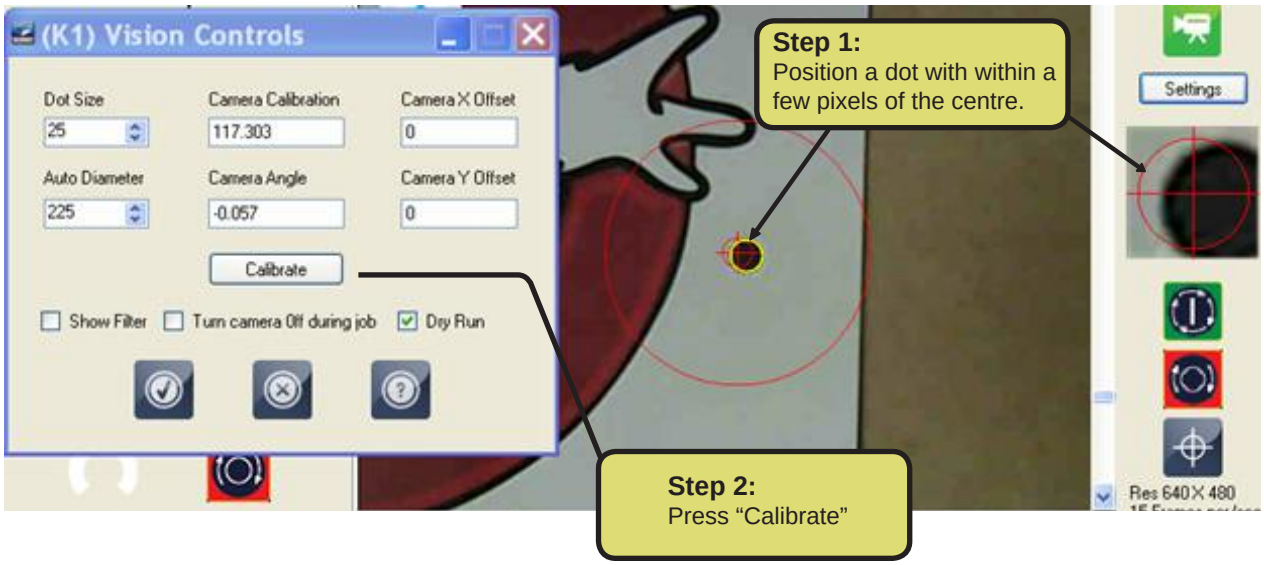
The auto diameter determines the automatic search radius when the AVS system is looking for dots. This value varies by the operator preference. Set it initially to about 200 pixels and then as you use the system make adjustments that work best for your types of jobs.

Camera calibration and Camera Angle

Cameras' resolutions are measured in pixels. The machine's resolution will be either in inches or millimetres so there needs to be a conversion between pixels and inches or millimetres.

The camera calibration will be in either pixels per inch or pixels per millimetre. The exact value will depend on how high the camera is actually installed above the material but is normally around 100 pixels per inch or about 4 pixels per millimetre.

The camera is often not installed perfectly square to the X and Y axis so there is a camera angle adjustment for that measured in degrees. The camera should be mounted so "camera top" is the positive Y axis so the camera angle is usually quite small, normally between -2 and +2 degrees.



Calculating the camera calibration and the camera angle is done automatically by:

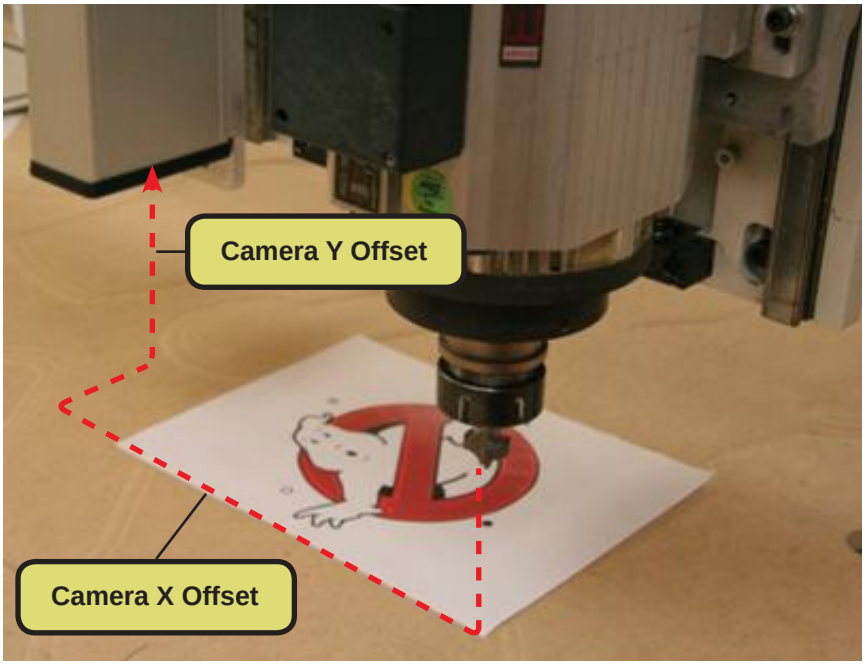
1. Position a dot within a few pixels of the centre of the screen as shown. The dot must be circumscribed with a yellow border. You can either jog the machine to the dot or simply move the dot under the camera.

2. Make sure the Auto Diameter is set to at least 200 pixels. You can always shrink it later but the calibration is more accurate if the auto diameter is set larger.

