

F7000NV

ROBOT VISION

OPERATING MANUAL



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Chapter 1. Getting Started

1. Preface

Congratulations on the purchase of the Fisnar Vision System.

The Vision System package uses a CCD camera, light source, Touchscreen PC and software to allow the robot to check the location of the work piece, and make dispensing tip adjustments to account for up to 5mm variation in work-piece location. To accomplish this, the software will compare the current work piece location to a 'reference' location stored in memory. If a difference in the X and Y position and angle of rotation of the work-piece is detected, the system will adjust the dispensing path to correct for the difference.

This system features a touch screen monitor. All images and control buttons may be selected either by using the mouse, or by touching the actual object on the screen. For example, if you select the CAMERA Display Page, the primary screen will show the actual camera view. When you bring the object under the camera into view, you may move the camera to different positions on the work piece simply by touching the location on the screen to which you want the camera to move. As a result, this system is designed to be used without a teach pendant.

2. Manuals

Two manuals are supplied with this system:

- This F7000NV Series Operating Manual for the operation of the Vision System.
- The F7000N Series Operating Manual.

This Vision System manual is designed to explain how to use the unique vision system interfacing capabilities. It is designed to be used in coordination with the F7000N Operating Manual, which fully describes the operation for the F7300N and F7400N robots, and all programming concepts. Therefore, only the more common programming concepts are repeated in this Vision System operating manual.

Where more definition on concepts is needed, the following phrase will appear:

For more information about these concepts, please see the F7000N Operating Manual.

The Vision System possesses functions that extend beyond dispensing applications. Where references to non-dispensing functions may appear, the term NA (Not Applicable) will appear, and that information may be disregarded.

3. Setting up the System

The system comes with the following components: Touchscreen PC, keyboard, mouse, robot, teach pendant, camera, and light source.

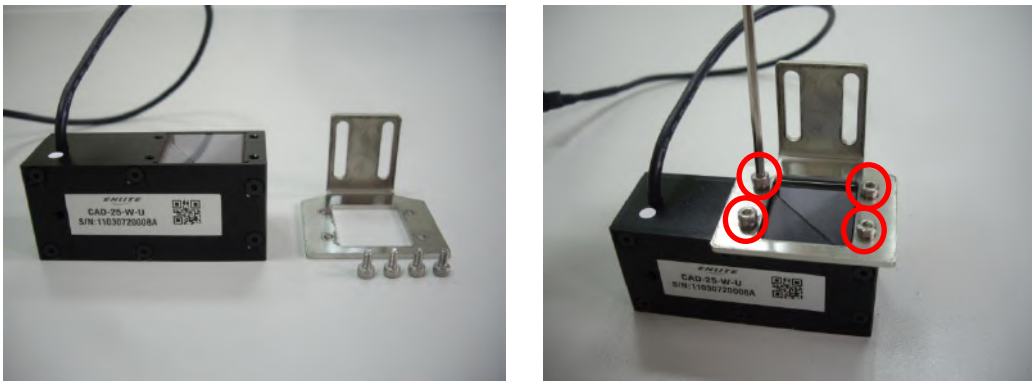


In order to have all the components communicate properly with each other, the following connections are required. Multiple PC/Touchscreen monitors are approved in the production of this product. Although the product you receive may have a different appearance than the picture shown here, the same connections are required.

Install the CCD mounting plate onto the Z axis.



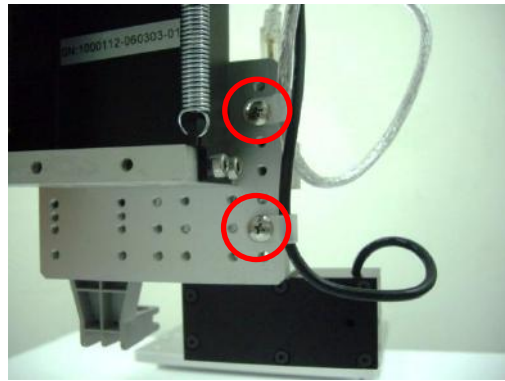
Install the LED Light onto the 90 degree L-shaped fixture.



Install the L fixture onto the Z axis and attach the CCD fixture.



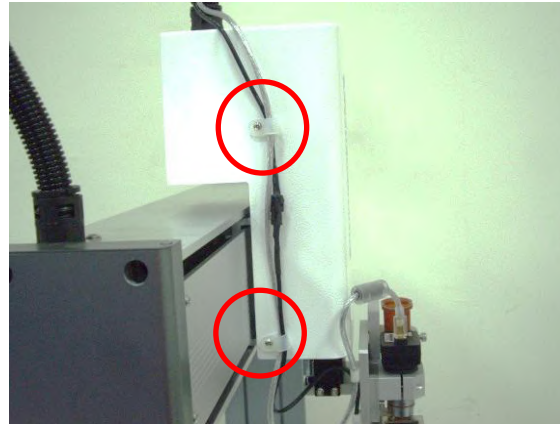
Put CCD into the fixture and gently fasten. Assemble CCD signal wire behind the fixture.



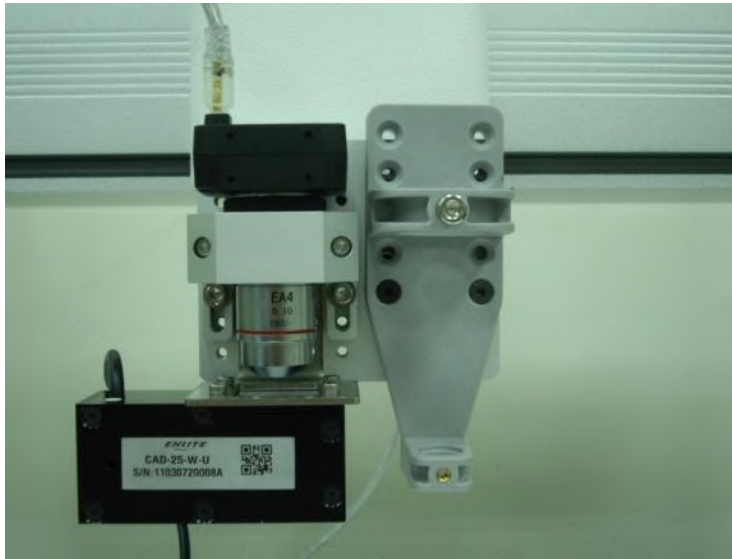
Attach the USB & Power wires on the left side of Z axis cover using the existing cover screws.



Caution - Leave the CCD signal wire longer length in order to prevent binding during movement.



Install the barrel holder at right side of fixture plate.



Install the LED light controller.



Assemble LED light controller and bottom plate. Fasten 2 screws at the bottom of LDF light controller, and install the controller in the desired position.



Turn on POWER. Adjust the light brightness in order to have clear vision of CCD.



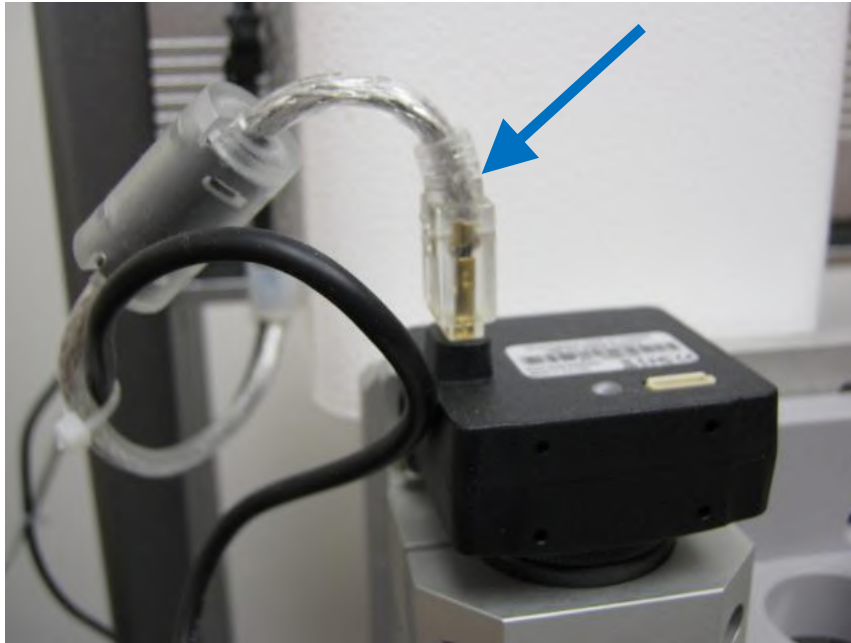
Connect the Mouse and Keyboard into the side of PC, as shown from top to bottom.



Connect the LAN cord, Camera cord, Dongle, and AC power cable, into the back of the PC as shown from left to right.



Connect the Camera cord into the Camera as shown.



Connect the Light Source data cable, and power cable to the light source as shown from top to bottom.



Connect the LAN cord, Dispenser cord and External Control SHORT plug into the back of the Robot as shown from left to right,



Remove all protective plastic wrapping from the PC.

Cable Management: Leave enough length of cable to prevent binding of cables and to prevent strain on connectors during movement of the robot.

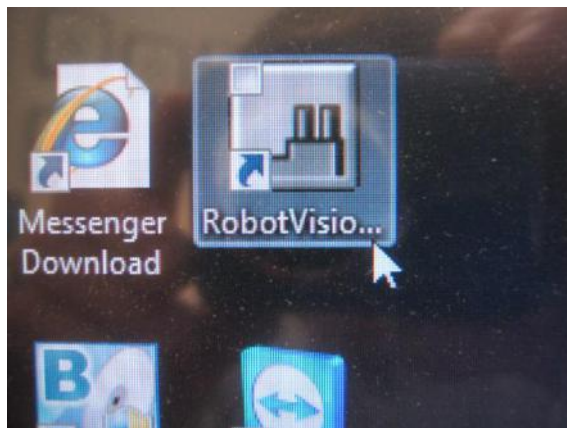
4. Turning on the Power

The following steps need to be done in this order:

- 1) Turn on PC. If prompted for a password, use “ABCD”, which is the factory default password.
- 2) Turn on the Robot, and Light Source. Adjust the Light Source intensity dial to gain a sharp visual image on the screen. Generally, leave the intensity set between 5 and 6. Consistent room lighting will ensure consistent camera viewing performance.



- 3) Then open RobotVision program by double clicking the icon.



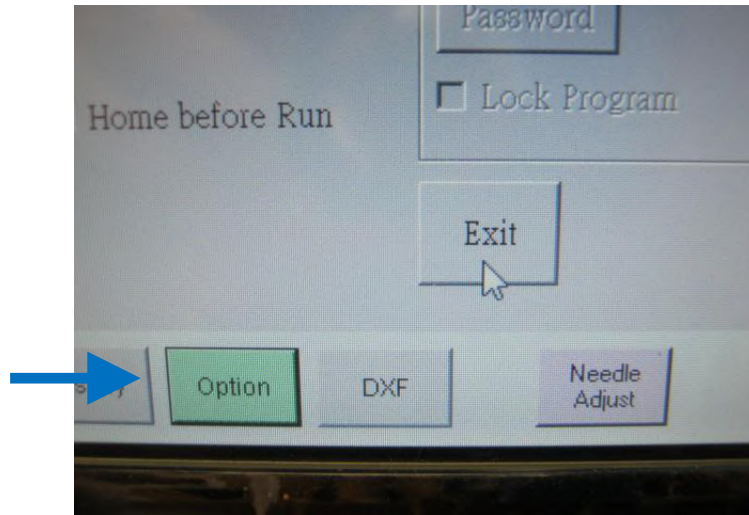
The robot is now active, and should move to the home position set by the factory.

The system is now ready to begin.

5. Turning off the Power

In reverse order of powering the system up:

- 1) Close the RobotVision program - select the OPTION Display page, then select EXIT to shut down the program. When prompted to save the file, select YES or NO.



- 2) Turn off power to the Robot and Camera.
- 3) Turn off power to the PC.

