## **CNC Vision Setup**

This manual is designed to introduce the reader to the setup process of the CNC vision system, and some of its applications.

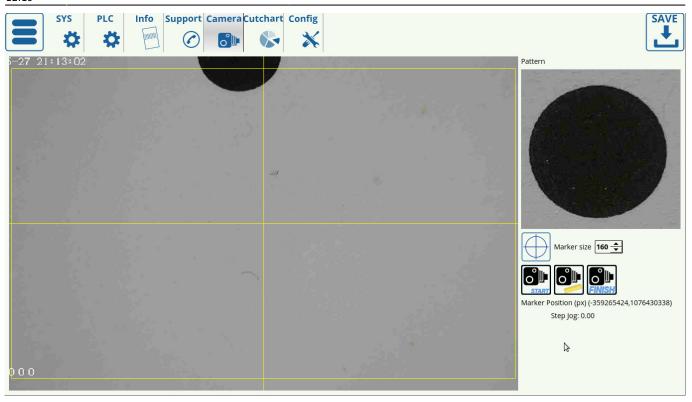
In order to set up the camera to work properly, you must go into the **CNC Settings > Camera**. The screen presented to you will be the one shown below:

Info Info Camera Config Config		SAVE
CNC Settings Axes/Motors	Camera interface	IP Camera 🔻
<ul> <li>Inputs/Outputs/Sensors</li> <li>Network</li> </ul>	IP Camera initialization line	rtsp://192.168.0.80
Motion	Pattern Size	160
<ul> <li>PLC</li> <li>G-codes settings</li> </ul>	Region of Interest, px	1920 * 1080
DXF import settings	Coefficient Pixel-to-Length	0.02560 * 0.10000
Macro List Macro Wizard	Camera Shift, mm	99 * 99
<ul> <li>Probing Wizard</li> </ul>	Tool number assigned to Camera	99 🔔
Preferences     Screen	Camera Offset, mm	0 x 0
Work Offsets	Camera "Tool Length"	
Parking Coordinates ▶ Technology	Ignore Decoder Errors	X
Camera		
5 axes RTCP Panel/Pendant	Pattern Match Level	
▶ Hardware		
Advanced	95 85 75 65 55 45 55 15 5 15 5 15 15 15 15 15	Reset Min/Max Data

**Camera Interface** allows to choose between a camera connected through a USB cord or through LAN. If the camera is connected through LAN, the **Initialization line** must list the correct IP address of the camera, while the USB channel is used if the camera is connected through a USB cord.

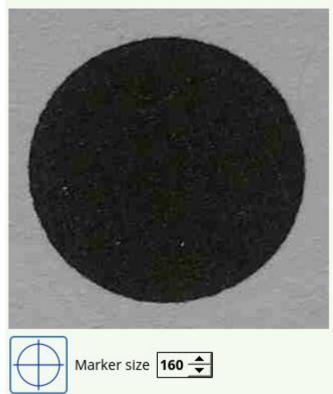
**Region of interest** (in pixels) signifies the area in which the camera is actively looking for markers, and should usually be set to be equal or slightly smaller than the actual resolution of the camera. When switching to the Camera tab, it can be seen that the region of interest is visually highlighted in yellow, as shown in the image below:

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**Marker size** can be set experimentally to be slightly larger than the marker itself, in order to account for the visual transition between the marker and its surroundings. In the case of the particular marker used in this scenario, its size has been set to 160 pixels. NOTE: The camera focus must be properly adjusted in order for the camera to recognize markers.

Pattern



**Pixel to length coefficient** is used to convert the pixels travelled into the actual physical distance moved, in mm. You are able to calibrate this for both the x- and the y-axes. In order to set up the

correct coefficient for your camera, use the Calibrate button in the Camera tab, or consult the full set of manual set up instructions below.

**Tool number** is usually assigned to be 10, however other tool numbers can be used if necessary.

**Camera offset** values are used to specify the distance from the camera to the working tool in the xyplane.

**Camera length** value is used to specify the distance from the camera to the working tool tip in the z-axis.

Ignore decoder errors flag is set to OFF by default.