3. Press "Calibrate".

4. The machine will move the dot around the inside of the auto diameter and will take sufficient measurements to calculate both the camera calibration and the camera angle. These values will automatically be placed into the form.

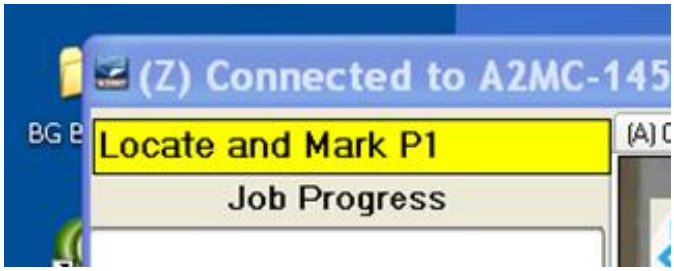
Camera X and Y Offset



The camera X offset and camera Y offset is the distance from the centre of the tool in Position 1 to the centre of the camera image as shown on this diagram.

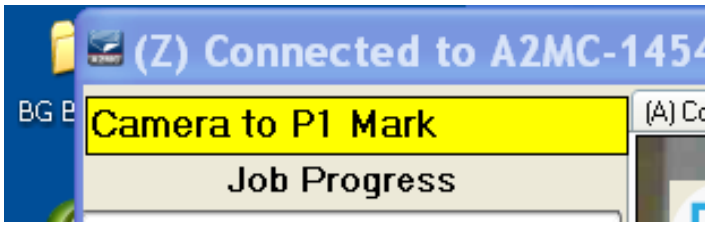
If you have a multiple position machine always measure the camera from position 1. All the rest of the offsets will then be calculated correctly.

These offsets can be typed in manually however they are also calculated as part of the calibration process. After the camera calibration and camera angle are calculated the operator console will prompt:

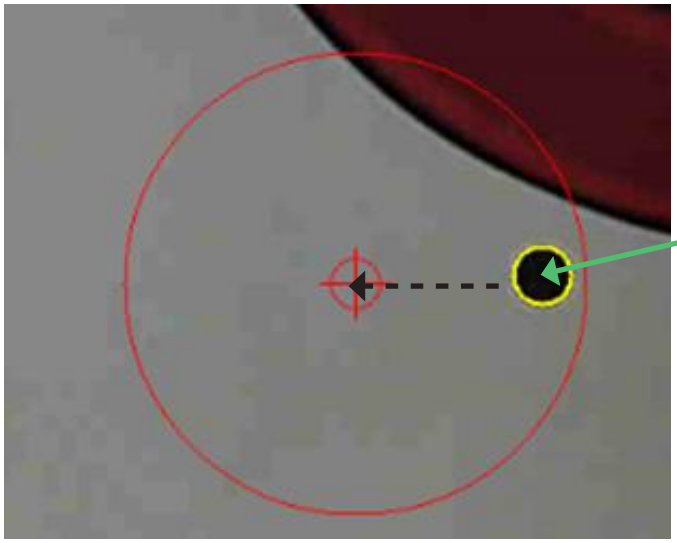


You can either use the jog keys to locate position 1 (P1) directly over a printed dot or you can drill a ¼ inch (6 mm) hole with position 1 (P1) into a white piece of plastic.

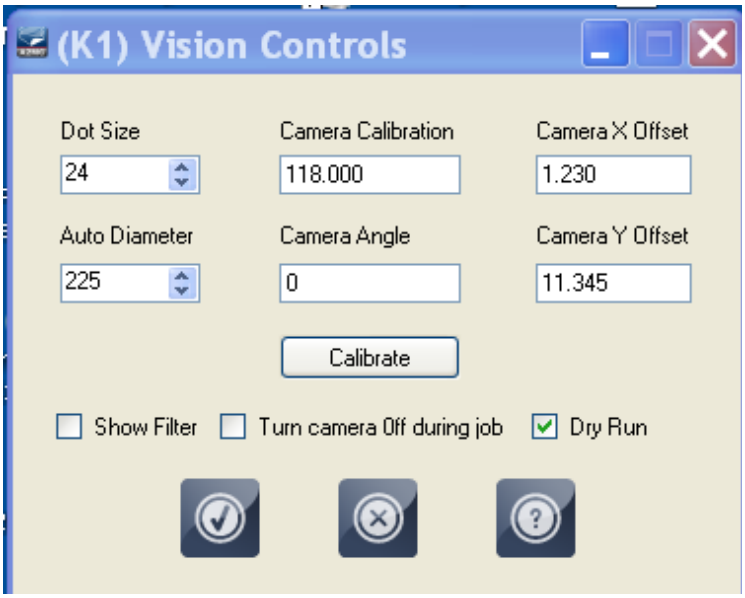
Either way you need to align the centre of a dot exactly with the centre of the tool in P1.



Once the tool inn P1 has been located the operator console will prompt, “Camera to P1 Mark”. Return to the AVS software and use the jog features to move close to the dot that was marked.



Once it is visible on the screen simply click into the middle of the dot and the AVS software will command the machine to find and centre the dot.