Chapter 2. Getting to Know Your Vision System

1. Overview of the screen - Sections A through G

The screenshot displays the software interface with several key components:

- Section A:** File Management and Program Edit Menu (top toolbar).
- Section B:** Program Edit Function Keys (left sidebar).
- Section C:** Dispensing Function Keys (middle-right panel with buttons like Input, Output, D. On, D. Off, A. Pos, Initial, Home, Wait, Stop, Dum., Circle, Loop, Find, Retra, Laser Detect, Laser Adjust, Laser Height, Laser AVG).
- Section D:** Primary View screen (table of program data).
- Section E:** Different Display Pages and Timer (bottom status bar).
- Section F:** Secondary View Screen (right side image of a target with a crosshair).
- Section G:** Navigation and Jogging Menu (bottom-right panel with X, Y, Z axes and speed controls).

#	Command	1	2	3	4	5	6
1	Initialize						
2	Vision Mark	108.76	6.041	52.582	9		
3	Vision Mark	262.15	5.654	52.582	10		
4	Line Speed	50					
5	Laser Detect	1					
6	Line Start	211.07	5.321	64.26			
7	Line Passing	211.72	277.38	62.412			
8	Line Passing	56.515	277.89	64.26			
9	Line Passing	56.001	5.399	64.26			
10	Line End	211.35	5.155	64.26			
11	Laser Detect	0					
12	Laser Adjust	1					
13	Line Start	210.17	6.002	64.26			
14	Line Passing	211.72	277.38	62.412			
15	Line Passing	57.74	276.79	64.26			
16	Line Passing	57.115	6.407	64.26			
17	Line End	210.10	6.095	64.26			

This arrow points to the PROGRAM Display Page view.

Section A - File Management and Program Edit Menu.

Section B - Program Edit Function Keys.

Section C - Dispensing Function Keys. There are two pages P1 and P2. Page 1 is shown here.










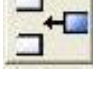





Section D – Primary View screen. It will show different data depending on which Display Page is selected.

Section E - Different Display Pages and Timer. Newer software versions may not show the timer in this location.








Section F – This is the Secondary View Screen. Similar to the Primary View Screen, it will show different data depending on which Display Page is selected.

Section G - Navigation and Jogging Menu. Page 1 and Page 2.

2. Section A - File Management and Program Edit Menu

 List Empty, open a new file.	 Open a file.
 Save file.	 Save As.
 Undo.	 Redo.
 Cut.	 Copy.
 Paste.	 Insert a memory address before the current address.
 Delete current memory address.	 Switch CCD (Light up) / TIP Mode.
 Adjust XYZ Offset.	 Proceed Finding the vision mark.
 Edit Basic script.	

3. Section B - Program Edit Function Keys

	Move TIP or CCD to point location currently in the display.
//	Comment the row you choose. This will skip the command line in which it appears.
~//	Cancel comment. This will eliminate the skip.
	Move to focus position.
	Block Start - Input Step & Repeat Label No.
	DXF Transfer Function
	Expand values from array function to real address.
	Select items and modify Line Speed values, it only effects Line Speed. Ratio examples: Ratio: 2, the speed will double. Ratio: 0.5, the speed will come to half.
X+ Y+ Z+	Select items together and modify Offset values. It only effects Dispense Point, Line Start, Line Pass, Line End, Arc Point, Dummy Point.
	Select items together and modify Point Dispense Time. It only effects Point Dispense Time. Ratio examples: If the time is 6 sec, with a Ratio: 1.5, then time will be 9 sec. With a Ratio: 0.5, time will be 3 sec.
Z	Select items together and modify Z value. It only effects Dispense Point, Line Start, Line Pass, Line End, Arc Point, and Dummy Point.

4. Section C - Dispensing Function Keys

	Dispense Dot Point.		Line Speed.
	Dispensing Line Start.		Line Dispense Setup.
	Line Passing Point.		Point Dispense Setup.
	Dispensing Line End.		Stop Point.
	Arc Point.		Dispense End.
	Dummy Point.		Z Clearance.
	End Program. Program will stop here.		Label No.
	Dispense On.		Go To Label.
	Dispense Off.		Vision Mark. XYZ move to point location to check the vision mark.
	Go to Address.		Loop Function.
	Step & Repeat Start.		Initial run memory.
	Step & Repeat X.		Circle move.
	Step & Repeat Y.		Find a mark.
	Input Port (1-8), appointed Status (0 off, 1 on) and Address.		Retract setup.
	Output Port (0-8), appointed Status (0 off, 1 on).		Home Position.
	Wait Point.		

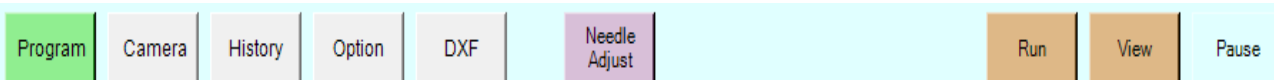
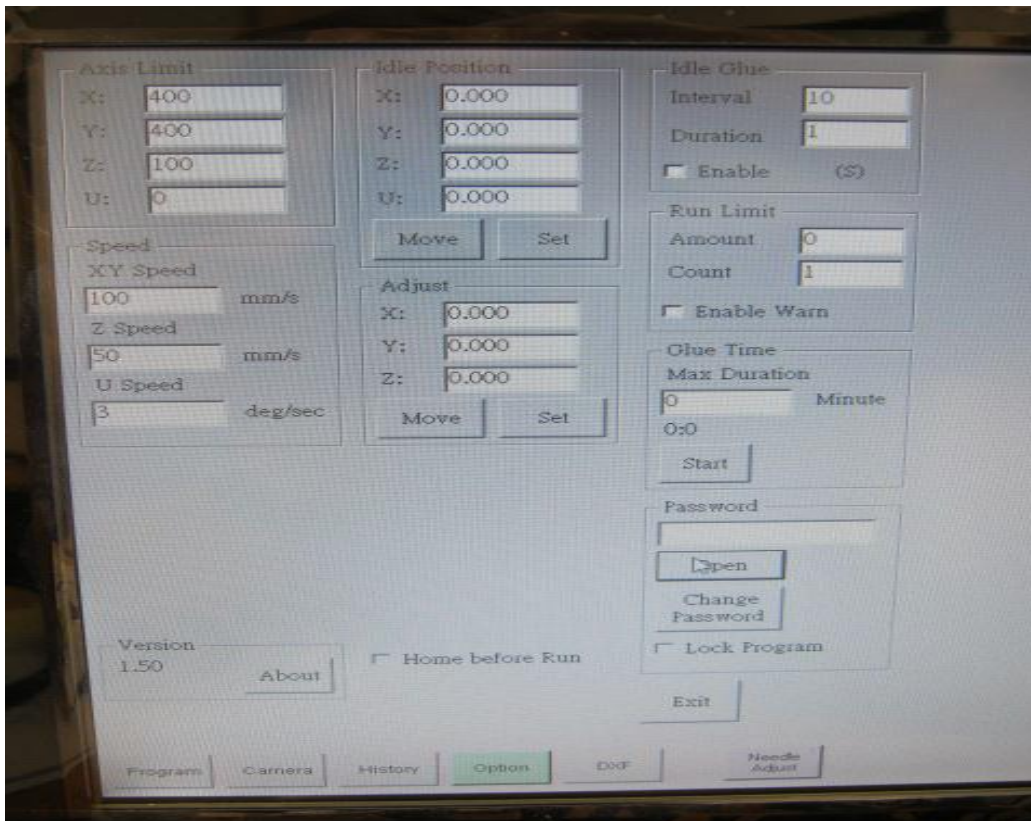
5. Section D – Program Address List

This is an excel spreadsheet record of the program addresses.

6. Section E – Primary View Screen, Display Pages & Function Timer

The Primary View screen on the left side of the screen will show different data depending on which Display Page is selected.

- When the PROGRAM Display Page is selected, the Data Command List (an excel chart of program addresses) will appear.
- When the CAMERA Display Page is selected, the actual camera view will appear.
- When the HISTORY Display Page is selected, the log of user actions will appear.
- When the OPTION Display Page is selected (shown below), the following screen will appear.



Program - Go to the program page.

Camera - Go to the camera page.

History - Go to the history page.

Option - Go to the option page.

DXF - Go to the DXF page.

Needle Adjust – Adjusts the position of the needle after changing tips.

Run - Run the Program with actual dispensing.

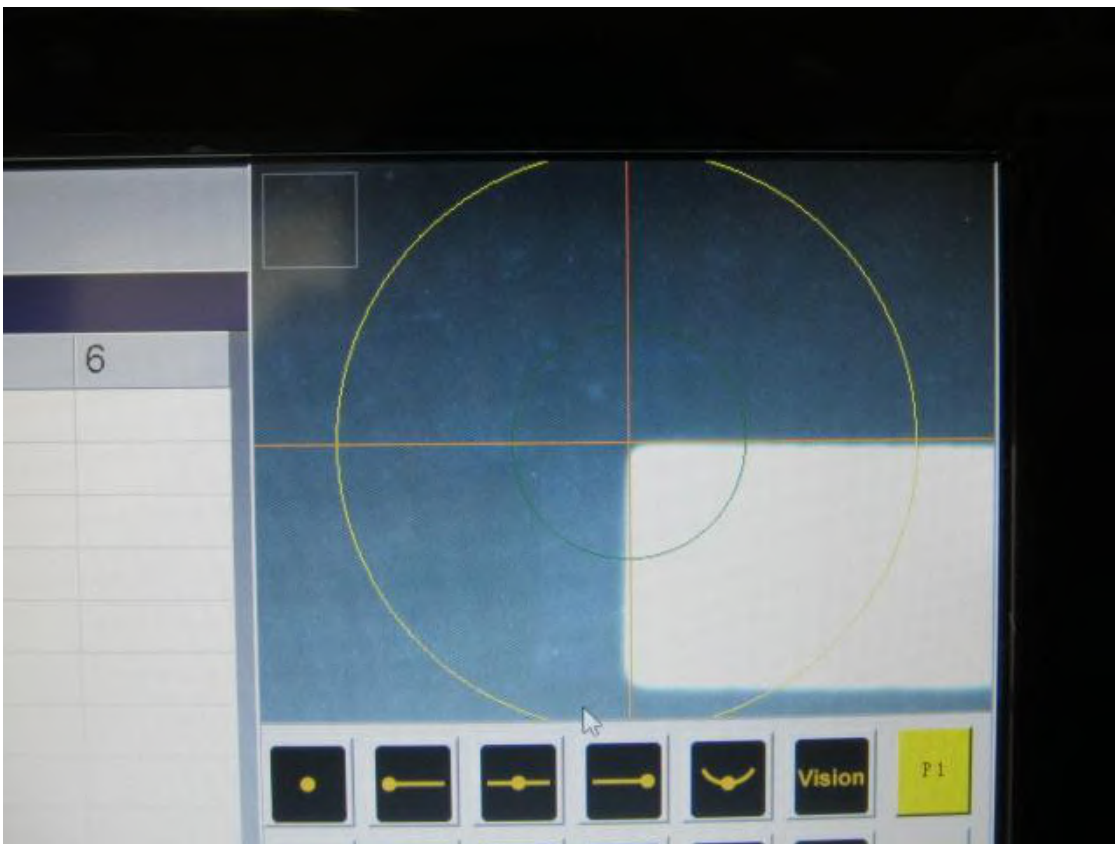
View - Camera Simulation Mode – runs the program with the camera displaying the path, not the needle. No dispensing will occur.

Pause - Stops the robot temporarily. This only works after Dispense Point and Line End.