**Camera Shift** describes the distance the machine will move by if it does not locate a marker after it has been instructed to look for one. This can happen when the marker is not fully within the region of interest, and then the camera will keep on moving around until it either finds the marker or reaches the end of this specified Camera Shift.

**Shift Speed** describes the speed with which the machine is moving during its camera shift phase while trying to find the marker.

**Pattern Match Level** describes the level of parity with the original reference marker that each new marker must have for the system to recognize it. Higher numbers mean less parity (more differences between the markers), so as to avoid false positives it is advised to keep the numbers on the lower end of the scale. The graph below the Pattern Match Level indicates the parity levels during the machine search for markers, with the low points of the graph being indicative of the places where marker parity is highest (differences between new marker and reference are lowest).

**Image sensor correction** corrects for sensors with different aspect ratios. Use this if the marker image appears distorted or stretched when viewed through the Camera tab in myCNC software.

## Setting up the pixel to length coefficients (older software versions)

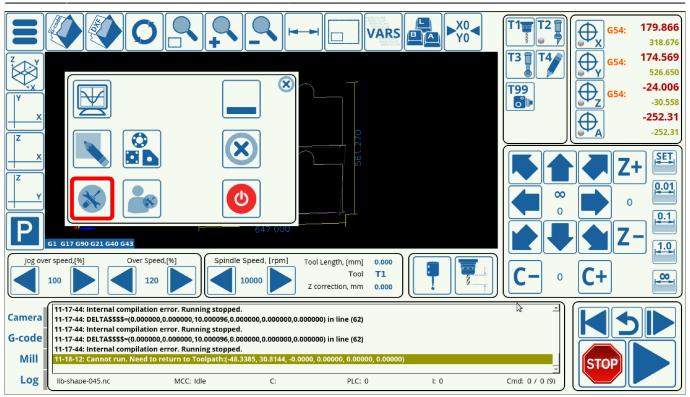
The pixel to length coefficient is necessary for the camera to know how many millimeters it had moved after having traversed a certain number of pixel to the left/right/top/bottom of its original position. This procedure is done by finding the ratio of millimeters moved to pixels travelled. While it is automated in the newer versions of myCNC software, it can also be done manually in the older software versions.

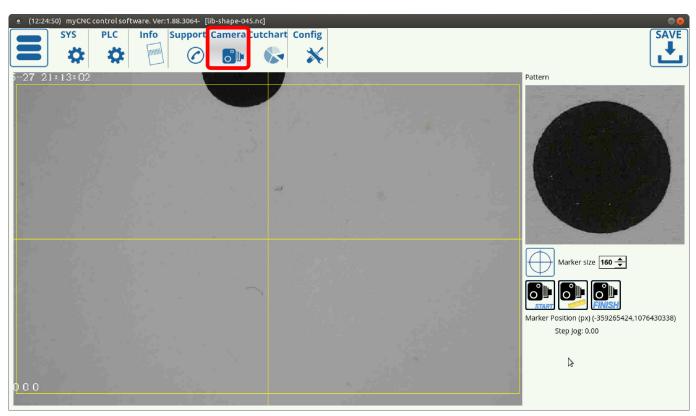
In order to do so:

1. Go to the Camera tab of the myCNC software

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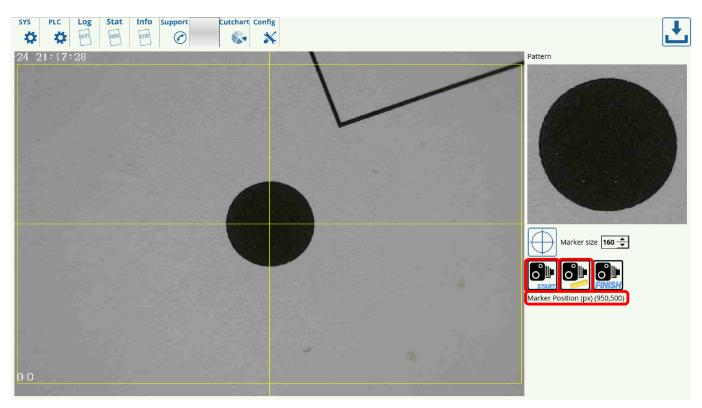