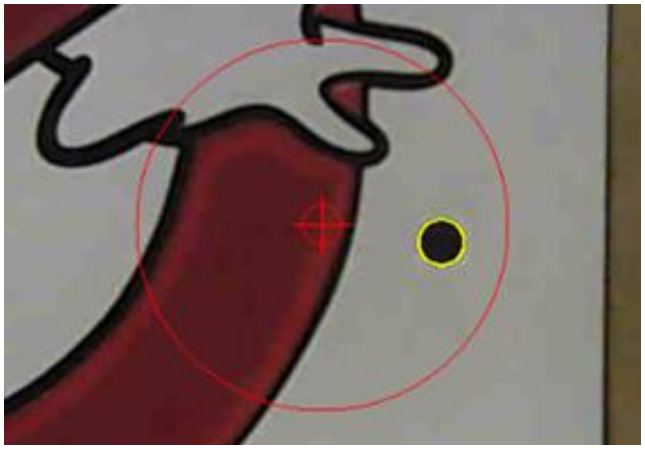


Once the dot is centered the Camera X Offset and Camera Y Offset will be calculated and the values filled into the form as shown below.

Camera Filter

In order to properly “find” black dots on white backgrounds the AVS software filters the camera image. This filter can be viewed by checking the “Show Filter” feature in the Vision Controls form.

Filter OFF



Filter ON

Normally leave the filter off in order to get a full colour image on the camera. However, the filter can be turned on to check if the camera is producing a clean image. If the camera is out of focus or the ambient light is insufficient then the filtered image will clearly show any problems.

Turn Camera Off During Job

Sometimes all the equipment such as vacuum pumps, spindles, and dust collectors will interfere with the camera and cause the software to crash or the camera to disconnect unexpectedly. The camera is not really needed while a job is running so it can be turned off to avoid these interference problems. The camera will automatically re-connect after the job is complete.

Dry Run

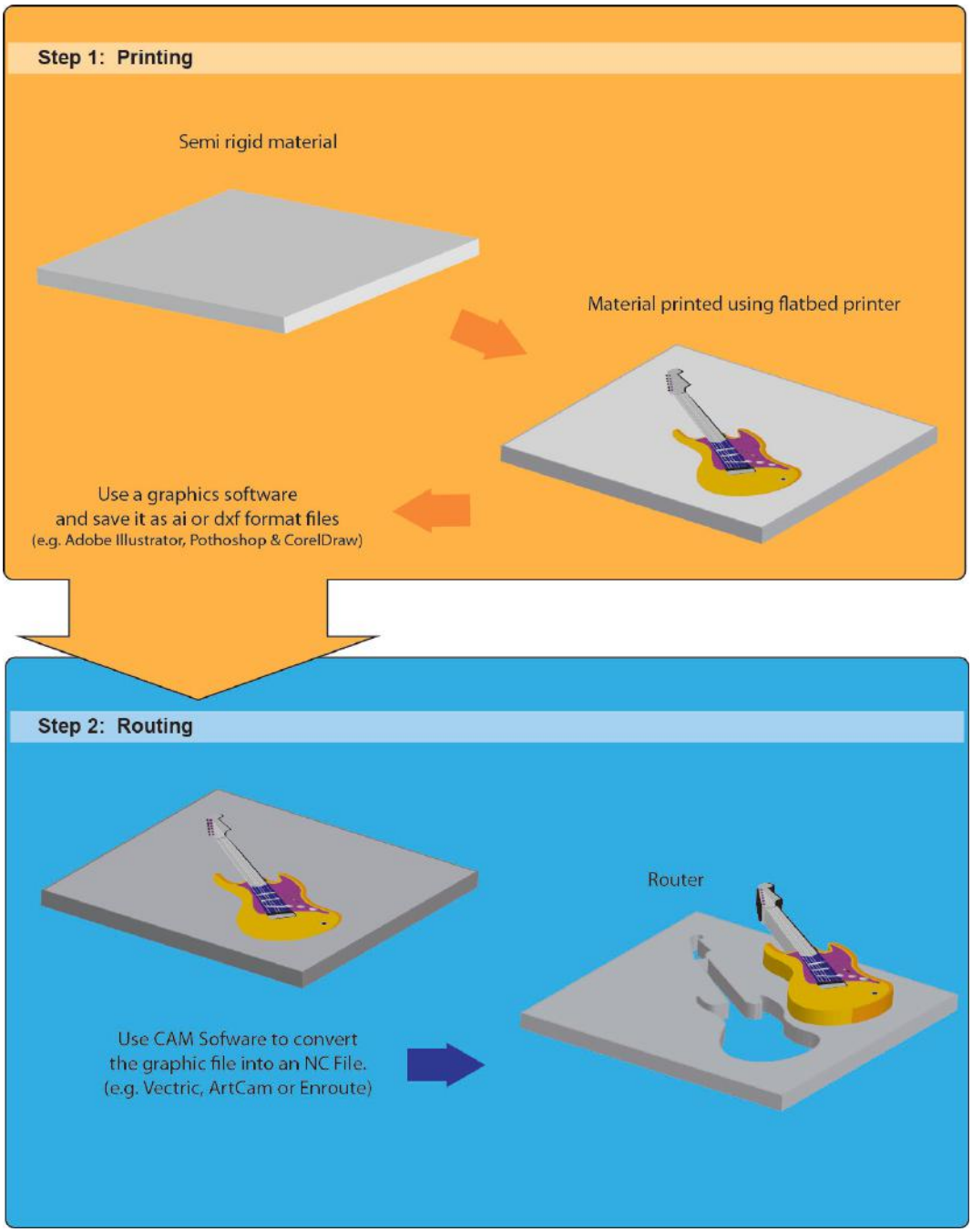
If Dry Run is selected the job will run without actually lowering the spindle and without turning the spindle on. This feature is very useful for training purposes as well as testing out a job to see if things line up before actually cutting into the material.