7. Section F - Secondary View screen

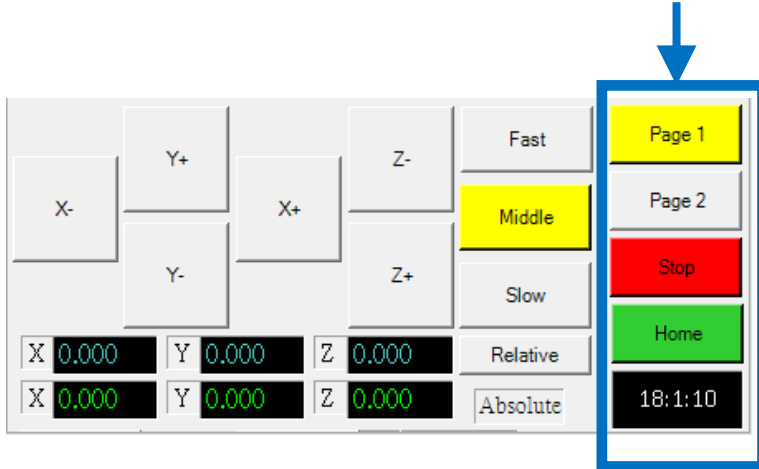
The Secondary View screen in the upper right section of the screen will show different data depending on which Display Page is selected.

- When the PROGRAM Display Page is selected, the camera view will appear (shown below).
- When all other Display Pages are selected, the library of Vision Marks (up to 60 marks) view will appear.



8. Section G - Navigation and Jogging Menu

The following buttons always appear, whether you have selected Page 1 or Page 2:



Page 1 – selects the first page of buttons.

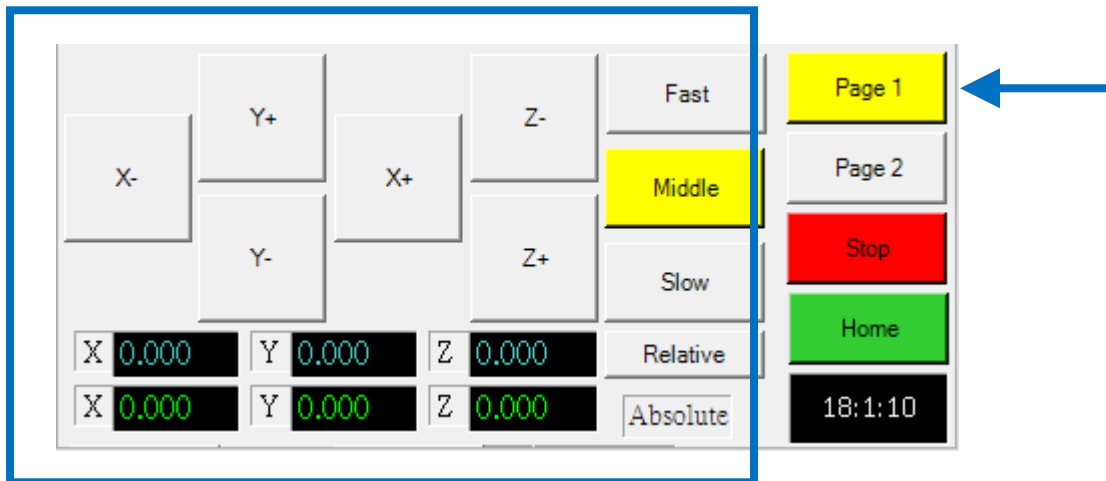
Page 2 – selects the second page of buttons.

STOP – stops the robot.

HOME – send the robot to home position.

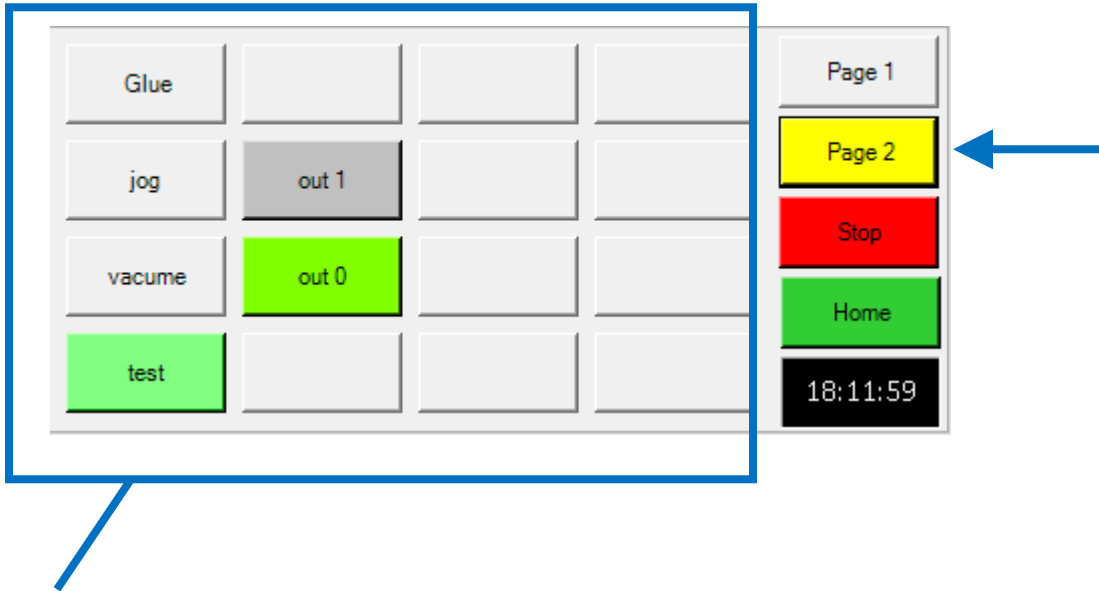
Timer Counter box – provides the time of system activity.

Page 1 of the Navigation and Jogging Menu (see the blue arrow and blue box)



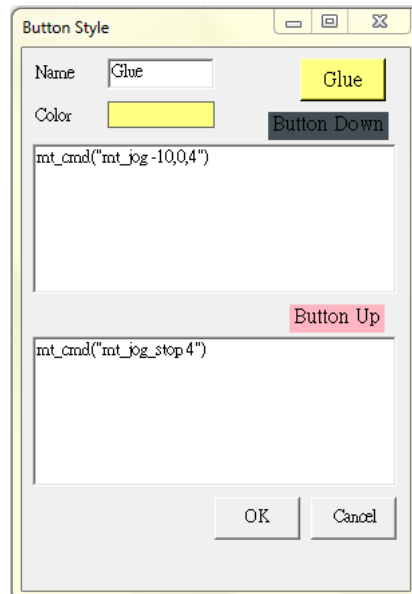
- X+ Jog the X axis to the right direction.
- X- Jog the X axis to the left direction.
- Y+ Jog the Y axis to the forward direction.
- Y- Jog the Y axis to the backward direction.
- Z+ Jog the Z axis down.
- Z- Jog the Z axis up.
- Fast - This is the fastest jogging speed.
- Middle – Medium jogging speed.
- Slow - Slowest jogging speed.
- Relative – Sets the origin relative to the coordinates of the work piece.
- Absolute – Sets the origin relative to the zero home position, vs. the work piece.

Page 2 of the Navigation and Jogging Menu (see the blue arrow and blue box).



These 16 buttons are available for the user to define. They may be defined as quick links to frequently used features, specific to the particular application.

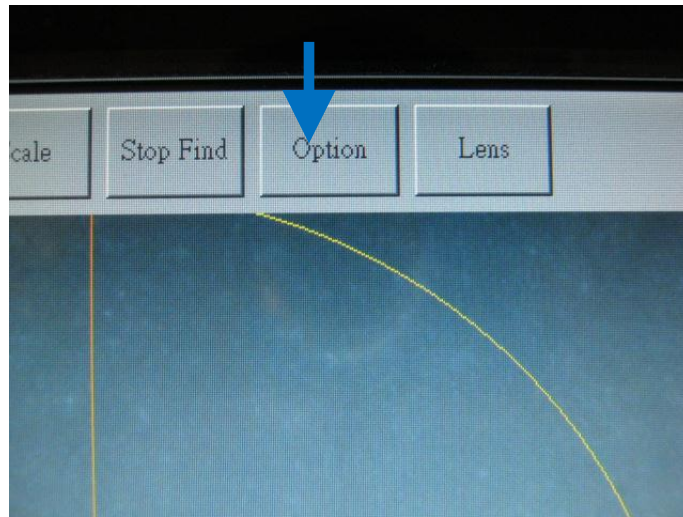
Select a button by hovering your mouse over it, right click to select, and a window will appear. See the next picture.



You may name it, and assign a color. Press OK. At this point, it would appear as you have defined it on the screen.

9. Key Functions while in CAMERA display page

- Center** – Move the camera focal point to the center of an object.
- Set Mark**– The system needs Vision Marks to recognize both the presence and orientation of a work piece. Select attributes of a work piece such as a corner, for the system to register as a “Vision Mark”.
- Cancel**– Cancel the last command.
- Range-
Scale** - The area within which the system will search for a Vision Mark. Screen scale to camera view scale. The default is 1 to 1 unless changed. To change, press RANGE, then AUTO, then select YES when prompted to save new values.
- Stop Find** – Stop the attempt to find a Vision Mark.
- Option** – When this Option button is pressed, (continued next page)



The following screen of options will appear.

The screenshot displays a control interface with three main sections: Abnormal, Match, and Offset. The Abnormal section contains radio buttons for Skip (selected), Stop, Pause, Ask, Manual, and a checkbox for Music. The Match section includes input fields for Score (0.6), Delay(s) (0.2), and Circle Size (1.25 and 0.6), along with checkboxes for Fast match, Search detail, and X,Y calc. The Offset section features buttons for Needle move and Camera move, each with a Set button and three input fields (all 0.000). It also has a Focus button with a Set button and an input field (0.000). At the bottom, there are input fields for Mark No (0), Mark Time (0.2), Tail Time (0.2), Glue score (0.1), and Dispense (0.1), plus a Glue button.

Abnormal - An example of an “abnormal” condition is when the system is unable to recognize a Vision Mark. The following options are available to you during an abnormality:

Skip - The robot will skip to the next program address.

Stop - The robot will stop.

Pause - The robot will pause.

Ask - The machine will ask you if you want to: **Find Again, or Find Next, or Stop Find or use the Manual** mode.

Manual – The machine will ask you to move the camera to the next Vision Mark, then Press PAUSE to continue the program. In this context, PAUSE means to skip the failure to recognize the Vision Mark, and continue on.

Music - If you check music, music will play to alert you when the robot experiences the following abnormalities: **STOP, PAUSE, or MANUAL.**

Match -

Score - A value of 0.1 to 1 is permitted. A higher value delivers stricter matching.

Delay(s) - When the camera move on the mark, the machine will delay seconds the quantity that you specify.

Circle Size - The size of yellow and green circles on the monitor seen during the vision mark process. Higher values will create a larger circles.

Fast match - It takes a shorter amount of time to match, but lessens the accuracy.

Search Detail – Select either ON (check the box) or OFF (no check).

ON – If the system is unable to locate the vision mark in current camera area, it will attempt to find the vision mark by moving the X & Y axis.

OFF – If the system is unable to locate the vision mark in the current camera area, it will keep looking for the vision mark in current camera area.

X,Y calc - If the box is checked, when the machine will compute vision mark X and Y values separately.

Offset – This is the distance between the center of the camera view and tip of the needle. This must be properly set to ensure that the needle tip will follow the same path that the camera traveled during the programing. The four major aspects of Offset are: focus, Set, Needle Move, and Camera Move.

Needle move - Moves the needle tip to the position that you define.

Needle Set – Sets the coordinates of the Needle Tip.

Camera move - Moves the camera to the desired position.

Camera Set – Set the coordinates of the Camera focal point.

Focus - Z axis position will automatically move to an optimum height for best focus.

Focus Set – Sets the Z coordinate of the focus.

Mark No – The Mark Point stored in memory used in the Offset process.