2. Move your camera to the center of the marker and press the **Center** button

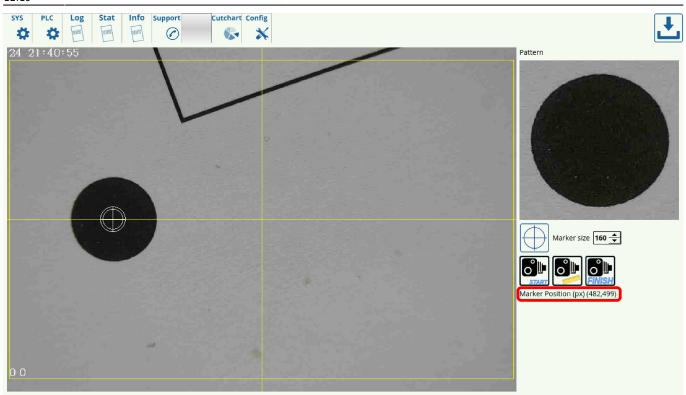


3. Press the **Start** and **Measure** buttons, and note the xy-position of the camera before moving it.



4. Move the camera some distance (in mm) and record that distance. Note the change from the original pixel xy-position, and find out how many pixels the camera has travelled over this movement. Divide the millimeters moved by the pixels travelled to obtain the pixel to length coefficient for each respective axis.

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For example, in this setup, the machine has moved 12 mm to the right, while the x-position value has changed from 950 to 482.

950 - 482 = 468 pixels 12 mm ÷ 468 pixels = 0.0256

Therefore, the pixel to length coefficient is 0.256

5. Input the new coefficient into the CNC Settings > Camera > Pixel to length coefficient and press Save

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Info Support Camera Config		SAVE CFG
CNC Settings Axes/Motors	Camera interface	IP Camera 👻
Inputs/Outputs/Sensors     Network	IP Camera initialization line	rtsp://192.168.0.80
Motion	USB camera channel	0
<ul> <li>PLC</li> <li>G-codes settings</li> </ul>	Region of Interest, px	1900 × 1000
DXF import settings Macro List	Marker size	160 🚖
Macro Wizard     Probing Wizard	Coefficient Pixel-to-Length	0.0256
Preferences	Tool number assigned to Camera	99 🔶
<ul> <li>Screen</li> <li>Work Offsets</li> <li>Parking Coordinates</li> </ul>	Camera Offset, mm	
<ul> <li>Technology</li> </ul>	Camera "Tool Length"	0
Camera 5 axes RTCP	Ignore Decoder Errors	×
<ul> <li>Panel/Pendant</li> <li>Hardware</li> </ul>	Camera Shift, mm	99 🔶 x 99 🔶
<ul> <li>Advanced</li> </ul>	Pattern Match Level	20 +
	95	Reset Min/Max Data
	Image sensor correction	X
1		

6. Repeat the procedure for the other axis.

After both axes have been calibrated, the machine will now have a proper coefficient of the number of pixels it moved by versus actual distance travelled in millimeters.

## Using the hotkeys to move the camera

In order to move the camera straight from the Camera tab, a set of hotkeys have been designed specifically for that purpose. Note that the hotkeys are only present in the more recent versions of myCNC software. Please update if the camera hotkeys are not present in your profile version.

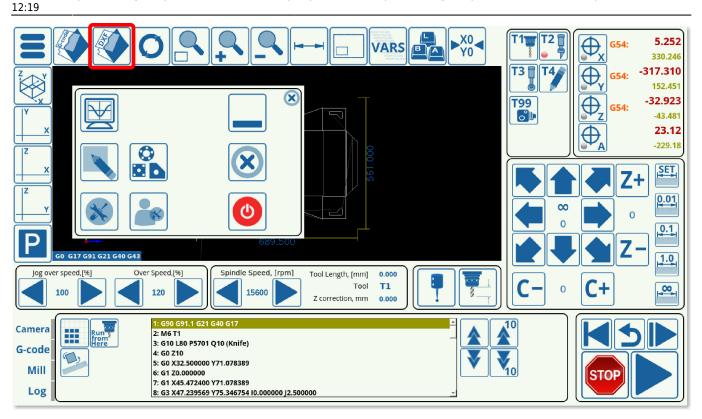
HOTKEY	ACTION
Arrow Up	Move in positive y-direction
Arrow Right	Move in positive x-direction
Arrow Down	Move in negative y-direction
Arrow Left	Move in negative x-direction
Space	Switch the step jog (00.1 through 1 mm)
Hold Control and Arrow keys	Move by the selected step jog