Print to Cut

Print to cut is a two step process:

1. An image is printed onto usually a rigid or semi rigid material using a flatbed printer.

2. The image is mechanically cut out using a router table or knife cutter.



The process starts by creating a graphic using some sort or graphics software. In the example above the graphic is a green smiley face. The graphics software can be anything that will operate the printer but likely the most popular is Adobe Illustrator.

The material is loaded on to the flatbed printer and the image from the graphics software is printed using the appropriate printer driver as shown on the right side of the diagram.

The graphics software also exports the cutting outline in either “.ai” or “.dxf” format. The “.ai” or “.dxf” file is then imported into a CAM (computer aided manufacturing) software such as Enroute, ArtCAM, or Vectric.

The CAM software then generates an “.nc” format file that the router table can understand.

Finally the router table runs the nc file and cuts out the printed image for the final product.

Alignment

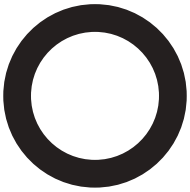
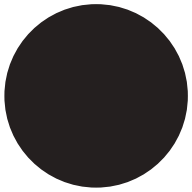
The challenge of the above process is to accurately align the cut file being run on the router to the image printed on the material by the flat bed cutter.

This is done by printing a number of dots on the material outside of the image:

The dots should be black and about 0.25 inches or 6 mm in diameter. They should be well spread out. There should be at least three dots with four or five being optimal. The centre of these dots are then located by the AVS camera, processed by the AVS software which then adjusts the cutting file to exactly match the printed image.

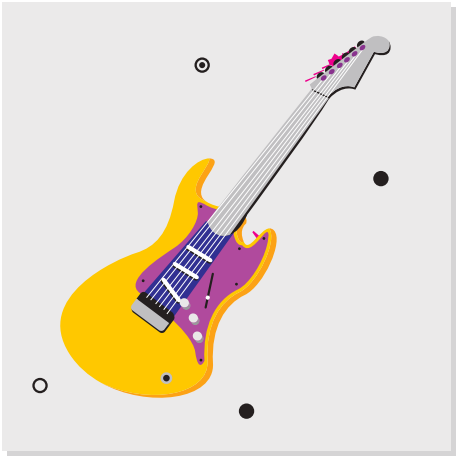
Dot Types

The dots can be all the same but this method has the disadvantage in that it is sometimes difficult to know which dot should be located first and which dot is second. The AVS software can recognize three different types of dots:

Type A Type B  Type C 

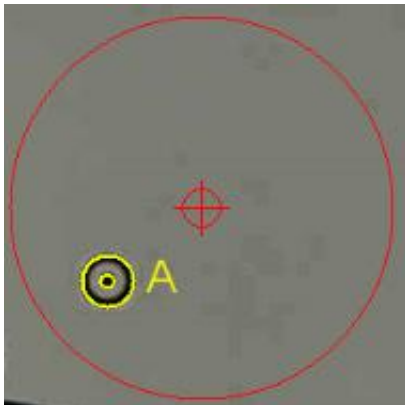
Type A is a “target” and is the first dot the software will search for, type B is a donut or annular ring and is the second dot the software will seek, all the rest of the dots are type C and are simply dots.

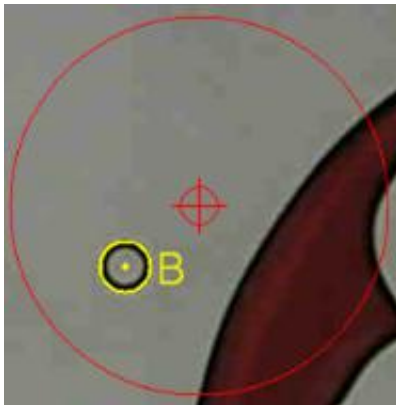
If dot types A and B are used then there must be only one of each in the printed image, all the remaining dots are then type C:

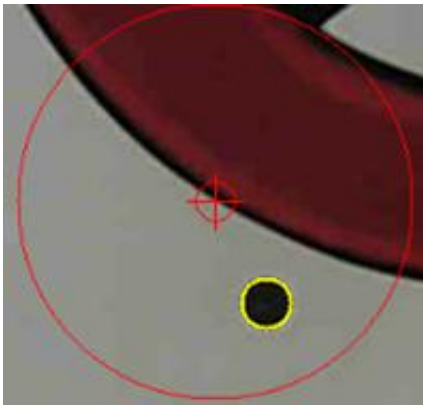


This diagram shows a typical printed output from the flatbed printer using one type A, one type B, and two type C dots.

On the actual AVS operator's screen the different dot types appear as follows:







Note that dot type C is not labelled

Creating Dot Types

It is important that the dot types are created properly in Adobe or whatever graphics software is being used.

WRONG!

When creating the annular ring or "type B" the wrong way is to create a circle and then give the outline a thickness as shown on the left.

RIGHT!