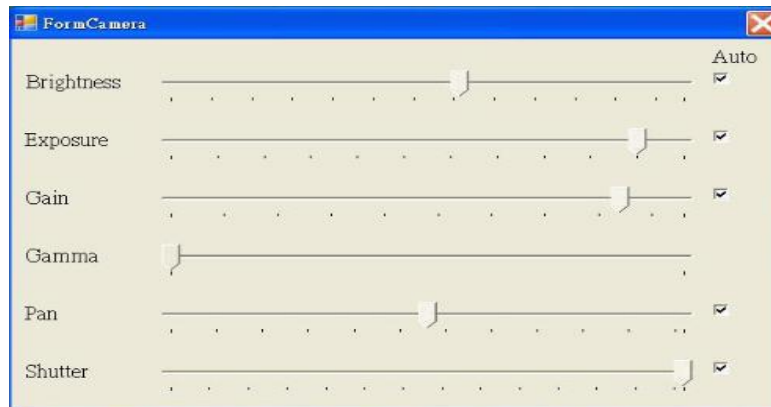
Mark Time – The time allotted to locate the Mark Point during the Needle Adjust process, typically 0.2.

Tail time - The time allotted to raise the tip after the dispense is complete.

Glue Score – A higher value of the range 0.1 to 1.0 will provide stricter matching. Enter 0.6 to 0.9 if the dispensing area is small.

Dispense – The time allotted to dispense during the Needle Adjust process. 0.5 is typical.

Lens - The camera image quality is adjustable to achieve the sharpest and most useful image.



Brightness - The offset is added to the CCD's output signal. This parameter may be adjusted manually or automatically. Therefore, adding the offset increases all gray levels. Thus, the image appears brighter.

Exposure - Exposure is defined as the total amount of light allowed to fall on the photographic medium (image sensor) during the process of taking a photograph. Exposure is measured in lux seconds, and can be computed from exposure value (EV) and scene luminance over a specified area.

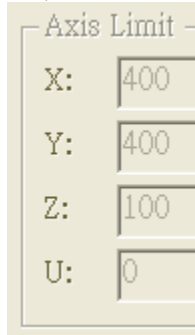
Gain: - Gain determines the amplification of the CCD's output signal. This parameter may be adjusted manually or automatically (see Auto Exposure and Exposure Reference). The amplification increases the contrast. A high gain, however, leads to noisy images.

Gamma – This control increases or decreases the middle gray levels. In other words, you may compensate the non-linear behavior of picture tubes.

Pan - The horizontal movement or rotation of a still or video camera, or the scanning of a subject horizontally on video or a display device. Panning a camera results in a motion similar to that of someone shaking their head "no" or of an aircraft performing a yaw rotation.

Shutter – This determines the camera’s exposure time. It may be adjusted manually or automatically.

Axis Limit – Sets the range limits within which the robot may move. This system is a 3 axis, and thus, the “U:” value, the 4th axis (rotation) may be disregarded.



Axis Limit

X: 400

Y: 400

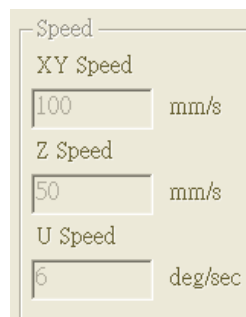
Z: 100

U: 0

Speed - Set the desired speed.



CAUTION – EXCEEDING THE RECOMMENDED SPEED DEFINED IN THE F7000N OPERATING MANUAL MAY DAMAGE THE ROBOT. As of this writing, the maximum X and Y speeds is 800 mm/second, and the maximum Z speed is 320 mm/seconds.



Speed

XY Speed
100 mm/s

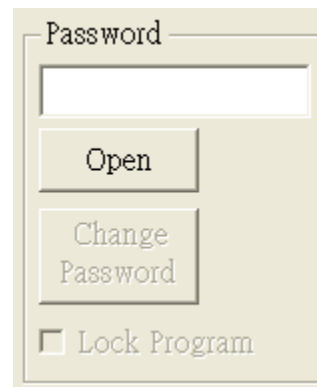
Z Speed
50 mm/s

U Speed
6 deg/sec

Open – If a password has been set by the factory, the default password is ABCD. After entering the password and click you may change system parameters.

Change Password - After typing a new password and click you may change system parameters.

Lock Program: If you check this, you cannot change parameters.



Password

Open

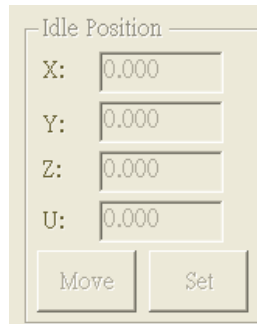
Change Password

Lock Program

Open,

Open,

Idle Position - After the program ends, the robot will remain in the position you specified.



Idle Position

X: 0.000

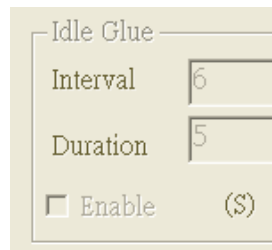
Y: 0.000

Z: 0.000

U: 0.000

Move Set

Idle Glue - If you enable Idle Glue, glue will dispense for 5 seconds every 6 seconds.



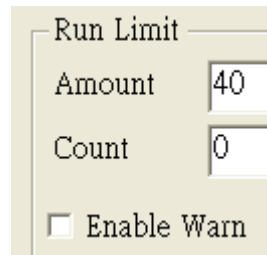
Idle Glue

Interval 6

Duration 5

Enable (S)

Run Limit - Enable limit of run amount. If your count is more than the Run amount, you cannot run more.



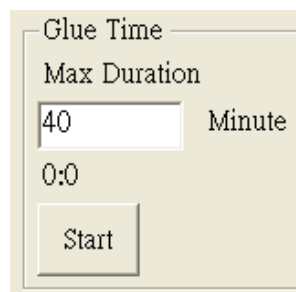
Run Limit

Amount 40

Count 0

Enable Warn

Glue Time - If you enter 40 and click start, it will show a message about your glue being exposed to air for that 40 minute period of time.



Glue Time

Max Duration

40 Minute

0:0

Start

Home before Run - the machine will go to the home position before it runs.

Exit - Shut down the RobotVision software.

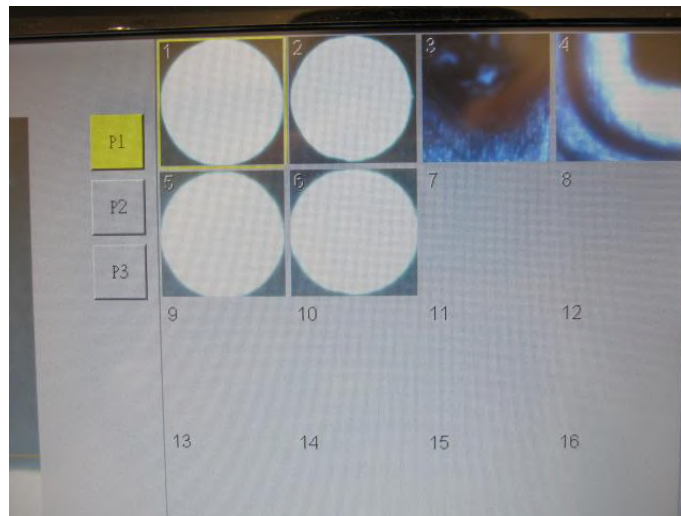
Chapter 3. Using Your Vision System

1. Vision Mark - The Concept

In order to recognize that a work piece is present, and to determine their orientation on a fixture, the system uses two (2) “Vision Marks” per work piece design. Vision Marks are used for horizontally level & flat work-pieces where the fixture may not guarantee that work piece rotation will not occur.

Vision Marks are reference images stored in the Mark List (See Picture 1). The Mark List may be viewed in the Secondary View screen when the Camera Display Page is selected, as shown here. These individual images are shown on the Mark List in their picture “sockets”. Sockets #1 through #6 show their stored images. Other sockets in the Mark List appear blank because they do not yet have any stored images.

n a work piece to 1) identify if the work piece is present in the proper location and 2) account for an angle of rotation.



(Picture 1)

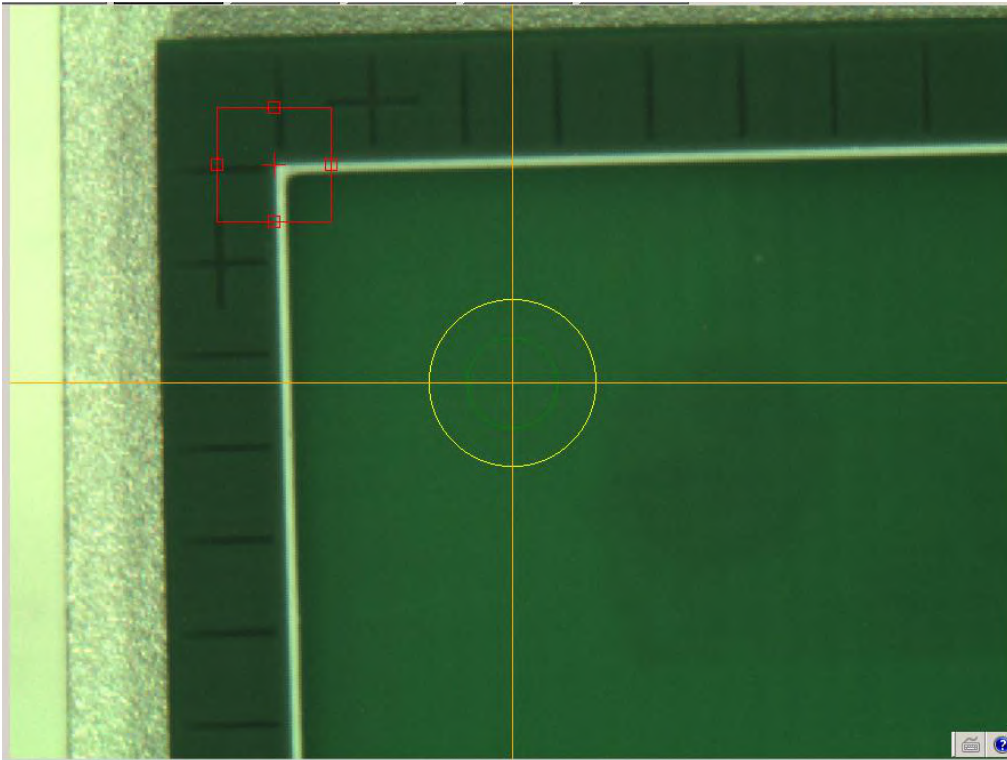
There are several critical factors to consider when deciding what objects to use as Vision Marks:

- The object should be on the actual work piece, not a fixture because it is the work piece position to which the system is designed to adjust.

- The object should be unique. There should be only one object of its' kind within the camera view. Do not select one of many small circles within the camera view.
- Sharp features are best. Example: the intersection of two lines in the capital letter **T**. This is more measureable than the center of a circle, which possess no finite lines.
- An actual dispensing position such as a corner of a silkscreened solder pad is more effective than the break-off corner edge of a pallet of circuit boards due to the differences in their manufacturing precision.
- Two Vision Marks are required. The further away they are from each other, the more precise the system will be in locating the object.

2. Setting Vision Marks

Our first of two target Vision Marks is the intersection of these white lines (Picture 1).



(Picture 1)

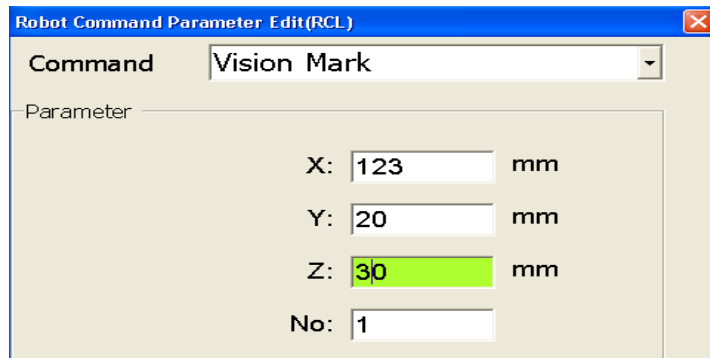
1. Ensure you have selected the Camera page so the camera view appears in the Primary View screen, and the sockets are visible in the Secondary View screen.
2. Use the Mouse or touch the screen to position the X & Y axis precisely over the desired object position.
3. Click **Set Mark** button, and a red square will appear. (See picture 1)
4. Use the mouse to move the cross-hair **+** of the red square precisely over the object. Extend the borders of the square to envelop the object.
5. Click socket 1 to save this mark in that socket. Select **OK** when prompted to accept the frmEdgePattern. The frmEdgePattern parameters include Origin, Border, Dilation, Erosion and Low/Middle High, and are set by the camera system, and changing them is not necessary.