## **CNC Vision Example**

The CNC Vision correction of a program to be used on a shifted or distorted working material can be done easily after the markers have been calibrated. In order to open and use a file with the CNC Vision system, use the following instructions:

1. From the myCNC software's main screen, click the Open DXF File button.

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2. Select the particular DXF file you would like to open.

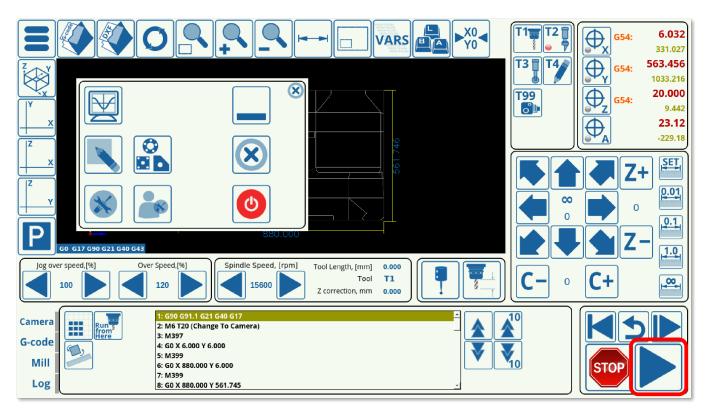
3. When selecting the tools, include Camera as one of the tools, and assign to it the same tool number as the one specified in the Camera Settings (this will be Tool 99 in our case). Assign the other tool or tools and their priorities as necessary for your particular program.

Path /home/mycnc/DNC/XHC v /home/mycnc/DNC/ demo-plasma kerf knives v vision TEST VISION 2.dxf TEST VISION 2.dxf testMultipleParts002.DXF	Folder /home/mycne Folder /home/mycne Folder /home/mycne File /home/mycne File /home/mycne	z/DNC/XHC z/DNC/ z/DNC//demo-plasma z/DNC//kerf z/DNC//knives	Tool Z Feed Feed		ockets Pen Laser	Pointer Plasma/Ga ◀ ►
			SAVE	x, y     0       Priority     Dir.       0     X       0     X       X     X	DRAWING T5 T MARKS T20 T	
Destination Folder: /home/mycnc File name: /home/mycnc	/DNC/XHC /DNC//vision/TEST VISION.d	vf	_			
	/DINC//VISION/TEST VISION.Q.	· •				$\times$

4. Once you have loaded the DXF file, the program should now have inserted the M397, M398, and M399 macros which refer to camera actions into the program G-code.

		T2       G54:       5.252         330.246       330.246         G54:       -317.310         G54:       -317.310         G54:       -32.923         G54:       -43.481         G54:       -43.481         G54:       -229.18
Z Y G0 G17 G91 G21 G40 G43	830.000	
Jog over speed.[%]         O           100         Image: Comparison of the system of the	120 Tool	C- • C+
Camera G-code Mill Log	1: 690 691.1 621 640 617 2: 46 700 (Change Te Campra) 3: M397 4: 60 X 6:00 1 0:000 5: M399 6: 60 X 600 000 X 6:000 7: M399 8: 60 X 880:000 Y 501.745	STOP D

5. Press Run.



The machine will move the camera towards the supposed marker positions, and, if the markers are not immediately present in the Region of Interest, will move around this supposed marker position by the distance specified by the Camera Shift. After running through the camera macros and locating all of the markers for which the program has been calibrated, the program will automatically adjust for any shift or distortion that was introduced, and will immediately begin running the main program.

NOTE: The program will not begin the main cutting process unless all the markers that were expected to be adjusted for have been located.

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