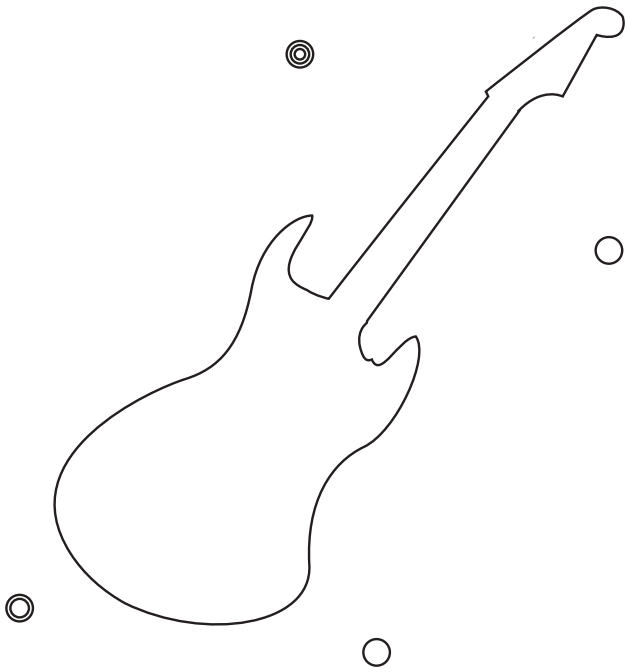
When this gets exported as an outline to the CAM program all you will get is a single circle indicated by the red dashes.

RIGHT!

The right way is on the left. Put a white dot into the centre of a black dot. Now you will get two outlines as shown. For a "type A" dot put a third black dot in the middle to get a third outline.

Importing into CAM Software

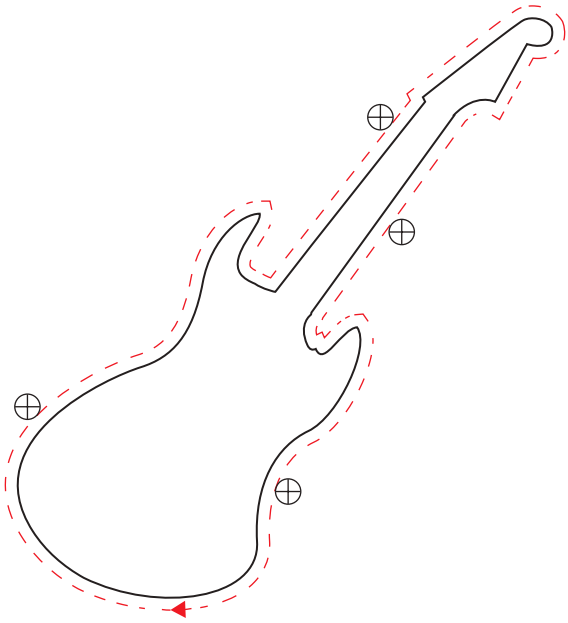
The next step is to export the cut outline and the dots to the CAM software. Once imported into the CAM software the file should appear as shown below:



Note that the cut file is now a single large shape as this is the outline of the guitar. The type C dots are simply small circles. Type A dot are three concentric circles and type B dots are two concentric circles.

Tool Pathing the Cut Outline

The actual cutting outline is tool pathed using whichever tool is required to cut the material. All the dots must be pathed as “drill” points and assigned as tool 1000 (T1000). The AVS system recognizes tool 1000 to be a dot that will be searched for by the camera.



The dots must be sequenced first, before any of cutting contours.

It does not matter the order of the dots as the AVS software will find the type A dot first, the type B second, and it really doesn’t matter what the order of the rest of the dots is.

It also will not matter what the depth of the drill is.

The NC File

The nc file (smiley.nc) generated by the post from the CAM software must output the dots as drill points first followed by the normal tool path:

G20G90	Inches and absolute mode
M6T1000	Set to tool 1000 (AVS Camera)
G0X1Y1	
G1Z0	
G0Z3	
G1Z0	This is a double drill point so dot type B
G0Z3	
G0X1Y11	
G1Z0	
G0Z3	
G1Z0	
G0Z3	
G1Z0	This is triple drill point so dot type A
G0Z3	
G0X11Y11	
G1Z0	Single drill point so dot type C
G0Z3	
G0X11Y1	
G1Z0	Single drill point so dot type C
G0Z3	
M6T1	Set to cutting tool T1
G0X1Y6	
G1Z0	
G2X1Y6I6J6F300	Cut the guitar outline at 300
G0Z3	
M30	End of cutting file

This is the file that must be downloaded to the A2MC controller to run the machine.

Sample Files

Sample AVS cut files are available for download at the following link:

http://www.a2mc-cnc.com/avs.html

The downloads are available by clicking the icon in the lower left corner of the web page. A “zip” file with a number of folders will be downloaded.

Each folder is separate job and will include 5 files:

1. An “.ai” file that is the entire graphic. This can be opened up in Adobe Illustrator.

2. An “.ai” file that contains just the outline of the graphic and the registration dots. This is the file that can be imported into your CAM package.

3. A “.dxf” file that contains just the outline of the graphic and the registration dots. This is the exact same file as number 2 except in “.dxf” format. Some CAM packages do not do well with “.ai” files so this is an alternative.

4. A “.pdf” file of the graphic. This can be used to print your own graphic to try out on the machine. All the graphics are small enough to fit on a normal printer.

5. Finally a “.nc” file which can be downloaded to the machine and run.

The quickest way to learn how to use the AVS system is to print the “.pdf” graphics supplied in the sample files and download the associated “.nc” files in the A2MC controller. Once you have the sample “.pdf” and “.nc” files running as you expect simply work backwards through your graphics and cam software using the attached “.ai” files. I little experimentation and you should get the hang of how it all works.

Running Ghostbusters

One of the folders has the “Ghostbusters” AVS files. Open the pdf file and you should see the image on the left.

Print it the image on any printer. It can be black and white or in colour.

Note the four registration dots on the image.

There is one type A dot at the top, one type B on the left side and the lower and right hand ones are type C.