6. Click the Center button. If the mark moves to the center of the object, then disappears, you have set the mark successfully. If not, repeat steps 2 through 6.
7. In the Option screen, click Scale button to calculate scale. We need to click the Scale button only after changing camera height.
8. Click Center button. Make the mark 1 in the center.
9. Go to Program page.



10. Keep the [camera] button highlighted in yellow.

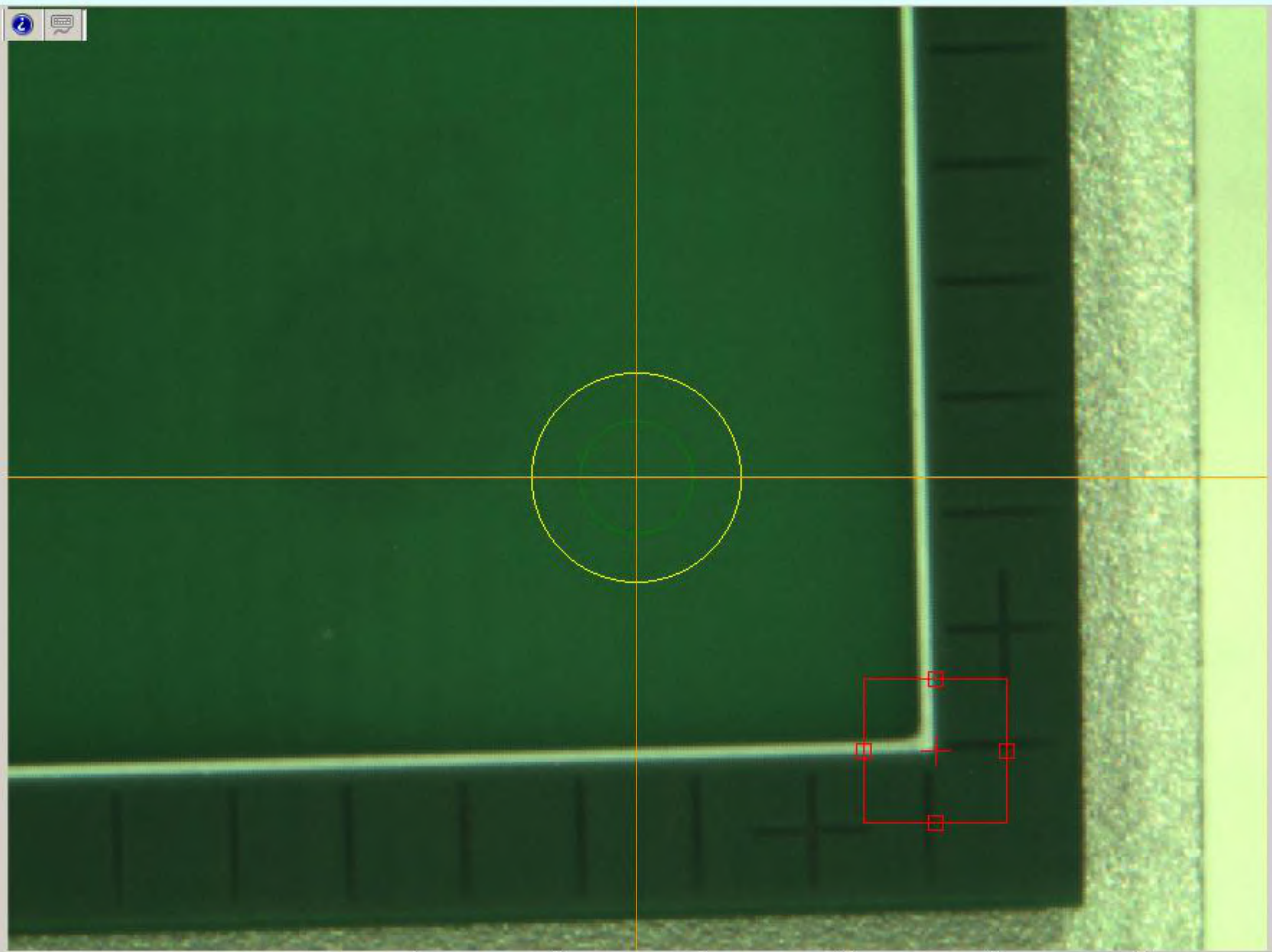
11. Input a Vision Mark command. See picture 2.



(picture 2)

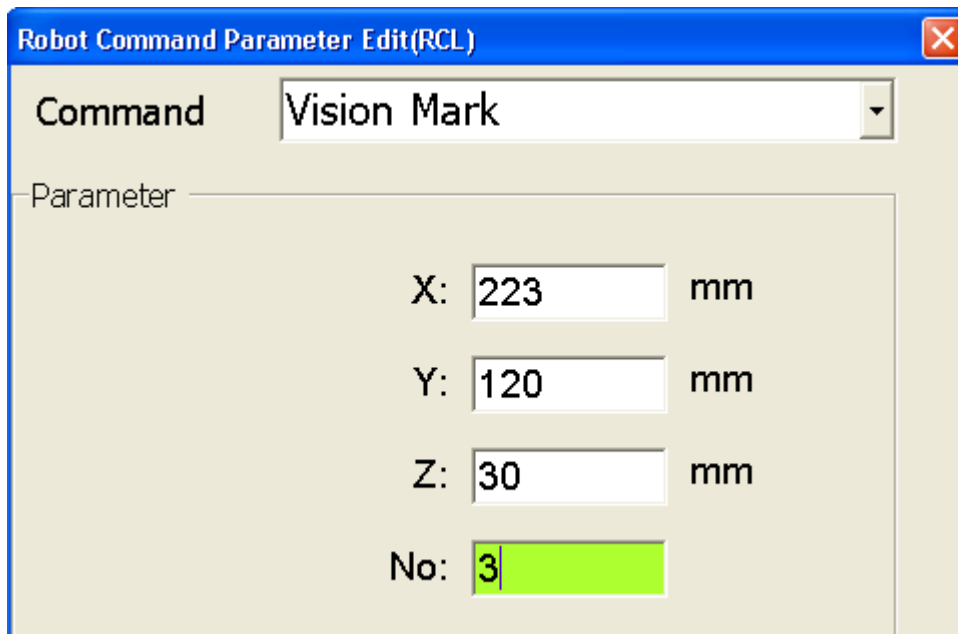
Vision Mark #1 is now recorded and visible in socket #1.

12. Go to the Camera page.
13. Use the mouse to move X, Y axis precisely over the desired object position.
14. Click Set Mark button, then a red rectangle appears. (See picture 3)
15. Use the mouse to move the cross-hair **+** of the red square precisely over the object.
Extend the borders of the square to to envelop the object.



(picture 3)

16. Click socket 3 to save mark. Select **OK** when prompted to accept the frmEdgePattern.
17. Click Center button. If the mark moves to the center of the object, then disappears, you have set the mark successfully. If not, repeat steps 14 through 17.
18. Go to Program page.
19. Input a Vision Mark command. (See below picture)



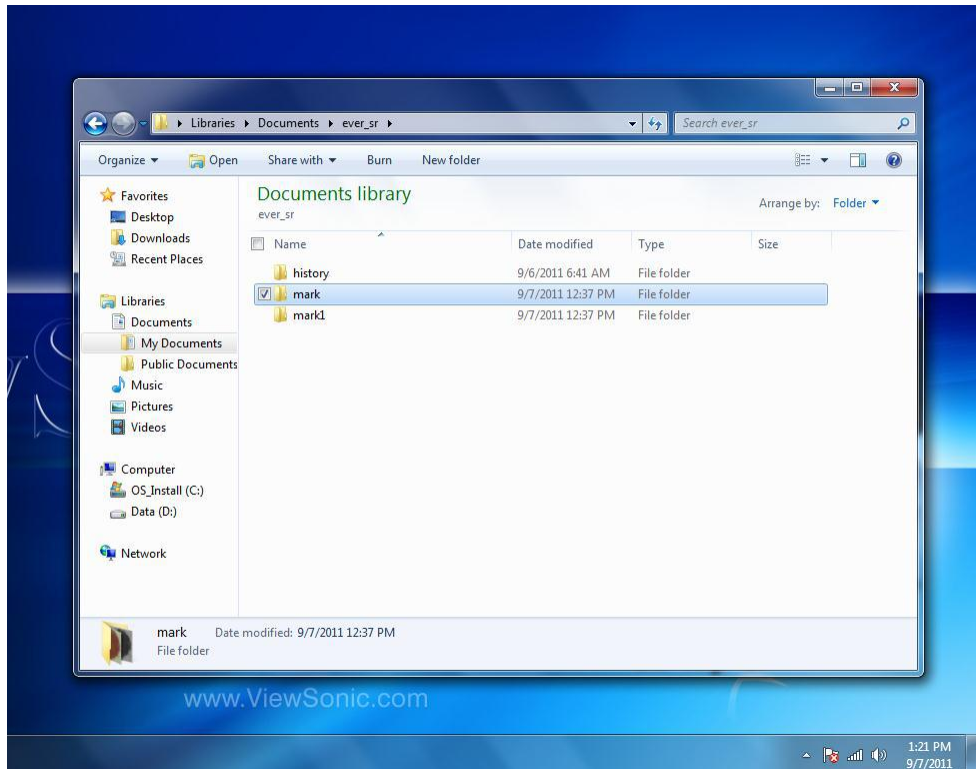
(picture 4)

You have now successfully set the second Vision Mark, but placed it in socket #3.

- Vision Marks were purposely assigned different socket numbers for this exercise to demonstrate that Vision Marks can be recorded in any socket, and will function properly as long as they are properly identified as Vision Mark 1 and Vision Mark 2 in the Program Command lines

3. File Management of Mark lists

60 Vision Marks can be stored in the 60 sockets available in the Mark List on pages 1, 2 and 3 of the active screen. These 60 Vision Marks are stored in the PC – separate from the RobotVision software - in a Library file under Documents under the “Mark” folder. See the following screen:



When additional Vision Marks are required, the previous 60 Vision Marks can be moved to a new “Mark” file. In this example the new folder is called “Mark1”. Older Vision Marks from “Mark” were cut and pasted into “Mark 1”, and thus, “Mark” is cleared out and made available to store 60 new Vision Marks.

When the earlier Vision Marks are needed, they need to be placed back into the “Mark” folder, because the Vision Marks in the “Mark” folder are viewable – and usable - in the active screen.

In this method of file management, the PC is able to store hundreds of Vision Marks, and they are retrievable as necessary.

4. Find Mark vs. Vision Mark

Where Vision Mark uses two marks to operate, Find Mark uses only one mark on a work piece to identify if the work piece is present in the proper location. It is used for horizontally level & flat work-pieces and assumes the work piece fixture will guarantee that no part rotation can occur. The system will use this single “Find Mark” on each work piece as it progresses to the next work piece. Since it finds only one mark, it is faster than using two Vision Marks.

The screenshot displays the software interface for the F7000NV system. On the left is a program editor window titled 'C:\Users\labor\Documents\test1.SRC' containing a table of program commands. The table has columns for line numbers (1-6) and command fields. Line 3 is highlighted, showing 'Dispense Point' with coordinates 102.28, 70.182, and 68.68. Below the table are various icons for program control. On the right is a camera view showing a dark circular feature on a light background, with a yellow crosshair and a green circle centered on the feature. Below the camera view is a control panel with buttons for 'Setup', 'Speed', 'Z Cl.', 'D. End', 'Go to', 'Step X', 'Step Y', 'Block Start', 'Initial', 'Find', and 'End Pr.'. At the bottom right is a numeric keypad with 'Fast', 'Middle', and 'Slow' buttons, and a display showing coordinates: X: 142.827, Y: 69.740, Z: 68.680. The display also shows 'Relative' and 'Absolute' modes, and a timestamp of 11:13:16.

A	Command	1	2	3	4	5	6
1	Z Clearance S	0	1				
2	Find Mark	142.82	69.74	68.68	14		
3	Dispense Point	102.28	70.182	68.68			
4	Step & Repeat	62.5	62.5	3	3	2	1
5	End Program						
6							

- 1) Move the camera to a particular feature on the work piece.
- 2) Select the Camera mode, and select a blank socket. A yellow line will appear around the selected socket to verify that it has been selected.
- 3) Press the Set Mark button.
- 4) Position the red square to envelop the feature.
- 5) Double click the selected socket.
- 6) Press OK to select the frmEdgePattern window.
- 7) Select the Program mode.
- 8) Select a program address line into which you want to record the Find Mark command,
- 9) Select the Command field.

- 10) Scroll down through the available commands and select Find Mark command to enter the Find Mark command address into the program.
- 11) Enter the socket number in the “No.” field, and then press OK.

The Find Mark is now set.

In this example, the X Y & Z coordinates of the Find Mark feature were 142.82mm, 69.74mm, & 68.68mm respectively, and the socket number was 14.

As a result, the system will find the one mark & execute the program to the first work piece, and then proceed to the next work piece to repeat the process.

5. Setting the Offset

The physical mounting of the camera and needle tips to the robot results in a distance between the two, known as offset. This needs to be accounted for before a dispensing program is run. To set the offset, follow these steps:

- 1) In the CAMERA mode, select the OPTION on the top bar.
- 2) Select NEEDLE MOVE, then move the needle tip in the X, Y & Z directions to a feature point, and press SET.
- 3) Select CAMERA MOVE, then move the camera to focus on that same feature point, and press SET.
- 4) When prompted to “CHANGE OFFSET”, press YES.
- 5) Next to the FOCUS button, press SET. The CAMERA Z and FOCUS Z values will now display equivalent values.
- 6) Return the needle tip to the same feature point, and press GLUE.
- 7) For Glue Score, enter 0.6 to 0.9 if the dispensing area is small.
- 8) Mark Time is the time allotted to locate the Mark Point during the Needle Adjust action, typically 0.2.
- 9) Tail time is the time allotted to raising the tip after the dispensing is complete.

The Offset is now set.

6. Needle Adjust

After changing materials / needles or if the needle tip position has inadvertently been moved, the offset needs to be adjusted to recognize the new position of the needle tip. There needs to be a fixed position to use for this process, and it is necessary to use a feature on a fixture which will always be in the same location vs. a feature on a work piece, which may not always be in the same location.

To set the Needle Adjust, follow these steps:

- 1) Save the selected position in the Mark List in one of the numbered sockets, and then enter that socket # into "Mark No" in the Offset Menu. This will be the position to which both the needle and camera travel for adjustment during this process.
- 2) Press Needle Adjust. The needle tip will move to that location and dispense a drop of fluid. The camera will then move to search for that drop of fluid, and align the focal point to the position of the drop. The camera and needle tip are adjusted, and the adjustment needs to be accepted.
- 3) When prompted "**Do you want to update Lens Offset?**", select YES.
- 4) When prompted "**Do you want to change Offset?**", select YES.

The Needle Adjust is now set. You may resume running the dispensing program.

7. Step & Repeat

Step & Repeat will enable repeating the dispensing pattern on multiple work pieces when fixture in an array. Please see the picture below.

The screenshot shows a software interface with a table of commands and a dialog box for editing parameters. The table below is a representation of the data shown in the image:

A	Command	1	2	3	4	5	6
1	Z Clearance S	0	1				
2	Vision Mark	143.11	69.799	59.177	14		
3	Vision Mark	178.00	71.909	59.177	15		
4	Step & Repeat						
5	Dispense Point	102.28	70.182	68.68			
6	Circle	94.866	74.696	57.246	5.5		
7	Step & Repeat	62.5	62.5	3	3	2	1
8	End Program						
9							

The 'Robot Command Parameter Edit(RCL)' dialog box shows the following settings:

- Command: Step & Repeat X
- X Offset: 62.5 mm
- Y Offset: 62.5 mm
- Columns (x): 3
- rows (y): 3
- 1.S Path 2.N Path: 2
- Address: 1

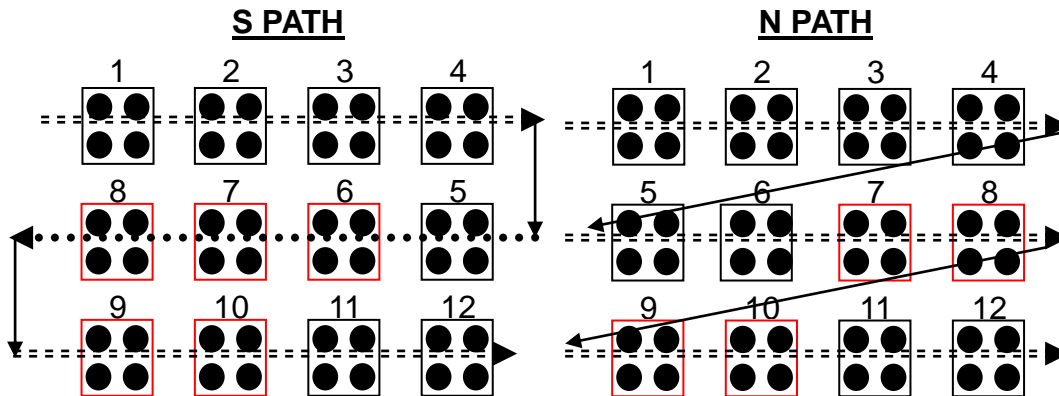
X-Offset is the distance between each work piece in the X direction. In this example, the distance has been measured as 62.5. Therefore, 62.5 has been entered in the X Offset field.

Y-Offset is the distance between each work piece in the Y direction. In this example, the distance has been measured as 62.5 mm – and happens to be same as the X Offset. Therefore, 62.5 has been entered in the Y Offset field.

Columns (x) is the number of columns of work pieces to be repeated in the X direction. In this example the fixture holds 9 work pieces in 3 columns & 3 rows. Therefore, 3 has been entered in the Columns (x) field.

The Rows (y) List the number of rows to be repeated in the Y direction. In this example the fixture holds 9 work pieces in 3 columns and 3 rows. Therefore, 3 has been entered in the Columns (y) field.

1.S Path 2.N Path – The path of pattern travel is defined as either an S-shape pattern or an N-shape pattern, per this diagram. (Disregard the red coloring of some of the squares. They appear red for the Block Start example.)



In this example, the N path was desired. Therefore 2 has been entered.

Address – The address where the Step & Repeat program needs to begin. In this example, the desire was to repeat the program starting with the Z Clearance command, then run through the rest of the program. The Z Clearance command resides at Address 1. Therefore, 1 has been entered for the Address.

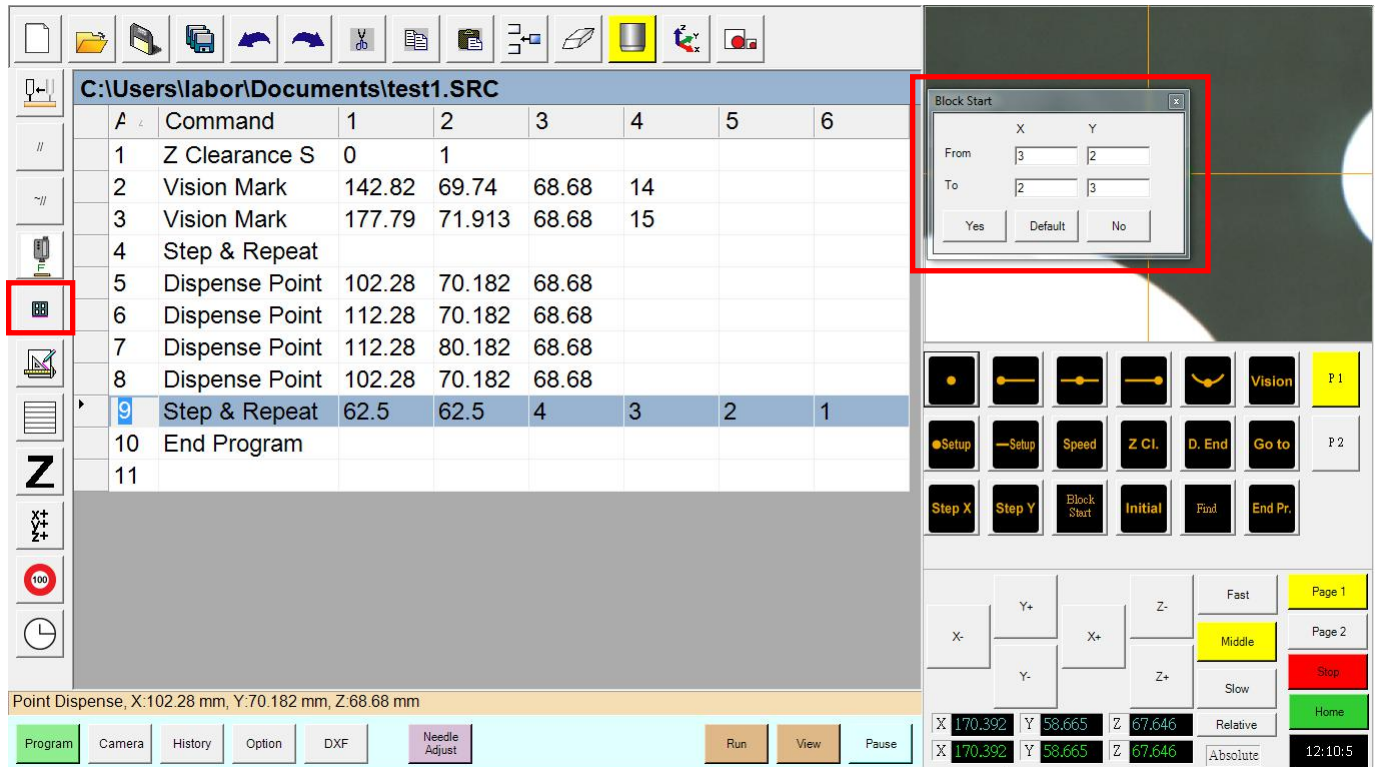
Select OK to save parameters.

8. Block Start (Step & Repeat Start) with Label No.

Due to programming limitations, this BLOCK START command is titled “STEP AND REPEAT START” in the drop down list of available commands. In order to enter a Block Start command, the STEP AND REPEAT START command must be recorded in the program.

This command designates the start and stop locations of a repeating BLOCK dispensing pattern. When Block Start is pressed, it shows a window **shown in red below** and asks you to define the beginning and ending locations of an array, or BLOCK area that you want to repeat the program.

A	Command	1	2	3	4	5	6
1	Initialize						
2	Step & Repeat						
3	Label No	1					
4	Z Clearance S	5	1				
5	Find Mark	96.522	217.30	51.478	45		
6	Step & Repeat	5	5	6	6	1	10001
7							
8	Label No	2					
9	Z Clearance S	5	1				
10	Find Mark	96.522	217.30	51.478	45		
11	Dispense Point	46.27	217.64	68.201			
12	Step & Repeat	5	5	6	6	1	10002
13	Goto Address	1					
14	End Program						
15							

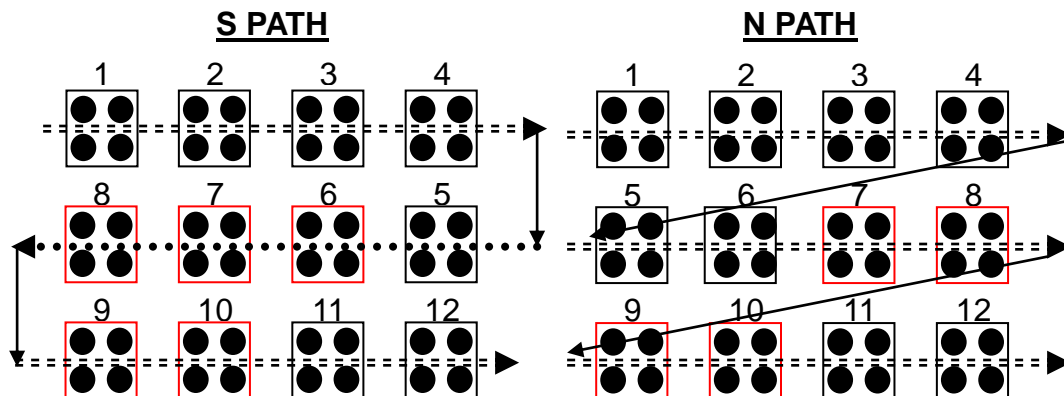


The X refers to the number of columns of workpieces on the fixture, and the Y refers to the number of rows of workpieces on the fixture.