Lay the printed image on top of the machine.

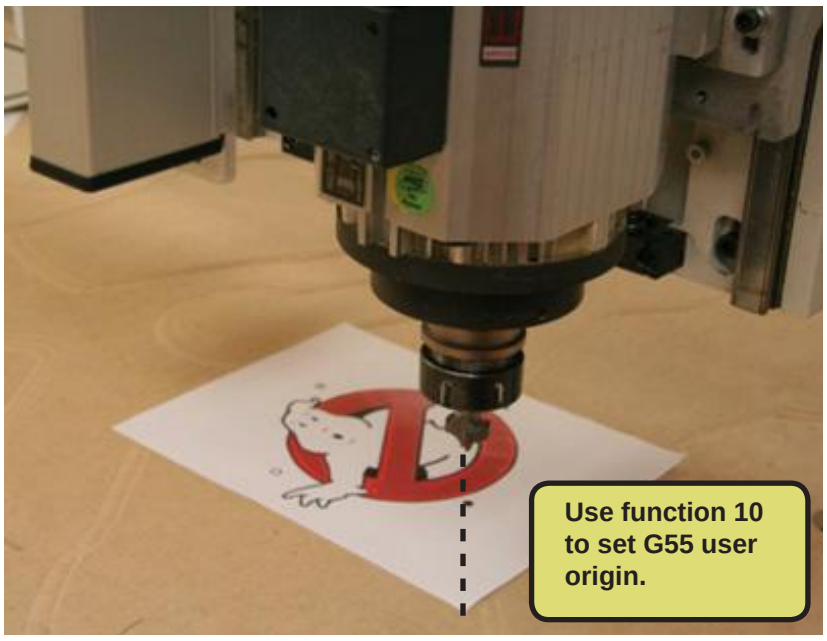
Download the “ghostbusters.nc” file into the A2MC Controller.

The first time you run the job you should put the AVS software into “Dry Run” mode by checking the box in the Vision Controls form. You get to this form by selecting “Settings” from the main Vision tab.

The AVS system will stay in “Dry Run” until you uncheck it.

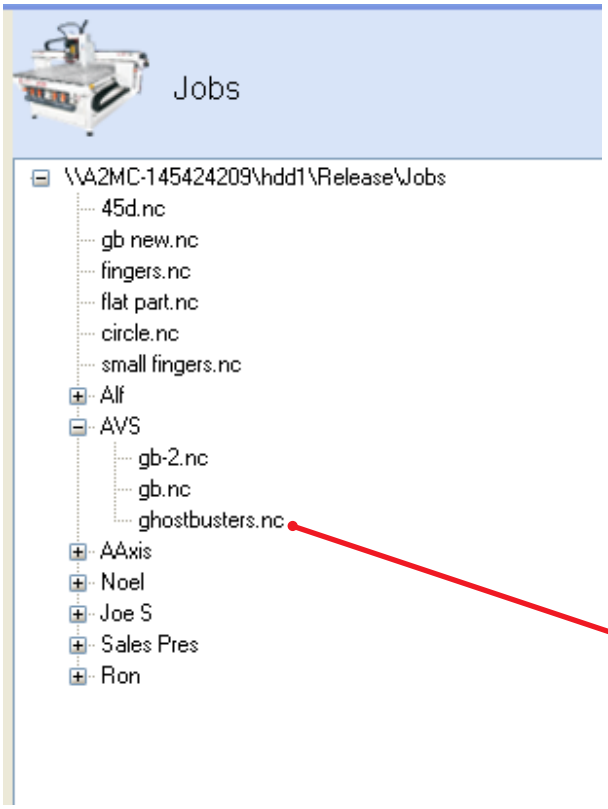
Dry run will simply run the job in the air so you can see what is going on. Once you are ready uncheck it and the AVS system will run the full job.

The next step is to set the G55 origin of the job close to the lower left corner of the sheet of paper as shown below:



The next step is to set the G55 origin of the job close to the lower left corner of the sheet of paper.

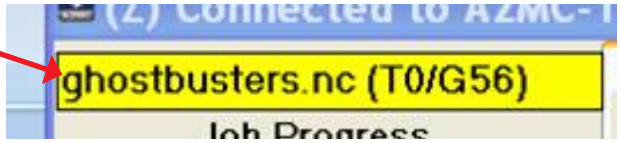
The reason you need to do this is so that the camera will get close enough to the first dot so that the AVS system can find it automatically.

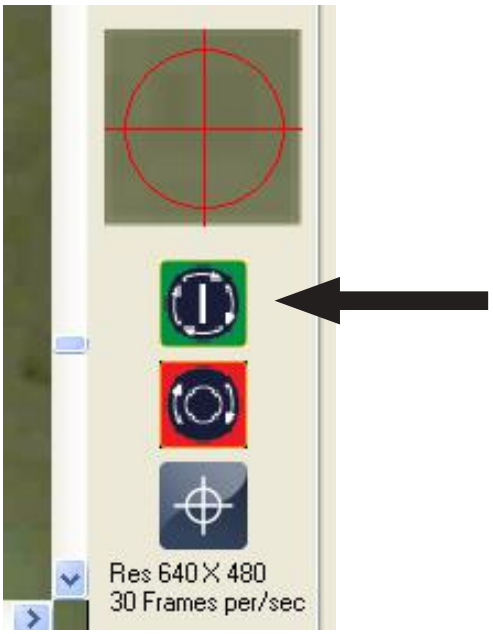


The ghostbusters job needs to be selected. This can be done by clicking on the file key in the Setup GUI:

Find the job in the directory, right click and click on “Select”.