For Example: From X: 3 Y: 2 to X: 2 Y: 3

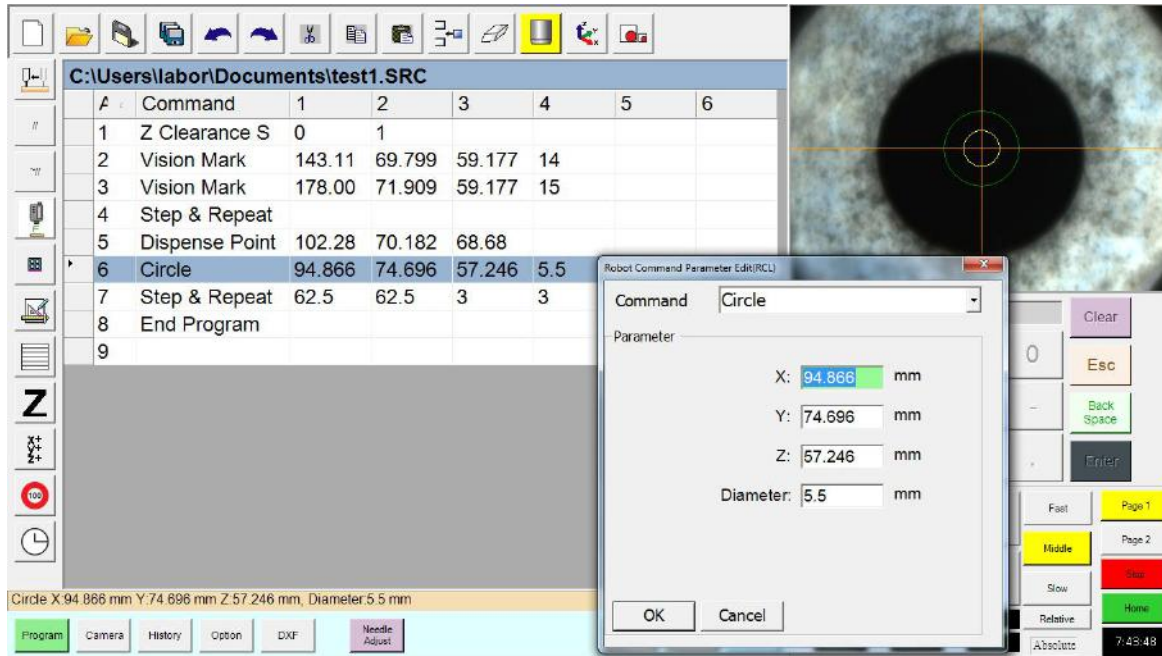
- The repeating pattern will begin at the 3rd column (X = 3) of the 2nd row (Y = 2).
- The repeating pattern will end at the 2nd column (X = 2) of the 3rd row (Y = 3).

Note that your original setting on S-PATH or N-PATH selection will influence the path. See the diagram below:



9. Circle Function.

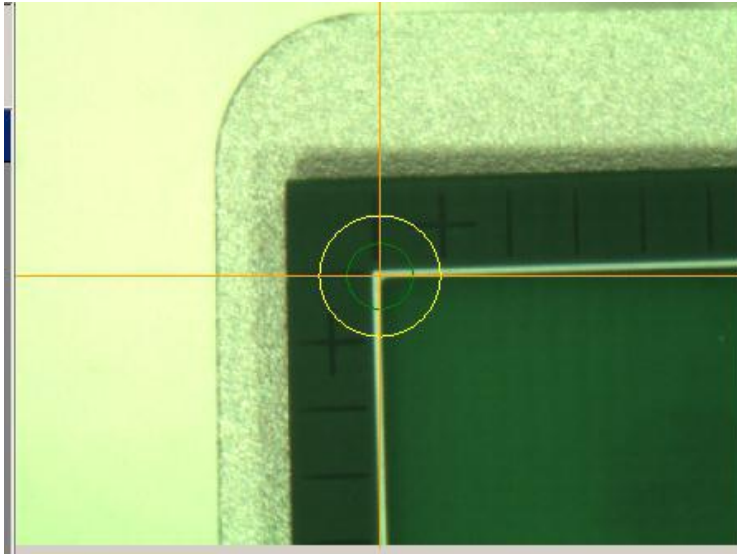
The following picture shows the Circle command. The X and Y location is the center of the circle. The diameter needs to be entered.



In this example, the X dimension was determined to be 94.866mm, the Y dimension was determined to be 74.696mm, and the Z dimension was determine to be 57.246mm. Therefore, the X, Y and Z parameters were entered accordingly. The diameter of the circle on the work piece was measured to be 5.5mm, therefore 5.5 was entered in to the Diameter field. Pressing OK would accept the input parameters.

10. Create a Line Start and Line End Program

Move the camera view to the beginning of a desired line where you want to start dispensing.
(See Picture 1)



(picture 1)

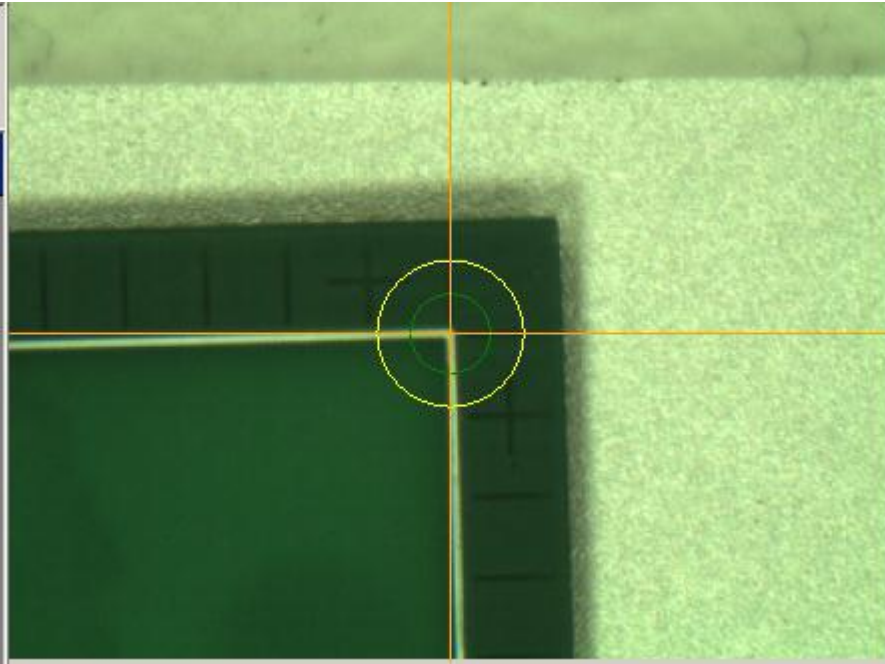
Input a Line Start command. (See picture 2)

A screenshot of the Robot Command Parameter Edit(RCL) dialog box. The Command field is set to "Line Start". The Parameter field is empty. The X coordinate is 203 mm, the Y coordinate is 158 mm, and the Z coordinate is 58 mm. The Z coordinate field is highlighted in red.

Parameter	Value	Unit
X:	203	mm
Y:	158	mm
Z:	58	mm

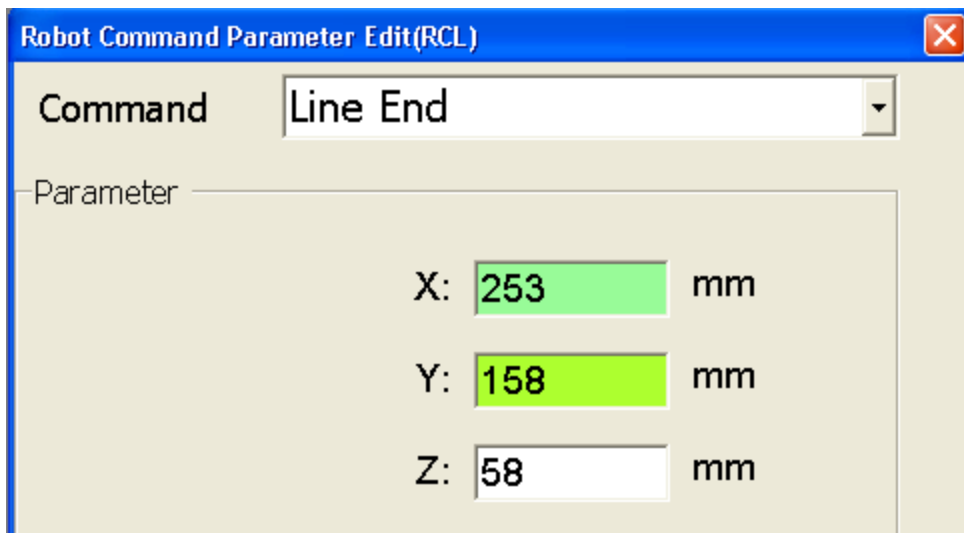
(picture 2)

Move the camera view to the end of a desired line where you want to stop dispensing. (See Picture 3)



(picture 3)

Input a Line End command. (See picture 4)



(picture 4)

Now input an End Program command.

The sample program may now be run in either of two modes. With either the Camera following the dispense path, or the needle tip following the dispense path.

To test the result showing the camera view, select VIEW. The system will display the following:

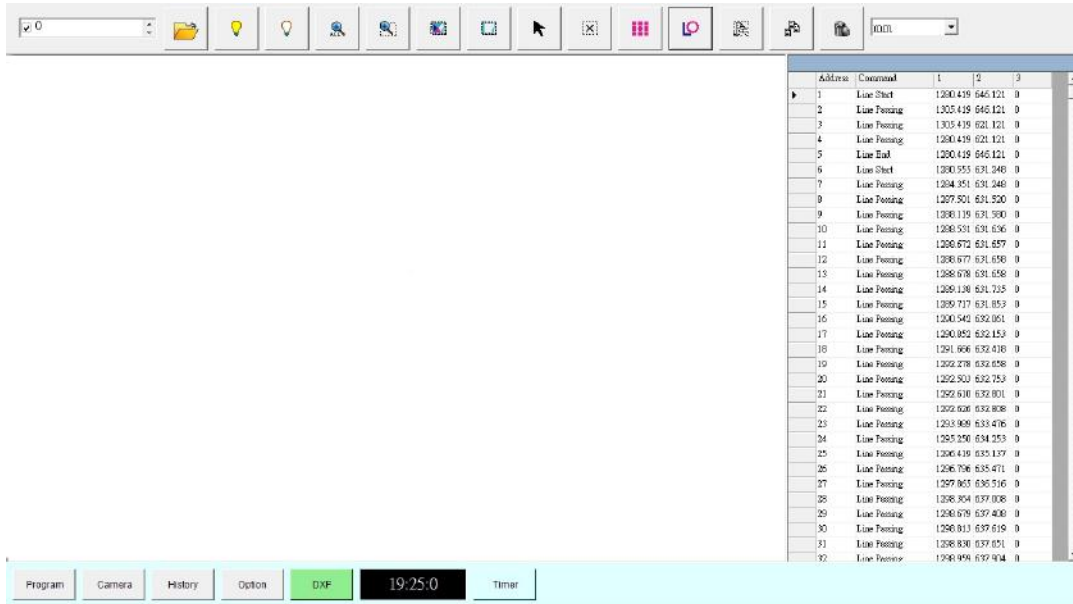
- Camera will move to the first Vision Mark.
- Camera will move to the second Vision Mark.
- Camera will move to the beginning of the dispense line.
- Camera will move to the end of the dispense line.
- Return to the home position.

To test the result with the needle tip movement, select RUN. The system will display the following:















- Camera will move to the first Vision Mark.
- Camera will move to the second Vision Mark.
-now you need to watch the needle tip, not the camera.....**
- Needle Tip will move to the beginning of the dispense line.
- Needle Tip will move to the end of the dispense line.
- Return to the home position.

11. DXF File Transfer

This is the screen appearance:



Command Buttons:

	Open DXF file.		Highlight Selective Function: Press this button, click with one graph. If you select ALL, this graph will not be highlighted.
	Show each layer.		Cancel Selection.
	Hide each layer.		Transfer Circle in DXF to Dispense Point.
	View All.		Transfer Line in DXF to Dispensing Route—Line Start, Line Passing, Line End.
	Partial Enlarge.		Select All Addresses.
	Select All.		Copy Address.
	Select Variable Dimension by Mouse.		Delete Address.

12. How to use the DXF File Transfer

- Copy Addresses from DXF to RobotVision. Use the Select/Copy/Paste Function button.



- Press the Program Edit Key, and the following screen will appear:

DXF			Table		
X	Y		X	Y	
234.56	234.56	Set	234.56	234.56	Set
234.56	234.56	Set	234.56	234.56	Set
Change		Back	<input type="checkbox"/> Reverse Y		

- Select the first address from the command list, then press **Set** in the DXF side.
- Select the second address from the command list (Please do not choose both addresses that are too close together), then press second **Set** in the DXF side.
- Move the camera to the first address you just selected, press **Set** in the Table side.
- Move the camera to the second address you just selected, then press **Set** in the Table side.
- Press **Change** to finish the coordinates transferring.

Back - Go back to the DXF Main Menu.

Reverse - If the transferring coordinates are opposite of the Y axis, press **Reverse** to fix it.

Chapter 4. Programming Examples

1. Example #1 - Step & Repeat

The screenshot displays the software interface for the F7000NV. On the left, a file explorer shows the path `C:\Users\labor\Documents\test1.SRC`. The main editor area contains a table with the following data:

A	Command	1	2	3	4	5	6
//	1 Z Clearance S	0	1				
	2 Vision Mark	142.82	69.74	68.68	14		
~/	3 Vision Mark	177.79	71.913	68.68	15		
	4 Dispense Point	102.28	70.182	68.68			
	5 Step & Repeat	62.5	62.5	3	3	2	1
	6 End Program						
	7						

On the right side of the interface, there is a camera view showing a workpiece with a green circle and a yellow crosshair. Below the camera view is a control panel with various buttons: Vision, P.1, P.2, Setup, Speed, Z Cl., D. End, Go to, Step X, Step Y, Block Start, Initial, Find, End Pr., and a numeric keypad. At the bottom, there are buttons for Program, Camera, History, Option, DXF, Needle Adjust, Run, View, and Pause. The status bar at the bottom right shows coordinates (X: 0.000, Y: 0.000, Z: 0.000) and a time of 10:45:29.

The following steps are featured in this example:

- Z Clearance Setup – Enter a value in mm for the desired Z position. Enter 0 for Absolute value or 1 for relative value.
- Record two Vision Marks.
- Set one Dispense Point per work piece.
- Step and Repeat the pattern.
- End Program

2. Example #2 - Step & Repeat with Line and Arc

A	Command	1	2	3	4	5	6
1	Vision Mark	278.73	34.888	64.835	7		
2	Vision Mark	272.66	44.908	64.835	9		
3	Line Speed	15					
4	Line Start	203.03	42.622	64.335			
5	Arc Point	209.22	48.865	64.335			
6	Line Passing	203.16	55.184	64.335			
7	Arc Point	196.83	48.769	64.335			
8	Line Passing	203.12	42.563	64.335			
9	Dispenser On/	0					
10	Arc Point	209.22	48.865	64.335			
11	Line End	203.16	55.184	63.335			
12	Step & Repeat	-33.5	0	5	1	1	1
13	End Program						
14							

The following steps are featured in this example:

- Vision Marks - Record two Vision Marks according to previous instructions.
- Line Speed – Shown set to 15mm per second.
- Line Start - Select an X Y & Z location and press OK to enter the parameters.
- Arc Point - Select an X Y & Z location at the mid-point of an arc (semicircle) and press OK to enter the parameters.
- Line Passing - Select an X Y & Z location of the line to pass through and press OK to enter the parameters.
- Line End - Select an X Y & Z location and press OK to enter the parameters.
- Dispenser On/Off – either enter 1 for ON, or 0 (zero) for OFF, the press OK to enter the parameters.
- Step & Repeat X – Enter Step & repeat Parameters according to previous instructions.
- End Program.

3. Example #3 - Step & Repeat with Find Mark.

A	Command	1	2	3	4	5	6
1	Z Clearance S	0	1				
2	Find Mark	142.82	69.74	68.68	14		
3	Dispense Point	102.28	70.182	68.68			
4	Step & Repeat	62.5	62.5	3	3	2	1
5	End Program						
6							

The following steps are featured in this example:

- Z Clearance Setup – Enter a value in mm for the desired Z position. Enter 0 for Absolute value or 1 for relative value.
- Find Mark – See previous instruction on this command.
- Dispense Point – registers X Y & Z coordinates of points to dispense.
- Step & Repeat X – Enter Step & repeat Parameters according to previous instructions.
- End Program.

4. Example #4 - Step & Repeat with Brush

	Command	1	2	3	4	5	6
1	Vision Mark	278.93	69.322	65.018	7		
2	Vision Mark	272.70	79.483	65.018	9		
3	Line Speed	10					
4	Line dispense	0.08	0.1	0	0		
5	Brush Area	1	15	2			
6	Line Start	210.95	79.177	74.796			
7	Line End	216.44	88.42	74.796			
8	Step & Repeat	-33.8	0	5	1	1	1
9	End Program						
10							

- Vision Marks - Record two Vision Marks according to previous instructions.
- Line Speed – Shown set to 15mm per second.
- Line Dispense Setup – Enter desired parameters for:
 - Head Time – Time at the beginning of a line during which the tip will not move, but dispensing will occur.
 - Tail Time – Time at the end of a line during which the dispensing will stop, but the tip will continue to move.
 - Node Time – Time delay of tip movement at a corner during which the dispensing will occur. This minimizes a “break” in the dispensed material line as the tip turns a corner.
 - Tail Length – Time the tip will continue to move after the dispensing has stopped.

For more information about these concepts, please see the F7000N Operating Manual.

- End Program.

Example #4 - Step & Repeat with Brush (Continued)

- Brush Area – Causes the tip to “paint” the defined area. The defined area can be in the form of
 - Rectangle – solid rectangular fill.
 - Circle – solid circular fill.
 - Rectangle1
 - Rectangle Band – rectangular border of desired width.
 - Circle Band – circular ring of desired width.

Enter the parameters as desired.

For more information about these concepts, please see the F7000N Operating Manual.

- Line Start - Select an X Y & Z location and press OK to enter the parameters.
- Line End - Select an X Y & Z location and press OK to enter the parameters.
- Step & Repeat X – Enter Step & repeat Parameters according to previous instructions.
- End Program.

5. Example #5 - Step and Repeat with Block

The screenshot displays the software interface for the F7000NV. The main window shows a program editor with the following table:

A	Command	1	2	3	4	5	6
1	Z Clearance S	0	1				
2	Vision Mark	142.82	69.74	68.68	14		
3	Vision Mark	177.79	71.913	68.68	15		
4	Step & Repeat						
5	Dispense Point	102.28	70.182	68.68			
6	Step & Repeat	62.5	62.5	3	3	2	1
7	End Program						
8							

The interface also includes a control panel on the right with buttons for Vision, P.1, P.2, Step X, Step Y, Block Start, Initial, Find, End Pr., and a numeric keypad. The status bar at the bottom shows coordinates (X: 0.000, Y: 0.000, Z: 0.000) and a timer (10:44:0).

The following steps are featured in this example:

- Z Clearance Setup – Enter a value in mm for the desired Z position. Enter 0 for Absolute value or 1 for relative value.
- Vision Marks - Record two Vision Marks according to previous instructions.
- Step and Repeat Start – Recall that this name is actually a command to begin a BLOCK START.
- Dispense Point – registers X Y & Z coordinates of points to dispense.
- Step & Repeat X – Enter Step & repeat Parameters according to previous instructions.
- End Program.

6. Example #6 - Step and Repeat with Line, Arc and Dispense Dot

A	Command	1	2	3	4	5	6
1	Z Clearance S	3	1				
2	Line dispense	0	0.08	0	1.5		
3	Point Dispensi	0.1	0.1				
4	Vision Mark	120.02	17.815	67.056	3		
5	Vision Mark	140.67	37.509	67.056	4		
6	Line Speed	20					
7	ReTract Setup	3	0.5	10	2		
8	Line Start	60.363	24.417	77.852			
9	Line End	76.078	24.361	77.852			
10	Line Start	80.264	36.303	77.852			
11	Line End	80.207	44.988	77.852			
12	Dispense Point	76.906	44.531	77.852			
13	Dispense Point	74.949	44.475	77.852			
14	Dispense Point	73.307	44.446	77.852			
15	Dispense Point	72.522	48.632	77.852			
16	Dispense Point	74.434	48.646	77.852			
17	Dispense Point	75.979	48.617	77.852			

The following steps are featured in this example:

- Z Clearance Setup – Enter a value in mm for the desired Z position. Enter 0 for Absolute value or 1 for relative value.
- Line Dispense Setup – Enter desired parameters for:
 - Head Time – Time at the beginning of a line during which the tip will not move, but dispensing will occur.
 - Tail Time – Time at the end of a line during which the dispensing will stop, but the tip will continue to move.
 - Node Time – Time delay of tip movement at a corner during which the dispensing will occur. This minimizes a “break” in the dispensed material line as the tip turns a corner.
 - Tail Length – Time the tip will continue to move after the dispensing has stopped.

For more information about these concepts, please see the F7000N Operating Manual.

- Point Dispense Time – Enter desired parameters for:
 - Dispense Time
 - Tail Time.
- Vision Marks - Record two Vision Marks according to previous instructions.
- Line Speed – Shown set to 20mm per second.
- Retract Set-Up – Enter the desired parameters for:
 - Length – Distance to travel away from the line endpoint.
 - Height – Distance to rise as the tip moves away from the line end. This value must be less than the value of the Z-clearance in that point.
 - Speed – The speed at which to move along the retract path.

For more information about these concepts, please see the F7000N Operating Manual.

- Retract Type
 - Enter 0 = Normal – The tip rises straight up.
 - Enter 1 = Back – The tip rises up and back at angle.
 - Enter 2 = Square Back – The tip moves straight up, then back.
 - Enter 3 = Forward - The tip rises up and forward at angle.
 - Enter 4 = Square Forward - The tip moves forward, then up, then forward again.

For more information about these concepts, please see the F7000N Operating Manual.

The program continues with a series of Line Starts, Line Ends and Dispense points and concludes with an End Program Command, all of which have been previously described.

Chapter 5. Trouble Shooting Guide

PROBLEM	ACTION	
The Touch Screen fails to operate.	In accordance with the Power On and Off procedures, turn all components off, and then unplug the monitor for 30 seconds. Plug in the PC and then turn on the power to all components.	
Screen Freeze - The screen fails to display what the camera is registering.	Ensure all cable connections between the camera and PC are properly connected.	
Changes made to the program do not execute properly.	Close the RobotVision program – be sure to save the program. Reopen the RobotVision program, then retry the program.	



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