Alternatively the file button can be used on the operator console. Either way “ghostbusters.nc” needs to become the active job:

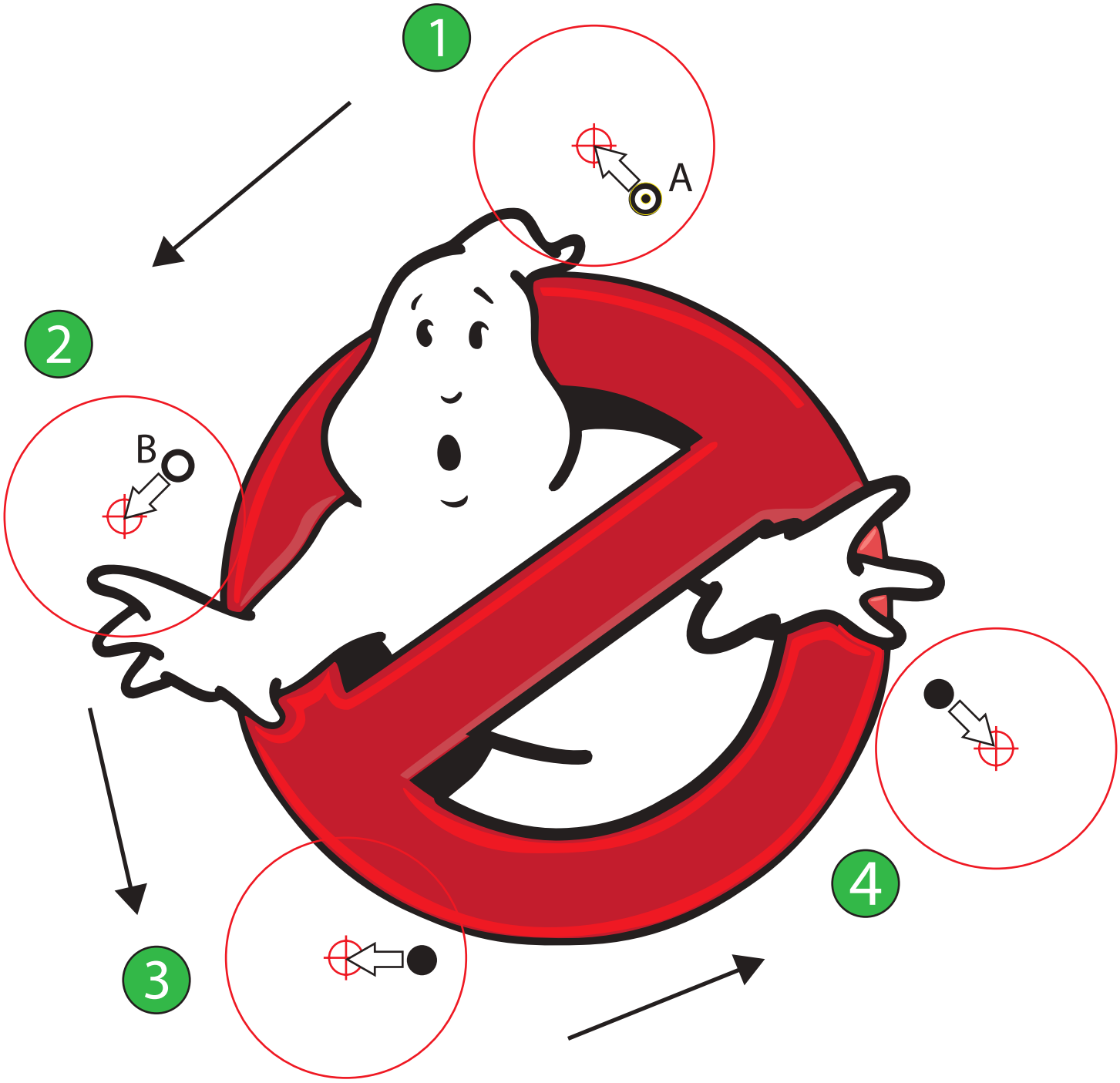




Once the AVS software has been set to “Dry Run”, the origin has been set to the lower left corner of the “material”, and the ghostbusters.nc job has been selected the job is ready to run.

Click on the START key to run the job.

The machine will now search for each of the dots in sequence starting with the Type A dot, then the Type B dot, and then all the rest. In this job there are four dots. Each one will be “found” and the machine will centre itself over the dot and move on to the next one as shown by the number diagrams on this page.



If the AVS is set to “Dry Run” the machine will retrace all the dots and check and report on the accuracy. You will see this on the display as well as it is printed out in the activity log:

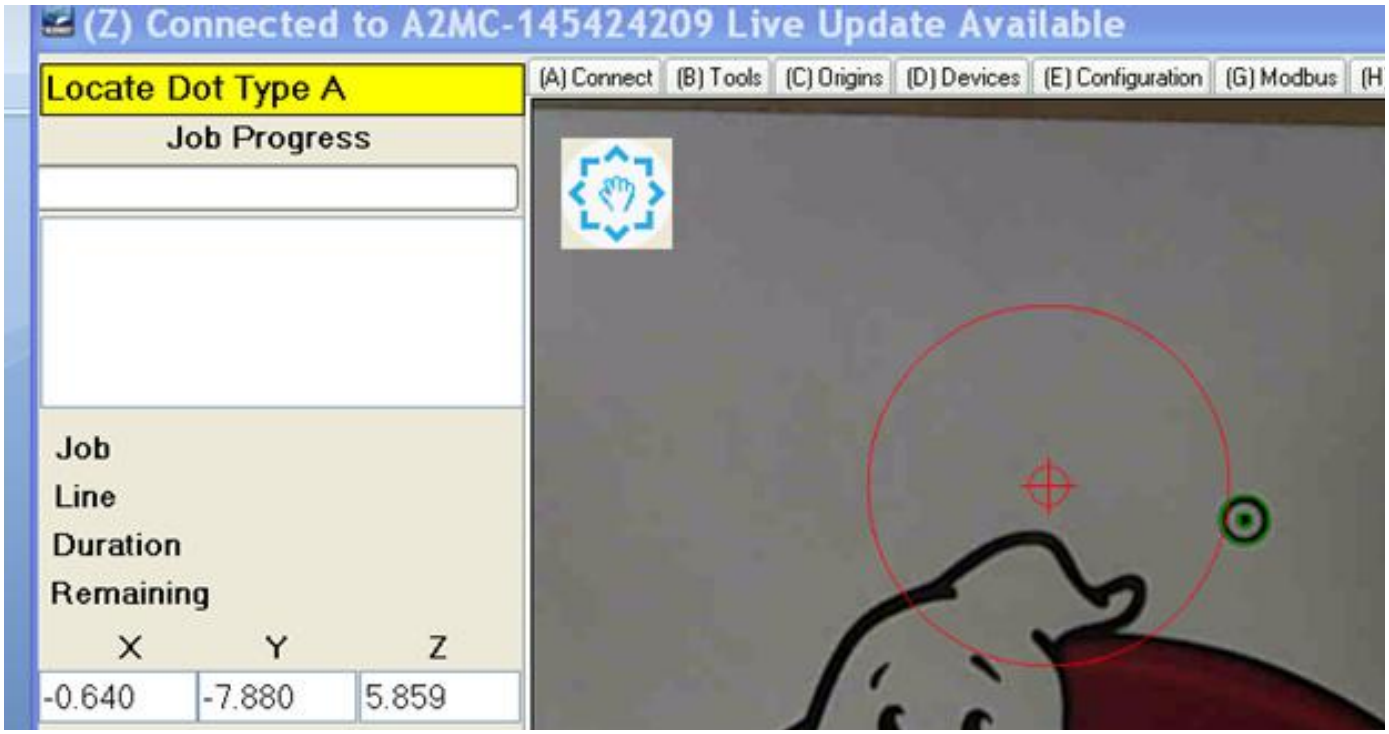
- 4:44:25 PM Dry run dot testing started...
- 4:44:25 PM in stretchy. XSCos= 1.0014 YSSin= -0.0080 YSCos= 0.9997 XSSin= -0.0117
- 4:44:25 PM offset X = -5.374 offset Y= -17.577
- 4:44:29 PM dot #1 x=0.379 y=-8.049 dx=0.008 dy=0.000
- 4:44:34 PM dot #2 x=-3.522 y=-10.217 dx=0.004 dy=-0.004
- 4:44:38 PM dot #3 x=-1.529 y=-14.333 dx=-0.004 dy=-0.004
- 4:44:42 PM dot #4 x=2.777 y=-12.179 dx=0.004 dy=0.000
- 4:44:42 PM ....Dry run dot testing ended.

The displacement values dx and dy are shown in inches and should be less than 0.01 inches if everything is working properly.

The operator console display will prompt you to start the job by pressing the START again.

The job will run in dry run mode with the camera running exactly over the image so you can watch on the computer screen exactly how closely the image is traced out.

The only difference when not running in “dry mode” is that the dots are not retraced and the spindle will actually cut on the image.



If the origin is off by a considerable distance or the image is severely rotated out of place the first and/or second dot might be significantly out of place and outside the auto circle as shown in the example above.

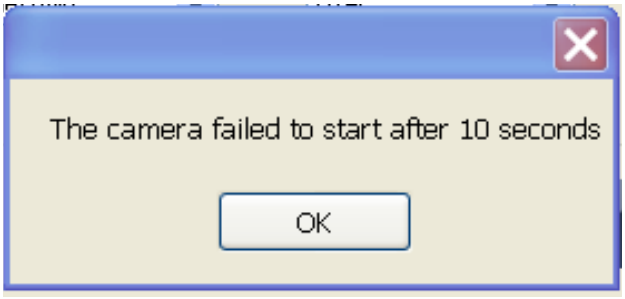
In this case the operator display will prompt you to locate the correct dot type. Simply jog until the correct dot appears on the screen and click on the dot. The dot will center and the AVS will proceed to find the rest of the dots.

After the second dot the AVS system will have calculated the correct origin and rotation adjustment and it should find the rest of the dots without further operator intervention.

To get familiar with the AVS system use the three sample files and practice rotating and shifting the sample jobs around on the table.

Trouble Shooting

Camera not Connecting



The AVS software will attempt to connect to the camera and obtain a “live” image. I after 10 seconds it cannot “see” an image you will get this message.

This message usually indicates that the camera is not working or the camera driver is not working. Often this is a result of the driver not being compatible to the version of Windows operating system you are using. This needs to be checked.

If the AVS software cannot see the camera then neither can other camera software utilities. The best way to trouble-shoot this problem is to use the “Scanner and Camera Wizard” utility that can be found under “Accessories” in your programs list. This utility is standard with Windows: